# N. Beauregard Street at N. Chambliss Street Intersection Improvements

## Analysis of Proposed Pedestrian Improvements

*Synchro and VISSIM Operational Analyses and Safety Evaluation*

FINAL REPORT November 2017

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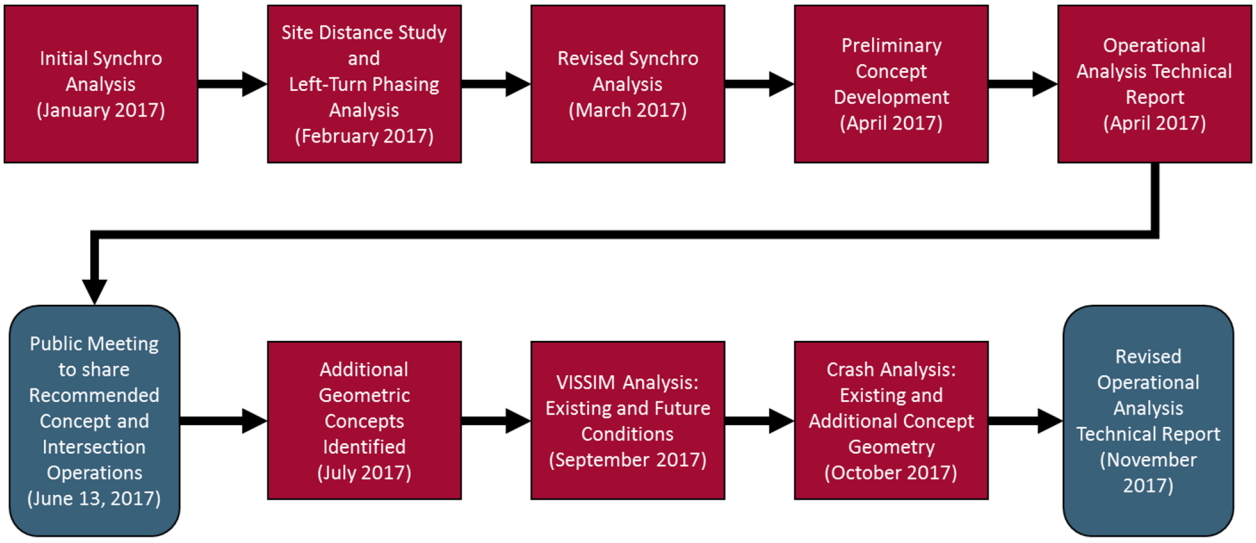
# Executive Summary

The intersection of N. Beauregard Street with N. Chambliss Street limits pedestrian mobility. Although marked crosswalks are provided across three of the four approaches to the intersection, pedestrian signals are only present for two of these crossings. In addition, the crosswalk at the slip lane from southbound N. Chambliss Street onto southbound N. Beauregard Street exposes pedestrians to greater risk as the crossing is unsignalized and carries a high volume of traffic during peak periods. Given these existing conditions, the Fairfax County Department of Transportation (FCDOT) has identified the need to improve the intersection of N. Beauregard Street and N. Chambliss Street to enhance pedestrian safety and mobility.

The development of intersection improvements included a multi-tier traffic and safety analysis. The process was informed by stakeholders at the Virginia Department of Transportation (VDOT), FCDOT, and the residents of the Lincolnia community. **Figure E1** provides an overview of the traffic analysis timeline and process that evolved during 2017. The initial traffic analysis was completed using Synchro software to identify the optimal lane configurations and operations of the intersection. Given the results of a site distance study, left-turn phasing was an additional consideration at this stage of the traffic analysis and further informed signal operations recommendations. Based upon feedback from the community at a June 13, 2017 public information meeting, FCDOT completed further traffic analyses to evaluate the potential queue spillback and travel time impacts on southbound traffic along N. Chambliss Street. This analysis was completed using VISSIM software and considered additional geometric concepts to improve operations of this particular movement. In addition, a crash analysis of existing conditions and the crash mitigation potential of the additional concepts was completed.

*Figure E1: Traffic Analysis Project Work Flow*



## Synchro Analysis

Existing and future conditions were initial evaluated using Synchro software. An exponential growth rate of 1.3 percent was applied to existing traffic volumes to develop future condition (2026) turning volumes. Under existing conditions, demand exceeds available capacity; thus, the additional volume associated with traffic growth further strains intersection operations. Without any additional capacity to support growth (i.e. green time, turning lanes), delay subsequently increases for the side street intersection movements at N. Chambliss Street. Overall intersection level of service (LOS) C is maintained during the AM peak hour, worsens to LOS D during the PM peak hour, and is maintained at LOS D during the Saturday peak hour.

Three build conditions were considered in the Synchro analysis:

- **Base Scenario**: removal of channelized eastbound right turn onto N. Beauregard Street from N. Chambliss Street
- **Scenario A**: protected/permissive left-turn phasing from N. Chambliss Street and Plaza at Landmark Shopping Center approaches
- **Scenario B**: protected/permissive left-turn phasing for northbound N. Beauregard Street, protected left-turn phasing for southbound N. Beauregard Street and westbound Plaza at Landmark Shopping Center approaches, and permissive left-turn phasing for eastbound N. Chambliss Street.

Scenario A was initially identified as the recommended operations for the preliminary intersection design configuration. Following a left-turn phasing evaluation, which included a sight distance study and high-level assessment of available crash information, changes in signal operations were deemed necessary. The changes to signal phasing are reflected in Scenario B. The results of the Synchro analyses indicated that Scenario A offered a modest improvement to PM peak hour operations, with an overall LOS C. The no build, Base Scenario, and Scenario B operations resulted in overall LOS D. Similar operations are expected among no build and build conditions during the AM and Saturday peak hours. Overall, Scenario B was the recommended signal operations for the intersection based upon the Synchro analysis given the preliminary intersection design configuration in April 2017.

## VISSIM Analysis

The results of the Synchro analysis were presented at a public information meeting on June 13, 2017. Residents of the Lincolnia community present at the meeting shared concerns regarding the potential increase in queues and travel time along N. Chambliss Street that could result from the operations of the preliminary intersection design configuration. In response to the feedback shared at the meeting, FCDOT initiated a subsequent traffic analysis effort using VISSIM software. This additional analysis was completed to better understand queue and travel time impacts, which are not as well reported using Synchro software under over-saturated conditions. Traffic microsimulation models were developed in VISSIM for the following four scenarios:

- **No Build:** 2026 conditions considering existing geometry
- **VISSIM Scenario 1:** 2026 conditions with an intersection reconfiguration; the same geometric and operational configuration as Synchro Scenario B
- **VISSIM Scenario 2:** 2026 conditions similar to VISSIM Scenario 1 with the addition of a second right-turn lane onto southbound N. Beauregard Street from N. Chambliss Street
- **VISSIM Scenario 3:** 2026 conditions with a signalized slip lane from southbound N. Chambliss Street to southbound N. Beauregard Street; no turns permitted on red and new dedicated pedestrian signal across the slip lane approach

**Table E1** provides a summary of the benefits and shortcomings of the four VISSIM scenarios.

**Table E1: Summary of VISSIM Scenario Benefits and Shortcomings for the Southbound Movement from N. Chambliss Street to N. Beauregard Street**

| VISSIM Scenario | Benefits | Shortcomings |
|---|---|---|
| No Build | • Free-flow operations | • Poor and uncontrolled accommodations for pedestrians<br>• Uncontrolled merge south of the traffic signal |
| Scenario 1 | • Permits right turn on red<br>• Single turning conflict with crosswalk | • Adds vehicular signal control |
| Scenario 2 | • Two lanes of turning capacity | • Two turning lanes creates multiple conflicts with pedestrians (VDOT does not prefer dual right-turn lanes across pedestrian crosswalk)<br>• No turn on red from interior right-turn lane (assuming VDOT permits this) |
| Scenario 3 | • Two lanes of turning capacity<br>• Signalized pedestrian crossing | • No turn on red from slip lane |

Overall, VISSIM Scenario 1 provides the greatest improvement to overall operations of the study intersection of N. Beauregard Street and N. Chambliss Street. The LOS improves from F to E, corresponding to a reduction in overall intersection delay by approximately 15 seconds. The southbound through movement along N. Beauregard Street improves by more than 100 seconds, and compared to other scenarios, has the least amount of delay for the eastbound right-turn movement.

The results of the 2026 build conditions VISSIM analysis indicate that the queuing and delay issues at the study intersection are strongly influenced by the downstream congestion issues at Little River Turnpike. In coordination with FCDOT staff, an alternative lane configuration to the intersection was identified that could increase the capacity of the heavy southbound left-turn movement onto Little River Turnpike. In turn, it was expected that the improved capacity would process additional demand through the intersection and improve operations at N. Chambliss Street. The proposed lane modification includes the restriping of the southbound approach to include two exclusive left-turn lanes and one shared through and right-turn lane. The lane modification was altered in each of the

VISSIM models and the signal timings were adjusted accordingly. Intersection operations remained the same, with no changes to phase sequencing or signal overlaps. Split phase operations were maintained for the side street approaches given the low demand on the northbound approach. All the VISSIM scenarios were simulated again considering the lane modifications at Little River Turnpike.

### Safety Analysis

A crash analysis for the intersections of N Beauregard Street and N Chambliss Street was conducted using the latest seven years of available crash data. There were 51 crashes reported within the study intersection in the 7-year analysis period, with the majority located within the intersection itself (27 crashes, 53%). Overall, angle crashes were the most common collision type (25 crashes, 47%), most frequently involving northbound left turn and southbound through movements (5 of 25 angle crashes) and southbound left turn and northbound through movements (9 of 25 angle crashes).

It is anticipated that the existing safety concerns and crash patterns at the study intersection will be reduced if one of the proposed VISSIM scenario improvements is implemented. Using the Highway Safety Manual methodology and the Crash Modification Factors (CMF) Clearinghouse data, CMFs were developed associated with the proposed improvements:

- **Change southbound left turn to protected only – CMF = 0.45**
  *(all VISSIM scenarios, 55% reduction in southbound collisions)*
- **Change eastbound left turn to permissive only – CMF = 1.42**
  *(all VISSIM scenarios, 42% increase in eastbound collisions)*
- **Perpendicular realignment of N. Chambliss Street – CMF = 0.56**
  *(VISSIM scenarios 1 and 2, 44% reduction in all crashes)*
- **Improved pedestrian crossing of N. Chambliss Street – CMF = 0.85**
  *(VISSIM scenario 3, 15% reduction in all crashes)*

Based upon the CMFs above, VISSIM scenarios 1 and 2 are expected to result in the highest reduction in annual crash rates, dropping from 8 crashes per year to 4 crashes per year. VISSIM scenario 3 results in a lesser reduction in crashes, or 5 crashes per year.

### Conclusions and Recommendations

The microsimulation analyses of no build and three build conditions reinforced the recommendation that Synchro Scenario B (VISSIM Scenario 1) provides the best overall intersection operations at N. Beauregard Street and N. Chambliss Street. This scenario reflects the preliminary intersection design configuration with protected only southbound and westbound left-turn movements, protected-permissive northbound left-turn movement, and permissive only eastbound left-turn movement. It results in the greatest reduction in intersection delay and a propensity to reduce intersection crash rates by improving the line of sight on N. Chambliss Street and changing the protected-permissive southbound left-turn movement to protected only.

Should VDOT be amenable to the geometric and operational modifications at Little River Turnpike, the change in intersection operations could yield even greater benefits to operations considering VISSIM Scenario 1 geometry and intersection control. The additional capacity of the exclusive dual left-turn lanes would process more vehicles through the signal, reducing the magnitude of queue spillback beyond the intersection at N. Chambliss Street. This would also reduce travel times even further as compared to no build conditions for the predominant southbound movements from N. Chambliss Street and N. Beauregard Street.

The proposed intersection improvements will provide enhanced access and improved safety for pedestrians navigating the intersection of N. Beauregard Street and N. Chambliss Street. All conflicts between pedestrians and vehicles will be signal controlled and marked with crosswalks. This in turn reduces the potential for pedestrian collisions with vehicles. The modification to the eastbound right-turn movement from N. Chambliss Street to N. Beauregard Street also improves safety for motorists by eliminating the existing weave segment between the two signals along N. Beauregard Street. This improvement also reduces the number of conflict points a right-turning vehicle from Shackelford Terrace must yield to down to one; all conflicts will originate from the signalized intersection of N. Beauregard Street and N. Chambliss Street. Overall, the proposed geometric improvements have the potential to reduce the number of crashes at the intersection by as much as 50 percent, resulting in fewer injuries and less property damage than indicated by crash patterns over the past seven years.

## Introduction

The intersection of N. Beauregard Street at N. Chambliss Street is a signalized intersection located approximately 800 feet north of the signalized intersection of Little River Turnpike (State Route 236) at N. Beauregard Street. The latter intersection is located less than 1,000 feet to the west of the interchange of Interstate 395 (I-395) with Duke Street (State Route 236) (see **Figure 1**). Primary access to the Plaza at Landmark shopping center is provided at the intersection of N. Beauregard Street and N. Chambliss Street.

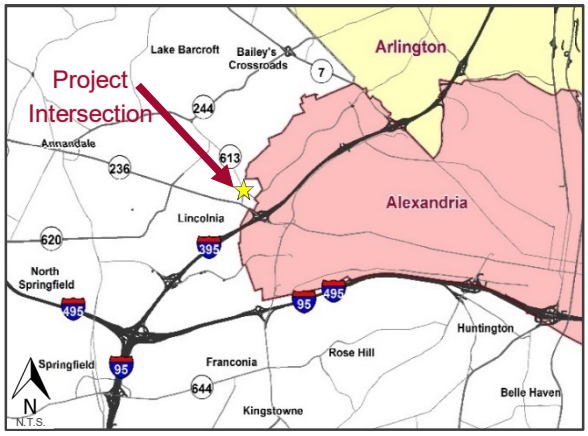



*Figure 1: Project Location Map*

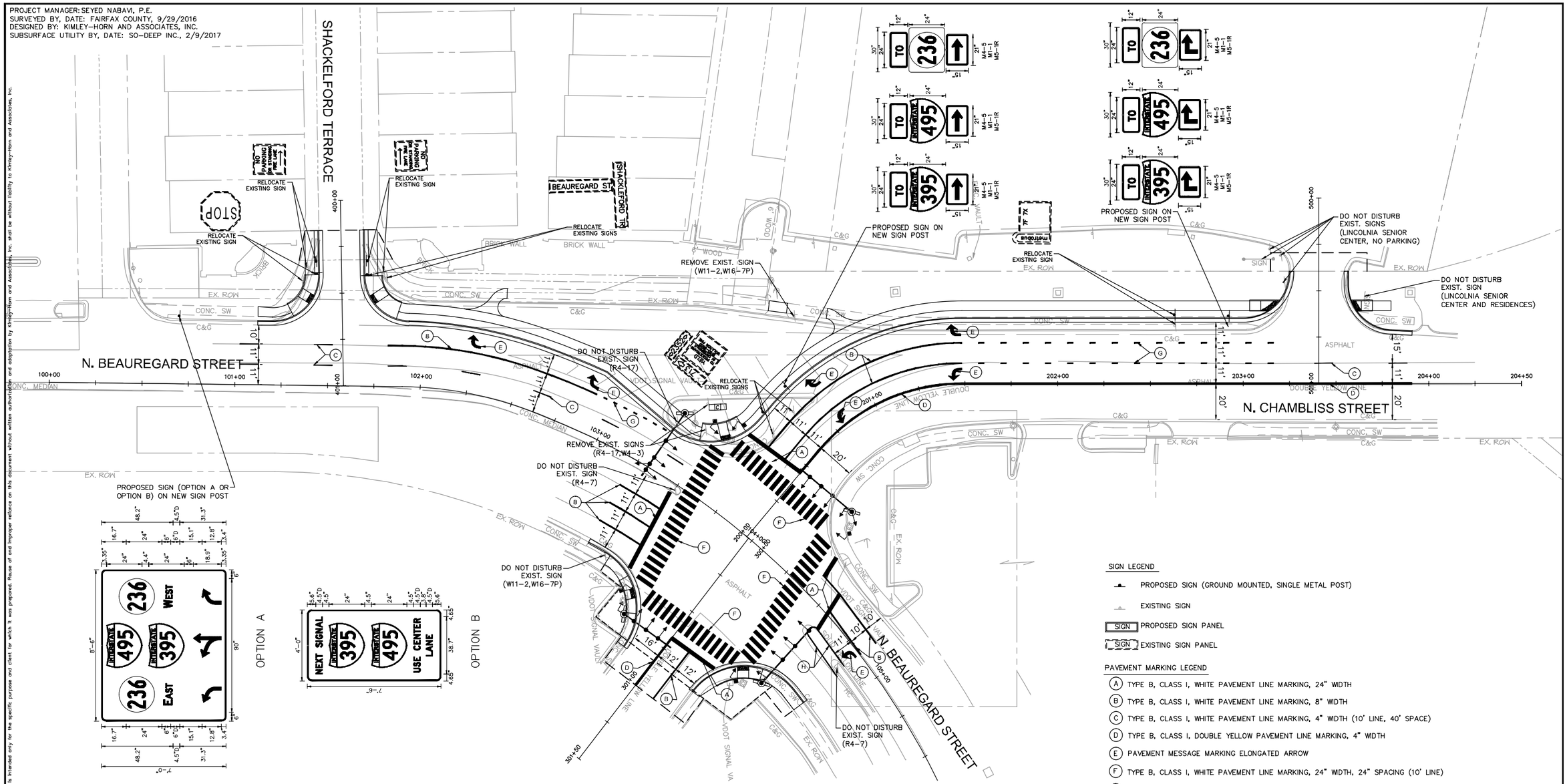
The current configuration and operation of the study intersection limits pedestrian mobility. Crosswalks are marked across three of the four approaches to the intersection and sidewalk ramps are provided on each corner. However, two of the sidewalk ramps are substandard, and pedestrian signals are only provided for two of the three crosswalks. In addition, the high speed, free-flow movement from southbound N. Chambliss Street to continue southbound on N. Beauregard Street makes it difficult for pedestrians to travel along the west side of N. Beauregard Street.

