



# **AMBERLEY**

DRAFT Traffic Impact Analysis

Nixon Road  
Belmont, North Carolina

Prepared for:

**City of Belmont**

February 2019

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**Kimley»»Horn**

**DRAFT Traffic Impact Analysis for  
Amberley  
Nixon Road  
Belmont, North Carolina**

**Prepared for:**

**City of Belmont  
Belmont, North Carolina**

**Prepared by:**

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**February 2019  
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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 Amberley residential development. The primary objectives of the study are:

- To estimate trip generation and distribution for the proposed development.
- To perform intersection capacity analyses for each of the identified study intersections.
- To determine the potential traffic impacts of the proposed development.
- To identify improvements to mitigate the proposed development's traffic impacts.

The proposed Amberley residential development is located on the vacant land that sits west of where Nixon Road currently ends into a cul-de-sac, west of both the South Point Ridge neighborhood and South Point High School in Belmont, North Carolina. Based on the site plan provided by the applicant, the proposed development is currently envisioned to include 188 single-family homes.

The proposed development exceeded the City of Belmont's TIA threshold as established by the *City of Belmont Land Development Code – Section 16.14 Traffic Impact Analysis*, resulting in the requirement of this study. The overall site density did not meet North Carolina Department of Transportation's (NCDOT's) TIA threshold; however, it should be noted that coordination also occurred with NCDOT staff in review of the assumptions and methodology documented in this TIA.

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 will be accessed via the following access points:

- Driveway #1 – Connection to Rachel Anne Drive, which provides full-movement access onto Southridge Drive approximately 1,150 feet south of Nixon Road
- Driveway #2 – A full-movement, unsignalized driveway connection to the extension of Nixon Road approximately 850 feet west of where Nixon Road currently ends into a cul-de-sac; the Driveway #2 connection will serve as the eastbound approach, while the extension of Rachel Anne Drive (Driveway #1) will serve as the westbound approach of this proposed intersection
- Driveway #3 – A full-movement, unsignalized driveway connection to the extension of Nixon Road approximately 200 feet west of where Nixon Road currently ends into a cul-de-sac

A TIA Scoping Meeting was held with the City of Belmont, NCDOT and representatives of the applicant in Belmont on January 7, 2019, 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, NCDOT and the applicant. The approved MOU is included in the **Appendix**.

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

- 2019 Existing Conditions
- 2023 Background Conditions
- 2023 Build-out Conditions

- 2028 Build-out Conditions + 5 years

Based on coordination at the TIA scoping meeting, this TIA evaluated operations under each of the AM and PM peak-hour scenarios above for the following study area intersections:

1. S Central Avenue and Keener Boulevard (NC 273)
2. S Point Road (NC 273) and Nixon Road/R L Stowe Road
3. S Point Road (NC 273) and South Point HS/Red Raider Run
4. S Point Road (NC 273) and Belwood Drive/Belmont Middle School Driveway
5. Nixon Road and Southridge Drive
6. Southridge Drive and Rachel Anne Drive/Driveway #1 (build-out only)
7. Nixon Road and Rachel Anne Drive/Driveway #2 (build-out only)
8. Nixon Road and Driveway #3 (build-out only)

The following modifications from the background data collected were applied to the capacity analyses to meet NCDOT *Congestion Management Capacity Analysis Guidelines*:

- Right-turn-on-red (RTOR) operations were not allowed.
- Protected-only left-turn phasing was used where protected/permitted left-turn phasing exists (except as noted below).
- 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.

Given the intersection configuration, the protected/permitted left-turn phasing for the southbound approach of Central Avenue at Kenner Boulevard (NC 273) was maintained in the analyses.

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:

**S Point Road (NC 273) and R L Stowe Road/Nixon Road**

- Southbound right-turn lane along S Point Road (NC 273) with 100 feet of storage

**Rachel Anne Extension (Driveway #1)**

- Extend Rachel Anne Drive where it currently stubs west of Southridge Drive to the west to connect to the extension of Nixon Road (also referred to as Driveway #1 in this TIA)

**Nixon Road and Rachel Anne Drive/Driveway #2**

- Single westbound egress and single ingress lane along Driveway #1 (Rachel Anne Dr Ext)
- Single eastbound egress and single ingress lane along Driveway #2
- Southbound right-turn lane along Nixon Road with 100 feet of storage

**Nixon Road and Driveway #3**

- Single eastbound egress and single ingress lane along Driveway #3
- Southbound right-turn lane along Nixon Road with 100 feet of storage

**Nixon Road Extension**

- Applicant should coordinate w/ GCLMPO, City and NCDOT to confirm appropriate alignment/cross-section for the planned Nixon Road Widening, and to confirm proposed site does not prohibit Nixon Road connection to future Belmont-Mt Holly Connector.

**Belmont-Mt Holly Connector**

- Applicant should coordinate with GCLMPO, City and NCDOT to confirm the appropriate alignment and/or to confirm the proposed site does not prohibit construction of the planned connector; current alignment shown through proposed site.

Though not recommended as mitigation of the proposed residential development, further study should be performed to evaluate the feasibility of adding a future southbound left-turn lane along S Central Avenue at Keener Boulevard. Further discussion is provided in **Section 6.1**.

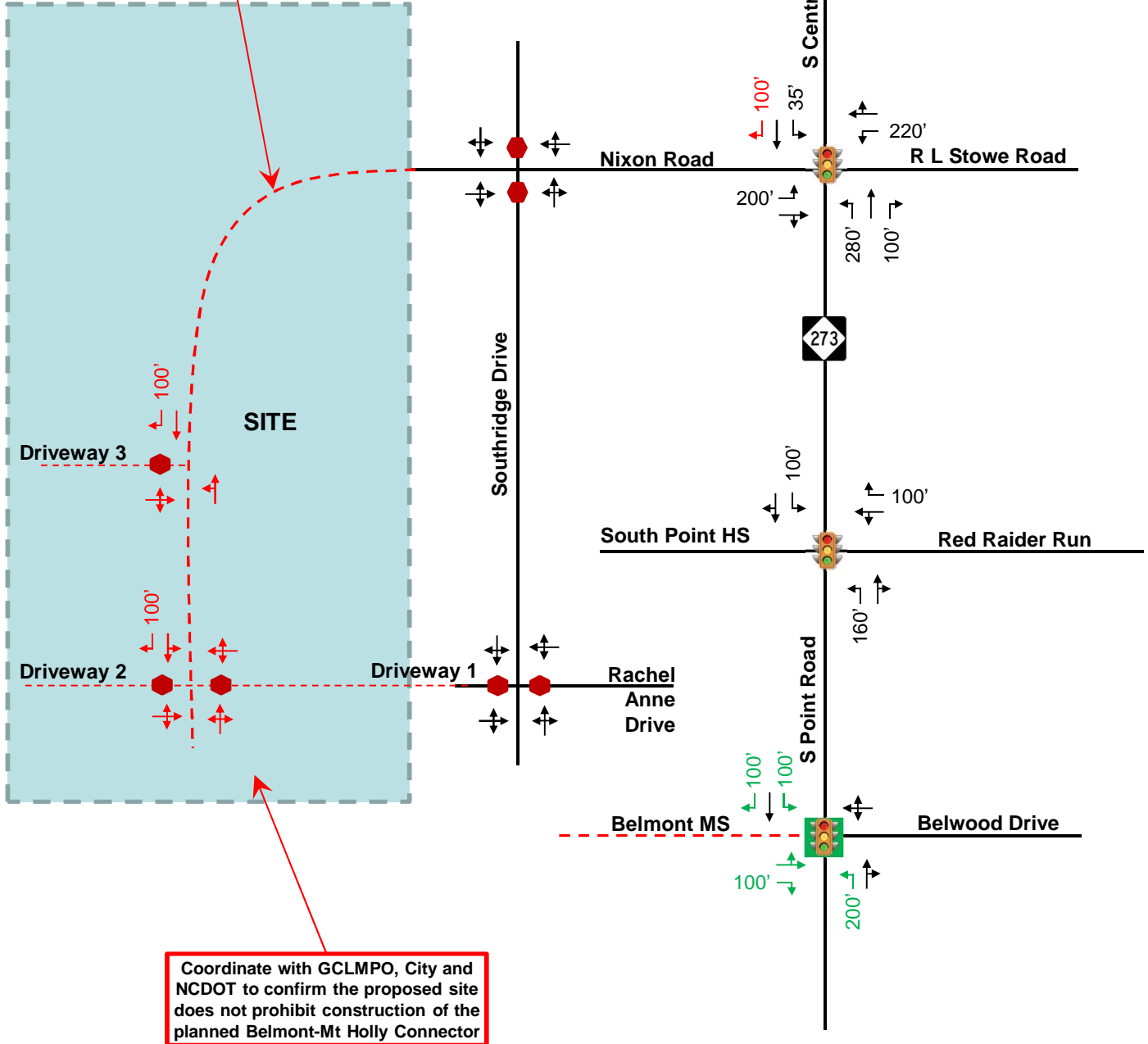
The mitigation improvements identified within the study area are shown in **Figure 1.1**. The improvements shown on this figure are subject to approval by NCDOT and the City of Belmont. All additions and attachments to the State and City roadway system shall be properly permitted, designed and constructed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

**LEGEND**

- Existing Lane
- Approved Development Improvement
- Laneage Improvement Identified
- X' Storage Length
- 🚦 Traffic Signal
- Stop Control

NOT TO SCALE

Coordinate with GCLMPO, City and NCDOT to determine appropriate alignment and cross-section

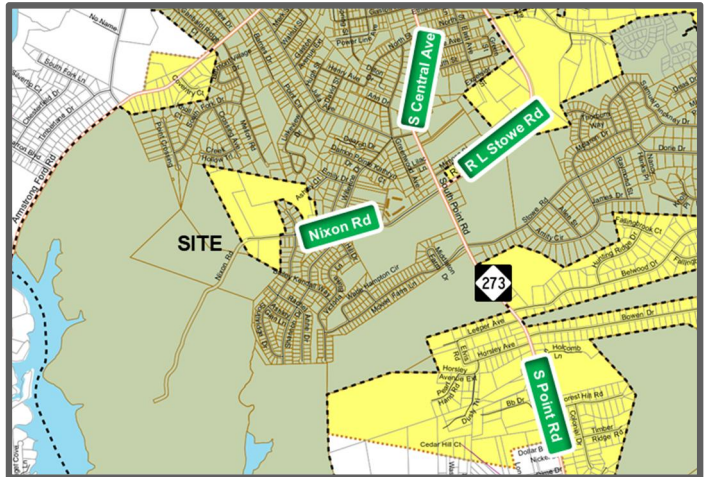


Coordinate with GCLMPO, City and NCDOT to confirm the proposed site does not prohibit construction of the planned Belmont-Mt Holly Connector



## 2.0 Introduction

The proposed Amberley residential development is located on the vacant land that sits west of where Nixon Road currently ends into a cul-de-sac, west of both the South Point Ridge neighborhood and South Point High School in Belmont, North Carolina. Based on the site plan provided by the applicant, the proposed development is currently envisioned to include 188 single-family homes.



The proposed development exceeded the City of Belmont's TIA threshold as established by the *City of Belmont Land Development Code – Section 16.14 Traffic Impact Analysis*, resulting in the requirement of this study. The overall site density did not meet NCDOT's TIA threshold; however, it should be noted that coordination also occurred with NCDOT staff in review of the assumptions and methodology documented in this TIA.

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- Driveway #3 – A full-movement, unsignalized driveway connection to the extension of Nixon Road approximately 200 feet west of where Nixon Road currently ends into a cul-de-sac

A TIA Scoping Meeting was held with the City of Belmont, NCDOT and representatives of the applicant in Belmont on January 7, 2019, 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, NCDOT and the applicant. The approved MOU is included in the **Appendix**.

Kimley-Horn was retained to determine the potential transportation impacts of this development (in accordance with the traffic study guidelines in the *NCDOT Policy on Street and Driveway Access to North Carolina Highways* and set forth by the *City of Belmont Land Development Code – Section 16.14 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 and NCDOT 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 the City NCDOT and the applicant, the study area for this TIA includes the following existing intersections:

1. S Central Avenue and Keener Boulevard (NC 273)
2. S Point Road (NC 273) and Nixon Road/R L Stowe Road
3. S Point Road (NC 273) and South Point HS/Red Raider Run
4. S Point Road (NC 273) and Belwood Drive
5. Nixon Road and Southridge Drive
6. Southridge Drive and Rachel Anne Drive

The study area was based on the *City of Belmont Land Development Code – Section 16.14 Traffic Impact Analysis*, which states “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.”

**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 S Point Road (NC 273), S Central Avenue, Keener Boulevard, R L Stowe Road and Nixon Road.

S Point Road (NC 273) is a two-lane, undivided minor arterial with intermittent turn lanes throughout the study area, with a speed of 45 mph south of Stowe Road and 35 mph north of Stowe Road. S Point Road (NC 273) serves as the primary north/south route along the peninsula formed between the Catawba River and South Fork River where portions of Belmont and Gaston County exists. This route serves both North Carolina and South Carolina commuters via a bridged connection to York County, South Carolina. S Point Road (NC 273) carries an annual average daily traffic (AADT) volume of 17,000 vehicles per day (vpd) south of R L Stowe Road and 9,700 vpd north of R L Stowe Road based on 2017 NCDOT AADT data. During the AM peak hour, the traffic flow is heavily distributed northbound towards I-85, Belmont, Charlotte and Gastonia, and the heavy southbound flow is experienced more during the evening peak hour.

S Point Road (NC 273) transitions to become S Central Avenue north of Julia Avenue, and the NC 273 designation turns onto Keener Boulevard to the east. Central Avenue is also a two-lane, undivided minor arterial with very limited turn lanes throughout the study area and a speed limit of 45 mph. S Central Avenue carries an AADT volume of 10,000 vpd south of Keener Boulevard and 12,000 vpd north of Keener Boulevard based on the 2017 NCDOT AADT maps.

Keener Boulevard (NC 273) is a four-lane, undivided minor arterial that connects to Park Street to the north to provide access to US 74/US 29 and I-85. Keener Boulevard (NC 273) has a posted speed limit of 35 mph and a 2017 AADT volume of 5,700 vpd immediately east of S Central Avenue. Note that the AADT increases from 5,700 to 19,000 vpd east of R L Stowe Road. This shows that much of the traffic from the south wanting to access US 74/29 and/or I-85 utilizes R L Stowe Road to turn off S Point Road, rather than continuing north to turn onto Keener Boulevard.

R L Stowe Road is a two-lane local road that connects S Point Road (NC 273) to Keener Boulevard (NC 273). R L Stowe Road has a speed limit of 45 mph and a 2016 ADT volume of 10,000 vpd east of S Point Road (NC 273).

Nixon Road is a two-lane, undivided local road that primarily carries residential traffic and school traffic to-and-from South Point High School. Nixon Road has a speed limit of 25 mph and a 2017 ADT volume of 3,500 vpd west of S Point Road (NC 273).

### 3.2 EXISTING TRAFFIC VOLUME DEVELOPMENT

AM (6:30-8:30 AM) intersection turning-movement, heavy-vehicle, pedestrian and bicycle counts collected by National Data & Surveying Services on Tuesday, May 22, 2018 were obtained from the *Belmont Middle School TIA* (Kimley-Horn, September 2018) and used in this TIA at the following intersections:

1. S Central Avenue and Keener Boulevard (NC 273)
2. S Point Road (NC 273) and Nixon Road/R L Stowe Road
3. S Point Road (NC 273) and South Point HS/Red Raider Run
4. S Point Road (NC 273) and Belwood Drive

An annual growth rate of two percent (2%) was applied to these 2018 existing AM peak-hour traffic volumes to reflect base 2019 traffic volumes.

