



CAROMONT REGIONAL MEDICAL CENTER

Traffic Impact Analysis

Beatty Drive (NC 273)
Belmont, North Carolina

Prepared for:

City of Belmont

May 2020

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**DRAFT Traffic Impact Analysis for
CaroMont Regional Medical Center
Beatty Drive (NC 273)
Belmont, North Carolina**

Prepared for:

**City of Belmont
Belmont, North Carolina**

Prepared by:

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**May 2020
015020014**

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1.0 Executive Summary

The purpose of this Traffic Impact Analysis (TIA) is to evaluate the impacts on the surrounding transportation infrastructure as a result of the proposed CaroMont Regional Medical Center. 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 determine the potential transportation impacts of the proposed development.
- To identify improvements to mitigate the proposed development's transportation impacts.

The proposed CaroMont Regional Medical Center is located east of Belmont Abbey College along the west side of Beatty Drive (NC 273) and just north of I-85 in Belmont, North Carolina. The 29-acre site is currently undeveloped and zoned as Business Campus Development (BC-D). Based on the site plan provided by the applicant, the proposed development is currently envisioned to include the following land uses and intensities for the purposes of this TIA:

- 220,000 square feet of hospital space
- 80,000 square feet of medical office building space

For the purposes of this TIA, the development is assumed to be completed (built-out) in 2023. Based on the provided site plan, the proposed development is currently planned to be accessed via one full-movement connection to Beatty Drive (NC 273) at YMCA Drive, creating the fourth leg of the existing signalized, tee-intersection. A secondary emergency vehicle access is also proposed to provide gate-controlled access to Belmont Abbey College to the west; however, this access was not evaluated as part of this TIA.

A TIA Scoping Meeting was held with the City of Belmont, City of Mount Holly, North Carolina Department of Transportation (NCDOT), Gaston-Cleveland-Lincoln Metropolitan Planning Organization (GCLMPO) and representatives of the applicant in Belmont on February 11, 2020, 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 that documented all scoping parameters to be used for the TIA and was reviewed and agreed upon by the City of Belmont, City of Mount Holly, NCDOT, GCLMPO and the applicant. City of Mount Holly staff was included in the development of the scope for this TIA given the proposed access to Beatty Drive (NC 273), which serves Mount Holly residents as their southern entrance into the City from I-85 including the parcels along the east side of Beatty Drive (NC 273), which utilize this corridor as their primary access given their limitations to alternative access options with Catawba River and I-85 to their east and south. 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:

- 2019 Existing Conditions
- 2023 Background Conditions
- 2023 Build-out Conditions
- 2028 Build-out Conditions + 5 years

Based on 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:

1. Beatty Drive (NC 273) and Tuckaseegee Road
2. Belmont-Mt. Holly Road and Beatty Road
3. Belmont-Mt. Holly Road and Ferstl Avenue
4. Beatty Drive (NC 273) and Beatty Road
5. Beatty Road and Ferstl Avenue
6. Beatty Drive (NC 273) and YMCA Drive/Access 1
7. Beatty Drive (NC 273) and Caldwell Drive
8. Beatty Drive (NC 273) and I-85 SB Ramp
9. Park Street (NC 273) and I-85 NB Ramp
10. Park Street (NC 273) and Wilkinson Boulevard (US 74)

Note that the signalized intersection of Park Street (NC 273) and Hawley Avenue was also included in the Synchro model analysis to properly reflect the operational impact of this signal along the NC 273 corridor, specifically at the adjacent I-85 NB Ramp and Wilkinson Boulevard (US 74) intersections; however, as determined at the TIA Scoping Meeting, no mitigation analysis was performed for this intersection.

For the purposes of this study, the orientation of Beatty Drive (NC 273) and Belmont-Mt. Holly Road within the identified study area were established to be north-south.

Also note that NCDOT State Transportation Improvement Program (STIP or TIP) Project No. I-5719 is planned to significantly impact this corridor and was discussed as to how to appropriately incorporate into this TIA. The project is currently being designed to widen I-85 to eight lanes from US 321 to Beatty Drive/Park Street (NC 273) along with potential interchange improvements at each interchange between Exit 17 and Exit 27. Based on [NCDOT's project information page](#) as of April 2020, this project is scheduled for construction in FY 2024-2028; therefore, for the purposes of this TIA as discussed with City and NCDOT staff, this project was included in the 2028 build-out +5 analysis scenario (and was not included in the 2023 analyses).

Note 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 with the exception of the channelized, yield-control right-turn movements onto the I-85 ramps.
- 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.
- A minimum of 4 vehicles per hour were used for permissible movements.

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 Traffic Impact Analysis*) and to identify transportation improvements that may be required to mitigate these impacts. This report presents trip generation, distribution, capacity analyses, crash analyses and identified transportation improvements required to mitigate anticipated traffic demands produced by the subject development.

Based on the capacity analyses performed at each of the identified study intersections, 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:

3. Belmont-Mt. Holly Road and Ferstl Avenue

- Northbound right-turn lane along Belmont-Mt. Holly Road with 100' of storage

6. Beatty Drive (NC 273) and YMCA Drive/Access 1

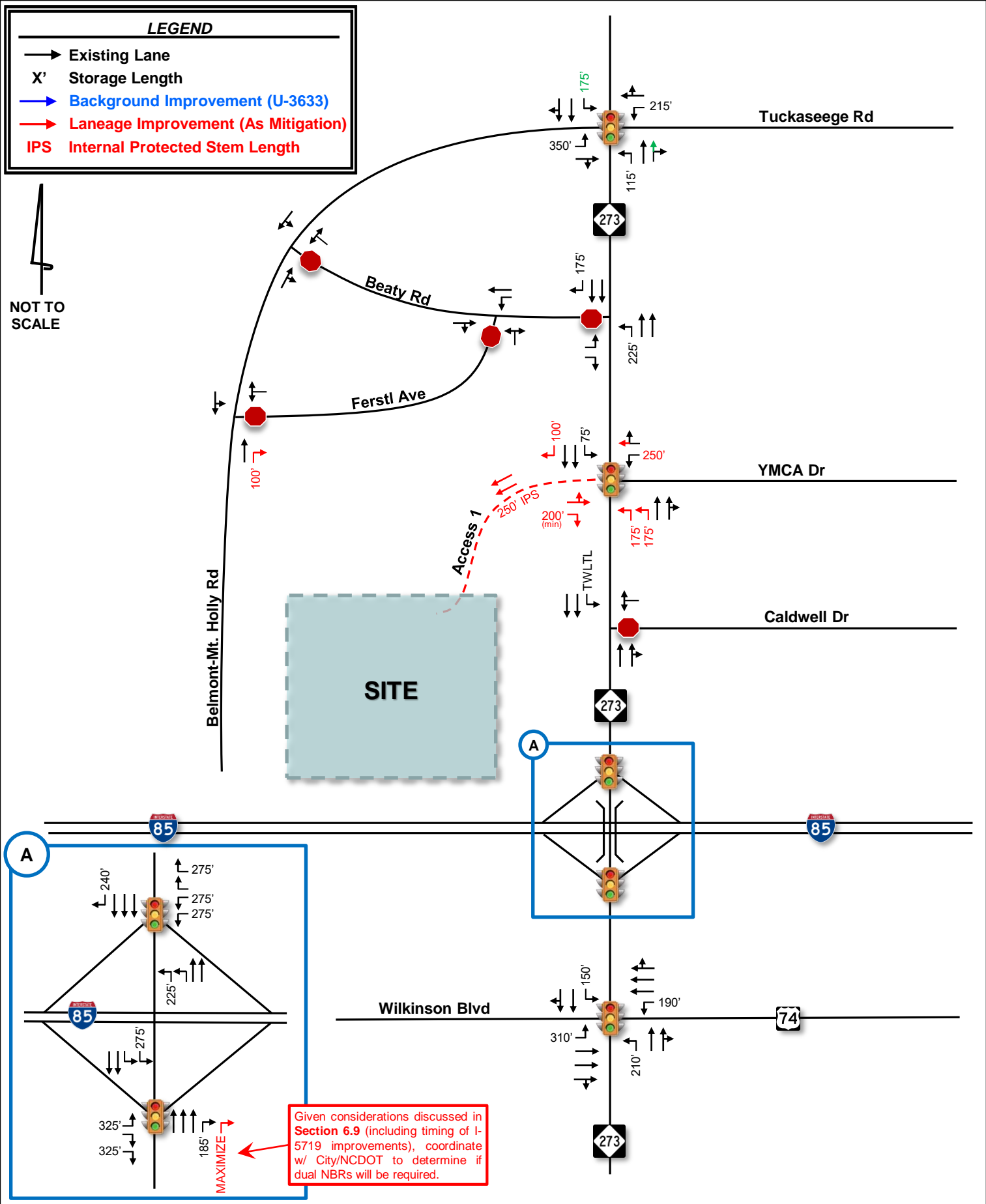
- Dual northbound left-turn lanes along Beatty Drive (NC 273) with 175' of storage each
 - Provide two ingress lanes along Access 1 to receive the dual left-turn lanes
- Southbound right-turn lane along Beatty Drive (NC 273) with 100' of storage
- Extend the westbound left-turn lane along YMCA Drive to provide 250 feet of storage (currently 150 feet)
- Restripe the westbound right-turn lane to a shared through/right lane
- Provide a shared eastbound left/through lane and exclusive right-turn lane along Access 1
 - Provide a minimum of 200 feet of storage for the eastbound right-turn lane
- Provide a 250-foot internal protected stem (IPS) along Access 1

9. Park Street (NC 273) and I-85 NB Ramp

- Additional northbound right-turn lane (creating dual right-turn lanes) along Park Street (NC 273) w/ storage maximized between I-85 NB Ramp and Browntown Road

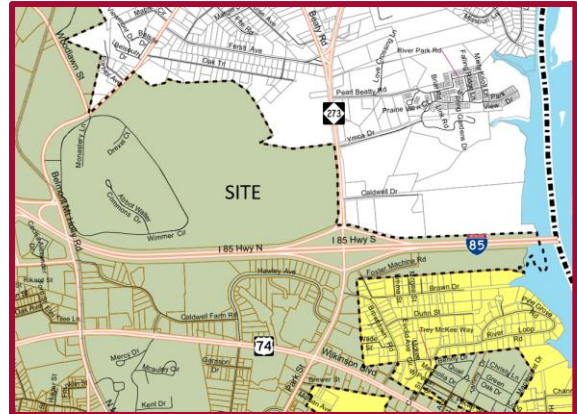
The operational benefit and timing of this potential mitigation improvement should be coordinated with City and NCDOT staff in consideration of the timing and preferred interchange configuration for the planned NCDOT TIP Project No. I-5719 to determine if this mitigation improvement will be required.

The mitigation improvements identified within the study area are shown in **Figure 1.1**. The improvements shown on 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.



2.0 Introduction

The proposed CaroMont Regional Medical Center is located east of Belmont Abbey College along the west side of Beatty Drive (NC 273) and just north of I-85 in Belmont, North Carolina. As shown in the graphic to the right, this parcel is located at the northeastern limits of the City of Belmont, with City of Mount Holly property to the north and east. The 29-acre site is currently undeveloped and zoned as Business Campus Development (BC-D). Based on the site plan provided by the applicant, the proposed development is currently envisioned to include the following land uses and intensities for the purposes of this TIA:



- 220,000 square feet of hospital space
- 80,000 square feet of medical office building space

For the purposes of this TIA, the development is assumed to be completed (built-out) in 2023. Based on the provided site plan, the proposed development is currently planned to be accessed via one full-movement connection to Beatty Drive (NC 273) at YMCA Drive, creating the fourth leg of the existing signalized, tee-intersection. A secondary emergency vehicle access is also proposed to provide gate-controlled access to Belmont Abbey College to the west; however, this access was not evaluated as part of this TIA.

A TIA Scoping Meeting was held with the City of Belmont, City of Mount Holly, NCDOT, GCLMPO and representatives of the applicant in Belmont on February 11, 2020, 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 that documented all scoping parameters to be used for the TIA and was reviewed and agreed upon by the City of Belmont, City of Mount Holly, NCDOT, GCLMPO and the applicant. City of Mount Holly staff was included in the development of the scope for this TIA given the proposed access to Beatty Drive (NC 273), which serves Mount Holly residents as their southern entrance into the City from I-85 including the parcels along the east side of Beatty Drive (NC 273), which utilize this corridor as their primary access given their limitations to alternative access options with Catawba River and I-85 to their east and south. 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 Traffic Impact Analysis*) and to identify transportation improvements that may be required to mitigate these impacts. This report presents trip generation, distribution, capacity analyses, crash analyses and identified transportation improvements required to mitigate anticipated traffic demands produced by the subject development.

3.0 Existing Traffic Conditions

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

3.1 STUDY AREA

Based on coordination with each agency and the applicant, the study area for this TIA includes the following existing intersections:

1. Beatty Drive (NC 273) and Tuckaseege Road
2. Belmont-Mt. Holly Road and Beatty Road
3. Belmont-Mt. Holly Road and Ferstl Avenue
4. Beatty Drive (NC 273) and Beatty Road
5. Beatty Road and Ferstl Avenue
6. Beatty Drive (NC 273) and YMCA Drive
7. Beatty Drive (NC 273) and Caldwell Drive
8. Beatty Drive (NC 273) and I-85 SB Ramp
9. Park Street (NC 273) and I-85 NB Ramp
10. Park Street (NC 273) and Wilkinson Boulevard (US 74)

Note that the signalized intersection of Park Street (NC 273) and Hawley Avenue was also included in the Synchro model analysis to properly reflect the operational impact of this signal along the NC 273 corridor, specifically at the adjacent I-85 NB Ramp and Wilkinson Boulevard (US 74) intersections; however, as determined at the TIA Scoping Meeting, no mitigation analysis was performed for this intersection.

For the purposes of this study, the orientation of Beatty Drive (NC 273) and Belmont-Mt. Holly Road within the identified study area were established to be north-south.

The study area was based on the *City of Belmont Land Development Code – Section 16.14 Traffic 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 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 streets and signalized intersections within a 1-mile radius of the proposed site 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 Cities of Belmont/Mount Holly, NCDOT, GCLMPO 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 Beatty Drive/Park Street (NC 273), Wilkinson Boulevard (US 74), and I-85. The information below describes existing conditions for portions of these roadways within the vicinity of the site.

NC 273 is a state highway and named Park Street with a posted speed limit of 35 mph south of I-85 that transitions to Beatty Drive and 50 mph north of I-85 before transitioning back to 35 mph north of Tuckaseege Road. South of Wilkinson Boulevard (US 74), Park Street (NC 273) is a four-lane, undivided highway. North of Wilkinson Boulevard (US 74), Beatty Drive/Park Street (NC 273) is a five-lane highway that currently transitions down to a two-lane roadway north of Tuckaseege Road. NCDOT TIP Project No. U-3633 (discussed in **Section 4.3**) is currently under construction to widen Beatty Drive (NC 273) to a four-lane divided facility north of Tuckaseege Road. Beatty Drive/Park Street (NC 273) is classified as a minor arterial by NCDOT’s functional classification system and as a boulevard by GCLMPO. Based on 2018 NCDOT annual average daily traffic (AADT) maps, Beatty Drive/Park Street (NC 273) carries 19,500 vehicles per day (vpd) south of Wilkinson Boulevard (US 74), 34,000 vpd between Wilkinson Boulevard (US 74) and I-85, 25,000 vpd north of I-85 in the vicinity of the proposed site, and 17,000 vpd north of Tuckaseege Road.

Wilkinson Boulevard (US 74) is a six-lane, divided facility with a posted speed limit of 50 mph in the vicinity of Park Street (NC 273). US 74 is classified as a principal arterial by NCDOT’s functional classification system and as a boulevard by GCLMPO. Based on 2018 NCDOT AADT maps, Wilkinson Boulevard (US 74) carries 21,500 vpd west of, and 22,000 vpd east of, Park Street (NC 273).

I-85 is an eight-lane, divided interstate with a posted speed limit of 60 mph in the vicinity of Exit 27, Beatty Drive/Park Street (NC 273), and currently transitions to a six-lane facility approximately one-half mile west of this interchange. I-85 is classified as an interstate by NCDOT’s functional classification system and as a freeway by GCLMPO. Based on 2018 NCDOT AADT maps, I-85 carries 134,000 vpd west of, and 149,000 vpd east of, Exit 27, Beatty Drive/Park Street (NC 273).

3.2 EXISTING INTERSECTION VOLUME DEVELOPMENT

AM (6:30-8:30) and PM (4:30-7:00) intersection turning-movement, heavy-vehicle, pedestrian and bicycle counts were performed by National Data & Surveying Services on Thursday, December 5, 2019 (when both Belmont Abbey College and Gaston County Schools were in session), at the following intersections:

1. Beatty Drive (NC 273) and Tuckaseege Road
2. Belmont-Mt. Holly Road and Beatty Road
3. Belmont-Mt. Holly Road and Ferstl Avenue
4. Beatty Drive (NC 273) and Beatty Road
5. Beatty Road and Ferstl Avenue
6. Beatty Drive (NC 273) and YMCA Drive
7. Beatty Drive (NC 273) and Caldwell Drive
8. Beatty Drive (NC 273) and I-85 SB Ramp
9. Park Street (NC 273) and I-85 NB Ramp
10. Park Street (NC 273) and Wilkinson Boulevard (US 74)
11. Park Street (NC 273) and Hawley Avenue*

Counts were collected at the intersection of Park Street (NC 273) and Hawley Avenue for modeling purposes; however, no mitigation analysis was performed at this intersection.

The AM and PM peak hours identified differed amongst some of the study intersections yet were found to be relatively consistent given the vast number of intersections. The AM peak hour was found to begin at either 7:00 or 7:15 AM throughout the study area, while the PM peak hour was found to begin between 4:45 and 5:15 PM. The specific 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 peak hours for each intersection are shown in **Table 3.1**.

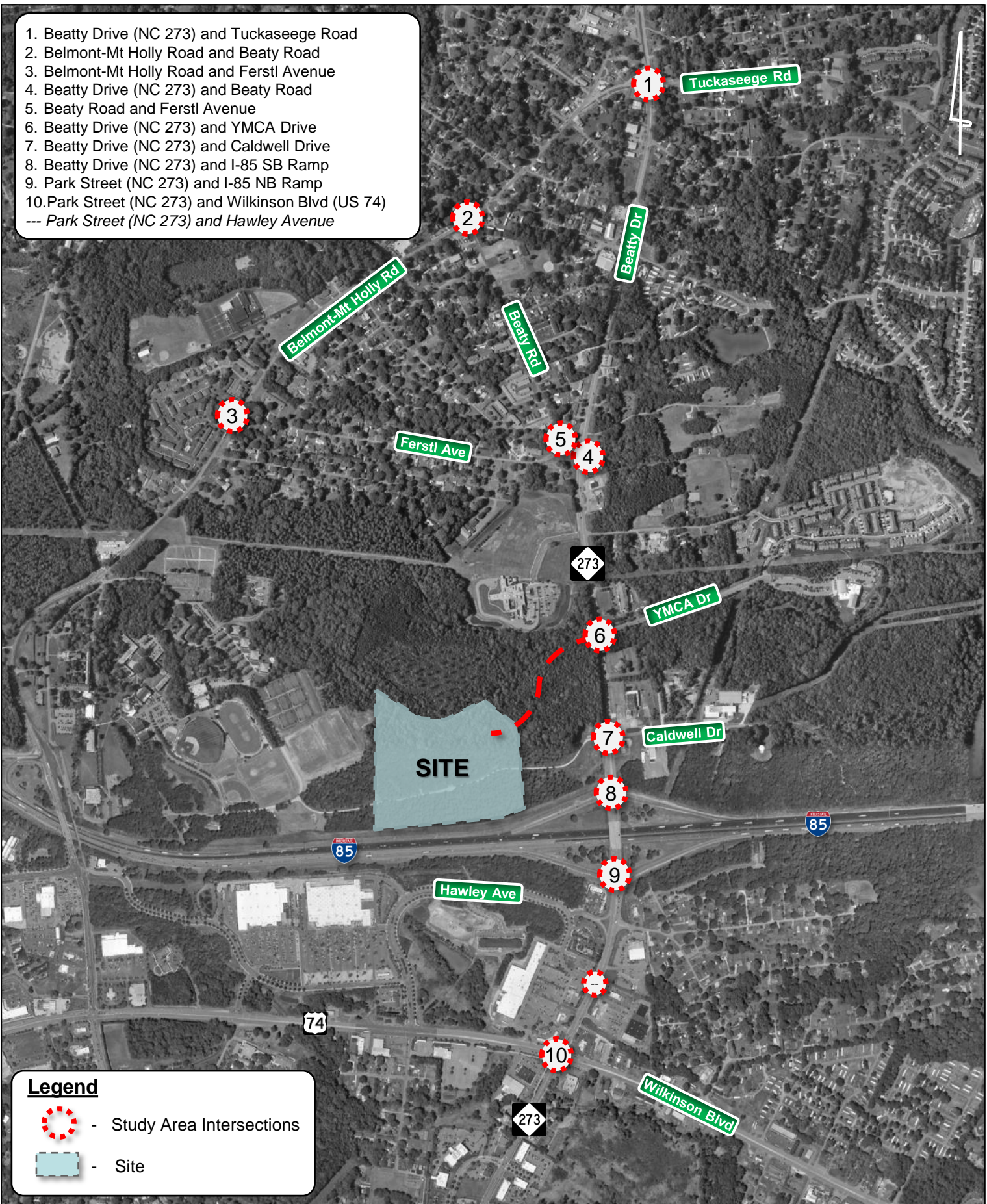
Table 3.1 – AM & PM Intersection Peak Hours

| Intersection | AM Peak Hour | PM Peak Hour |
|---|-------------------|-------------------|
| 1. Beatty Dr (NC 273) and Tuckaseege Rd | 7:15 AM - 8:15 AM | 5:15 PM - 6:15 PM |
| 2. Belmont-Mt. Holly Rd and Beatty Rd | 7:15 AM - 8:15 AM | 5:00 PM - 6:00 PM |
| 3. Belmont-Mt. Holly Rd and Ferstl Ave | 7:15 AM - 8:15 AM | 5:00 PM - 6:00 PM |
| 4. Beatty Dr (NC 273) and Beatty Rd | 7:00AM - 8:00 AM | 5:00 PM - 6:00 PM |
| 5. Beatty Rd and Ferstl Ave | 7:00 AM - 8:00 AM | 4:45 PM - 5:45 PM |
| 6. Beatty Dr (NC 273) and YMCA Dr | 7:00 AM - 8:00 AM | 5:00 PM - 6:00 PM |
| 7. Beatty Dr (NC 273) and Caldwell Dr | 7:00 AM - 8:00 AM | 4:45 PM - 5:45 PM |
| 8. Beatty Dr (NC 273) and I-85 SB Ramp | 7:00 AM - 8:00 AM | 4:45 PM - 5:45 PM |
| 9. Park St (NC 273) and I-85 NB Ramp | 7:00AM - 8:00 AM | 4:45 PM - 5:45 PM |
| 10. Park St (NC 273) and Wilkinson Blvd (US 74) | 7:00 AM - 8:00 AM | 4:45 PM - 5:45 PM |



Volumes were balanced along Beatty Road between Ferstl Avenue and Beatty Drive (NC 273) and along Beatty Drive (NC 273) between YMCA Drive and the I-85 NB Ramp due to the limited number of driveways between these intersections. 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 turning-movement count data is provided in the **Appendix**.