The Fairfax County Department of Transportation (FCDOT) has identified the need to improve the intersection of N. Beauregard Street and N. Chambliss Street to enhance pedestrian safety and mobility. As part of the project, FCDOT initially requested an evaluation of existing signal operations and a review of potential geometric modifications to the N. Beauregard Street and N. Chambliss Street. This traffic analysis was completed using Synchro 9 software in April 2017, which included operational recommendations for the preliminary intersection design configuration shown in **Figure 2**.

Results from the Synchro analysis were presented at a public information meeting on June 13, 2017. The feedback received at the meeting indicated that the Lincolnia community has concerns regarding the potential queuing impacts along N. Chambliss Street associated with the recommended intersection improvements. In order to respond to these concerns, FCDOT requested additional traffic analysis using VISSIM microsimulation software to be able to provide information back to the community in August 2017. VISSIM 9.0 software was used to model the PM peak period traffic simulation models for existing, no-build, and three alternative improvements. The alternative improvements were developed separate from the initial traffic analysis efforts in April 2017, with a primary focus on increasing throughput and reducing vehicle queues for the southbound movement from N. Chambliss Street.

This report provides a comprehensive overview of the traffic analyses completed to date for the N. Beauregard Street at N. Chambliss Street Intersection Improvements project.

**Figure 2: Preliminary Design of Intersection Improvements at N. Beauregard Street and N. Chambliss Street**




SIGN LEGEND

- PROPOSED SIGN (GROUND MOUNTED, SINGLE METAL POST)
- EXISTING SIGN
- SIGN PROPOSED SIGN PANEL
- SIGN EXISTING SIGN PANEL

PAVEMENT MARKING LEGEND

- (A) TYPE B, CLASS I, WHITE PAVEMENT LINE MARKING, 24" WIDTH
- (B) TYPE B, CLASS I, WHITE PAVEMENT LINE MARKING, 8" WIDTH
- (C) TYPE B, CLASS I, WHITE PAVEMENT LINE MARKING, 4" WIDTH (10' LINE, 40' SPACE)
- (D) TYPE B, CLASS I, DOUBLE YELLOW PAVEMENT LINE MARKING, 4" WIDTH
- (E) PAVEMENT MESSAGE MARKING ELONGATED ARROW
- (F) TYPE B, CLASS I, WHITE PAVEMENT LINE MARKING, 24" WIDTH, 24" SPACING (10' LINE)
- (G) TYPE B, CLASS I, WHITE PAVEMENT LINE MARKING, 8" WIDTH, (2' LINE, 4' SPACE)
- (H) TYPE B, CLASS I, YELLOW PAVEMENT LINE MARKING, 4" WIDTH

SIGNAGE GENERAL NOTES:

1. All signs and pavement markings shall be in accordance with the most current edition of each of the following manuals or the most recent revision thereof:

A. Manual on Uniform Traffic Control Devices (MUTCD)
B. The Virginia Supplement to the Manual on Uniform Traffic Control Devices
C. The Virginia Department of Transportation Road and Bridge Specifications
D. The Virginia Department of Transportation Road and Bridge Standards

2. All signs as necessary or directed by Fairfax County shall be installed in accordance with St'd STP-1 with breakaway metal post. All signs, as necessary or directed by Fairfax County, designated to be relocated, shall be reinstalled in such a manner that the relocated sign complies with St'd STP-1

3. The Contractor shall stake all the proposed sign locations and relocations for review and approval by Fairfax County prior to any installation or relocation.

4. Proposed sign locations are approximate and shall be modified in the field to avoid conflicts with underground utilities or other obstructions and to comply with standards referenced in Signage General Note 1. Contractor is responsible for any disruptions in utility service due to digging for signage structure. If proposed signage will impact utility service, it shall be relocated with the approval of Fairfax County at no additional cost.

5. Contractor must provide shop drawings for all nonstandard signs to be approved by Fairfax County. Contractor shall design signs in accordance with the current VDOT Road and Bridge Standards and any subsequent revisions.

6. Unless otherwise indicated on plans, all breakaway sign structures shall be located within 25 feet of the sign's current field location or as directed by Fairfax County.

7. The Contractor is to coordinate with Fairfax County for the handling of all salvaged materials (sign panels, framing members and miscellaneous hardware).

PAVEMENT MARKING GENERAL NOTES;:

1. All signs and pavement markings shall be in accordance with the most current edition of each of the following manuals or the most recent revision thereof:

A. Manual on Uniform Traffic Control Devices (MUTCD)
B. The Virginia Supplement to the Manual on Uniform Traffic Control Devices
C. The Virginia Department of Transportation Road and Bridge Specifications
D. The Virginia Department of Transportation Road and Bridge Standards

2. All pavement markings shall be Type B, Class I, unless otherwise noted in the Pavement Marking legend and in accordance with VDOT Road and Bridge Standards and VDOT Road and Bridge Specifications.

3. Any existing pavement markings that conflict with the proposed pavement markings shall be completely eradicated.

4. Limits of proposed pavement markings and raised markers are approximate and shall be modified in the field to ensure that proposed pavement markings and raised markers continue until existing pavement markings can be matched.

5. Elongated arrows shall be in accordance with MUTCD and VDOT Road and Bridge Specifications.

6. Any changes to the pavement marking plan as shown shall be approved by Fairfax County.

GRAPHIC SCALE IN FEET
0 12.5 25 50

NORTH

TAX MAP 72-2

EMERGENCY POLICE - FIRE - RESCUE 911

FAIRFAX COUNTY, VIRGINIA
DEPARTMENT OF PUBLIC WORKS AND ENVIRONMENTAL SERVICES
12000 GOVERNMENT CENTER PARKWAY, SUITE 449 FAIRFAX, VA., 22035-0052

CAPITAL FACILITIES
703-324-5800

**N. Beauregard Street at N. Chambliss Street Intersection Improvements**

**SIGNING AND STRIPING PLAN**

PRELIMINARY PLANS NOT FOR CONSTRUCTION

| REVISIONS △# | DESCRIPTION | BY | APPROVED | DATE |
|---|---|---|---|---|

PROJECT NO. 5G25-059-003 FUND NO. 300-C30050

| SCALE | DESIGNED BY: DD | SHEET |
|---|---|---|
| SEE GRAPHIC SCALE | DRAFTED BY: MP | 4 |
| | CHECKED BY: BB | |

Kimley»Horn


11400 Commerce Park Drive, Suite 400, Reston, VA 20191
Phone: 703-674-1300

# Existing Conditions

## TRAFFIC DATA COLLECTION

Turning movement count (TMC) data was collected at the intersections of N. Chambliss Street and Little River Turnpike with N. Beauregard Street to perform operational analyses of existing conditions at the study area intersections. TMC data was collected on Tuesday, November 15, 2016 from 6:30 to 9:30 AM and from 3:30 to 6:30 PM to capture weekday commuting traffic and again on Saturday, November 19, 2016 between 11:00 AM and 6:00 PM to capture weekend retail activity at the Plaza at Landmark shopping center. Based on the traffic data collected, representative peak hours of the study area were identified for the intersections as follows:

- Weekday AM peak hour: 7:30 to 8:30 AM
- Weekday PM peak hour: 4:15 to 5:15 PM
- Saturday peak hour: 3:00 to 4:00 PM

The local intersection peak hours differed during the AM peak hour and Saturday peak hour. The representative peak hours noted above reflect the hour during which the highest combined volume of traffic was traveling through the two intersections. **Figure 3** illustrates the existing roadway network geometry at the two study intersections and **Figure 4** summarizes the weekday AM and PM peak hours as well as the Saturday peak hour. **Appendix A** includes detailed TMC data in 15-minute increments.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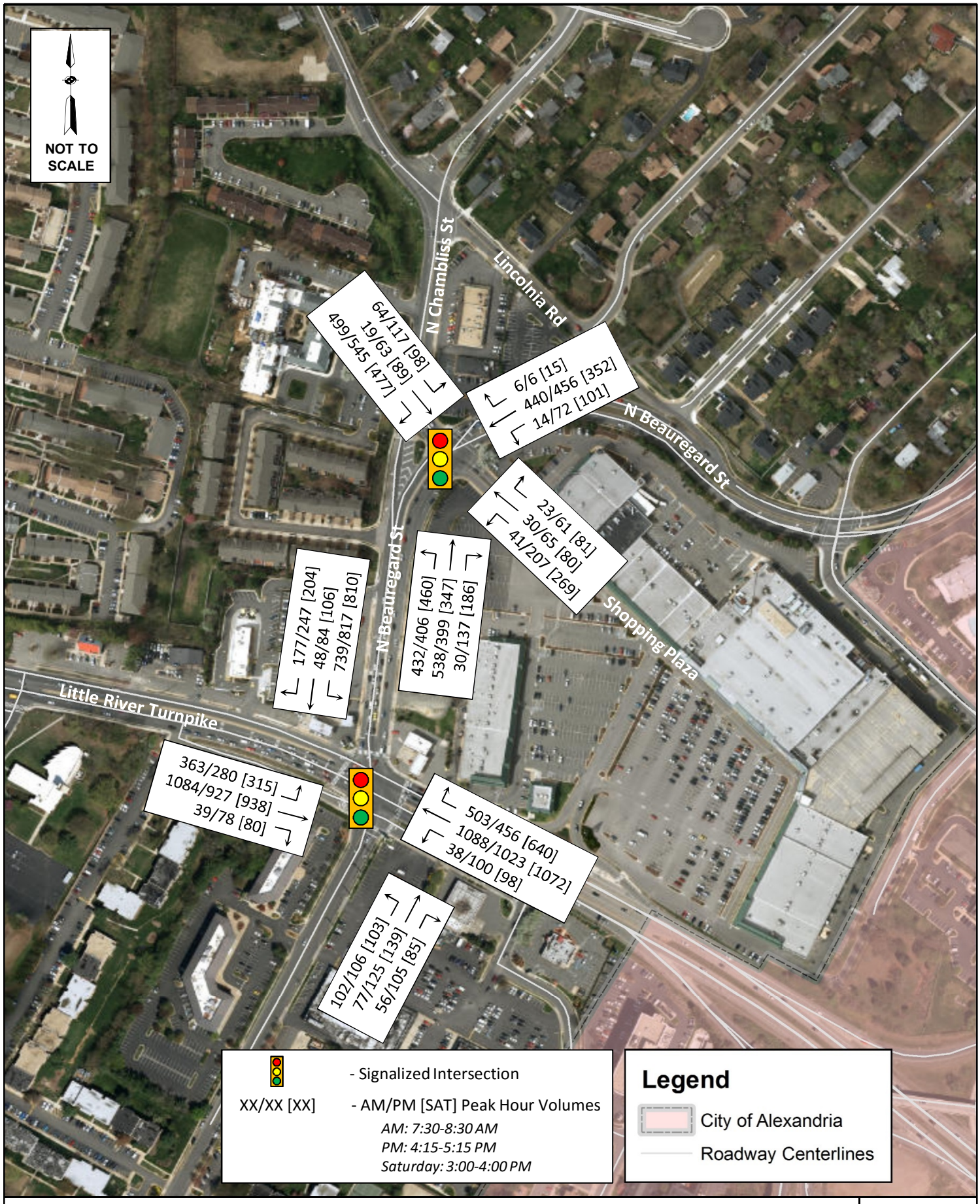
**N Beauregard Street at N Chambliss Street Intersection**
Lane Designations and Traffic Control

**Figure 3**

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**N Beauregard Street at N Chambliss Street Intersection**
Existing Peak Hour Turning Movement Volumes
*Weekday data collected November 15, 2016, Saturday data collected November 19, 2016

**Figure 4**

## CRASH ANALYSIS

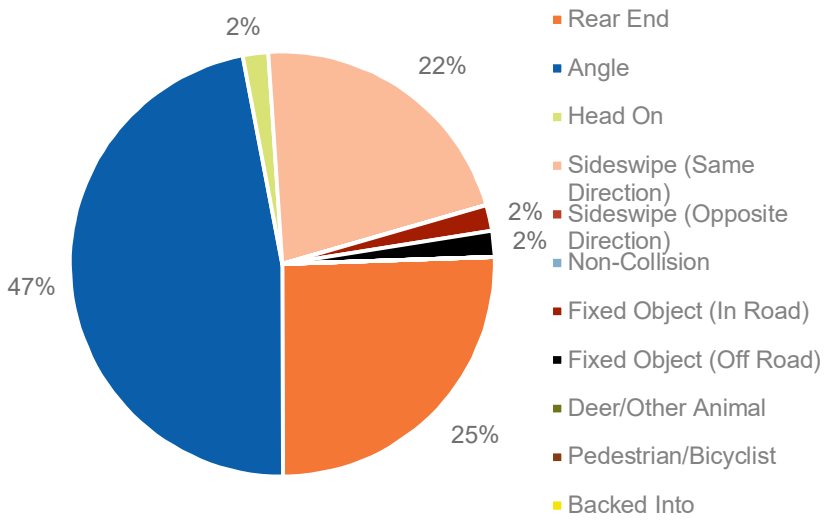
A crash analysis for the intersections of N Beauregard Street and N Chambliss Street was conducted using the latest seven years of available crash data. Crash reports from January 1, 2010 to December 31, 2016 were obtained from the Virginia Department of Transportation (VDOT) database and individual police reports (FR-300). There were 51 crashes reported within the study intersection in the 7-year analysis period, with the majority located within the intersection itself (27 crashes, 53%).

Overall, angle crashes were the most common collision type (25 crashes, 47%), most frequently involving northbound left turn and southbound through movements (5 of 25 angle crashes) and southbound left turn and northbound through movements (9 of 25 angle crashes). Leading up to the intersection, there were several rear end crashes (13 crashes, 25%) and other collision types, which are summarized in **Figure 5**. **Figure 6** Figure 6through **Figure 9** classify the types of crashes within the study area into different categories such as crash severity, time of day, weather, and light conditions.

**Figure 10** illustrates the 51 crash locations and corresponding crash characteristics. The following subsections provide additional information associated with the 51 total crashes that occurred at the study intersections.

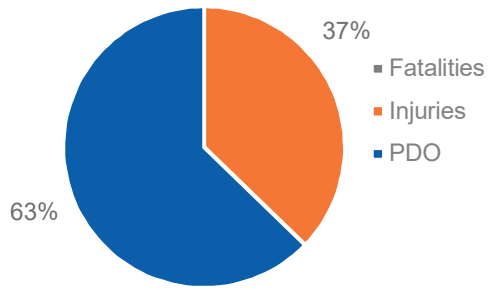
### Crash Trends

*Figure 5: Collision Types*



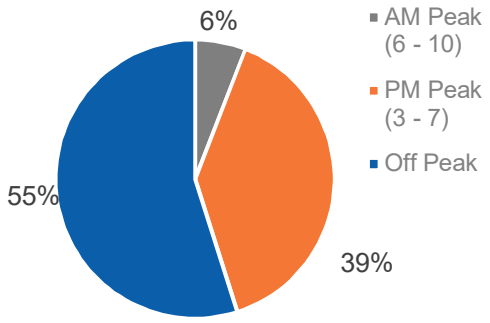

- 25 crashes (47%) resulted from angle collisions
- 13 crashes (25%) resulted from rear end collisions
- 11 crashes (22%) resulted from sideswipe (same direction) collisions
- Head on, fixed object (in road), and fixed object (off road) all had 1 crash each (2%)

*Figure 6: Crash Severity*



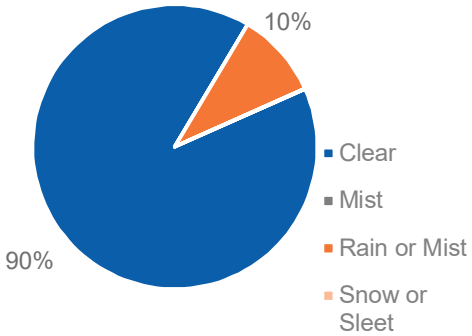

- No fatal crashes occurred
- 19 crashes (37%) resulted in an injury
- 32 crashes (63%) resulted in property damage only

*Figure 7: Time of Day*



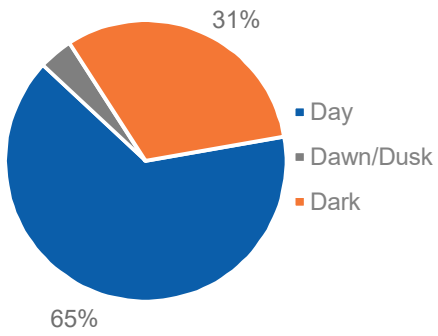

- 28 crashes (55%) occurred during Off Peak periods
- 20 crashes (39%) occurred during the PM Peak (3 to 7 PM)
- 3 crashes (6%) occurred during the AM Peak (6 to 10 AM)