PM (4:30-7:00 PM) intersection turning-movement, heavy-vehicle, pedestrian and bicycle counts were performed by Quality Counts on Thursday, January 10, 2019 at the following intersections:

1. S Central Avenue and Keener Boulevard (NC 273)
2. S Point Road (NC 273) and Nixon Road/R L Stowe Road
3. S Point Road (NC 273) and South Point HS/Red Raider Run
4. S Point Road (NC 273) and Belwood Drive
5. Nixon Road and Southridge Drive
6. Southridge Drive and Rachel Anne Drive

AM (6:30-8:30 AM) intersection turning-movement, heavy-vehicle, pedestrian and bicycle counts were performed by Quality Counts on Friday, January 11, 2019 at the following intersections:

1. Nixon Road and Southridge Drive
2. Southridge Drive and Rachel Anne Drive

Note that the Friday AM counts were coordinated with City staff and determined appropriate to collect on Friday morning given the relatively low-volume, residential nature of these two intersections along with consideration for the project schedule. The next opportunity to collect counts would have been nearly two weeks later on January 23<sup>rd</sup> due to exams and a holiday.

The AM and PM peak hours identified differed amongst some of the study intersections. 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 of the intersections are shown in **Table 3.1**.

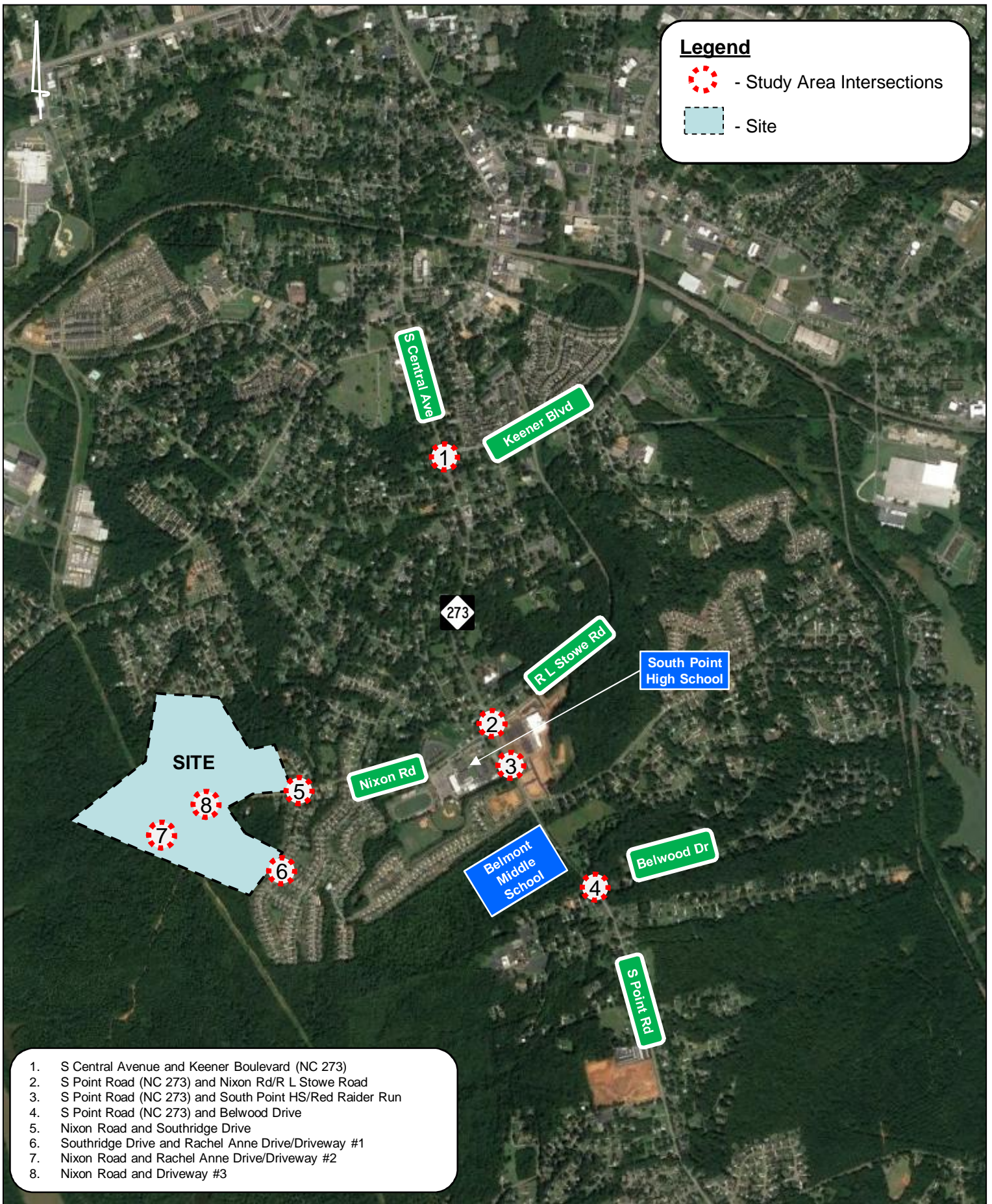
**Table 3.1 – AM & PM Intersection Peak Hours**

<b>Intersection</b>	<b>AM Peak Hour</b>	<b>PM Peak Hour</b>
1. S Central Ave and Keener Blvd (NC 273)	7:15 AM - 8:15 AM	5:00 PM - 6:00 PM
2. S Point Rd and Nixon Rd/RL Stowe Rd	7:00 AM - 8:00 AM	5:00 PM - 6:00 PM
3. S Point Rd and South Point HS/Red Raider Run	7:00 AM - 8:00 AM	5:00 PM - 6:00 PM
4. S Point Rd and Belwood Dr	6:45 AM - 7:45 AM	5:00 PM - 6:00 PM
5. Nixon Rd and Southridge Dr	7:00 AM - 8:00 AM	6:00 PM - 7:00 PM
6. Southridge Dr and Rachel Anne Dr	7:00 AM - 8:00 AM	6:00 PM - 7:00 PM

Volume balancing was performed between study area intersections where reasonable, including along S Point Road (NC 273) between Nixon Road/RL Stowe Road and South Point HS/Red Raider Run. No volume balancing was performed between the remaining study area intersections due to the presence of commercial and residential driveways. Peak-hour intersection turning-movement count data is provided in the **Appendix**.

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









**PROVIDENT  
LAND  
SERVICES**

**AMBERLEY  
SUBDIVISION**

**OVERALL  
SKETCH PLAN**

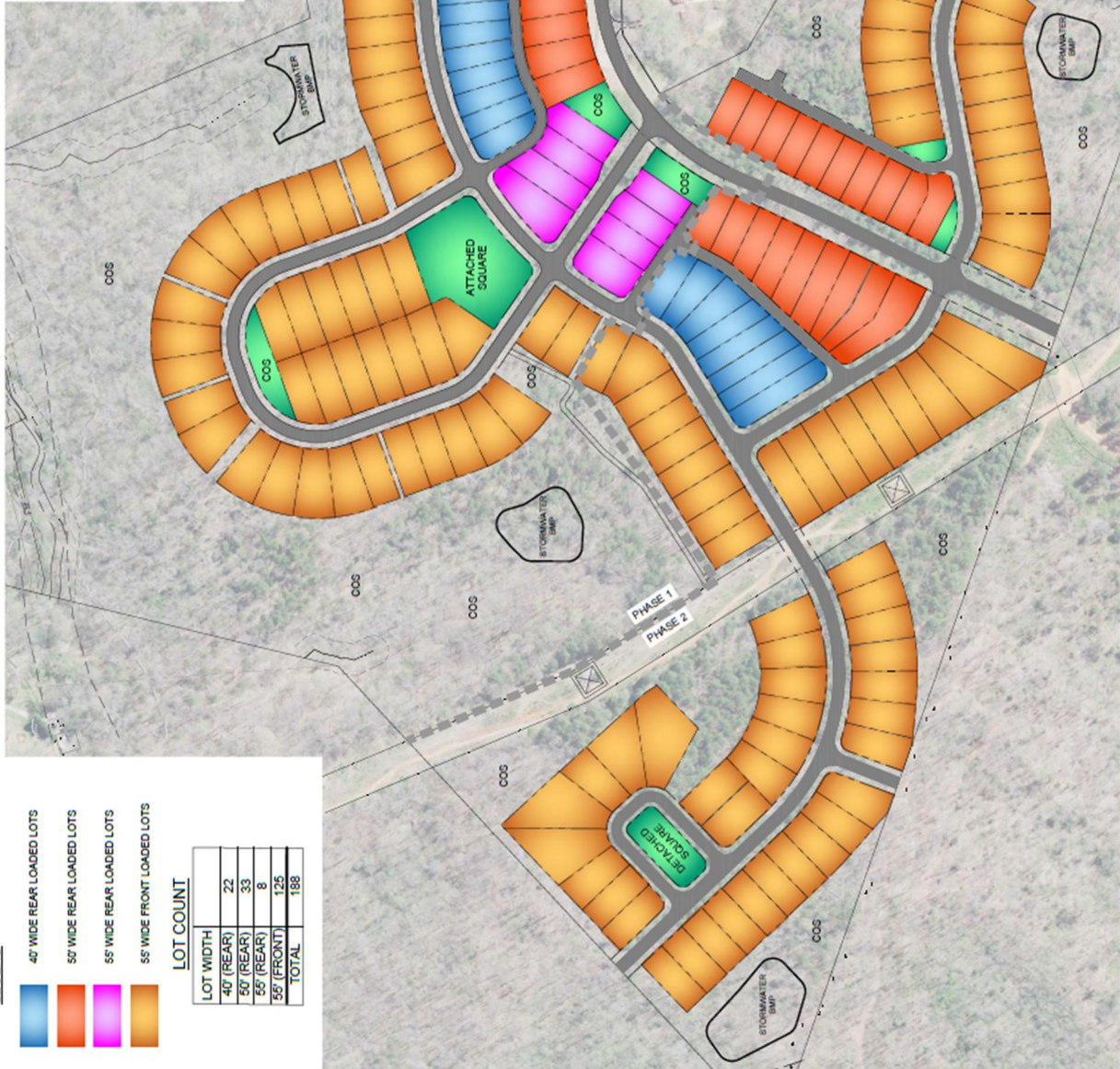
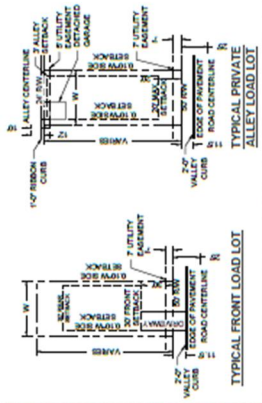


