

I-77 at Exit 26

INTERCHANGE JUSTIFICATION REPORT (IJR)

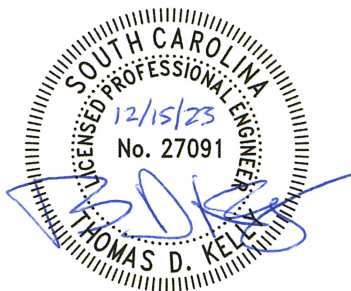
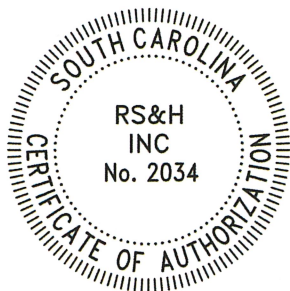
Richland County, South Carolina

Prepared for



South Carolina Department of Transportation

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Executive Summary

The purpose of this Interchange Justification Report (IJR) is to provide the South Carolina Department of Transportation (SCDOT) and Federal Highway Administration (FHWA) the required technical documentation for the approval of a new interchange on I-77 at Exit 26 and modification of the existing I-77 at US 21 [Exit 24] interchange. The project is located in Richland County, and the project limits extend along I-77 from south of US 21 to north of Blythewood Road and includes the arterial intersecting roadways along Blythewood Road and US 21 east and west of the interstate.

A Traffic Analysis Methodology Memorandum which outlined the proposed traffic development and analysis methodology and assumptions was submitted to SCDOT in April 2023. The primary basis for traffic projections in this IJR is the Central Midlands Council of Governments (CMOG) Columbia Area Transportation Study (COATS) travel demand model which has a base year of 2018 and a horizon year of 2045. The analysis years for the study include Existing Year 2023, Opening Year 2026, and Design Year 2046. The operational analysis for this study was performed primarily using Highway Capacity Software 2023 (HCS 2023), Synchro/SimTraffic 11, and SIDRA 9.

The purpose of the proposed new interchange is to add needed connectivity to/from I-77 between the existing interchanges at US 21 and Blythewood Road to support large-scale development expected within the project study area. Without this new interchange, traffic demand will exceed the capacity of the existing interchanges causing exacerbation of delays for roadway users and degrading operations along the I-77 mainline.

Two future year analysis alternatives were analyzed which included a No-Build alternative and a Build alternative. The No-Build alternative includes widening along Blythewood Road from west of I-77 to the I-77 southbound ramp terminal intersection and minor side-street capacity improvements but largely maintains the existing roadway geometry and traffic control in the remainder of the study area. The Build alternative proposes a new interchange with I-77 at Exit 26 as well as enhanced I-77 mainline capacity, several intersection improvements within the study area, and replacing the US 21 southbound loop on-ramp to I-77 southbound with a signalized left-turn movement to the existing ramp that serves US 21 northbound to I-77 southbound traffic.

Under existing conditions, I-77 is a four-lane, divided interstate freeway facility with interchanges at US 21 (Exit 24) and Blythewood Road (Exit 27). The intersecting roadways consist of two-lane to four-lane urban arterials and local roads. Existing Year 2023 Annual Average Daily Traffic (AADT) on I-77 within the study area ranges from 47,200 vehicles per day to 71,800 vehicles per day. I-77 serves as a major freight and commuter route between Columbia to the south of the study area

and Charlotte to the north of the study area. Existing Conditions analysis indicates that while the I-77 mainline and ramp junctions operate at level of service (LOS) D or better, several of the study intersections experience congestion during the existing peak periods. The Design Year 2046 No-Build analysis indicates that without improvements within the study area, the existing operational conditions are expected to degrade resulting in multiple ramp terminal intersection failures as well as several ramp junction failures within the study area.

A historical analysis of crashes along I-77 within the project area was conducted for the three-and-three quarter-year period between January 2019 and September 2022. During the analysis period, a total of 145 crashes occurred in the study area; this includes 22 injury crashes and 3 fatal crashes. The predominant crash types were sideswipe (33%), run off the road crashes (28%), and rear end crashes (25%). The historical crash analysis concluded that there were no unusual crash trends within the study area.

The CMOG COATS model was used to determine the forecast growth rates for the future year analysis. Growth rates derived from the model indicated that volumes on I-77 are expected to grow at a rate of 0.8% per year, and volumes on US 21 and Blythewood Road were expected to grow at a rate of 0.8% and 2.4% per year, respectively. These rates were used to develop the background traffic for the Opening Year 2026 and Design Year 2046 AADTs and directional design hour volumes (DDHVs). Additional traffic demand from a planned large-scale manufacturing development were developed using the Institute of Transportation Engineers (ITE) Trip Generation Manual and information from peer facilities. The trip generation and distribution were provided by the developer's consultant and added on top of the study area background growth to obtain the traffic used in the future year analysis.

The Design Year 2046 mainline analysis indicates that the I-77 mainline is expected to operate similarly under both the No-Build and Build conditions with most of the mainline segments operating at LOS D or better during all analysis periods. The I-77 Southbound mainline south of US 21 is expected to operate at LOS E in the Design Year 2046 under both the No-Build and Build conditions. The No-Build analysis indicates that without the proposed new interchange the US 21 northbound off-ramp and Blythewood Road northbound off-ramp are expected to operate at LOS F and E, respectively in one or more peak periods. Under the Build scenario, these ramp junctions improved to LOS D or better for all analysis periods. Additionally, the ramp junctions associated with the proposed new interchange are expected to operate at LOS D or better during all analysis periods.

The Design Year 2046 intersection analysis indicates that without the proposed new interchange, many of the study intersections are expected to experience high levels of delay including the ramp

terminal intersections at US 21 and Blythewood Road. In the No-Build condition, the I-77 southbound ramp terminal at US 21 is expected to operate at LOS F during the manufacturing morning and mid-day shift changes (Shift peak periods) and the I-77 northbound ramp terminal intersection is expected to operate at LOS F during both the typical AM and PM peaks as well as the Shift peak periods. The Blythewood Road ramp terminal intersections experience similar operations with LOS E or F expected during all analysis periods. In the Design Year 2046 Build condition, implementation of the proposed new interchange at Exit 26 results in significant operational improvements at the existing ramp terminal intersections. The US 21 ramp terminals improve from LOS E or F to LOS D or better except for the I-77 Northbound off-ramp which is expected to operate at LOS E during the PM peak under the Build condition. While the intersection is expected to operate at LOS E, the queues at the off-ramp approach are not expected to impact I-77 operations.

Significant reductions in delay are also observed at the study intersections along Blythewood Road; however, they are still expected to operate at LOS E or F under the Build scenario in the Design Year 2046. The high delays remaining in the Design Year 2046 Build condition are a result of the increased traffic demand from Phase 2 of the manufacturing development, which is anticipated to double the number of manufacturing jobs. This indicates a need for additional improvements at the Blythewood Road interchange prior to Phase 2 of the manufacturing plant coming online.

The analysis indicates that the I-77 ramp terminal intersections at the proposed interchange with Connector Road are expected to operate at LOS A or B in the Design Year 2046 Build condition. In addition to the intersection analysis, a Design Year queueing analysis was conducted using SimTraffic to determine whether ramp terminal intersection queues at the proposed new interchange were expected to impact the I-77 mainline. The results of the queueing analysis indicate that the off-ramps associated with the new interchange are expected to have minimal queues which do not reach the I-77 mainline in the Design Year 2046.

Based on the operational benefits of the Build Alternative, it is considered the preferred alternative for this IJR.

E.1 Compliance with FHWA General Requirements

The following requirements serve as the primary decision criteria used in approval of interchange modification projects. Responses to the two FHWA policy points are provided to show that the proposed project is viable based on the analysis performed to date.

E.1.1 The request does not have a significant adverse impact on the safety and operation of the freeway system.

An operational and safety analysis has concluded that the proposed change in access does not have a significant adverse impact on the safety and operation of the Interstate facility (which includes mainline lanes, existing, new, or modified ramps, ramp intersections with crossroad) or on the local street network based on both the current and the planned future traffic projections. The analysis shall, particularly in urbanized areas, include at least the first adjacent existing or proposed interchange on either side of the proposed change in access (23 CFR 625.2(a), 655.603(d) and 771.111(f)). The crossroads and the local street network, to at least the first major intersection on either side of the proposed change in access, shall be included in this analysis to the extent necessary to fully evaluate the safety and operational impacts that the proposed change in access and other transportation improvements may have on the local street network (23 CFR 625.2(a) and 655.603(d)). Requests for a proposed change in access must include a description and assessment of the impacts and ability of the proposed changes to safely and efficiently collect, distribute and accommodate traffic on the Interstate facility, ramps, intersection of ramps with crossroad, and local street network (23 CFR 625.2(a) and 655.603(d)). Each request must also include a conceptual plan of the type and location of the signs proposed to support each design alternative (23 U.S.C. 109(d), and 23 CFR 655.603(d)).

The safety analysis for this IJR indicated that, historically, there were no unusual trends in crashes or crash types susceptible to correction in the design of the new interchange. During the historical three and three quarters-year analysis period, the study area experienced approximately 39 crashes per year with 33% sideswipe crashes, 28% run off road, and 25% rear-end crashes. These types of crashes are typically attributed to careless driving due to improper lane changing or going too fast for conditions. While there are no existing safety concerns within the project study area, the recommended alternative is expected to reduce the crash frequency from a qualitative standpoint by providing enhanced capacity throughout the study area and thus reducing the overall density of traffic through the study area when compared to the No-Build alternative.

The Design Year 2046 operational analysis results show that the Build alternative provides improvements in operations for both the I-77 mainline and ramps as well as the study area intersections. Under the No-Build conditions the I-77 Northbound off-ramps to both US 21 and Blythewood Road are expected to experience LOS E or F conditions in one or more analysis hours. Implementation of the proposed new interchange improves the operations of the off-ramp

junctions to LOS D or better during all analysis hours. Additionally, the ramp junctions associated with the proposed new interchange are expected to operate at LOS D or better during all analysis periods.

In terms of intersection operations, the I-77 ramp terminal intersections at the US 21 and Blythewood Road interchanges are expected to fail during two or more analysis hours, under the No-Build alternative. Under Build conditions, the ramp terminal intersections at US 21 improve to LOS D or better for all hours except for I-77 Northbound off-ramp during the PM peak which is expected to operate at LOS E. While the intersection is expected to operate at LOS E, the queues at the off-ramp approach are not expected to impact I-77 operations. The Blythewood Road ramp terminal intersections also experience a substantial reduction in delay during all four analyzed hours when comparing the Build to the No-Build condition. The I-77 ramp terminal intersections associated with the proposed new interchange are expected to operate at LOS A or B and the remaining new intersections along Connector Road (which is the new crossroad of the proposed interchange) are expected to operate at LOS D or better during all analysis periods in the Design Year 2046.

E.1.2 The proposed access connects to a public road only and will provide for all traffic movements

The proposed access connects to a public road only and will provide for all traffic movements. Less than "full interchanges" may be considered on a case-by-case basis for applications requiring special access, such as managed lanes (e.g., transit or high occupancy vehicle and high occupancy toll lanes) or park and ride lots. The proposed access will be designed to meet or exceed current standards (23 CFR 625.2(a), 625.4(a)(2), and 655.603(d)). In rare instances where all basic movements are not provided by the proposed design, the report should include a full-interchange option with a comparison of the operational and safety analyses to the partial-interchange option. The report should also include the mitigation proposed to compensate for the missing movements, including wayfinding signage, impacts on local intersections, mitigation of driver expectation leading to wrong-way movements on ramps, etc. The report should describe whether future provision of a full interchange is precluded by the proposed design

The proposed new interchange connects to a public road (Connector Road) that intersects with US 21 and Community Road which are existing public roadways within the study area. The proposed interchange is a full interchange which serves all movements to and from I-77. The Build alternative concept evaluated in this IJR is designed to meet current standards for federal aid projects and conforms to American Association of State Highway and Transportation Officials (AASHTO) design standards and the SCDOT 2021 Roadway Design Manual.

There is one known design exception within the limits of the project study area. A shoulder width design exception exists for the I-77 southbound mainline outside shoulder within the vicinity of

the I-77 southbound bridge over US 21. Under the existing condition the southbound US 21 to southbound I-77 loop on-ramp creates a lane add on the I-77 southbound bridge over US 21. To provide lane continuity without widening the existing bridge, this lane add is aligned with the upstream third mainline lane. While the existing four-foot shoulder on the bridge did not constitute a design exception when the adjacent lane was a ramp lane, this now becomes an exception when the shoulder is adjacent to a mainline travel lane. Approval of this design exception is currently on-going.

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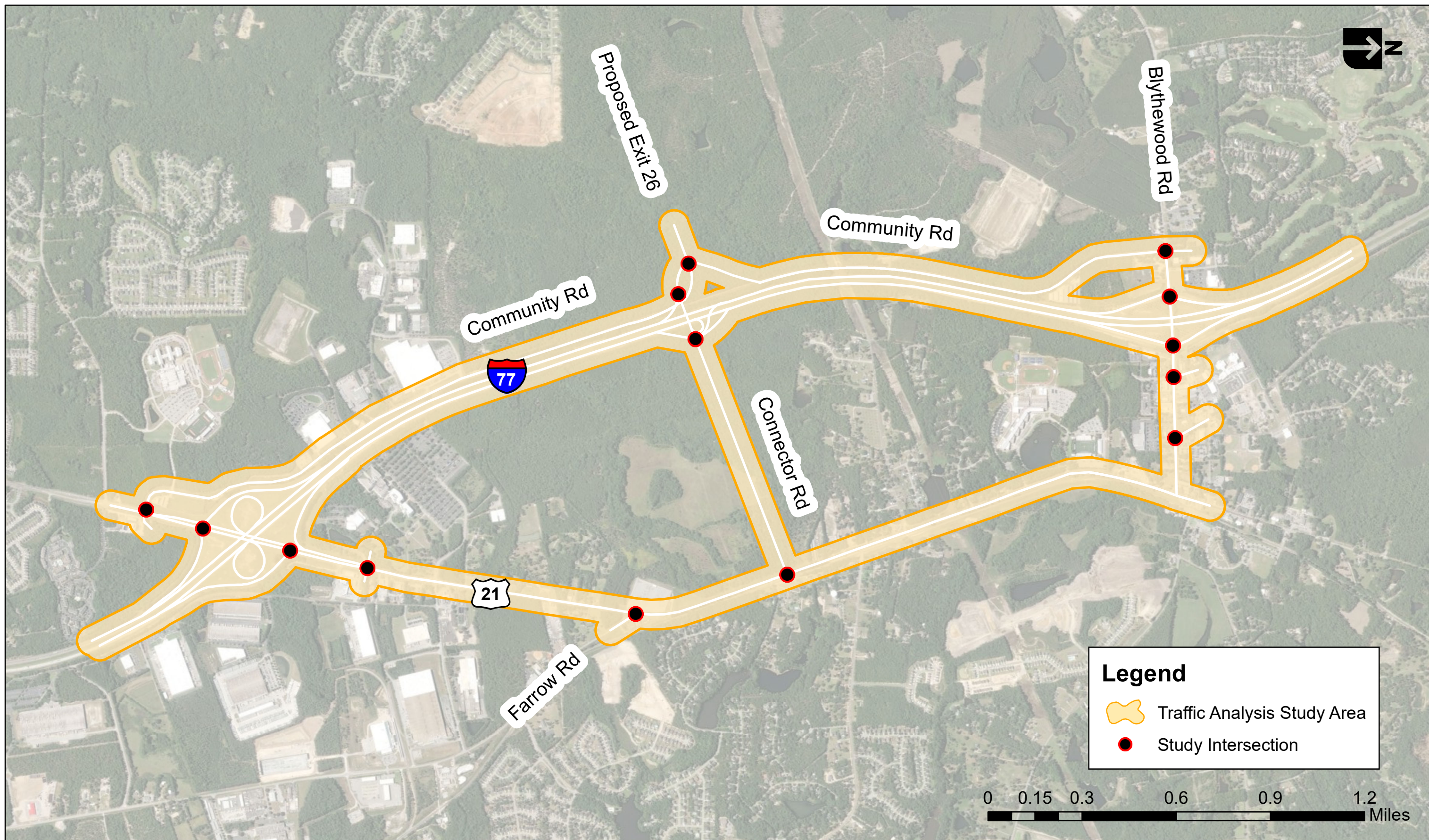
1.0 INTRODUCTION

1.1 Background

The South Carolina Department of Transportation (SCDOT) is evaluating alternatives to provide a new connection on I-77 at Exit 26 in Richland County, South Carolina, to support significant growth within the area. A new interchange and modification of the existing I-77 at US 21 [Exit 24] interchange, along with potential I-77 mainline improvements were evaluated as part of this Interchange Justification Report (IJR)

1.2 Project Location

The study area for this IJR spans along I-77 from US 21 to Blythewood Road, which is a distance of approximately 3.2 miles, and includes the existing interchanges at US 21 (Exit 24) and Blythewood Road (Exit 27). Along the intersecting arterial roadways, the study area includes the I-77 ramp terminal intersections as well as at least the first intersection adjacent to the ramp terminal on each side of the interstate. The study area falls primarily within the Town of Blythewood in Richland County. Currently, I-77 is a 6-lane freeway facility from south of US 21 to north of US 21 where it transitions to a four-lane facility for the remainder of the study area. US 21 is a four-lane divided roadway within the project area and Blythewood Road is a two-lane undivided roadway on the west side of I-77 and a three-lane roadway on the east side of I-77 within the project area. The existing land uses adjacent to US 21 and Blythewood Road include a mix of residential, commercial/retail, and industrial. **Figure 1-1** depicts the project location.



1.3 Purpose and Need

SCDOT proposes a new interchange with I-77 at Exit 26, modification of the existing I-77 at US 21 [Exit 24] interchange, and mainline improvements along I-77 in the northbound and southbound directions. The purpose of the project is to provide additional access to the interstate between the existing interchanges at US 21 (Exit 24) and Blythewood Road (Exit 27) to accommodate future traffic demands within the study area.

Under existing conditions, I-77 is a four-lane, divided interstate freeway facility with interchanges at US 21 (Exit 24) and Blythewood Road (Exit 27). The intersecting roadways consist of two to four-lane roadways. Existing Year 2023 Annual Average Daily Traffic (AADT) on I-77 within the study area ranges from 47,200 vehicles per day to 71,800 vehicles per day. I-77 serves as a major freight and commuter route between Columbia to the south of the study area and Charlotte to the north of the study area. Existing Conditions analysis indicates that while the I-77 mainline and ramp junctions operate at LOS D or better, several of the study intersections experience congestion during the existing peak periods. The Design Year 2046 No-Build analysis indicates that without improvements within the study area, the existing operational conditions are expected to degrade resulting in multiple ramp terminal intersection failures as well as several ramp junction failures within the study area.

The purpose of the proposed new interchange is to add needed connectivity to/from I-77 between the existing interchanges at US 21 and Blythewood Road to support large-scale development expected within the project study area. Without this new interchange, traffic demand will exceed the capacity of the existing interchanges causing exacerbation of delays for roadway users and degrading operations along the I-77 mainline.

2.0 TRAFFIC ANALYSIS ASSUMPTIONS AND METHODOLOGY

2.1 Overview

A Traffic Analysis Methodology Memorandum (TAMM) was prepared to document the methodology for the analysis and evaluation of this IJR. The following sections summarize the methodology as set forth in the TAMM and used in the IJR including data collection, traffic forecasting, design hour traffic development, level of service (LOS) criteria, and operational analysis. Additional details are included in subsequent sections.

2.2 Analysis Years

The following study years are established for the analysis:

- Existing Year: 2023
- Opening Year: 2026
- Design Year: 2046

2.3 Area of Influence

The area of influence for this study includes I-77 from US 21 to Blythewood Road. Along US 21, the area of influence extends from Community Road to the Office Park/QuikTrip driveway and along Blythewood Road the study area extends from Community Road to Boney Road. The IJR provides analysis for the I-77 mainline and ramps and the signalized and unsignalized intersections along the arterials within the area of influence. The study elements included in the IJR are summarized as follows:

Along I-77 mainline:

- US 21
- Exit 26 (future Build conditions only)
- Blythewood Road

Along US 21:

- Community Road (signalized)
- I-77 Southbound Ramp Terminal (unsignalized)
- I-77 Northbound Ramp Terminal (unsignalized)
- Office Park/QuikTrip driveway (signalized)
- Farrow Road (unsignalized)

Along Connector Road (future Build conditions only):

- Community Road (signalized)
- I-77 Southbound Ramp Terminal (signalized)
- I-77 Northbound Ramp Terminal (signalized)
- US 21 (signalized)

Along Blythewood Road:

- Locklier Road (unsignalized), which is combined with Community Road in the future conditions
- Community Road (unsignalized)
- I-77 Southbound Ramp Terminal (signalized)
- I-77 Northbound Ramp Terminal (signalized)
- Creech Road/McNulty Street (unsignalized)
- Boney Road (signalized)

2.4 Data Collection

The primary source of traffic data for this study is field traffic counts. The field-collected data were supplemented with traffic data and other transportation data as needed from existing available data sources. The data sources within the project study area include the following:

- Existing Year (2023) project traffic counts
- SCDOT Transportation System Data
- Central Midlands Council of Governments (CMOG) Metropolitan Planning Organization's Columbia Area Transportation Study (COATS) Travel Demand Model

2.5 Base Traffic Data and Traffic Factors

Numerous field traffic counts were conducted to obtain the existing traffic for the study area. Thirteen-hour turning movement counts (TMCs) were performed for the 11 existing intersections listed in **Section 2.3**. Seven-day bi-directional vehicle classification counts were collected along the I-77 mainline, 48-hour ramp classification counts were collected at all I-77 ramps within the project study area, and 48-hour bi-directional arterial classification counts were taken at several locations within the study area. The counts were conducted in March and April 2023 with the 48-hour counts collected on a typical weekday (Tuesday, Wednesday, or Thursday). The count locations that were used for the study include the following:

Turning Movement Counts

- US 21 at Community Road
- US 21 at I-77 Southbound Ramp Terminal
- US 21 at I-77 Northbound Ramp Terminal

- US 21 at Office Park/QuikTrip Driveway
- US 21 at Farrow Road
- Blythewood Road at Locklier Road
- Blythewood Road at Community Road
- Blythewood Road at I-77 Southbound Ramp Terminal
- Blythewood Road at I-77 Northbound Ramp Terminal
- Blythewood Road at Creech Road/McNulty Street
- Blythewood Road at Boney Road

7-Day Bi-directional Classification Counts

- I-77 south of US 21
- I-77 between US 21 and Blythewood Road
- I-77 north of Blythewood Road
- US 21 between I-77 ramp terminals
- US 21 south of Rimer Pond Road

48-Hour Bi-directional Classification Counts

- US 21 south of I-77
- Community Road south of Blythewood Road
- Blythewood Road west of I-77

48-Hour Ramp Classification Counts

- I-77 southbound off-ramp to US 21
- I-77 southbound on-ramp from southbound US 21
- I-77 southbound on-ramp from northbound US 21
- I-77 northbound off-ramp to US 21
- I-77 northbound on-ramp from northbound US 21
- I-77 northbound on-ramp from southbound US 21
- I-77 southbound off-ramp to Blythewood Road
- I-77 southbound on-ramp from Blythewood Road
- I-77 northbound off-ramp to Blythewood Road
- I-77 northbound on-ramp to Blythewood Road

The 7-day and 48-hour counts were converted to Annual Average Daily Traffic (AADT) for the existing conditions.