Figure 3.4 shows the 2019 existing AM and PM peak-hour traffic volumes.

1. Beatty Drive (NC 273) and Tuckaseege Road
 2. Belmont-Mt Holly Road and Beatty Road
 3. Belmont-Mt Holly Road and Ferstl Avenue
 4. Beatty Drive (NC 273) and Beatty Road
 5. Beatty Road and Ferstl Avenue
 6. Beatty Drive (NC 273) and YMCA Drive
 7. Beatty Drive (NC 273) and Caldwell Drive
 8. Beatty Drive (NC 273) and I-85 SB Ramp
 9. Park Street (NC 273) and I-85 NB Ramp
 10. Park Street (NC 273) and Wilkinson Blvd (US 74)
- Park Street (NC 273) and Hawley Avenue



Legend

-  - Study Area Intersections
-  - Site



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 Planning & Architecture
 Landscape Architecture
 Civil Engineering
 Surveying
 Charlotte, North Carolina
 704.375.1234



CaroMont Health
 3555 COURT DRIVE
 GASTONIA, NC 28854
**CAROMONT
 REGIONAL
 MEDICAL CENTER-
 BELMONT**

SKETCH PLAN

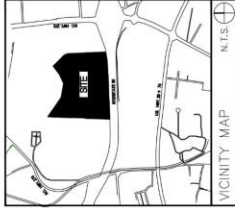
Project No.
 4643
 Issued
 08/07/2019

Revised

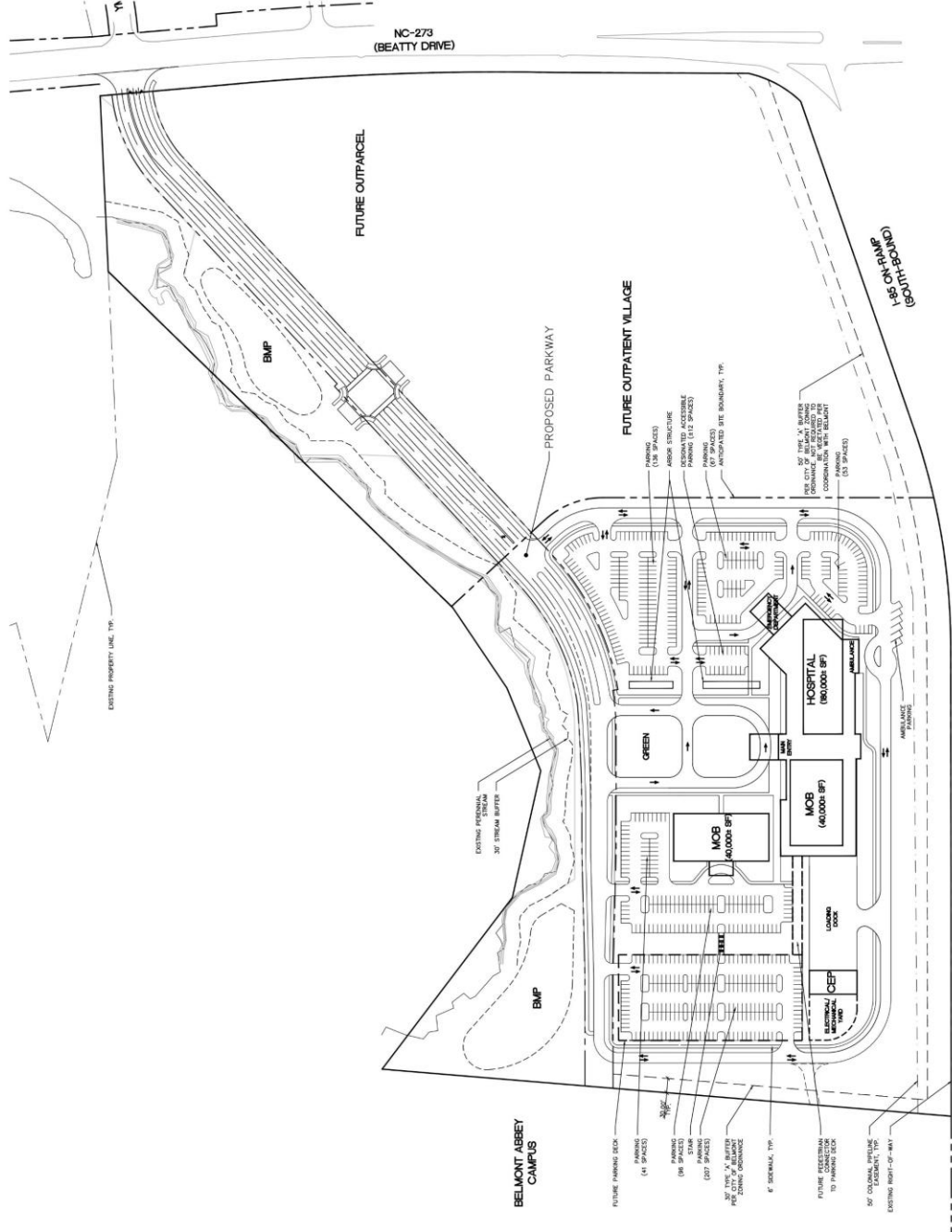


SCALE: 1" = 100'
 0 50 100
SHEET 1



CaroMont Health
 3555 COURT DRIVE
 GASTONIA, NC 28854
 704.375.1234
 © 2019 CaroMont Health



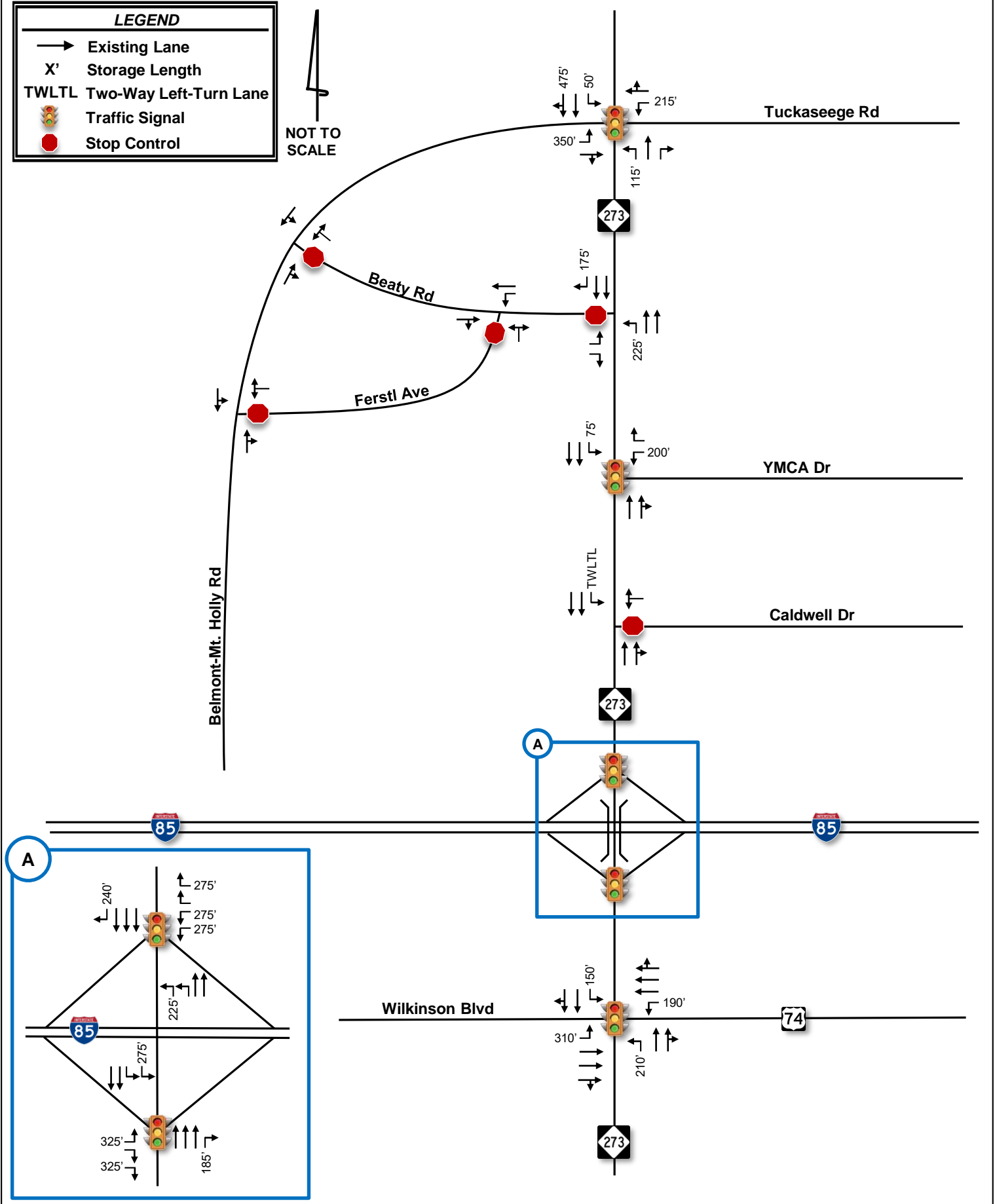
NOTES
 1. THE PROPOSED IMPROVEMENTS SHOWN ON THE SKETCH PLAN ARE CONCEPTUAL IN NATURE AND SHOULD BE USED AS A GUIDE ONLY. THE FINAL DESIGN AND CONSTRUCTION SHALL BE DETERMINED BY THE CITY OF BELMONT AND THE BELMONT FIRE DEPARTMENT. THE CITY OF BELMONT AND THE BELMONT FIRE DEPARTMENT SHALL BE THE AUTHORITY FOR THE FINAL DESIGN AND CONSTRUCTION OF THE PROJECT.
 2. THE SKETCH PLAN IS A PRELIMINARY DESIGN AND SHOULD NOT BE USED FOR CONSTRUCTION. THE SKETCH PLAN IS SUBJECT TO CHANGE WITHOUT NOTICE.
 3. THE DEVELOPMENT OF THE PROPERTY AS SHOWN ON THE SKETCH PLAN IS SUBJECT TO THE CITY OF BELMONT AND THE BELMONT FIRE DEPARTMENT APPROVAL. THE SKETCH PLAN IS SUBJECT TO THE CITY OF BELMONT AND THE BELMONT FIRE DEPARTMENT APPROVAL. THE SKETCH PLAN IS SUBJECT TO THE CITY OF BELMONT AND THE BELMONT FIRE DEPARTMENT APPROVAL.



LEGEND

- Existing Lane
- X' Storage Length
- TWLTL Two-Way Left-Turn Lane
-  Traffic Signal
-  Stop Control

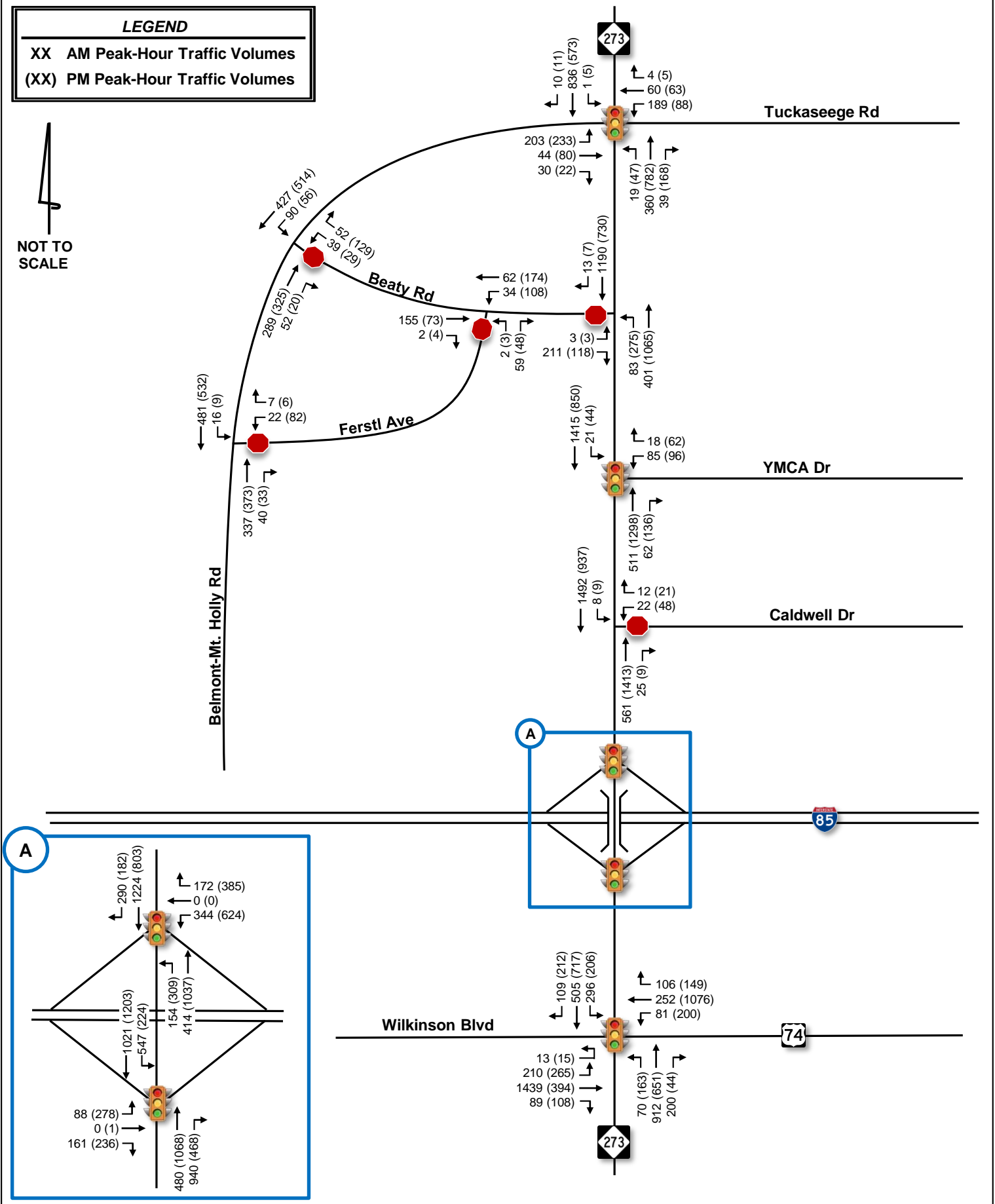
NOT TO SCALE



LEGEND

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

NOT TO SCALE



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 the existing counts were collected (2019) and the expected build-out year (2023) 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.

4.1 HISTORICAL 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 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 one percent (1%) was applied to the 2019 existing peak-hour traffic volumes to calculate base 2023 and 2028 background traffic volumes. This growth rate was determined based on review of historical NCDOT AADT maps, specifically along Beatty Drive/Park Street (NC 273) between 2008 and 2018, in coordination with NCDOT, City of Belmont, City of Mount Holly and GCLMPO, along with consideration of the additional specific traffic being added by the approved developments discussed below.

4.2 APPROVED DEVELOPMENTS

Based on input from the City of Belmont, City of Mount Holly and NCDOT staff, four approved developments that are expected to impact traffic volumes within the study area were included in the background traffic volumes for this TIA. The land uses, intensities, approximate build-out percentages at the time the counts were collected, and required transportation improvements at overlapping study intersections are outlined in **Table 4.1**.

Table 4.1 – Approved Developments

| Development | Land Use/Intensity | % Build-out | TIA Included? | Required Improvements |
|------------------------------------|-----------------------|-------------|---------------|---|
| The Morris (Wayforth) | 325 multifamily units | 0% | Yes | No required improvements at study intersections |
| Beatty Woods (N of Water's Edge) | 110 townhomes | 0% | No | No required improvements at study intersections |
| Fairfield Inn & Suites (Mt. Holly) | 91 rooms | 0% | No | No required improvements at study intersections |
| Home2 Suites (Belmont) | 107 rooms | 0% | No | No required improvements at study intersections |

The Morris development was previously known as Wayforth at Belmont at the time the TIA was performed and is located in the southeast quadrant of the Park Street (NC 273) and Wilkinson Boulevard (US 74) intersection. Site volumes for The Morris (Wayforth) development were obtained from the *Wayforth at Belmont Traffic Impact Analysis* (Kimley-Horn, February 2019). Existing turning-movement splits were used to carry and assign the site volumes appropriately at study area intersections that were not included in the approved study. Site traffic volume figures from the approved study is included in the **Appendix**.

Trip generation analyses were performed for the approved Beatty Woods, Fairfield Inn & Suites, and Home2 Suites developments using the trip generation rates published in *Trip Generation* (Institute of Transportation Engineers, Tenth Edition, 2017) for all land uses. Site trips associated with these developments were assigned to the study area intersections based on the existing turning-movement splits. Based on information provided by City of Mount Holly staff, the Beatty Woods development is located north of the Water's Edge neighborhood with access to both YMCA Drive and Pearl Beatty Road. Projected site traffic was assigned to both of these connections even though Pearl Beatty Road was not included as a study intersection. Some of the Beatty Woods site traffic, particularly exiting southbound traffic, would likely utilize the signalized access at YMCA Drive to access Beatty Drive (NC 273). Mount Holly's Fairfield Inn & Suites is being constructed across the street from the proposed CaroMont site, east of Beatty Drive (NC 273) between Caldwell Drive and YMCA Drive. Based on information provided by Mount Holly staff, this hotel was assumed to have access to both Caldwell Drive and YMCA Drive. Belmont's Home2Suites is being constructed west of Chick-fil-A between Hawley Avenue and I-85. Hawley Avenue provides signalized access to both Park Street (NC 273) and Wilkinson Boulevard (US 74). Projected site traffic was assigned appropriately given both connections. Trip generation calculations and site trip assignments for these developments are included in the **Appendix**.

Figures 4.1 and **4.2** show the specific AM and PM peak-hour approved development trips, respectively. **Figures 4.3** and **4.4** show the projected 2023 background AM and PM peak-hour traffic volumes, respectively, that include the historical growth traffic and approved development trips.

4.3 PLANNED TRANSPORTATION PROJECTS

Based on review of the adopted transportation plans for the area, ten future transportation projects have been identified within the study area, four of which are funded through construction based on current planning documents:

1. Beatty Drive (NC 273) Widening (**U-3633**) – Under Construction
2. Wilkinson Boulevard (US 74) Signal Improvements (**U-6038**) – Under Construction
3. Wilkinson Boulevard (US 74) and Park Street (NC 273) Intersection Improvements (**U-5959**) – Funded
4. I-85 Widening (**I-5719**) – Funded
5. South Gateway Connector
6. Beatty Drive (NC 273) Improvements
7. Beatty Drive (NC 273) and Beatty Road/Ferstl Avenue Intersection Improvements
8. Caldwell Drive Multi-Use Path
9. Beatty Drive (NC 273) and YMCA Drive Intersection Crossing Improvements
10. Beatty Drive (NC 273) Bike Lanes

Note that only project numbers 1 and 2 above (U-3633 and U-6038) were included in all future-year analyses included in this TIA as they are both under construction and assumed to be completed prior to build-out of the CaroMont Regional Medical Center in 2023. Though funded for construction, project number 3 (U-5959) was not included in the operations analyses since the preferred intersection configuration has not yet been identified at the time of scoping for this TIA. Project number 4 (I-5719) is not expected to be completed prior to 2023; therefore, was only included in 2028 analyses. The remaining identified projects above were not included since they are currently unfunded.