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PRELIMINARY DRAWINGS - DO NOT USE FOR CONSTRUCTION



**LEGEND**

- 40' WIDE REAR LOADED LOTS
- 50' WIDE REAR LOADED LOTS
- 55' WIDE REAR LOADED LOTS
- 55' WIDE FRONT LOADED LOTS

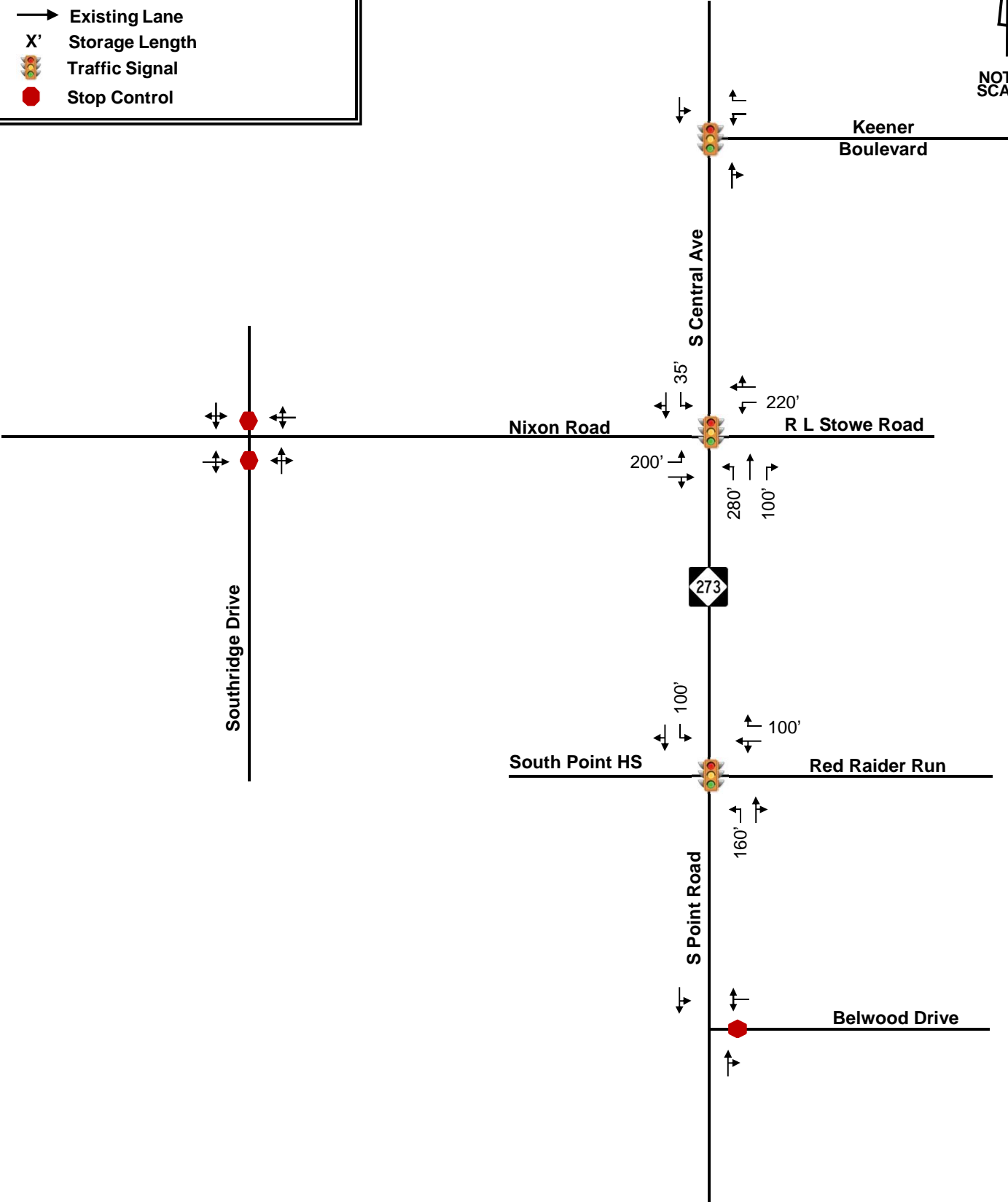
**LOT COUNT**

LOT WIDTH	COUNT
40' (REAR)	22
50' (REAR)	33
55' (REAR)	8
55' (FRONT)	125
<b>TOTAL</b>	<b>188</b>

**LEGEND**

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

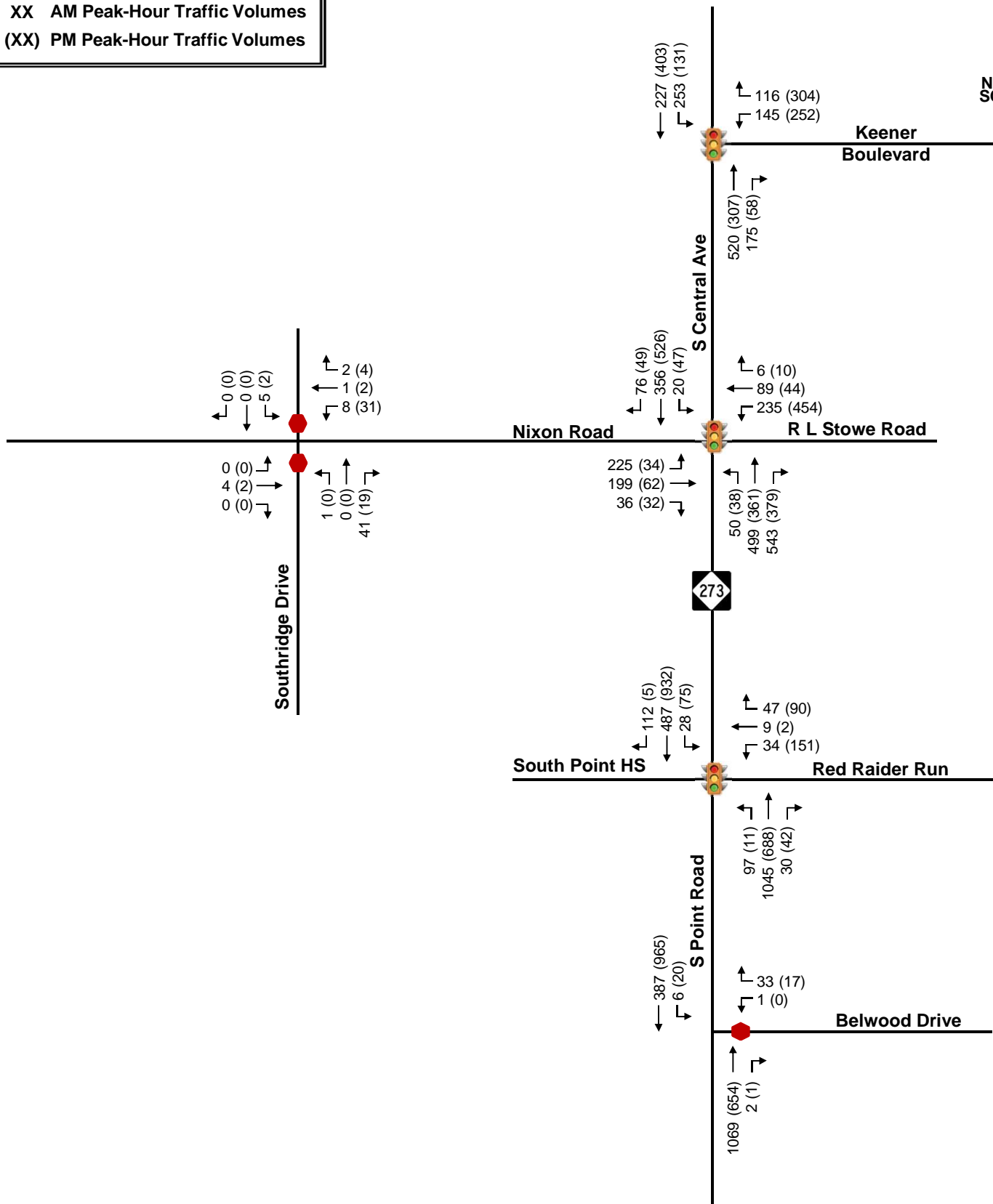
NOT TO SCALE



**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 two percent (2%) 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 S Point Road (NC 273), with consideration taken into account for the approved development traffic volumes also being added as discussed in **Section 4.2**. The growth rate was coordinated with NCDOT and City of Belmont staff.

Note that this non-specific growth rate was not applied to the background volumes traveling to and from the following streets, as each of these serve specific traffic generators:

- Belmont Town Center driveway (Red Raider Run)
- South Point High School Driveway
- Belwood Drive
- Belmont Middle School Driveway
- Southridge Drive
- Rachel Anne Drive

The southern portion of Belmont is uniquely situated along a peninsula formed between the Catawba River and South Fork River, where S Point Road (NC 273) serves as the only north/south collector route along the peninsula. Therefore, as the southern portion of the peninsula has developed, and continues to develop, most, if not all, generated traffic is forced to use S Point Road (NC 273). Additionally, this route also serves South Carolina commuters via a bridged connection to York County, South Carolina. The upper state of South Carolina, and in particular York County, has experienced tremendous growth over the past decade, specifically new residential developments bringing in new residents looking to commute to Charlotte for work. The impacts of this growth are felt in Belmont and Gaston County and along S Point Road (NC 273). Based on NCDOT AADT maps, S Point Road (NC 273) has experienced 7.7% annual growth between 2012 and 2016 south of the proposed site near Plant Allen Road, and 4.5% annual growth between the same timeframe just south of the site near Belwood Drive. Considering that this study also includes growth from five specific approved developments (described in Section 4.2), the non-specific annual growth rate determined and agreed to be used to calculate base 2023 and 2028 background traffic volumes was lower at 2% per year.

## 4.2 APPROVED DEVELOPMENTS

Based on input from the City of Belmont and NCDOT staff, five approved developments that are expected to impact traffic volumes within the study area were included in the background traffic volumes for this TIA. These developments, land uses and intensities, and build-out percentages are outlined in **Table 4.1**. The table also identifies which of these developments has an associated TIA, and the improvements required by these respective developments.

**Table 4.1 – Approved Developments**

Development	Land Use/Intensity	% Build-out	TIA Included?	Required Improvements
Rivermist (N of Bowen Rd)	86 Single-Family units	0%	No	No required improvements at study intersections. <i>(SBL on S Point Rd at site drive)</i>
Belmont Town Square (N of Stowe Rd)	83 Single-Family units	0%	No	No required improvements at study intersections.
McLean (Armstrong Rd)	810 Single-Family units 100 Multifamily units 125,000 SF Shopping Center	20%	Yes	No required improvements at study intersections.
Belmont Town Center (N of Stowe Rd)	16 Single-Family units 92 Townhome units 27,800 SF General Office 21,600 SF Specialty Retail 53,000 SF Supermarket 4,330 SF Fast Food Restaurant 14 FP Gas Station	60% <i>(of approved trip gen)</i>	Yes	- Construct new connection between R L Stowe Road and Stowe Road <b><u>S Point Rd/R L Stowe Rd/Nixon Rd</u></b> - Reduce NBL storage to 280' <b><u>S Point Rd and South Point HS D/W</u></b> - Install traffic signal - NBL w/ ~175' - SBL w/ ~100' - WBT/R and WBR
Belmont Middle School (SW quadrant of NC 273/McKee Farm Ln)	1,200 students (Relocation/Expansion of existing BMS)	0%	Yes	<b><u>S Point Rd and BMS D/W / Belwood Dr</u></b> - Install traffic signal - Laneage Improvements at D/W/Belwood - Realign Belwood Dr

Note that some of the improvements required of the identified approved developments (and listed in both the MOU and **Table 4.1**) were not included as modifications between 2019 existing and 2023 background conditions as these have already been constructed since the time the respective TIA was approved. These are listed in *italics* in **Table 4.1** and are reflected as existing laneage in this TIA.

There was no TIA performed for the Rivermist and Belmont Town Square residential developments. Therefore, a trip generation analysis was performed using the trip generation rates published in *Trip Generation* (Institute of Transportation Engineers, Tenth Edition, 2017). Using the approved trip distribution from the *Henry Chapel Residential Development TIA* (Kimley-Horn, February 2018) as a baseline, the trips were assigned throughout the network based on a similar trip distribution given their similar residential land uses. These calculations are provided in the **Appendix**.

Site volumes for the McLean and Belmont Town Center developments were obtained from the *Hope Armstrong Peninsula Development TIA* (J.M. Teague, May 2014) and the *Belmont Town Center Revised TIA* (Ramey Kemp, July 2015), respectively. Given that the McLean development is primarily residential, the McLean site trips were assigned throughout the network based on a similar trip distribution as the approved residential developments discussed above. Given that the Belmont Town Center is a much different type of land use, the existing turning-movement splits were used to carry and assign these site volumes appropriately at study area intersections that were not included in the approved Belmont Town Center TIA. Site traffic volume figures from the approved TIAs are included in the **Appendix**.

Site volumes for the proposed relocation of Belmont Middle School were obtained from the *Belmont Middle School TIA* (Kimley-Horn, September 2018). The proposed Belmont Middle School is planned to replace the smaller existing Belmont Middle School located in the northeast quadrant of the N Central Avenue/Myrtle Street intersection. Because the study was done for a relocation rather than for a new development, the estimated traffic for the proposed middle school was applied as a positive approved development, while the existing middle school traffic was treated as a negative approved development.

It should be noted that the PM peak hour for the approved Belmont Middle School was analyzed as an afternoon peak between 2:30-4:30 PM. Based on review of the average vehicle/student rate from ITE's PM Peak of Adjacent Street Traffic (0.17) to ITE's PM Peak Hour of Generator (0.35), a factor of 48.6% was applied to the PM peak hour volumes from the TIA to convert the afternoon PM site volumes from the Belmont Middle School TIA to evening PM site volumes (4:30-6:30PM).

The ultimate intersection configuration to be constructed as part of the approved Belmont Middle School has yet to be finalized at the time of this TIA; however, based on input at the TIA Scoping Meeting and reflected in the approved MOU, for purposes of this TIA, the following improvements were included in all future-year conditions analyses:

- Installation of a traffic signal
- Realignment of Belwood Drive to the north to tie into S Point Road (NC 273) at the approved Belmont Middle School Driveway location
- Northbound left-turn lane with 200 feet of storage
- Southbound left-turn lane with 100 feet of storage
- Southbound right-turn lane with 100 feet of storage
- Eastbound shared left/through lane
- Eastbound right-turn lane with 100 feet of storage
- Split phasing operations for the side-street approaches

Required and planned as part of the Belmont Town Center, a new roadway connection will be constructed between Stowe Road and R L Stowe Road east of the existing Harris Teeter. This connection is expected to provide benefit to the S Point Road (NC 273) intersections between Stowe Road and R L Stowe Road by allowing the residential traffic east along Stowe Road to utilize this connection to access R L Stowe Road without accessing S Point Road (NC 273). Reassignment percentages of background traffic were obtained from the *Belmont Middle School TIA* (Kimley-Horn, September 2018) and applied to the 2023 background volumes. These calculations are provided in the **Appendix**.

**Figure 4.1** geographically illustrates the location of each of these five approved developments. **Figures 4.2** and **4.3** show the specific AM and PM peak-hour approved development trips, respectively. **Figures 4.4** and **4.5** show the projected 2023 background AM and PM peak-hour traffic volumes, respectively, that include the historical growth traffic and approved development trips.

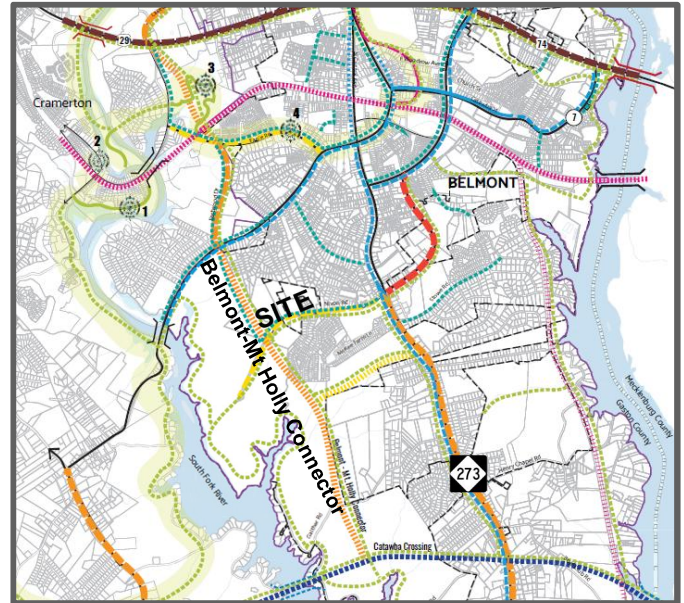
### 4.3 PLANNED TRANSPORTATION PROJECTS

Based on review of the adopted transportation plans for the area, five future transportation projects have been identified within the study area. However, none of these are currently funded based on

the current planning documents and therefore were not included in the operations analyses discussed in **Section 6**. These projects include:

1. Belmont-Mt Holly Connector
2. Nixon Road Widening
3. S Point Road (NC 273) Widening
4. R L Stowe Rd Widening
5. NC 273 Bicycle Lanes (B171787)

The Belmont-Mt Holly Connector is a planned, but not yet funded transportation project that will play a vital role in helping to alleviate traffic from S Point Road (NC 273) by providing a new north/south alternative as the southern portion of the peninsula continues to develop. This project is represented by the orange-dotted line on Belmont’s Future Transportation Map within the *Comprehensive Land Use Plan* (adopted in 2018 and shown to the right) and is currently in the preliminary planning phase. Gaston-Cleveland-Lincoln Metropolitan Planning Organization (GCLMPO) has developed multiple alternatives, but the project is generally expected to connect US 29/74 near the South Fork River to either the future Catawba Crossings alignment or S Point Road (NC 273) north of Duke Energy’s Allen Steam Station. The specific alignment has not yet been determined; however, Belmont’s *Comprehensive Land Use Plan* shows the alignment passing through or nearby the proposed Amberley site. Therefore, the applicant should coordinate with GCLMPO, City staff and NCDOT to confirm the appropriate alignment and/or to confirm the proposed site does not prohibit construction of the future Belmont-Mt Holly Connector. This should be completed early in the site planning process as the potential need to dedicate additional right-of-way through the site may have significant impacts to the site design. Note that since this project is currently not funded, it was not included in the volume development and capacity analyses.



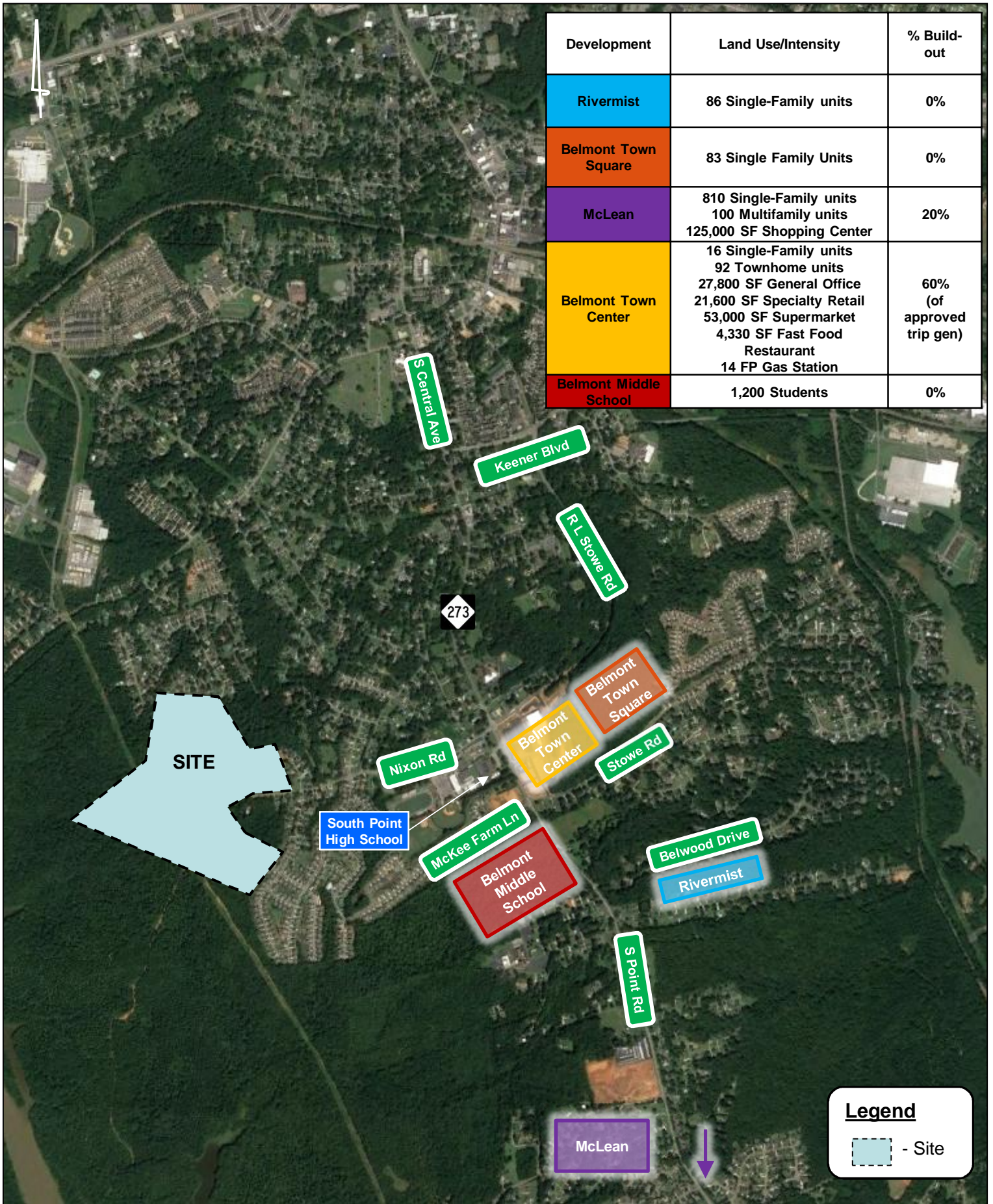
Note that the bike/ped project to construct bicycle lanes along NC 273 between S Main Street and Belwood Drive (B171787) is currently being reviewed for funding as part of NCDOT’s strategic prioritization process. However, this project did not receive local input points based on GCLMPO’s Division Needs Local Input Points (October 2018) and is not included in the Draft 2020-2029 STIP.