The factors used to develop the design traffic volumes were derived from the project traffic counts as described in the following sections.

2.5.1 K Factor Development

The K factor, or peak to daily factor, is the proportion of the daily traffic that occurs during the peak hour of the day represented as a percentage. K factors for the study area roadways were derived from the 7-day and 48-hour counts described in **Section 2.5** and are summarized in **Table 2-1**.

2.5.2 D Factor Development

The D factor, or directional factor, is the proportion of the peak-hour traffic traveling in the peak direction. D factors were calculated for this project from the 7-day and 48-hour bi-directional tube count data. The D factors calculated from the three tube counts along I-77 ranged from 54% to 59%. An average value of 57% was identified for use in pavement design. Similar to I-77, D factors were calculated for US 21 and Blythewood Road and are summarized in **Table 2-1**.

2.5.3 Peak Hour Factor (PHF)

The PHF is a measure of variability of demand during the peak hour [$\text{PHF} = \text{peak hour volume} / (4 \times \text{peak 15-minute volume within the peak hour})$]. Project traffic counts were used to derive the PHF by intersection, I-77 ramp, and for the I-77 mainline for the existing conditions. A uniform PHF of 0.90 will be used for the future conditions analysis.

2.5.4 Truck Factor Development

The peak-hour truck factors (T_f) for the study area intersections were calculated from the existing turning movement counts and vehicle classification counts. The 7-day and 48-hour classification counts were used to establish the daily and peak hour truck percentages for the I-77 mainline and ramps. The daily (T_{24}) and peak hour truck factors calculated from the classification counts were used in the existing and future conditions analyses and were modified where necessary to account for truck movements associated with the proposed development in the future conditions.

The following table summarizes the traffic factors used in the analysis of the study alternatives.

Table 2-1 Traffic Factor Summary

Facility	K (%)	D (%)	T_{24} (%)	T_f (%)	PHF
I-77 Mainline	8%	57%	varies	varies	0.90
US 21	9%	56%	varies	varies	0.90
Blythewood Road	9%	53%	varies	varies	0.90

2.6 Travel Demand Forecasting

This study utilized the adopted CMOG COATS model which has a base year of 2018 and forecast year of 2045. The COATS model is the primary travel demand forecasting tool used to support transportation planning needs within the CMOG MPO area which includes the project study area.

2.6.1 Forecast Model Review

As a part of the forecasting effort, a review of the Base Year 2018 and 2045 Long Range Transportation Plan Constrained (LRTPC) Network model run was conducted to assess the reasonableness of future traffic projections in the study corridor. The study area model review checked for illogical speed and capacity calculations, illogical trip pathing, reasonableness of trip distribution and assignment, and the reasonableness of population and employment growth.

The COATS 2045 LRTPC Network serves as the base network for the design year alternatives. The Network was reviewed to ensure that the appropriate planned transportation improvements were included in the forecast year model network.

2.6.2 Model Adjustments

As part of the forecasting effort for this project, Community Road was added to the base year 2018 and 2045 LRTPC model networks to enhance forecasts for the study area. Centroid connectors were adjusted for the traffic analysis zones (TAZs) adjacent to Community Road which would have a connection to the roadway. No other adjustments were made to the models for the purpose of improving forecasting accuracy.

2.6.3 Modeling Scenarios

Two future conditions modeling scenarios were developed for this IJR, a No-Build scenario and a Build scenario. The No-Build scenario reflects the 2045 LRTPC model network with the addition of Community Road as described in Section 2.6.2. The Build scenario includes a new interchange with I-77 between the existing interchanges at US 21 and Blythewood Road. The roadway connected to the new interchange includes an intersection with Community Road on the west side of I-77 and an intersection with US 21 on the east side of I-77.

Socio-economic (SE) data was reviewed for the TAZs collocated with the proposed manufacturing development to determine how much, if any, manufacturing development was assumed in the horizon year travel demand model. Review of the SE data indicated there was considerable growth in employment assumed in the travel demand model for the TAZs covering the manufacturing development land-area. Since the manufacturing trips were being handled outside of the model using trip generation methodologies (see Section 4.2), a sensitivity analysis was conducted on the

No-Build modeling scenario to determine the impact of the employment numbers coded in the SE data. Two No-Build modeling scenarios were developed for the sensitivity analysis, one which included the growth in the SE data in the TAZs associated with the manufacturing development. The second scenario replaced the 2045 SE data with the 2018 SE data only for the TAZs associated with the manufacturing development to create a scenario with no employment growth within these zones. The resulting forecast volumes were used to develop growth rates which were compared between modeling scenarios and used to select the final growth rates used in the study.

Linear annual growth rates for the study area roadways were developed using the 2045 LRTPC No-Build models and the 2018 Base model forecast volumes. Once these growth rates were determined, they were applied to the existing AADT and peak hour volumes to obtain the Design Year 2046 background AADTs and peak hour volumes. The growth rates used in this IJR are described in more detail in **Section 4**.

The Build modeling scenario was used to determine the overall change in traffic patterns within the study area due to the introduction of a new connection to I-77. A comparison of the forecast volumes between the No-Build and Build scenarios was used to determine the traffic diversion from the existing interchanges to the new interchange. These diversion rates were used to adjust the No-Build volumes to the Build condition.

2.7 Development of Design Traffic

The future year peak period volumes were developed through the application of the selected growth rates described in **Section 2.6** to the existing turning movement volumes. Traffic generated by the planned manufacturing plant was provided by the developer and added to the background traffic derived from the model growth rates to determine the total future conditions traffic demand. Additional details on the proposed development trip generation and trip distribution are provided in **Section 4**.

2.8 Operational Analysis Procedures

The primary tools that were used to perform the traffic analysis for this study were the Highway Capacity Software 2023 (HCS 2023), Synchro/SimTraffic 11, and SIDRA 9. The HCS 2023 Freeway Facilities module was used to evaluate the I-77 mainline segments, weave segments, and merge/diverge junctions. Synchro 11 was used to evaluate intersection operations within the study area based on HCM 6th Edition results unless the intersection configuration was not compatible with HCM 6th Edition analysis. SIDRA 9 was used to analyze proposed roundabouts within the study area. For the Design Year 2046, SimTraffic was used to identify the 95th percentile queue lengths of signalized intersections for evaluating storage length needs.

2.8.1 Performance Measures

Several performance measures were used to establish the existing operating conditions and compare the operational performance of the future No-Build and Build conditions. The following summarizes the measures of effectiveness (MOEs) which were used in the study:

- Freeway mainline, weaving segments, merge/diverge junctions: Density (passenger cars/mile/lane), level of service (LOS), and average speed (miles per hour)
- Intersections: Delay (seconds/vehicle), LOS, and 95th percentile queue length

The traffic operation conditions of the No-Build and Build Alternatives were compared using the above MOEs.

2.9 Safety Analysis Procedures

A safety analysis was performed to determine the historical safety conditions along I-77 within the study area. The safety analysis also includes Blythewood Road and US 21 in the vicinity of I-77. The historical crash analysis was conducted for the most recent data available (January 2019 through September 2022). The analysis focused on identifying flaws in the existing system which could be improved as part of the Build alternatives. The crash analysis is summarized by the following metrics:

- Temporal and spatial crash frequency
- Crash severity
- Crash type
- Pavement condition
- Lighting condition

3.0 EXISTING CONDITIONS

The following section provides an evaluation of the existing conditions within the study area. The discussion items include transportation systems information, existing traffic data, and existing operating conditions.

3.1 Existing Transportation Network

3.1.1 Existing Roadway Network

The existing transportation network within the study area consists of an urban principal arterial interstate, urban major collectors, urban minor collectors, and urban local roads. **Table 3-1** summarizes the features of the major roadways in the study area including number of lanes and roadway classifications. **Figure 3-1** shows the existing lane configuration for the study area.

Table 3-1 Roadway Functional Classification

Roadway	Functional Classification	Number of Lanes
I-77	Urban Principal Arterial – Interstate	4/6
US 21 north of I-77	Urban Major Collector	4
US 21 south of I-77	Urban Minor Arterial	4
Blythewood Road	Urban Major Collector	2/3
Community Road	Urban Local Road	2

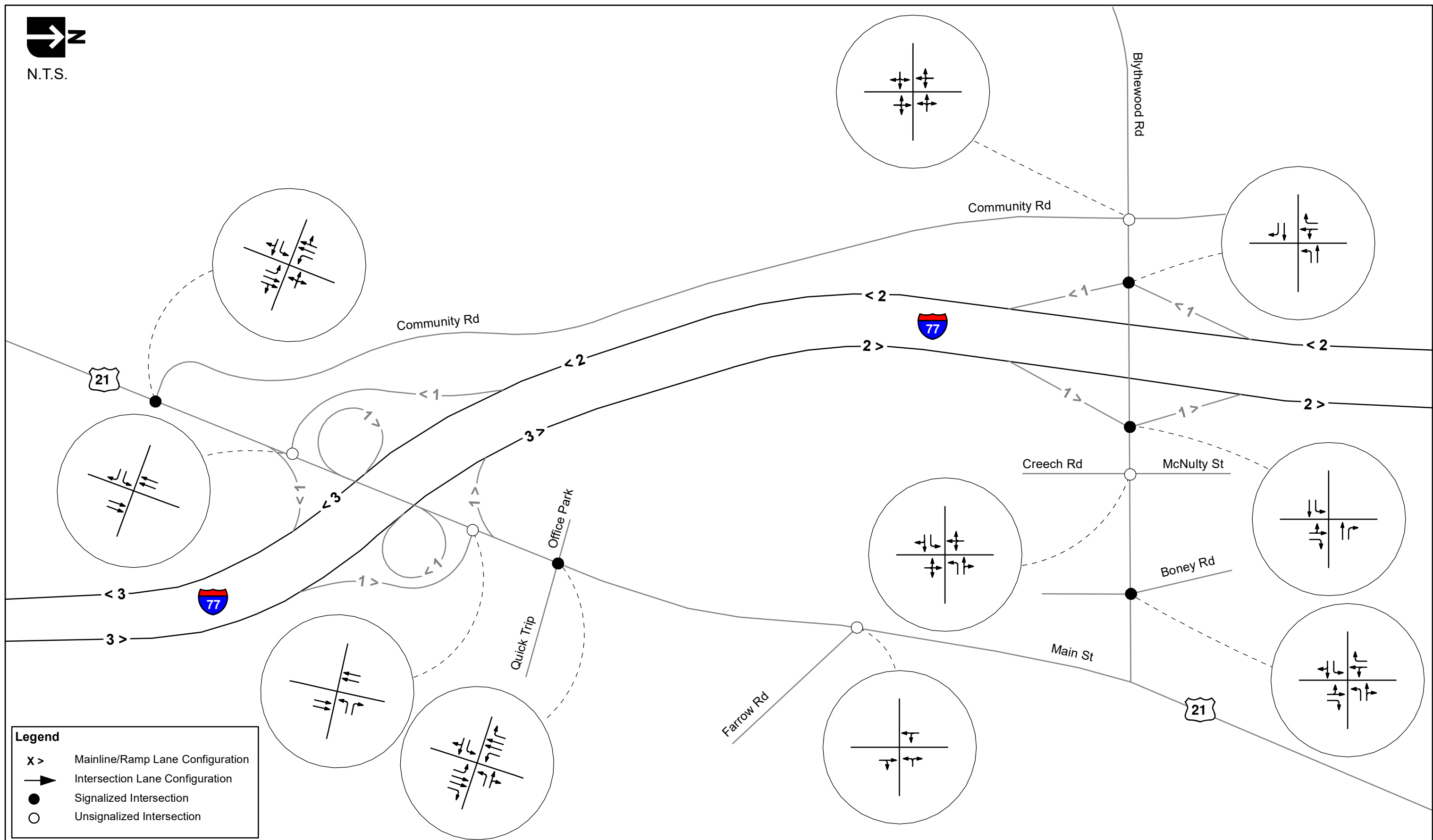
I-77 is a six-lane urban interstate from south of US 21 to between US 21 and Blythewood Road where it transitions to a four-lane facility for the remainder of the study area. The speed limit on I-77 within the study area is 70 mph. The facility serves as a primary north-south route for traffic traveling to/from the Columbia metro area.

US 21 is a four-lane urban major collector north of I-77 and a four-lane urban minor arterial south of I-77 with a posted speed limit of 45 miles per hour. US 21 serves primarily residential uses on the south side of I-77 and a mixture of industrial, commercial/retail, and residential uses on the north side of I-77.

Blythewood Road is a two-lane urban major collector on the west side of I-77 and a three-lane urban major collector on the east side of I-77. The posted speed limit on Blythewood Road is 35 miles per hour on the west side of I-77 and 30 miles per hour on the east side of I-77. Blythewood

Road serves a mixture of residential and commercial land uses on the west side of I-77 and primarily commercial/retail land uses on the east side of I-77.

Community Road is a two-lane urban local road with a posted speed limit of 45 miles per hour which connects US 21 and Blythewood Road on the west side of I-77. Community Road primarily serves industrial and institutional land uses near its southern terminus at US 21. The remainder of the frontage along Community Road is currently undeveloped; however, this site will become a large vehicle manufacturing plant with its main access driveway on Community Road.



3.2 Historical Crash Analysis

Historical crash data along I-77 in the project study area was provided by SCDOT for the period spanning from January 1, 2019 to September 30, 2022. The crash data included number of crashes by location for each year, number of vehicles involved, type of crash, crash severity, contributing causes and roadway and weather conditions. This data was reviewed and summarized with the intent of identifying trends and potential safety issues in the current transportation system.

The historical crash analysis indicated that there was a total of 145 crashes during the analysis period. The most common crash types reported during the analysis period were sideswipe crashes (48 crashes, 33% of total), run off the road crashes (40 crashes, 28% of total) and rear-end crashes (36 crashes, 25% of total). Analysis of lighting and pavement conditions indicated that 64% of crashes occurred during daylight conditions and 84% of crashes occurred on dry pavement. The most common probable causes for crashes during the analysis period were improper lane use/lane change (33%) and driving too fast for conditions (32%). **Table 3-2** summarizes the total number of crashes per year and **Table 3-3** summarizes the crash types by manner of collision. **Figure 3-2** illustrates the density of the historical crashes within the study area. As shown in the figure, the highest density of crashes occurred within the vicinity of the existing interchanges in the study area.

Among the 145 crashes, there were 3 fatal crashes (2%), 22 injury crashes (15%), and 120 property damage only crashes (83%). To gain a better understanding of the fatal crashes within the study area, the Traffic Collision Report Form (TR 310) reports for the fatal crashes were reviewed. A brief description of each of the fatal crashes follows:

Crash 1: The crash occurred on July 26, 2019, in the southbound lanes of I-77 0.14 miles south of Blythewood Road during nighttime, dry pavement conditions. Two vehicles were disabled in the roadway from a collision that had just occurred, one vehicle was towing a trailer that detached and was in the southbound roadway. A vehicle traveling southbound struck the detached trailer and continued south, striking the rear of the other vehicle that was disabled in the roadway and a pedestrian that was standing next to the vehicle. The pedestrian sustained fatal injuries as a result of the collision.

Crash 2: The crash occurred on July 26, 2019, in the southbound lanes of I-77 0.12 miles south of Blythewood Road during nighttime, dry pavement conditions. This is a secondary crash to Crash 1 listed above. A vehicle was disabled in the roadway from a previous collision which had just occurred. A pedestrian was standing at the rear of the disabled vehicle when another vehicle traveling southbound struck the rear of the disabled vehicle and the pedestrian. The pedestrian sustained fatal injuries as a result of the collision.

Crash 3: The crash occurred on September 26, 2022, in the northbound lanes of I-77 near US 21 during daylight and dry pavement conditions. A driver traveling southbound on I-77 ran off the road to the left side and crossed over the median striking a vehicle traveling northbound. The driver of the vehicle that crossed the median sustained fatal injuries as a result of the collision.

Based on the review of the historical crashes within the study area, no unusual trends or crash types susceptible to correction in the design of the new interchange were identified. Additional historical crash information is provided in **Appendix A**.

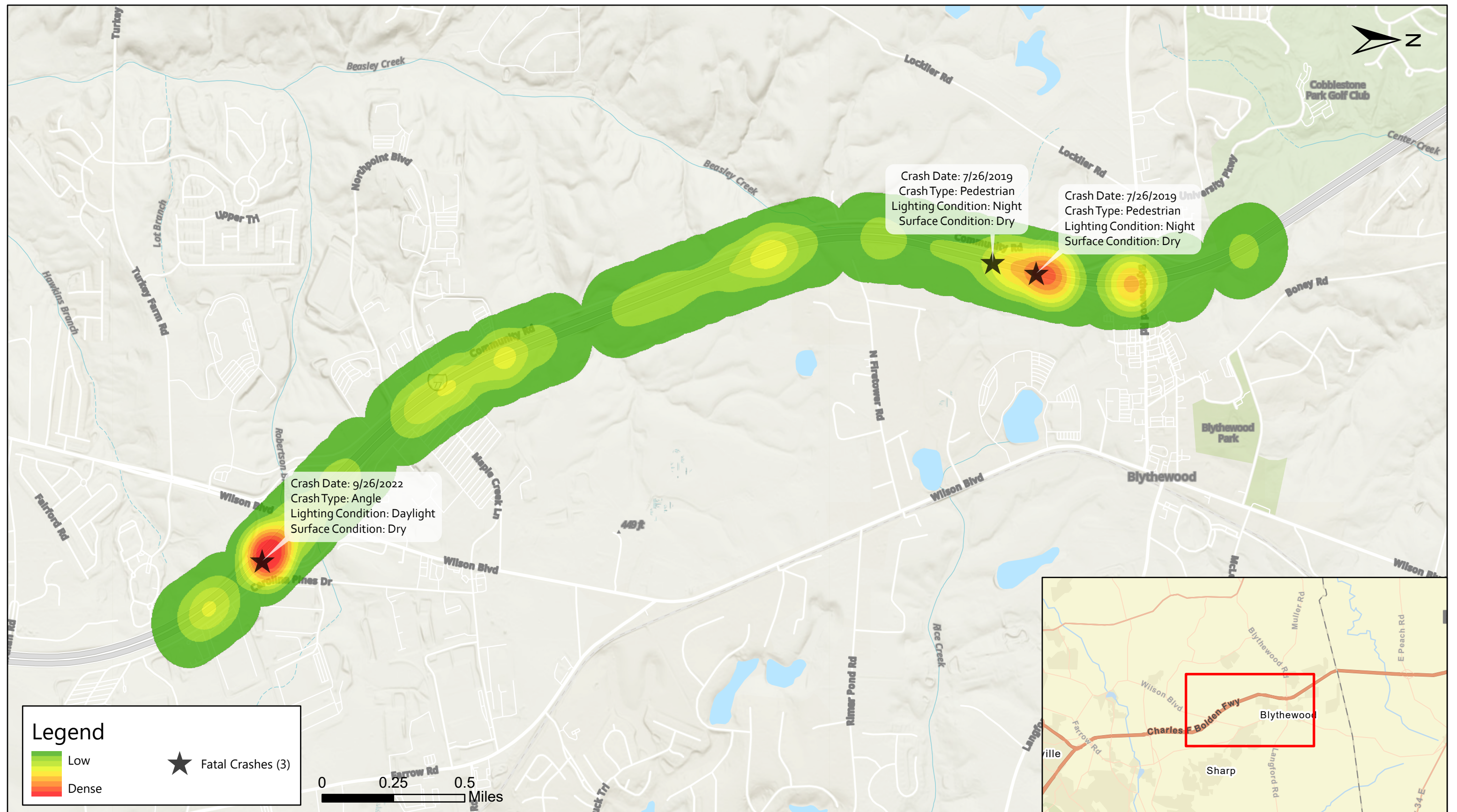
Table 3-2 Study Area Crashes by Year

Year	Number of Crashes	Percentage of Total
2019	25	17%
2020	27	19%
2021	59	41%
2022*	34	23%
Grand Total	145	100%

* 2022 Crashes only include January through September

Table 3-3 5-Study Area Crashes by Crash Type

Crash Type	Number of Crashes	Percentage of Total
Rear End	36	25%
Sideswipe	48	33%
Angle	13	9%
Run Off Road	40	28%
Animal	4	3%
Pedestrian	2	1%
Head On	0	0%
Bicycle	0	0%
Other	2	1%
Grand Total	145	100%



3.3 Existing Traffic Volumes

3.3.1 Existing Traffic Data

Traffic data collection was conducted during March and April 2023. Thirteen-hour TMCs were collected at the study area intersections. In addition, seven-day bi-directional vehicle classification counts were collected along the I-77 mainline, 48-hour ramp classification counts were collected at all of the I-77 ramps within the study area, and 48-hour bi-directional arterial classification counts were taken at several locations within the study area. **Appendix B** contains the raw traffic counts.