*Figure 8: Weather Conditions*



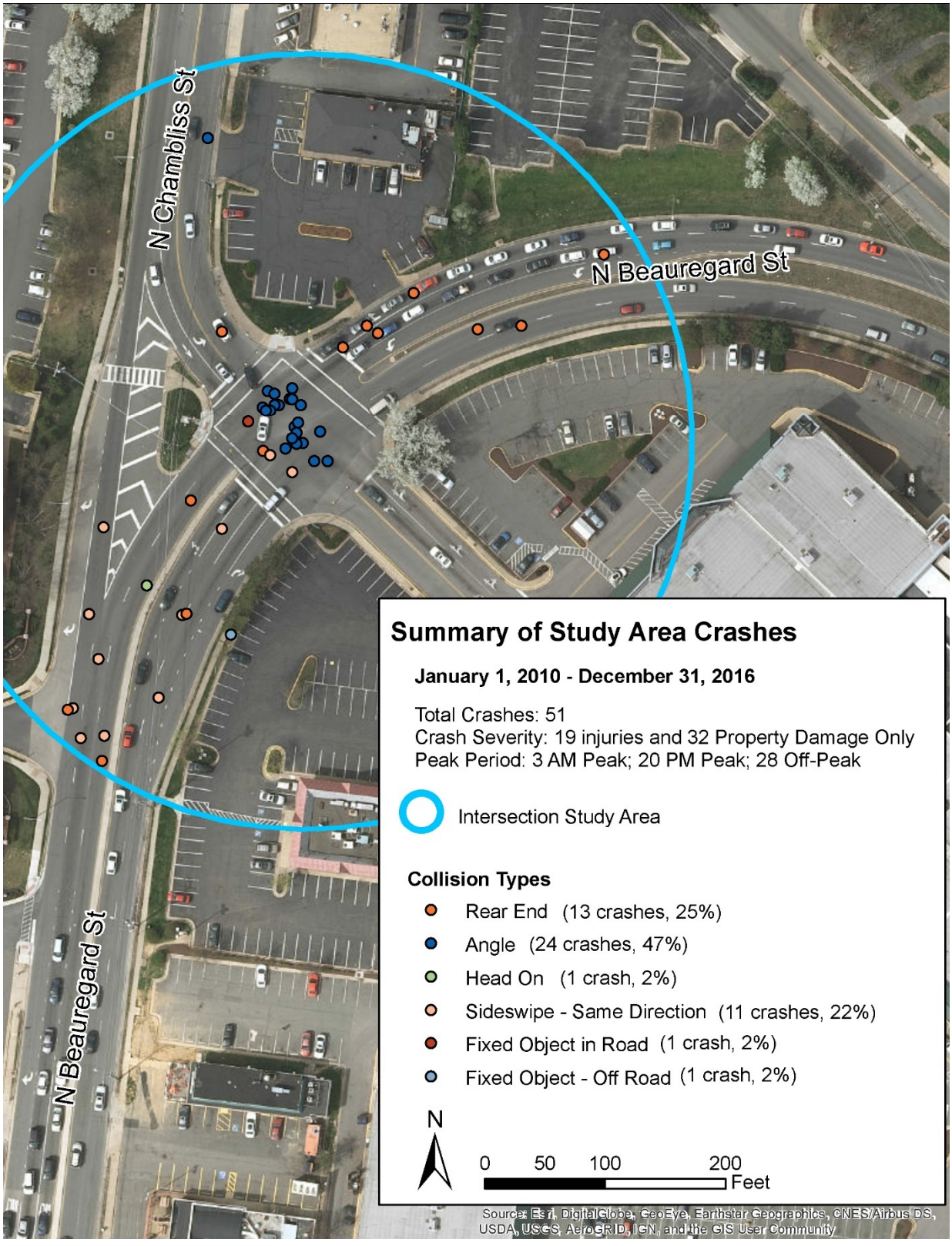

- The vast majority of crashes (46 total crashes or 90%) occurred under clear/cloudy weather conditions
- Weather conditions do not represent a major contributing factor to intersection collisions

*Figure 9: Light Conditions*




- Most crashes (33 total crashes or 65%) occurred under day light conditions
- Light conditions do not represent a major contributing factor to intersection collisions

*Figure 10: Intersection Crash Analysis*



## TRAFFIC OPERATIONS ANALYSIS

Traffic operations analyses were performed in two stages. Initial traffic analyses were completed using Synchro 9 software to evaluate existing and future no build conditions as well as mitigation scenarios that optimized overall intersection operations. These analyses were completed in advance of the June 13, 2017 public meeting. VISSIM software was used in order to perform a microsimulation analysis that better simulated traffic behaviors of the study area. This software platform was also better suited to evaluate queuing impacts along N. Chambliss Street, a major concern of residents in the Lincolnia community. The ultimate objective of the traffic operations analysis was to identify the optimal intersection geometry and operations in order to guide the design of improvements that enhance pedestrian safety and mobility and balance operations for all vehicular movements at the intersection.

### Synchro Existing Conditions Analysis

Existing conditions analyses were based on the existing peak hour turning movement volumes described above, intersection geometry, peak hour factors and heavy vehicle percentages (when available), traffic control and signal timing, and speed. The traffic signal timings were obtained from VDOT. Both signals operate as actuated-coordinated intersections during the peak hours evaluated in this study, which allows for controlled progression of traffic between the two intersections. The intersection at N. Chambliss Street operates with protected-permissive left-turn signal phasing along N. Beauregard Street and split phase left-turn sequencing for the side street approaches. A pedestrian signal phase is programmed to run concurrently with the westbound approach and operates as an actuated pedestrian signal phase. The Little River Turnpike intersection operates with split phase left-turn sequencing for the northbound and southbound approaches and protected left-turn phasing for the westbound and eastbound left turns. Actuated pedestrian signals are programmed to operate with the northbound, southbound, and westbound vehicle movements.

All intersections were analyzed using Synchro 9 software, which provides an assessment of the operational conditions at each study intersection. The Transportation Research Board's (TRB) *Highway Capacity Manual* (HCM) methodologies govern the methodology for evaluating capacity and the quality of service provided to road users, defined as the level of service (LOS). LOS ranges from A to F—A indicating a condition of little or no congestion and F indicating a condition with severe congestion, unstable traffic flow, and stop-and-go conditions. For intersections, LOS is based on the average delay experienced by all traffic using the intersection during the busiest (peak) 15-minute period. LOS A through D are considered acceptable. **Table 1** summarizes the delay associated with each LOS category.

**Table 1 - Level of Service Criteria for Signalized Intersections**

| LOS | Delay per Vehicle (seconds per vehicle) |
|---|---|
| A | ≤ 10 |
| B | > 10 – 20 |
| C | > 20 – 35 |
| D | > 35 – 55 |
| E | > 55 – 80 |
| F | > 80 |

** Source: Transportation Research Board, Highway Capacity Manual 2010*

The HCM 2000 module of Synchro was used to report LOS and delay for each study intersection to evaluate the configurations of the study intersections due to the fact that the HCM 2010 module in Synchro requires strict NEMA phasing and geometry. At Little River Turnpike, HCM 2010 cannot calculate delay for movements with exclusive and shared lanes, and for the intersection at N. Chambliss, detectors are required for all movements. The 95$^{th}$ percentile queue lengths for all approaches and lane groups were also evaluated in Synchro. **Table 2** summarizes the LOS, delay, and queue by movement for all study intersections for existing conditions. Failing levels of service are indicated in yellow (LOS E) or red (LOS F). The Synchro HCM reports can be found in **Appendix B**.

The results of the existing conditions analyses indicate that the intersection of N. Beauregard Street at N. Chambliss Street operates at an overall LOS D or better during the three peak hours evaluated. The cycle length during the AM and PM peak hours is relatively low (less than two minutes), which contributes to reduced levels of delay experienced by the majority of the turning movements. On Saturday, the cycle length increases to nearly three minutes. The green time allocated to the side street approaches, while adequate to serve the demand based upon the reported volume to capacity ratios, represents less than 30 percent of the cycle length. Due to the less frequent turnover of the signal green time as compared to weekday peak hours, delay is much higher for the side street movements. 95$^{th}$ percentile queues are largely contained within the available storage with the exception of the westbound through and right-turn movement on Saturday and the northbound left-turn movement during all peaks.

The Little River Turnpike and N. Beauregard Street intersection is operating at an overall LOS E during all peak hours under existing conditions evaluated as part of this study. 95$^{th}$ percentile queues in the southbound direction extend to the north between 800 and 1,000 feet, which is greater than the available storage distance of approximately 650 feet between the two traffic signals. This indicates that there are periods of time when the queues at Little River Turnpike could be negatively impacting the signal operations at N. Beauregard Street and N. Chambliss Street.

**Table 2: Synchro Summary of LOS, Delay, Queues (Existing Conditions)**

| Intersection | | Existing Conditions (2016) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Approach | Movement | Available Storage (ft) | AM | | PM | | SAT | | |
| 1. Little River Turnpike & N. Beauregard Street | | | LOS | Queue (ft) | LOS | Queue (ft) | LOS | Queue (ft) | |
| Eastbound (Little River Turnpike) | L | 375 | F (93.9) | 302 | F (120.0) | #297 | F (85.4) | 239 | |
| | TR | ‡ | D (40.8) | 745 | D (47.3) | 683 | D (45.1) | 611 | |
| | *Overall* | | D (53.7) | | E (63.2) | | D (54.6) | | |
| Westbound (Little River Turnpike) | L | 215 | F (101.6) | 100 | F (121.4) | #227 | F (98.0) | #196 | |
| | T | ‡ | E (58.4) | #893 | D (51.2) | 708 | E (55.3) | 698 | |
| | R | ‡ | B (17.7) | 280 | B (13.5) | 265 | C (20.5) | 453 | |
| | *Overall* | | D (46.9) | | D (44.8) | | D (45.3) | | |
| Northbound (N. Beauregard Street) | L | 145 | F (102.4) | 207 | F (125.6) | #271 | F (80.1) | 185 | |
| | T | ‡ | F (90.1) | 163 | F (146.9) | #326 | F (95.2) | #255 | |
| | R | ‡ | E (79.3) | 113 | F (80.6) | 203 | E (61.2) | 135 | |
| | *Overall* | | F (92.8) | | F (119.5) | | F (81.6) | | |
| Southbound (N. Beauregard Street) | L | ‡ | F (95.9) | #776 | F (116.5) | #951 | F (126.3) | #757 | |
| | T | ‡ | F (93.6) | #836 | F (112.9) | #1025 | F (127.3) | #795 | |
| | R | ‡ | D (46.4) | 88 | D (49.0) | 193 | D (50.4) | 76 | |
| | *Overall* | | F (85.9) | | F (100.5) | | F (112.9) | | |
| **Overall Intersection** | | | E (60.5) | | E (70.7) | | E (67.1) | | |
| 2. North Chambliss Street & N. Beauregard Street | | | LOS | Queue (ft) | LOS | Queue (ft) | LOS | Queue (ft) | |
| Eastbound (North Chambliss Street) | L | ‡ | D (46.3) | 83 | D (54.5) | 138 | F (86.7) | 175 | |
| | T | ‡ | D (43.6) | 34 | D (44.9) | 83 | F (82.2) | 163 | |
| | *Overall* | | D (45.7) | | D (51.1) | | F (84.5) | | |
| Westbound (Plaza at Landmark Shopping Center) | L | ‡ | D (46.1) | 60 | E (55.1) | #231 | F (81.5) | 388 | |
| | TR | 140 | D (45.3) | 57 | D (40.5) | 110 | E (61.9) | 204 | |
| | *Overall* | | D (45.7) | | D (49.6) | | E (74.1) | | |
| Northbound (N. Beauregard Street) | L | 110 | C (24.2) | 379 | C (24.2) | m230 | B (16.1) | 454 | |
| | T | ‡ | A (9.7) | 138 | B (15.5) | m108 | B (17.4) | 182 | |
| | R | 175 | B (10.1) | m0 | D (37.5) | m12 | B (19.7) | m75 | |
| | *Overall* | | B (16.0) | | C (22.4) | | B (17.2) | | |
| Southbound (N. Beauregard Street) | L | 195 | B (17.8) | 13 | C (22.9) | 48 | C (28.5) | 95 | |
| | TR | ‡ | C (22.6) | 181 | C (31.0) | 202 | D (36.5) | 256 | |
| | *Overall* | | C (22.5) | | C (29.9) | | C (34.8) | | |
| **Overall Intersection** | | | **C (21.0)** | | **C (31.6)** | | **D (39.0)** | | |

# 95th percentile volume exceeds capacity, queue may be longer
m volume for 95th percentile is metered by upstream signal
‡ storage distance is continuous to the upstream intersection

### VISSIM Existing Conditions Analysis

VISSIM 9.0 software was used to model the PM peak period. VISSIM microsimulation efforts were limited to the PM peak period since the traffic volumes and operating conditions represent the most congested operations within the study area. Note that the intersection of N. Chambliss Street and Lincolnia Road was included in the microsimulation model in order to replicate the metering effect of the signal on traffic traveling toward the study intersection. An existing conditions VISSIM model was developed to use as a starting point for modeling future no build and alternative geometry conditions.

The VISSIM existing conditions PM model was calibrated to meet predefined thresholds based on the VDOT Traffic Operations and Safety Analysis Manual (TOSAM) Version 1.0. The model meets thresholds for volume throughput and travel times. Queue spillback in the model is consistent with field observations for critical turning movements. The VISSIM calibration memorandum can be found in **Appendix C**.

**Table 3** identifies the volume throughput, average delay, average queue, and maximum queue of the two intersection on N. Beauregard Street. As part of the coding of the VISSIM model, a queue counter was assigned to the southbound through movement from N. Chambliss Street onto N. Beauregard Street in order to capture the total queue impact for the movement, not just the queue associated with the traffic signal. As such, LOS and delay are not reported for this movement in **Table 3**. It is important to note that the delays and queues for the VISSIM models were not calculated using the same HCM methodology as the Synchro outputs; therefore, the results in the VISSIM model cannot be directly compared to those of Synchro. The signalized intersection LOS reported is based on average VISSIM microsimulation delay and is an approximation to the HCM.

The results in the VISSM model show that the following existing conditions were simulated in the model:

- The southbound approach along N. Beauregard Street at Little River Turnpike spills back through the intersection of N. Beauregard Street and N. Chambliss Street, which intermittently limits the ability of southbound through movements along N. Beauregard Street and N. Chambliss Street to proceed on green.
- The westbound left turn out of the shopping center at N. Beauregard Street and N. Chambliss Street also cannot always proceed on green due to the southbound queue spillback along N. Beauregard Street. Some vehicles, which do make it through the signal on green, end up preventing the southbound through movement from proceeding on green (i.e. “blocking the box”).
- The northbound left-turn movement from N. Beauregard Street to N. Chambliss Street exceeds its storage and routinely spills back out of its short turn bay, which is less than 150 feet in length.

- The southbound merge from N. Chambliss Street onto N. Beauregard Street (to access the southbound left-turn bay at Little River Turnpike) spills back to Lincolnia Road and onto Lincolnia Road eastbound, as observed in the field.

Table 3: VISSIM Summary of Volume Throughput, Delay, and Queues (Existing Conditions)

| PM Peak Hour (4:15 - 5:15 PM) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Intersection** | **Approach** | **Movement** | **Average Volume (vph)** | | **Average Delay (sec/veh)** | | **Average Queue Length (feet)** | | **Maximum Queue Length (feet)** | |
| **Beauregard Street and Chambliss Street** | **NB** | **LT** | 382 | 891 | 28.2 (C) | 19.1 (B) | 111 | 111 | 165 | 165 |
| | | **TH** | 373 | | 15.7 (B) | | 30 | | 45 | |
| | | **RT** | 136 | | 3.1 (A) | | 1 | | 2 | |
| | **SB** | **LT** | 65 | 488 | 71.1 (E) | 138.6 (F) | 20 | 358 | 106 | 538 |
| | | **TH** | 416 | | 149.3 (F) | | 358 | | 538 | |
| | | **RT** | 7 | | 130.3 (F) | | 358 | | 538 | |
| | **EB** | **LT** | 120 | 181 | 50.6 (D) | 51.7 (D) | 48 | 48 | 89 | 89 |
| | | **TH** | 61 | | 53.8 (D) | | 23 | | 41 | |
| | **WB** | **LT** | 211 | 342 | 78.4 (E) | 63 (E) | 113 | 113 | 150 | 150 |
| | | **TH** | 70 | | 46.2 (D) | | 18 | | 28 | |
| | | **RT** | 61 | | 29.3 (C) | | 22 | | 32 | |
| | **Intersection** | | 1902 | | 60.8 (E) | | | | | |
| **Chambliss Street SB Merge at Beauregard Street** | | **SBT** | | | | | 241 | | 1,147 | |
| **Beauregard Street and Little River Turnpike** | **NB** | **LT** | 102 | 334 | 158.1 (F) | 138.2 (F) | 125 | 159 | 216 | 216 |
| | | **TH** | 128 | | 158.8 (F) | | 159 | | 197 | |
| | | **RT** | 104 | | 93.4 (F) | | 79 | | 119 | |
| | **SB** | **LT** | 807 | 1130 | 91.8 (F) | 80.7 (F) | 377 | 377 | 422 | 422 |
| | | **TH** | 80 | | 91.4 (F) | | 377 | | 422 | |
| | | **RT** | 243 | | 40.1 (D) | | 44 | | 71 | |
| | **EB** | **LT** | 281 | 1267 | 154 (F) | 64.5 (E) | 190 | 190 | 456 | 456 |
| | | **TH** | 908 | | 38.8 (D) | | 174 | | 306 | |
| | | **RT** | 78 | | 42.2 (D) | | 174 | | 306 | |
| | **WB** | **LT** | 99 | 1607 | 146.9 (F) | 42.6 (D) | 111 | 188 | 166 | 207 |
| | | **TH** | 1010 | | 42.1 (D) | | 188 | | 207 | |
| | | **RT** | 498 | | 22.7 (C) | | 107 | | 129 | |
| | **Intersection** | | 4338 | | 66.3 (E) | | | | | |

# Future Conditions

## TRAFFIC VOLUME DEVELOPMENT

To evaluate future conditions, traffic volumes were developed to reflect anticipated growth over a ten-year period between 2016 and 2026. 2026 is the design year established by FCDOT. Historical traffic data and regional traffic models were evaluated to determine an appropriate growth rate to apply to existing TMC data. The Virginia Department of Transportation (VDOT) publishes average annual daily traffic (AADT) data for the majority of primary roadways throughout the state. In addition, the Metropolitan Washington Council of Governments (MWCOG) maintains a regional travel demand model (TDM) that contains traffic data for base year (2010) and future year (2040) roadway conditions. These two data sources were reviewed in the development of a traffic volume growth rate.