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

- **Belmont-Mt Holly Connector**
  - Recommended four-lane, divided facility to serve as parallel route to NC 273 and connect US 29/74 near the South Fork River to either the future Catawba Crossings alignment or S Point Road (NC 273) north of Duke Energy’s Allen Steam Station
  - **Alignment shown through proposed site; Applicant should coordinate with GCLMPO, City and NCDOT to confirm the appropriate alignment and/or to confirm the proposed site does not prohibit construction of the planned connector.**

- Included in the following transportation planning documents:
  - Belmont's *Comprehensive Land Use Plan* (2018) (w/ multi-use path/greenway)
  - Belmont Bicycle Master Plan (2012) (w/ multi-use path/greenway)
  - GCLMPO 2045 MTP – Unfunded
  - GCLMPO CTP (functional design has been developed)
- **Nixon Rd Widening**
  - Widening to a two-lane boulevard w/ median and turn pockets west of NC 273 (S Point Rd)
  - **Includes extension of Nixon Road through proposed site; Applicant to coordinate w/ GCLMPO, City and NCDOT to confirm appropriate alignment/cross-section, and to confirm proposed site does not prohibit Nixon Road connection to future Belmont-Mt Holly Connector**
  - Included in the following transportation planning documents:
    - Belmont's *Comprehensive Land Use Plan* (2018) (w/ sidewalk improvements and multi-use path/greenway)
    - Belmont Bicycle Master Plan (2012) (w/ bike lanes and multi-use path/greenway)
    - Belmont Pedestrian Master Plan (2009) (w/ sidewalk)
- **S Point Rd (NC 273) Widening –**
  - Widening to a four-lane, divided boulevard between R L Stowe Rd and Armstrong Rd
  - Included in the following transportation planning documents:
    - Belmont's *Comprehensive Land Use Plan* (2018) (w/ sidewalk improvements and multi-use path/greenway)
    - Belmont Bicycle Master Plan (2012) (w/ bike lanes and multi-use path/greenway)
    - GCLMPO 2045 MTP – Unfunded
    - GCLMPO CTP
- **R L Stowe Rd Widening**
  - Widening to a four-lane, undivided boulevard between S Point Rd and Keener Blvd
  - Included in the following transportation planning documents:
    - Belmont's *Comprehensive Land Use Plan* (2018) (w/ multi-use path/greenway)
    - Belmont Bicycle Master Plan (2012) (w/ multi-use path/greenway)
    - GCLMPO CTP
- **NC 273 Bicycle Lanes (B171787)**
  - Construct bicycle lanes along both sides of NC 273 (S Central Ave/S Point Rd) from S Main St to Belwood Drive
  - Currently being reviewed for funding as part of NCDOT's strategic prioritization process; based on GCLMPO's Division Needs Local Input Points (October 2018), the project did not receive local input points.





Development	Land Use/Intensity	% Build-out
Rivermist	86 Single-Family units	0%
Belmont Town Square	83 Single Family Units	0%
McLean	810 Single-Family units 100 Multifamily units 125,000 SF Shopping Center	20%
Belmont Town Center	16 Single-Family units 92 Townhome units 27,800 SF General Office 21,600 SF Specialty Retail 53,000 SF Supermarket 4,330 SF Fast Food Restaurant 14 FP Gas Station	60% (of approved trip gen)
Belmont Middle School	1,200 Students	0%

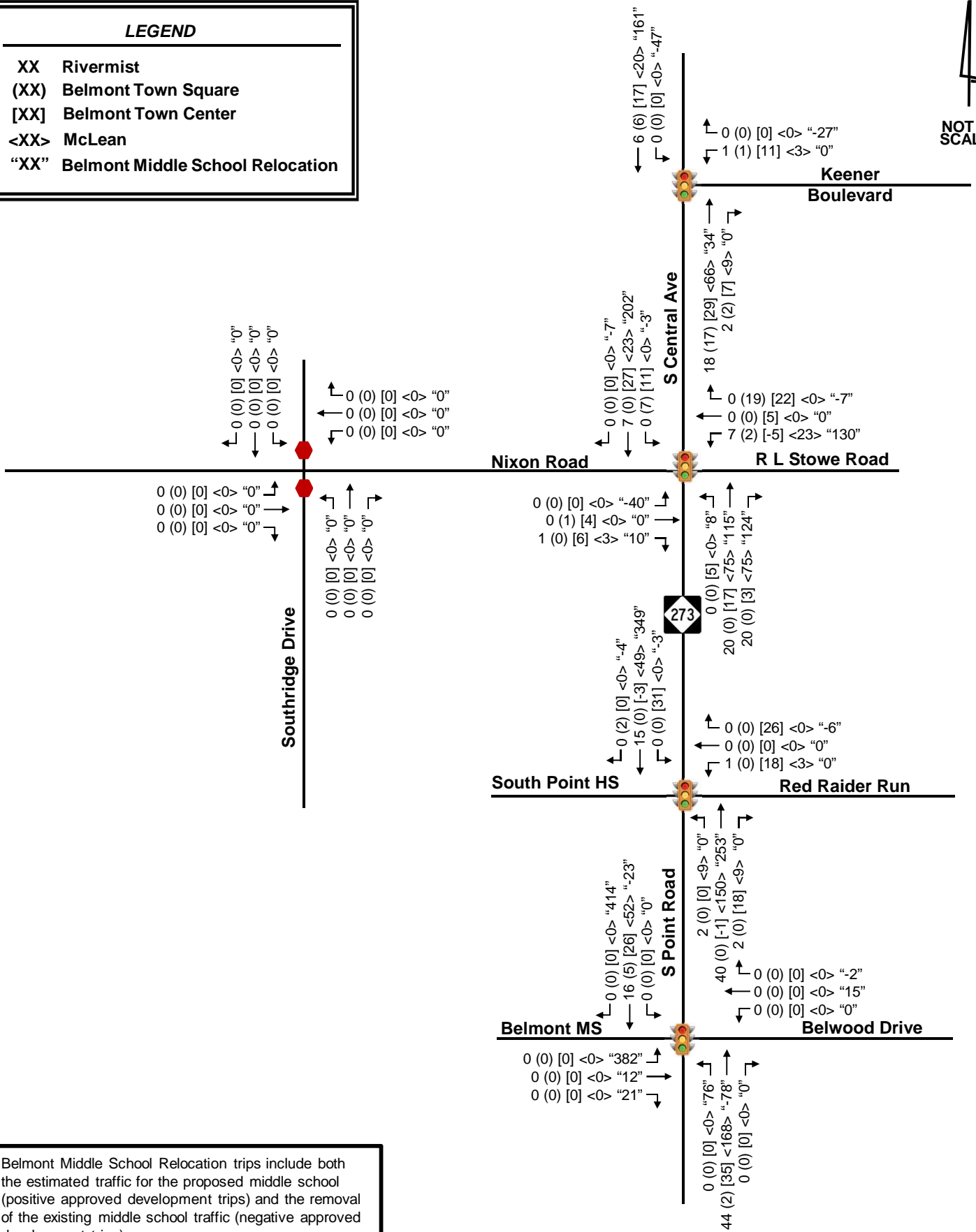
**Legend**

 - Site

**LEGEND**

- XX** Rivermist
- (XX)** Belmont Town Square
- [XX]** Belmont Town Center
- <XX>** McLean
- "XX"** Belmont Middle School Relocation

NOT TO SCALE

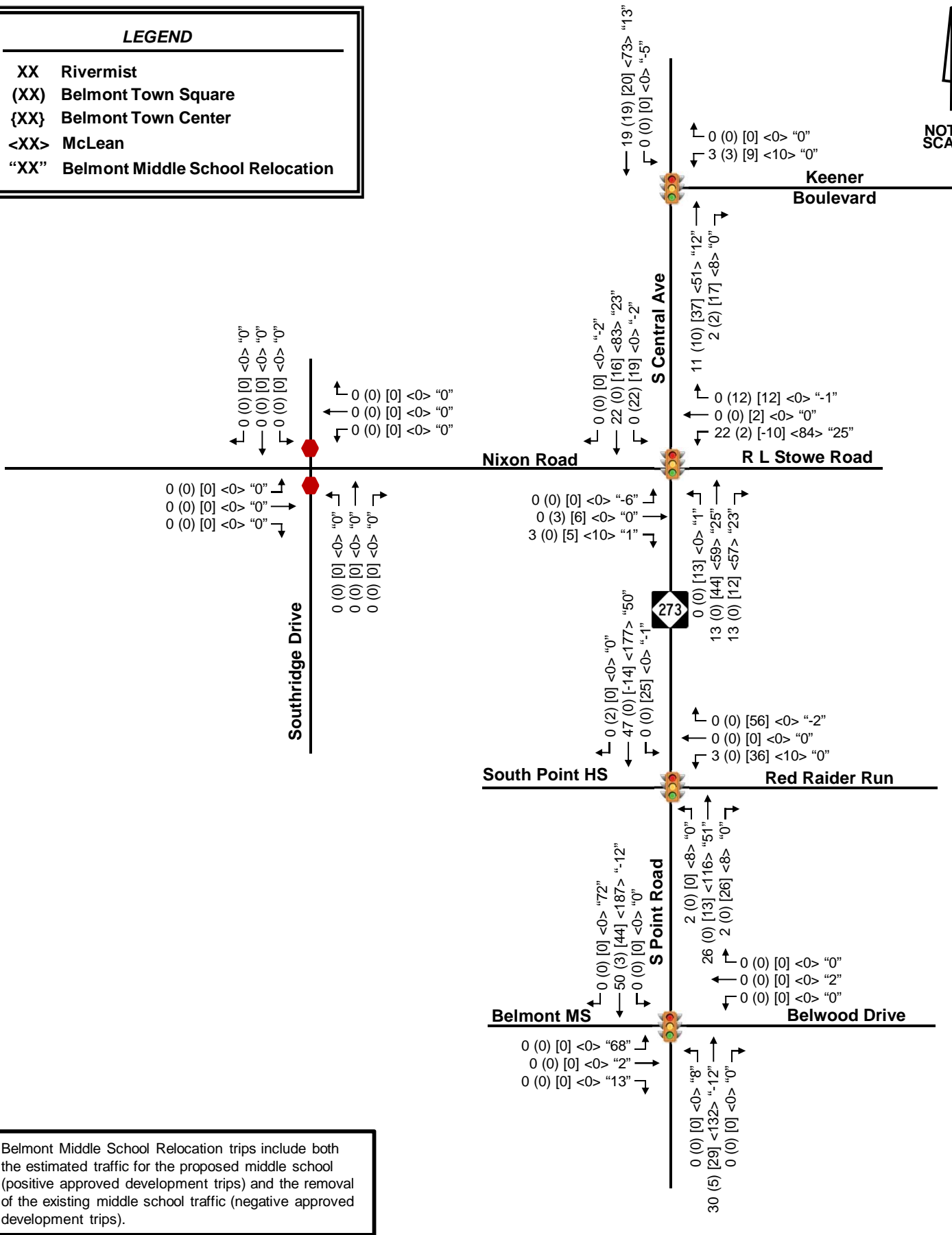


Belmont Middle School Relocation trips include both the estimated traffic for the proposed middle school (positive approved development trips) and the removal of the existing middle school traffic (negative approved development trips).

**LEGEND**

- XX Rivermist
- (XX) Belmont Town Square
- {XX} Belmont Town Center
- <XX> McLean
- "XX" Belmont Middle School Relocation

NOT TO SCALE



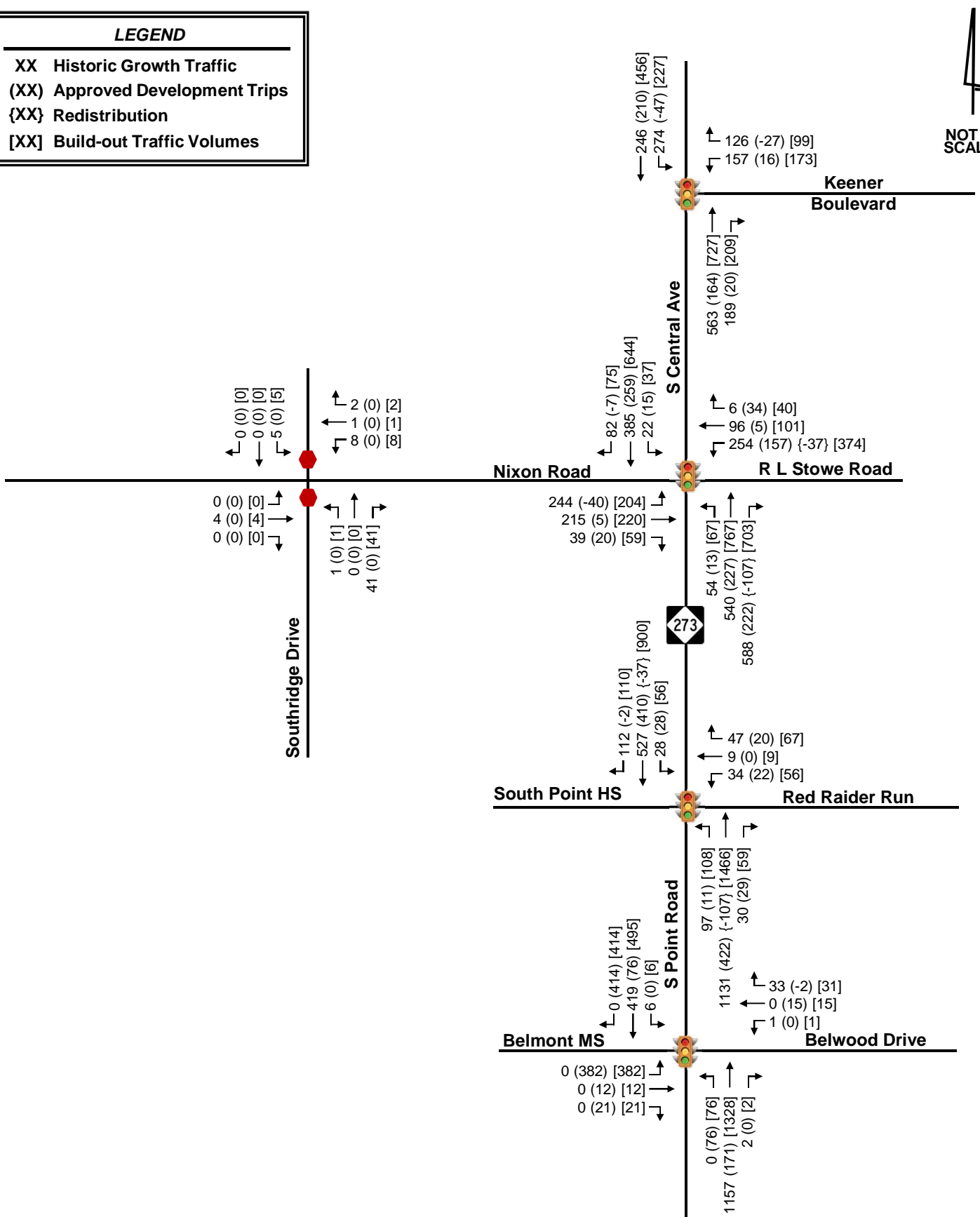
Belmont Middle School Relocation trips include both the estimated traffic for the proposed middle school (positive approved development trips) and the removal of the existing middle school traffic (negative approved development trips).