3.3.2 Daily Traffic

Existing Year 2023 AADTs were developed using the 7-day and 48-hour bi-directional counts within the project study area. The daily traffic counts were averaged to convert the existing count to an AADT. Existing Year AADTs for the study area are illustrated in **Figure 3-3**.

3.3.3 Peak Hour Traffic

Study area peak hours were determined by analyzing the turning movement count data and tube count data to find the most frequent peak hour across the study intersections and segments. The AM peak hour was identified as 7:15 AM – 8:15 AM while the PM peak hour was from 4:15 PM - 5:15 PM. The I-77 mainline was balanced based on the established peak hour volumes and peak hour turning movement volumes were balanced where no driveways exist between study intersections. **Figure 3-4** shows the study area AM and PM peak hour volumes.

3.4 Existing Operational Performance

The following sections discuss the Existing Year 2023 operating conditions in the study area.

3.4.1 Existing Mainline and Ramp Analysis

The Existing Conditions on the I-77 mainline and ramps were assessed using the HCS 2023 freeway facilities module. The results of the analysis are summarized in **Table 3-4**. As shown in the table, the I-77 mainline and ramps operate at LOS D or better during both the AM and PM peaks under the existing traffic conditions. Backup documentation for the Existing Conditions HCS analysis is provided in **Appendix C**.

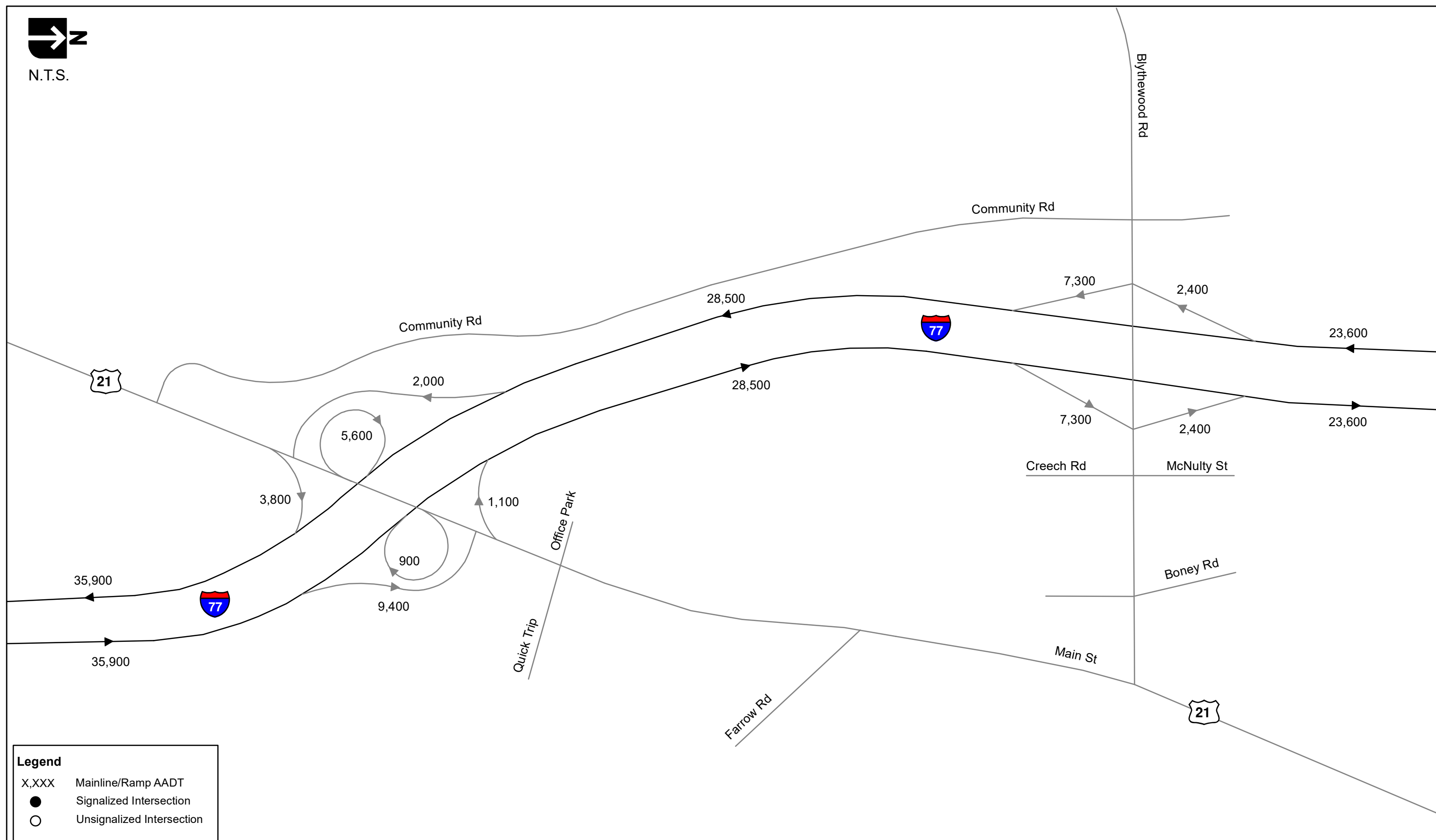


Table 3-4 Existing Year 2023 Mainline and Ramp Operations

I-77 Segment	Type		AM Peak				PM Peak			
	Coded	Analyzed	Volume	Average Speed ¹ (mph)	Density ² (pc/mi/ln)	LOS	Volume	Average Speed ¹ (mph)	Density ² (pc/mi/ln)	LOS
I-77 Northbound										
South of US 21	Basic	Basic	862	75.0	10.8	A	1,787	73.9	17.8	B
US 21 Off-Ramp	Diverge	Diverge	273	66.8 / 63.1	12.1 / 18.2	B	571	66.7 / 62.1	19.7 / 26.5	C
From US 21 Off-Ramp to NB US 21 On-Ramp	Basic	Basic	589	74.3	7.3	A	1,216	74.3	12.5	B
NB US 21 On-Ramp	Merge	Merge	26	68.2 / 65.3	9.3 / 10.2	B	140	67.7 / 64.9	14.5 / 14.7	B
From NB US 21 On-Ramp to SB US 21 On-Ramp	Basic	Basic	615	73.9	8.2	A	1,356	73.8	13.0	B
SB US 21 On-Ramp	Merge	Merge	49	69 / 66.2	9.4 / 10.3	B	76	68.1 / 65.7	15.3 / 16.0	B
From US 21 to Blythewood Rd (3 lanes)	Basic	Basic	664	74.9	8.7	A	1,432	74.9	13.9	B
From US 21 to Blythewood Rd (2 lanes)	Basic	Basic	664	75.0	13.0	B	1,432	71.5	21.8	C
Blythewood Rd Off-Ramp	Diverge	Diverge	64	63.3 / 63.3	15.4 / 19.3	B	485	62.0 / 62.0	25.2 / 29.4	D
From Blythewood Rd Off-Ramp to Blythewood Rd On-Ramp	Basic	Basic	600	74.8	8.6	A	947	74.8	13.8	B
Blythewood Rd On-Ramp	Merge	Merge	100	66.0 / 66.0	11.2 / 12.4	B	154	65.3 / 65.3	17.5/ 18.7	B
North of Blythewood Rd	Basic	Basic	700	75.0	10.0	A	1,101	74.8	15.3	B
I-77 Southbound										
North of Blythewood Rd	Basic	Basic	819	75.0	13.2	B	1,529	74.9	14.6	B
Blythewood Rd Off-Ramp	Diverge	Diverge	61	64.6 / 64.6	15.3 / 19.7	B	123	64.5 / 64.5	16.9 / 21.5	C
From Blythewood Rd Off-Ramp to Blythewood Rd On-Ramp	Basic	Basic	758	74.8	12.1	B	1,406	74.8	12.9	B
Blythewood Rd On-Ramp	Merge	Merge	257	64.0 / 64.0	22.9 / 23.7	C	958	64.8 / 64.8	19.2 / 20.5	C
From Blythewood Rd to US 21	Basic	Basic	1,015	71.9	21.3	C	2,364	74.2	17.2	B
US 21 Off-Ramp	Diverge	Diverge	54	64.6 / 64.6	23.7 / 28.1	D	157	64.6 / 64.6	19.7 / 23.8	C
From US 21 Off-Ramp to SB US 21 On-Ramp	Basic	Basic	961	73.0	19.6	C	2,207	74.1	15.8	B
SB US 21 On-Ramp	Merge	Basic	219	74.2 / 74.2	17.0 / 17.0	B	739	74.9 / 74.9	14.5 / 14.5	B
From SB US 21 On-Ramp to NB US 21 On-Ramp	Basic	Basic	1180	74.2	17.1	B	2,946	75.0	13.7	B
NB US 21 On-Ramp	Merge	Merge	129	66.5 / 64.2	21.6 / 22.9	C	425	67.3 / 64.9	18.0 / 19.9	B
South of US 21	Basic	Basic	1,309	69.3	24.8	C	3,371	74.3	17.0	B

¹Ramp Junction Speed/Ramp Influence Area Speed

²Average Freeway Density/Ramp Influence Area Density

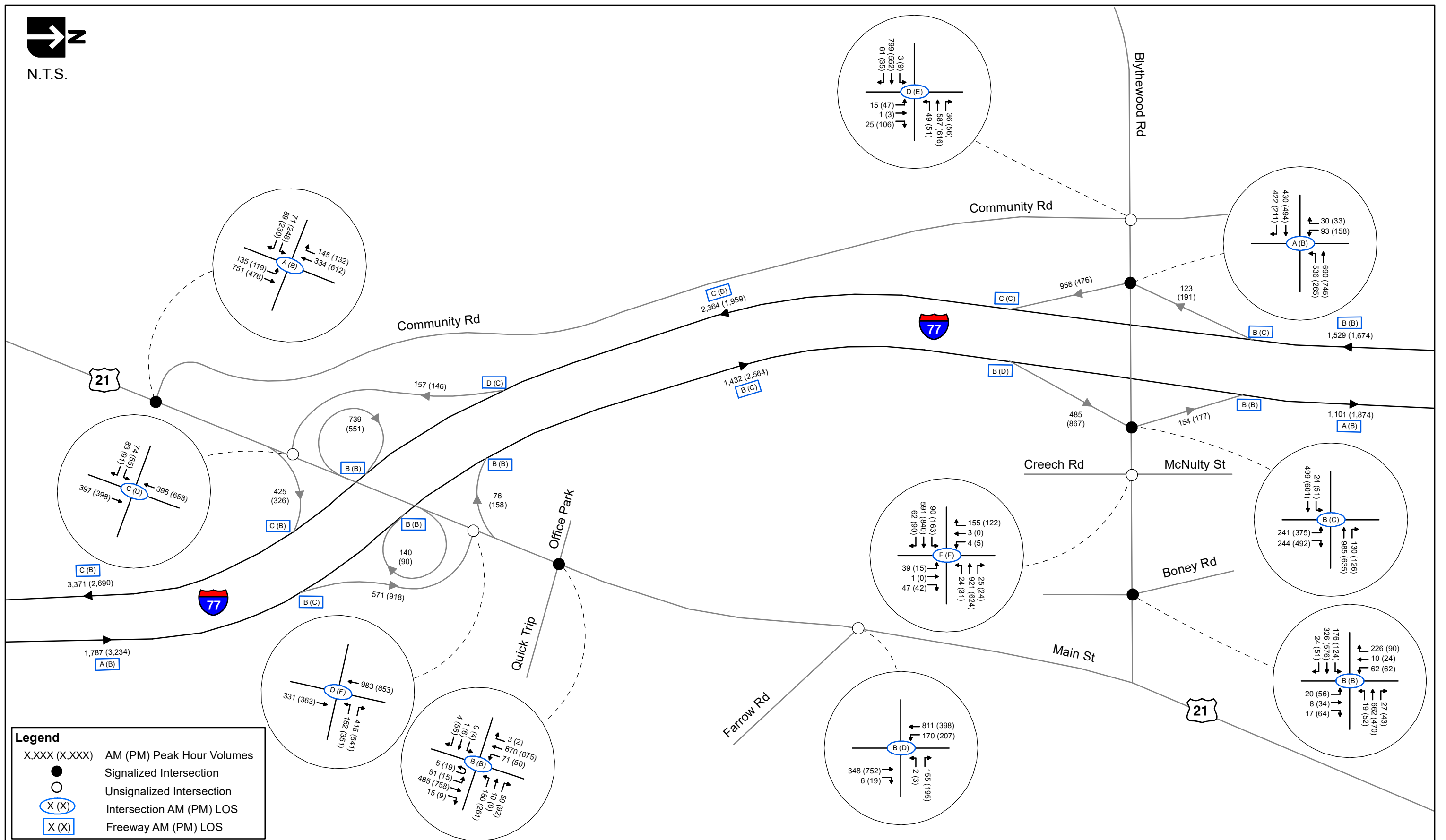
3.4.2 Existing Conditions Intersection Analysis

Synchro 11 was used to analyze the Existing Year 2023 study intersections. Timing plans were obtained from SCDOT for the signalized intersections within the study area to represent the field conditions more accurately. For signalized intersections, the overall intersection delay and LOS are reported. For unsignalized intersections, the highest stop-controlled delay and LOS are reported. **Table 3-5** summarizes the delay and LOS for the study intersections for the AM and PM peak hours. The results of the analysis indicate that several of the study area's unsignalized intersections operate at LOS E or F in the existing conditions. The study area's signalized intersections operate at LOS D or better under the existing conditions. The Existing Year 2023 Peak Hour volumes and LOS are illustrated in **Figure 3-4**. Backup documentation for the Existing Conditions Synchro analysis is provided in **Appendix D**.

Table 3-5 Existing Year 2023 Intersection Operations

Intersection	Control Type	AM Peak		PM Peak	
		Delay	LOS	Delay	LOS
US 21 at Community Rd	Signal	9.5	A	17.9	B
US 21 at I-77 SB Ramps	Stop	16.9	C	32.5	D
US 21 at I-77 NB Ramps	Stop	33.0	D	365.2	F
US 21 at Office Park/QuikTrip ¹	Signal	11.9	B	17.6	B
US 21 at Farrow Rd	Stop	13.3	B	34.1	D
Blythewood Rd at Locklier Rd	Stop	70.8	F	59.0	F
Blythewood Rd at Community Rd	Stop	30.1	D	41.2	E
Blythewood Rd at I-77 SB Ramps	Signal	9.5	A	12.4	B
Blythewood Rd at I-77 NB Ramps	Signal	17.4	B	20.8	C
Blythewood Rd at Creech Rd/ McNulty St	Stop	1906.4	F	212.0	F
Blythewood Rd at Boney Rd	Signal	12.3	B	12.3	B

¹Analyzed using Synchro output. HCM 6th Edition Methodology not supported.



4.0 DEVELOPMENT OF FUTURE YEAR TRAFFIC

Traffic volume development for the future No-Build and Build conditions includes the typical AM and PM peak hours. Since the manufacturing plant will have shift changes outside of the typical commuting peak hours, two additional peaks were developed and analyzed to assess the impact of the manufacturing trips on the study area roadways. The following sections summarize the traffic development to support the analysis effort.

4.1 Background Traffic Growth

Background traffic growth for the study area was developed using growth rates derived from the CMOG COATs model as described in Section 2.6. The "No-Build" scenario model was utilized to determine linear annual growth rates by comparing base year 2018 and horizon year 2045 modeled AADTs. **Table 4-1** summarizes the background growth rates selected for the study area roadways.

Table 4-1 Selected Growth Rates

Location	Recommended Growth Rate ¹
I-77 Mainline	0.80%
US 21 Ramps	0.80%
Blythewood Road Ramps	1.60%
US 21	0.80%
Blythewood Road	2.40%
Community Road	1.60%

¹Linear Annual Growth Rate

These selected growth rates were applied to the Existing Year 2023 daily and peak hour traffic volumes to establish the Opening Year 2026 and Design Year 2046 background AADTs and peak hour volumes. This represents the traffic demand for the study area without the proposed manufacturing development.

In addition to the AM and PM commuter peak hours, two additional shift peak hours were developed: Shift 1 Peak (5:30-6:30 AM) and Shift 2 Peak (1:30-2:30PM). Similar to the typical AM and PM peak hours, the 2023 Existing Year shift peak hour volumes were derived from the project traffic counts and the selected growth rates were applied to determine the background traffic demand for the shift peaks.

4.2 Proposed Development Traffic Volumes

Traffic volumes for the proposed manufacturing plant (project trips) were developed by the land developer using the Institute of Transportation Engineers (ITE) Trip Generation Manual 11th Edition along with information on trip generation from similar manufacturing plants. This trip generation was documented in a memorandum which is provided in **Appendix E**.

Construction of the proposed manufacturing plant is expected to occur in two phases which have different trip generation totals. The Opening Year of this IJR corresponds with Phase 1 of the manufacturing development and Phase 2 (full buildout) is expected to occur by the Design Year of this IJR. The peak period trips produced by the proposed manufacturing plant are summarized in **Table 4-2**.

Table 4-2 Project Trips by Analysis Period

Trip Type	Shift 1 Peak		AM Peak		Shift 2 Peak		PM Peak	
	Enter	Exit	Enter	Exit	Enter	Exit	Enter	Exit
Phase 1								
Manufacturing	1,440	1,440	144	144	1,440	1,440	144	144
Related Industrial	1,465	783	147	78	793	1,626	79	163
Trucks	50	50	50	50	50	50	50	50
Total	2,955	2,273	341	272	2,283	3,116	273	357
Phase 2								
Manufacturing	2,880	2,880	288	288	2,880	2,880	288	288
Related Industrial	1,465	783	147	78	793	1,626	79	163
Trucks	100	100	100	100	100	100	100	100
Total	4,445	3,763	535	466	3,773	4,606	467	551

These project trips were assigned to the Build roadway network based on the trip distribution provided by the land developer (**Appendix E**). These trips were added to the background traffic to establish the total demand for the Build condition. For the No-Build condition, adjustments were made to the trip distribution to account for the absence of the proposed interchange at Exit 26. An assumption was made such that project trips would not backtrack to reach their destination in the No-Build condition, so any project trips utilizing the new interchange from the south was reassigned to the US 21 interchange and any project traffic utilizing the new interchange from the north was assigned to the Blythewood Road interchange. The reassigned project trips were then added to the background traffic to establish the total demand for the No-Build condition.

4.3 Traffic Diversion to New Interchange

When a new interchange is introduced to an established transportation network, it is known that it may cause a change in travel patterns due to the new access point to the interstate. To determine

the location and magnitude of changes in travel patterns due to the proposed interchange, the "Build" modeling scenario was developed. This model includes the proposed new interchange of I-77 at Exit 26 and the connecting roadway (Connector Road) along with the proposed intersections of Connector Road with Community Road and Connector Road with US 21 on the west and east sides of I-77, respectively. This model run produced forecasts which indicated a reduction in AADTs on the ramps at the adjacent I-77 interchanges at US 21 and Blythewood Road due to the introduction of the new interchange. These reductions were quantified and are summarized as follows:

- 25% reduction in AADT observed in the southerly facing ramps at US 21
- 15% reduction in AADT from the northerly facing ramps at Blythewood Road

These changes in AADTs indicated that the traffic demand on I-77 that was destined for land uses between US 21 and Blythewood Road were now using the proposed new interchange to access their destination instead of the existing roadway network. To prevent additional trips on I-77, it was assumed that vehicles would not backtrack along surface streets to reach their destination, so no adjustments to the US 21 northerly facing ramps or Blythewood Road southerly facing ramps were made. That is, no southbound traffic was assumed to exit at the new Exit 26 interchange and then continue north to Blythewood Road intersections and no northbound traffic was assumed to exit at Exit 26 and then travel south to intersections on US 21.