### VDOT AADT

AADT were obtained from the VDOT website for the period between 2011 and 2015, the most recent year of available traffic data. AADT information was extracted for several roadway segments in the vicinity of the study area intersections. **Table 4** summarizes the AADT data for each roadway segment for the calendar years between 2011 and 2015. As shown, many roadways exhibit negative growth over the four-year period. Only two roadways demonstrate a nominal amount of growth—N. Beauregard Street between Little River Turnpike and N. Chambliss Street and Lincolnia Road between N. Beauregard Street and N. Chambliss Street.

**Table 4: VDOT AADT Traffic Data Summary**

| ROADWAY | | | HISTORIC ANNUAL AVERAGE DAILY TRAFFIC (AADT) | | | | | TRAFFIC GROWTH RATE |
|---|---|---|---|---|---|---|---|---|
| Name | From | To | 2011 | 2012 | 2013 | 2014 | 2015 | 4 YEARS (2011-2015) |
| N Beauregard Street | Little River Turnpike (Route 236) | N Chambliss Street | 29,000 | 28,000 | 28,000 | 27,000 | 31,000 | 1.72% |
| | N Chambliss Street/N Beauregard Street | Lincolnia Road | 18,000 | 20,000 | 20,000 | 20,000 | 16,000 | -2.78% |
| | Lincolnia Road | WCL Alexandria | 17,000 | 17,000 | 17,000 | 16,000 | 16,000 | -1.47% |
| North Chambliss Street | N Beauregard Street | Lincolnia Road | 14,000 | 14,000 | 13,000 | 13,000 | 14,000 | 0.00% |
| | Lincolnia Road | Kling Drive | 3,000 | 2,400 | 2,400 | 2,400 | 2,400 | -5.00% |
| Lincolnia Road | N Beauregard Street | N Chambliss Street | 3,100 | 3,300 | 3,200 | 3,200 | 3,200 | 0.81% |
| | N Chambliss Street | Braddock Road | 16,000 | 14,000 | 14,000 | 14,000 | 13,000 | -4.69% |
| Little River Turpike | Braddock Road | WCL Alexandria | 36,000 | 36,000 | 34,000 | 34,000 | 33,000 | -2.08% |

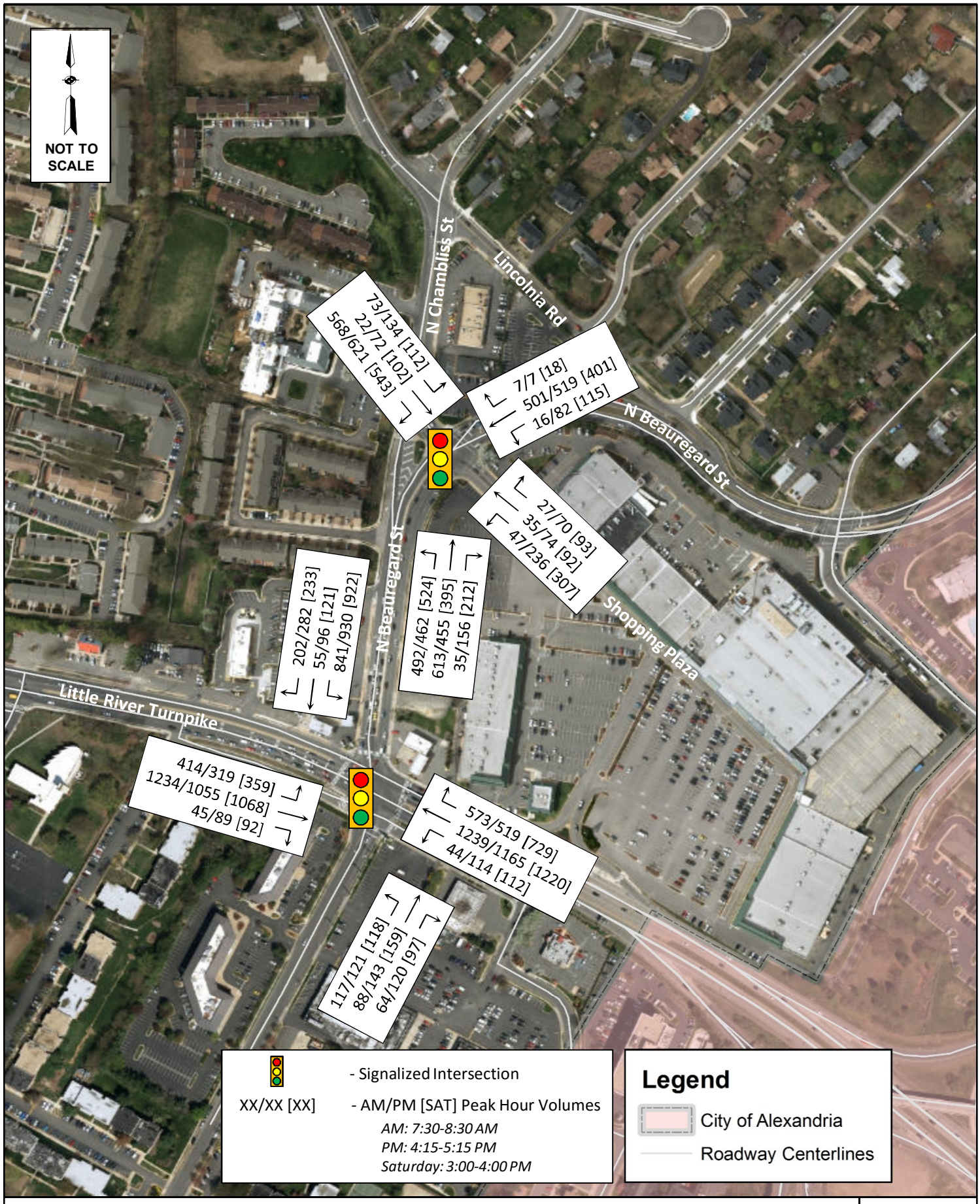
### MWCOG TDM

24-hour daily traffic volumes were extracted from the MWCOG TDM to provide another reference point in identifying an appropriate growth rate. Model version 2.3.57a was used to capture traffic assignments for the base year (2015) model and the future year (2040) conditions for roadway links consistent with those listed in **Table 4**. The resultant 24-hour daily traffic volumes are summarized in **Table 5**. "N/A" is noted for roadway segments not included in the model. Although the data suggest growth along study area roadways, more than half are expected to increase at an annual growth rate of 0.5 percent. Little River Turnpike exhibits the highest rate of annual traffic volume growth at 1.27 percent.

**Table 5: MWCOG Traffic Data Summary**

| ROADWAY | | | 24-HOUR VOLUMES | | TRAFFIC GROWTH RATE |
|---|---|---|---|---|---|
| Name | From | To | 2015 | 2040 | 25 YEARS (2015-2040) |
| N Beauregard Street | Little River Turnpike (Route 236) | N Chambliss Street | 29,790 | 32,437 | 0.36% |
| | N Chambliss Street/N Beauregard Street | Lincolnia Road | 25,734 | 26,707 | 0.15% |
| | Lincolnia Road | WCL Alexandria | 18,171 | 22,525 | 0.96% |
| North Chambliss Street | N Beauregard Street | Lincolnia Road | 15,470 | 16,088 | 0.16% |
| | Lincolnia Road | Kling Drive | NA | NA | NA |
| Lincolnia Road | N Beauregard Street | N Chambliss Street | NA | NA | NA |
| | N Chambliss Street | Braddock Road | 13,878 | 14,137 | 0.07% |
| Little River Turpike | Braddock Road | WCL Alexandria | 47,685 | 62,789 | 1.27% |

Based on a review of the data sources above, a relatively low growth rate would be appropriate for the study area intersections. FCDOT completed an independent traffic analysis of the study intersections in October 2016, in which a growth rate of 1.3 percent was used to develop traffic volumes for 2026 conditions. To be consistent with work previously done by the county and to be conservative, an exponential growth rate of 1.3 percent was applied to existing traffic volumes to develop future condition (2026) turning volumes. Error! Reference source not found. summarizes the future weekday AM and PM peak hour traffic volumes as well as the Saturday peak hour conditions.

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**N Beauregard Street at N Chambliss Street Intersection**
Future (2026) Peak Hour Turning Movement Volumes

**Figure 11**

## TRAFFIC OPERATIONS ANALYSIS

The future traffic operations analyses were also completed in two stages. Synchro analysis results were used to help identify the optimal geometric and operational configuration considering the preliminary intersection design configuration. This was factored into the development of the preliminary design plans in April 2017. Following the June 13, 2017 public meeting, a more detailed approach to future traffic operations analyses was considered using VISSIM software to understand queuing impacts. As part of this, additional concepts were considered that focused on increasing throughput and reducing vehicle queues for the southbound movement from N. Chambliss Street.

The 2026 future conditions analyses were based on the future traffic volumes with existing and proposed intersection geometry and traffic control at the study area intersections. Peak hour factors and heavy vehicle percentages were the same as those used in the existing conditions analyses. Since the intersection geometry at Little River Turnpike was not modified and future traffic volumes were identical between all scenarios, very minor adjustments to existing signal timings were made to optimize existing signal operations. The same adjustments were applied across all future scenarios; thus, any changes in intersection delay at Little River Turnpike can be attributed to changes in operations and vehicle progression from the signal at N. Chambliss Street. For the no-build scenario, existing signal timings at N. Chambliss were maintained, while in the build scenarios, signal timings were optimized to account for changes in signal operations and geometry.

### Synchro Future Conditions Analysis

In this report, four different scenarios were evaluated using Synchro for the future conditions analysis as part of the preliminary intersection design configuration developed in April 2017:

- **No-Build**: 2026 future volumes
- **Base Scenario**: removal of channelized eastbound right turn onto N. Beauregard Street from N. Chambliss Street
- **Scenario A**: protected/permissive left-turn phasing from N. Chambliss Street and Plaza at Landmark Shopping Center approaches
- **Scenario B**: protected/permissive left-turn phasing for northbound N. Beauregard Street, protected left-turn phasing for southbound N. Beauregard Street and westbound Plaza at Landmark Shopping Center approaches, and permissive left-turn phasing for eastbound N. Chambliss Street.

#### *Synchro 2026 No-Build Conditions*

Under 2026 no-build conditions, the intersection at N. Chambliss Street experiences an incremental increase in delay of approximately of five seconds for the overall intersection compared to existing conditions. Individual movement delays generally increase between 5 and 15 seconds as a result of higher traffic volumes traveling through the study intersection. At the Little River Turnpike intersection, changes in delay vary much more, with increases in delay of more than 25 seconds expected during the PM peak hour among the eastbound left-turn and the northbound and southbound through and left-turn movements. Under existing conditions, demand exceeds available

capacity; thus, the additional volume associated with traffic growth further strains intersection operations. Without any additional capacity to support growth (i.e. green time, turning lanes), delay subsequently increases for these non-primary intersection movements. The results of the operational analysis are shown in **Table 6.** The Synchro HCM and queuing reports can be found in **Appendix B.**

***Table 6: Synchro Summary of LOS, Delays, and 95th Percentile Queues (2026 No-Build Conditions)***

| Intersection | | | No-Build Scenario (2026) | | | | | |
|---|---|---|---|---|---|---|---|---|
| Approach | Movement | Average Storage (ft) | AM | | PM | | SAT | |
| 1. Little River Turnpike & N. Beauregard Street | | | LOS | Queue (ft) | LOS | Queue (ft) | LOS | Queue (ft) |
| Eastbound (Little River Turnpike) | L | 375 | F (102.6) | #364 | F (147.2) | #360 | F (98.9) | #306 |
| | TR | ‡ | D (48.4) | 875 | D (52.3) | 819 | D (52.1) | 726 |
| | *Overall* | | E (61.7) | | E (73.0) | | E (63.2) | |
| Westbound (Little River Turnpike) | L | 215 | F (148.9) | #130 | F (129.9) | #278 | F (119.2) | #250 |
| | T | ‡ | F (83.9) | #1063 | E (56.2) | 848 | E (74.6) | #881 |
| | R | ‡ | C (20.1) | 390 | B (14.6) | 328 | C (23.8) | 592 |
| | *Overall* | | E (65.8) | | D (48.9) | | E (59.1) | |
| Northbound (N. Beauregard Street) | L | 145 | F (114.1) | #256 | F (151.4) | #322 | F (92.3) | #236 |
| | T | ‡ | F (92.6) | 184 | F (182.5) | #384 | F (133.3) | #339 |
| | R | ‡ | F (80.7) | 131 | F (80.5) | 228 | E (62.5) | 156 |
| | *Overall* | | F (99.1) | | F (140.8) | | F (102.0) | |
| Southbound (N. Beauregard Street) | L | ‡ | F (98.6) | #894 | F (163.5) | #1152 | F (151.1) | #744 |
| | T | ‡ | F (95.5) | #1023 | F (159.1) | #1151 | F (151.2) | #822 |
| | R | ‡ | D (42.1) | 111 | D (50.3) | 248 | D (40.6) | 81 |
| | *Overall* | | F (86.9) | | F (137.3) | | F (131.0) | |
| **Overall Intersection** | | | E (70.9) | | F (86.5) | | F (80.9) | |
| 2. North Chambliss Street & N. Beauregard Street | | | LOS | Queue (ft) | LOS | Queue (ft) | LOS | Queue (ft) |
| Eastbound (North Chambliss Street) | L | ‡ | D (48.2) | 93 | E (59.3) | #174 | F (88.6) | 195 |
| | T | ‡ | D (43.4) | 37 | D (44.6) | 92 | F (83.9) | 182 |
| | *Overall* | | D (47.1) | | D (54.2) | | F (86.3) | |
| Westbound (Plaza at Landmark Shopping Center) | L | ‡ | D (46.1) | 66 | E (62.3) | #281 | F (84.0) | 446 |
| | TR | 140 | D (45.3) | 62 | D (40.5) | 128 | E (60.4) | 237 |
| | *Overall* | | D (45.7) | | D (54.1) | | E (75.1) | |
| Northbound (N. Beauregard Street) | L | 110 | D (37.4) | #610 | D (39.9) | m298 | C (22.9) | m505 |
| | T | ‡ | B (10.0) | 166 | B (17.5) | m129 | B (19.9) | m196 |
| | R | 175 | B (10.4) | m0 | C (26.2) | m14 | C (25.5) | m73 |
| | *Overall* | | C (21.8) | | C (28.4) | | C (22.4) | |
| Southbound (N. Beauregard Street) | L | 195 | C (23.2) | 14 | C (25.7) | 53 | D (36.4) | 109 |
| | TR | ‡ | C (30.6) | 207 | D (36.5) | 231 | D (47.1) | 293 |
| | *Overall* | | C (30.4) | | C (35.0) | | D (44.8) | |
| **Overall Intersection** | | | **C (26.9)** | | **D (36.8)** | | **D (44.1)** | |

# 95th percentile volume exceeds capacity, queue may be longer
m volume for 95th percentile is metered by upstream signal
‡ storage distance is continuous to the upstream intersection

Changes to the existing intersection configuration at N. Beauregard Street and N. Chambliss Street are proposed to enhance pedestrian access and provide the optimal geometric and operational configuration that is conducive to the pedestrian enhancements. One of the primary geometric changes is the elimination of the free-flow eastbound right-turn movement, which is intended to alleviate weaving that occurs between free-flow eastbound right-turn vehicles onto N. Beauregard Street with through and westbound left-turn vehicles. By eliminating the free-flow movement, the right turn can be controlled by the traffic signal, which provides for safer access for pedestrians.