**LEGEND**

- XX** Historic Growth Traffic
- (XX)** Approved Development Trips
- {XX}** Redistribution
- [XX]** Build-out Traffic Volumes

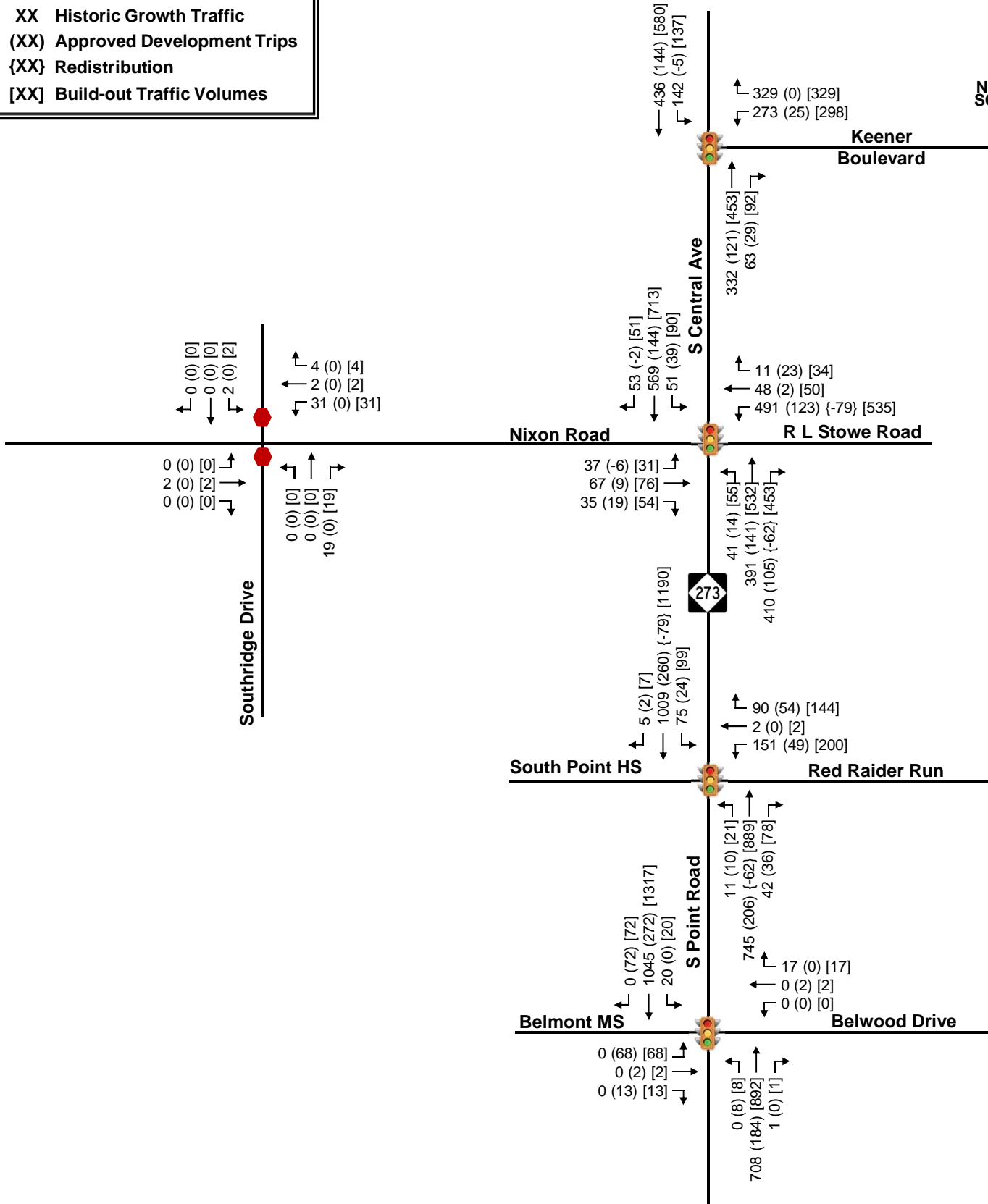
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**LEGEND**

- XX** Historic Growth Traffic
- (XX)** Approved Development Trips
- {XX}** Redistribution
- [XX]** Build-out Traffic Volumes

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 construction of the proposed development, and the distribution and assignment of that traffic throughout the surrounding network.

### 5.1 SITE ACCESS

Based on the site plan provided by the applicant, the proposed development will be accessed via the following proposed access points:

- Driveway #1 – Connection to Rachel Anne Drive, which provides full-movement access onto Southridge Drive approximately 1,150 feet south of Nixon Road
- Driveway #2 – A full-movement, unsignalized driveway connection to the extension of Nixon Road approximately 850 feet west of where Nixon Road currently ends into a cul-de-sac; the Driveway #2 connection will serve as the eastbound approach, while the extension of Rachel Anne Drive (Driveway #1) will serve as the westbound approach of this proposed intersection
- Driveway #3 – A full-movement, unsignalized driveway connection to the extension of Nixon Road approximately 200 feet west of where Nixon Road currently ends into a cul-de-sac

### 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 all land uses.

Based on the most recent site plan provided by the applicant, the proposed development is envisioned to include 188 single-family homes.

**Table 5.1** summarizes the projected trip generation for the proposed residential development. During a typical weekday, the proposed development has the potential to generate 138 and 186 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
Single-Family Homes	188 DU	1,859	138	35	103	186	117	69
<b>Net New External Trips</b>		<b>1,859</b>	<b>138</b>	<b>35</b>	<b>103</b>	<b>186</b>	<b>117</b>	<b>69</b>

### 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, NCDOT and the applicant:

- 25% to/from the north along S Point Road/S Central Avenue (NC 273)
- 50% to/from the east along R L Stowe Road
- 10% to/from the south along S Point Road (NC 273)
- 5% to/from South Point High School (with driveways along both S Point Rd and Nixon Rd)
- 5% to/from Belmont Middle School
- 5% to/from Belmont Town Center (Red Raider Run)

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 TRAFFIC VOLUMES**

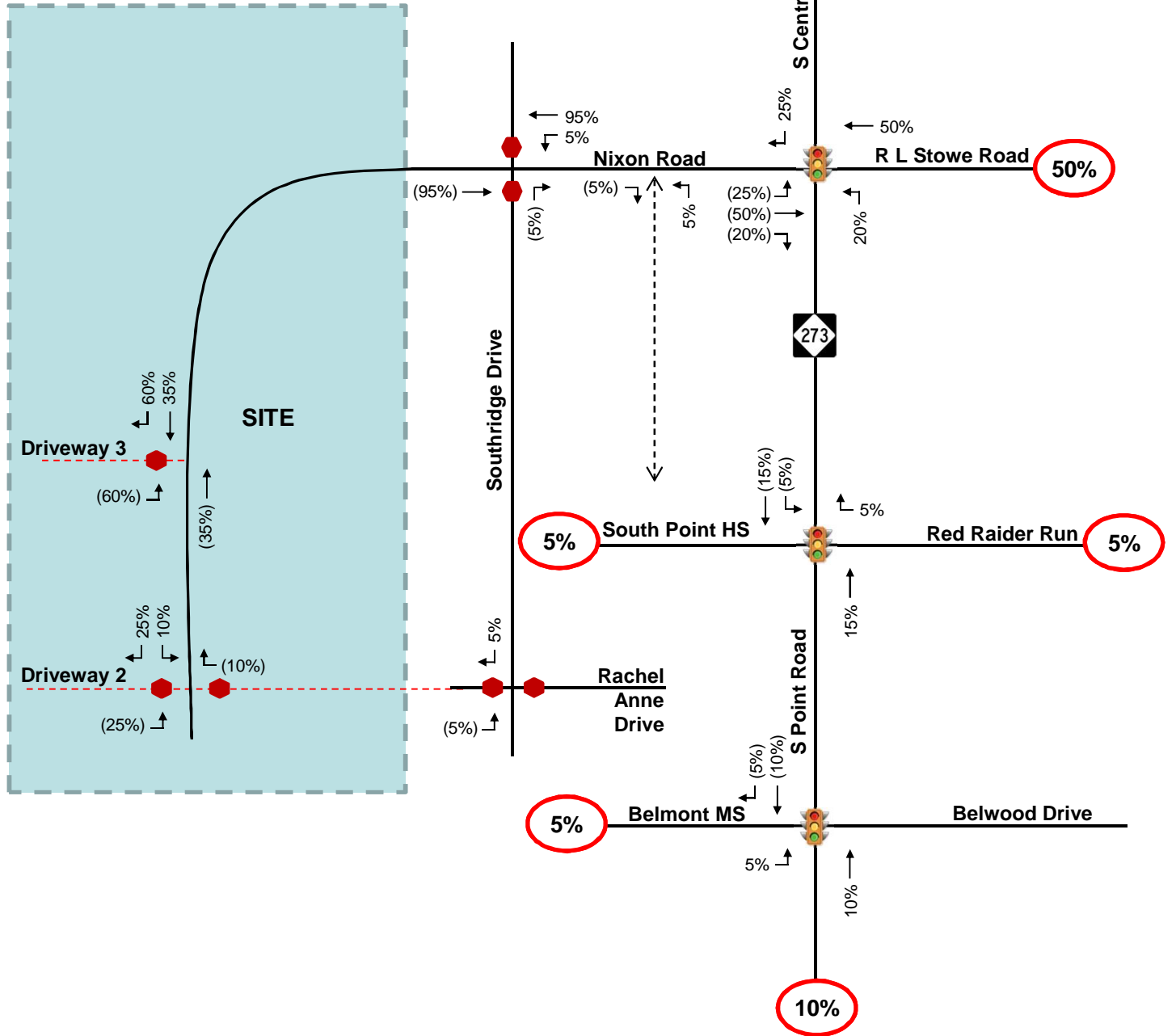
As required by the *City of Belmont Land Development Code – Section 16.14 Traffic Impact Analysis*, an analysis scenario of five years after the build-out year was performed. The 2028 build-out traffic volumes include the approved development traffic and the assignment of the proposed site traffic generation added to the 2028 base background traffic volumes. **Figure 5.4** shows the projected 2028 AM and PM peak-hour build-out traffic volumes.

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

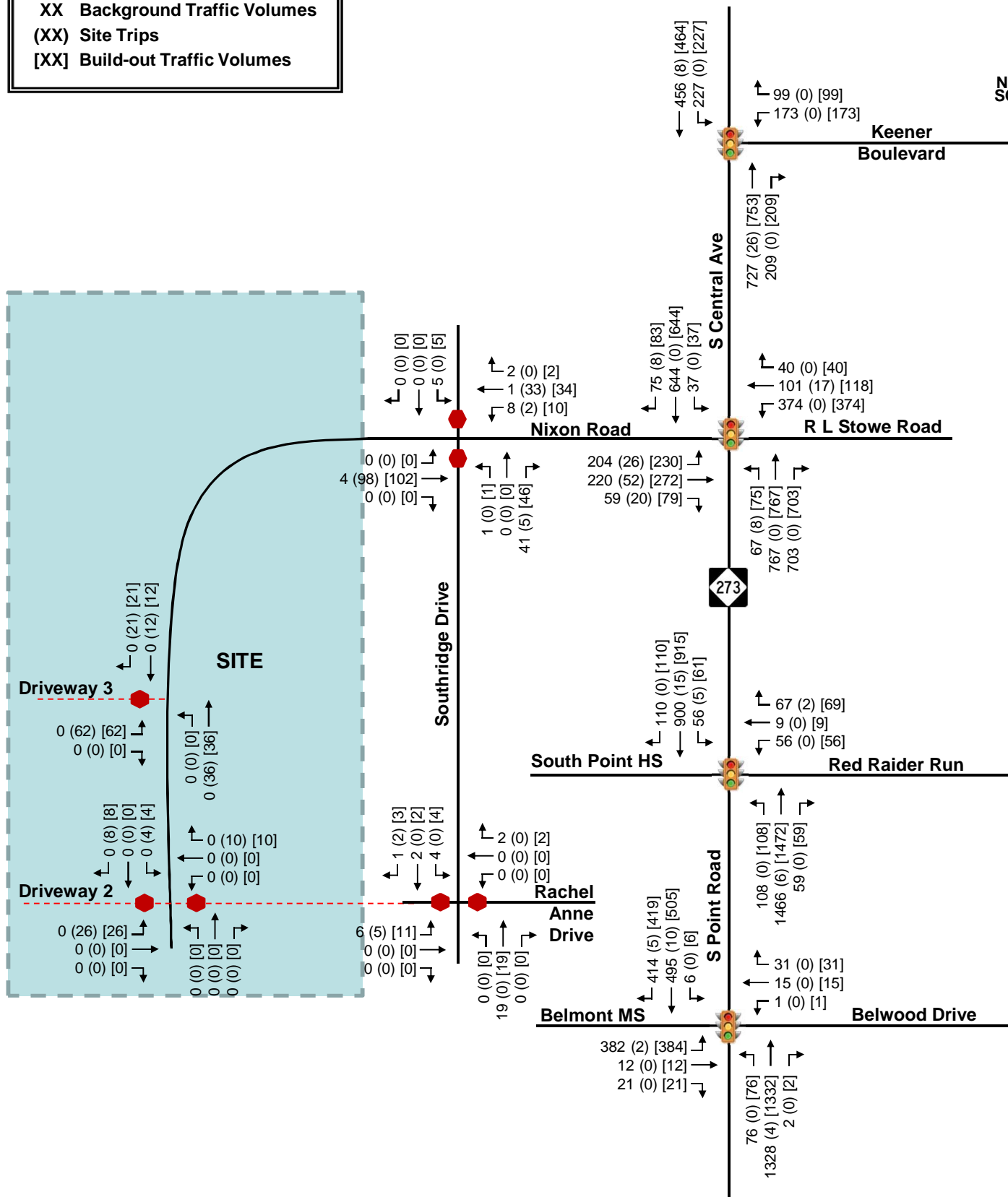
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**LEGEND**