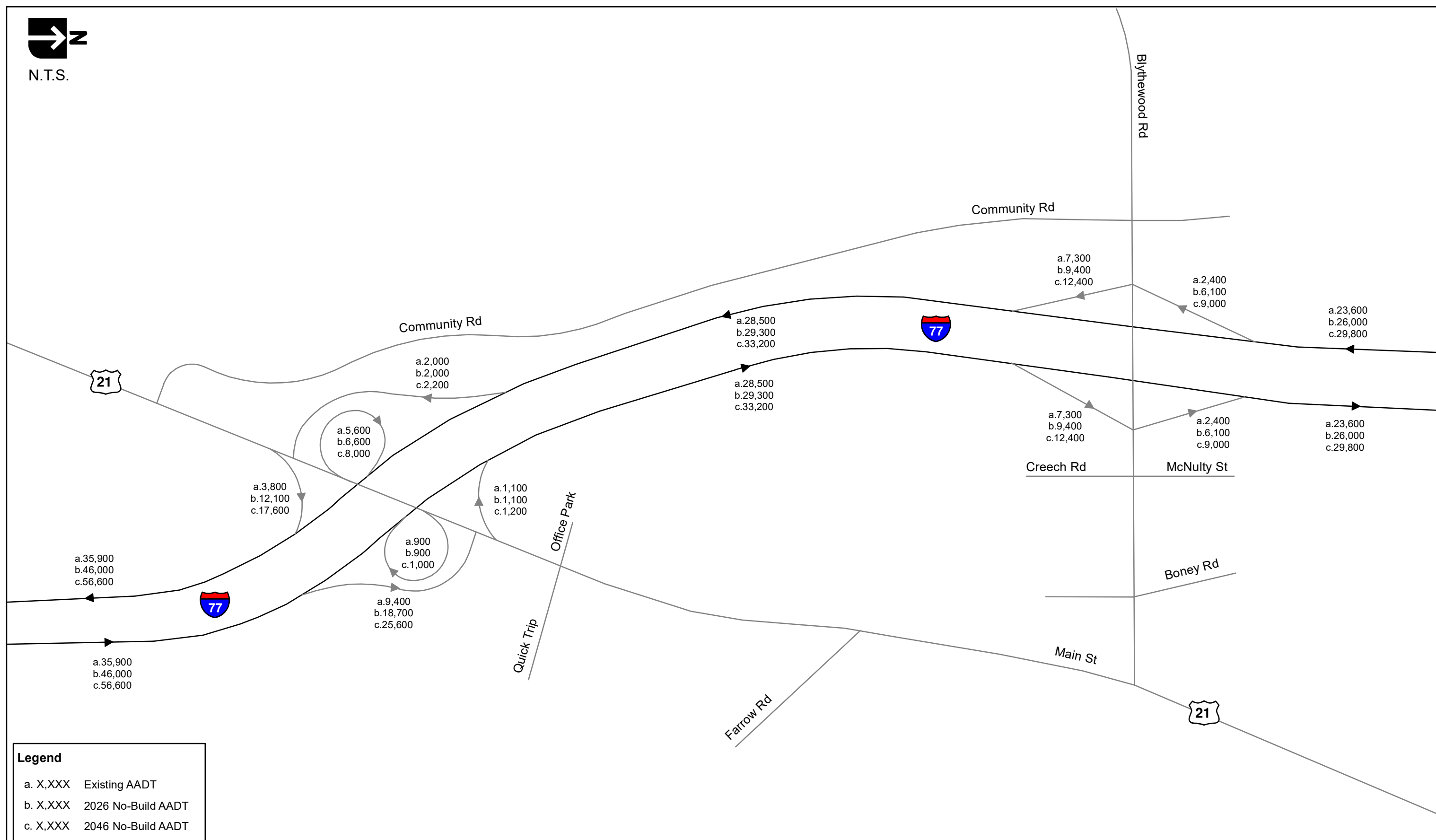
The observed reduction in forecast AADTs was applied to the daily and peak period traffic volumes to determine the adjusted background traffic volumes for the Build scenario.

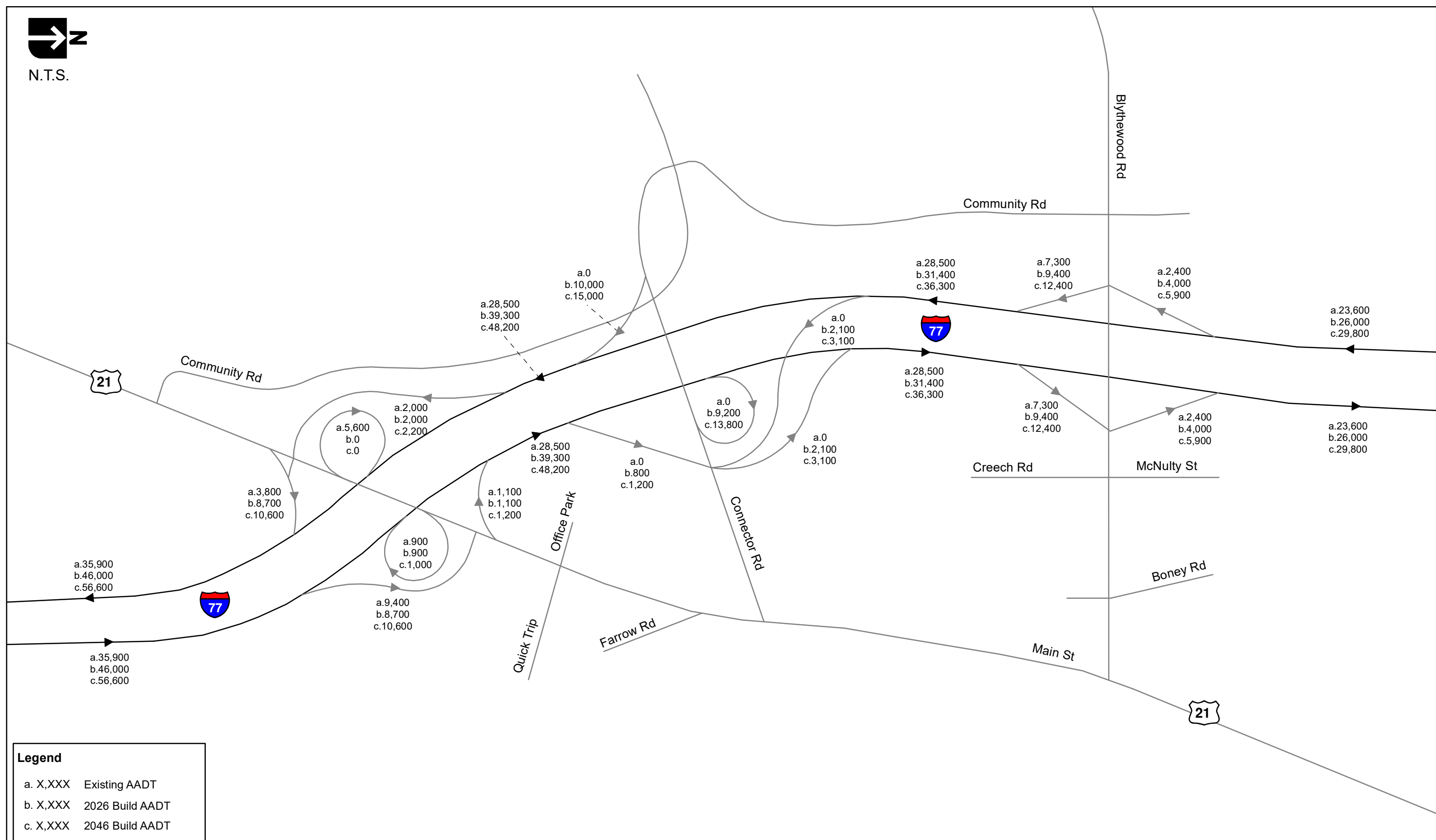
4.4 Future Traffic Development Summary

The Opening Year 2026 and Design Year 2046 No-Build daily and peak hour volumes were obtained by adding the background traffic and the adjusted No-Build project trips as described in **Section 4.2**. The No-Build AADTs are illustrated in **Figure 4-1**.

The Opening Year 2026 and Design Year 2046 Build daily and peak hour volumes were obtained by applying the new interchange diversion rates to the background traffic volumes and then adding the project trips to the adjusted background traffic demand. The Build AADTs are illustrated in **Figure 4-2**.

Peak hour traffic volumes for the four analysis periods are provided in **Section 6**.





5.0 ALTERNATIVES

This section offers a discussion on the alternatives considered as part of this IJR, which are as follows:

- No-Build
- Build

The alternatives were analyzed to assess their effectiveness in meeting the future travel demand of the area, as well as the physical impacts associated with each alternative.

5.1 No-Build

The No-Build Alternative provides a baseline for comparison to all study alternatives. This alternative represents the existing roadway network within the area of influence and includes the project trips from the proposed manufacturing development. There are several other planned improvements within the study area which are included in the No-Build condition and are summarized below:

- Blythewood Road from Syrup Mill Road to I-77 Southbound ramp terminal intersection – widen from two lanes to five lanes and convert Blythewood Road at Community Road/Locklier Road intersection from stop-control to a roundabout (Richland County Transportation Penny Program)
- Blythewood Road at Creech Road/McNulty Street – new northbound left turn lane and Creech Road Extension to US 21 (Richland County Transportation Penny Program)
- Community Road from US 21 to Blythewood Road – widen from two lanes to five lanes (manufacturing development)
- Blythewood Road from Muller Road to Syrup Mill Road – widen from two lanes to five lanes (Richland County manufacturing development)

The No-Build network lane configuration is shown in **Figure 5-1**.

5.2 Build

The Build Alternative for this IJR includes all of the improvements listed in the No-Build scenario as well as a new interchange on I-77 at Exit 26 between the existing interchanges at US 21 and Blythewood Road. Several interchange configurations were considered for the new interchange which were screened out prior to the IJR including a dog bone interchange, single point urban interchange (SPUI), diverging diamond interchange (DDI), partial cloverleaf interchange, and a traditional diamond interchange. These interchange forms were eliminated for further consideration due to capacity limitations as well as the compatibility of the interchange and adjacent intersection of Connector Road and Community Road to flush the significant traffic demand destined for the proposed manufacturing development away from the interchange to

prevent impacts to the I-77 mainline. This screening process is documented in a memorandum provided in **Appendix F**. As a result of the screening process, an offset interchange configuration was selected for the proposed new interchange at Exit 26.

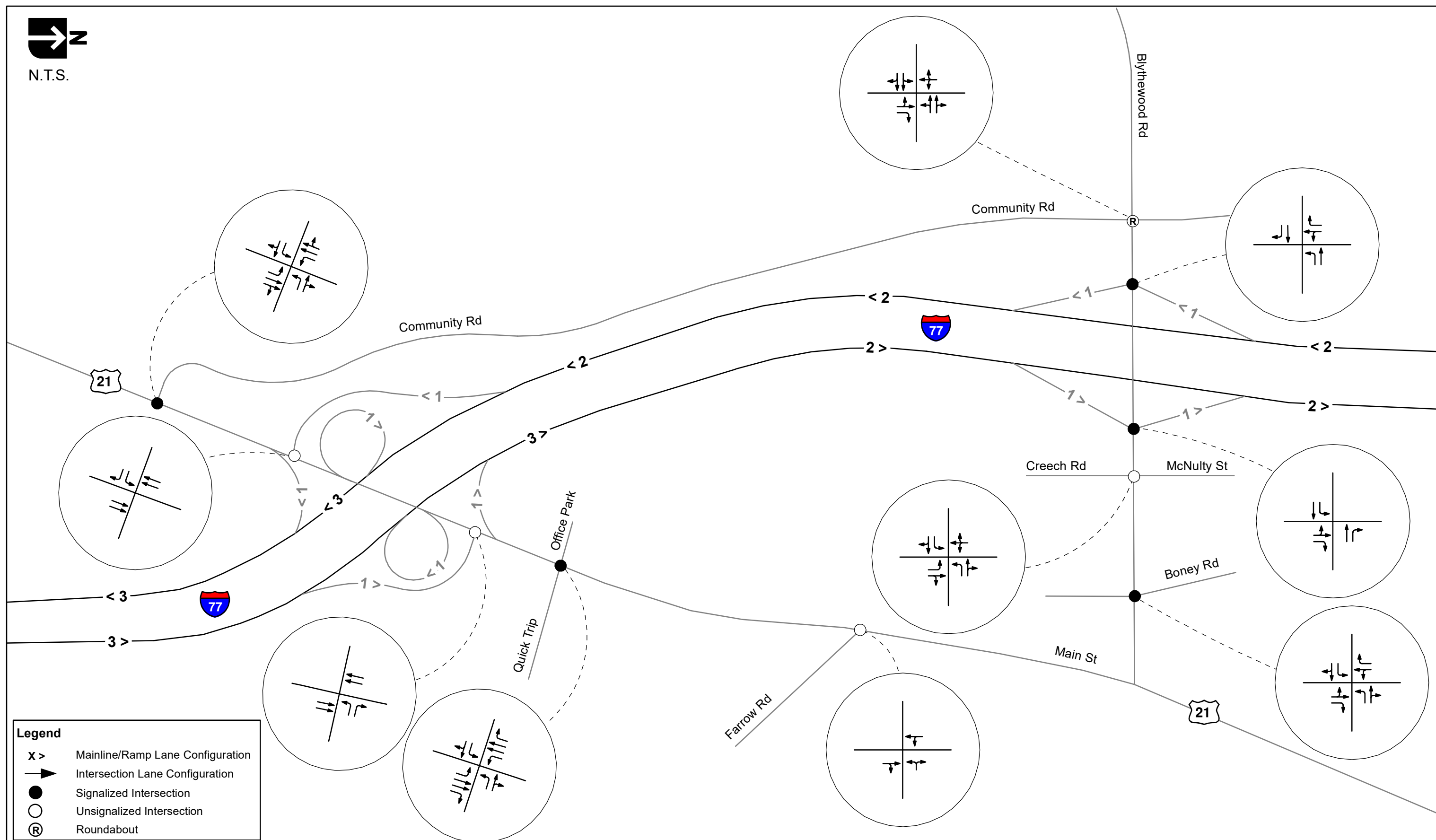
The offset interchange configuration consolidates all of the off-ramp movements on the east side of I-77 under a single signalized intersection and includes a free-flowing loop off-ramp for the I-77 northbound to Connector Road westbound movement. The southbound on-ramp remains on the west side of I-77 in this configuration.

The offset interchange configuration also includes a realignment of Community Road within the vicinity of the new interchange such that it passes under Connector Road near the proposed new interchange and then intersects with Connector Road northwest of the interchange before continuing northward along its existing alignment. Connector Road continues east from the proposed interchange to US 21 where it terminates with a signalized intersection north of Farrow Road.

Along the I-77 mainline, the proposed interchange includes single lane ramps and two northbound off-ramps; one to provide access to eastbound Connector Road and a loop off-ramp which provides access to westbound Connector Road. I-77 mainline improvements are also proposed within the vicinity of the new interchange which includes the addition of a northbound mainline lane from north of US 21 to Blythewood Road northbound off-ramp.

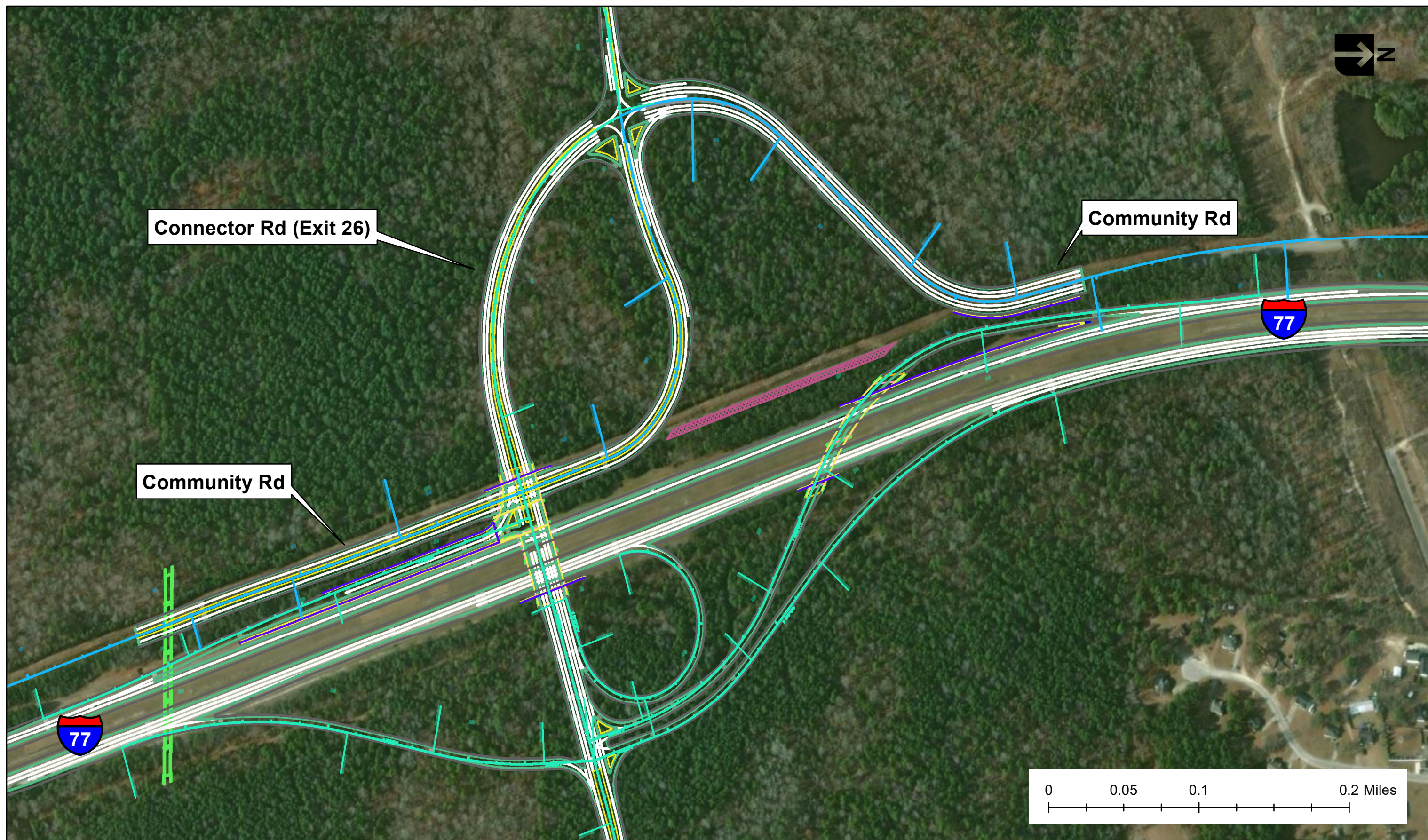
Along I-77 southbound, a third mainline lane is required from the Connector Road on-ramp through the US 21 interchange. To provide lane continuity without widening the I-77 bridge over US 21, the loop on-ramp from southbound US 21 is eliminated and this movement is converted to a signalized left turn movement which will utilize the existing US 21 on-ramp which currently only serves northbound US 21 traffic. This allows the third southbound lane introduced at the Connector Road on-ramp to continue beyond the US 21 off-ramp gore and align with the existing lane add provided by the loop on-ramp. To accommodate the new left turn movement at the I-77 at US 21 southbound ramp terminal intersection, the intersection is signalized and a left turn lane is provided.

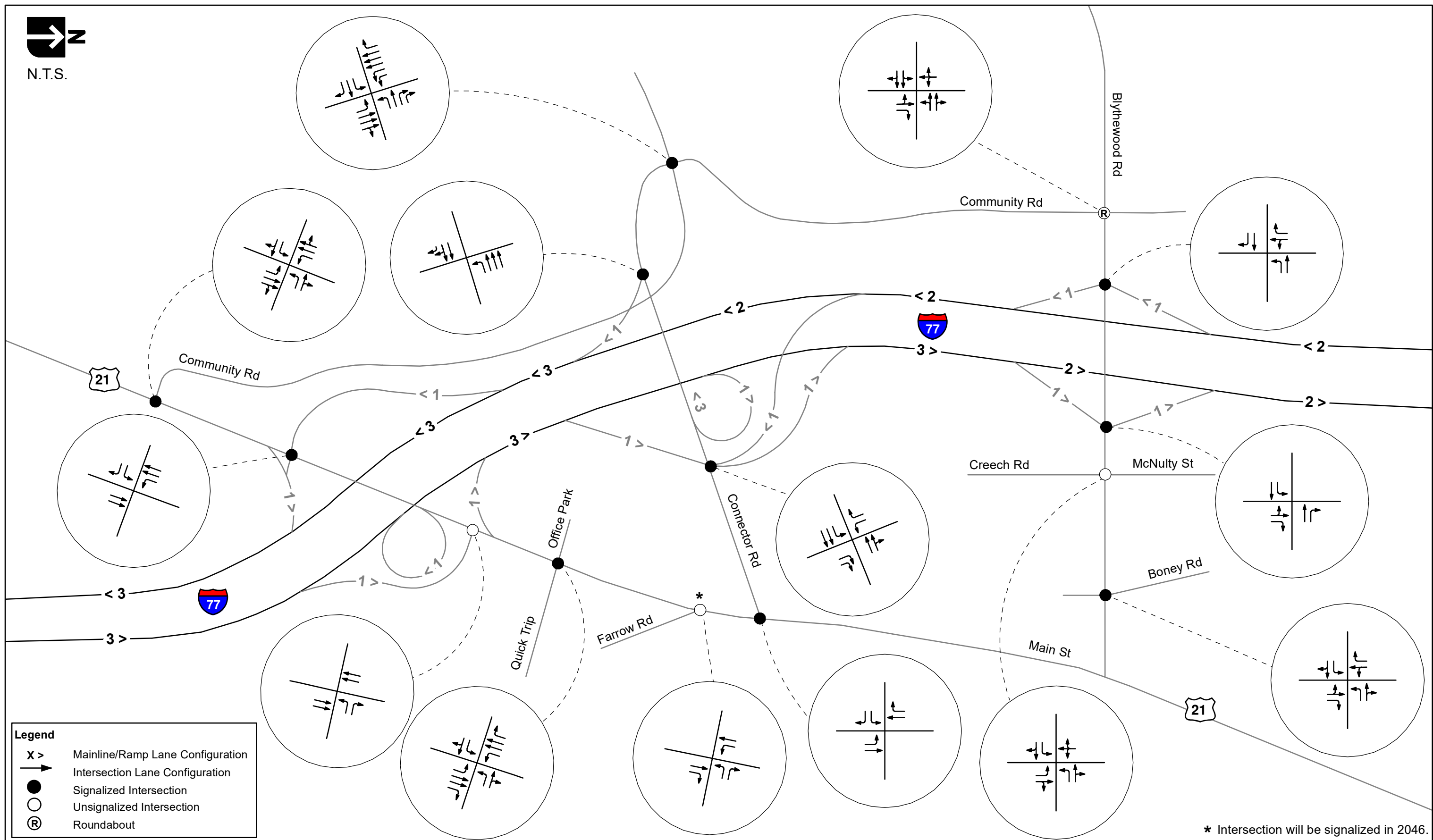
Turn lane improvements at US 21 and Farrow Road are also included as part of the Build scenario. An overview of the Build alternative concept is provided in **Figure 5-2**. The Build alternative lane configuration is shown in **Figure 5-3**.