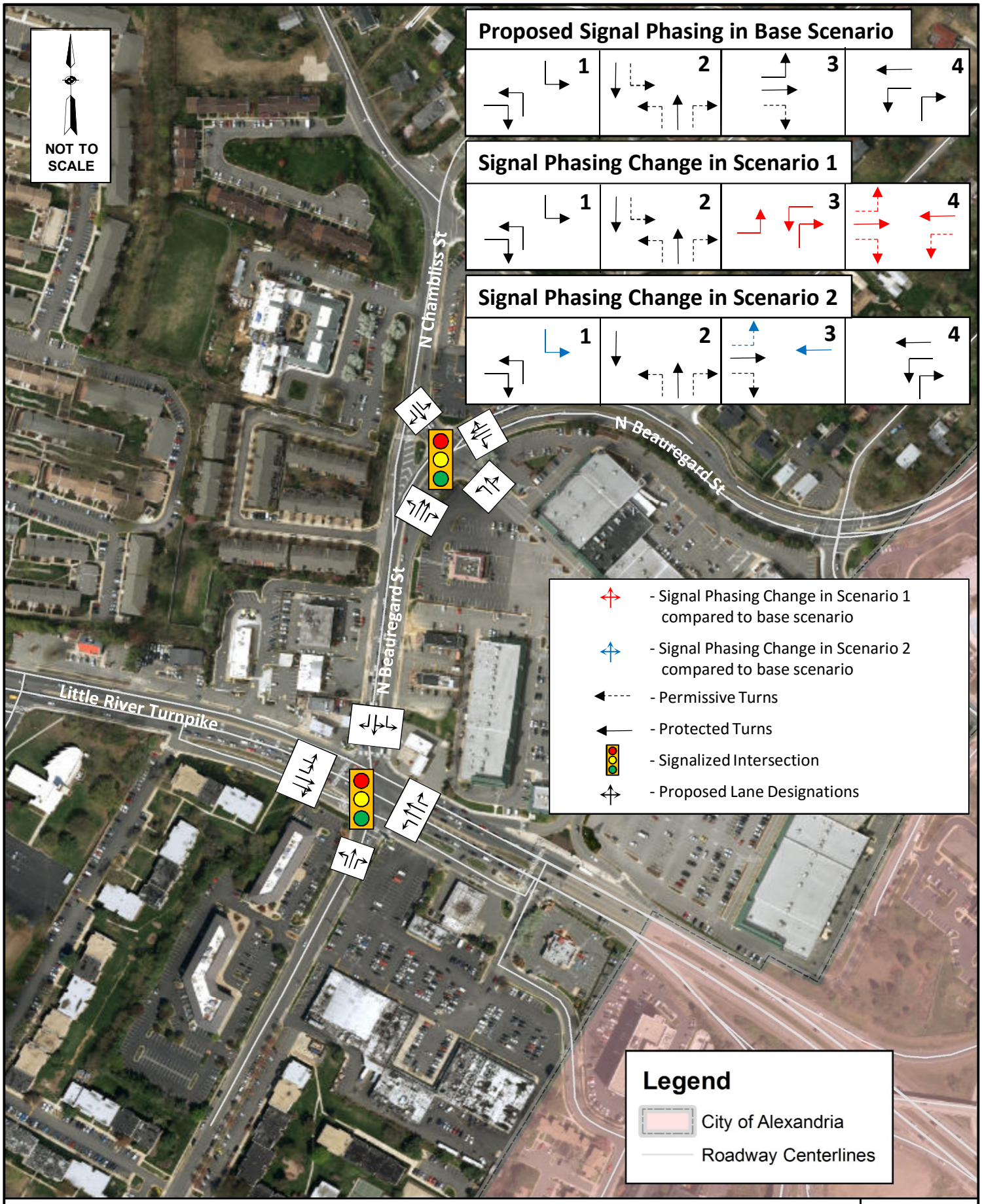
Initially, FCDOT requested that the intersection at N. Beauregard Street and N. Chambliss Street be reconfigured to eliminate the free-flow right-turn movement and shift the turning movement to the signalized intersection (referred to as the base scenario). As part of this study, VDOT requested that intersection operations be evaluated to determine the appropriate signal control that provides for optimal signal operations. An additional alternative (referred to as Scenario A) was identified that consists of an eastbound right-turn from N. Chambliss Street controlled by the traffic signal (similar to the base scenario) with protected-permissive left-turn phasing for N. Chambliss Street and the Plaza at the Landmark shopping center approaches. In both scenarios, the eastbound right-turn operates as a permissive movement with the eastbound approach to allow for pedestrian access across the northbound approach. During the protected left-turn phase for the northbound left-turn movement, the eastbound right-turn movement receives additional green time with a protected right-turn overlap phase.

The results of the crash analysis suggest there is an angle crash pattern within the study intersection. This prompted the analysis of left-turn phasing at the intersection, which considered crash history, sight distance, and volume cross products. The results of the analysis indicated that the initial phasing proposed in Scenario A was inadequate given the intersection conditions. Protected-permissive flashing yellow arrow (FYA) left-turn phasing was proposed for all movements. It was determined through the left-turn phasing analysis that the southbound and westbound left-turn movements could not operate in a permissive mode. In addition, it was determined the eastbound left-turn movement did not require a protected signal phase. The phasing considered in Scenario B reflects the final recommended signal phasing at the intersection and is summarized in **Table *7***. The results of the left-turn phasing analysis is included in **Appendix D**.

**Table 7: Summary of Existing and Proposed Left-Turn Phasing**

| Approach | Existing Left-Turn Phasing | Scenario A Left-Turn Phasing | Proposed Scenario B Left-Turn Phasing |
|---|---|---|---|
| NB | Protected-Permissive | Protected-Permissive (FYA) | Protected-Permissive (FYA) |
| SB | Protected-Permissive | Protected-Permissive (FYA) | Protected |
| EB | Protected (Split) | Protected-Permissive (FYA) | Permissive (FYA) |
| WB | Protected (Split) | Protected-Permissive (FYA) | Protected |

**Figure 12** illustrates the proposed geometry and signal operations of the Base Scenario, Scenario A, and Scenario B. **Table 8** and **Table 9** summarize the Synchro results of the operational analysis in Synchro for LOS, delay, and 95$^{th}$ percentile queuing for the intersections of N. Beauregard Street at Little River Turnpike and N. Chambliss Street, respectively. The Synchro HCM and queuing reports can be found in **Appendix B**. A comparative tabular summary of the Synchro HCM and queuing reports can also be found at the beginning of **Appendix B**.

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**N Beauregard Street at N Chambliss Street Intersection**

Proposed Traffic Control for the Base Scenario, Scenario 1, and Scenario 2

**Figure 12**

*Table 8: Synchro Summary of LOS, Delays, and 95th Percentile Queues*
*(Existing, No-Build, Base Scenario, Scenario A, and Scenario B, N. Beauregard Street at Little River Turnpike)*

| Intersection | | | Existing Conditions (2016) | | | | | | No-Build Scenario (2026) | | | | | | Base Scenario (2026): Removal of channelized eastbound right turn onto N Beauregard Street from N Chambliss Street | | | | | | Scenario A (2026): Protected/Permissive left-turn phasing for the N Chambliss Street and Plaza at Landmark Shopping Center approaches | | | | | | Scenario B (2026): Protected/Permissive left-turn phasing for NB N Beauregard Street, protected left-turn phasing for SB N Beauregard Street and Plaza at Landmak Shopping Center approaches, and permissive left-turn phasing for EB N. Chambliss Street | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach | Movement | Average Storage (ft) | AM | | PM | | SAT | | AM | | PM | | SAT | | AM | | PM | | SAT | | AM | | PM | | SAT | | AM | | PM | | SAT | |
| 1. Little River Turnpike & Beauregard Street | | | LOS | Queue (ft) | LOS | Queue (ft) | LOS | Queue (ft) | LOS | Queue (ft) | LOS | Queue (ft) | LOS | Queue (ft) | LOS | Queue (ft) | LOS | Queue (ft) | LOS | Queue (ft) | LOS | Queue (ft) | LOS | Queue (ft) | LOS | Queue (ft) | LOS | Queue (ft) | LOS | Queue (ft) | LOS | Queue (ft) |
| Eastbound (Little River Turnpike) | L | 375 | F (93.9) | 302 | F (120.0) | #297 | F (85.4) | 239 | F (102.6) | #364 | F (147.2) | #360 | F (98.9) | #306 | F (102.6) | #364 | F (147.2) | #360 | F (98.9) | #306 | F (102.6) | #364 | F (147.2) | #360 | F (98.9) | #306 | F (102.6) | #364 | F (147.2) | #360 | F (98.9) | #306 |
| | TR | ‡ | D (40.8) | 745 | D (47.3) | 683 | D (45.1) | 611 | D (48.4) | 875 | D (52.3) | 819 | D (52.1) | 726 | D (48.4) | 875 | D (52.3) | 819 | D (52.1) | 726 | D (48.4) | 875 | D (52.3) | 819 | D (52.1) | 726 | D (48.4) | 875 | D (52.3) | 819 | D (52.1) | 726 |
| | *Overall* | | D (53.7) | | E (63.2) | | D (54.6) | | E (61.7) | | E (73.0) | | E (63.2) | | E (61.7) | | E (73.0) | | E (63.2) | | E (61.7) | | E (73.0) | | E (63.2) | | E (61.7) | | E (73.0) | | E (63.2) | |
| Westbound (Little River Turnpike) | L | 215 | F (101.6) | 100 | F (121.4) | #227 | F (98.0) | #196 | F (148.9) | #130 | F (129.9) | #278 | F (119.2) | #250 | F (148.9) | #130 | F (129.9) | #278 | F (119.2) | #250 | F (148.9) | #130 | F (129.9) | #278 | F (119.2) | #250 | F (148.9) | #130 | F (129.9) | #278 | F (119.2) | #250 |
| | T | ‡ | E (58.4) | #893 | D (51.2) | 708 | E (55.3) | 698 | F (83.9) | #1063 | E (56.2) | 848 | E (74.6) | #881 | F (83.9) | #1063 | E (56.2) | 848 | E (74.6) | #881 | F (83.9) | #1063 | E (56.2) | 848 | E (74.6) | #881 | F (83.9) | #1063 | E (56.2) | 848 | E (74.6) | #881 |
| | R | ‡ | B (17.7) | 280 | B (13.5) | 265 | C (20.5) | 453 | C (20.1) | 390 | B (14.6) | 328 | C (23.8) | 592 | C (20.1) | 390 | B (14.6) | 328 | C (23.8) | 592 | C (20.1) | 390 | B (14.6) | 328 | C (23.8) | 592 | C (20.1) | 390 | B (14.6) | 328 | C (23.8) | 592 |
| | *Overall* | | D (46.9) | | D (44.8) | | D (45.3) | | E (65.8) | | D (48.9) | | E (59.1) | | E (65.8) | | D (48.9) | | E (59.1) | | E (65.8) | | D (48.9) | | E (59.1) | | E (65.8) | | D (48.9) | | E (59.1) | |
| Northbound (Beauregard Street) | L | 145 | F (102.4) | 207 | F (125.6) | #271 | F (80.1) | 185 | F (114.1) | #256 | F (151.4) | #322 | F (92.3) | #236 | F (114.1) | #256 | F (151.4) | #322 | F (92.3) | #236 | F (114.1) | #256 | F (151.4) | #322 | F (92.3) | #236 | F (114.1) | #256 | F (151.4) | #322 | F (92.3) | #236 |
| | T | ‡ | F (90.1) | 163 | F (146.9) | #326 | F (95.2) | #255 | F (92.6) | 184 | F (182.5) | #384 | F (133.3) | #339 | F (92.6) | 184 | F (182.5) | #384 | F (133.3) | #339 | F (92.6) | 184 | F (182.5) | #384 | F (133.3) | #339 | F (92.6) | 184 | F (182.5) | #384 | F (133.3) | #339 |
| | R | ‡ | E (79.3) | 113 | F (80.6) | 203 | E (61.2) | 135 | F (80.7) | 131 | F (80.5) | 228 | E (62.5) | 156 | F (80.7) | 131 | F (80.5) | 228 | E (62.5) | 156 | F (80.7) | 131 | F (80.5) | 228 | E (62.5) | 156 | F (80.7) | 131 | F (80.5) | 228 | E (62.5) | 156 |
| | *Overall* | | F (92.8) | | F (119.5) | | F (81.6) | | F (99.1) | | F (140.8) | | F (102.0) | | F (99.1) | | F (140.8) | | F (102.0) | | F (99.1) | | F (140.8) | | F (102.0) | | F (99.1) | | F (140.8) | | F (102.0) | |
| Southbound (Beauregard Street) | L | ‡ | F (95.9) | #776 | F (116.5) | #951 | F (126.3) | #757 | F (93.2) | m#823 | F (158.1) | m#1141 | F (161.4) | m#925 | F (92.1) | m#830 | F (152.4) | m#1021 | F (148.1) | #964 | F (93.2) | m#823 | F (158.1) | m#1141 | F (161.4) | m#925 | F (95.6) | m#844 | F (154.0) | m#1052 | F (149.9) | m#914 |
| | T | ‡ | F (93.6) | #836 | F (112.9) | #1025 | F (127.3) | #795 | F (88.7) | m#893 | F (151.8) | m#1217 | F (156.9) | m#926 | F (87.6) | m#897 | F (146.2) | m#1108 | F (140.7) | #985 | F (88.7) | m#893 | F (151.8) | m#1217 | F (156.9) | m#926 | F (90.7) | m#910 | F (148.7) | m#1138 | F (152.6) | m#948 |
| | R | ‡ | D (46.4) | 88 | D (49.0) | 193 | D (50.4) | 76 | D (48.6) | m104 | D (51.6) | m235 | D (54.9) | m120 | D (45.2) | m101 | D (49.2) | m179 | C (30.1) | m92 | D (48.6) | m104 | D (51.6) | m235 | D (54.9) | m120 | D (45.2) | m99 | D (51.8) | m195 | D (51.7) | m157 |
| | *Overall* | | F (85.9) | | F (100.5) | | F (112.9) | | F (83.2) | | F (132.7) | | F (140.0) | | F (81.6) | | F (127.7) | | F (123.5) | | F (83.2) | | F (132.7) | | F (140.0) | | F (84.3) | | F (129.9) | | F (133.0) | |
| **Overall Intersection** | | | E (60.5) | | E (70.7) | | E (67.1) | | E (70.1) | | F (85.2) | | F (83.1) | | E (69.7) | | F (83.9) | | E (79.0) | | E (70.1) | | F (85.2) | | F (83.1) | | E (70.3) | | F (84.5) | | F (81.4) | |

* storage distance is for the build condition only
# 95th percentile volume exceeds capacity, queue may be longer
m volume for 95th percentile is metered by upstream signal
‡ storage distance is continuous to the upstream intersection

*Table 9: Synchro Summary of LOS, Delays, and 95th Percentile Queues*
*(Existing, No-Build, Base Scenario, Scenario A, and Scenario B, N. Beauregard Street at N. Chambliss Street)*

| Intersection | | | Existing Conditions (2016) | | | | | | No-Build Scenario (2026) | | | | | | Base Scenario (2026): Removal of channelized eastbound right turn onto N Beauregard Street from N Chambliss Street | | | | | | Scenario A (2026): Protected/Permissive left-turn phasing for the N Chambliss Street and Plaza at Landmark Shopping Center approaches | | | | | | Scenario B (2026): Protected/Permissive left-turn phasing for NB N Beauregard Street, protected left-turn phasing for SB N Beauregard Street and Plaza at Landmak Shopping Center approaches, and permissive left-turn phasing for EB N. Chambliss Street | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach | Movement | Average Storage (ft) | AM | | PM | | SAT | | AM | | PM | | SAT | | AM | | PM | | SAT | | AM | | PM | | SAT | | AM | | PM | | SAT | |
| 2. North Chambliss Street & Beauregard Street | | | LOS | Queue (ft) | LOS | Queue (ft) | LOS | Queue (ft) | LOS | Queue (ft) | LOS | Queue (ft) | LOS | Queue (ft) | LOS | Queue (ft) | LOS | Queue (ft) | LOS | Queue (ft) | LOS | Queue (ft) | LOS | Queue (ft) | LOS | Queue (ft) | LOS | Queue (ft) | LOS | Queue (ft) | LOS | Queue (ft) |
| Eastbound (North Chambliss Street) | L | ‡ | D (46.3) | 83 | D (54.5) | 138 | F (86.7) | 175 | D (48.2) | 93 | E (59.3) | #174 | F (88.6) | 195 | D (47.4) | 92 | E (64.9) | #186 | F (86.9) | 193 | D (43.4) | 77 | D (37.0) | 118 | E (62.6) | 148 | D (36.9) | 82 | C (30.5) | 126 | D (42.9) | 139 |
| | T | ‡ | D (43.6) | 34 | D (44.9) | 83 | F (82.2) | 163 | D (43.4) | 37 | D (44.6) | 92 | F (83.9) | 182 | D (43.2) | 37 | D (45.1) | 93 | F (82.6) | 180 | D (49.3) | 38 | D (46.6) | 89 | F (81.6) | 177 | D (52.0) | 39 | E (57.6) | 95 | F (83.9) | 181 |
| | R | 350* | | | | | | | | | | | | | D (43.3) | #561 | E (62.9) | #521 | E (64.3) | 427 | D (35.9) | 438 | D (38.0) | #578 | D (50.4) | 577 | D (40.2) | #444 | E (58.8) | #563 | E (64.6) | 479 |
| | *Overall* | | D (45.7) | | D (51.1) | | F (84.5) | | D (47.1) | | D (54.2) | | F (86.3) | | D (43.7) | | E (61.7) | | E (70.1) | | D (37.2) | | D (38.6) | | E (56.4) | | D (40.2) | | D (54.1) | | E (64.0) | |
| Westbound (Plaza at Landmark Shopping Center) | L | ‡ | D (46.1) | 60 | E (55.1) | #231 | F (81.5) | 388 | D (46.1) | 66 | E (62.3) | #281 | F (84.0) | 446 | D (46.1) | 66 | F (81.8) | #317 | E (64.8) | #487 | C (31.8) | 54 | D (39.8) | #229 | F (80.0) | #430 | D (44.9) | 69 | E (68.5) | #293 | F (88.7) | 450 |
| | TR | 140 | D (45.3) | 57 | D (40.5) | 110 | E (61.9) | 204 | D (45.3) | 62 | D (40.5) | 128 | E (60.4) | 237 | D (45.3) | 62 | D (42.3) | 134 | D (54.3) | 248 | D (42.5) | 63 | D (47.2) | 137 | E (72.3) | 259 | C (35.0) | 53 | C (28.6) | 99 | D (42.0) | 176 |
| | *Overall* | | D (45.7) | | D (49.6) | | E (74.1) | | D (45.7) | | D (54.1) | | E (75.1) | | D (45.7) | | E (66.8) | | E (60.9) | | D (37.9) | | D (42.6) | | E (77.1) | | D (39.3) | | D (53.4) | | E (71.1) | |
| Northbound (Beauregard Street) | L | 110 | C (24.2) | 379 | C (24.2) | m230 | B (16.1) | 454 | D (37.4) | #610 | D (39.9) | m298 | C (22.9) | m505 | D (38.4) | #663 | C (25.9) | m297 | C (29.1) | m539 | D (37.5) | 533 | C (25.8) | m303 | B (12.7) | m280 | C (30.5) | 525 | C (21.0) | m279 | D (40.4) | m#685 |
| | T | ‡ | A (9.7) | 138 | B (15.5) | m108 | B (17.4) | 182 | B (10.0) | 166 | B (17.5) | m129 | B (19.9) | m196 | B (10.1) | 167 | B (15.8) | m102 | C (23.7) | m187 | B (11.4) | 190 | B (14.2) | m100 | B (12.6) | m127 | A (9.0) | 189 | B (14.8) | m100 | C (32.6) | m171 |
| | R | 175 | B (10.1) | m0 | D (37.5) | m12 | B (19.7) | m75 | B (10.4) | m0 | C (26.2) | m14 | C (25.5) | m73 | A (7.4) | m0 | B (19.1) | m17 | D (39.0) | m64 | A (6.0) | m0 | A (6.4) | m17 | A (3.3) | m13 | A (5.9) | m0 | B (18.9) | m17 | B (19.5) | m18 |
| | *Overall* | | B (16.0) | | C (22.4) | | B (17.2) | | C (21.8) | | C (28.4) | | C (22.4) | | C (22.2) | | C (20.6) | | C (29.1) | | C (22.5) | | B (18.1) | | B (10.9) | | B (18.2) | | B (18.1) | | C (33.8) | |
| Southbound (Beauregard Street) | L | 195 | B (17.8) | 13 | C (22.9) | 48 | C (28.5) | 95 | C (23.2) | 14 | C (25.7) | 53 | D (36.4) | 109 | C (28.9) | 15 | C (32.5) | 48 | D (50.7) | 104 | C (29.9) | 13 | C (30.2) | 48 | D (39.2) | 89 | D (49.5) | 32 | E (77.1) | #123 | E (79.8) | 109 |
| | TR | ‡ | C (22.6) | 181 | C (31.0) | 202 | D (36.5) | 256 | C (30.6) | 207 | D (36.5) | 231 | D (47.1) | 293 | D (39.8) | 216 | D (53.9) | #267 | E (66.8) | #328 | D (42.2) | 232 | D (44.9) | 234 | D (49.9) | 296 | D (41.2) | 232 | E (63.3) | #267 | E (57.8) | 308 |
| | *Overall* | | C (22.5) | | C (29.9) | | C (34.8) | | C (30.4) | | C (35.0) | | D (44.8) | | D (39.5) | | D (51.0) | | E (63.3) | | D (41.8) | | D (42.9) | | D (47.6) | | D (41.5) | | E (65.2) | | E (62.5) | |
| **Overall Intersection** | | | **C (21.0)** | | **C (31.6)** | | **D (39.0)** | | **C (26.9)** | | **D (36.8)** | | **D (44.1)** | | **C (32.8)** | | **D (44.9)** | | **D (51.4)** | | **C (31.3)** | | **C (32.4)** | | **D (40.6)** | | **C (30.2)** | | **D (43.0)** | | **D (53.2)** | |