NCDOT TIP Project No. U-3633 is currently under construction to widen Beatty Drive/S Main Street (NC 273) to a four-lane divided roadway between Tuckaseege Road (where Beatty Drive turns into S Main Street) and A & E Drive (where S Main Street turns into Highland Street south of downtown Mount Holly). Specific to the study area included in this TIA, the following laneage improvements are planned at the intersection of Beatty Drive (NC 273) and Tuckaseege Road based on April 2017 design plans provided by NCDOT:

- Restriping the existing northbound right-turn lane to a shared through/right lane
- Exclusive westbound left-turn lane along Tuckaseege Road
- Exclusive eastbound left-turn lane along Tuckaseege Road

Based on the site visit performed for this study, the eastbound and westbound left-turn lanes along Tuckaseege Road have already been constructed and therefore were included in the existing conditions analysis discussed in **Section 6.0**. Additionally, as part of TIP Project No. U-3633, the unsignalized eastbound left-turn movement previously allowed from S Main Street to Beatty Drive (NC 273) north of Tuckaseege Road has been removed. Instead, drivers that previously utilized this movement have been redirected to turn left at the Tuckaseege Road traffic signal. This portion of TIP Project No. U-3633 had already been completed when traffic counts were collected, and therefore was reflected in the existing traffic counts. U-3633 design plans for this intersection are included in the **Appendix**.

NCDOT TIP project U-6038 is currently under construction to improve mobility along Wilkinson Boulevard (US 74) by implementing a coordinated signal system between Catawba Street (NC 7) and Wesleyan Drive that will dynamically adjust signal timing based on traffic demand. Based on input from NCDOT at the TIA Scoping Meeting, U-6038 is scheduled for completion in Spring 2020. This project was first identified through the Build A Better Boulevard initiative.

NCDOT TIP Project No. U-5959 is currently being designed to improve the intersection of Wilkinson Boulevard (US 74) and Park Street (NC 273). Based on the current NCDOT STIP as of April 2020, U-5959 is scheduled for construction in FY 2021 through State Highway Trust funds. However, based on coordination at the TIA Scoping Meeting, NCDOT indicated that the preferred intersection configuration and specific improvements have not yet been determined; therefore, improvements associated with U-5959 were not included in the analysis of this TIA.

NCDOT TIP Project No. I-5719 is currently being designed to widen I-85 to eight lanes from US 321 to Beatty Drive/Park Street (NC 273) along with potential interchange improvements at each interchange between Exit 17 and Exit 27. Based on [NCDOT's project information page](#) as of April 2020, this project is scheduled for construction in FY 2024-2028; therefore, for the purposes of this TIA as discussed with City and NCDOT staff, this project was included in the 2028 build-out +5 analysis scenario (and was not included in the 2023 analyses). Based on [NCDOT's project information page](#), three potential interchange alternatives are under consideration at Exit 27 (Beatty Drive/Park Street (NC 273)):

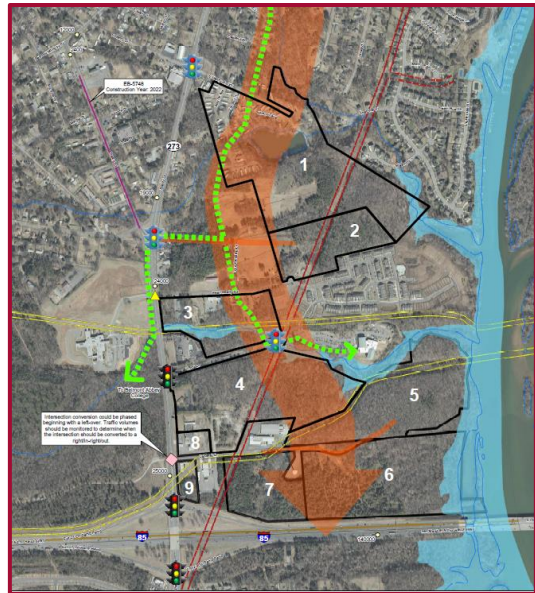
- Option 1 – Improve Existing Interchange
- Option 2 – Partial Cloverleaf Interchange w/ loop in NW quadrant
- Option 3 – Diverging Diamond Interchange (DDI)

Based on coordination with NCDOT at the TIA Scoping Meeting, the preferred alternative has been narrowed down to Options 1 and 3 only; therefore, Options 1 and 3 were evaluated under 2028 analyses for the purposes of this TIA. Note that Option 1 was included in the 2028 build-out +5 scenario that included the full study area. Evaluation of Option 3 only included the study

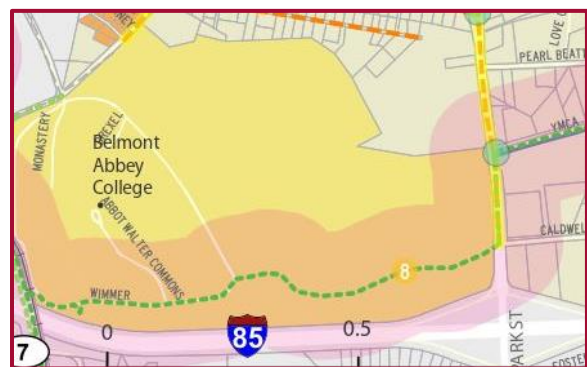
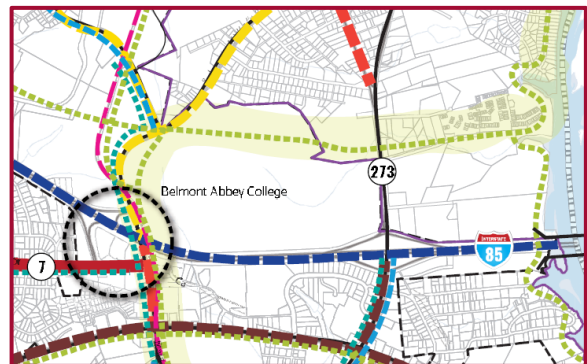
intersections along Beatty Drive/Park Street (NC 273) between the I-85 NB Ramp and YMCA Drive. Concepts for all three options provided by NCDOT are included in the **Appendix**.

Note that based on the provided concepts, the DDI alternative (Option 3) is shown to impact the Caldwell Drive intersection, restricting it to right-in/right-out operations only. Therefore, under the 2028 build-out +5 scenario with the DDI configuration, volumes turning left into and out of Caldwell Drive were redistributed to the Beatty Drive (NC 273)/YMCA Drive signalized intersection via the connection between YMCA Drive and Caldwell Drive planned to be constructed as part of the Fairfield Inn & Suites approved development discussed in **Section 4.2**.

The South Gateway Connector has been identified in multiple planning documents as a new boulevard and multi-use path recommended to be constructed parallel to Beatty Drive (NC 273) between Caldwell Drive and Tuckasee Road. The intent of the boulevard is to serve and connect the future development potential within Mount Holly's South Gateway area between Beatty Drive (NC 273) and the Catawba River, and preserving the Beatty Drive (NC 273) corridor by providing a direct route amongst development parcels without being forced to use Beatty Drive (NC 273) to travel between any of these parcels. An exhibit from the *South Gateway Alignment Study* is shown to the right.



The Caldwell Drive Multi-use Path has been identified through multiple planning documents with a conceptual east-west alignment shown to traverse the proposed CaroMont site. Included in these documents are recommendations for the multi-use path to cross Beatty Drive (NC 273) at either Caldwell Drive or YMCA Drive. At either location, especially at the unsignalized location of Caldwell Drive, bicycle improvements are recommended to ensure safe crossing. Additionally, the specific alignment of this multi-use path is shown to traverse the site through different locations throughout the planning documents. For example, *Belmont's Comprehensive Land Use Plan* (shown in the middle-right image) indicates the multi-use path along the northern edge of the proposed site, whereas *Mount Holly's Comprehensive Pedestrian Plan* (shown in the lower-right image) indicates the path along the southern edge of the proposed site. The green-dotted line labeled as "8" represents the proposed Caldwell Drive Multi-use Path and is shown to connect



Belmont Abbey College with Beatty Drive (NC 273) through the proposed site. The specific multi-use path alignment and cross-section should be coordinated with Carolina Thread Trail, GCLMPO, City of Belmont and City of Mount Holly staff. It is important that the applicant coordinate with these agencies early in the site planning phase to determine the appropriate alignment and cross-section of this multi-use path.

Below is additional information found in the adopted transportation planning documents relative to each of the identified projects:

- **NC 273 Widening (U-3633)**
 - Under Construction
 - Widen Beatty Dr/S Main St (NC 273) to a four-lane divided roadway between Tuckaseege Road (at Beatty Dr) to A & E Dr (at Highland St)
 - Completion expected June 2020 (based on NCDOT at the TIA Scoping Meeting)
- **Wilkinson Boulevard (US 74) Signal Improvements (U-6038)**
 - Under Construction
 - Implement coordinated signal system along Wilkinson Boulevard (US 74) between Catawba Street (NC 7) and Wesleyan Drive
 - Completion expected Spring 2020 (based on NCDOT at the TIA Scoping Meeting)
- **Wilkinson Blvd (US 74) and Park St (NC 273) Intersection Improvements (U-5959)**
 - Based on projected funding, short-term improvements expected to be minor capacity/safety improvements, while long-term vision is to grade-separate this intersection
 - Construction - FY 2021 (based on current NCDOT STIP as of April 2020)
 - **Based on NCDOT at the TIA Scoping Meeting, intersection improvements have not yet been identified; therefore, future U-5959 improvements at this intersection will not be included in the scope of this TIA.**
- **I-85 Widening (I-5719)**
 - Widen I-85 to eight lanes between US 321 and Beatty Dr (NC 273) along w/ interchange improvements from Exit 17 to Exit 27
 - Construct interchange improvements at Exit 27 – I-85/Beatty Dr (NC 273)
 - Option 1 - Improve Existing,
 - Option 2 - Partial Cloverleaf with loop in NW quadrant (Removed)
 - Option 3 - DDI
 - Construction – 2024-2028 (Design Build) -based on [NCDOT's project information page](#)
 - I-5719 will not be included in 2019 and 2023 analyses; will be included in 2028 analysis
 - **Based on discussion at TIA Scoping Meeting, Options 1 and 3 will both be evaluated in 2028 analysis.**
- **South Gateway Connector**
 - New boulevard connecting Caldwell Dr and Tuckaseege Rd parallel to Beatty Dr (NC 273) (includes multi-use path)
 - Identified in:
 - South Gateway Alignment Study (2019)
 - Bike Mount Holly (2019)
 - Mt. Holly Strategic Vision Plan Update (2018)
 - GCLMPO Comprehensive Transportation Plan (CTP)

- **Beatty Drive (NC 273) Improvements**
 - From CTP – Identified as needing improvements between I-85 to Tuckaseege Rd
 - From South Gateway Alignment Study – Widen to 6-LN section from I-85 to Beatty Rd
 - Identified in:
 - South Gateway Alignment Study (2019)
 - GCLMPO CTP

- **Beatty Drive (NC 273) and Beatty Road/Ferstl Avenue Intersection Improvements**
 - From MTP – Turn lanes, crosswalks, ped heads on each approach
 - From South Gateway Alignment Study – Signal and 4th leg to the east (connect to South Gateway Connector)
 - Identified in:
 - South Gateway Alignment Study (2019)
 - GCLMPO 2045 Metropolitan Transportation Plan (MTP)

- **Caldwell Drive Multi-Use Path**
 - Multi-use path along Caldwell Drive to cross Beatty Drive (NC 273) and connect to Belmont Abbey College; also includes connection to Stowe Family YMCA
 - Should include improvements at Beatty Drive (NC 273) intersection for safe bicycle crossing
 - Shown to cross Beatty Drive (NC 273) at YMCA Drive instead of Caldwell Drive in Belmont’s plans and Carolina Thread Trail
 - **Alignment shown through proposed site; Applicant to coordinate with Carolina Thread Trail, GCLMPO, City of Belmont and City of Mount Holly to determine appropriate alignment and cross-section**
 - Identified in:
 - Belmont Comprehensive Land Use Plan (2018)
 - Belmont Bicycle Master Plan (2012)
 - Belmont Pedestrian Master Plan (2009)
 - Bike Mount Holly (2019)
 - South Gateway Alignment Study (2019)
 - Mount Holly Comprehensive Pedestrian Plan (2013)
 - GCLMPO CTP
 - Carolina Thread Trail

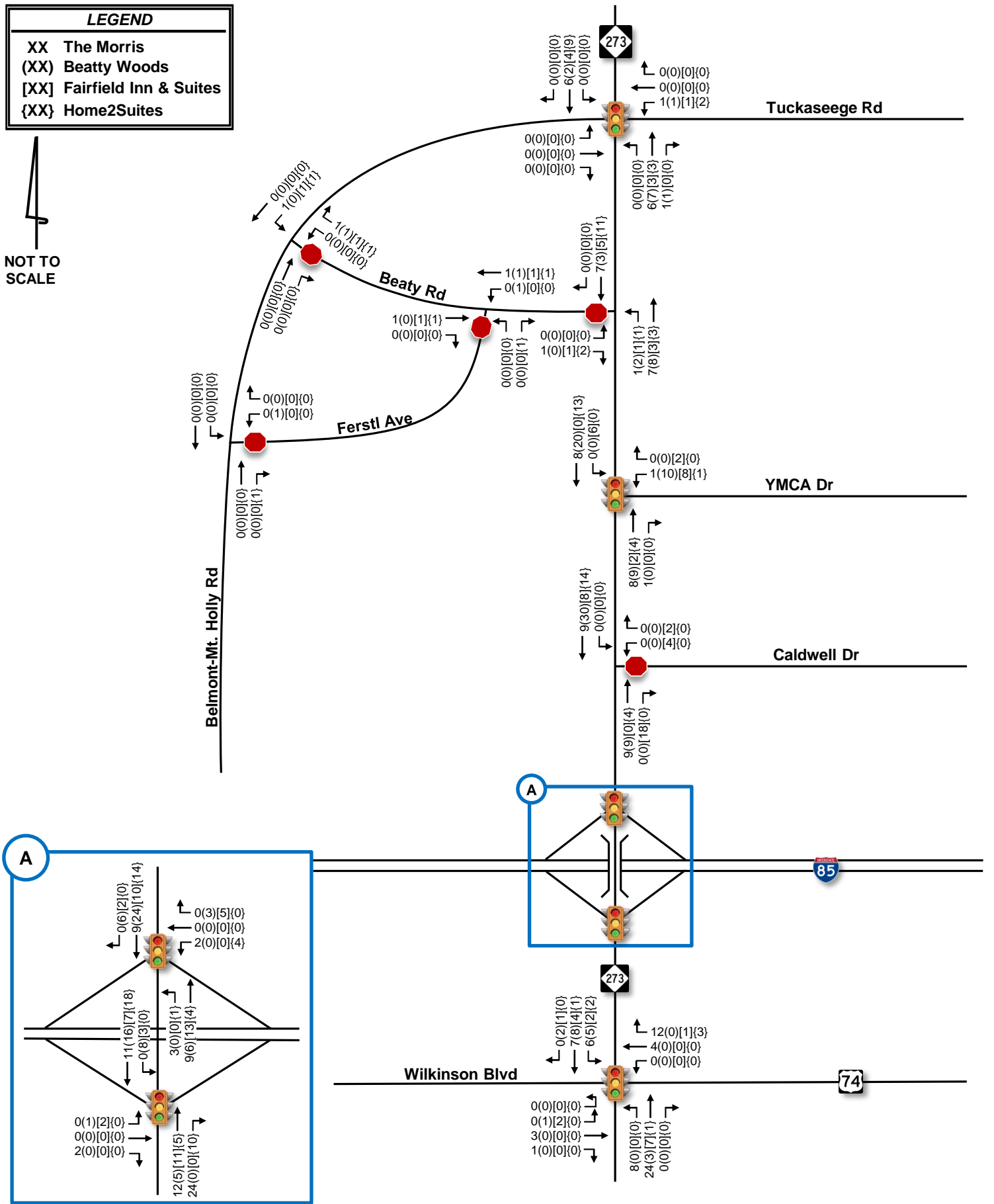
- **NC 273 and YMCA Drive Intersection Crossing Improvements**
 - Sidewalk and/or crosswalk improvements to this intersection
 - Identified in Mount Holly Comprehensive Pedestrian Plan (2013)

- **NC 273 Bike Lanes**
 - Recommended bike lanes along Beatty Drive (NC 273) north of Caldwell Drive
 - Identified in Bike Mount Holly (2019)

LEGEND

- XX The Morris
- (XX) Beatty Woods
- [XX] Fairfield Inn & Suites
- {XX} Home2Suites

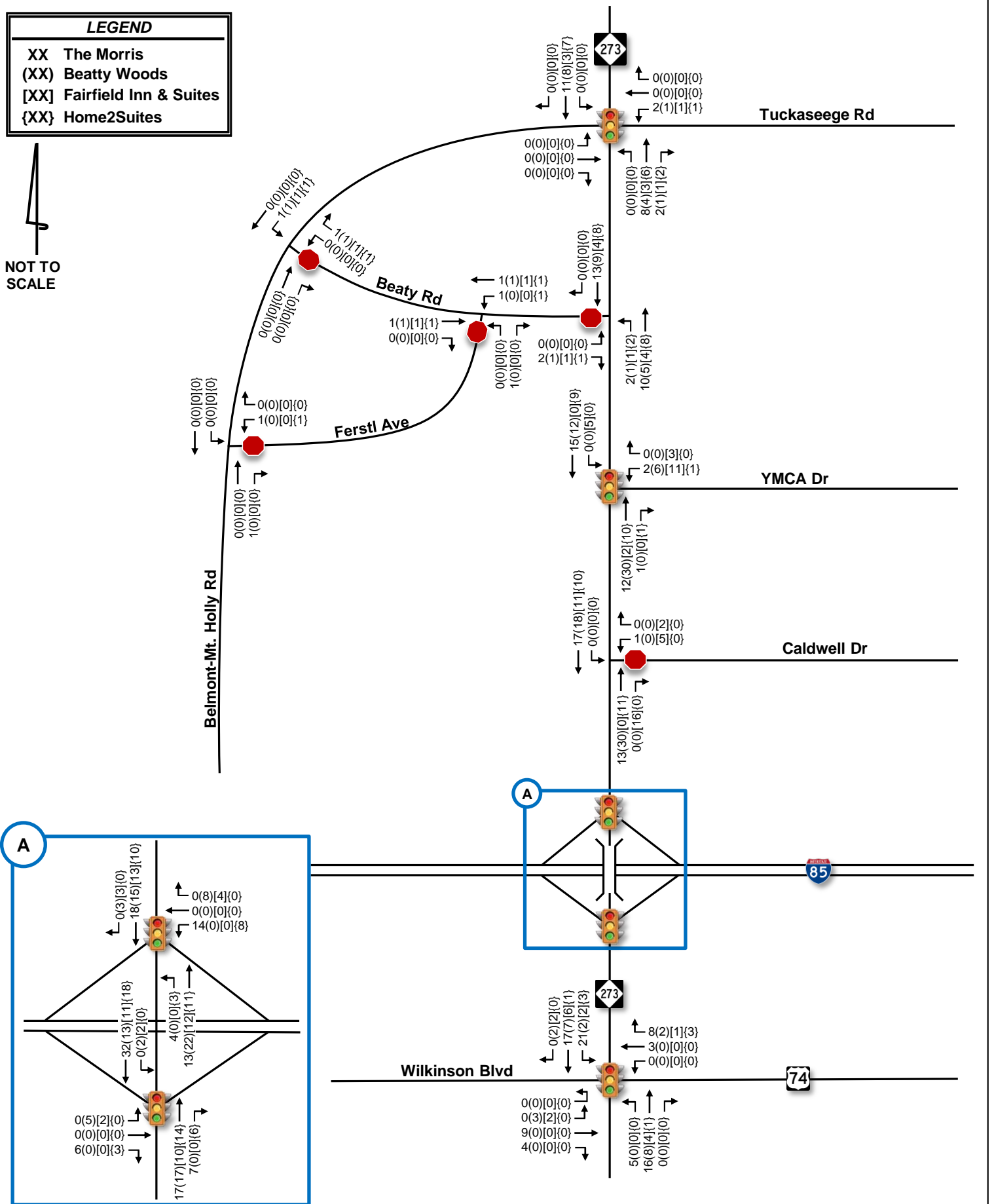
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LEGEND

- XX The Morris
- (XX) Beatty Woods
- [XX] Fairfield Inn & Suites
- {XX} Home2Suites