Legend

- X > Mainline/Ramp Lane Configuration
- ➔ Intersection Lane Configuration
- Signalized Intersection
- Unsignalized Intersection
- Ⓡ Roundabout





6.0 EVALUATION OF ALTERNATIVES

This section discusses the analysis of alternatives based on safety and engineering factors. The No-Build and Build alternatives are discussed in this section. The evaluation criteria include:

- Conformance with Regional and State Transportation Plans
- Compliance with Federal Highway Administration (FHWA) Requirements
- Traffic Operational Performance

The No-Build and Build alternatives were evaluated under Opening Year 2026 and Design Year 2046 conditions to determine their ability to accommodate future year traffic demand. The future year analysis included AM and PM peak hour as well as Shift 1 and Shift 2 peak hour HCS analysis of the I-77 mainline and ramps, and intersection capacity analysis using Synchro 11 and SIDRA 9. The preferred alternative was selected based on the comparison of analysis results between the No-Build and Build alternative as well as considerations given to each alternative's conformance to local plans and compliance with FHWA criteria.

6.1 2026 Opening Year No-Build Analysis

6.1.1 2026 No-Build Mainline and Ramp Analysis

Under Opening Year 2026 No-Build conditions, the I-77 mainline and ramps maintain the same geometric configuration as the Existing Conditions. The results of the Opening Year 2026 HCS analysis are summarized in **Table 6-1**. As shown in the table, the I-77 mainline and ramps are expected to operate at LOS D or better during all analysis peaks. Backup documentation for the Opening Year HCS analysis is provided in **Appendix G**.

Table 6-1 Opening Year 2026 No-Build Mainline and Ramp Operations

I-77 Segment	Type		AM Peak				PM Peak				Shift 1 Peak				Shift 2 Peak			
	Coded	Analyzed	Mainline/ Ramp Volume	Average Speed (mph) ¹	Density ² (pc/mi/ln)	LOS	Mainline/ Ramp Volume	Average Speed (mph) ¹	Density ² (pc/mi/ln)	LOS	Mainline/ Ramp Volume	Average Speed (mph) ¹	Density ² (pc/mi/ln)	LOS	Mainline/ Ramp Volume	Average Speed (mph) ¹	Density ² (pc/mi/ln)	LOS
I-77 Northbound																		
South of US 21	Basic	Basic	1922	75.0	11.9	B	3372	72.7	20.1	C	1810	75.0	12.4	B	2932	73.8	18.1	C
US 21 Off-Ramp	Diverge	Diverge	712	66.4/ 62.7	13.4/ 19.8	B	1048	66.0/ 61.4	22.1/ 29.1	D	1381	63.0/ 60.3	14.8/22.5	C	1372	64.0/ 59.9	20.9/ 28.6	D
From US 21 Off-Ramp to NB US 21 On-Ramp	Basic	Basic	1210	74.3	7.5	A	2324	74.3	13.4	B	429	74.0	2.9	A	1560	74.1	9.5	A
NB US 21 On-Ramp	Merge	Merge	140	68.4/ 65.3	9.0/ 9.7	A	90	67.5/ 64.8	15.5/ 15.6	B	30	68.8/ 65.5	3.4/ 4.0	A	50	68.3/ 65.2	10.7/ 11.0	B
From NB US 21 On-Ramp to SB US 21 On-Ramp	Basic	Basic	1350	73.9	8.3	A	2414	73.8	13.9	B	459	74.0	3.1	A	1610	73.9	9.8	A
SB US 21 On-Ramp	Merge	Merge	80	69.0/ 66.2	9.6/ 10.4	B	160	68.0/ 65.6	16.3/ 17.0	B	50	69.3/ 66.4	3.8/ 4.7	A	70	68.8/ 66.1	11.2/ 11.9	B
From US 21 to Blythewood Rd (3 lanes)	Basic	Basic	1430	74.9	8.8	A	2574	74.9	14.9	B	509	74.9	3.5	A	1680	74.9	10.2	A
From US 21 to Blythewood Rd (2 lanes)	Basic	Basic	1430	75.0	13.2	B	2574	70.0	23.9	C	509	75.0	5.3	A	1680	74.8	15.3	B
Blythewood Rd Off-Ramp	Diverge	Diverge	532	63.2/ 63.2	15.7/ 19.6	B	916	61.9/ 61.9	27.0/ 31.3	D	310	63.9/ 63.9	6.2/ 9.3	A	656	62.7/ 62.7	18.3/ 22.3	C
From Blythewood Rd Off-Ramp to Blythewood Rd On-Ramp	Basic	Basic	898	74.8	8.3	A	1658	74.7	14.4	B	199	74.8	2.1	A	1024	74.8	9.3	A
Blythewood Rd On-Ramp	Merge	Merge	206	66.0/ 66.0	11.3/ 12.4	B	239	65.1/ 65.1	18.7/ 19.8	B	447	66.3/ 66.3	6.8/ 7.6	A	623	65.5/ 65.5	16.6/ 17.5	B
North of Blythewood Rd	Basic	Basic	1104	75.0	10.2	A	1897	74.4	16.6	B	646	75.0	6.7	A	1647	74.8	15.1	B
I-77 Southbound																		
North of Blythewood Rd	Basic	Basic	1570	75.0	13.8	B	1710	74.8	15.4	B	840	75.0	8.2	A	1560	74.9	14.7	B
Blythewood Rd Off-Ramp	Diverge	Diverge	187	64.4/ 64.4	16.1/ 20.6	C	247	64.2/ 64.2	17.9/ 22.5	C	509	63.3/ 63.3	9.7/ 13.2	B	488	63.3/ 63.3	17.4/ 21.7	C
From Blythewood Rd Off-Ramp to Blythewood Rd On-Ramp	Basic	Basic	1383	74.8	12.2	B	1463	74.8	13.1	B	331	74.8	3.2	A	1072	74.8	10.1	A
Blythewood Rd On-Ramp	Merge	Merge	1006	63.8/ 63.8	23.5/ 24.3	C	523	64.7/ 64.7	20.0/ 21.3	C	446	66.0/ 66.0	7.8/ 9.2	A	603	65.2/ 65.2	17.1/ 18.5	B
From Blythewood Rd to US 21	Basic	Basic	2389	71.3	22.2	C	1986	73.8	18.1	C	777	75.0	7.5	A	1675	74.6	15.8	B
US 21 Off-Ramp	Diverge	Diverge	160	64.6/ 64.6	24.5/ 29.0	D	150	64.6/ 64.6	20.7/ 24.8	C	60	64.9/ 64.9	8.7/ 11.5	B	80	64.8/ 64.8	18.2/ 22.2	C
From US 21 Off-Ramp to SB US 21 On-Ramp	Basic	Basic	2229	72.5	20.3	C	1836	74.1	16.6	B	717	74.2	7.0	A	1595	74.2	15.1	B
SB US 21 On-Ramp	Merge	Basic	760	74.1/ 74.1	17.4/ 17.4	B	560	74.9/ 75.0	14.0/ 14.0	B	220	74.9/ 75.0	5.9/ 5.9	A	250	74.9/ 75.0	11.5/ 11.5	B
From SB US 21 On-Ramp to NB US 21 On-Ramp	Basic	Basic	2989	73.9	17.8	B	2396	74.9	14.3	B	937	75.0	6.1	A	1845	75.0	11.6	B
NB US 21 On-Ramp	Merge	Merge	546	66.1/ 63.7	23.1/ 24.6	C	468	67.2/ 64.8	18.7/ 20.6	C	978	67.3/ 65.4	12.4/ 16.3	B	1350	65.6/ 63.4	21.2/ 25.1	C
South of US 21	Basic	Basic	3535	67.5	27.0	D	2864	72.9	19.6	C	1915	74.9	14.5	B	3195	69.3	24.7	C

¹Ramp Junction Speed/Ramp Influence Area Speed

²Average Freeway Density/Ramp Influence Area Density

6.1.2 2026 No-Build Intersection Analysis

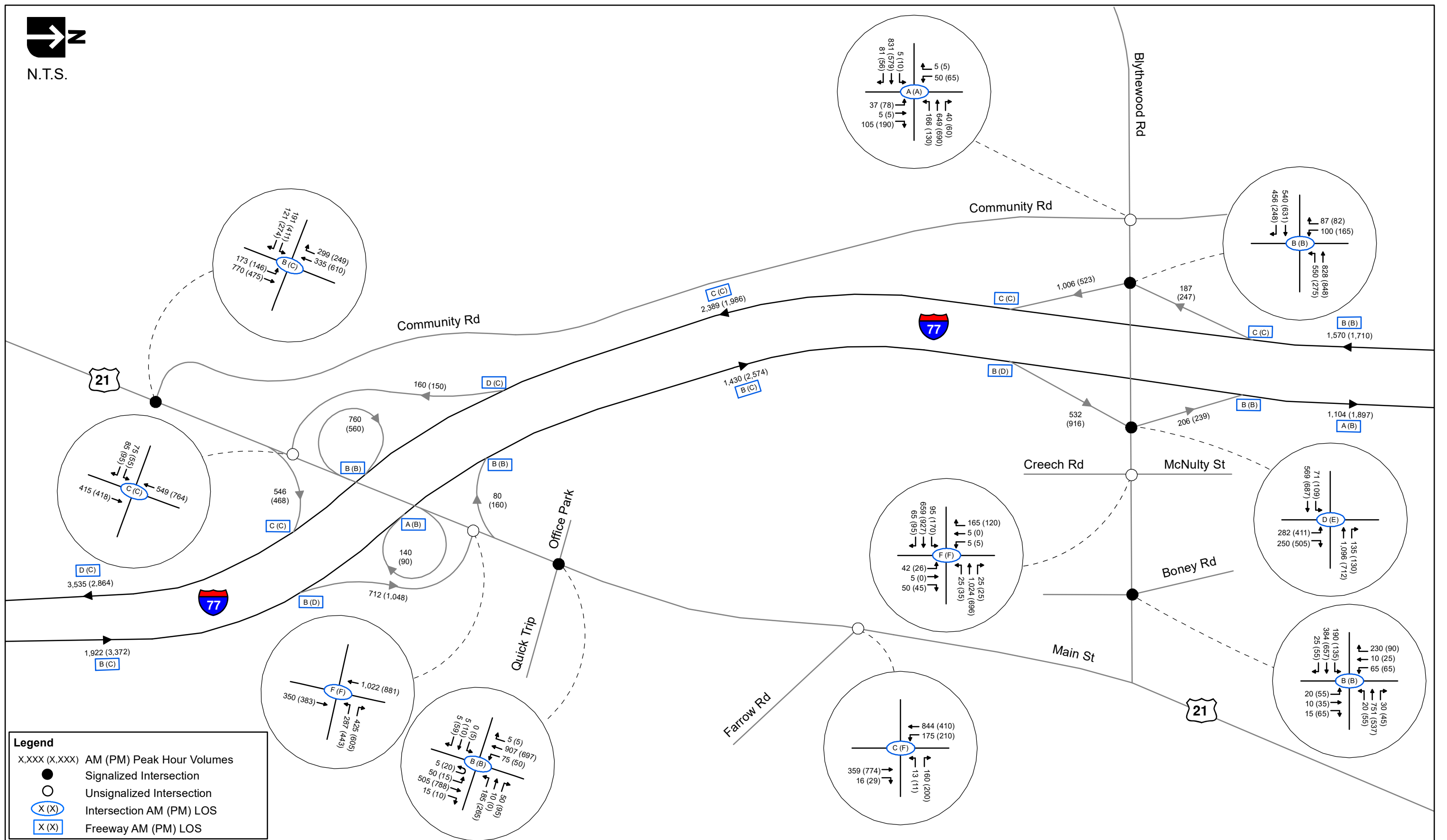
The 2026 No-Build roadway network includes capacity and intersection improvements on Blythewood Road and Community Road which include widening the existing roadways and converting the intersection of Blythewood Road and Community Road/Locklier Road from an unsignalized intersection to a two-lane roundabout. The signalized intersections in the study area were optimized under the No-Build conditions to improve overall delay and LOS. The analyses utilized HCM-based output unless otherwise noted. For unsignalized intersections, the highest stop-controlled delay and LOS are reported. **Table 6-2** summarizes the delay and LOS for the study intersections. The analysis results show that during the typical AM and PM commuter peaks, four of the study intersections are expected to operate at LOS E or F; however, during the manufacturing peaks, eight of the ten study intersections are expected to operate at LOS E or F under the No-Build conditions. **Figure 6-1** and **6-2** shows the 2026 No-Build peak hour volumes and LOS for each study intersection. **Appendix H** contains the Synchro 11 and SIDRA 9 output for the Opening Year 2026 No-Build analysis.

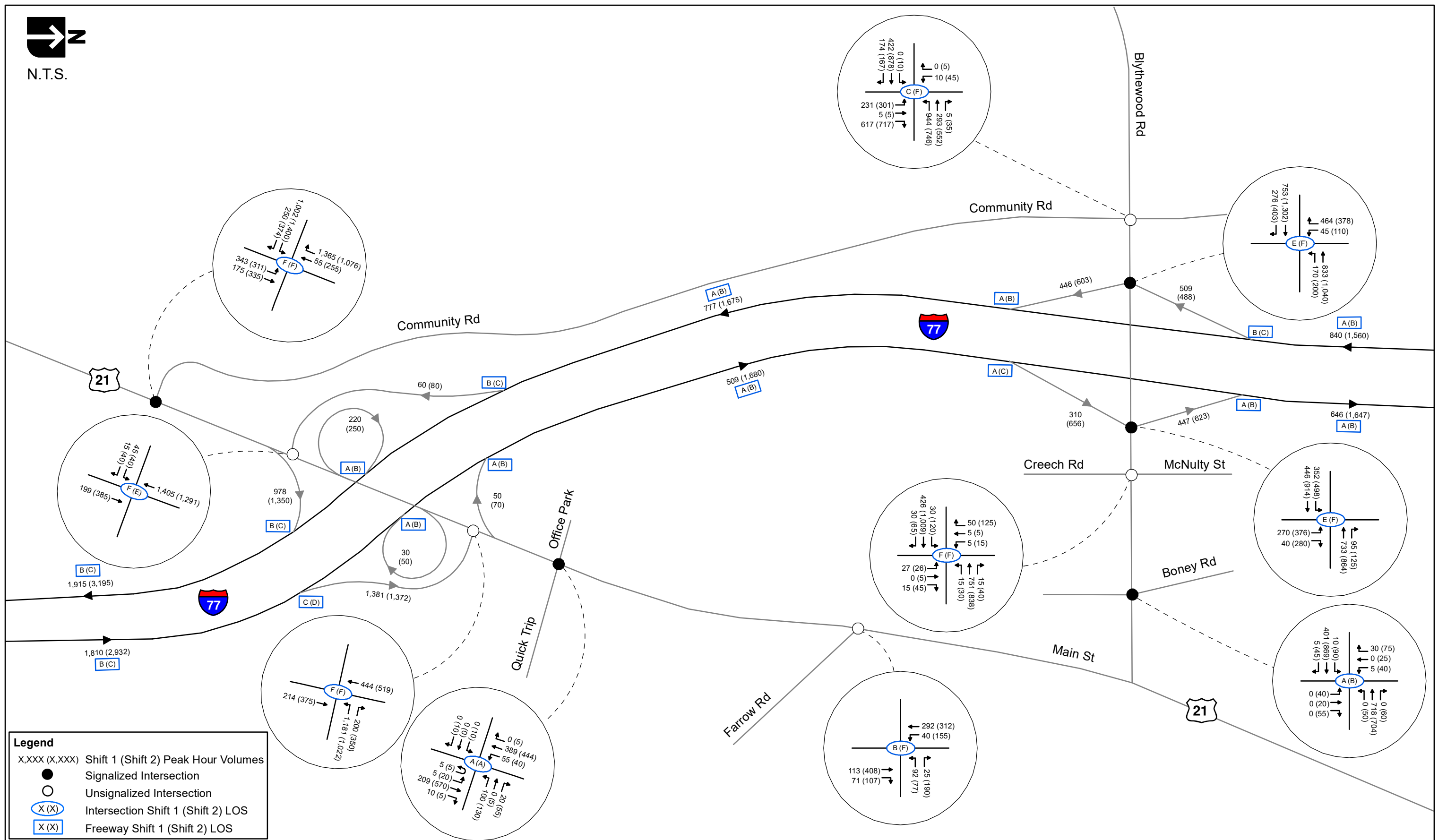
Table 6-2 Opening Year 2026 No-Build Intersection Operations

Intersection	Control Type	AM Peak		PM Peak		Shift 1 Peak		Shift 2 Peak	
		Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
US 21 at Community Rd	Signal	14.6	B	27.1	C	453.7	F	456.3	F
US 21 at I-77 SB Ramps	Stop	16.9	C	22.6	C	57	F	44.2	E
US 21 at I-77 NB Ramps	Stop	53.9	F	166.6	F	604.6	F	679.3	F
US 21 at Office Park/QuikTrip ¹	Signal	10.1	B	12.1	B	6.5	A	7.8	A
US 21 at Farrow Rd	Stop	23.9	C	66.7	F	14.4	B	66.7	F
Blythewood Rd at Community Rd ²	Roundabout	8.0	A	7.5	A	22.6	C	74.2	F
Blythewood Rd at I-77 SB Ramps	Signal	15.5	B	15.1	B	73.9	E	176.7	F
Blythewood Rd at I-77 NB Ramps	Signal	37.9	D	60.2	E	66.1	E	248.4	F
Blythewood Rd at Creech Rd	Stop	6,543.1	F	2,427.1	F	74.8	F	6,141.7	F
Blythewood Rd at Boney Rd	Signal	15.0	B	13.3	B	6.7	A	13.5	B

¹Analyzed using Synchro output. HCM 6th Edition Methodology not supported.

²Analyzed using SIDRA 9





6.2 Design Year 2046 No-Build Analysis

6.2.1 2046 No-Build Mainline and Ramp Analysis

Under Design Year 2046 No-Build conditions, the I-77 mainline and ramps maintain the same geometric configuration as the Existing Conditions. The results of the Design Year 2046 HCS analysis are summarized in **Table 6-3**. As shown in the table, several of the study segments are expected to operate at LOS E or F under 2046 No-Build condition as summarized below:

- I-77 Northbound Off-Ramp to US 21 – Shift 1 Peak and Shift 2 Peak
- I-77 Northbound Off-Ramp to Blythewood Road – PM Peak
- I-77 Southbound Mainline south of US 21 – AM Peak

Backup documentation for the Design Year No-Build analysis is provided in **Appendix G**.