* storage distance is for the build condition only
# 95th percentile volume exceeds capacity, queue may be longer
m volume for 95th percentile is metered by upstream signal
‡ storage distance is continuous to the upstream intersection

The intersection of N. Chambliss Street and N. Beauregard Street maintained the same overall intersection levels of service in the build scenarios as the no-build condition. The one exception to this occurred in the PM peak under Scenario A, where overall intersection LOS improves to LOS C, with a reduction in overall delay of more than 12 seconds. The majority of turning movements are expected to operate at LOS D or better during the AM, PM, and Saturday peak hours. Those expected to operate at LOS E or worse (indicated by yellow (LOS E) or red (LOS F) font in **Table 8** and **Table 9** ) generally consist of the side street movements.

Signal timing optimization was completed for each scenario as compared to the no-build scenario; however, higher side street demand combined with sustained mainline demand along N. Beauregard Street allowed for less flexibility in allocating signal green time. Cycle lengths were maintained between no-build and build conditions, so mitigating side street delay while maintaining progression along N. Beauregard Street was a challenge as was the case under existing conditions. Similar levels of queuing can be expected, with queue spillback a possibility for the northbound left-turn and westbound through and right-turn movements during peak conditions.

Increases in delay at the N. Chambliss Street and N. Beauregard in Scenario B as compared to Scenario A and the no build condition can be attributed to the following:

- Protected only operations of the southbound left-turn movement, which under existing protected-permissive signal phasing, the left-turn movement could take advantage of the permissive green phase.
- Increased side street green time allocation to the westbound left-turn movement to accommodate protected only left-turn phasing. This reduced the green time allocated to the eastbound approach; thus, the northbound left-turn green time was increased to accommodate high demand on the eastbound right-turn movement, which operates as an overlap to the left-turn movement. Ultimately, this reduced green time allocated to the southbound through movement on N. Beauregard Street.

One of the challenges to changing the southbound left-turn movement to protected only left-turn phasing is the potential for queue spillback from the available storage lane. The available storage is approximately 200 feet, which accommodates the anticipated queuing according to Synchro. However, conditional left-turn service during the Saturday peak hour was required to mitigate initially observed queues exceeding the available storage. Since the opposing northbound through demand along N. Beauregard Street is not that high, the conditional service operation allows a reservice of the protected left-turn phase if there is demand. This reduced the anticipated queue lengths from more than 200 feet to approximately 110 feet.

For the intersection of Little River Turnpike and N. Beauregard Street, the overall intersection LOS ranged between E and F, with very minor changes expected compared to existing and no-build conditions. AM and PM peak hour levels of service were maintained, while the Saturday peak hour

worsened from LOS E to LOS F in Scenarios A and B as compared to the baseline condition. The slight increase in delay can be attributed to changes in vehicle progression between the two signals.

Overall, Scenario B was the recommended signal operations mode given the preliminary intersection design configuration. With the existing split phase operations, a pedestrian actuation of the eastbound and westbound crosswalks during a single cycle could result in mainline delays of 75 seconds to accommodate pedestrian crossing times. In Scenario B, the mainline delay could be as low as 50 seconds depending upon the vehicular demand for the protected westbound left-turn phase. Scenario B is also consistent with the VDOT preferred operating mode for crosswalks on both sides of an intersection. Typically, under a split phase operating mode, only one crosswalk would be provided to reduce signal delay for conflicting turning movements. It should be noted that FYA signals are recommended for the protected-permissive and permissive left-turn phases to allow for greater flexibility in signal operations and to avoid creating a yellow trap condition. This allows for the operation of lagging left-turn phases, which are proposed during all timing plans for the westbound approach and during the Saturday peak hour for the southbound approach (conditional left-turn service). The Synchro HCM and queuing reports can be found in **Appendix B.** A comparative tabular summary of the Synchro HCM and queuing reports can also be found at the beginning of **Appendix B**.

### VISSIM Future Conditions Analysis

Using the results acquired from the Synchro analysis, new proposed intersection concepts were analyzed to address comments that were expressed at the public meeting on June 13, 2017. These new concepts were modeled using VISSIM Software to better understand queue and travel time impacts, which are not as well reported using Synchro software under over-saturated conditions. Traffic microsimulation models were developed in VISSIM for the following four scenarios:

- **No Build:** 2026 conditions considering existing geometry
- **VISSIM Scenario 1:** 2026 conditions with an intersection reconfiguration; the same geometric and operational configuration as Synchro Scenario B
- **VISSIM Scenario 2:** 2026 conditions similar to VISSIM Scenario 1 with the addition of a second right-turn lane onto southbound N. Beauregard Street from N. Chambliss Street
- **VISSIM Scenario 3:** 2026 conditions with a signalized slip lane from southbound N. Chambliss Street to southbound N. Beauregard Street; no turns permitted on red and new dedicated pedestrian signal across the slip lane approach

The VISSIM scenarios provide different improvements to congestion and pedestrian safety as those evaluated using Synchro. The concepts evaluated in VISSIM were developed with the goal of reducing potential delay and queuing for the southbound movement from N. Chambliss Street to N. Beauregard Street. **Table 10** provides a summary of the benefits and shortcomings of the four VISSIM scenarios.

**Table 10: Summary of VISSIM Scenario Benefits and Shortcomings for the Southbound Movement from N. Chambliss Street to N. Beauregard Street**

| VISSIM Scenario | Benefits | Shortcomings |
|---|---|---|
| No Build | • Free-flow operations | • Poor and uncontrolled accommodations for pedestrians<br>• Uncontrolled merge south of the traffic signal |
| Scenario 1 | • Permits right turn on red<br>• Single turning conflict with crosswalk | • Adds vehicular signal control |
| Scenario 2 | • Two lanes of turning capacity | • Two turning lanes creates multiple conflicts with pedestrians (VDOT does not prefer dual right-turn lanes across pedestrian crosswalk)<br>• No turn on red from interior right-turn lane (assuming VDOT permits this) |
| Scenario 3 | • Two lanes of turning capacity<br>• Signalized pedestrian crossing | • No turn on red from slip lane |

The concept geometry for each of the three build scenarios evaluated in VISSIM are illustrated in **Figure 13** through **Figure 15**. **Table 11** summarizes the different VISSIM concepts that were evaluated for travel time, delays, and queues. The VISSIM measures of effectiveness (MOEs), including delay, travel times, and queuing, can be found in **Appendix E**.