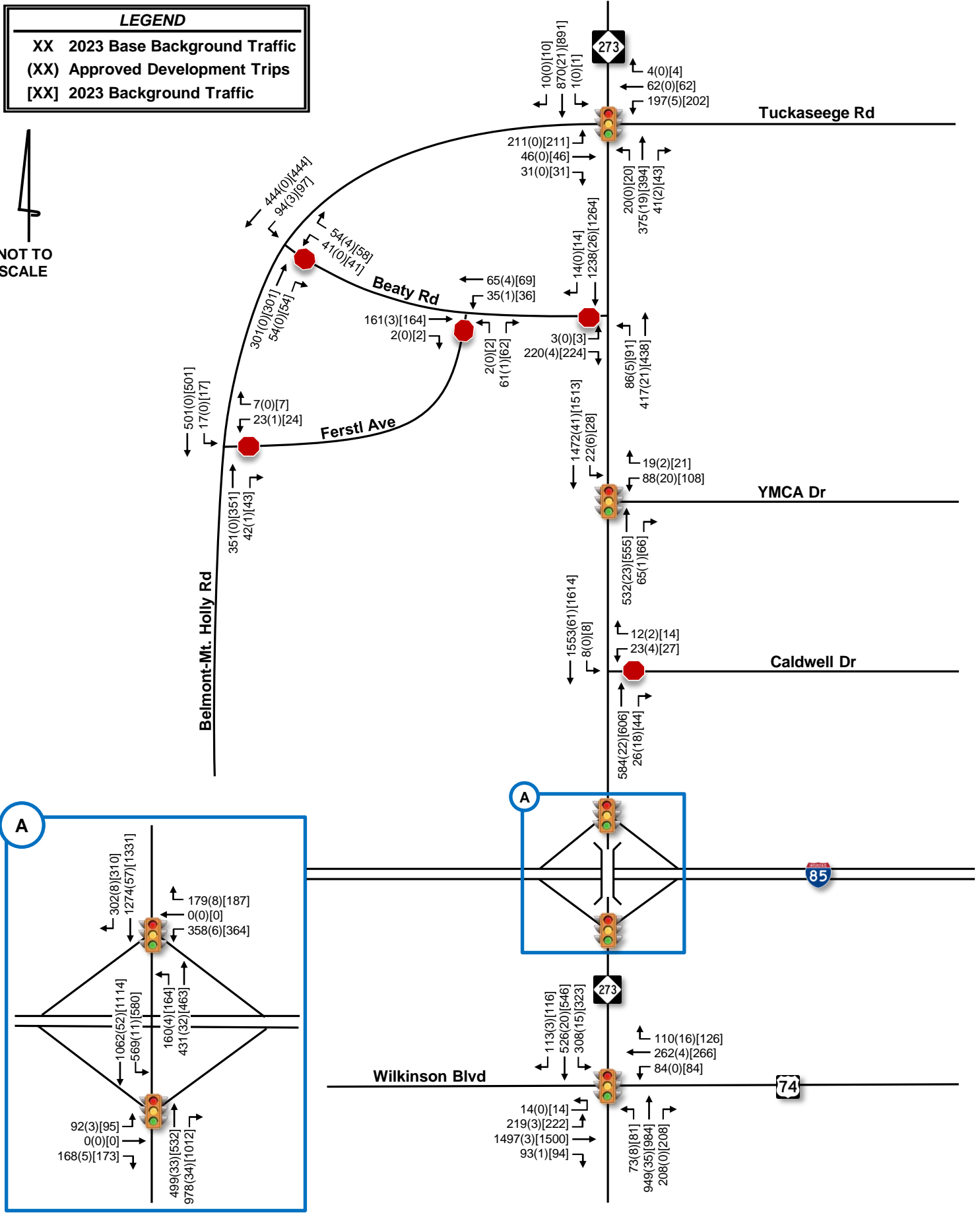
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LEGEND

- XX 2023 Base Background Traffic
- (XX) Approved Development Trips
- [XX] 2023 Background Traffic

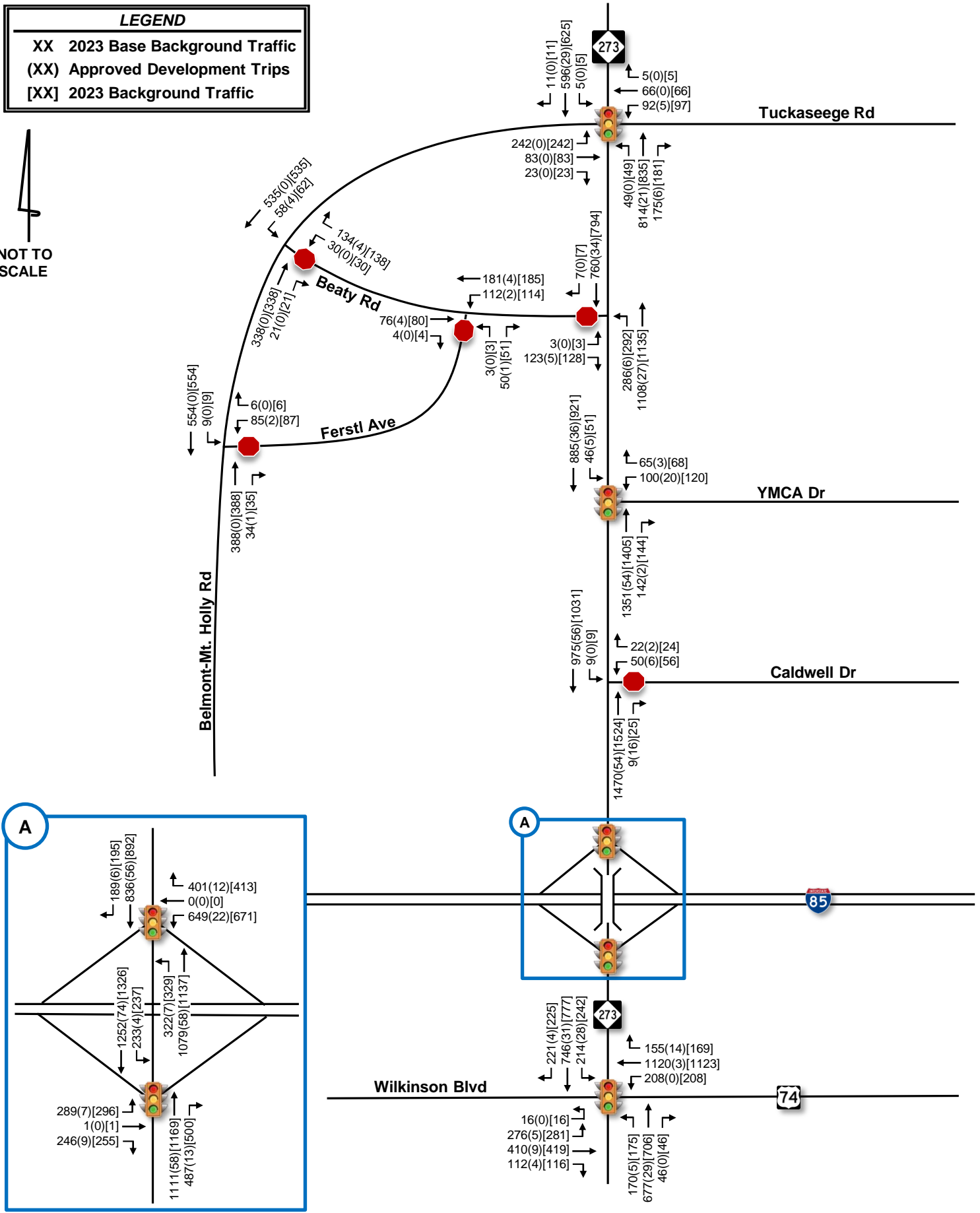
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LEGEND

- XX 2023 Base Background Traffic
- (XX) Approved Development Trips
- [XX] 2023 Background Traffic

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 one full-movement connection to Beatty Drive (NC 273) at YMCA Drive, creating the fourth leg of the existing signalized, tee-intersection. A secondary emergency vehicle access is also proposed to provide gate-controlled access to Belmont Abbey College to the west; however, this access was not evaluated as part of this TIA.

5.2 TRAFFIC GENERATION

The traffic generation potential of the proposed development was determined using the trip generation rates published in *Trip Generation* (Institute of Transportation Engineers, Tenth Edition, 2017) for both land uses.

Based on the site plan provided by the applicant, the proposed development is currently envisioned to include the following land uses and intensities for the purposes of this TIA:

- 220,000 square feet of hospital space
- 80,000 square feet of medical office building space

Table 5.1 summarizes the projected trip generation for the proposed development. During a typical weekday, the proposed development has the potential to generate 511 and 562 net new external trips during the AM and PM peak hours, respectively.

| Land Use | Intensity | | Daily | AM Peak Hour | | | PM Peak Hour | | |
|-------------------------------|-----------|----|--------------|--------------|------------|------------|--------------|------------|------------|
| | | | | Total | In | Out | Total | In | Out |
| Medical Office Building | 80,000 | SF | 2,784 | 222 | 173 | 49 | 277 | 78 | 199 |
| Hospital | 220,000 | SF | 4,017 | 289 | 197 | 92 | 285 | 91 | 194 |
| Net New External Trips | | | 6,801 | 511 | 370 | 141 | 562 | 169 | 393 |

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 use and population densities in the area. The following site traffic distribution was reviewed and approved as part of the MOU by the City of Belmont, City of Mount Holly, NCDOT, GCLMPO and the applicant:

- 15% to/from the north along Beatty Drive/S Main Street (NC 273)
- 15% to/from the south along Park Street (NC 273)
- 5% to/from the east along Wilkinson Boulevard (US 74)
- 5% to/from the west along Wilkinson Boulevard (US 74)
- 15% to/from the south along I-85
- 20% to/from the north along I-85

- 5% to/from the east along YMCA Drive
- 10% to/from the south/west along Belmont-Mt. Holly Road
- 5% to/from the north/west along Belmont-Mt. Holly Road
- 5% to/from the north/east along Tuckaseege Road

The overall site traffic distribution and assignment is shown in **Figure 5.1**.

5.4 2023 BUILD-OUT TRAFFIC VOLUMES

The 2023 build-out traffic volumes include the assignment of the projected site traffic generation added to the 2023 background traffic volumes. **Figures 5.2** and **5.3** show the projected 2023 build-out traffic volumes for the AM and PM peak hours, respectively.

5.5 2028 BUILD-OUT +5 TRAFFIC VOLUMES

As required by the *City of Belmont Land Development Code – Section 16.14 Traffic Impact Analysis*, an analysis scenario of five years after the build-out year was performed. The 2028 build-out +5 traffic volumes include assignment of the proposed site traffic generation along with the approved development traffic added to the 2028 base background traffic volumes.

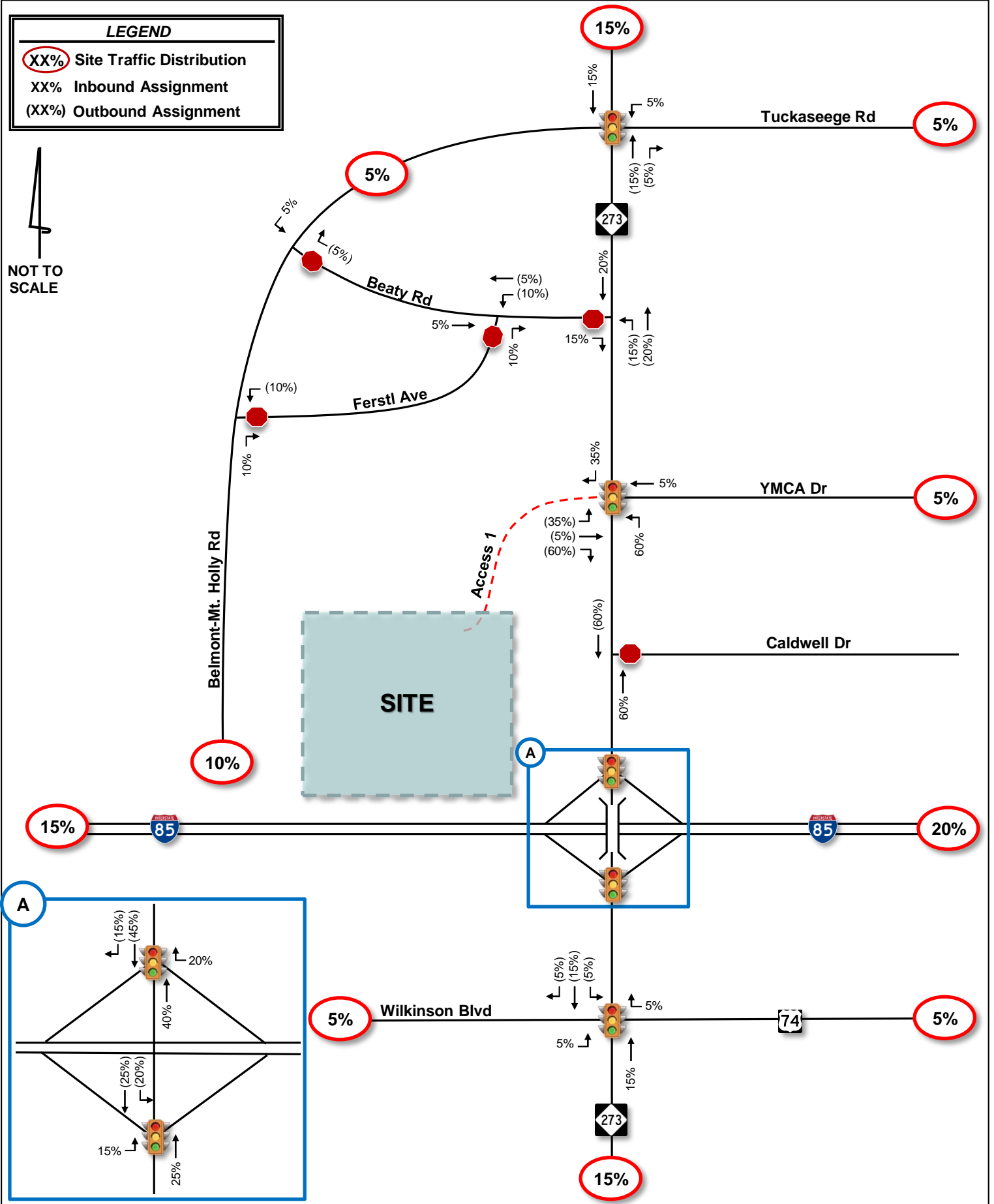
As discussed in **Section 4.3**, two I-85 interchange alternatives were evaluated as part of NCDOT TIP Project No. I-5719 under 2028 build-out +5 conditions. Volumes were manually reassigned to reflect the DDI alternative in the vicinity of the I-85 interchange. The projected 2028 AM and PM peak-hour build-out +5 volumes for both alternatives are shown on **Figure 5.4**.

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

LEGEND

- XX% Site Traffic Distribution
- XX% Inbound Assignment
- (XX%) Outbound Assignment

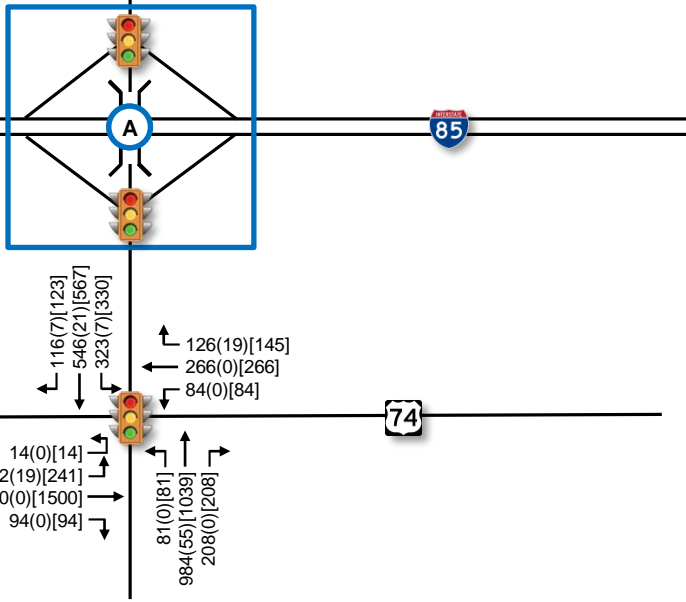
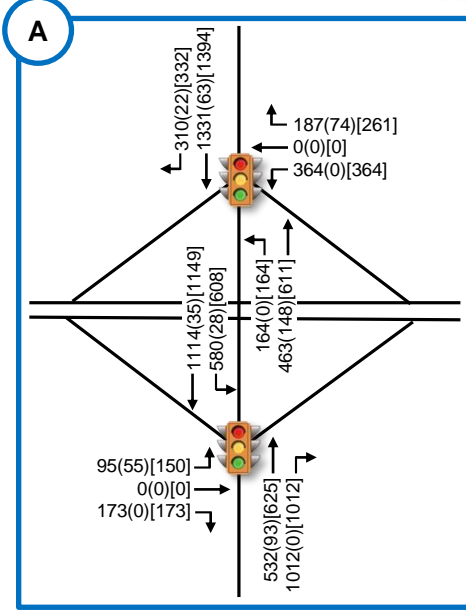
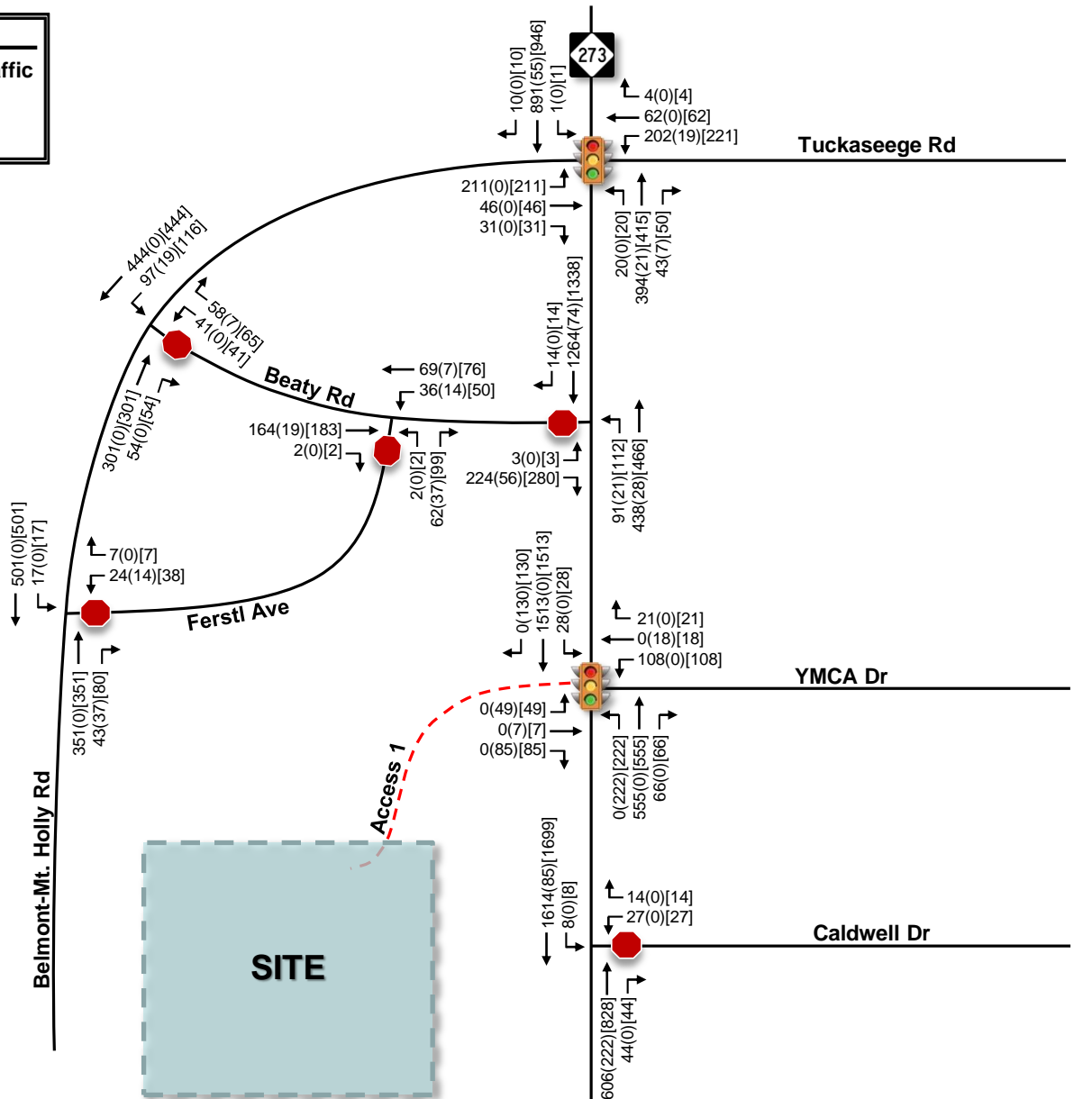
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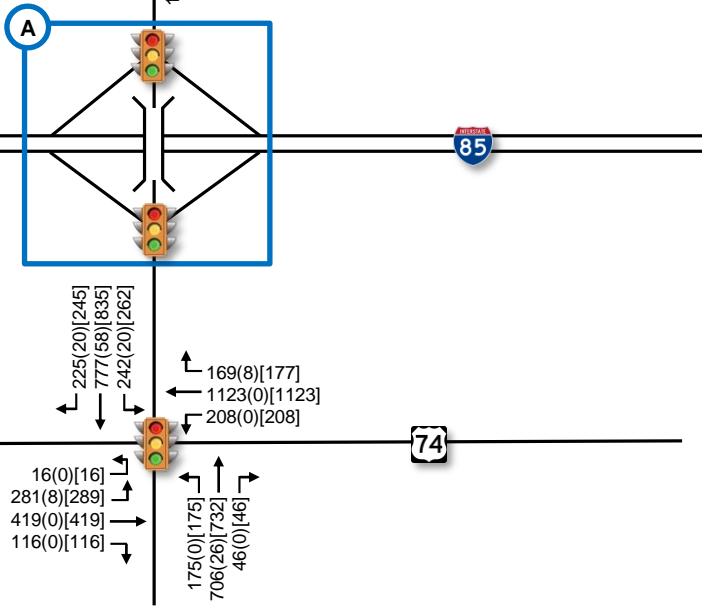
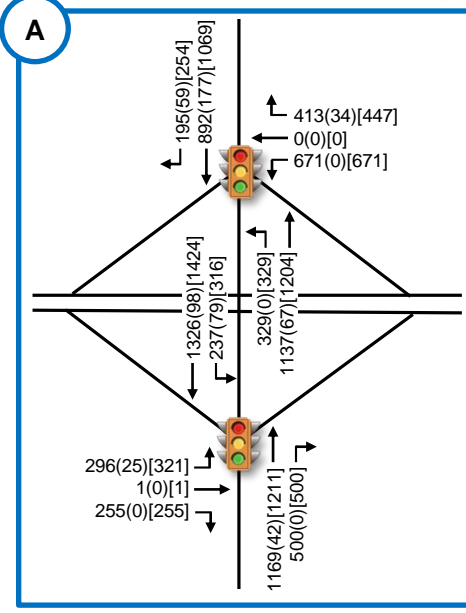
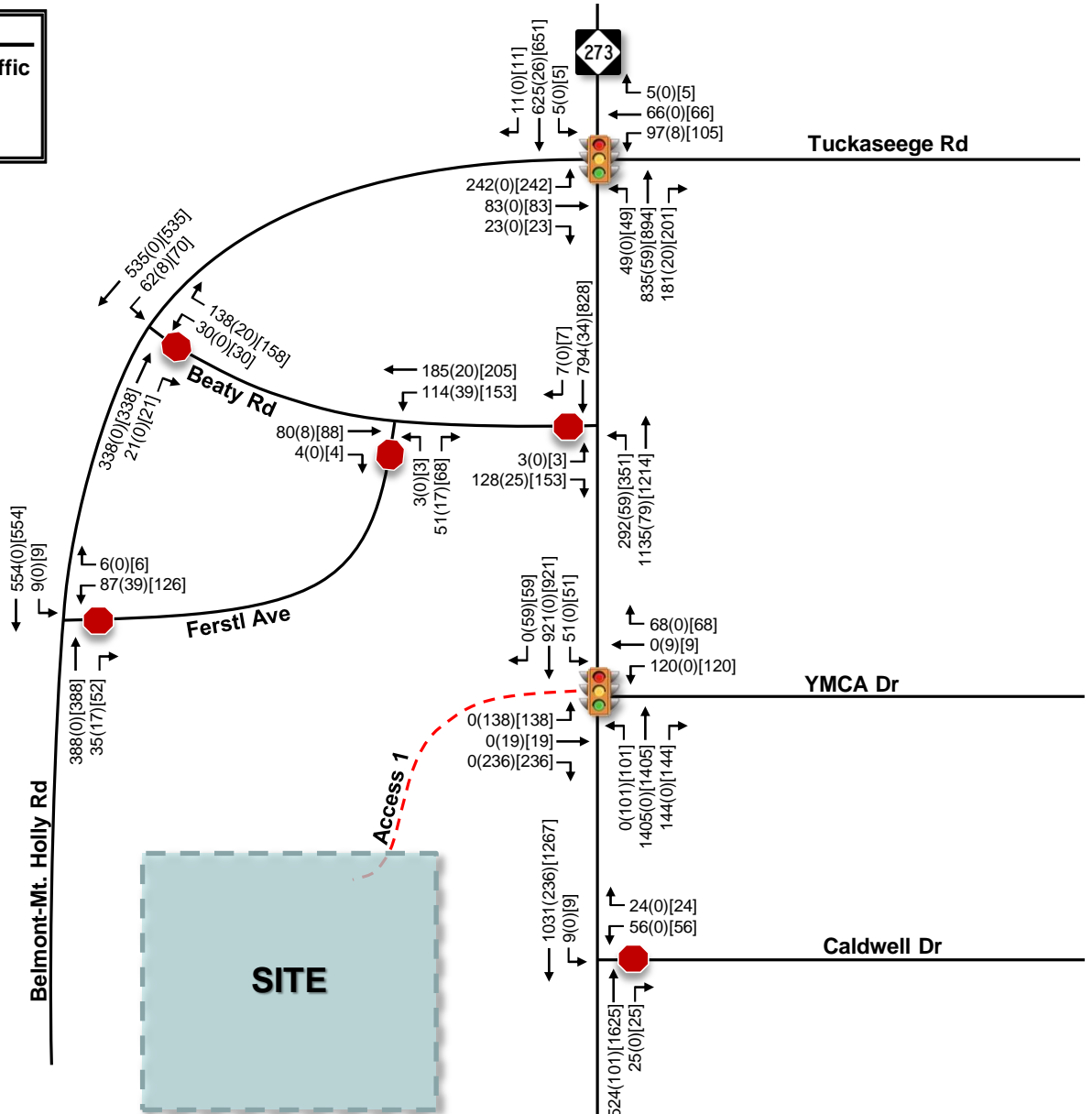
- XX Background Traffic
- (XX) Site Trips
- [XX] Build-out Traffic