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

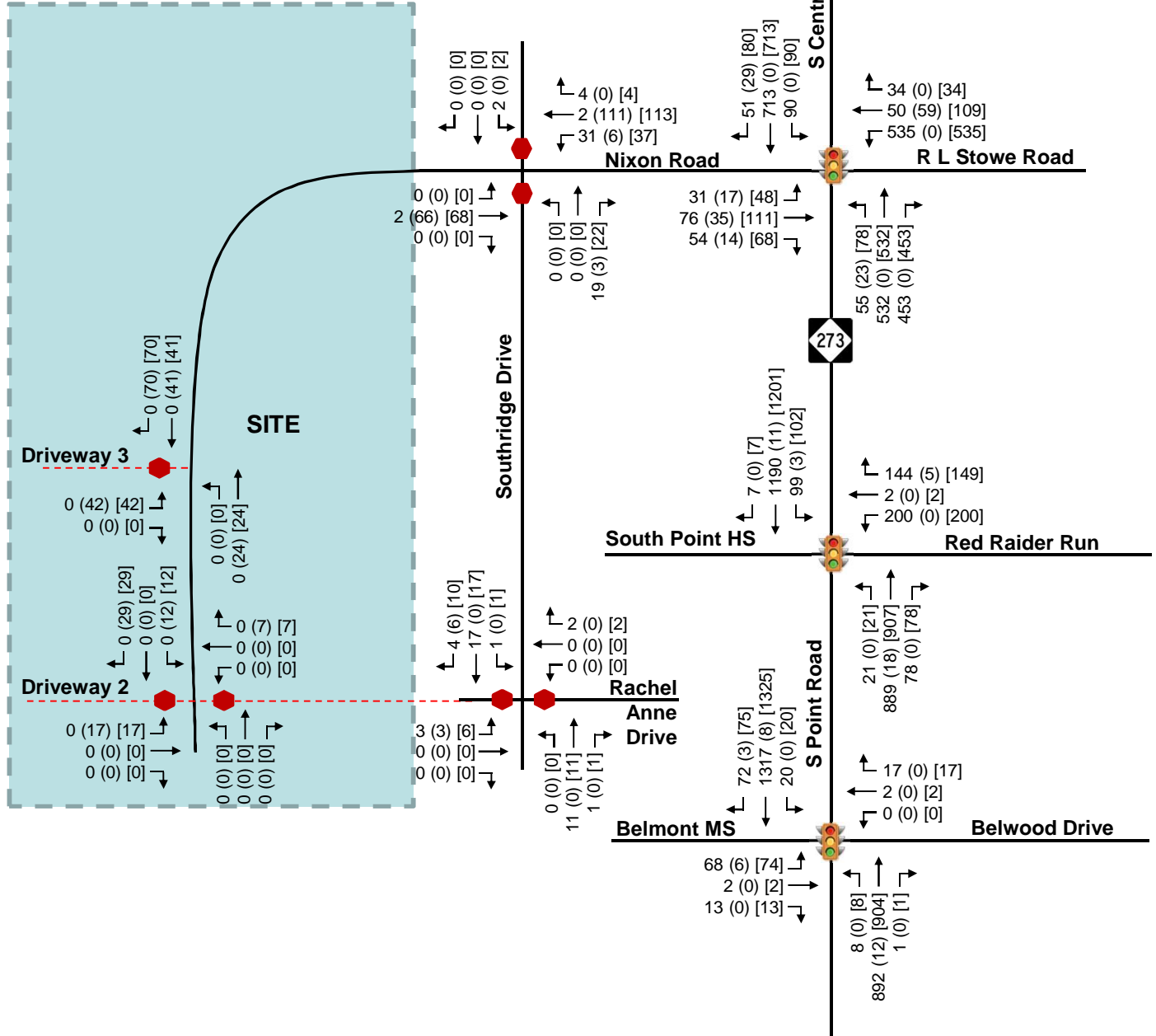
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**LEGEND**

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

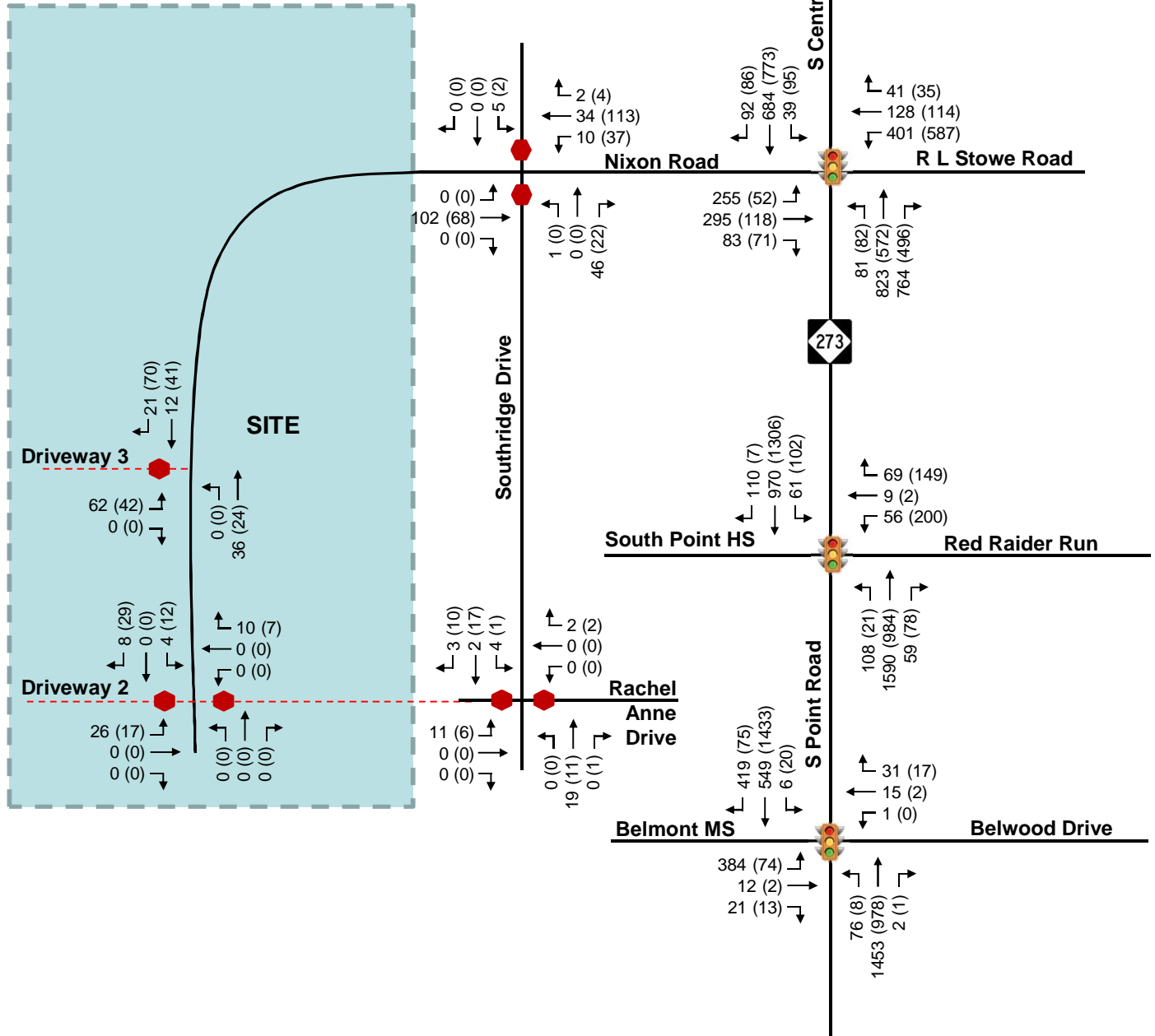
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**LEGEND**

- 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 9 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, also 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 staff provided the signal geometric plans for the following signalized intersections:

- S Central Avenue and Keener Boulevard (NC 273)
- S Point Road (NC 273) and Nixon Road/R L Stowe Road
- S Point Road (NC 273) and South Point High School/Red Raider Run

The provided signal plans were used in the development of the existing conditions Synchro network. The cycle lengths and splits were optimized given the timing inputs in the existing conditions network and in accordance with NCDOT Congestion Management guidelines, and were maintained throughout the background, build-out and build-out +5 scenarios unless otherwise noted. Signal geometric plans are included in the **Appendix**.

The future intersection of S Point Road (NC 273) and Belwood Drive/Belmont MS Driveway was assumed signalized for the purposes of this TIA as approved in the MOU, and was modeled based on the phasing included in the *Belmont Middle School TIA* (Kimley-Horn, September 2018).

The following modifications from the background data collected were applied to the capacity analyses to meet NCDOT *Congestion Management Capacity Analysis Guidelines*:

- RTOR operations were not allowed.
- Protected-only left-turn phasing was used where protected/permitted left-turn phasing exists (except as noted below).

- Lost time adjust was added to the yellow and all-red times provided in the existing signal plans to maintain a total lost time of 5 seconds for each movement.

Note that the protected/permitted left-turn phasing for the southbound approach of S Central Avenue at Kenner Boulevard (NC 273) was maintained in the analyses. This approach currently includes a single combination left/through lane. If the analyses were performed to include protected-only phasing, the northbound approach (which is the heaviest approach particularly in the morning) would not be permitted to run concurrently with the southbound approach. From an analysis perspective, this setup would model the intersection to operate similar to a split-phased intersection for all three approaches. Congestion Management guidelines recommend using protected-only phasing “to identify the required storage in the event that protected-only phasing is necessary.” Given that this phase is unlikely to be modified to protected-only left-turn phasing under the current configuration, the protected/permitted phasing was maintained for this approach only.

Note that zero-volume movements were not changed to four vehicles per hour in the analysis. Given that these volumes were located on movements where little to no volume would be regularly expected during the peak hours (e.g., accessing Nixon Road from the South Point Ridge neighborhood and from the proposed Amberley development), these movements were kept at zero to match the counts collected in the field and to avoid showing traffic travelling to/from the end of Nixon Road.

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 9 software are included in the **Appendix**. Additionally, queuing and blocking reports generated by the SimTraffic microsimulation model are included in the **Appendix**.

**6.1 S CENTRAL AVENUE AND KEENER BOULEVARD (NC 273)**

**Table 6.1** summarizes the LOS, control delay and 95<sup>th</sup> percentile queue lengths at the signalized intersection of S Central Avenue and Keener Boulevard (NC 273).

Table 6.1 - S Central Avenue and Keener Boulevard (NC 273)						
Condition	Measure	WB		NB	SB	Intersection
		WBL	WBR	NBTR	SBLT	LOS (Delay)
<b>AM Peak Hour</b>						
2019 Existing	LOS (Delay)	D (44.0)		C (26.6)	C (30.7)	C (31.1)
	Synchro 95th Q	#181'	81'	#587'	#338'	
2023 Background	LOS (Delay)	F (112.7)		F (81.5)	F (121.1)	F (100.3)
	Synchro 95th Q	#381'	106'	#1374'	#1081'	
2023 Build-out	LOS (Delay)	F (112.7)		F (90.7)	F (125.9)	F (106.5)
	Synchro 95th Q	#381'	106'	#1431'	#1099'	
2028 Build-out +5	LOS (Delay)	F (131.9)		F (123.6)	F (159.5)	F (137.6)
	Synchro 95th Q	#422'	118'	#1609'	#1223'	
<b>PM Peak Hour</b>						
2019 Existing	LOS (Delay)	C (26.3)		C (24.8)	B (10.3)	C (20.0)
	Synchro 95th Q	230'	151'	294'	214'	
2023 Background	LOS (Delay)	D (44.2)		D (41.7)	D (48.5)	D (45.1)
	Synchro 95th Q	#351'	182'	#509'	#566'	
2023 Build-out	LOS (Delay)	D (46.6)		C (28.9)	D (53.3)	D (44.0)
	Synchro 95th Q	#351'	212'	428'	#509'	
2028 Build-out +5	LOS (Delay)	D (53.6)		E (55.3)	F (176.7)	F (101.4)
	Synchro 95th Q	#394'	204'	#592'	#841'	

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

This intersection currently operates with an unusual configuration where the southbound approach of S Central Avenue is a single, combined through/left lane operating under protected/permitted phasing. Note that the protected/permitted left-turn phasing was maintained in the analyses; if the analyses were performed to include protected-only phasing, the northbound approach (which is the heaviest approach particularly in the morning) would not be permitted to run concurrently with the southbound approach. From an analysis perspective, this setup would model the intersection to operate similar to a split-phased intersection for all three approaches. Congestion Management guidelines recommend using protected-only phasing “to identify the required storage in the event that protected-only phasing is necessary.” Given that this phase is unlikely to be modified to protected-only left-turn phasing under the current configuration, the protected/permitted phasing was maintained for this approach only.

However, note that the capacity analyses still differ from field conditions and reflect NCDOT *Congestion Management Capacity Analysis Guidelines* by not allowing RTOR operations. Additionally, based on the signal plans provided by NCDOT, this intersection operates as an isolated, actuated traffic signal, and is not part of a coordinated signal system. Therefore, the analysis reflects optimization of the cycle length and splits between scenarios to account for the change in demand at each of the movements and approaches.

**Table 6.1** shows the overall intersection is expected to operate at LOS F and LOS D under 2023 background conditions during the AM and PM peak hours, respectively, with all approaches at LOS F during the AM peak hour.

When the proposed site traffic is added to the 2023 background volumes, the overall intersection delay is expected to increase during the AM peak hour while operating at LOS F. Additionally, the delay on the northbound and southbound approaches of S Central Avenue are expected to increase. Therefore, identification of potential mitigation improvements is required. Note that the slight decrease in delay during the AM peak hour reflects changes in the signal timing splits given the actuated, uncoordinated operations of this signal.

Review of the volume-to-capacity (v/c) ratios under 2023 build-out AM peak-hour conditions shows the southbound approach with the highest v/c ratio. Additionally, as discussed above, the current southbound laneage and phasing configuration presents some inefficiencies to this intersection and approach when the southbound through-movement is forced to stop behind a left-turn vehicle who is waiting for a gap on the northbound approach. Given this, a southbound left-turn lane improvement was considered. With this turn lane in place, the site traffic impact is fully mitigated with the overall intersection expected to improve to LOS C during both peak hours, fully mitigating well-beyond the operational impact shown to be caused by the proposed Amberley development. However, **Figures 5.2** and **5.3** show that the proposed site is expected to add less than 3% of the total entering traffic to this intersection during either peak hour, while only adding through traffic along S Central Avenue. The majority of site traffic would likely use R L Stowe Road to access Keener Boulevard rather than making a turn at this intersection. Additionally, installation of a left-turn lane at this location would likely require utility relocations, property impacts and potentially impacts to large, mature trees. Considering the relatively small portion of traffic volumes and vehicular delay at this intersection contributable to the proposed site with the extent of impacts required to install this improvement, a southbound left-turn lane is not recommended to be installed at this intersection as mitigation for the proposed Amberley development. However, further study should be performed to evaluate the feasibility of adding a future southbound left-turn lane given the operational improvements discussed above.

## 6.2 S POINT ROAD (NC 273) AND NIXON RD/R L STOWE RD

**Table 6.2** summarizes the LOS, control delay and 95<sup>th</sup> percentile queue lengths at the signalized intersection of S Point Road (NC 273) and Nixon Road/R L Stowe Road.