Table 6-3 Design Year 2046 No-Build Mainline and Ramp Operations

I-77 Segment	Type		AM Peak				PM Peak				Shift 1 Peak				Shift 2 Peak			
	Coded	Analyzed	Mainline/ Ramp Volume	Average Speed (mph) ¹	Density ² (pc/mi/ln)	LOS	Mainline/ Ramp Volume	Average Speed (mph) ¹	Density ² (pc/mi/ln)	LOS	Mainline/ Ramp Volume	Average Speed (mph) ¹	Density ² (pc/mi/ln)	LOS	Mainline/ Ramp Volume	Average Speed (mph) ¹	Density ² (pc/mi/ln)	LOS
I-77 Northbound																		
South of US 21	Basic	Basic	2,265	75.0	14.0	B	3,935	68.4	25.9	C	2,392	74.1	17.3	B	3,724	68.4	25.9	C
US 21 Off-Ramp	Diverge	Diverge	890	66.0/ 62.0	15.9/ 22.7	C	1276	65.4/ 60.5	27.1/ 33.6	D	1,979	61.3/ 58.2	20.9/ 29.6	F	2,010	62.0/ 57.5	28.6/ 36.5	F
From US 21 Off-Ramp to NB US 21 On-Ramp	Basic	Basic	1,375	74.3	8.5	A	2,659	74.2	16.9	B	413	73.9	6.6	A	1,714	73.9	12.1	B
NB US 21 On-Ramp	Merge	Merge	170	68.1/ 65.2	10.3/ 11.0	B	110	66.9/ 64.3	19.4/ 19.2	B	30	68.8/ 65.4	7.4/ 7.8	A	60	67.9/ 65.0	13.8/ 13.9	B
From NB US 21 On-Ramp to SB US 21 On-Ramp	Basic	Basic	1,545	73.9	9.5	A	2,769	73.7	17.6	B	443	74.0	6.7	A	1,774	73.9	12.5	B
SB US 21 On-Ramp	Merge	Merge	90	68.8/ 66.1	11.0/ 11.8	B	190	67.2/ 64.9	20.5/ 20.8	C	60	69.2/ 66.3	7.7/ 8.6	A	90	68.3/ 65.8	14.3/ 14.9	B
From US 21 to Blythewood Rd (3 lanes)	Basic	Basic	1,635	74.9	10.1	A	2,959	73.4	18.8	C	503	74.9	7.1	A	1,864	74.9	13.1	B
From US 21 to Blythewood Rd (2 lanes)	Basic	Basic	1,635	74.8	15.2	B	2,959	62.4	33.1	D	503	75.0	10.7	A	1,864	72.6	20.2	C
Blythewood Rd Off-Ramp	Diverge	Diverge	710	62.6/ 62.6	18.1/ 22.1	C	1,234	60.8/ 60.8	34.0/ 38.1	E	452	63.4/ 63.4	12.7/ 16.4	B	928	61.6/ 61.6	23.8/ 27.8	C
From Blythewood Rd Off-Ramp to Blythewood Rd On-Ramp	Basic	Basic	925	74.8	8.6	A	1,725	73.8	18.0	B	51	74.8	6.6	A	936	74.7	11.7	B
Blythewood Rd On-Ramp	Merge	Merge	289	66.0/ 66.0	12.3/ 13.4	B	332	63.9/ 63.9	23.8/ 24.5	C	715	65.7/ 65.7	14.8/ 15.6	B	901	64.3/ 64.3	22.3/ 22.8	C
North of Blythewood Rd	Basic	Basic	1,214	75.0	11.2	B	2,057	72.0	21.1	C	766	75.0	12.9	B	1,837	72.9	19.7	C
I-77 Southbound																		
North of Blythewood Rd	Basic	Basic	1,810	74.6	16.0	B	1,980	73.8	18.0	B	970	75.0	9.4	A	1,810	74.1	17.2	B
Blythewood Rd Off-Ramp	Diverge	Diverge	260	64.1/ 64.1	18.7/ 23.3	C	340	63.9/ 63.9	20.8/ 25.6	C	757	62.4/ 62.4	11.3/ 14.9	B	756	62.3/ 62.3	20.5/ 24.7	C
From Blythewood Rd Off-Ramp to Blythewood Rd On-Ramp	Basic	Basic	1,550	74.8	13.7	B	1,640	74.8	14.7	B	213	74.8	2.1	A	1,054	74.8	9.9	A
Blythewood Rd On-Ramp	Merge	Merge	1,354	61.5/ 61.5	29.5/ 29.0	D	701	63.7/ 63.7	23.8/ 24.7	C	658	66.0/ 66.0	8.4/ 9.7	A	835	64.8/ 64.8	19.1/ 20.3	C
From Blythewood Rd to US 21	Basic	Basic	2,904	65.6	29.3	D	2,341	71.4	22.0	C	871	75.0	8.5	A	1,889	73.8	18.1	C
US 21 Off-Ramp	Diverge	Diverge	190	64.4/ 64.4	29.8/ 34.9	D	170	64.5/ 64.5	24.4/ 28.9	D	60	64.9/ 64.9	9.8/ 12.7	B	100	64.8/ 64.8	20.6/ 24.8	C
From US 21 Off-Ramp to SB US 21 On-Ramp	Basic	Basic	2,714	68.0	26.4	D	2,171	72.7	20.1	C	811	74.2	7.9	A	1,789	74.2	17.0	B
SB US 21 On-Ramp	Merge	Basic	870	71.7/ 71.7	21.6/ 21.6	C	650	74.4/ 74.4	16.6/ 16.6	B	260	74.9/ 75.0	6.8/ 6.8	A	290	74.9/ 75.0	13.0/ 13.0	B
From SB US 21 On-Ramp to NB US 21 On-Ramp	Basic	Basic	3,584	71.3	22.2	C	2,821	74.2	17.0	B	1,071	75.0	6.9	A	2,079	75.0	13.0	B
NB US 21 On-Ramp	Merge	Merge	684	64.2/ 61.5	28.7/ 29.4	D	606	66.2/ 63.8	22.7/ 24.4	C	1,556	66.0/ 64.3	17.1/ 22.2	C	1,938	62.0/ 59.4	27.8/ 31.6	D
South of US 21	Basic	Basic	4,268	59.1	37.2	E	3,427	69.4	24.7	C	2,627	72.4	20.6	C	4,017	61.8	33.9	D

¹Ramp Junction Speed/Ramp Influence Area Speed

²Average Freeway Density/Ramp Influence Area Density

6.2.2 2046 No-Build Intersection Analysis

The 2046 No-Build roadway network is the same as the 2026 No-Build roadway network. The signalized intersections were optimized to improve overall delay and LOS. The analyses utilized HCM-based output unless otherwise noted. For unsignalized intersections, the highest stop-controlled delay and LOS are reported. **Table 6-4** summarizes the delay and LOS for the study intersections. The analysis results show that during the typical AM and PM commuter peaks, the majority of the study area intersections are expected to operate at LOS E or F including the I-77 northbound ramp terminal at US 21 and both the I-77 ramp terminal intersections at Blythewood Road. During the manufacturing shift peaks, all four existing ramp terminal intersections are expected to operate at LOS F under the No-Build conditions. **Figure 6-3** and **6-4** shows the 2046 No-Build peak hour volumes and LOS for each study intersection. **Appendix H** contains the Synchro 11 and SIDRA 9 output for the Design Year 2046 No-Build analysis.

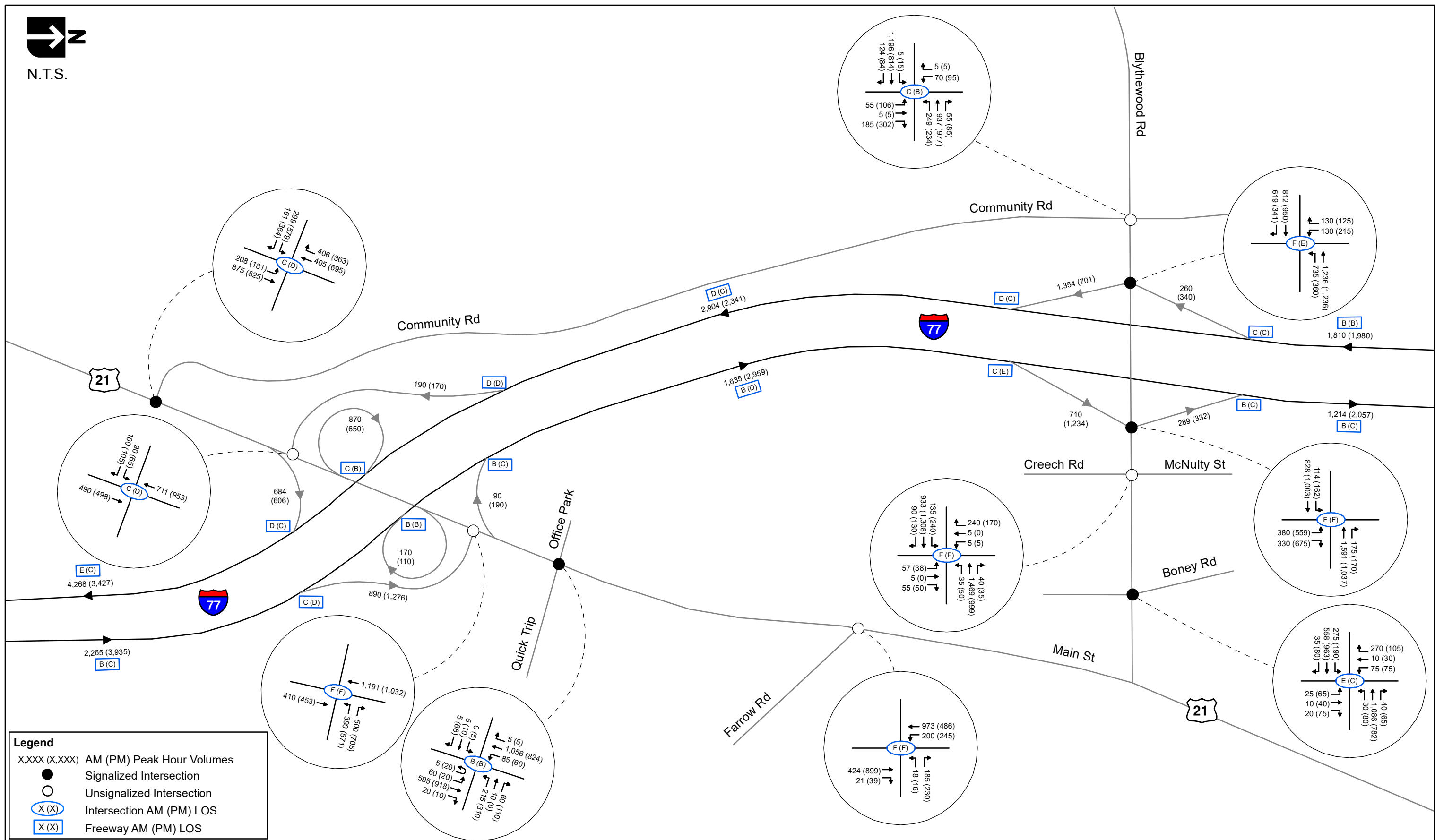
Table 6-4 Design Year 2046 No-Build Intersection Operations

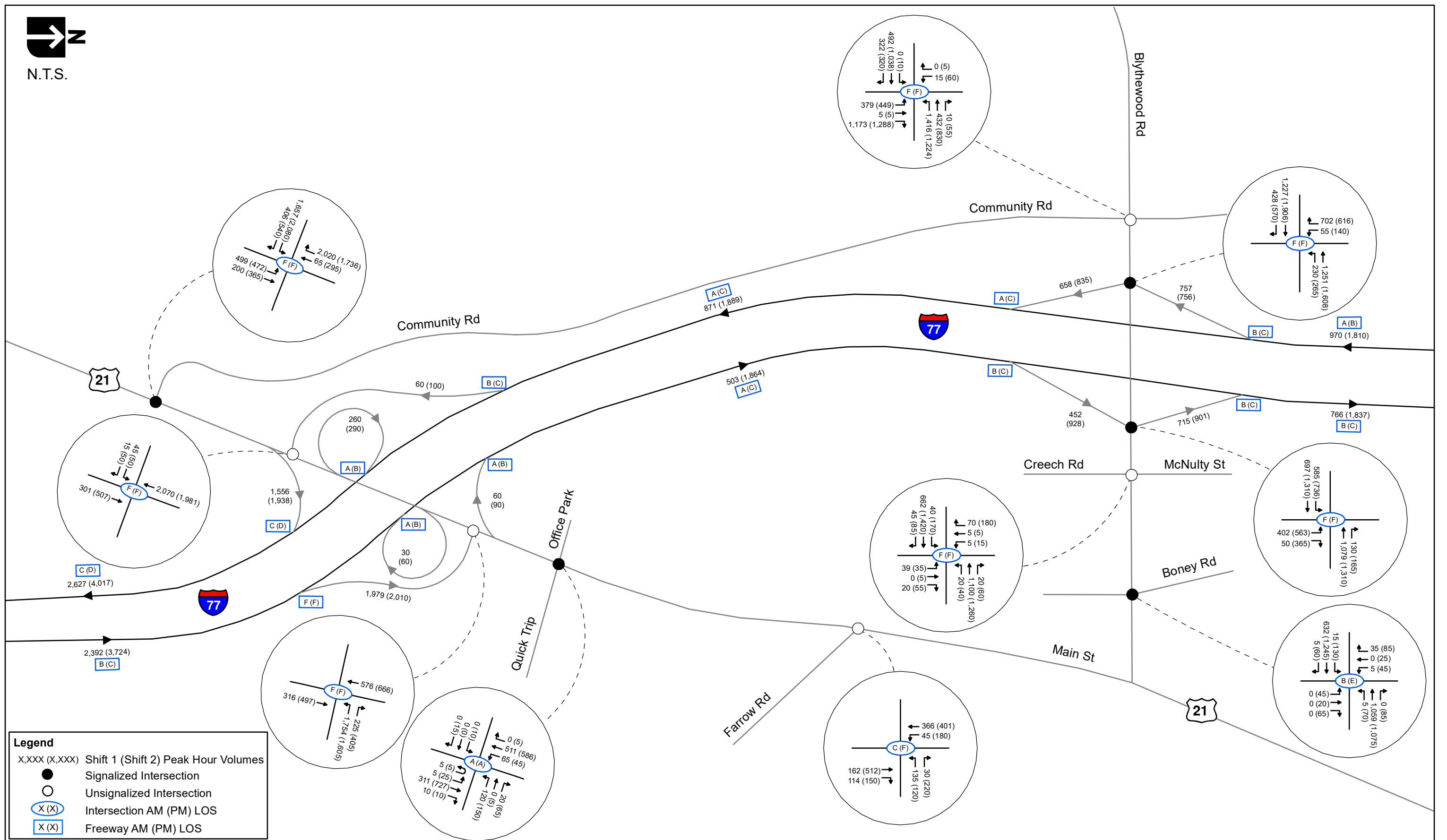
Intersection	Control Type	AM Peak		PM Peak		Shift 1 Peak		Shift 2 Peak	
		Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
US 21 at Community Rd	Signal	21.5	C	50.4	D	889.6	F	888.6	F
US 21 at I-77 SB Ramps	Stop	22.3	C	32.8	D	337.8	F	304.5	F
US 21 at I-77 NB Ramps	Stop	227.9	F	442.2	F	1395.6	F	1,688.3	F
US 21 at Office Park/QuikTrip ¹	Signal	12.0	B	15.2	B	6.7	A	8.7	A
US 21 at Farrow Rd	Stop	105.1	F	356.2	F	21.4	C	485.1	F
Blythewood Rd at Community Rd ²	Roundabout	15.8	C	12.9	B	182.3	F	285.4	F
Blythewood Rd at I-77 SB Ramps	Signal	89.6	F	64.2	E	279.4	F	462.9	F
Blythewood Rd at I-77 NB Ramps	Signal	152.8	F	144.6	F	486.8	F	624.1	F
Blythewood Rd at Creech Rd	Stop	UD ³	F	UD ³	F	1,264.0	F	UD ³	F
Blythewood Rd at Boney Rd	Signal	63	E	25.6	C	10.4	B	63.7	E

¹Analyzed using Synchro output. HCM 6th Edition Methodology not supported.

²Analyzed using SIDRA 9

³Delay exceeds computation in Synchro and is "Undefined"





6.3 Opening Year 2026 Build Analysis

6.3.1 2026 Build Mainline and Ramp Analysis

Under Opening Year 2026 Build conditions, the I-77 mainline includes all improvements described in Section 5.2. The results of the Opening Year HCS analysis are summarized in **Table 6-5**. As shown in the table, the I-77 mainline and ramps are expected to operate at LOS D or better during all analysis peaks in the Opening Year 2026. The ramp junctions associated with the new interchange at Exit 26 (Connector Road) are expected to operate at LOS C or better in the Opening Year. Backup documentation of the Opening Year Build HCS analysis is provided in **Appendix I**.

Table 6-5 Opening Year 2026 Build Mainline and Ramp Operations

I-77 Segment	Type		AM Peak				PM Peak				Shift 1 Peak				Shift 2 Peak			
	Coded	Analyzed	Mainline/ Ramp Volume	Average Speed (mph) ¹	Density ² (pc/mi/ln)	LOS	Mainline/ Ramp Volume	Average Speed (mph) ¹	Density ² (pc/mi/ln)	LOS	Mainline/ Ramp Volume	Average Speed (mph) ¹	Density ² (pc/mi/ln)	LOS	Mainline/ Ramp Volume	Average Speed (mph) ¹	Density ² (pc/mi/ln)	LOS
I-77 Northbound																		
South of US 21	Basic	Basic	1922	75.0	11.9	B	3372	72.7	20.1	C	1810	75.0	12.4	B	2932	73.8	18.1	C
US 21 Off-Ramp	Diverge	Diverge	460	67.6/ 63.5	13.2/ 19.2	B	726	67.3/ 62.5	21.7/ 28.2	D	414	67.9/ 63.7	13.7/ 19.7	B	547	67.8/ 63.1	19.7/ 26.1	C
From US 21 Off-Ramp to NB US 21 On-Ramp	Basic	Basic	1462	74.4	9.0	A	2646	74.4	15.3	B	1396	74.4	9.6	A	2385	74.4	14.5	B
NB US 21 On-Ramp	Merge	Merge	140	68.2/ 65.2	10.7/ 11.3	B	90	67.2/ 64.6	17.6/ 17.5	B	30	68.3/ 65.2	10.7/ 10.9	B	50	67.4/ 64.7	16.4/ 16.3	B
From NB US 21 On-Ramp to SB US 21 On-Ramp	Basic	Basic	1602	73.9	9.9	A	2736	73.7	15.9	B	1426	73.9	9.8	A	2435	73.8	14.8	B
SB US 21 On-Ramp	Merge	Merge	80	68.8/ 66.1	11.3/ 12.1	B	160	67.6/ 65.3	18.5/ 18.9	B	50	68.8/ 66.1	11.0/ 11.7	B	70	68.0/ 65.6	16.8/ 17.2	B
From US 21 to Connector Rd	Basic	Basic	1682	74.5	10.4	A	2896	74.3	16.9	B	1476	74.5	10.1	A	2505	74.4	15.3	B
Off-ramp to Connector Rd EB	Diverge	Diverge	60	69.3/ 65.0	11.2/ 12.2	B	99	69.4/ 64.8	18.1/ 19.8	B	30	69.4/ 65.1	11.0/ 11.9	B	56	69.6/ 65.0	16.4/ 18.0	B
From Connector Rd EB Off to WB Off	Basic	Basic	1622	73.6	10.0	A	2797	73.7	16.3	B	1446	73.7	9.9	A	2449	73.7	14.9	B
Off-ramp to Connector Rd WB	Diverge	Diverge	192	65.2/ 60.4	11.5/ 10.9	B	223	65.9/ 60.3	18.4/ 18.2	B	937	61.2/ 57.9	12.2/ 12.6	B	769	63.4/ 58.4	17.6/ 17.9	B
From WB Connector Rd Off-Ramp to Connector Rd On-ramp	Basic	Basic	1430	74.1	8.8	A	2574	74.2	14.9	B	509	73.8	3.5	A	1680	74.0	10.2	A
Connector Rd On-Ramp	Merge	Merge	40	74.9/ 75.0	6.8/ 6.8	A	56	74.9/ 75.0	11.4/ 11.4	B	171	74.9/ 75.0	3.3/ 3.3	A	240	74.9/ 75.0	8.6/ 8.6	A
From Connector Rd to Blythewood Rd (4 lanes)	Basic	Basic	1470	75.0	6.8	A	2630	75.0	11.4	B	680	75.0	3.5	A	1920	75.0	8.7	A
From Connector Rd to Blythewood Rd (3 lanes)	Basic	Basic	1470	75.0	9.1	A	2630	74.8	15.2	B	680	75.0	4.7	A	1920	75.0	11.7	B
Blythewood Rd Off-Ramp	Diverge	Basic	532	75.0/ 75.0	9.1/ 9.1	A	916	74.8/ 74.8	15.2/ 15.2	B	310	75.0/ 75.0	4.7/ 4.7	A	656	75.0/ 75.0	11.7/ 11.7	B
From Blythewood Rd Off-Ramp to Blythewood Rd On-Ramp	Basic	Basic	938	75.0	8.7	A	1714	74.9	14.9	B	370	75.0	3.8	A	1264	75.0	11.5	B
Blythewood Rd On-Ramp	Merge	Merge	166	66.0/ 66.0	11.3/ 12.5	B	183	65.1/ 65.1	18.8/ 19.9	B	276	66.3/ 66.3	7.1/ 8.0	A	383	65.4/ 65.4	16.9/ 17.9	B
North of Blythewood Rd	Basic	Basic	1104	75.0	10.2	A	1897	74.4	16.6	B	646	75.0	6.7	A	1647	74.8	15.1	B
I-77 Southbound																		
North of Blythewood Rd	Basic	Basic	1570	75.0	13.8	B	1710	74.8	15.4	B	840	75.0	8.2	A	1560	74.9	14.7	B
Blythewood Rd Off-Ramp	Diverge	Diverge	142	64.6/ 64.6	16.1/ 20.6	C	196	64.4/ 64.4	17.9/ 22.5	C	290	64.1/ 64.1	9.5/ 13.2	B	306	64.0/ 64.0	17.2/ 21.7	C
From Blythewood Rd Off-Ramp to Blythewood Rd On-Ramp	Basic	Basic	1428	74.8	12.6	B	1514	74.8	13.6	B	550	74.8	5.3	A	1254	74.8	11.8	B
Blythewood Rd On-Ramp	Merge	Merge	1006	63.6/ 63.6	24.1/ 24.8	C	523	64.5/ 64.5	20.6/ 21.8	C	446	65.9/ 65.9	10.2/ 11.7	B	603	64.8/ 64.8	19.2/ 20.5	C
From Blythewood Rd to New Connector Rd	Basic	Basic	2434	70.9	22.7	C	2037	73.5	18.6	C	996	73.8	9.7	A	1857	73.6	17.7	B
Connector Rd Off-Ramp	Diverge	Diverge	45	65.0/ 65.0	24.8/ 24.9	C	51	65.0/ 65.0	21.1/ 20.8	C	219	64.4/ 64.4	11.3/ 9.7	A	182	64.5/ 64.5	20.3/ 19.8	B
From Connector Rd Off-Ramp to Connector Rd On-Ramp	Basic	Basic	2389	71.3	22.2	C	1986	73.8	18.1	C	777	74.8	7.5	A	1675	74.6	15.8	B
Connector Rd On-Ramp	Merge	Basic	391	74.5/ 74.5	16.3 /16.3	B	337	75.0/ 75.0	13.7/ 13.7	B	772	75.0/ 75.0	9.0/ 9.0	A	1055	74.6/ 74.6	16.0/ 16.0	B
Connector Rd to US 21	Basic	Basic	2780	74.4	16.5	B	2323	75.0	13.9	B	1549	75.0	10.0	A	2730	74.1	17.3	B
US 21 Off-Ramp	Diverge	Diverge	160	66.1/ 60.5	18.5/ 18.5	B	150	69.2/ 64.6	15.1/ 15.7	B	60	68.6/ 64.9	11.0/ 11.5	B	80	69.4/ 64.8	18.5/ 19.2	B
From US 21 Off-Ramp to US 21 On-Ramp	Basic	Basic	2620	74.7	15.5	B	2173	74.9	13.0	B	1489	74.9	9.6	A	2650	74.3	16.8	B
US 21 On-Ramp	Merge	Merge	915	65.7/ 63.3	23.1/ 25.7	C	691	66.9/ 64.6	18.7/ 21.2	C	426	67.9/ 65.5	13.2/ 15.5	B	545	66.3/ 63.9	22.2/ 23.8	C
South of US 21	Basic	Basic	3535	67.5	27.0	D	2864	72.9	19.6	C	1915	74.9	14.5	B	3195	69.3	24.7	C