**Figure 13: VISSIM Scenario 1 Geometry (Intersection Reconfiguration)**

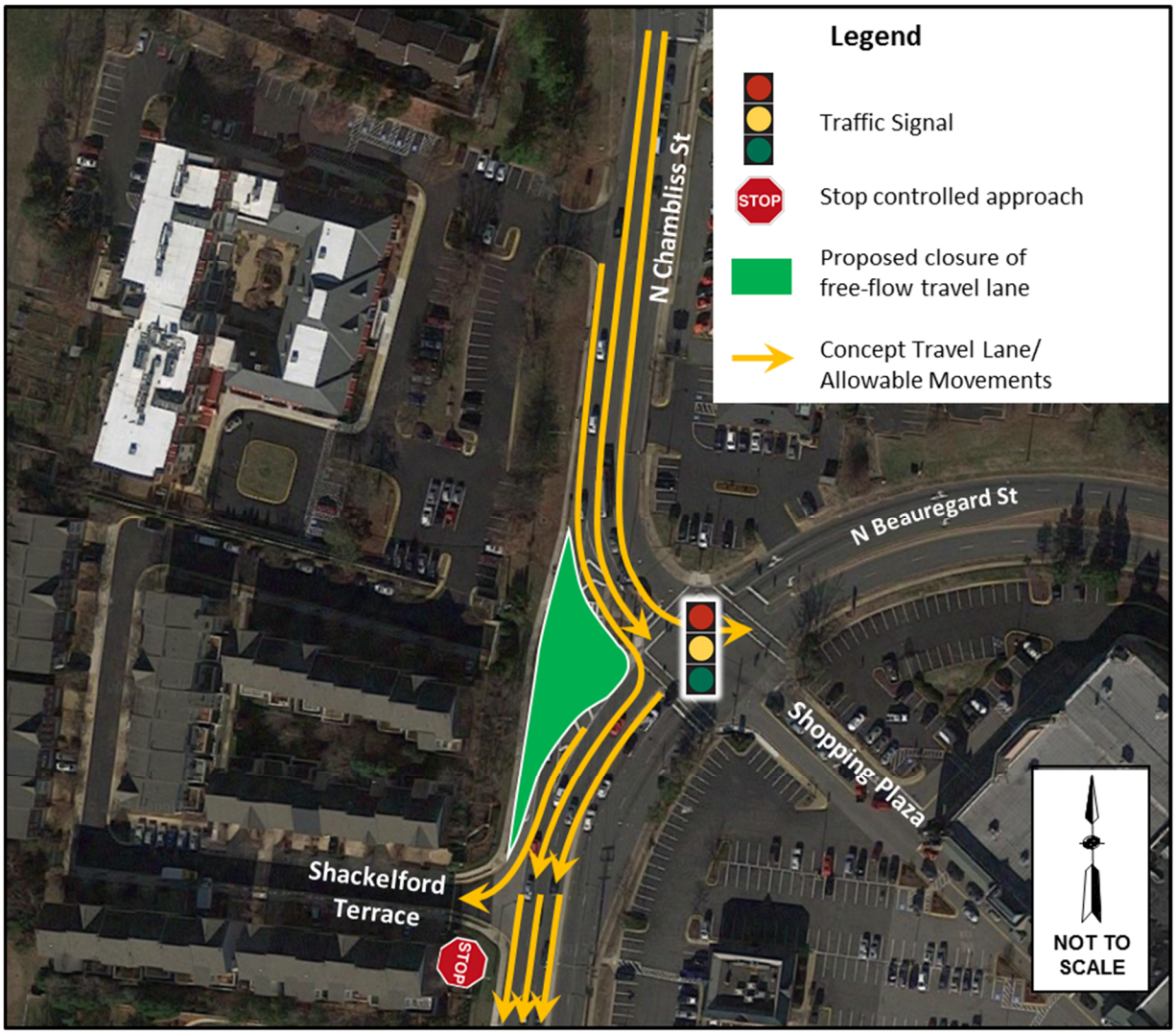


**Figure 14: VISSIM Scenario 2 Geometry (Intersection Reconfiguration with Dual Right-Turn Lanes)**

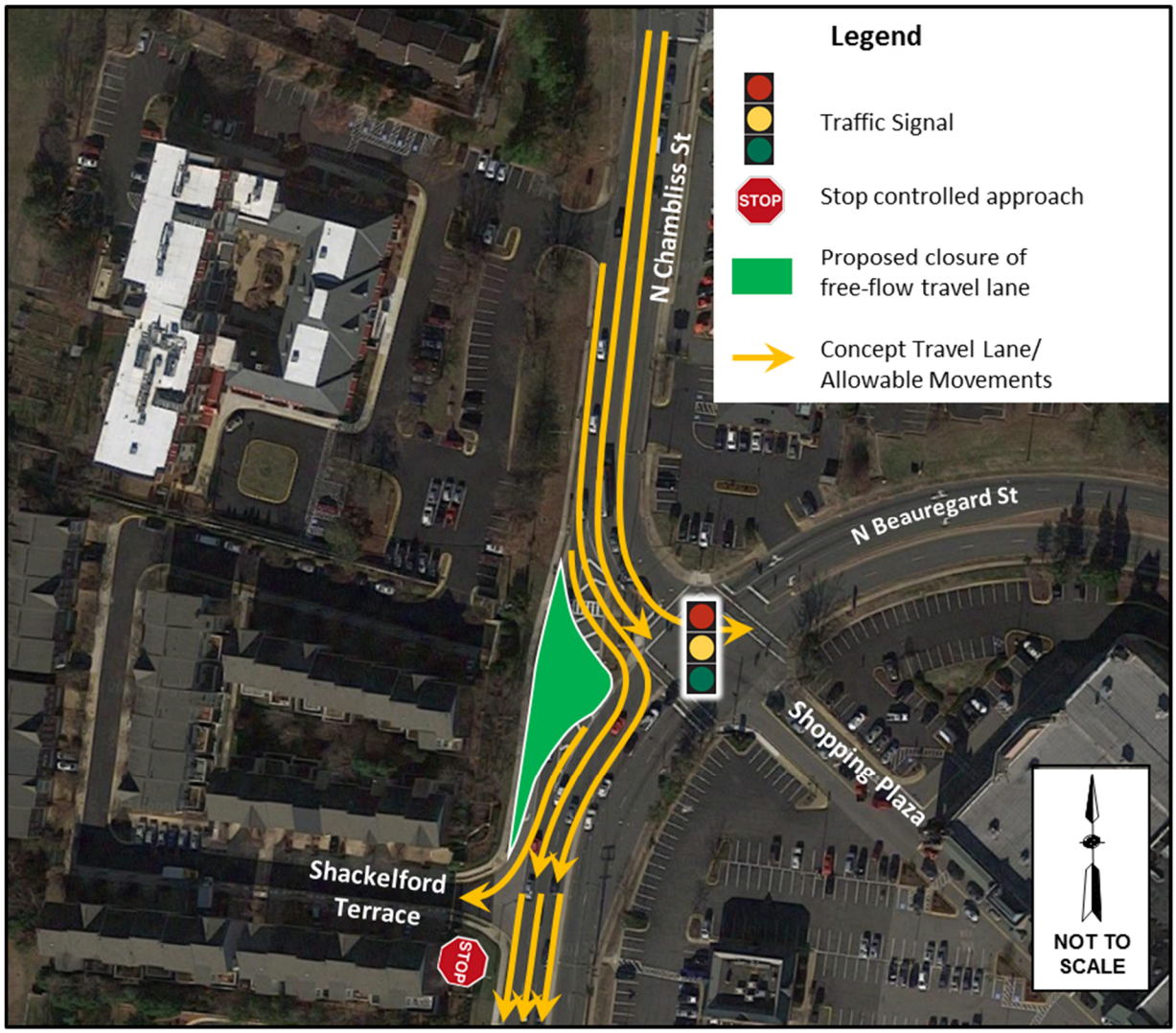


**Figure 15: VISSIM Scenario 3 Geometry (Signalized Slip Lane to N. Beauregard Street)**

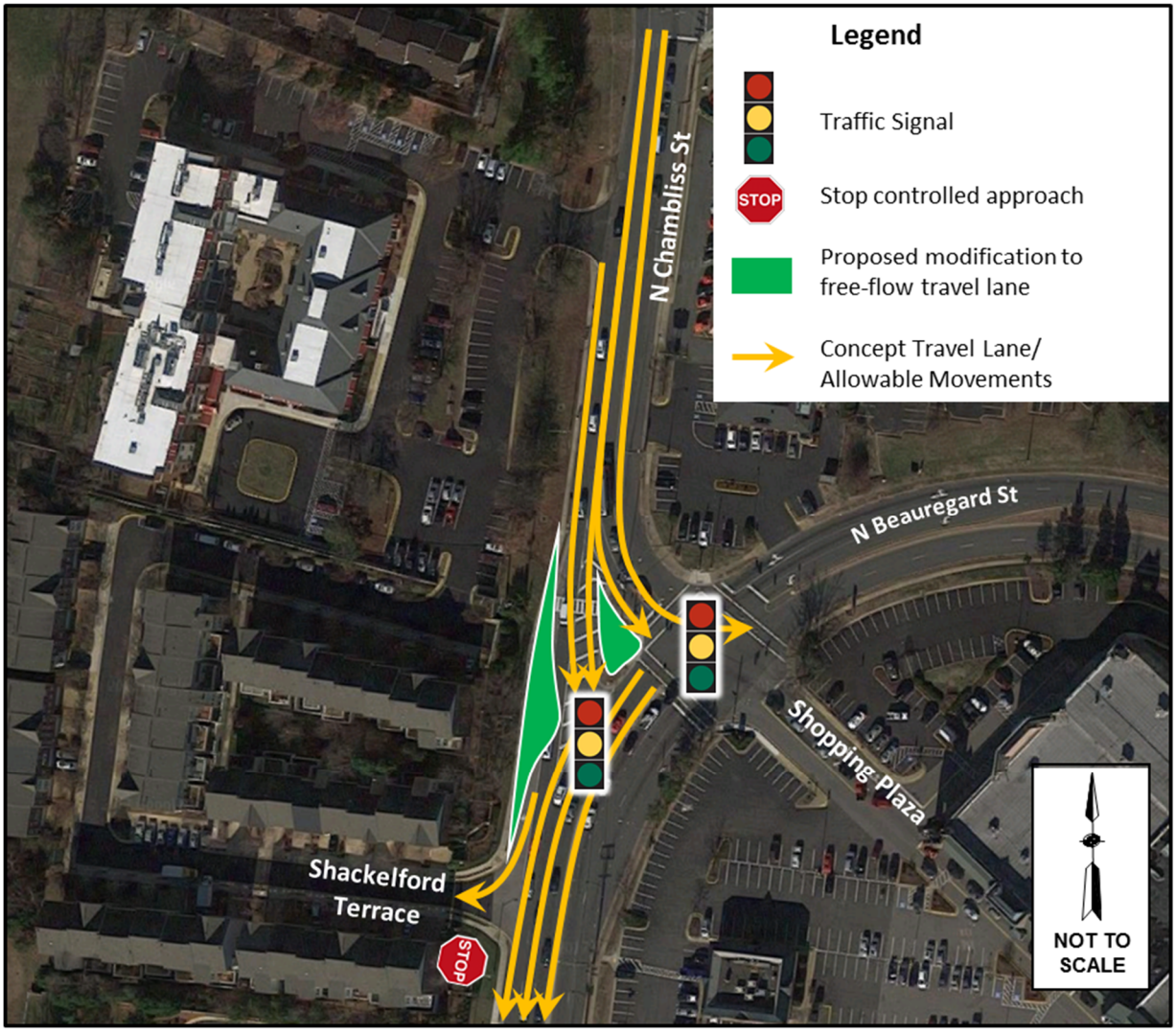


**Table 11: VISSIM Summary of Travel Time, Delays, Queues (Existing, No-Build, and Build Scenarios)**

| | | | Existing | No-Build | VISSIM Scenario 1 | VISSIM Scenario 2 | VISSIM Scenario 3 |
|---|---|---|---|---|---|---|---|
| Travel Times (min) | Lincolnia Road\Linmar Court to Little River Turnpike (SB N. Chambliss Street from west) | | 4.2 | 6.9 | 7.9 | 7.5 | 7.6 |
| | Little River Turnpike to Lincolnia Road\Gloucester Road | | 1.1 | 1.2 | 0.9 | 1.1 | 1.0 |
| | Lincolnia Road\Gloucester Road to Little River Turnpike (SB N. Beauregard Street from east) | | 6.1 | 10.9 | 6.2 | 8.0 | 8.1 |
| | Little River Turnpike to Lincolnia Road\Linmar Court | | 2.7 | 3.8 | 2.8 | 3.9 | 3.3 |
| Overall Intersection Delays | Lincolnia Road and N. Chambliss Street | | 15.4 (B) | 41.6 (D) | 49.4 (D) | 45.7 (D) | 42.9 (D) |
| | N. Beauregard Street and N. Chambliss Street | | 60.8 (E) | 89.4 (F) | 76.2 (E) | 93.5 (F) | 100.4 (F) |
| | N. Beauregard Street and Little River Turnpike | | 66.3 (E) | 75.5 (E) | 63.6 (E) | 71.9 (E) | 66.9 (E) |
| Critical Movements | Lincolnia Road and N. Chambliss Street: EBR | Delay (seconds/veh) | 13.2 (B) | 80.2 (F) | 108.2 (F) | 91.5 (F) | 83.1 (F) |
| | | Average Queue (feet) | 19 | 1,165 | 1,735 | 1,322 | 1,221 |
| | | Max Queue (feet) | 175 | 1,684 | 1,838 | 1,727 | 1,755 |
| | N. Beauregard Street and N. Chambliss Street: EBR | Delay (seconds/veh) | - | - | 67.3 (E) | 78 (E) | 107.1 (F) |
| | N. Chambliss Street SB/EB "Merge" w/ N. Beauregard Street* | Average Queue (feet) | 241 | 2,027 | 2,560 | 2,101 | 2,008 |
| | | Max Queue (feet) | 1,147 | 2,926 | 2,920 | 2,813 | 2,896 |
| | N. Beauregard Street and N. Chambliss Street: NBL | Delay (seconds/veh) | 28.2 (C) | 40.7 (D) | 33.8 (C) | 42.8 (D) | 41 (D) |
| | | Average Queue (feet) | 111 | 171 | 95 | 172 | 136 |
| | | Max Queue (feet) | 165 | 206 | 138 | 197 | 162 |
| | N. Beauregard Street and N. Chambliss Street: SBT | Delay (seconds/veh) | 149.3 (F) | 278.7 (F) | 165.9 (F) | 220.1 (F) | 230.7 (F) |
| | | Average Queue (feet) | 358 | 788 | 514 | 714 | 728 |
| | | Max Queue (feet) | 538 | 879 | 837 | 854 | 871 |
| | N. Beauregard Street and N. Chambliss Street: WBL | Delay (seconds/veh) | 78.4 (E) | 96.9 (F) | 150.5 (F) | 190.9 (F) | 208.1 (F) |
| | | Average Queue (feet) | 113 | 175 | 330 | 420 | 444 |
| | | Max Queue (feet) | 150 | 232 | 443 | 450 | 474 |
| | N. Beauregard Street and Little River Turnpike: SBL | Delay (seconds/veh) | 91.8 (F) | 96.5 (F) | 75.9 (E) | 79.8 (E) | 75.1 (E) |
| | | Average Queue (feet) | 377 | 410 | 329 | 349 | 331 |
| | | Max Queue (feet) | 422 | 422 | 338 | 356 | 342 |
| | N. Beauregard Street and Little River Turnpike: SBTR | Delay (seconds/veh) | 40.1 (D) | 60.4 (E) | 32.6 (C) | 33.4 (C) | 31.3 (C) |
| | | Average Queue (feet) | 44 | 410 | 329 | 349 | 331 |
| | | Max Queue (feet) | 71 | 422 | 338 | 356 | 342 |

*Note: Beauregard Street and Little River Turnpike SBTR is configured as a SBR only for the scenarios without dual lefts at Little River Turnpike*
**Queue measured from merge gore for Existing/No-Build, EBR signal head for Alt 1/2, and channelized SB Chambliss signal head for Alt 3*

The 2026 No-Build VISSIM model indicates that the study area intersections operate with significant congestion, delays, and queues, especially in the southbound direction along N. Chambliss Street and N. Beauregard Street towards Little River Turnpike. The travel time increases up to by as much as 4 minutes as compared to the existing conditions model and the overall intersection delay for the study intersection increases by about 30 seconds. The southbound through movement on N. Beauregard Street experiences the greatest amount of delay, in excess of 120 seconds. Additionally, the average queuing spillback from the merge point with N. Beauregard Street and N. Chambliss Street is eight times greater in 2026 than it is in existing conditions. This can be attributed to sustained queue spillback from Little River Turnpike.

The three VISSIM models show an improvement to certain movements while others experience increased delays and queuing. Overall, there is a collective reduction in travel times among the two predominant southbound movements toward Little River Turnpike. In the No-Build condition, the average combined travel time among the southbound N. Chambliss Street and southbound N. Beauregard Street movements is 17.8 minutes. Although there is an expected increase in travel time of up to one minute for southbound N. Chambliss Street, there is a much larger decrease in travel time expected for N. Beauregard Street by nearly 5 minutes. The collective reduction in travel times for these movements is nearly 3 minutes. In addition, other predominant movements through the intersection are expected to see a reduction in travel times, indicating the alternative scenarios provide an overall benefit to intersection operations for vehicles. This benefit is paired with enhanced safety for pedestrians moving through the intersection.

Overall, VISSIM Scenario 1 provides the greatest improvement to overall operations of the study intersection of N. Beauregard Street and N. Chambliss Street. The LOS improves from F to E, corresponding to a reduction in overall intersection delay by approximately 15 seconds. The southbound through movement along N. Beauregard Street improves by more than 100 seconds, and compared to other scenarios, has the least amount of delay for the eastbound right-turn movement.

VISSIM Scenario 2 provides additional capacity for the eastbound right-turn movement, which reduces the maximum queue along N. Chambliss Street by approximately 100 feet. However, with an increase in capacity on the eastbound right, more vehicles tend to queue from Little River Turnpike, causing other movements to experience increased delay. The westbound left-turn movement delay increases by about 100 seconds but the southbound through movement improves by about 50 seconds as compared to No Build. The overall intersection delay increased compared to the no-build scenario and is about 20 seconds greater than Scenario 1. VISSIM Scenario 3 demonstrates similar results to Scenario 2, with some movements performing slightly worse. The two slip lanes onto N. Beauregard Street from N. Chambliss Street provide increased capacity over Scenario 1, but the no turn on red restriction limits the throughput of this movement. This scenario exhibits the worst performance of the three mitigation concepts.

### VISSIM 2026 Build Conditions (Alternative Configuration at Little River Turnpike)

The results of the 2026 build conditions VISSIM analysis indicate that the queuing and delay issues at the study intersection are strongly influenced by the downstream congestion issues at Little River Turnpike. In coordination with FCDOT staff, an alternative geometric configuration to the intersection was identified that could increase the capacity of the heavy southbound left-turn movement onto Little River Turnpike. In turn, it was expected that the improved capacity would process additional demand through the intersection and improve operations at N. Chambliss Street. The proposed lane configuration includes the restriping of the southbound approach to include two exclusive left-turn lanes and one shared through and right-turn lane. The lane configuration was altered in each of the VISSIM models and the signal timings were adjusted accordingly. Intersection operations remained the same, with no changes to phase sequencing or signal overlaps. Split phase operations were maintained for the side street approaches given the low demand on the northbound approach. All the VISSIM scenarios were simulated again considering the modified lane configuration at Little River Turnpike. **Table 12** summarizes the different VISSIM concepts that were evaluated for travel time, delays, and queues. The VISSIM measures of effectiveness (MOEs), including delay, travel times, and queuing, can be found in **Appendix E**.

As shown in **Table 12**, the provision of exclusive left-turn lanes provides a benefit under all scenarios. The average queue results for the free-flow movement from N. Chambliss Street to N. Beauregard Street clearly demonstrate the benefit of this modification. The average queue length is reduced by more than 1,200 feet. Although the queue lengths for turning movements at Little River Turnpike remain relatively constant, indicating that the block between the two signals continues to fill with vehicles, the reduction in queues at N. Chambliss Street indicate greater throughput for the southbound left-turn movement at Little River Turnpike.

Similar to the previous results, the build scenarios demonstrate increased queue results for the southbound movement from N. Chambliss Street as compared to no build. However, there is a reduction in average queue lengths expected considering exclusive dual left-turn lanes at Little River Turnpike. Overall travel times also demonstrate an improvement in the build scenarios. The average combined travel time among the southbound N. Chambliss Street and southbound N. Beauregard Street movements is 14.2 minutes in the no-build condition (reduction of 2.6 minutes). Considering the build scenario geometry and operations, average combined travel times are between 11.8 and 13.6 minutes, indicating a net improvement in overall intersection operations compared to no build.

The modifications to lane configuration and operations at Little River Turnpike will require minor adjustments to existing infrastructure. The existing signal displays could be rearranged to provide two 3-section arrow displays, retain the existing 3-section ball indication assembly, and install a secondary 3-section ball indication assembly on the signal pole itself. Pavement markings will also need to be modified to indicate the allowable movements, and signs on the mast arm rearrange to do the same. This modification would need to be reviewed and approved by VDOT. Regardless, the VISSIM analyses demonstrate that VISSIM Scenario 1 provides the greatest benefit to overall intersection operations and enhanced accommodations for pedestrians as compared to existing conditions.

**Table 12: VISSIM Summary of Travel Time, Delays, Queues**
**(Existing, No-Build, and Build scenarios, with and without dual exclusive left-turn lanes at Little River Turnpike (LRT Dual Left))**