Table 6.2 - S Point Road (NC 273) and Nixon Road/R L Stowe Road												
Condition	Measure	EB		WB		NB			SB			Intersection LOS (Delay)
		EBL	EBTR	WBL	WBTR	NBL	NBT	NBR	SBL	SBT	SBR	
<b>AM Peak Hour</b>												
2019 Existing	LOS (Delay)	E (69.3)		E (57.2)		B (10.3)			D (35.7)			C (33.5)
	Synchro 95th Q	#298'	#312'	#292'	120'	m20'	m358'	34'	33'	460'	-	
2023 Background	LOS (Delay)	F (109.2)		F (101.9)		D (53.9)			F (107.1)			F (81.8)
	Synchro 95th Q	#369'	#592'	#754'	229'	m79'	m671'	m39'	#139'	#1274'	-	
2023 Build-out	LOS (Delay)	F (160.4)		F (100.8)		E (55.3)			F (115.6)			F (93.7)
	Synchro 95th Q	#455'	#804'	#754'	254'	m90'	m665'	m40'	#139'	#1297'	-	
2023 Build-out IMP w/ SBR	LOS (Delay)	F (104.9)		F (100.8)		E (59.7)			F (93.5)			F (81.3)
	Synchro 95th Q	394'	#719'	#754'	254'	m89'	m755'	m111'	#143'	#1154'	55'	
2028 Build-out +5	LOS (Delay)	F (118.6)		F (115.0)		E (72.7)			F (109.1)			F (95.2)
	Synchro 95th Q	437'	#797'	#833'	273'	m91'	m758'	m110'	#150'	#1264'	60'	
<b>PM Peak Hour</b>												
2019 Existing	LOS (Delay)	E (71.2)		E (77.3)		B (12.9)			D (45.6)			D (42.7)
	Synchro 95th Q	67'	152'	#688'	78'	m35'	285'	93'	65'	#813	-	
2023 Background	LOS (Delay)	F (102.6)		F (115.4)		C (28.1)			F (104.8)			E (77.3)
	Synchro 95th Q	76'	#265'	#1044'	135'	m96'	560'	m100'	149'	#1393'	-	
2023 Build-out	LOS (Delay)	F (123.5)		F (110.0)		D (38.3)			F (118.4)			F (86.9)
	Synchro 95th Q	108'	#420'	#1044'	215'	m#173'	m562'	m100'	151'	#1476'	-	
2023 Build-out IMP w/ SBR	LOS (Delay)	F (123.5)		F (95.1)		D (36.6)			F (99.5)			E (76.9)
	Synchro 95th Q	108'	#420'	#1008'	209'	m#137'	m595'	m100'	162'	#1317'	67'	
2028 Build-out +5	LOS (Delay)	F (131.1)		F (120.4)		D (47.6)			F (126.8)			F (96.0)
	Synchro 95th Q	116'	#449'	#1155'	218'	m131'	m301'	m96'	188'	#1486'	72'	

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

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

Note that the results shown for all future year scenarios in **Table 6.2** reflect the following modifications applied to the capacity analyses that differ from the background data collected in order to meet NCDOT *Congestion Management Capacity Analysis Guidelines*:

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

The operations and LOS for this intersection play a vital role in the overall mobility along Belmont's peninsula because of its location. This intersection is located where a major portion of northbound traffic disperses away from S Point Road (NC 273), either east towards Charlotte (turn onto R L Stowe Road) or north/west towards downtown Belmont or Gastonia (continue north along S Point Road). This location is also where two heavy traffic streams combine onto S Point Road (NC 273) heading southbound. This combination creates an issue because these two heavy movements (the southbound through and westbound left) conflict with one another. The heavy southbound volume demands green time from the signal, which reduces the amount available for the westbound approach, and vice versa. As traffic increases from the approved developments and other non-specific growth throughout the area (including South Carolina traffic), the congestion at this intersection will continue to worsen under its current configuration. This is evidenced in **Table 6.2** by the sharp increase in overall intersection delay between existing and background conditions, with the intersection expected to operate at LOS F during the AM peak hour and LOS E during the PM peak hour.

When the proposed site traffic is added to the 2023 background volumes, the overall intersection delay is expected to increase during the AM peak hour while operating at LOS F and drop from LOS E to LOS F during the PM peak hour. In addition, the eastbound approach of Nixon Road and the southbound approach of S Point Road (NC 273) are expected to increase in delay while already operating at LOS F during both peak hours. Given the increase in delay expected to be caused by the proposed residential site, identification of mitigation improvements is required. The following options for laneage improvements were evaluated:

- Option 1 – Southbound right-turn lane along S Point Road (NC 273)
- Option 2 – Eastbound right-turn lane along Nixon Road

Review of the v/c ratios for the southbound approach under 2023 build-out conditions shows that this approach with a shared through/right lane is expected to operate over capacity during both peak hours. As shown in **Table 6.2**, the addition of a southbound right-turn lane along S Point Road (NC 273) is expected to mitigate the operational impact caused by the proposed Amberley site by improving the overall intersection delay and LOS back to background conditions during both peak hours. This exclusive right-turn would allow additional capacity for the southbound approach by separating right-turn traffic (including Amberley site traffic) from the through traffic.

Note that based on review of the v/c ratios for the eastbound approach under 2023 build-out conditions, the eastbound approach of Nixon Road with a shared through/right lane is expected to operate over capacity during the AM peak hour. Evaluation of this mitigation option showed similar benefit to the intersection and would also provide appropriate mitigation for the site impact. However, the southbound right-turn lane along S Point Road (NC 273) is shown to provide slightly more improvement in delay during both peak hours. Additionally, sidewalk and curb/gutter exist along the south side of Nixon Road where the eastbound right-turn lane would require widening, whereas this infrastructure does not currently exist along the west side of S Point Road (NC 273) where the southbound right-turn lane would require widening. Therefore, the following improvement is recommended to mitigate the added delay caused by the addition of site traffic:

- Southbound right-turn lane along S Point Road (NC 273) with 100' of storage

The 100 feet of storage is based on review of the 95<sup>th</sup> percentile queue lengths shown in **Table 6.2**. SimTraffic could not accurately report queues for the southbound right-turn lane, because the southbound right-turning vehicles were observed to queue behind the southbound through vehicles; however, observation of the SimTraffic simulation shows that the queues for vehicles in the southbound right-turn lane are expected to be contained within 100 feet.



**6.3 S POINT ROAD (NC 273) AND S POINT HS/RED RAIDER RUN**

**Table 6.3** summarizes the LOS, control delay and 95<sup>th</sup> percentile queue lengths at the signalized intersection of S Point Road (NC 273) and South Point HS/Red Raider Run. Red Raider Run serves as a signalized driveway to Belmont Town Center, which is currently only partially open and still developing based on the approved plan described in Section 4.2. Note that the eastbound approach serves as an entrance only for South Point High School; therefore, there is no exiting volume, and thus no operations reported for the eastbound approach.

Table 6.3 - S Point Road (NC 273) and South Point High School/Red Raider Run								
Condition	Measure	WB		NB		SB		Intersection
		WBLT	WBR	NBL	NBTR	SBL	SBTR	LOS (Delay)
<b>AM Peak Hour</b>								
2019 Existing	LOS (Delay)	D (52.1)		B (15.5)		A (2.7)		B (13.0)
	Synchro 95th Q	75'	70'	22'	#1015'	m4'	82'	
2023 Background	LOS (Delay)	F (89.3)		E (77.7)		B (17.1)		E (55.4)
	Synchro 95th Q	142'	133'	m127'	m#1214'	m70'	m162'	
2023 Build-out	LOS (Delay)	F (88.9)		E (79.9)		C (22.6)		E (58.6)
	Synchro 95th Q	142'	139'	m126'	m#1243'	m75'	m183'	
2028 Build-out +5	LOS (Delay)	F (89.6)		F (116.6)		C (23.5)		F (80.4)
	Synchro 95th Q	142'	139'	m118'	m#1319'	m73'	m185'	
<b>PM Peak Hour</b>								
2019 Existing	LOS (Delay)	E (67.7)		B (15.4)		B (10.1)		B (19.1)
	Synchro 95th Q	228'	127'	10'	526'	m3'	m0'	
2023 Background	LOS (Delay)	F (96.6)		C (24.5)		D (48.1)		D (45.6)
	Synchro 95th Q	#441'	240'	m43'	826'	m118'	m311'	
2023 Build-out	LOS (Delay)	F (96.3)		C (25.5)		D (53.9)		D (48.7)
	Synchro 95th Q	#441'	248'	m42'	867'	m117'	m341'	
2028 Build-out +5	LOS (Delay)	F (96.8)		D (37.8)		D (54.5)		D (53.3)
	Synchro 95th Q	#441'	248'	m40'	m#1077'	m109'	m286'	

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

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

Note that the results shown for all future year scenarios in **Table 6.3** reflect the following modifications applied to the capacity analyses that differ from the background data collected in order to meet NCDOT *Congestion Management Capacity Analysis Guidelines*:

- RTOR operations were not allowed.
- Protected-only left-turn phasing was used for the northbound and southbound approaches where protected/permitted left-turn phasing exists.

As discussed in **Section 6.2**, two separate heavy travel streams are combined along S Point Road (NC 273) until they split at R L Stowe Road to the north. These are currently combined into a single through lane both northbound and southbound at this signalized intersection. As traffic increases from the approved developments and other non-specific growth throughout the area (including South Carolina traffic), the congestion at this intersection will continue to worsen under its current configuration. This is evidenced in **Table 6.3** where the northbound approach is expected to operate at LOS E during the AM peak hour, while the southbound approach is expected to operate at LOS D during the PM peak hour under 2023 background conditions. This table also shows the overall intersection is expected to operate at LOS E and LOS D under 2023 background conditions during the AM and PM peak hours, respectively.



When the proposed site traffic is added to the 2023 background volumes, the overall intersection is expected to continue to operate at LOS E and LOS D during the AM and PM peak hours, respectively. Note that the intersection delay is increased along with the northbound approach during the AM peak hour and southbound approach during the PM peak hour between background and build-out conditions; however, the average delay is expected to only slightly increase by approximately three seconds per vehicle. Based on review of the v/c ratios in context with the heavy S Point Road (NC 273) volume discussed above, additional northbound and southbound through lanes are needed to significantly improve operations at this intersection and along this section of S Point Road (NC 273). However, **Figures 5.2** and **5.3** show that the proposed site is expected to add less than 1.5% of the total entering traffic to this intersection during either peak hour. Considering the relatively small portion of traffic volumes and vehicular delay at this intersection contributable to the proposed site with the extent of impacts associated with the construction of additional through lanes, improvements to this intersection is not recommended as mitigation for the proposed Amberley development.

**6.4 S POINT RD (NC 273) AND BELWOOD DR/BELMONT MS D/W**

**Table 6.4** summarizes the LOS, control delay and 95<sup>th</sup> percentile queue lengths for the 2019 existing conditions at the existing unsignalized, tee-intersection of S Point Road (NC 273) and Belwood Drive. The future 2023 and 2028 conditions reflect the realignment of Belwood Drive to tie into the approved Belmont Middle School Driveway as a four-leg, signalized intersection.

Table 6.4 - S Point Road (NC 273) and Belwood Drive/Belmont Middle School Driveway										
Condition	Measure	EB		WB	NB		SB			Intersection
		EBLT	EBR	WBLTR	NBL	NBTR	SBL	SBT	SBR	LOS (Delay)
<b>AM Peak Hour</b>										
2019 Existing	LOS (Delay)	-		C (24.5)	A (0.0)		A (0.4)			
	Synchro 95th Q	-	-	15'	-	0'	-	1'	-	
2023 Background	LOS (Delay)	F (176.3)		F (113.2)	F (105.2)		B (12.2)			F (85.3)
	Synchro 95th Q	#866'	52'	#129'	63'	#2357'	m6'	m538'	m119'	
2023 Build-out	LOS (Delay)	F (179.2)		F (113.2)	F (106.4)		B (12.3)			F (86.1)
	Synchro 95th Q	#874'	52'	#129'	63'	#2367'	m6'	m542'	m119'	
2028 Build-Out +5	LOS (Delay)	F (179.2)		F (113.2)	F (149.1)		B (14.3)			F (108.5)
	Synchro 95th Q	#874'	52'	#129'	65'	#2690'	m5'	m572'	m111'	
<b>PM Peak Hour</b>										
2019 Existing	LOS (Delay)	-		B (13.9)	A (0.0)		A (0.8)			
	Synchro 95th Q	-	-	4'	-	0'	-	2'	-	
2023 Background	LOS (Delay)	F (127.4)		F (90.6)	A (7.5)		B (10.9)			B (14.2)
	Synchro 95th Q	#207'	45'	59'	12'	506'	m4'	m#1955'	m9'	
2023 Build-out	LOS (Delay)	F (129.7)		F (90.6)	A (7.8)		B (11.5)			B (15.0)
	Synchro 95th Q	#224'	45'	59'	12'	520'	m4'	m#1945'	m9'	
2028 Build-Out +5	LOS (Delay)	F (153.9)		F (90.6)	A (8.7)		B (16.0)			B (18.4)
	Synchro 95th Q	#224'	45'	59'	12'	630'	m3'	m#1973'	m8'	

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

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

The ultimate intersection configuration to be constructed as part of the approved Belmont Middle School has yet to be finalized at the time of this TIA; however, based on input at the TIA Scoping Meeting and reflected in the approved MOU, for purposes of this TIA, the following improvements were included in all future-year conditions analyses:

- Installation of a traffic signal
- Realignment of Belwood Drive to the north to tie into S Point Road (NC 273) at the approved Belmont Middle School Driveway location
- Northbound left-turn lane with 200 feet of storage
- Southbound left-turn lane with 100 feet of storage
- Southbound right-turn lane with 100 feet of storage
- Eastbound shared left/through lane
- Eastbound right-turn lane with 100 feet of storage
- Split phasing operations for the side-street approaches

It should be noted that, in addition to the improvements discussed above, the recommendations for this intersection identified in the approved *Belmont Middle School TIA* (Kimley-Horn, September 2018) also included:

- Additional northbound through lane along S Point Road (NC 273) that provides a minimum of 325' of storage and extends to R L Stowe Road
- Eastbound approach to include dual left-turn lanes

- Extension of the recommended southbound right turn-lane to the R L Stowe Road /Nixon Road intersection

Note that the results shown in **Table 6.4** reflect NCDOT *Congestion Management Capacity Analysis Guidelines* where RTOR operations are not allowed.

**Table 6.4** shows that with these improvements in place, the signalized intersection is expected to operate at LOS F during the AM peak hour and LOS B during the PM peak hour under 2023 background conditions. Note that the PM peak hour referenced in this TIA reflects the highest peak hour between 4:30-7:00 PM. The PM peak hour analyzed in the approved *Belmont Middle School TIA* reflected the highest peak hour between 2:30-4:30 PM.

When the proposed site traffic is added to the 2023 background volumes, the overall intersection is expected to continue to operate at LOS F and LOS B during the AM and PM peak hours, respectively. Note that the overall intersection delay is increased while already operating at LOS F during the AM peak hour; however, the average delay is expected to only slightly increase by less than one second per vehicle. 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.

## 6.5 NIXON ROAD AND SOUTHRIDGE DRIVE

**Table 6.5** summarizes the LOS, control delay and 95<sup>th</sup> percentile queue lengths at the unsignalized intersection of Nixon Road and Southridge Drive.

Table 6.5 - Nixon Road and Southridge Drive						
Condition	Measure	EB	WB	NB	SB	Intersection LOS (Delay)
		EBLTR	WBLTR	NBLTR	SBLTR	
<b>AM Peak Hour</b>						
2019 Existing	LOS (Delay)	A (0.0)	A (5.4)	A (8.5)	A (9.1)	
	Synchro 95th Q	0'	0'	3'	1'	
2023 Background	LOS (Delay)	A (0.0)	A (5.4)	A (8.5)	A (9.1)	
	Synchro 95th Q	0'	0'	3'	1'	
2023 Build-out	LOS (Delay)	A (0.0)	A (1.7)	A (9.1)	B (10.3)	
	Synchro 95th Q	0'	1'	4'	1'	
2028 Build-Out +5	LOS (Delay)	A (0.0)	A (1.7)	A (9.1)	B (10.3)	
	Synchro 95th Q	0'	1'	4'	1'	
<b>PM Peak Hour</b>						
2019 Existing	LOS (Delay)	A (0.0)	A (6.2)	A (8.4)	A (9.2)	
	Synchro 95th Q	0'	2'	1'	0'	
2023 Background	LOS (Delay)	A (0.0)	A (6.2)	A (8.4)	A (9.2)	
	Synchro 95th Q	0'	2'	1'	0'	
2023 Build-out	LOS (Delay)	A (0.0)	A (1.9)	A (8.7)	B (10.9)	
	Synchro 95th Q	0'	2'	2'	0'	
2028 Build-Out +5	LOS (Delay)	A (0.0)	A (1.9)	A (8.7)	B (10.9)	
	Synchro 95th Q	0'	2'	2'	0'	

**Table 6.5** shows the stop-controlled northbound and southbound approaches of Southridge Drive currently operate with short delays during both peak hours and are expected to continue to operate with short delays under 2023 background and build conditions with the addition of proposed site traffic. Note that the southbound approach is expected to drop from LOS A to LOS B during both peak hours; however, the average delay is only slightly increased by less than two seconds per vehicle. 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.