¹Ramp Junction Speed/Ramp Influence Area Speed

²Average Freeway Density/Ramp Influence Area Density

6.3.2 2026 Build Intersection Analysis

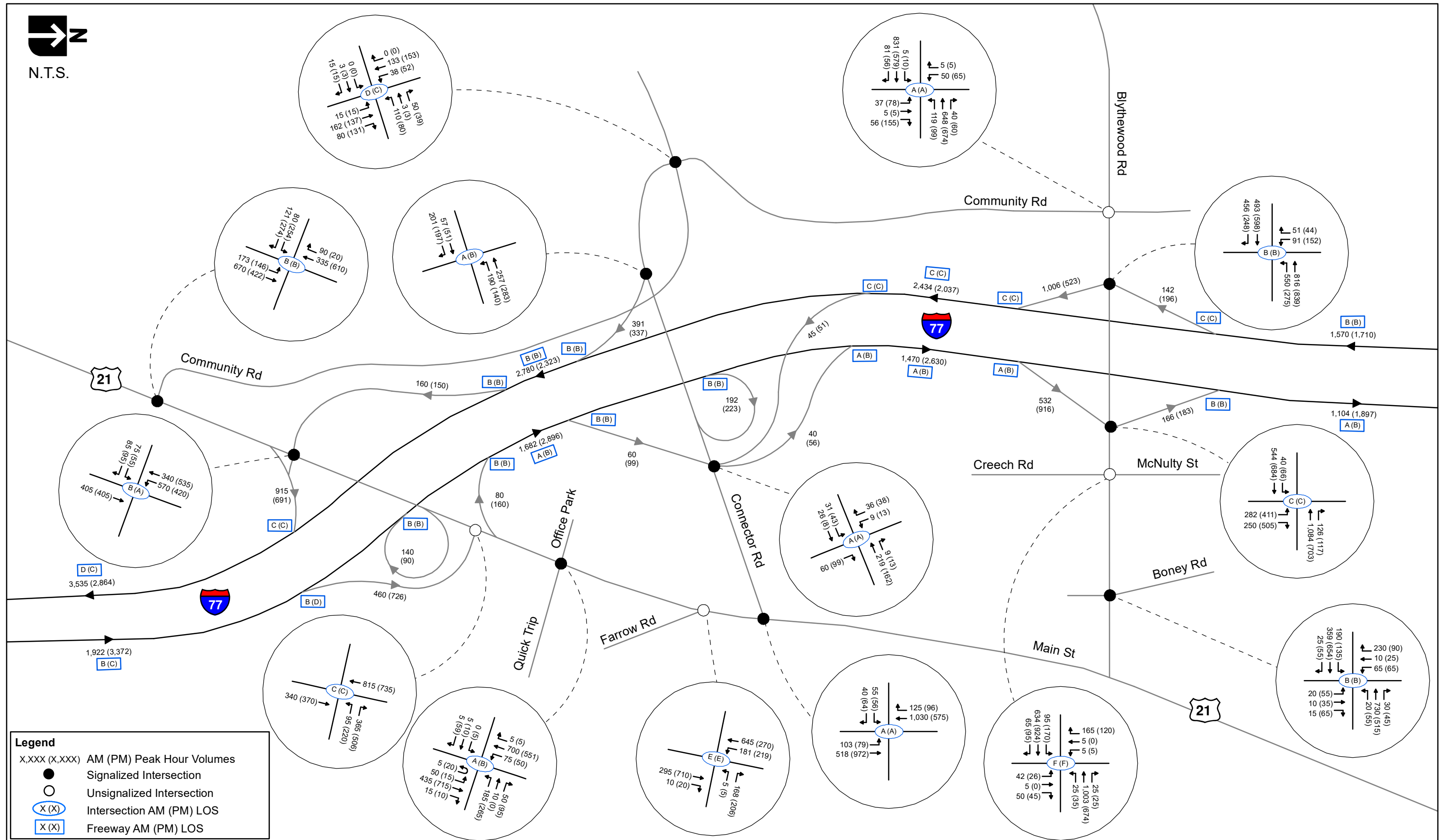
The 2026 Opening Year Build roadway network includes all of the improvements included in the No-Build along with the proposed new interchange of I-77 at Exit 26 (Connector Road) and the Connector Road intersections with Community Road and US 21. Turn lane improvements were also implemented at the I-77 Southbound at US 21 ramp terminal intersection and the intersection of Farrow Road and US 21 in the Opening Year Build scenario (see Section 5.2). The signalized intersections in the study area were optimized under the Build conditions to improve overall delay and LOS. The analyses utilize HCM-based output unless otherwise noted. For unsignalized intersections, the highest stop-controlled delay and LOS are reported. **Table 6-6** summarizes the delay and LOS for the study intersections. The analysis results indicate that the new interchange is expected to improve operations at the existing study intersections. The existing ramp terminal intersections at Blythewood Road and US 21 which are expected to operate at LOS E or F in the 2026 Opening Year No-Build improve to LOS D or better under the Build conditions. Additionally, all of the new intersections associated with the proposed new interchange are expected to operate at LOS D or better during all analysis periods. **Figures 6-5** and **6-6** show 2026 Build peak hour volumes and LOS for each study intersection. **Appendix J** contains the Synchro 11 and SIDRA 9 output for the Opening Year 2026 Build analysis.

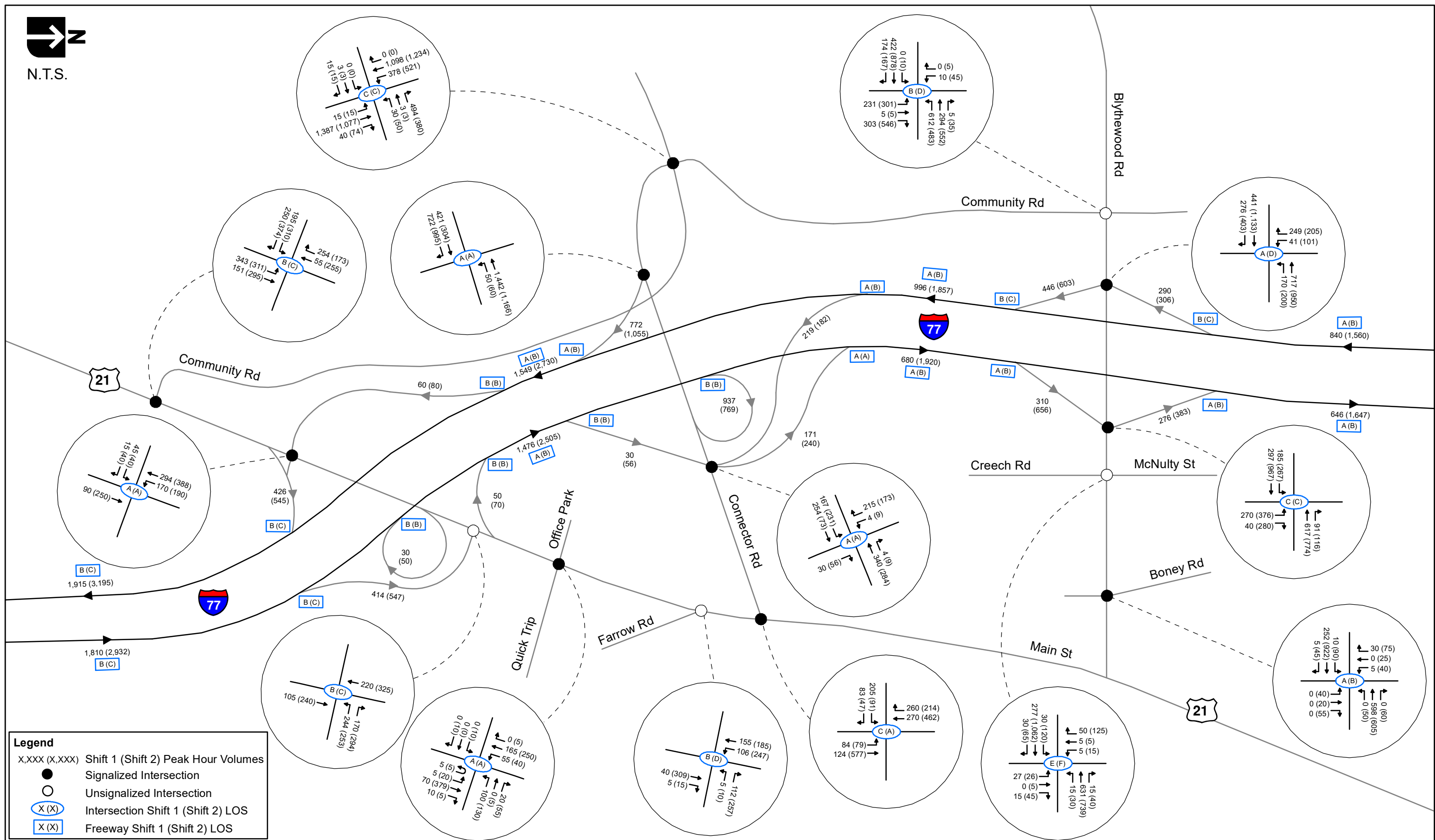
Table 6-6 Opening Year 2026 Build Intersection Operations

Intersection	Control Type	AM Peak		PM Peak		Shift 1 Peak		Shift 2 Peak	
		Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
US 21 at Community Rd	Signal	10.4	B	17.2	B	19.8	B	22.3	C
US 21 at I-77 SB Ramps	Signal	13.0	B	7.3	A	6.2	A	5.9	A
US 21 at I-77 NB Ramps	Stop	16.2	C	23.7	C	12.7	B	16.4	C
US 21 at Office Park ¹	Signal	9.4	A	11.4	B	7.1	A	7.7	A
US 21 at Farrow Rd	Stop	35.9	E	49.7	E	11.9	B	27.2	D
Blythewood Rd at Community Rd ²	Roundabout	7.3	A	6.6	A	10.0	B	32.3	D
Blythewood Rd at I-77 SB Ramps	Signal	10.8	B	13.3	B	5.7	A	37	D
Blythewood Rd at I-77 NB Ramps	Signal	30.2	C	32.6	C	20.8	C	28.5	C
Blythewood Rd at Creech Rd	Stop	4,233.7	F	1,273.8	F	37.6	E	2,427.1	F
Blythewood Rd at Boney Rd	Signal	13.3	B	13	B	3.2	A	10.7	B
Connector Rd at Community Rd	Signal	42.6	D	32.3	C	26.1	C	24.9	C
Connector Rd at I-77 NB Ramps	Signal	8.1	A	11.7	B	1.3	A	1.4	A
Connector Rd at I-77 SB Ramps	Signal	4.3	A	4.6	A	7.9	A	8.2	A
Connector Rd at US 21	Signal	5.2	A	8.3	A	23.5	C	7.9	A

¹Analyzed using Synchro output. HCM 6th Edition Methodology not supported.

²Analyzed using SIDRA 9





6.4 2046 Design Year Build Analysis

6.4.1 2046 Build Mainline and Ramp Analysis

Under 2046 Design Year Build conditions, the I-77 mainline and ramps maintain the same geometric configuration as in the 2026 Opening Year Build conditions. The results of the Design Year HCS analysis are summarized in **Table 6-7**. As shown in the table, only the I-77 southbound segment south of US 21 in AM peak and Shift 2 peak is expected to operate at LOS E under the 2046 Build conditions.

The I-77 southbound segment south of US 21 operates at LOS E in the AM peak under both No-Build and Build conditions. In the Shift 2 peak hour, this segment operates at LOS D in the No-Build conditions and degrades to LOS E under the Build conditions. Under the No-Build condition, the upstream southbound on-ramp from US 21 northbound has demand that exceeds the capacity of the on-ramp. The HCS facilities module adjusts the downstream demand to approximate the impacts of the ramp bottleneck and reduced throughput. This results in a lower demand volume and LOS D in the No-Build condition. In the Build condition, the on-ramp from US 21 northbound has a lower demand due to this movement also being accommodated at the new interchange. As such, the full I-77 southbound entering demand is served, which results in the true demand being analyzed on the basic segment south of US 21 and the resulting LOS E conditions. If the No-Build condition was not demand restricted, both scenarios would result in LOS E at this location. Backup documentation of the Design Year Build HCS analysis is provided in **Appendix I**.

Table 6-7 Design Year 2046 Build Mainline and Ramp Operations

I-77 Segment	Type		AM Peak				PM Peak				Shift 1 Peak				Shift 2 Peak			
	Coded	Analyzed	Mainline/ Ramp Volume	Average Speed (mph) ¹	Density ² (pc/mi/ln)	LOS	Mainline/ Ramp Volume	Average Speed (mph) ¹	Density ² (pc/mi/ln)	LOS	Mainline/ Ramp Volume	Average Speed (mph) ¹	Density ² (pc/mi/ln)	LOS	Mainline/ Ramp Volume	Average Speed (mph) ¹	Density ² (pc/mi/ln)	LOS
I-77 Northbound																		
South of US 21	Basic	Basic	2265	75.0	14.0	B	3935	68.4	25.9	C	2392	74.4	16.6	B	3724	69.6	24.4	C
US 21 Off-Ramp	Diverge	Diverge	540	67.6/ 63.3	15.5/ 21.8	C	846	67.0/ 62.1	26.5/ 32.5	D	545	67.9/ 63.3	18.1/ 24.6	C	708	67.3/ 62.5	25.2/ 31.4	D
From US 21 Off-Ramp to NB US 21 On-Ramp	Basic	Basic	1725	74.4	10.7	A	3089	73	19.6	C	1847	74.4	12.7	B	3016	73.5	18.7	C
NB US 21 On-Ramp	Merge	Merge	170	67.8/ 65.0	12.7/ 13.2	B	110	66.3/ 63.8	22.2/ 21.7	C	30	67.8/ 65.0	14.2/ 14.2	B	60	66.6/ 64.1	21.0/ 20.4	C
From NB US 21 On-Ramp to SB US 21 On-Ramp	Basic	Basic	1895	73.8	11.7	B	3199	72.5	20.3	C	1877	73.8	12.9	B	3076	73.2	19.1	C
SB US 21 On-Ramp	Merge	Merge	90	68.5/ 65.9	13.4/ 14.1	B	190	66.5/ 64.3	23.3/ 23.2	C	60	68.3/ 65.8	14.6/ 15.1	B	90	67.0/ 64.8	21.6/ 21.5	C
From US 21 to Connector Rd	Basic	Basic	1985	74.4	9.8	A	3389	71.6	21.7	C	1937	74.4	13.3	B	3166	72.8	19.8	C
Off-ramp to Connector Rd EB	Diverge	Diverge	73	69.4/ 64.9	13.2/ 14.6	B	116	69.4/ 64.8	22.4/ 24.0	C	34	69.6/ 65.0	14.3/ 15.7	B	64	69.5/ 64.9	20.8/ 22.4	C
From Connector Rd EB Off to WB Off	Basic	Basic	1912	73.7	11.8	B	3273	72.1	20.9	C	1903	73.7	13.1	B	3102	73.1	19.3	C
Off-ramp to Connector Rd WB	Diverge	Diverge	277	65.0/ 60.0	13.6/ 13.3	B	314	65.6/ 59.9	23.0/ 22.6	C	1400	59.7/ 56.3	16.4/ 17.7	B	1238	62.0/ 56.8	22.8/ 23.3	C
From WB Connector Rd Off-Ramp to Connector Rd On-ramp	Basic	Basic	1635	74.1	10.1	A	2959	73.4	18.8	C	503	73.6	3.5	A	1864	73.8	11.3	B
Connector Rd On-Ramp	Merge	Merge	65	74.9/ 75.0	7.8/ 7.8	A	81	68.4/ 68.4	15.5/ 15.5	B	287	74.9/ 75.0	3.7/ 3.7	A	356	74.9/ 75.0	9.8/ 9.8	A
From Connector Rd to Blythewood Rd (4 lanes)	Basic	Basic	1700	75.0	7.9	A	3040	74.4	14.1	B	790	75.0	4.1	A	2220	75.0	10.1	A
From Connector Rd to Blythewood Rd (3 lanes)	Basic	Basic	1700	75.0	8.4	A	3040	73.1	19.3	C	790	75.0	5.4	A	2220	75.0	13.5	B
Blythewood Rd Off-Ramp	Diverge	Basic	710	75.0/ 75.0	10.5/ 10.5	A	1234	65.3/ 65.3	21.6/ 21.6	C	452	75.0/ 75.0	5.4/ 5.4	A	928	75.0/ 75.0	13.5/ 13.5	B
From Blythewood Rd Off-Ramp to Blythewood Rd On-Ramp	Basic	Basic	990	75.0	9.2	A	1806	73.4	18.8	C	338	75.0	3.5	A	1292	75.0	11.8	B
Blythewood Rd On-Ramp	Merge	Merge	224	66.0/ 66.0	12.4/ 13.5	B	251	63.9/ 63.9	23.9/ 24.6	C	428	66.2/ 66.2	8.2/ 9.1	A	545	65.1/ 65.1	18.8/ 19.7	B
North of Blythewood Rd	Basic	Basic	1214	75.0	11.2	B	2057	71.9	21.2	C	766	75.0	7.9	A	1837	74.3	16.9	B
I-77 Southbound																		
North of Blythewood Rd	Basic	Basic	1810	74.6	16	B	1980	73.8	18.0	B	970	75.0	9.4	A	1810	74.1	17.2	B
Blythewood Rd Off-Ramp	Diverge	Diverge	190	64.4/ 64.4	18.6/ 23.3	C	264	64.2/ 64.2	20.7/ 25.6	C	432	63.6/ 63.6	11.1/ 14.9	B	458	63.4/ 63.4	20.1/ 24.7	C
From Blythewood Rd Off-Ramp to Blythewood Rd On-Ramp	Basic	Basic	1620	74.8	14.3	B	1716	74.7	15.4	B	538	74.8	5.2	A	1352	74.8	12.7	B
Blythewood Rd On-Ramp	Merge	Merge	1354	61.0/ 61.0	30.5/ 29.7	D	701	63.4/ 63.4	24.7/ 25.5	C	658	65.7/ 65.7	12.1/ 13.4	B	835	64.0/ 64.0	22.7/ 23.6	C
From Blythewood Rd to Connector Rd	Basic	Basic	2974	64.7	30.4	D	2417	70.7	23.0	C	1196	73.8	11.6	B	2187	71.7	21.5	C
Connector Rd Off-Ramp	Diverge	Diverge	70	64.9/ 64.9	30.3/ 31.1	D	76	64.9/ 64.9	25.0/ 25.2	C	325	64.1/ 64.1	13.6/ 12.2	B	298	64.1/ 64.1	24.1/ 23.8	C
From Connector Rd Off-Ramp to Connector Rd On-Ramp	Basic	Basic	2904	65.6	29.3	D	2341	71.4	22.0	C	871	74.8	8.5	A	1889	73.8	18.1	C
Connector Rd On-Ramp	Merge	Basic	499	72.4/ 72.4	20.5/ 20.5	C	445	74.4/ 74.4	16.6/ 16.6	B	1249	75.0/ 75.0	12.0/ 12.0	B	1522	72.6/ 72.6	20.2/ 20.2	C
Connector Rd to US 21	Basic	Basic	3403	72.2	20.8	C	2786	74.3	16.8	B	2120	75.0	13.7	B	3411	71.0	22.6	C
US 21 Off-Ramp	Diverge	Diverge	190	69.1/ 64.4	21.7/ 22.4	C	170	69.1/ 64.5	18.1/ 18.9	B	60	69.5/ 64.9	14.8/ 15.3	B	100	69.4/ 64.8	23.1/ 23.7	C
From US 21 Off-Ramp to US 21 On-Ramp	Basic	Basic	3213	73.1	19.4	C	2616	74.7	15.7	B	2060	74.9	13.3	B	3311	71.6	21.8	C
US 21 On-Ramp	Merge	Merge	1055	63.4/ 60.6	28.9/ 30.5	D	811	65.9/ 63.5	22.7/ 25.1	C	567	67.0/ 64.7	18.4/ 20.6	C	706	64.0/ 61.3	28.8/ 29.6	D
South of US 21	Basic	Basic	4268	59.1	37.2	E	3427	69.4	24.7	C	2627	72.4	20.6	C	4017	60.2	35.8	E

¹Ramp Junction Speed/Ramp Influence Area Speed

²Average Freeway Density/Ramp Influence Area Density

6.4.2 2046 Build Intersection Analysis

The 2046 Design Year Build roadway network is the same as the 2026 Opening Year Build roadway network except for US 21 at Farrow Road which is converted from stop-control to signal-control in the Design Year. The signalized intersections were optimized under the Build conditions to improve overall delay and LOS. The analyses utilize HCM-based output unless otherwise noted. For unsignalized intersections, the highest stop-controlled delay and LOS are reported. **Table 6-8** summarizes the delay and LOS for the study intersections. The 2046 Design Year Build intersection analysis indicates that many of the study area intersections are expected to experience improved operations in the Build conditions over the No-Build.