NOT TO SCALE



LEGEND

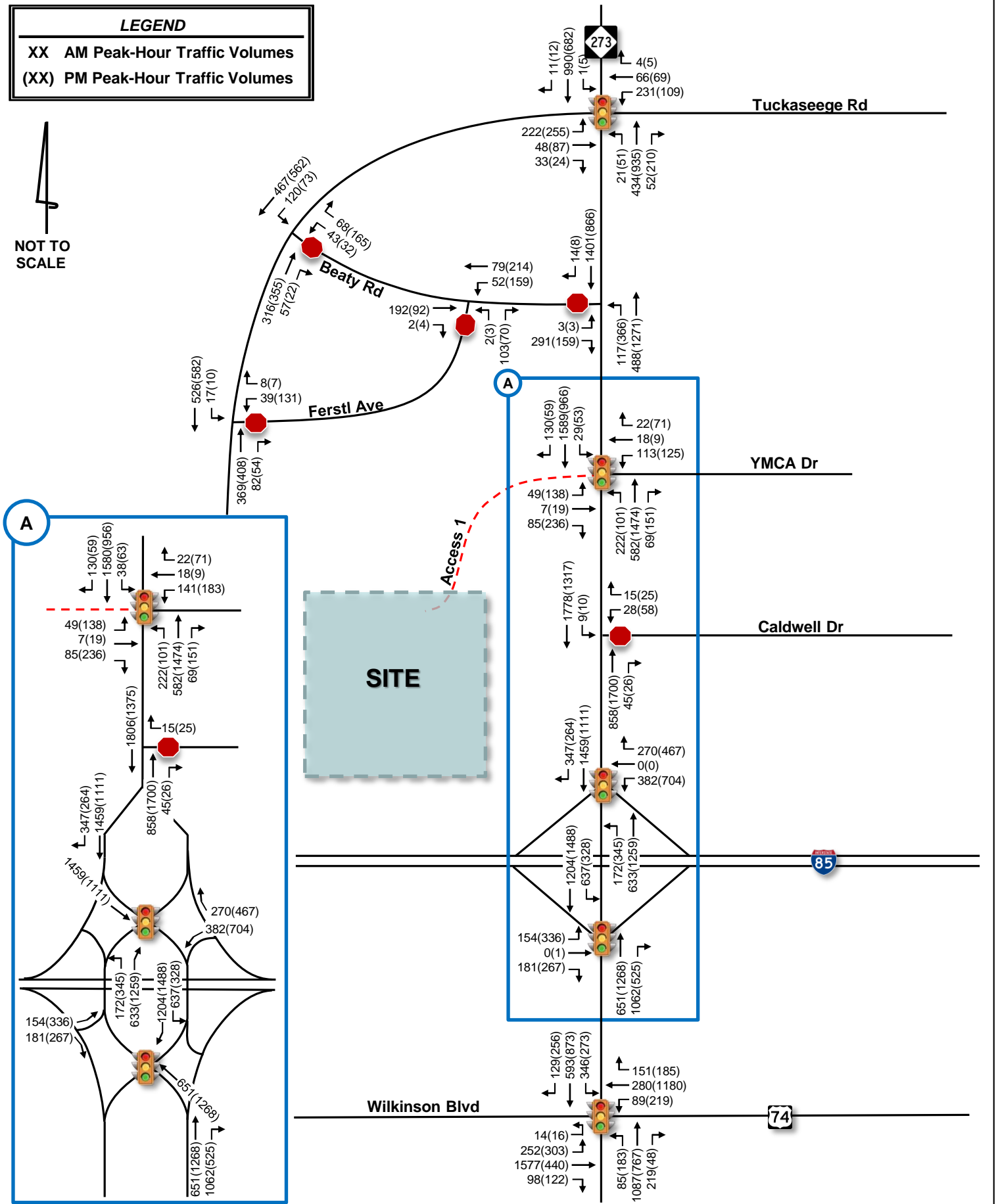
- XX Background Traffic
- (XX) Site Trips
- [XX] Build-out Traffic



LEGEND

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

NOT TO SCALE



6.0 Capacity Analysis

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

- 2019 Existing Conditions
- 2023 Background Conditions
- 2023 Build-out Conditions
- 2028 Build-out Conditions + 5 years

Capacity analyses were performed for the AM and PM peak hours using the Synchro Version 10 software to determine the operating characteristics at the signalized and stop-controlled intersections of 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.

The *Highway Capacity Manual (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 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 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-A and **6.0-B** list the LOS control delay thresholds published in the HCM for unsignalized and signalized intersections, respectively, as well as the unsignalized operational descriptions assumed herein.

| Table 6.0-A Vehicular LOS Control Delay Thresholds for Unsignalized Intersections | | |
|---|--|--------------------|
| Level-of-Service | Average Control Delay per Vehicle [sec/veh] | |
| A | ≤ 10 | Short Delays |
| B | > 10 – 15 | |
| C | > 15 – 25 | |
| D | > 25 – 35 | Moderate Delays |
| E | > 35 – 50 | |
| F | > 50 | Long Delays |

| Table 6.0-B Vehicular LOS Control Delay Thresholds for Signalized Intersections | |
|---|--|
| Level-of-Service | Average Control Delay per Vehicle [sec/veh] |
| A | ≤ 10 |
| B | > 10 – 20 |
| C | > 20 – 35 |
| D | > 35 – 55 |
| E | > 55 – 80 |
| F | > 80 |

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

- Beatty Drive (NC 273) and Tuckaseege Road (uncoordinated)
- Beatty Drive (NC 273) and YMCA Drive (US 29-74/NC 273 Closed Loop Signal System)
- Beatty Drive (NC 273) and I-85 SB Ramp (US 29-74/NC 273 Closed Loop Signal System)
- Park Street (NC 273) and I-85 NB Ramp (US 29-74/NC 273 Closed Loop Signal System)
- Park Street (NC 273) and Hawley Avenue (US 29-74/NC 273 Closed Loop Signal System)
- Park Street (NC 273) and Wilkinson Boulevard (US 74) (Belmont Signal System)

Based on the provided signal plans, the intersections of Beatty Drive/Park Road (NC 273) with YMCA Drive, I-85 SB Ramp, I-85 NB Ramp, and Hawley Avenue are part of the US 29-74/NC 273 Closed Loop Signal System. Therefore, the cycle lengths for these intersections were optimized as a system given the timing inputs in the existing conditions network and in accordance with NCDOT *Congestion Management Capacity Analysis Guidelines*.

Per NCDOT *Congestion Management Capacity Analysis Guidelines*, protected only left-turn phasing was used for analysis of future operations where protected/permitted left-turn phasing exists. With the change from protected/permitted to protected phasing at the intersection of Beatty Drive (NC 273) and YMCA Drive, the splits were optimized at this intersection only under 2023 background conditions with the cycle lengths and offsets for the signal system maintained. With the addition of the proposed site access to form the fourth leg of the YMCA Drive signal under 2023 build-out conditions, a protected northbound left-turn movement was assumed to be incorporated

into the signal which increased the number of phases at the signalized intersection from three in existing/background conditions to four in build-out conditions. This increased the minimum cycle length from 90 seconds (with three phases) to 120 seconds (with four or more phases) to comply with NCDOT *Congestion Management Capacity Analysis Guidelines*. As part of a coordinated system where the cycle lengths should match, the added phase at this intersection resulted in the need to then re-optimize the entire US 29-74/NC 273 Closed Loop Signal System again under 2023 build-out conditions, which were maintained throughout the build-out improved and build-out +5 scenarios.

As part of a separate coordinated system, the cycle length and splits were optimized in the existing conditions network at the signalized intersection of Park Street (NC 273) and Wilkinson Boulevard (US 74) given the timing inputs and in accordance with NCDOT *Congestion Management Capacity Analysis Guidelines*. As discussed in **Section 4.3**, NCDOT TIP Project No. U-6038 is currently under construction to implement a coordinated signal system along Wilkinson Boulevard (UC 74) between Catawba Street (NC 7) and Wesleyan Drive that will dynamically adjust signal timing based on traffic demand. Therefore, cycle lengths and splits were re-optimized at this intersection under 2023 background conditions to account for U-6038 and maintained throughout 2023 build-out and 2028 build-out +5 conditions.

The cycle length and splits were optimized in the existing conditions network at the uncoordinated intersection of Beatty Drive (NC 273) and Tuckasee Road given the timing inputs and in accordance with NCDOT *Congestion Management Capacity Analysis Guidelines*. As discussed in **Section 4.3**, NCDOT TIP Project No. U-3633 is currently under construction to widen Beatty Drive (NC 273) to a four-lane, divided roadway and improve the intersection at Tuckasee Road. Therefore, the cycle length and splits were re-optimized under 2023 background conditions to account for U-3633 and maintained throughout 2023 build-out and 2028 build-out +5 conditions.

Signal geometric plans are included in the **Appendix**.

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 with the exception of the channelized, yield-control right-turn movements onto the I-85 ramps.
- 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.
- A minimum of 4 vehicles per hour were used for permissible movements.

Field-observed peak-hour factors (PHFs) were used in the 2020 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 minimum.

Mitigation for traffic impacts caused by the proposed development were noted and identified based on City of Belmont and NCDOT mitigation requirements. When determining the proposed development's traffic impact to the study area intersections, the 2023 build-out conditions were compared to the 2023 background conditions. Based on the *City of Belmont Land Development Code*, "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 10 software are included in the **Appendix** along with queuing and blocking reports generated by the SimTraffic microsimulation model.

6.1 BEATTY DRIVE (NC 273) AND TUCKASEEGE ROAD

Table 6.1 summarizes the LOS, control delay and 95th percentile queue lengths at the signalized intersection of Beatty Drive (NC 273) and Tuckaseege Road.

| Table 6.1 - Beatty Drive (NC 273) and Tuckaseege Road | | | | | | | | | | | |
|---|----------------|----------|------|----------|------|----------|-------|-----|----------|-------|-----------------------------|
| Condition | Measure | EB | | WB | | NB | | | SB | | Intersection LOS (Delay) |
| | | EBL | EBTR | WBL | WBTR | NBL | NBT | NBR | SBL | SBTR | |
| AM Peak Hour | | | | | | | | | | | |
| 2019 Existing | LOS (Delay) | B (14.8) | | B (15.8) | | B (10.7) | | | B (10.6) | | B (12.1) |
| | Synchro 95th Q | 111' | 41' | 100' | 38' | 12' | 149' | 21' | 3' | 174' | |
| 2023 Background | LOS (Delay) | B (14.8) | | B (14.9) | | A (8.4) | | | B (10.4) | | B (11.2) |
| | Synchro 95th Q | 96' | 36' | 94' | 32' | 16' | 78' | - | 5' | 178' | |
| 2023 Build-out | LOS (Delay) | B (15.4) | | B (16.7) | | A (9.8) | | | B (13.9) | | B (13.5) |
| | Synchro 95th Q | 96' | 36' | 103' | 32' | 18' | 88' | - | 5' | 205' | |
| 2028 Build-out +5 | LOS (Delay) | B (15.8) | | B (17.2) | | B (10.1) | | | B (15.1) | | B (14.3) |
| | Synchro 95th Q | 101' | 37' | 107' | 33' | 19' | 95' | - | 5' | #260' | |
| PM Peak Hour | | | | | | | | | | | |
| 2019 Existing | LOS (Delay) | C (29.5) | | B (19.5) | | B (17.8) | | | A (7.7) | | B (16.5) |
| | Synchro 95th Q | #177' | 70' | 63' | 49' | 23' | #462' | 54' | 4' | 83' | |
| 2023 Background | LOS (Delay) | B (16.9) | | B (11.6) | | B (15.5) | | | B (10.6) | | B (14.0) |
| | Synchro 95th Q | 111' | 46' | 46' | 34' | 32' | #271' | - | 7' | 125' | |
| 2023 Build-out | LOS (Delay) | B (16.8) | | B (11.8) | | B (17.4) | | | B (10.7) | | B (15.0) |
| | Synchro 95th Q | 111' | 46' | 49' | 34' | 32' | #305' | - | 7' | 132' | |
| 2028 Build-out +5 | LOS (Delay) | B (17.0) | | B (11.7) | | B (19.9) | | | B (11.4) | | B (16.4) |
| | Synchro 95th Q | 117' | 48' | 50' | 34' | 36' | #336' | - | 7' | 145' | |

95th percentile volume exceeds capacity, queue may be longer

As discussed in **Section 4.3**, NCDOT TIP Project No. U-3633 is currently under construction to widen Beatty Drive/S Main Street (NC 273) to a four-lane divided roadway between Tuckaseege Road (where Beatty Drive turns into S Main Street) and A & E Drive (where S Main Street turns into Highland Street south of downtown Mount Holly). The following laneage improvements are planned at the intersection of Beatty Drive (NC 273) and Tuckaseege Road as part of U-3633 based on April 2017 design plans provided by NCDOT:

- Restriping the existing northbound right-turn lane to a shared through/right lane
- Exclusive westbound left-turn lane along Tuckaseege Road
- Exclusive eastbound left-turn lane along Tuckaseege Road

Based on the site visit performed for this study, the eastbound and westbound left-turn lanes along Tuckaseege Road have already been constructed and therefore were included in the existing conditions analysis. Additionally, the unsignalized eastbound left-turn movement previously allowed from S Main Street to Beatty Drive (NC 273) north of Tuckaseege Road has been removed. Instead, drivers that previously utilized this movement have been redirected to turn left at the Tuckaseege Road traffic signal. This portion of TIP Project No. U-3633 had already been completed when traffic counts were collected, and therefore was reflected in the existing traffic counts.

Table 6.1 shows that the overall intersection currently operates at LOS B during both peak hours. 2023 background conditions reflect the completion of all U-3633 improvements at this intersection, which includes the restriping of the existing northbound right-turn lane to a shared through/right lane (providing two through lanes northbound). With this improvement in place, **Table 6.1** shows the overall intersection is expected to operate at LOS B during both peak hours under 2023 background, and is expected to continue to operate at LOS B when the proposed site traffic is added in 2023 build-out 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 capacity purposes.**

6.2 BELMONT-MT. HOLLY ROAD AND BEATY ROAD

Table 6.2 summarizes the LOS, control delay and 95th percentile queue lengths at the unsignalized, tee-intersection of Belmont-Mt. Holly Road and Beaty Road. Belmont-Mt. Holly Road is considered the northbound/southbound approaches with Beaty Road as the westbound approach.

| Table 6.2 - Belmont-Mt. Holly Road and Beaty Road | | | | |
|---|----------------|----------|---------|---------|
| Condition | Measure | WB | NB | SB |
| | | WBLR | NBTR | SBLT |
| AM Peak Hour | | | | |
| 2019 Existing | LOS (Delay) | C (24.1) | A (0.0) | A (2.8) |
| | Synchro 95th Q | 50' | 0' | 9' |
| 2023 Background | LOS (Delay) | C (19.1) | A (0.0) | A (2.4) |
| | Synchro 95th Q | 31' | 0' | 8' |
| 2023 Build-out | LOS (Delay) | C (20.0) | A (0.0) | A (2.8) |
| | Synchro 95th Q | 35' | 0' | 9' |
| 2028 Build-out +5 | LOS (Delay) | C (21.8) | A (0.0) | A (2.9) |
| | Synchro 95th Q | 41' | 0' | 10' |
| PM Peak Hour | | | | |
| 2019 Existing | LOS (Delay) | C (17.8) | A (0.0) | A (1.5) |
| | Synchro 95th Q | 48' | 0' | 4' |
| 2023 Background | LOS (Delay) | C (17.0) | A (0.0) | A (1.5) |
| | Synchro 95th Q | 45' | 0' | 5' |
| 2023 Build-out | LOS (Delay) | C (17.6) | A (0.0) | A (1.7) |
| | Synchro 95th Q | 52' | 0' | 5' |
| 2028 Build-out +5 | LOS (Delay) | C (19.5) | A (0.0) | A (1.8) |
| | Synchro 95th Q | 62' | 0' | 6' |

Table 6.2 shows the stop-controlled, westbound approach of Beaty Road currently operates with short delays during both peak hours and is expected to continue to operate with short delays during both peak hours through 2023 and 2028 background and build-out 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 capacity purposes.***

Note that the decrease in side-street approach delay shown in **Table 6.2** between 2019 existing and 2023 background conditions during both peak hours reflects the change in PHFs. As previously noted, based on NCDOT *Congestion Management Capacity Analysis Guidelines*, the PHFs obtained from the collected traffic count data were used for 2019 existing conditions only (0.67 AM PHF and 0.84 PM PHF for the westbound approach); however, a PHF of 0.9 was used for all future conditions. The increase in PHF assumes the traffic volume to be more evenly distributed throughout the 60-minute peak-hour in the model, which results in a reduction in the average approach delay.