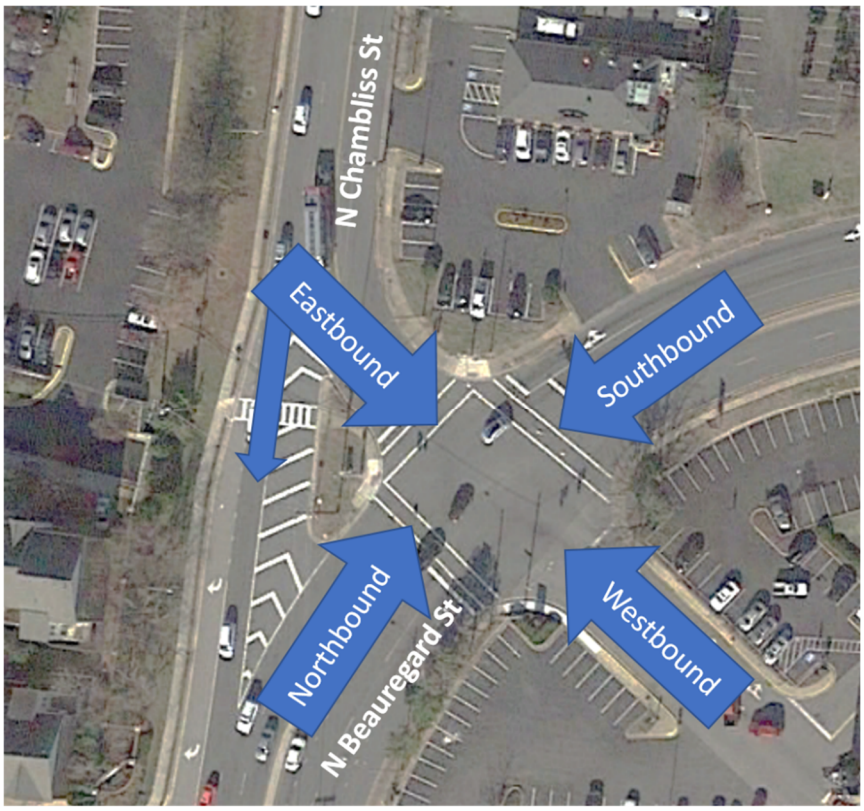
| | | | Existing | No-Build | No-Build LRT Dual Left | VISSIM Scenario 1 | VISSIM Scenario 1 LRT Dual Left | VISSIM Scenario 2 | VISSIM Scenario 2 LRT Dual Left | VISSIM Scenario 3 | VISSIM Scenario 3 LRT Dual Left |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Travel Times (min) | Lincolnia Road\Linmar Court to Little River Turnpike (SB N. Chambliss Street from west) | | 4.2 | 6.9 | 5.1 | 7.9 | 6.9 | 7.5 | 7.0 | 7.6 | 7.1 |
| | Little River Turnpike to Lincolnia Road\Gloucester Road | | 1.1 | 1.2 | 1.1 | 0.9 | 0.9 | 1.1 | 1.0 | 1.0 | 1.0 |
| | Lincolnia Road\Gloucester Road to Little River Turnpike (SB N. Beauregard Street from east) | | 6.1 | 10.9 | 9.1 | 6.2 | 4.9 | 8.0 | 6.6 | 8.1 | 4.9 |
| | Little River Turnpike to Lincolnia Road\Linmar Court | | 2.7 | 3.8 | 3.3 | 2.8 | 2.9 | 3.9 | 3.7 | 3.3 | 3.2 |
| Overall Intersection Delays | Lincolnia Road and N. Chambliss Street | | 15.4 (B) | 41.6 (D) | 25.7 (C) | 49.4 (D) | 43.9 (D) | 45.7 (D) | 41.5 (D) | 42.9 (D) | 39.7 (D) |
| | N. Beauregard Street and N. Chambliss Street | | 60.8 (E) | 89.4 (F) | 82.8 (F) | 76.2 (E) | 68.6 (E) | 93.5 (F) | 84.2 (F) | 100.4 (F) | 81.5 (F) |
| | N. Beauregard Street and Little River Turnpike | | 66.3 (E) | 75.5 (E) | 69.2 (E) | 63.6 (E) | 65.5 (E) | 71.9 (E) | 72.6 (E) | 66.9 (E) | 63.4 (E) |
| Critical Movements | Lincolnia Road and N. Chambliss Street: EBR | Delay (seconds/veh) | 13.2 (B) | 80.2 (F) | 36 (D) | 108.2 (F) | 88.3 (F) | 91.5 (F) | 79 (E) | 83.1 (F) | 73.7 (E) |
| | | Average Queue (feet) | 19 | 1,165 | 289 | 1,735 | 1,336 | 1,322 | 1,200 | 1,221 | 1,096 |
| | | Max Queue (feet) | 175 | 1,684 | 1,573 | 1,838 | 1,821 | 1,727 | 1,757 | 1,755 | 1,690 |
| | N. Beauregard Street and N. Chambliss Street: EBR | Delay (seconds/veh) | - | - | - | 67.3 (E) | 61.1 (E) | 78 (E) | 39.3 (D) | 107.1 (F) | 101.2 (F) |
| | N. Chambliss Street SB/EB "Merge" w/ N. Beauregard Street* | Average Queue (feet) | 241 | 2,027 | 744 | 2,560 | 2,070 | 2,101 | 1,915 | 2,008 | 1,809 |
| | | Max Queue (feet) | 1,147 | 2,926 | 2,198 | 2,920 | 2,838 | 2,813 | 2,751 | 2,896 | 2,696 |
| | N. Beauregard Street and N. Chambliss Street: NBL | Delay (seconds/veh) | 28.2 (C) | 40.7 (D) | 36.4 (D) | 33.8 (C) | 34.2 (C) | 42.8 (D) | 40.1 (D) | 41 (D) | 39.1 (D) |
| | | Average Queue (feet) | 111 | 171 | 150 | 95 | 96 | 172 | 158 | 136 | 128 |
| | | Max Queue (feet) | 165 | 206 | 195 | 138 | 145 | 197 | 193 | 162 | 170 |
| | N. Beauregard Street and N. Chambliss Street: SBT | Delay (seconds/veh) | 149.3 (F) | 278.7 (F) | 239.3 (F) | 165.9 (F) | 128.7 (F) | 220.1 (F) | 176.6 (F) | 230.7 (F) | 145.4 (F) |
| | | Average Queue (feet) | 358 | 788 | 700 | 514 | 339 | 714 | 566 | 728 | 363 |
| | | Max Queue (feet) | 538 | 879 | 873 | 837 | 511 | 854 | 810 | 871 | 526 |
| | N. Beauregard Street and N. Chambliss Street: WBL | Delay (seconds/veh) | 78.4 (E) | 96.9 (F) | 98.7 (F) | 150.5 (F) | 156.7 (F) | 190.9 (F) | 192.5 (F) | 208.1 (F) | 171.9 (F) |
| | | Average Queue (feet) | 113 | 175 | 189 | 330 | 367 | 420 | 426 | 444 | 379 |
| | | Max Queue (feet) | 150 | 232 | 399 | 443 | 449 | 450 | 464 | 474 | 467 |
| | N. Beauregard Street and Little River Turnpike: SBL | Delay (seconds/veh) | 91.8 (F) | 96.5 (F) | 95.3 (F) | 75.9 (E) | 75.3 (E) | 79.8 (E) | 81.6 (F) | 75.1 (E) | 73.8 (E) |
| | | Average Queue (feet) | 377 | 410 | 387 | 329 | 322 | 349 | 346 | 331 | 317 |
| | | Max Queue (feet) | 422 | 422 | 420 | 338 | 332 | 356 | 350 | 342 | 325 |
| | N. Beauregard Street and Little River Turnpike: SBTR** | Delay (seconds/veh) | 40.1 (D) | 60.4 (E) | 42.3 (D) | 32.6 (C) | 74.2 (E) | 33.4 (C) | 79.6 (E) | 31.3 (C) | 20.4 (C) |
| | | Average Queue (feet) | 44 | 410 | 282 | 329 | 300 | 349 | 324 | 331 | 204 |
| | | Max Queue (feet) | 71 | 422 | 314 | 338 | 336 | 356 | 373 | 342 | 213 |

**Queue measured from merge gore for Existing/No-Build, EBR signal head for Alt 1/2, and channelized SB Chambliss signal head for Alt 3*
***Note: Beauregard Street and Little River Turnpike SBTR is configured as a SBR only for the scenarios without dual lefts at Little River Turnpike*

## CRASH MODIFICATION FACTORS

Given the nature of the proposed improvements, it is anticipated that the existing safety concerns and crash patterns at the study intersection could be reduced. As previously mentioned, 51 crashes occurred between January 1, 2010 and December 31, 2016. There were 24 crashes along the northbound approach, 19 crashes along the southbound approach, 6 along the eastbound approach (inclusive of the existing slip lane), and 2 along the westbound approach to the intersection. This equates to an estimated 8 crashes per year. **Figure 16** illustrates the approach geometry assumed when assigning crashes at the intersection.

**Figure 16: Intersection Approach Geometry Diagram**




Using the Highway Safety Manual and the Crash Modification Factors Clearinghouse data maintained by the U.S. Department of Transportation Federal Highway Administration, the following Crash Modification Factors (CMF) were obtained as listed in Error! Reference source not found.. The table shows the expected crash frequency that would be anticipated with the installation of each individual improvement.

CMFs for each of the three alternative scenarios were calculated. Changing the permissive left-turn phasing to protected only on the southbound left-turn movement resulted in a CMF of 0.45 (or a 55% reduction in crashes associated with southbound and westbound movements). Changing the signal phasing for eastbound left to be permissive only has a CMF of 1.42 (or a 42% increase in crashes associated

**Table 13: Crash Modification Factors for Scenarios**

| Scenario Summary | | Phasing Changes SBL | | Phasing Changes NBL/WBL | | Phasing Changes EBL | | N. Chambliss Street Realignment | | N. Chambliss Street Turn Lane Additions | | CMF SB | CMF NB | CMF EB | CMF WB | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | CMF | Crashes Affected | CMF | Crashes Affected | CMF | Crashes Affected | CMF | Crashes Affected | CMF | Crashes Affected | | | | | |
| VISSIM Scenario 1 | -Realignment of N. Chambliss St. Through to Right Turn -SBL protected only, WBL protected only (no change), NBL protected-permissive (no change), EBL permissive only | Change permissive left-turn phasing to protected only =0.45 | SB | No Change=1 | NB/WB | Increase NB/SB = 1.42 | EB | Change right-turn lane geometry to increase line of sight (intersection level) = 0.56 | All | NA | NA | **0.25** | **0.56** | **0.7952** | **0.56** | **0.54** |
| VISSIM Scenario 2 | -Realignment of N. Chambliss St. Through to Dual Right Turn - SBL protected only, WBL protected only (no change), NBL protected-permissive (no change), EBL permissive only | Change permissive left-turn phasing to protected only =0.45 | SB | No Change=1 | NB/WB | Increase NB/SB = 1.42 | EB | Change right-turn lane geometry to increase line of sight (intersection level) = 0.56 | All | Add Turn Lane (to existing) = 0.97 | All | **0.24** | **0.54** | **0.77** | **0.54** | **0.53** |
| VISSIM Scenario 3 | -N. Chambliss St. Through to Dual Through; no right turn on red - SBL protected only, WBL protected only (no change), NBL protected-permissive (no change), EBL permissive only | Change permissive left-turn phasing to protected only =0.45 | SB | No Change=1 | NB/WB | Increase NB/SB = 1.42 | EB | Improve At-Grade Crossing = 0.85 | All | Add Turn Lane (to existing) = 0.97 | All | **0.37** | **0.82** | **1.17** | **0.82** | **0.80** |

with the eastbound movement). Changing the right-turn lane geometry to increase line of sight on N. Chambliss Street results in a CMF of 0.56 (or a 44% reduction of crashes associated with all the intersection movements). Although the skew of the approach in Scenario 3 is not improved, an enhanced pedestrian crossing is provided, which has an associated CMF. Improving this at-grade pedestrian crossing of N. Chambliss Street results in a CMF of 0.85 (or a reduction of 15% of total crashes associated with all intersection movements). Lastly, adding turn lanes to existing geometry has a CMF of 0.97 (or a reduction of 3% of total crashes associated with all movements).

These proposed improvements would provide an appreciable benefit to the users of the intersection. Overall, the scenario with the best safety improvement is Scenario 2 with the realigned N Chambliss Street dual right turns, followed closely by Scenario 1. Scenario 3 is expected to result in the lowest reduction in intersection crash rates. **Table 14** predicts the number of crashes per year that each scenario would have with the proposed improvements. Scenario 1 and 2 predict 4 crashes and Scenario 3 predicts 5, compared to 8 crashes happening with the current intersection configurations.

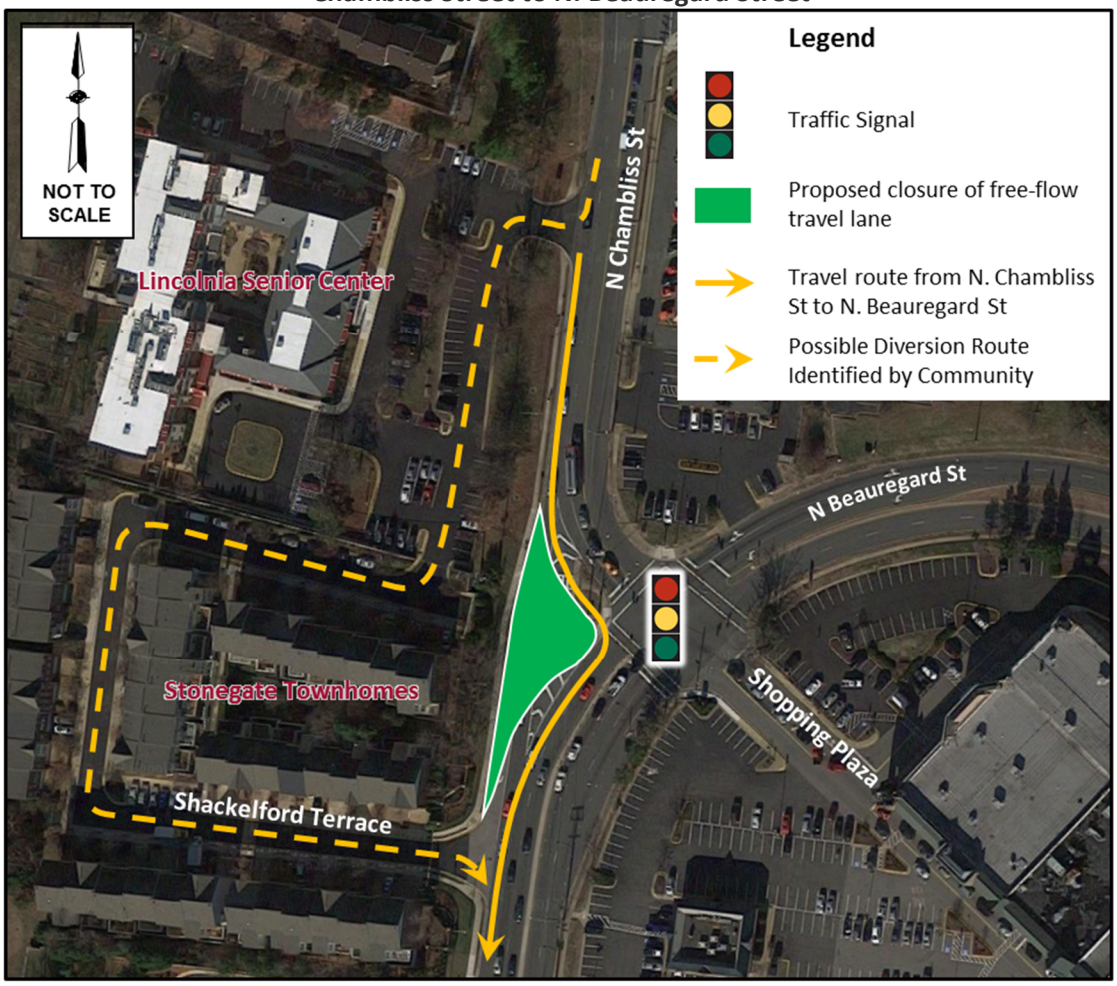
**Table 14: Predicted Crashes per Year**

| Crashes in Study Area per Year | Existing | VISSIM Scenario 1 | VISSIM Scenario 2 | VISSIM Scenario 3 |
|---|---|---|---|---|
| SB | 3 | 1 | 1 | 1 |
| NB | 4 | 2 | 2 | 3 |
| EB | 1 | 1 | 1 | 1 |
| WB | 0 | 0 | 0 | 0 |
| **Total** | 8 | 4 | 4 | 5 |

## ASSESSMENT OF DIVERSION POTENTIAL ONTO SHACKELFORD TERRACE

FCDOT understands that some community members have expressed concern about potential traffic diversion from N. Chambliss Street to Shackelford Terrace once the free-flow movement onto southbound N. Beauregard Street is removed. The concern is that changing the right-turn movement from free-flowing to signalized will increase the delay and drivers may divert through the parking lot of the Lincolnia Senior Center and private street (Shackelford Terrace) in the Stonegate Townhome community. **Figure 17** illustrates the modified travel route through the intersection and the possible diversion route identified by the community on Shackelford Terrace.

**Figure 17: Summary of Existing and Possible Diversion Route Identified by the Community from N. Chambliss Street to N. Beauregard Street**




The possible diversion route identified by the community through the Stonegate Townhome community doubles the distance a vehicle must travel to reach N. Beauregard Street. In addition, the tight geometry, narrow roadway width, potential for pedestrian activity, and presence of parked or maneuvering vehicles on Shackelford Terrace reduces the speed at which a vehicle could navigate the detour route.

During weekday peak periods, the traffic signal at N. Beauregard Street operates at half the cycle length as the signal at Little River Turnpike (105 seconds). During the weekend peak period, the signal matches the cycle length at Little River Turnpike (170 seconds). Given that the average delay for the right-turn movement is no more than 65 seconds, vehicles traveling to N. Beauregard Street should expect to clear the intersection within one signal cycle. The time to travel through the Lincolnia Senior Center parking lot and along Shackelford Terrace is estimated to be approximately 85 seconds assuming an average travel speed of 10 mph. Given these circumstances, it is unlikely that vehicles will utilize the diversion route identified by the community to avoid delays imposed by the signalized control of the right-turn onto N. Beauregard Street.

## Conclusion and Recommendations

This study evaluated the impacts to signal operations given the change in the configuration of the intersection. The initial Synchro evaluation of changes to signal phasing suggested that the preliminary design developed in April 2017 operating with the recommended left-turn signal phasing (Synchro Scenario B) would provide the optimal balance of signal operations and safety. It consisted of protected-permissive left-turn phasing for the northbound N. Beauregard Street approach, protected only left-turn phasing for the southbound and westbound left-turn movements into and out of the Plaza at Landmark Shopping Center, and permissive only left-turn phasing for the eastbound N. Chambliss Street approach.

In response to community concerns about queuing and delay, a VISSIM microsimulation modeling effort was conducted to evaluate the recommended Synchro Scenario B geometry and operations as well as other potential mitigation options. The microsimulation analyses of no build and three build conditions reinforced the recommendation that Synchro Scenario B (VISSIM Scenario 1) provides the best overall intersection operations at N. Beauregard Street and N. Chambliss Street. This scenario reflects the preliminary intersection design configuration with protected only southbound and westbound left-turn movements, protected-permissive northbound left-turn movement, and permissive only eastbound left-turn movement. It results in the greatest reduction in intersection delay and a propensity to reduce intersection crash rates by improving the line of sight on N. Chambliss Street and changing the protected-permissive southbound left-turn movement to protected only.

Should VDOT be amenable to the geometric and operational modifications at Little River Turnpike, the change in intersection operations could yield even greater benefits to operations considering VISSIM Scenario 1 geometry and intersection control. The additional capacity of the exclusive dual left-turn lanes would process more vehicles through the signal, reducing the magnitude of queue spillback beyond the intersection at N. Chambliss Street. This would also reduce travel times even further as compared to no build conditions for the predominant southbound movements from N. Chambliss Street and N. Beauregard Street.

The proposed intersection improvements will provide enhanced access and improved safety for pedestrians navigating the intersection of N. Beauregard Street and N. Chambliss Street. All conflicts between pedestrians and vehicles will be signal controlled and marked with crosswalks. This in turn reduces the potential for pedestrian collisions with vehicles. The modification to the eastbound right-turn movement from N. Chambliss Street to N. Beauregard Street also improves safety for motorists by eliminating the existing weave segment between the two signals along N. Beauregard Street. This improvement also reduces the number of conflict points a right-turning vehicle from Shackelford Terrace must yield to down to one; all conflicts will originate from the signalized intersection of N. Beauregard Street and N. Chambliss Street. Overall, the proposed geometric improvements have the potential to reduce the number of crashes at the intersection by as much as 50 percent, resulting in fewer injuries and less property damage than indicated by crash patterns over the past seven years.