Southridge Drive was included in the study area as it proposed to provide access to the Amberley site via an extension of Rachel Anne Drive south of Nixon Road. Based on review of the planned network shown in proposed site plan, only a small number of the Amberley residents would be expected to use Southridge Drive to access Nixon Road, as reflected in the site traffic assignment shown in **Figure 5.1**.

Review of auxiliary turn-lane warrants at this intersection is included in **Section 7.0**.

**6.6 SOUTHRIDGE DRIVE AND RACHEL ANNE DR/DRIVEWAY #1**

**Table 6.6** summarizes the LOS, control delay and 95<sup>th</sup> percentile queue lengths at the unsignalized intersection of Southridge Drive and Rachel Anne Drive/Driveway #1. Note that Rachel Anne Drive currently stubs approximately 200 feet west of Southridge Drive and serves five existing homes. Driveway #1 is proposed to tie into and extend existing Rachel Anne Drive where it will serve as the eastbound approach to this intersection.

Table 6.6 - Southridge Drive and Rachel Anne Drive/Driveway #1						
Condition	Measure	EB	WB	NB	SB	Intersection
		EBLTR	WBLTR	NBLTR	SBLTR	LOS (Delay)
<b>AM Peak Hour</b>						
2023 Build-out	LOS (Delay)	A (8.8)	A (8.4)	A (0.0)	A (3.2)	
	Synchro 95th Q	1'	0'	0'	0'	
2028 Build-out +5	LOS (Delay)	A (8.8)	A (8.4)	A (0.0)	A (3.2)	
	Synchro 95th Q	1'	0'	0'	0'	
<b>PM Peak Hour</b>						
2023 Build-out	LOS (Delay)	A (8.8)	A (8.4)	A (0.0)	A (0.2)	
	Synchro 95th Q	1'	0'	0'	0'	
2028 Build-out +5	LOS (Delay)	A (8.8)	A (8.4)	A (0.0)	A (0.2)	
	Synchro 95th Q	1'	0'	0'	0'	

As shown in **Table 6.6**, the stop-controlled eastbound and westbound approaches of Rachel Anne Drive/Driveway #1 are expected to operate with short delays and queues during both peak hours. Based on review of the planned network shown in proposed site plan, only a small number of the Amberley residents would be expected to use Southridge Drive to access Nixon Road, as reflected in the site traffic assignment shown in **Figure 5.1**. Therefore, no additional improvements beyond construction of the driveway to extend Rachel Anne Drive are recommended at this intersection for capacity purposes.

Review of auxiliary turn-lane warrants at this intersection is included in **Section 7.0**.

**6.7 NIXON ROAD AND RACHEL ANNE DRIVE/DRIVEWAY #2**

**Table 6.7** summarizes the LOS, control delay and 95<sup>th</sup> percentile queue lengths at the proposed unsignalized intersection of Nixon Road and Rachel Anne Drive/Driveway #2. Note that the eastbound approach (the driveway serving the development west of Nixon Road) is referred to as Driveway #2. The westbound approach is the proposed extension of Rachel Anne Drive, also referred to as Driveway #1.

Table 6.7 - Nixon Road and Rachel Anne Drive/Driveway #2						
Condition	Measure	EB	WB	NB	SB	Intersection LOS (Delay)
		EBLTR	WBLTR	NBLTR	SBLTR	
<b>AM Peak Hour</b>						
2023 Build-out	LOS (Delay)	A (8.8)	A (8.4)	A (0.0)	A (2.2)	
	Synchro 95th Q	2'	1'	0'	0'	
2028 Build-out +5	LOS (Delay)	A (8.8)	A (8.4)	A (0.0)	A (2.2)	
	Synchro 95th Q	2'	1'	0'	0'	
<b>PM Peak Hour</b>						
2023 Build-out	LOS (Delay)	A (8.9)	A (8.3)	A (0.0)	A (2.1)	
	Synchro 95th Q	2'	1'	0'	1'	
2028 Build-out +5	LOS (Delay)	A (8.9)	A (8.3)	A (0.0)	A (2.1)	
	Synchro 95th Q	2'	1'	0'	1'	

Based on the pavement width shown in the site plan in **Figure 3.2**, the eastbound and westbound egress lanes were assumed to include a single lane. **Table 6.7** shows the stop-controlled eastbound and westbound approaches of Driveway #2 and Rachel Anne Drive/Driveway #1 are expected to operate with short delays and queues during both peak hours. Therefore, no additional improvements beyond construction of the driveways are recommended at this intersection for capacity purposes.

Review of auxiliary turn-lane warrants at this intersection is included in **Section 7.0**.



**6.8 NIXON ROAD AND DRIVEWAY #3**

**Table 6.8** summarizes the LOS, control delay and 95<sup>th</sup> percentile queue lengths at the proposed unsignalized, tee-intersection of Nixon Road and Driveway #3, located approximately 200 feet west of where Nixon Road currently ends into a cul-de-sac.

Table 6.8 - Nixon Road and Driveway #3					
Condition	Measure	EB	NB	SB	Intersection
		EBLR	NBLT	SBTR	LOS (Delay)
AM Peak Hour					
2023 Build-out	LOS (Delay)	A (9.1)	A (0.0)	A (0.0)	
	Synchro 95th Q	6'	0'	0'	
2028 Build-out +5	LOS (Delay)	A (9.1)	A (0.0)	A (0.0)	
	Synchro 95th Q	6'	0'	0'	
PM Peak Hour					
2023 Build-out	LOS (Delay)	A (9.3)	A (0.0)	A (0.0)	
	Synchro 95th Q	4'	0'	0'	
2028 Build-out +5	LOS (Delay)	A (9.3)	A (0.0)	A (0.0)	
	Synchro 95th Q	4'	0'	0'	

Based on the pavement width shown in the site plan in **Figure 3.2**, the eastbound egress lane was assumed to include a single lane. **Table 6.8** shows the stop-controlled eastbound approach of Driveway #3 is expected to operate with short delays and queues during both peak hours. Therefore, no additional improvements beyond construction of the driveway are recommended at this intersection for capacity purposes.

Review of auxiliary turn-lane warrants at this intersection is included in **Section 7.0**.

## 7.0 Auxiliary Turn Lane Warrant Analysis

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

*No turn lanes warranted at the study intersections under 2023 background conditions.*

### 2023 Build-out Conditions

#### ***Nixon Road and Rachel Anne Drive/Driveway #2***

- Southbound right-turn lane along Nixon Road with a minimum storage length of 50'

Based on NCDOT *Congestion Management Capacity Analysis Guidelines*, full storage for a right-turn lane should accommodate a minimum of 100 feet; therefore, a southbound right-turn lane along Nixon Road with a minimum storage length of **100 feet** is recommended.

#### ***Nixon Road and Driveway #3***

- Southbound right-turn lane along Nixon Road with a minimum storage length of 75'

Based on NCDOT *Congestion Management Capacity Analysis Guidelines*, full storage for a right-turn lane should accommodate a minimum of 100 feet; therefore, a southbound right-turn lane along Nixon Road with a minimum storage length of **100 feet** is recommended.

## 8.0 Crash Data Analysis

Crash data was obtained at study intersections for crashes that occurred between June 1, 2015, and May 31, 2018. Over this three-year period, 37 total crashes were reported at the four existing study intersections along S Central Ave/S Point Road (NC 273). The breakdown of crashes at these four study intersections by severity, frequency and crash type can be seen the tables below.

**Table 8.1 – Crash Severity Summary**

Crash Type	Number of Crashes
Fatal Crashes	0
Class A	0
Class B	2
Class C	3
Property Damage Only	32
<b>Total</b>	<b>37</b>

**Table 8.1** above displays the total number of crashes by severity type from most to least severe. As shown, there were no fatal crashes or Class A crashes reported. 86% of the crashes over the past five 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 by Location**

Location	Crashes/100 MEV
S Central Ave at Keener Blvd (NC 273)	82.95
S Point Rd (NC 273) at R L Stowe Rd/Nixon Rd	80.37
S Point Rd (NC 273) at South Point HS/Red Raider Run	27.99
S Point Rd (NC 273) at Belwood Dr	19.14
<b>Weighted Average</b>	<b>50.25</b>

**Table 8.2** shows the crash rates at the study area intersections resulted in a weighted average crash rate of 50.25 crashes per 100 million entering vehicles (MEV), with the highest rates occurring at the signalized intersections of S Central Ave at Keener Blvd (NC 273) and S Point Rd (NC 273) at R L Stowe Rd/Nixon Rd. There have been 12 and 17 total crashes reported over this five-year period at these two intersections, respectively.

**Table 8.3 – Crash Type Summary**

Crash Type	Keener Blvd (NC 273)	RL Stowe Rd	South Point HS/Red Raider Run	Belwood Dr
Angle	0	3	1	1
Animal	0	1	0	0
Head On	1	0	0	0
Left-Turn, Different Roadways	0	0	0	0
Left-Turn, Same Roadway	0	0	0	0
Other Non-Collision	0	0	0	0
Pedestrian	1	0	0	0
Ran off Road - Left	0	0	1	0
Ran off Road - Right	1	0	1	0
Rear End, Slow or Stop	9	12	2	2
Right-Turn, Different Roadways	0	1	0	0
Right-Turn, Same Roadway	0	0	0	0
Sideswipe Opposite Direction	0	0	0	0
Sideswipe Same Direction	0	0	0	0
<b>Total</b>	<b>12</b>	<b>17</b>	<b>5</b>	<b>3</b>

The most common crash type within the study area was a rear-end collision caused by a slowing or stopping vehicle, with over 65% of crashes. This crash type is often associated with mainline traffic along a corridor with the lack of turn lanes onto side-streets and can also be associated with congestion. These types of crashes are typically on the lower end of the severity spectrum, which correlates with the data presented in **Table 8.1**.

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:

### S Point Road (NC 273) and R L Stowe Road/Nixon Road

- Southbound right-turn lane along S Point Road (NC 273) with 100 feet of storage

### Rachel Anne Extension (Driveway #1)

- Extend Rachel Anne Drive where it currently stubs west of Southridge Drive to the west to connect to the extension of Nixon Road (also referred to as Driveway #1 in this TIA)

### Nixon Road and Rachel Anne Drive/Driveway #2

- Single westbound egress and single ingress lane along Driveway #1 (Rachel Anne Dr Ext)
- Single eastbound egress and single ingress lane along Driveway #2
- Southbound right-turn lane along Nixon Road with 100 feet of storage

### Nixon Road and Driveway #3

- Single eastbound egress and single ingress lane along Driveway #3
- Southbound right-turn lane along Nixon Road with 100 feet of storage

### Nixon Road Extension

- Applicant should coordinate w/ GCLMPO, City and NCDOT to confirm appropriate alignment/cross-section for the planned Nixon Road Widening, and to confirm proposed site does not prohibit Nixon Road connection to future Belmont-Mt Holly Connector.

### Belmont-Mt Holly Connector

- Applicant should coordinate with GCLMPO, City and NCDOT to confirm the appropriate alignment and/or to confirm the proposed site does not prohibit construction of the planned connector; current alignment shown through proposed site.

Though not recommended as mitigation of the proposed residential development, further study should be performed to evaluate the feasibility of adding a future southbound left-turn lane along S Central Avenue at Keener Boulevard. Further discussion is provided in **Section 6.1**.

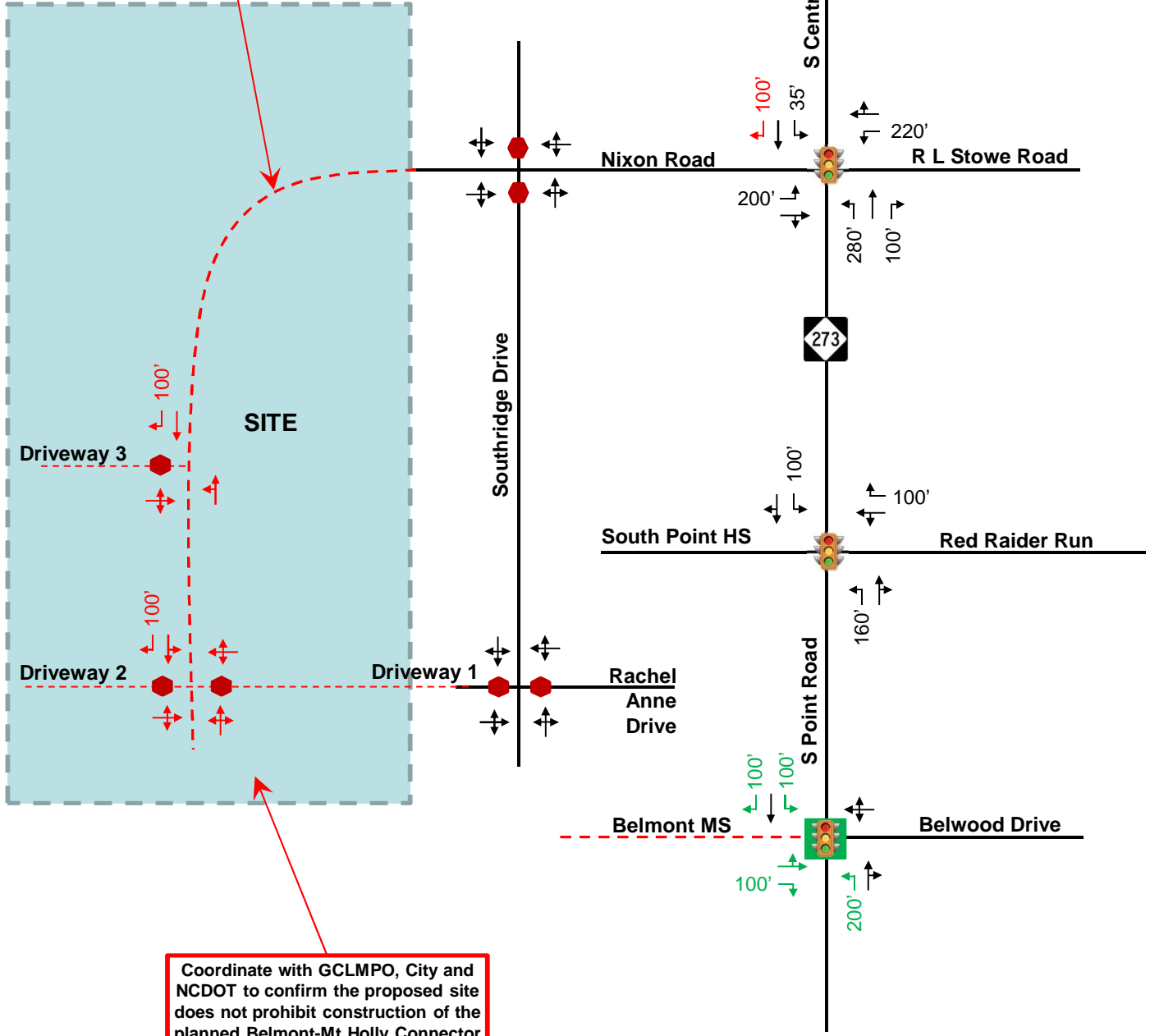
The mitigation improvements identified within the study area are shown in **Figure 9.1**. The improvements shown on this figure are subject to approval by NCDOT and the City of Belmont. All additions and attachments to the State and City roadway system shall be properly permitted, designed and constructed in conformance to standards maintained by the agencies.

**LEGEND**

- Existing Lane
- Approved Development Improvement
- Laneage Improvement Identified
- X' Storage Length
- 🚦 Traffic Signal
- Stop Control

NOT TO SCALE

Coordinate with GCLMPO, City and NCDOT to determine appropriate alignment and cross-section



Coordinate with GCLMPO, City and NCDOT to confirm the proposed site does not prohibit construction of the planned Belmont-Mt Holly Connector