6.3 BELMONT-MT. HOLLY ROAD AND FERSTL AVENUE

Table 6.3 summarizes the LOS, control delay and 95th percentile queue lengths at the unsignalized, tee-intersection of Belmont-Mt. Holly Road and Ferstl Avenue. Belmont-Mt. Holly Road is considered the northbound/southbound approaches with Ferstl Avenue as the westbound approach.

| Table 6.3 - Belmont-Mt. Holly Road and Ferstl Avenue | | | | | |
|--|----------------|----------|---------|-----|---------|
| Condition | Measure | WB | NB | | SB |
| | | WBLR | NBT | NBR | SBLT |
| AM Peak Hour | | | | | |
| 2019 Existing | LOS (Delay) | C (20.0) | A (0.0) | | A (0.6) |
| | Synchro 95th Q | 18' | 0' | - | 2' |
| 2023 Background | LOS (Delay) | C (18.6) | A (0.0) | | A (0.5) |
| | Synchro 95th Q | 10' | 0' | - | 1' |
| 2023 Build-out | LOS (Delay) | C (20.8) | A (0.0) | | A (0.5) |
| | Synchro 95th Q | 16' | 0' | - | 1' |
| 2023 Build-out IMP NBR | LOS (Delay) | C (19.7) | A (0.0) | | A (0.5) |
| | Synchro 95th Q | 15' | 0' | 0' | 1' |
| 2028 Build-out +5 NBR | LOS (Delay) | C (20.8) | A (0.0) | | A (0.5) |
| | Synchro 95th Q | 17' | 0' | 0' | 1' |
| PM Peak Hour | | | | | |
| 2019 Existing | LOS (Delay) | D (30.7) | A (0.0) | | A (0.3) |
| | Synchro 95th Q | 58' | 0' | - | 1' |
| 2023 Background | LOS (Delay) | D (29.8) | A (0.0) | | A (0.3) |
| | Synchro 95th Q | 49' | 0' | - | 1' |
| 2023 Build-out | LOS (Delay) | E (40.9) | A (0.0) | | A (0.3) |
| | Synchro 95th Q | 90' | 0' | - | 1' |
| 2023 Build-out IMP NBR | LOS (Delay) | E (37.9) | A (0.0) | | A (0.3) |
| | Synchro 95th Q | 84' | 0' | 0' | 1' |
| 2028 Build-out +5 NBR | LOS (Delay) | E (46.2) | A (0.0) | | A (0.3) |
| | Synchro 95th Q | 103' | 0' | 0' | 1' |

Table 6.3 shows the stop-controlled, westbound approach of Ferstl Avenue currently operates, and is expected to continue to operate with short delays during the AM peak hour and moderate delays during the PM peak hour through 2023 background conditions.

When the proposed site traffic is added to the 2023 background volumes, the stop-controlled westbound approach is expected to drop from LOS D to LOS E during the PM peak hour. Given the LOS degradation, identification of mitigation improvements is required. The following improvement was identified to potentially mitigate the operational impact and accommodate the added site traffic:

- Northbound right-turn lane along Belmont-Mt. Holly Road with 100' of storage

Table 6.3 shows that this improvement is expected to provide a minor reduction in three seconds to the westbound approach delay. Alternative mitigation options were also considered, a southbound left-turn lane and a westbound right-turn lane. However, **Figures 5.2** and **5.3** show relatively low westbound right- and southbound left-turn volume (less than 8 westbound rights and less than 20 southbound lefts in both peak hours). These movements likely serve only local residents, as traffic to/from the north along Belmont-Mt. Holly Road would instead use Beatty Road to access Beatty Drive (NC 273). Therefore, minimal safety and/or operational benefit would be expected of either of these two potential turn lanes. Given this, westbound right- and southbound left-turn lanes are not recommended as mitigation for the proposed CaroMont Regional Medical Center.

As shown in **Figures 5.2** and **5.3**, the proposed site is expected to increase the combined northbound right- and westbound left-turn movements by 76% and 46% during the AM and PM peak hours, respectively. Furthermore, the northbound right-turn movement also increases the warranted storage based on NCDOT auxiliary turn-lane warrants (discussed in **Section 7.0**). **Given the LOS degradation, the added site traffic and the increased warranted storage, a northbound right-turn lane with 100 feet of storage is identified to mitigate the traffic impact of the proposed development.** Review of auxiliary turn-lane warrants is included in **Section 7.0**.

6.4 BEATTY DRIVE (NC 273) AND BEATY ROAD

Table 6.4 summarizes the LOS, control delay and 95th percentile queue lengths at the unsignalized, tee-intersection of Beatty Drive (NC 273) and Beaty Road.

| Table 6.4 - Beatty Drive (NC 273) and Beaty Road | | | | | | | |
|--|----------------|----------|------|---------|-----|---------|-----|
| Condition | Measure | EB | | NB | | SB | |
| | | EBL | EBR | NBL | NBT | SBT | SBR |
| AM Peak Hour | | | | | | | |
| 2019 Existing | LOS (Delay) | D (27.3) | | A (3.4) | | A (0.0) | |
| | Synchro 95th Q | 2' | 94' | 26' | 0' | 0' | 0' |
| 2023 Background | LOS (Delay) | D (30.6) | | A (2.5) | | A (0.0) | |
| | Synchro 95th Q | 2' | 112' | 20' | 0' | 0' | 0' |
| 2023 Build-out | LOS (Delay) | F (54.8) | | A (3.1) | | A (0.0) | |
| | Synchro 95th Q | 2' | 207' | 28' | 0' | 0' | 0' |
| 2028 Build-out +5 | LOS (Delay) | F (72.9) | | A (3.4) | | A (0.0) | |
| | Synchro 95th Q | 2' | 251' | 32' | 0' | 0' | 0' |
| PM Peak Hour | | | | | | | |
| 2019 Existing | LOS (Delay) | B (14.0) | | A (2.8) | | A (0.0) | |
| | Synchro 95th Q | 3' | 26' | 50' | 0' | 0' | 0' |
| 2023 Background | LOS (Delay) | B (14.1) | | A (2.7) | | A (0.0) | |
| | Synchro 95th Q | 3' | 25' | 53' | 0' | 0' | 0' |
| 2023 Build-out | LOS (Delay) | C (15.4) | | A (3.4) | | A (0.0) | |
| | Synchro 95th Q | 4' | 33' | 78' | 0' | 0' | 0' |
| 2028 Build-out +5 | LOS (Delay) | C (16.1) | | A (3.7) | | A (0.0) | |
| | Synchro 95th Q | 5' | 36' | 92' | 0' | 0' | 0' |

Table 6.4 shows the stop-controlled, eastbound approach of Beaty Road currently operates, and is expected to continue to operate with moderate delays during the AM peak and short delays during the PM peak hour through 2023 background conditions.

When the proposed site traffic is added to the 2023 background volumes, the stop-controlled eastbound approach is expected to drop from LOS D to LOS F during the AM peak hour. Given the LOS degradation, identification of mitigation improvements is required. Recognizing that turn lanes are already present on each approach, a change in operational control (such as a traffic signal or a roundabout) would be needed to significantly improve operations at this intersection.



As discussed in **Section 4.3**, the South Gateway Alignment Study identified the need for a traffic signal at this intersection with the addition of a future fourth leg connecting east to the future South Gateway Connector. The recommendation in the South Gateway Alignment Study was based on potential development of vacant parcels to the east along with future consideration of proper signal spacing between I-85 and Tuckasee Road along the Beatty Drive (NC 273) corridor. With this intersection identified as a future signal location, installation of a traffic signal at this intersection was evaluated to potentially mitigate the operational impact and

accommodate the added site traffic during the AM peak hour, while minimizing disruption to the background traffic.

With a traffic signal installed under the existing laneage, the overall intersection is expected to operate at LOS B with the northbound and southbound approaches of Beatty Drive (NC 273) operating a LOS A and B, respectively. However, the eastbound approach of Beatty Road is expected to operate at LOS E with 57 seconds of delay. Note that, as shown in **Tables 6.0-A** and **6.0-B**, the delay thresholds published in the HCM differ between unsignalized and signalized intersections, whereas the threshold between LOS E and LOS F is 50 seconds for unsignalized intersections and 80 seconds for signalized intersections. Therefore, while the eastbound approach is expected to operate at LOS E under signalized operations (as compared to LOS F under unsignalized), the side-street approach delay shows an increase of over 2 seconds during the AM peak hour with the installation of a traffic signal. Even with RTOR allowed, the eastbound approach shows 50 seconds of delay. Furthermore, installation of a traffic signal would impact the northbound/southbound approaches, which accommodate the vast majority of the traffic volume and experience little to no delay under unsignalized operations, while also introducing the potential for increased rear-end collisions. 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. Also note that the long delays are only expected during one peak hour.

Given the limited projected benefit discussed above, no mitigation improvements, including installation of a traffic signal, are recommended as mitigation for the proposed CaroMont Regional Medical Center.

6.5 BEATY ROAD AND FERSTL AVENUE

Table 6.5 summarizes the LOS, control delay and 95th percentile queue lengths at the unsignalized, tee-intersection of Beaty Road and Ferstl Avenue. Beaty Road is considered the eastbound/westbound approaches with Ferstl Avenue as the northbound approach.

| Table 6.5 - Beaty Road and Ferstl Avenue | | | | | |
|--|----------------|---------|---------|-----|----------|
| Condition | Measure | EB | WB | | NB |
| | | EBTR | WBL | WBT | NBLR |
| AM Peak Hour | | | | | |
| 2019 Existing | LOS (Delay) | A (0.0) | A (2.3) | | B (10.0) |
| | Synchro 95th Q | 0' | 2' | 0' | 9' |
| 2023 Background | LOS (Delay) | A (0.0) | A (2.6) | | A (9.7) |
| | Synchro 95th Q | 0' | 2' | 0' | 7' |
| 2023 Build-out | LOS (Delay) | A (0.0) | A (3.1) | | B (10.1) |
| | Synchro 95th Q | 0' | 3' | 0' | 12' |
| 2028 Build-out +5 | LOS (Delay) | A (0.0) | A (3.1) | | B (10.2) |
| | Synchro 95th Q | 0' | 3' | 0' | 13' |
| PM Peak Hour | | | | | |
| 2019 Existing | LOS (Delay) | A (0.0) | A (3.0) | | A (9.8) |
| | Synchro 95th Q | 0' | 7' | 0' | 8' |
| 2023 Background | LOS (Delay) | A (0.0) | A (2.9) | | A (9.3) |
| | Synchro 95th Q | 0' | 7' | 0' | 5' |
| 2023 Build-out | LOS (Delay) | A (0.0) | A (3.3) | | A (9.5) |
| | Synchro 95th Q | 0' | 10' | 0' | 7' |
| 2028 Build-out +5 | LOS (Delay) | A (0.0) | A (3.3) | | A (9.5) |
| | Synchro 95th Q | 0' | 10' | 0' | 8' |

Table 6.5 shows the stop-controlled northbound approach of Ferstl Avenue currently operates with short delays during both peak hours and is expected to continue to operate with short delays during both peak hours through 2023 and 2028 background and build-out 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 capacity purposes.***

Note that the decrease in side-street approach delay shown in **Table 6.5** between 2019 existing and 2023 background conditions during both peak hours reflects the change in PHFs. As previously noted, based on NCDOT *Congestion Management Capacity Analysis Guidelines*, the PHFs obtained from the collected traffic count data were used for 2019 existing conditions only (0.76 AM PHF and 0.69 PM PHF for the northbound approach); however, a PHF of 0.9 was used for all future conditions. The increase in PHF assumes the traffic volume to be more evenly distributed throughout the 60-minute peak-hour in the model, which results in a reduction in the average approach delay.

6.6 BEATTY DRIVE (NC 273) AND YMCA DRIVE/ACCESS 1

Table 6.6 summarizes the LOS, control delay and 95th percentile queue lengths at the existing signalized, tee-intersection of Beatty Drive (NC 273) and YMCA Drive. The fourth leg of this intersection is planned to be constructed as a part of the proposed CaroMont development.

| Table 6.6 - Beatty Drive (NC 273) and YMCA Drive/Access 1 | | | | | | | | | | | |
|---|----------------|----------|------|----------|------|----------|-------|----------|-------|------|-----------------------------|
| Condition | Measure | EB | | WB | | NB | | SB | | | Intersection LOS (Delay) |
| | | EBLT | EBR | WBL | WBTR | NBL | NBTR | SBL | SBT | SBR | |
| AM Peak Hour | | | | | | | | | | | |
| 2019 Existing | LOS (Delay) | - | | D (43.2) | | A (5.4) | | A (5.1) | | | A (7.3) |
| | Synchro 95th Q | - | - | 91' | 20' | - | 82' | 7' | 244' | - | |
| 2023 Background | LOS (Delay) | - | | D (44.1) | | A (7.0) | | A (6.8) | | | A (9.0) |
| | Synchro 95th Q | - | - | 115' | 22' | - | 106' | 38' | 289' | - | |
| 2023 Build-out | LOS (Delay) | E (56.3) | | F (88.2) | | C (31.4) | | D (37.0) | | | D (39.0) |
| | Synchro 95th Q | #123' | 94' | #224' | 66' | #378' | 182' | 60' | #942' | - | |
| 2023 Build-out Improved Options | | | | | | | | | | | |
| 2023 Build-out IMP Opt 1 - Dual NBLs | LOS (Delay) | E (58.0) | | E (73.5) | | C (24.5) | | C (28.8) | | | C (31.3) |
| | Synchro 95th Q | #123' | 100' | #200' | 65' | #167' | 131' | 60' | 796' | - | |
| 2023 Build-out IMP Opt 2 - Dual WBLs | LOS (Delay) | E (56.6) | | E (61.7) | | C (30.6) | | C (34.1) | | | D (35.6) |
| | Synchro 95th Q | #123' | 95' | 84' | 67' | #384' | 164' | 60' | #930' | - | |
| 2023 Build-out IMP Opt 3 - SBR | LOS (Delay) | D (54.1) | | F (81.9) | | C (28.3) | | C (31.7) | | | C (34.6) |
| | Synchro 95th Q | #123' | 90' | #212' | 66' | #361' | 139' | 60' | 776' | 100' | |
| 2023 Build-out IMP Opt 4 - Dual NBLs, SBR | LOS (Delay) | D (54.3) | | E (68.8) | | C (24.3) | | C (25.6) | | | C (28.9) |
| | Synchro 95th Q | #114' | 98' | #189' | 64' | #169' | 140' | 60' | 692' | 89' | |
| 2023 Build-out IMP Opt 5 - Dual NBLs/WBLs, SBR | LOS (Delay) | D (52.7) | | E (58.9) | | C (22.3) | | C (24.1) | | | C (26.8) |
| | Synchro 95th Q | #114' | 101' | 84' | 66' | 154' | 131' | 60' | 650' | 83' | |
| 2028 Build-out +5 (NCDOT I-5719 Options 1 & 3) | | | | | | | | | | | |
| 2028 Build-out +5 Opt 1 - Improve Existing | LOS (Delay) | D (54.9) | | E (70.3) | | C (24.1) | | C (27.7) | | | C (30.2) |
| | Synchro 95th Q | #114' | 98' | #201' | 64' | #169' | 181' | 62' | 762' | 89' | |
| 2028 Build-out +5 Opt 3 - DDI | LOS (Delay) | D (52.8) | | E (76.0) | | C (24.8) | | C (27.1) | | | C (30.7) |
| | Synchro 95th Q | #112' | 91' | #241' | 60' | #174' | 188' | 71' | 720' | 85' | |
| PM Peak Hour | | | | | | | | | | | |
| 2019 Existing | LOS (Delay) | - | | D (42.6) | | A (6.1) | | A (4.4) | | | A (8.5) |
| | Synchro 95th Q | - | - | 93' | 59' | - | 169' | 16' | 120' | - | |
| 2023 Background | LOS (Delay) | - | | D (43.3) | | A (6.8) | | A (6.5) | | | A (9.2) |
| | Synchro 95th Q | - | - | 130' | 68' | - | 169' | 70' | 116' | - | |
| 2023 Build-out | LOS (Delay) | D (50.8) | | E (70.7) | | C (27.2) | | D (39.3) | | | D (36.5) |
| | Synchro 95th Q | #270' | 186' | #228' | 95' | 128' | 677' | #100' | 441' | - | |
| 2023 Build-out Improved Options | | | | | | | | | | | |
| 2023 Build-out IMP Opt 1 - Dual NBLs | LOS (Delay) | D (50.8) | | E (70.7) | | D (36.1) | | D (39.3) | | | D (40.9) |
| | Synchro 95th Q | #270' | 186' | #228' | 95' | 65' | 677' | #100' | 441' | - | |
| 2023 Build-out IMP Opt 2 - Dual WBLs | LOS (Delay) | D (47.4) | | D (50.8) | | C (26.1) | | D (37.9) | | | C (33.9) |
| | Synchro 95th Q | #261' | 186' | 85' | 95' | 128' | 677' | #100' | 441' | - | |
| 2023 Build-out IMP Opt 3 - SBR | LOS (Delay) | D (49.9) | | E (70.7) | | D (35.8) | | D (38.9) | | | D (40.6) |
| | Synchro 95th Q | #270' | 181' | #228' | 95' | 124' | 655' | #100' | 415' | 60' | |
| 2023 Build-out IMP Opt 4 - Dual NBLs, SBR | LOS (Delay) | D (49.9) | | E (70.7) | | C (26.5) | | D (38.9) | | | D (35.9) |
| | Synchro 95th Q | #270' | 181' | #228' | 95' | 63' | 655' | #100' | 415' | 60' | |
| 2023 Build-out IMP Opt 5 - Dual NBLs/WBLs, SBR | LOS (Delay) | D (46.5) | | D (50.8) | | C (26.5) | | D (37.6) | | | C (33.8) |
| | Synchro 95th Q | #261' | 181' | 85' | 95' | 67' | 698' | #100' | 415' | 60' | |
| 2028 Build-out +5 (NCDOT I-5719 Options 1 & 3) | | | | | | | | | | | |
| 2028 Build-out +5 Opt 1 - Improve Existing | LOS (Delay) | D (50.5) | | E (73.2) | | C (30.4) | | D (39.9) | | | D (38.3) |
| | Synchro 95th Q | #270' | 185' | #240' | 98' | m63' | #844' | #103' | 432' | 59' | |
| 2028 Build-out +5 Opt 3 - DDI | LOS (Delay) | E (61.5) | | E (73.9) | | C (35.0) | | D (44.0) | | | D (43.7) |
| | Synchro 95th Q | #288' | 181' | #318' | 96' | m57' | #884' | #129' | 435' | 60' | |

95th percentile volume exceeds capacity, queue may be longer

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

Table 6.6 shows the overall intersection currently operates at LOS A and is expected to continue to operate at LOS A during both peak hours through 2023 background conditions.

Upon build-out of the site, proposed Access 1 is planned to serve as CaroMont’s single public access and create the fourth leg to the current signalized tee-intersection. Based on review of the existing laneage and projected traffic volumes, the following base laneage assumptions/modifications were reflected at this intersection under 2023 build-out conditions:

- Shared eastbound left/through lane and exclusive right-turn lane along Access 1
- Conversion of the northbound two-way left-turn lane (TWLTL) along Beatty Dr (NC 273) to a left-turn lane with protected phasing
- Conversion of the westbound right-turn lane along YMCA Dr to a shared through/right lane

Note that a tee-intersection typically allows for more flexibility in signal phasing and more-efficient operations, which will typically result in a better LOS. When a fourth leg is added to an intersection, the additional phases and increased demand for green time will typically reduce the efficiency provided for the tee-intersection. Therefore, it can sometimes be difficult to measure the direct impacts of the additional site trips, particularly for each approach.

When the proposed site traffic is added to the 2023 background traffic volumes along with the addition of the fourth leg and associated signal modifications, **Table 6.6** shows that the overall intersection and each approach are expected drop in LOS during both peak hours. As discussed above, the increased delay along Beatty Drive (NC 273) is a reflection of less green time available for the major-street movements caused by the added approach for Access 1. Given the LOS degradation, identification of mitigation improvements is required. Three potential mitigation improvement options (along with two additional options that combined these improvements) were evaluated at this intersection to potentially mitigate the operational impact and accommodate the added site traffic, while minimizing disruption to the background traffic:

- Option 1 – Dual NBLs
- Option 2 – Dual WBLs
- Option 3 – SBR
- Option 4 – Dual NBLs and SBR
- Option 5 – Dual NBLs, Dual WBLs and SBR

Option 1 – Dual NBLs

Table 6.6 shows the southbound approach of Beatty Drive (NC 273) is expected to be most significantly impacted by the addition of the fourth leg and proposed site traffic, dropping from LOS A to LOS D during both peak hours. While the proposed site is not expected to add any traffic to the southbound through movement, **Figure 5.2** shows over 200 vehicles added to the conflicting northbound left-turn movement during the AM peak hour. Therefore, Option 1 evaluated dual northbound left-turn lanes to limit the amount of green time needed to process the northbound left-turn movement, thus allowing additional green time to be allocated to the opposing southbound through movement, which accommodates the highest traffic volume during the AM peak hour (1,513 SBTs).

With this improvement in place, the southbound approach and overall intersection are expected to improve to LOS C during the AM peak hour; however, this improvement option does not provide significant benefit during the PM peak hour since the northbound left-turn movement (101 NBLs) operates with a volume-to-capacity ratio of 0.32 with a single left-turn lane. **Table 6.6** shows that the northbound approach, which accommodates the highest traffic volume during the PM peak hour (1,650 NB vehicles), is expected to operate at LOS D under Option 1. Since this heavy-volume approach currently operates at LOS A, other improvement options were evaluated in efforts to reduce the increased delay.

Option 2 – Dual WBLs

The amount of green time available to be allocated for the mainline northbound and southbound approaches is restricted by the amount green time needed to process the side-street traffic. Furthermore, **Table 6.6** shows poor side-street operations expected under 2023 build-out conditions. Therefore Option 2 evaluated dual westbound left-turn lanes along YMCA Drive. By adding capacity to the westbound approach, less time is required to process the side-street traffic, thus allowing for additional green time for the mainline approaches.