The I-77 Northbound off-ramp terminal at US 21 improves from LOS F to LOS D or better except for during the typical PM peak. The PM peak hour improves from LOS F in the No-Build conditions to LOS E in Build Conditions and the off-ramp queue is not expected to impact mainline I-77 operations. The modified I-77 Southbound off-ramp terminal at US 21 operates at LOS C or better during all analyzed hours. The intersection of US 21 at Farrow Road improves from LOS F in the No-Build conditions to LOS D or better under signalization in the Build condition. The Blythewood Road ramp terminal intersections also experience a reduction in delay especially during the Shift Peak periods; however, the intersections are expected to fail by the Design Year. The intersections along Connector Road are expected to operate at LOS D or better during all analysis periods. The remaining intersections operate similarly between No-Build and Build conditions.

The intersection failures along Blythewood Road in the Design Year 2046 are primarily due to increased traffic demand from Phase 2 of the manufacturing plant, which indicates a need for further roadway improvements prior to Phase 2 of the manufacturing plant coming online. **Figure 6-7** and **6-8** shows the 2046 Build peak hour volumes and LOS for each study intersection. **Appendix J** contains the Synchro 11 and SIDRA 9 output for the Design Year 2046 Build analysis.

Table 6-8 Design Year 2046 Build Intersection Operations

Intersection	Control Type	AM Peak		PM Peak		Shift 1 Peak		Shift 2 Peak	
		Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
US 21 at Community Rd	Signal	11.9	B	22.2	C	65.7	E	67.8	E
US 21 at I-77 SB Ramps	Signal	28.3	C	9.8	A	5.9	A	6.7	A
US 21 at I-77 NB Ramps	Stop	19.1	C	36.6	E	16.2	C	27.2	D
US 21 at Office Park ¹	Signal	10.8	B	13.6	B	7.3	A	8.2	A
US 21 at Farrow Rd	Signal	12.7	B	41.8	D	9.7	A	21.7	C
Blythewood Rd at Community Rd ²	Roundabout	12.4	B	10.3	B	36.7	E	113.8	F
Blythewood Rd at I-77 SB Ramps	Signal	65.4	E	40.5	D	48.2	D	172.1	F
Blythewood Rd at I-77 NB Ramps	Signal	139.4	F	132.3	F	95.9	F	393.1	F
Blythewood Rd at Creech Rd	Stop	UD ³	F	25306.8	F	109.6	F	UD ³	F
Blythewood Rd at Boney Rd	Signal	63.6	E	23.1	C	5.4	A	14.5	B
Connector Rd at Community Rd	Signal	48.4	D	43.0	D	44.6	D	44.9	D
Connector Rd at I-77 NB	Signal	6.5	A	10.8	B	1.7	A	1.8	A
Connector Rd at I-77 SB	Signal	4.8	A	5.1	A	7.7	A	9.7	A
Connector Rd at US 21	Signal	6.9	A	12.0	B	45.1	D	21.6	C

¹Analyzed using Synchro output. HCM 6th Edition Methodology not supported.

²Analyzed using SIDRA 9

³Delay exceeds computation in Synchro and is "Undefined"

6.4.3 2046 Build Queuing Analysis

A queuing assessment was conducted for the I-77 ramp terminal intersections of the proposed Exit 26 interchange under Design Year 2046 Build conditions using SimTraffic to determine whether queueing would impact I-77 mainline operations. The 95th percentile queues were determined from SimTraffic based on an average of 10 runs using a 15-minute seeding time and a 1-hour simulation duration. **Table 6-9** summarizes the queues by movement and compares the off-ramp approach queues to the actual ramp lengths. As shown in the table, the queues at the proposed Exit 26 interchange are not expected to impact I-77 mainline operations.

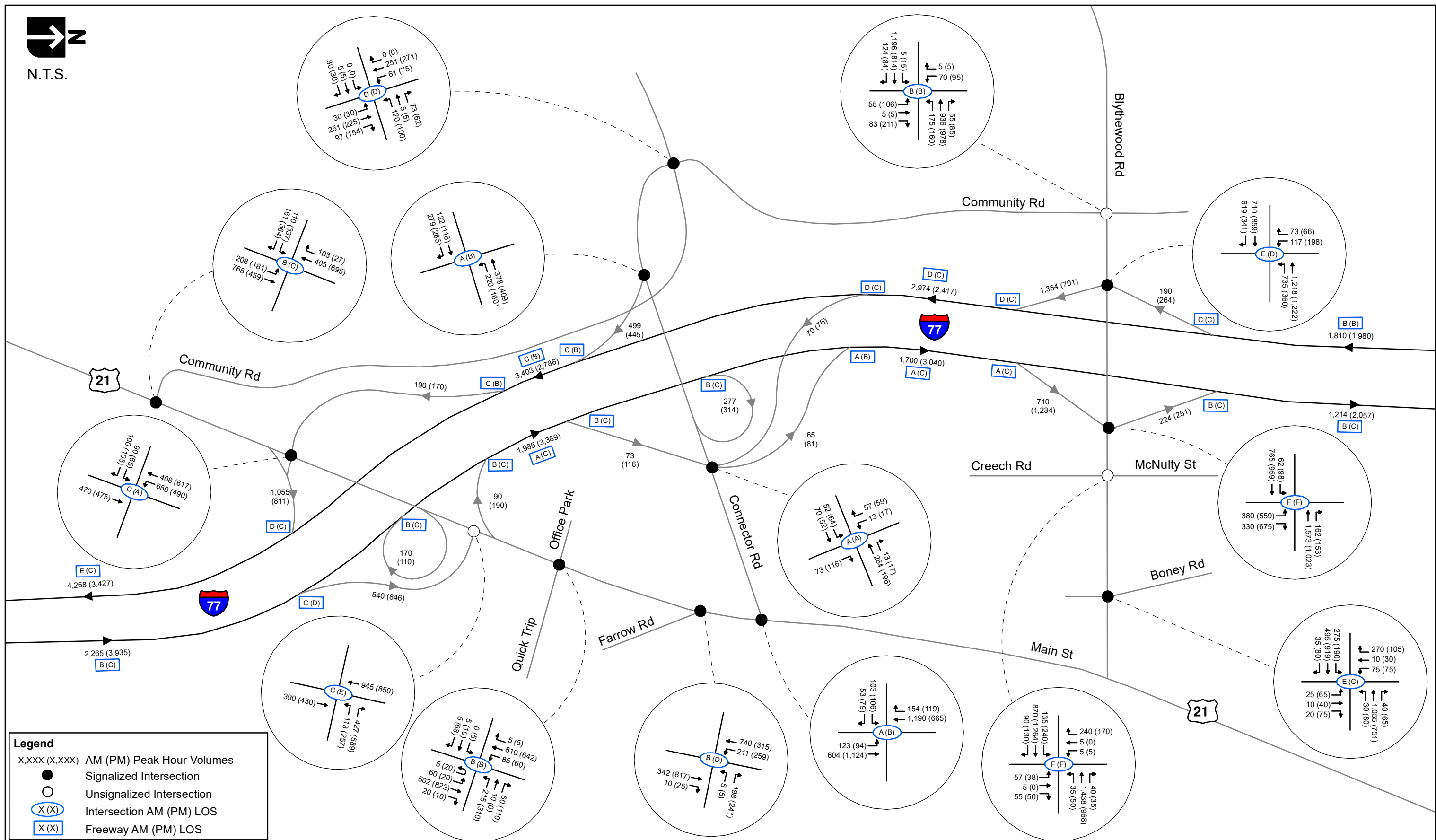
Table 6-9 Design Year 2046 Build 95th Percentile Queues

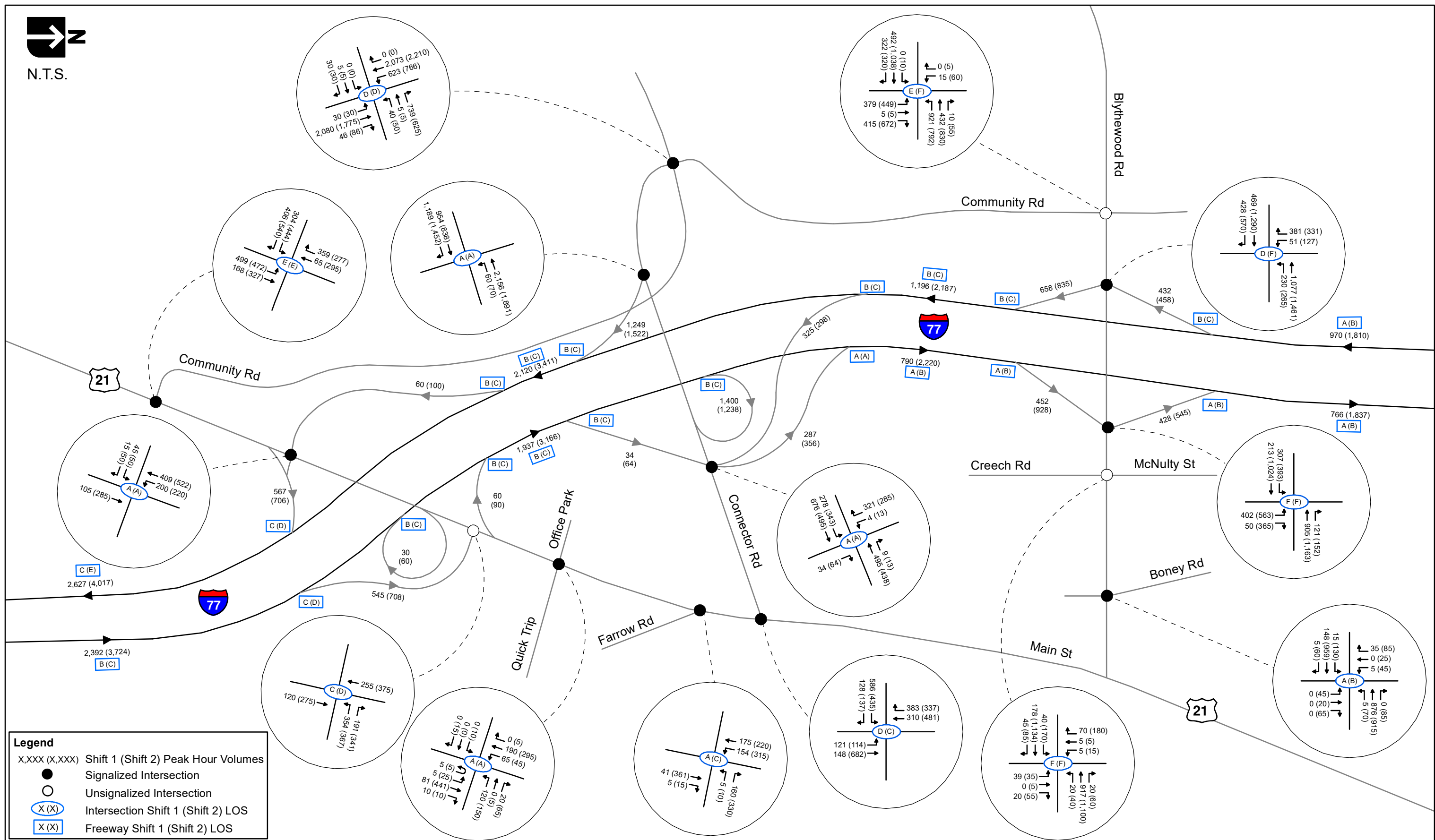
Intersection	Movement/ Approach ¹	95 th Percentile Queues (ft)				Off-Ramp Length (ft) ²
		AM	PM	Shift 1	Shift 2	
Connector Rd at I-77 SB On-Ramp	EBT	42	49	70	90	NA
	EBT/R	67	65	89	108	
	EBR	76	74	85	108	
	WBL	160	141	94	80	
	WBT	5	7	40	14	
Connector Rd at I-77 NB/SB Off-Ramps	EBL	42	52	100	120	NA
	EBT	11	19	81	84	
	WBT	54	41	142	117	
	WBT/R	53	42	152	122	
	SBL	33	43	26	36	2,680
	SBR	88	92	239	298	
	NBR ³	0	0	0	0	1,530

¹Highest 95th percentile queue is reported for lane groups with more than one lane.

²Ramp lengths were measured from the stop bar to the ramp painted gore.

³SimTraffic does not report for this movement, Synchro 95th percentile queues reported





6.5 Recommended Alternative

The analysis presented in this IJR shows that the No-Build alternative cannot accommodate the future traffic demands within the study area. Without a new interchange at Exit 26, the existing interchanges at US 21 and Blythewood Road are expected to experience increased congestion including failures at ramp terminal intersections and ramp queueing which may impact I-77 mainline operations. This report supports the conclusion that the proposed new interchange at Exit 26 along with the additional I-77 mainline enhancements and arterial intersection improvements of the Build alternative will benefit both the freeway and local transportation systems.

The I-77 mainline is expected to operate similarly under both the No-Build and Build conditions with most of the mainline segments operating at LOS D or better during all analysis periods. The highest densities are observed on the I-77 southbound mainline south of US 21 which is expected to operate at LOS E in the Design Year 2046 under both the No-Build and Build conditions. The No-Build analysis indicates that without the proposed new interchange the I-77 Northbound off-ramps to US 21 and Blythewood Road are expected to operate at LOS F and E, respectively, in one or more peak periods. Under the Build scenario, these ramp junctions improved to LOS D or better for all analysis periods. Additionally, the ramp junctions associated with the proposed new interchange are expected to operate at LOS D or better during all analysis periods.

The Design Year 2046 intersection analysis indicates that without the proposed new interchange, most of the study intersections are expected to experience high levels of delay including the ramp terminal intersections at US 21 and Blythewood Road. In the No-Build condition, the I-77 Southbound ramp terminal at US 21 is expected to operate at LOS F during both manufacturing Shift peak hours and the I-77 Northbound ramp terminal intersection is expected to operate at LOS F during all four analyzed hours. The Blythewood Road ramp terminal intersections are expected to operate at LOS F during all analysis hours except the I-77 Southbound ramp terminal in the PM peak, which is expected to operate at LOS E.

In the Design Year 2046 Build condition, implementation of the proposed new interchange at Exit 26 results in substantial operational improvements at the existing ramp terminal intersections. The US 21 ramp terminals improve to LOS D or better except for the I-77 Northbound off-ramp in the PM peak, which is expected to operate at LOS E. While the intersection is expected to operate at LOS E, the queues at the off-ramp approach are not expected to impact I-77 operations.

Substantial reductions in delay are also observed at the I-77 ramp terminal intersections at Blythewood Road; however, they are still expected to operate at LOS E or F under the Build scenario in the Design Year 2046. The I-77 Southbound ramp terminal operates at LOS E or F

during all analysis periods in the No-Build scenario with delays ranging from 64.2 seconds/vehicle (LOS E) to 462.9 seconds/vehicle (LOS F). These delays improve to a range of 40.5 seconds/vehicle (LOS D) to 172.1 seconds/vehicle (LOS F) in the Build condition. Similarly, the I-77 Northbound ramp terminal operates at LOS F during all analysis periods in the No-Build scenario with delays ranging from 144.6 seconds/vehicle to 624.1 seconds/vehicle. These delays improve to a range of 95.9 seconds/vehicle to 393.1 seconds/vehicle under the Build condition. The high delays remaining in the Design Year 2046 Build condition are a result of the increased traffic demand from Phase 2 of the manufacturing development. This indicates a need for additional improvements at the Blythewood Road interchange prior to Phase 2 of the manufacturing plant coming online.

The analysis indicates that the I-77 ramp terminal intersections at the proposed interchange with Connector Road are expected to operate at LOS A or B in the 2046 Design Year Build condition. In addition to the intersection analysis, a Design Year queueing analysis was conducted using SimTraffic to determine whether ramp terminal intersection queues at the proposed new interchange are expected to impact the I-77 mainline. The results of the queueing analysis indicate that the off-ramps associated with the new interchange are expected to have minimal queues which do not reach the I-77 mainline in the Design Year 2046.

Based on the operational benefits of the Build Alternative, it is considered the preferred alternative for this IJR. **Appendix K** provides the conceptual signing plan for the Build alternative.

7.0 Justification for Project

The proposed improvements of the Build Alternative provide substantial improvements in traffic operations within the project study area and enhance access for large-scale development expected for the area. The proposed improvements provide additional access to/from I-77 which is needed within the study area based on the analysis documented in this IJR.

7.1 Compliance with FHWA General Requirements

The following requirements serve as the primary decision criteria used in approval of interchange justification projects. Responses to the two FHWA policy points are provided to show that the proposed project is viable based on the analysis performed to date.

7.1.1 The request does not have a significant adverse impact on the safety and operation of the freeway system.

An operational and safety analysis has concluded that the proposed change in access does not have a significant adverse impact on the safety and operation of the Interstate facility (which includes mainline lanes, existing, new, or modified ramps, ramp intersections with crossroad) or on the local street network based on both the current and the planned future traffic projections. The analysis shall, particularly in urbanized areas, include at least the first adjacent existing or proposed interchange on either side of the proposed change in access (23 CFR 625.2(a), 655.603(d) and 771.111(f)). The crossroads and the local street network, to at least the first major intersection on either side of the proposed change in access, shall be included in this analysis to the extent necessary to fully evaluate the safety and operational impacts that the proposed change in access and other transportation improvements may have on the local street network (23 CFR 625.2(a) and 655.603(d)). Requests for a proposed change in access must include a description and assessment of the impacts and ability of the proposed changes to safely and efficiently collect, distribute and accommodate traffic on the Interstate facility, ramps, intersection of ramps with crossroad, and local street network (23 CFR 625.2(a) and 655.603(d)). Each request must also include a conceptual plan of the type and location of the signs proposed to support each design alternative (23 U.S.C. 109(d), and 23 CFR 655.603(d)).

The safety analysis for this IJR indicated that, historically, there were no unusual trends in crashes or crash types susceptible to correction in the design of the new interchange. During the historical analysis period from January 2019 through September 2022, the study area experienced approximately 39 crashes per year with the most predominant crash types being sideswipe crashes (33%) and run off road crashes (28%), which are typically attributed to careless driving due to improper lane changing or going too fast for conditions. While there are no existing safety concerns within the project study area, the recommended alternative is expected to reduce the crash frequency from a qualitative standpoint by providing enhanced capacity throughout the

study area and thus reducing the overall density of traffic through the study area when compared to the No-Build alternative.

The Design Year 2046 operational analysis results show that the Build alternative provides improvements in operations for both the I-77 mainline and ramps as well as the study area intersections. Under the No-Build conditions the I-77 Northbound off-ramps to both US 21 and Blythewood Road are expected to experience LOS E or F conditions in one or more analysis hours. Implementation of the proposed new interchange improves the operations of the off-ramp junctions to LOS D or better during all analysis hours. Additionally, the ramp junctions associated with the proposed new interchange are expected to operate at LOS D or better during all analysis periods.

In terms of intersection operations, the I-77 ramp terminal intersections at the US 21 and Blythewood Road interchanges are expected to fail during two or more analysis hours, under the No-Build alternative. Under Build conditions, the ramp terminal intersections at US 21 improve to LOS D or better for all hours except for the I-77 Northbound off-ramp during the PM peak which is expected to operate at LOS E. While the intersection is expected to operate at LOS E, the queues at the off-ramp approach are not expected to impact I-77 operations. The Blythewood Road ramp terminal intersections also experience a substantial reduction in delay during all four analyzed hours when comparing the Build to the No-Build condition. The I-77 ramp terminal intersections associated with the proposed new interchange are expected to operate at LOS A or B and the remaining new intersections along Connector Road (which is the new crossroad of the proposed interchange) are expected to operate at LOS D or better during all analysis periods in the Design Year 2046.

7.1.2 The proposed access connects to a public road only and will provide for all traffic movements

The proposed access connects to a public road only and will provide for all traffic movements. Less than “full interchanges” may be considered on a case-by-case basis for applications requiring special access, such as managed lanes (e.g., transit or high occupancy vehicle and high occupancy toll lanes) or park and ride lots. The proposed access will be designed to meet or exceed current standards (23 CFR 625.2(a), 625.4(a)(2), and 655.603(d)). In rare instances where all basic movements are not provided by the proposed design, the report should include a full-interchange option with a comparison of the operational and safety analyses to the partial-interchange option. The report should also include the mitigation proposed to compensate for the missing movements, including wayfinding signage, impacts on local intersections, mitigation of driver expectation leading to wrong-way movements on ramps, etc. The report should describe whether future provision of a full interchange is precluded by the proposed design.

The proposed new interchange connects to a public road (Connector Road) that intersects with US 21 and Community Road, which are existing public roadways within the study area. The proposed interchange is a full interchange which serves all movements to and from I-77. The Build alternative concept evaluated in this IJR is designed to meet current standards for federal aid projects and conforms to American Association of State Highway and Transportation Officials (AASHTO) design standards and the SCDOT 2021 Roadway Design Manual.

There is one known design exception within the limits of the project study area. A shoulder width design exception exists for the I-77 southbound mainline outside shoulder within the vicinity of the I-77 southbound bridge over US 21. Under the existing condition the southbound US 21 to southbound I-77 loop on-ramp creates a lane add on the I-77 southbound bridge over US 21. To provide lane continuity without widening the existing bridge, this lane add is aligned with the upstream third mainline lane. While the existing four-foot shoulder on the bridge did not constitute a design exception when the adjacent lane was a ramp lane, this now becomes an exception when the shoulder is adjacent to a mainline travel lane. Approval of this design exception is currently on-going.

8.0 Commitment to Additional Improvements

The Build analysis in this IJR indicated a need for additional capacity improvements within the study area that are outside the scope of this project. The Design Year 2046 analysis indicates that the I-77 at Blythewood Road interchange is expected to operate over capacity even under the Build conditions. These operational deficiencies are tied closely to the implementation of Phase 2 of the proposed manufacturing development as outlined in **Section 4.2** of this IJR. SCDOT commits to providing capacity improvements at the Blythewood Road interchange with I-77 prior to Phase 2 of the manufacturing plant coming online. These needed capacity improvements will be identified in a subsequent study.