With this improvement in place, delay along the westbound approach of YMCA Drive is significantly reduced; however, **Table 6.6** shows only minimal benefit provided to the remaining approaches and overall intersection. As shown, the heavy southbound approach during the AM peak hour shows an improvement from LOS D to LOS C; however, the reduction in delay is less than three seconds per vehicle and the delay is less than one second shy of LOS D. Similarly, the overall intersection shows an improvement from LOS D to LOS C during the PM peak hour; however, the reduction in delay is less than three seconds per vehicle and the delay is just over one second shy of LOS D.

Option 3 – SBR

The heavy southbound approach during the AM peak hour operates with a volume-to-capacity ratio of 0.93 with the right-turn movement combined with the southbound through lane. With 130 southbound right turns (as shown in **Figure 5.2**), Option 3 evaluated installation of an exclusive southbound right-turn lane to provide relief to the heavy southbound approach.

With this improvement in place, the southbound approach and overall intersection are expected to improve to LOS C during the AM peak hour; however, similar to Option 1, this improvement option does not provide significant benefit during the PM peak hour where the heavy northbound approach is expected to operate at LOS D. Therefore, additional options were evaluated that combined these improvements.

Option 4 – Dual NBLs and SBR

Option 4 combines Option 1 (dual northbound left-turn lanes) and Option 3 (southbound right-turn lane) along Beatty Drive (NC 273).

With these improvements in place, the benefits discussed under Option 1 and Option 3 during the AM peak hour are further realized, while improving the heavy northbound approach during the PM peak hour back to an acceptable LOS C.

Option 5 – Dual NBLs, Dual WBLs and SBR

Option 5 builds upon Option 4 by including the dual westbound left-turn lanes along YMCA Drive and combining all three options.

With all three improvements in place, **Table 6.6** shows the overall intersection is expected to operate at LOS C during both peak hours.

Review of Mitigation Options

When comparing the five options evaluated, Option 5 shows the best overall operations. However, **Table 6.6** shows that when compared to Option 4, the overall intersection delay is only expected to decrease by approximately 2 seconds during each peak hour with the dual westbound left-turn lanes added. **Considering the addition of dual westbound left-turn lanes is not expected to**

provide a significant benefit to operations at this intersection, Option 4 is identified as best mitigate the operational impact of the proposed CaroMont Regional Medical Center and accommodate the added site traffic, while minimizing disruption to the background traffic.

- Dual northbound left-turn lanes along Beatty Drive (NC 273) with 175' of storage each
- Southbound right-turn lane along Beatty Drive (NC 273) with 100' of storage

Based on review of the Synchro 95th percentile queue lengths under Option 4, the westbound and southbound left-turn queues are expected to exceed the existing storage during the PM peak hour under 2023 build-out conditions. A TWLTL is currently provided along the southbound approach of Beatty Drive (NC 273) that can serve as an extension of the southbound left-turn lane to accommodate the extended queues when needed. However, *an extension of the westbound left-turn lane along YMCA Drive to include 250 feet of storage is recommended to accommodate the additional queues.*

2028 Build-out + 5 (w/ I-5719)

As discussed in **Section 4.3**, interchange improvements at Exit 27 (Beatty Drive/Park Street (NC 273)) are currently being designed as part of NCDOT TIP Project No. I-5719. Based on [NCDOT's project information page](#) as of April 2020, this project is scheduled for construction in FY 2024-2028; therefore, for the purposes of this TIA as discussed with City and NCDOT staff, this project was included in the 2028 build-out +5 analysis scenario. Based on coordination with NCDOT at the TIA Scoping Meeting, the preferred interchange improvement alternative has been narrowed down to two options:

- Option 1 – Improve Existing Interchange
- Option 3 – Diverging Diamond Interchange (DDI)

The project limits are not expected to extend north to YMCA Drive. However, based on the concepts provided by NCDOT, the DDI alternative (Option 3) is shown to restrict the Caldwell Drive intersection to RIRO operations only. Therefore, under the 2028 build-out +5 scenario with the DDI configuration (Option 3), volumes turning left into and out of Caldwell Drive were redistributed to the Beatty Drive (NC 273)/YMCA Drive signalized intersection via the connection between YMCA Drive and Caldwell Drive planned to be constructed as part of the Fairfield Inn & Suites approved development discussed in **Section 4.2**.

Table 6.6 shows with the improvements from Option 4 above in place, the overall intersection is expected to continue to operate at LOS C during the AM peak hour and LOS D during the PM peak hour under 2028 build-out +5 conditions with and without the redistributed traffic from Caldwell Drive, as reflected under the DDI configuration (Option 3).

6.7 BEATTY DRIVE (NC 273) AND CALDWELL DRIVE

Table 6.7 summarizes the LOS, control delay and 95th percentile queue lengths at the unsignalized, tee-intersection of Beatty Drive (NC 273) and Caldwell Drive.

| Table 6.7 - Beatty Drive (NC 273) and Caldwell Drive | | | | | | |
|--|----------------|----------|---------|-----|---------|-----|
| Condition | Measure | WB | NB | | SB | |
| | | WBLR | NBT | NBR | SBL | SBT |
| AM Peak Hour | | | | | | |
| 2019 Existing | LOS (Delay) | B (13.2) | A (0.0) | | A (0.1) | |
| | Synchro 95th Q | 8' | 0' | - | 1' | 0' |
| 2023 Background | LOS (Delay) | B (13.3) | A (0.0) | | A (0.0) | |
| | Synchro 95th Q | 8' | 0' | - | 1' | 0' |
| 2023 Build-out | LOS (Delay) | B (14.8) | A (0.0) | | A (0.0) | |
| | Synchro 95th Q | 9' | 0' | - | 1' | 0' |
| 2028 Build-out +5 Opt 1 - Improve Existing | LOS (Delay) | C (21.3) | A (0.0) | | A (0.1) | |
| | Synchro 95th Q | 16' | 0' | - | 1' | 0' |
| 2028 Build-out +5 Opt 3 - DDI | LOS (Delay) | A (9.3) | A (0.0) | | A (0.0) | |
| | Synchro 95th Q | 2' | 0' | 0' | - | 0' |
| PM Peak Hour | | | | | | |
| 2019 Existing | LOS (Delay) | D (29.7) | A (0.0) | | A (0.2) | |
| | Synchro 95th Q | 46' | 0' | - | 3' | 0' |
| 2023 Background | LOS (Delay) | E (36.8) | A (0.0) | | A (0.1) | |
| | Synchro 95th Q | 52' | 0' | - | 2' | 0' |
| 2023 Build-out | LOS (Delay) | E (48.1) | A (0.0) | | A (0.1) | |
| | Synchro 95th Q | 66' | 0' | - | 2' | 0' |
| 2028 Build-out +5 Opt 1 - Improve Existing | LOS (Delay) | E (47.1) | A (0.0) | | A (0.1) | |
| | Synchro 95th Q | 67' | 0' | - | 3' | 0' |
| 2028 Build-out +5 Opt 3 - DDI | LOS (Delay) | B (11.1) | A (0.0) | | A (0.0) | |
| | Synchro 95th Q | 4' | 0' | 0' | - | 0' |

Table 6.7 shows the stop-controlled westbound approach of Caldwell Drive currently operates, and is expected to continue to operate with short delays during the AM peak hour and moderate delays during the PM peak hour through 2023 background conditions. This increased delay is caused by a reduction in gaps provided for the side-street traffic as traffic volumes increase along the mainline.

When the proposed site traffic is added to the 2023 background volumes, the westbound approach average PM peak-hour delay is expected to increase while operating at LOS E. Given the increase in delay, identification of potential mitigation improvements is required.

A southbound left-turn lane is already provided along the mainline of Beatty Drive (NC 273) in the form of a two-way left-turn lane (TWLTL). Therefore, a northbound right-turn lane and a westbound right-turn lane at this unsignalized, tee-intersection were considered for potential mitigation and further evaluated.

With both these improvements in place, the projected westbound approach delay decreases to 41 seconds while still at LOS E during the PM peak hour. **Figure 5.3** shows that these turn lanes would serve 25 northbound right-turn movements and 24 westbound right-turn movements, which equates to an average of one vehicle every 2.5 minutes on each approach. Furthermore, as discussed below, this intersection may potentially be converted to RIRO operations where only right turns would be allowed from Caldwell Drive. Under that configuration, the future cross-section of the westbound approach of Caldwell Drive would only require a right-turn lane. **Given the**

limited projected benefit discussed above, along with consideration that it is typical for stop sign-controlled side streets intersecting major streets to experience long delays during peak hours, particularly for left-turn movements, no mitigation improvements, including northbound and westbound right-turn lanes, are recommended as mitigation for the proposed CaroMont Regional Medical Center.

2028 Build-out + 5 (w/ I-5719)

As discussed in **Section 4.3**, interchange improvements at Exit 27 (Beatty Drive/Park Street (NC 273)) are currently being designed as part of NCDOT TIP Project No. I-5719. Based on [NCDOT's project information page](#) as of April 2020, this project is scheduled for construction in FY 2024-2028; therefore, for the purposes of this TIA as discussed with City and NCDOT staff, this project was included in the 2028 build-out +5 analysis scenario. Based on coordination with NCDOT at the TIA Scoping Meeting, the preferred interchange improvement alternative has been narrowed down to two options:

- Option 1 – Improve Existing Interchange
- Option 3 – DDI

Based on the concepts provided by NCDOT, the DDI alternative (Option 3) is shown to restrict the Caldwell Drive intersection to RIRO operations only. Therefore, under the 2028 build-out +5 scenario with the DDI configuration (Option 3), volumes turning left into and out of Caldwell Drive were redistributed to the Beatty Drive (NC 273)/YMCA Drive signalized intersection via the connection between YMCA Drive and Caldwell Drive planned to be constructed as part of the Fairfield Inn & Suites approved development discussed in **Section 4.2**.

Table 6.7 shows the westbound approach of Caldwell Drive would be expected to operate with short delays during both peak hours under the DDI configuration (Option 3) with Caldwell Drive restricted to RIRO operations.

6.8 BEATTY DRIVE (NC 273) AND I-85 SB RAMP

Table 6.8 summarizes the LOS, control delay and 95th percentile queue lengths at the signalized intersection of Beatty Drive (NC 273) and I-85 SB Ramp.

| Table 6.8 - Beatty Drive (NC 273) and I-85 SB Ramp | | | | | | | | | |
|--|----------------|----------|------|----------|----------|-------|----------|------|-----------------------------|
| Condition | Measure | WB | | | NB | | SB | | Intersection LOS (Delay) |
| | | WBL | WBT | WBR | NBL | NBT | SBT | SBR | |
| AM Peak Hour | | | | | | | | | |
| 2019 Existing | LOS (Delay) | D (37.6) | | | B (11.5) | | A (9.2) | | B (15.5) |
| | Synchro 95th Q | 140' | 100' | 91' | m53' | 27' | 128' | 10' | |
| 2023 Background | LOS (Delay) | D (37.3) | | | B (13.0) | | A (9.8) | | B (15.9) |
| | Synchro 95th Q | 147' | 100' | 100' | m84' | 95' | 162' | 18' | |
| 2023 Build-out | LOS (Delay) | E (58.4) | | | B (18.7) | | A (4.4) | | B (18.8) |
| | Synchro 95th Q | 212' | 187' | 189' | m119' | m238' | m164' | m7' | |
| 2028 Build-out +5 Opt 1 - Improve Existing | LOS (Delay) | E (57.9) | | | B (19.4) | | A (6.2) | | B (19.8) |
| | Synchro 95th Q | 221' | 190' | 193' | 129' | 199' | 213' | m13' | |
| 2028 Build-out +5 Opt 3 - DDI | LOS (Delay) | C (23.4) | - | A (5.7) | A (2.2) | | A (2.7) | | A (3.3)/A (7.0) |
| | Synchro 95th Q | 108' | - | 40' | - | 1' | 39' | - | |
| PM Peak Hour | | | | | | | | | |
| 2019 Existing | LOS (Delay) | C (32.4) | | | B (16.1) | | C (22.6) | | C (23.0) |
| | Synchro 95th Q | 220' | 180' | 161' | 147' | 108' | 200' | 66' | |
| 2023 Background | LOS (Delay) | C (31.8) | | | B (13.5) | | C (25.0) | | C (22.4) |
| | Synchro 95th Q | 236' | 175' | 171' | 163' | 425' | 253' | 83' | |
| 2023 Build-out | LOS (Delay) | D (44.2) | | | B (14.3) | | B (12.6) | | C (22.2) |
| | Synchro 95th Q | 315' | 248' | 244' | 207' | 136' | 303' | m21' | |
| 2028 Build-out +5 Opt 1 - Improve Existing | LOS (Delay) | D (44.4) | | | B (16.2) | | B (12.8) | | C (23.1) |
| | Synchro 95th Q | 340' | 265' | 261' | 216' | 142' | 325' | m22' | |
| 2028 Build-out +5 Opt 3 - DDI | LOS (Delay) | B (17.1) | - | B (12.4) | A (2.2) | | A (5.3) | | A (5.0)/A (9.9) |
| | Synchro 95th Q | 162' | - | 105' | - | 8' | 52' | - | |

m Volume for 95th percentile queue is metered by upstream signal
 *DDI results reported as WBR signal (includes NBT and WBR)/WBL signal (includes WBL and SBT)

Table 6.8 shows the overall intersection currently operates, and is expected to continue to operate at LOS B during the AM peak hour and LOS C during the PM peak hour through 2023 background conditions.

When the proposed site traffic is added to the 2023 background volumes, the overall intersection is expected to continue to operate at LOS B during the AM peak hour and LOS C during the PM peak hour; however, the westbound approach of I-85 SB Ramp is shown to drop in LOS during both peak hours. This reflects the increased cycle length of the entire US 29-74/NC 273 Closed Loop Signal System to accommodate the added fourth leg at the intersection of Beatty Drive (NC 273) and YMCA Drive. The added approach increased the minimum cycle length from 90 seconds (with three phases) to 120 seconds (with four or more phases) to comply with NCDOT *Congestion Management Capacity Analysis Guidelines*. As part of a coordinated system where the cycle lengths should match, the added phase at YMCA Drive resulted in the need to then re-optimize the entire coordinated signal system under 2023 build-out conditions.

The longer cycle length increases the amount of time the westbound approach vehicles have to wait in between green times, increasing the westbound approach delay (especially with no RTOR allowed per NCDOT capacity analysis guidelines). **Recognizing that dual northbound left-, westbound left- and westbound right-turn lanes are already present and that the overall intersection is expected to continue to operate acceptably at LOS B during the AM peak**

hour and LOS C during the PM peak hour, no mitigation improvements are recommended at this intersection for capacity purposes.

2028 Build-out + 5 (w/ I-5719)

As discussed in **Section 4.3**, interchange improvements at Exit 27 (Beatty Drive/Park Street (NC 273)) are currently being designed as part of NCDOT TIP Project No. I-5719. Based on [NCDOT's project information page](#) as of April 2020, this project is scheduled for construction in FY 2024-2028; therefore, for the purposes of this TIA as discussed with City and NCDOT staff, this project was included in the 2028 build-out +5 analysis scenario. Based on coordination with NCDOT at the TIA Scoping Meeting, the preferred interchange improvement alternative has been narrowed down to two options:

- Option 1 – Improve Existing Interchange
- Option 3 – DDI

Based on the concepts and laneage configurations provided by NCDOT, the only modification for Option 1 from the current laneage is extended storage along the westbound approach of I-85 SB Ramp. Given this, **Table 6.8** reflects similar operations between 2023 build-out conditions and 2028 build-out +5 conditions under the scenario where the existing interchange configuration is preserved and improved (Option 1).

Table 6.8 shows improved operations with the overall intersection operating at LOS A during both peak hours under the DDI configuration (Option 3).

6.9 PARK STREET (NC 273) AND I-85 NB RAMP

Table 6.9 summarizes the LOS, control delay and 95th percentile queue lengths at the signalized intersection of Park Street (NC 273) and I-85 NB Ramp.

| Table 6.9 - Park Street (NC 273) and I-85 NB Ramp | | | | | | | | | |
|--|----------------|----------|-------|----------|----------|--------|----------|------|-----------------------------|
| Condition | Measure | EB | | | NB | | SB | | Intersection LOS (Delay) |
| | | EBL | EBT | EBR | NBT | NBR | SBL | SBT | |
| AM Peak Hour | | | | | | | | | |
| 2019 Existing | LOS (Delay) | F (82.0) | | | D (42.0) | | C (21.8) | | D (36.0) |
| | Synchro 95th Q | #129' | #164' | #124' | 36' | #443' | #278' | 97' | |
| 2023 Background | LOS (Delay) | E (75.9) | | | D (48.6) | | C (28.7) | | D (41.1) |
| | Synchro 95th Q | #145' | #145' | #146' | 47' | #908' | #301' | 185' | |
| 2023 Build-out | LOS (Delay) | F (85.9) | | | D (43.7) | | C (28.8) | | D (40.4) |
| | Synchro 95th Q | #280' | 149' | 149' | 123' | #1135' | #428' | 7' | |
| 2023 Build-out IMP | LOS (Delay) | E (69.6) | | | B (20.0) | | B (18.9) | | C (23.8) |
| | Synchro 95th Q | #226' | 142' | 142' | 105' | 323' | 357' | 0' | |
| 2028 Build-out +5 | LOS (Delay) | E (69.5) | | | C (24.3) | | C (21.3) | | C (26.8) |
| Opt 1 - Improve Existing | Synchro 95th Q | 125' | 126' | #283' | 103' | #504' | #396' | 1' | |
| 2028 Build-out +5 | LOS (Delay) | A (8.9) | - | B (16.7) | A (4.1) | | A (2.1) | | A (5.1)/A (4.0) |
| Opt 3 - DDI | Synchro 95th Q | 30' | - | 101' | 18' | - | - | 13' | |
| PM Peak Hour | | | | | | | | | |
| 2019 Existing | LOS (Delay) | D (36.6) | | | B (11.6) | | A (8.4) | | B (14.4) |
| | Synchro 95th Q | 209' | 25' | 102' | 173' | m14' | 94' | 90' | |
| 2023 Background | LOS (Delay) | D (36.7) | | | B (11.2) | | A (8.7) | | B (13.9) |
| | Synchro 95th Q | 238' | 112' | 113' | m200' | m5' | 92' | 202' | |
| 2023 Build-out | LOS (Delay) | D (50.0) | | | B (14.0) | | B (16.6) | | C (20.3) |
| | Synchro 95th Q | 343' | 147' | 148' | m274' | m28' | 201' | 295' | |
| 2023 Build-out IMP | LOS (Delay) | D (49.5) | | | B (19.2) | | B (15.8) | | C (22.1) |
| | Synchro 95th Q | 339' | 146' | 146' | m271' | m168' | 200' | 295' | |
| 2028 Build-out +5 | LOS (Delay) | D (50.3) | | | B (17.9) | | B (16.7) | | C (22.0) |
| Opt 1 - Improve Existing | Synchro 95th Q | 191' | 188' | 293' | m282' | m171' | 207' | 774' | |
| 2028 Build-out +5 | LOS (Delay) | B (11.4) | - | B (16.2) | A (4.8) | | A (3.3) | | A (6.1)/A (5.3) |
| Opt 3 - DDI | Synchro 95th Q | 66' | - | 136' | 48' | - | - | 32' | |
| # 95th percentile volume exceeds capacity, queue may be longer | | | | | | | | | |
| m Volume for 95th percentile queue is metered by upstream signal | | | | | | | | | |
| *DDI results reported as EBL signal (includes NBT and EBL)/EBR signal (includes EBR and SBT) | | | | | | | | | |

Table 6.9 shows the overall intersection currently operates, and is expected to continue to operate at LOS D during the AM peak hour and LOS B during the PM peak hour through 2023 background conditions.

When the proposed site traffic is added to the 2023 background volumes, the overall intersection is expected to continue to operate at LOS D during the AM peak hour and drop from LOS B to LOS C during the PM peak hour. Additionally, the eastbound approach of I-85 NB Ramp is expected to drop from LOS E to LOS F during the AM peak hour. As discussed above in **Section 6.8**, the impacts to delay are partly caused by the increased cycle length of the entire US 29-74/NC 273 Closed Loop Signal System to accommodate the added fourth leg at the intersection of Beatty Drive (NC 273) and YMCA Drive. **Table 6.9** shows that during the AM peak hour, there is a trade-off where the side-street eastbound approach experiences added delay where more green time is given back to the mainline as reflected in the decreased delay for the northbound approach. However, during the PM peak hour, each approach as well as the overall intersection experiences increased delay, indicating impact caused by the added site traffic in addition to the modified cycle lengths. Given the increased delay and LOS degradation, identification of mitigation improvements

is required. The following improvement was identified to potentially mitigate the operational impact and accommodate the added site traffic:

- Additional northbound right-turn lane (creating dual right-turn lanes) along Park Street (NC 273) w/ storage maximized between I-85 NB Ramp and Browntown Road

Note that the existing northbound right-turn lane is currently channelized under yield control. Under the improved conditions, the dual right-turn lanes were assumed to be pulled into the intersection under signal control (and with no RTOR allowed per NCDOT capacity analysis guidelines). With this improvement in place, **Table 6.9** shows considerable improvement during the AM peak hour, particularly for the northbound approach, yet minimal benefit during the PM peak hour. Further analysis with RTOR allowed shows more benefit expected during both peak hours with an overall intersection delay of 16 seconds during the AM peak hour and 19 seconds during the PM peak hour (both LOS B).

The AM peak hour is particularly improved with a second northbound right-turn lane due to the amount of northbound right-turn volume shown in **Figure 5.2** during the AM peak hour (1,012 vehicles). This is considered a high amount of volume to serve with a single lane, as this movement shows a volume-to-capacity ratio of 1.06 under 2023 build-out AM conditions. With a second turn lane added and pulled into the intersection under 2023 build-out (Improved) AM conditions, the volume-to-capacity ratio drops to 0.78; with RTOR allowed, this drops to 0.63. ***The operational benefit and timing of this potential mitigation improvement should be coordinated with City and NCDOT staff in consideration of the timing and preferred interchange configuration for the planned NCDOT TIP Project No. I-5719 to determine if this mitigation improvement will be required.***

Based on review of the Synchro 95th percentile queue lengths at this intersection, the northbound right- and southbound left-turn queues are expected to exceed the existing storage during the AM peak hour under both background and build-out conditions. The identified mitigation improvement significantly reduces the northbound right-turn queue while also providing benefit to the southbound left-turn queue. Given that the queue is exceeded under background conditions along with the benefit provided by the additional northbound right-turn lane, extension of the southbound left-turn storages is not recommended as mitigation for the proposed CaroMont Regional Medical Center. Also note that the increase in eastbound queues reflect the longer coordinated cycle lengths discussed above.

2028 Build-out + 5 (w/ I-5719)

As discussed in **Section 4.3**, interchange improvements at Exit 27 (Beatty Drive/Park Street (NC 273)) are currently being designed as part of NCDOT TIP Project No. I-5719. Based on [NCDOT's project information page](#) as of April 2020, this project is scheduled for construction in FY 2024-2028; therefore, for the purposes of this TIA as discussed with City and NCDOT staff, this project was included in the 2028 build-out +5 analysis scenario. Based on coordination with NCDOT at the TIA Scoping Meeting, the preferred interchange improvement alternative has been narrowed down to two options:

- Option 1 – Improve Existing Interchange
- Option 3 – DDI

Based on the concepts and laneage configurations provided by NCDOT, the only modification for Option 1 from the current laneage is along the eastbound approach of I-85 NB Off-Ramp where dual right-turn lanes are recommended to be converted to dual left-turn lanes. With this

improvement in place, **Table 6.9** reflects similar operations between 2023 build-out conditions and 2028 build-out +5 conditions under the scenario where the existing interchange configuration is preserved and improved (Option 1).

Table 6.9 shows improved operations with the overall intersection operating at LOS A during both peak hours under the DDI configuration (Option 3).

6.10 PARK STREET (NC 273) AND WILKINSON BLVD (US 74)

Table 6.10 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 6.10 - 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 | | | | | | | | | | |
| 2019 Existing | LOS (Delay) | F (81.3) | | E (76.2) | | F (111.7) | | E (68.0) | | F (85.9) |
| | Synchro 95th Q | 304' | #733' | #168' | 160' | 123' | #796' | #521' | 329' | |
| 2023 Background | LOS (Delay) | F (111.7) | | E (70.5) | | F (128.8) | | E (73.2) | | F (103.9) |
| | Synchro 95th Q | #395' | #830' | #210' | 182' | 146' | #950' | #619' | 355' | |
| 2023 Build-out | LOS (Delay) | F (112.0) | | E (71.2) | | F (148.3) | | E (75.7) | | F (110.1) |
| | Synchro 95th Q | #441' | #830' | #210' | 190' | 146' | #1015' | #636' | 373' | |
| 2028 Build-out +5 | LOS (Delay) | F (131.6) | | E (74.7) | | F (170.3) | | F (82.4) | | F (125.9) |
| | Synchro 95th Q | #470' | #896' | #224' | 200' | 152' | #1084' | #674' | 393' | |
| PM Peak Hour | | | | | | | | | | |
| 2019 Existing | LOS (Delay) | E (69.9) | | E (69.2) | | E (77.9) | | F (93.1) | | E (77.6) |
| | Synchro 95th Q | #456' | 200' | 269' | #545' | #336' | 451' | #382' | #688' | |
| 2023 Background | LOS (Delay) | E (71.6) | | F (85.5) | | F (83.8) | | F (96.3) | | F (85.5) |
| | Synchro 95th Q | #548' | 225' | 305' | #649' | #362' | #556' | #438' | #766' | |
| 2023 Build-out | LOS (Delay) | E (74.7) | | F (87.0) | | F (90.9) | | F (120.8) | | F (95.4) |
| | Synchro 95th Q | #569' | 225' | 305' | #656' | #362' | #587' | #487' | #860' | |
| 2028 Build-out +5 | LOS (Delay) | F (80.6) | | F (101.1) | | F (101.3) | | F (138.1) | | F (108.1) |
| | Synchro 95th Q | #605' | 236' | 321' | #709' | #384' | #631' | #515' | #917' | |

95th percentile volume exceeds capacity, queue may be longer

As discussed in **Section 4.3**, NCDOT TIP Project No. U-5959 is currently being designed to improve this intersection, with construction currently scheduled for FY 2021 based on the current NCDOT STIP as of April 2020. Based on coordination at the TIA Scoping Meeting, NCDOT indicated that the preferred intersection configuration and specific improvements have not yet been determined; therefore, improvements associated with U-5959 were not included in the analysis of this TIA.

Table 6.10 shows the overall intersection currently operates at LOS F during the AM peak hour and LOS E during the PM peak hour and is expected to operate at LOS F during both peak hours under 2023 background conditions. When the proposed site traffic is added to the 2023 background volumes, the overall intersection is expected to increase in delay while already operating at LOS F during both peak hours. Given the expected increase in delay at an intersection already operating at LOS F, identification of potential mitigation improvements is required.

As shown in **Table 6.10** and in **Figures 5.2** and **5.3**, the proposed CaroMont Regional Medical Center is expected to have the most significant impact to the northbound and southbound approaches of Park Street (NC 273) during the AM and PM peak hours, respectively. Recognizing

two through 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 F (88 seconds), while only marginally improving the PM peak hour by two seconds (93 seconds). Conversely, evaluation of a southbound right-turn lane showed negligible improvement for the AM peak hour of less than one second (110 seconds), while significantly improving the PM peak hour, yet still LOS F (80 seconds).

Figures 5.2 and 5.3 show that the proposed site is expected to add three percent or less of the total entering traffic to this intersection during both peak hours. Additionally, as shown in the 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 and underground utility lines.



Given the funded intersection improvements as part of NCDOT TIP Project No. U-5959, constructing either right-turn lane along Park Street (NC 273) would likely require significant impacts to accommodate a temporary solution (based on the current U-5959 schedule) that would be expected to only provide minimal benefit to this intersection that would still be operating a LOS F during both peak hours with either turn lane in place. Note that, based on discussion at the TIA Scoping Meeting, the ultimate preferred improvement for this intersection is to grade-separate Park Street (NC 273) from Wilkinson Boulevard (US 74). Therefore, ***given the considerations described above, no mitigation improvements, including construction of a right-turn lane along Park Street (NC 273), are recommended as mitigation for the proposed CaroMont Regional Medical Center.***

7.0 Auxiliary Turn-Lane Warrants

Warrants for additional turn-lane improvements for unsignalized intersections 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 2023 background and build-out conditions are summarized by intersection below and included in the **Appendix**.

2023 Background Conditions

2. **Belmont-Mt. Holly Road and Beaty Road**

- Northbound right-turn lane along Belmont-Mt. Holly Rd with a minimum storage length of 50'
- Southbound left-turn lane along Belmont-Mt. Holly Rd with a minimum storage length of 100'

3. **Belmont-Mt. Holly Road and Ferstl Avenue**

- Northbound right-turn lane along Belmont-Mt. Holly Rd with a minimum storage length of 50'

4. **Beatty Drive (NC 273) and Beaty Road**

- Northbound left-turn lane along Beatty Dr (NC 273) with a minimum storage length of 500'

5. **Beatty Road and Ferstl Avenue**

- Westbound left-turn lane along Beatty Rd with a minimum storage length of 50'

7. **Beatty Drive (NC 273) and Caldwell Drive**

- Northbound right-turn lane along Beatty Dr (NC 273) with a minimum storage length of 50'
- Southbound left-turn lane along Beatty Dr (NC 273) with a minimum storage length of 75'

2023 Build-out Conditions

2. **Belmont-Mt. Holly Road and Beaty Road**

- Northbound right-turn lane along Belmont-Mt. Holly Rd with a minimum storage length of 50'
- Southbound left-turn lane along Belmont-Mt. Holly Rd with a minimum storage length of 100'

The proposed site is not expected to increase the warranted storage for either turn lane at this intersection; therefore, turn lanes are **not recommended** as mitigation for the proposed CaroMont Regional Medical Center.

3. **Belmont-Mt. Holly Road and Ferstl Avenue**

- Northbound right-turn lane along Belmont-Mt. Holly Rd with a minimum storage length of 75'

The addition of proposed site traffic at this intersection is expected to increase the warranted storage length for the northbound right-turn lane. Additionally, a northbound right-turn lane is identified as mitigation for capacity purposes at this intersection (discussed in **Section 6.3**). Based on NCDOT *Congestion Management Capacity Analysis Guidelines*, full storage for both right- and left-turn lanes should accommodate a minimum of 100 feet; therefore, a northbound right-turn lane Belmont-Mt. Holly Road with a minimum storage length of **100 feet** is recommended.

4. **Beatty Drive (NC 273) and Beatty Road**

- Northbound left-turn lane along Beatty Dr (NC 273) with a minimum storage length of 500'

There is currently a two-way left-turn lane (TWLTL) provided along the northbound approach of Beatty Drive (NC 273) that can safely accommodate the warranted northbound left-turn storage. Additionally, the proposed site is not expected to increase the warranted storage for the northbound left-turn lane at this intersection; therefore, a northbound left-turn lane is **not recommended** as mitigation for the proposed CaroMont Regional Medical Center.

5. **Beatty Road and Ferstl Avenue**

- Westbound left-turn lane along Beatty Rd with a minimum storage length of 50'

There is currently a westbound left-turn lane provided along Beatty Road at Ferstl Avenue. Additionally, the proposed site is not expected to increase the warranted turn lane storage; therefore, a westbound left-turn lane is **not recommended** as mitigation for the proposed CaroMont Regional Medical Center.

7. **Beatty Drive (NC 273) and Caldwell Drive**

- Northbound right-turn lane along Beatty Dr (NC 273) with a minimum storage length of 50'
- Southbound left-turn lane along Beatty Dr (NC 273) with a minimum storage length of 125'

The proposed site is not expected to increase the warranted storage for the northbound right-turn lane at this intersection; therefore, a northbound right-turn lane is **not recommended** as mitigation for the proposed CaroMont Regional Medical Center.

The proposed site is expected to increase the warranted southbound left-turn storage length by 50 feet during the PM peak-hour. However, there is currently a TWLTL provided along the southbound approach of Beatty Drive (NC 273) that can safely accommodate the warranted storage for the southbound left-turn lane at this intersection; therefore, a southbound left-turn lane is **not recommended** as mitigation for the proposed CaroMont Regional Medical Center.

8.0 Crash Data Analysis

Crash data was obtained at the study intersections for crashes that occurred between January 1, 2017, and December 31, 2019. Over this three-year period, 289 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 | 1 |
| Class A | 2 |
| Class B | 7 |
| Class C | 32 |
| Property Damage Only | 247 |
| Total | 289 |

Table 8.1 above shows the total number of crashes by severity type from most to least severe. As shown, there was one fatal crash, which occurred at the unsignalized Beatty Drive (NC 273) and Caldwell Drive intersection. 85% of the crashes over the past three 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 |
|---|-----------------|
| Beatty Dr (NC 273) and Tuckaseege Rd | 117.17 |
| Belmont-Mt. Holly Rd and Beatty Rd | 84.33 |
| Belmont-Mt. Holly Rd and Ferstl Ave | 36.06 |
| Beatty Dr (NC 273) and Beatty Rd | 27.80 |
| Beatty Rd and Ferstl Ave | 30.40 |
| Beatty Dr (NC 273) and YMCA Dr | 45.66 |
| Beatty Dr (NC 273) and Caldwell Dr | 57.49 |
| Beatty Dr (NC 273) and I-85 SB Ramp | 187.47 |
| Park St (NC 273) and I-85 NB Ramp | 140.68 |
| Park St (NC 273) and Wilkinson Blvd (US 74) | 154.85 |
| Average | 109.69 |

Table 8.2 shows the crash rates at the study area intersections resulted in a weighted average crash rate of 109.69 crashes per 100 million entering vehicles (MEV), with the highest rates occurring at the signalized intersections of Beatty Drive/Park Street (NC 273) with Tuckaseege Road, the I-85 interchange ramps, and Wilkinson Boulevard (US 74). There have been 29, 70, 59 and 78 total crashes reported over this three-year period at these four intersections, respectively.

All four of these intersections have significant improvements planned by NCDOT to address these documented safety concerns through several TIP projects.

Table 8.3 – Crash Type Summary

| Crash Type | Beatty Dr (NC 273) & Tuckaseege Rd | Belmont-Mt. Holly Rd & Beatty Rd | Belmont-Mt. Holly Rd & Ferstl Ave | Beatty Dr (NC 273) & Beatty Rd | Beatty Rd & Ferstl Ave | Beatty Dr (NC 273) & YMCA Dr | Beatty Dr (NC 273) & Caldwell Dr | Beatty Dr (NC 273) & I-85 SB Ramp | Park St (NC 273) & I-85 NB Ramp | Park St (NC 273) & Wilkinson Blvd (US 74) |
|--------------------------------|------------------------------------|----------------------------------|-----------------------------------|--------------------------------|------------------------|------------------------------|----------------------------------|-----------------------------------|---------------------------------|---|
| Angle | 14 | 3 | 0 | 0 | 0 | 4 | 6 | 10 | 15 | 14 |
| Animal | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 0 |
| Backing Up | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 |
| Fixed Object | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Head On | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| Jackknife | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| Left-Turn, Different Roadways | 1 | 3 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 |
| Left-Turn, Same Roadway | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 3 | 0 |
| Other Collision with Vehicle | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Parked Motor Vehicle | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| Pedalcyclist | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pedestrian | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 |
| Ran off Road - Left | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| Ran off Road - Right | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 2 |
| Rear End, Slow or Stop | 4 | 4 | 1 | 3 | 0 | 5 | 4 | 31 | 31 | 46 |
| Rear End, Turn | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| Right-Turn, Different Roadways | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 |
| Right-Turn, Same Roadway | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 4 |
| Sideswipe, Same Direction | 4 | 0 | 0 | 1 | 0 | 0 | 3 | 19 | 6 | 8 |
| Sideswipe, Opposite Direction | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Unknown | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| Total | 28 | 12 | 3 | 7 | 1 | 13 | 17 | 70 | 59 | 78 |

The most common crash types within the study area were rear-end collisions caused by slowing or stopping vehicles (40% of total crashes) and angle collisions (25% of total crashes). Rear-end collisions are often associated with higher levels of congestion at both signalized and unsignalized intersections. As shown in **Table 8.3**, these rear-end collisions were most prevalent at the signalized intersections of Beatty Drive/Park Street (NC 273) with the I-85 interchange ramps and Wilkinson Boulevard (US 74), which are also the three highest peak-hour volume intersections within the study area. As discussed in **Section 4.3**, two separate NCDOT TIP projects (I-5719 and U-5959) are currently being designed to address the safety and congestion issues by increasing capacity at each of these three intersections.

The most common crash type at the intersection of Beatty Drive (NC 273) and Tuckaseege Road were angle crashes. At signalized intersections, these crashes are often associated with heavy through traffic along a corridor with permitted left-turn phasing allowed that leaves limited gaps for vehicles to turn onto the side-streets and/or limited sight distance. Based on the crash data provided by NCDOT, the majority of angle crashes reported at this intersection involved at least one vehicle traveling southbound along Beatty Drive (NC 273). As discussed in **Section 4.3**, NCDOT TIP Project No. U-3633 is currently under construction to widen Beatty Drive (NC 273) to a four-lane divided roadway north of Tuckaseege Road. The crash data shows that all 14 angle crashes occurred after August 2017, which similarly aligns with when construction began on the TIP project along with the gas station located in the southwest quadrant of the intersection.

Crash data provided by NCDOT is included in the **Appendix**.

9.0 Mitigation Improvements

Based on the capacity analyses performed at each of the identified study intersections, 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:

4. Belmont-Mt. Holly Road and Ferstl Avenue

- Northbound right-turn lane along Belmont-Mt. Holly Road with 100' of storage

7. Beatty Drive (NC 273) and YMCA Drive/Access 1

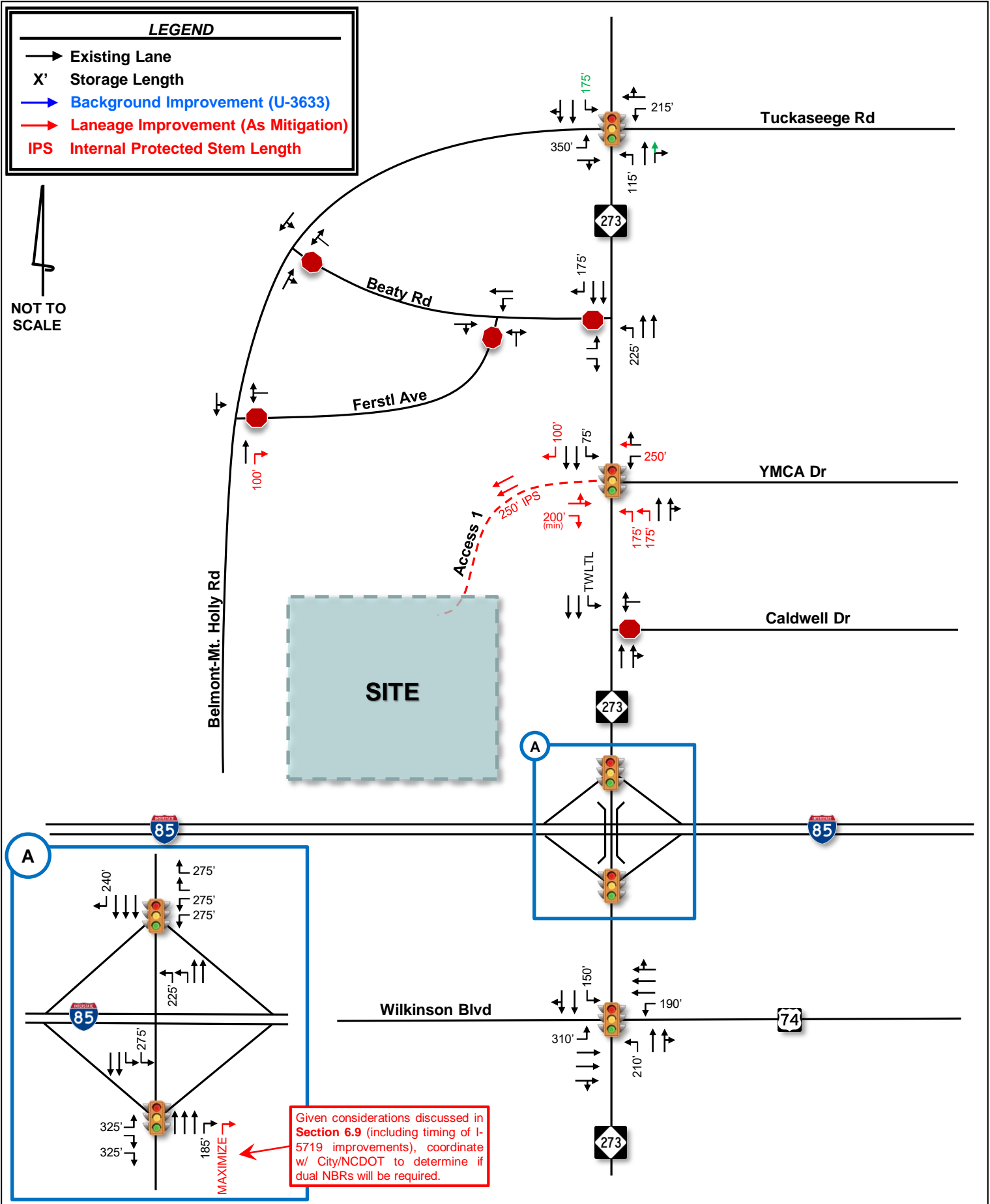
- Dual northbound left-turn lanes along Beatty Drive (NC 273) with 175' of storage each
 - Provide two ingress lanes along Access 1 to receive the dual left-turn lanes
- Southbound right-turn lane along Beatty Drive (NC 273) with 100' of storage
- Extend the westbound left-turn lane along YMCA Drive to provide 250 feet of storage (currently 150 feet)
- Restripe the westbound right-turn lane to a shared through/right lane
- Provide a shared eastbound left/through lane and exclusive right-turn lane along Access 1
 - Provide a minimum of 200 feet of storage for the eastbound right-turn lane
- Provide a 250-foot internal protected stem (IPS) along Access 1

10. Park Street (NC 273) and I-85 NB Ramp

- Additional northbound right-turn lane (creating dual right-turn lanes) along Park Street (NC 273) w/ storage maximized between I-85 NB Ramp and Browntown Road

The operational benefit and timing of this potential mitigation improvement should be coordinated with City and NCDOT staff in consideration of the timing and preferred interchange configuration for the planned NCDOT TIP Project No. I-5719 to determine if this mitigation improvement will be required.

The mitigation improvements identified within the study area are shown in **Figure 9.1**. The improvements shown on 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.



APPENDIX