N. Beauregard Street at N. Chambliss Street Intersection Improvements

Operational Analysis of Proposed Pedestrian Improvements

DRAFT REPORT April 2017

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Intersection Context and study area

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.

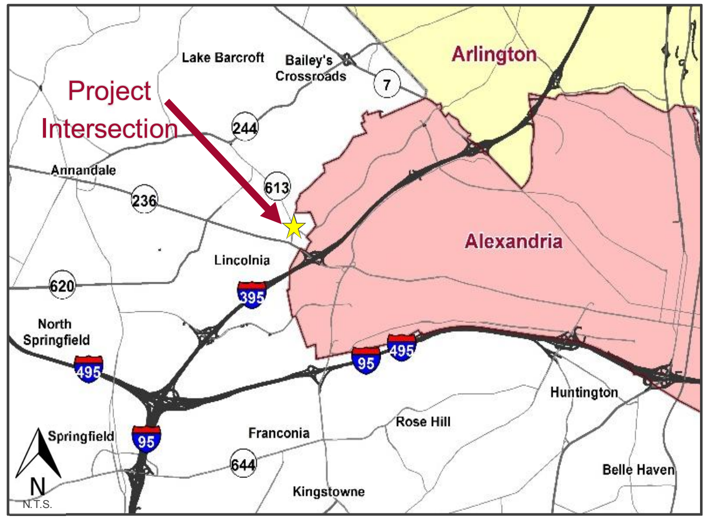
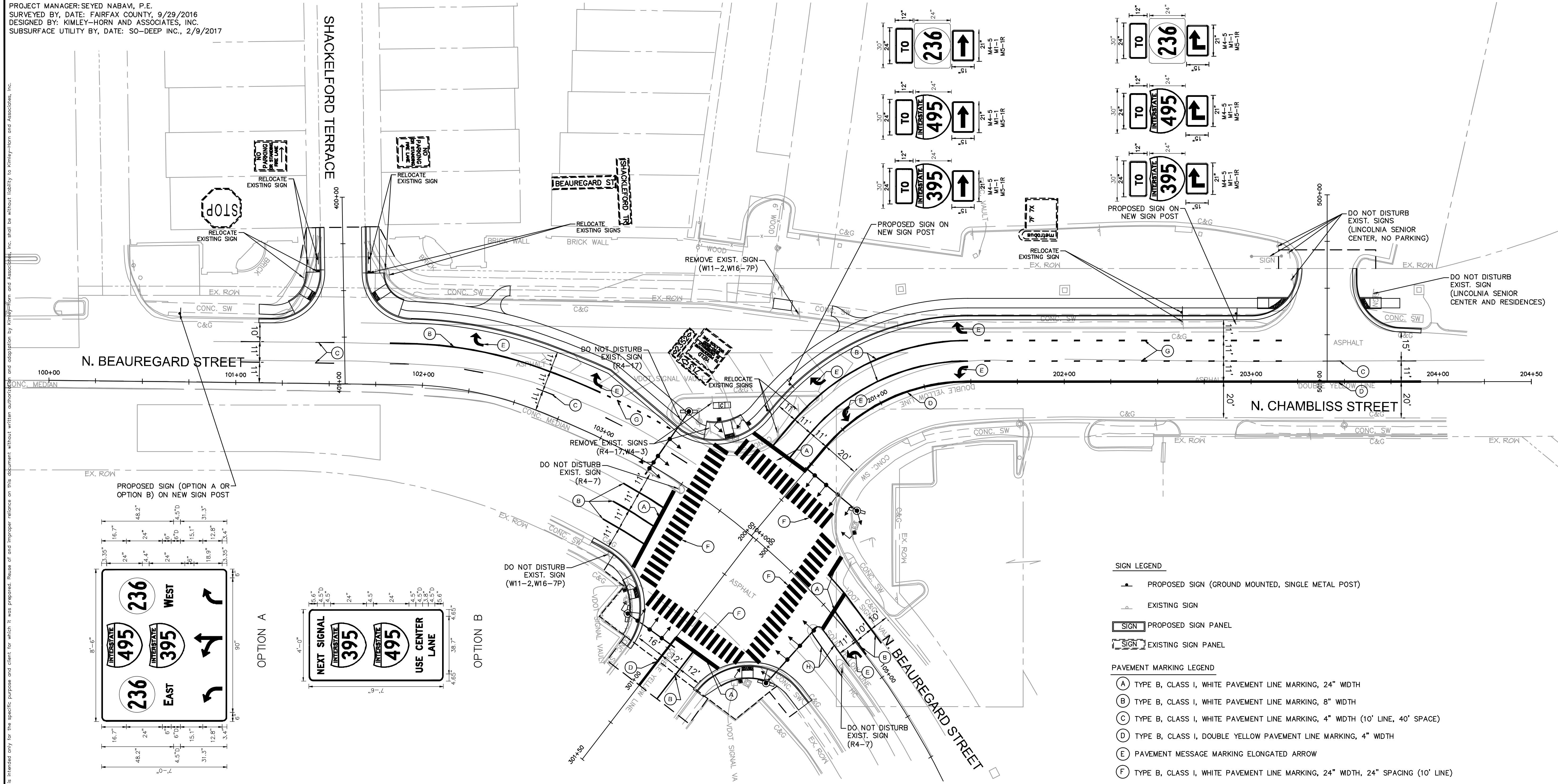


Figure 1: Project Location Map

The current configuration and operation of the intersection of N. Beauregard Street at N. Chambliss Street 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 mobility and safety. As part of the project, FCDOT has requested an evaluation of existing signal operations and a review of potential geometric modifications to the N. Beauregard Street and N. Chambliss Street prior to beginning design. This traffic analysis includes the intersections of N. Beauregard Street and N. Chambliss Street as well as N. Beauregard Street and Little River Turnpike. **Figure 1** illustrates the preliminary layout of the intersection reconfiguration.

PROJECT MANAGER: SEYED NABAVI, P.E.
SURVEYED BY, DATE: FAIRFAX COUNTY, 9/29/2016
DESIGNED BY: KIMLEY-HORN AND ASSOCIATES, INC.
SUBSURFACE UTILITY BY, DATE: SO-DEEP INC., 2/9/2017



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

Kimley»Horn

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

PRELIMINARY PLANS NOT FOR CONSTRUCTION

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

REVISIONS △#	DESCRIPTION	BY	APPROVED	DATE

PROJECT NO. 5G25-059-003		FUND NO. 300-C30050
SCALE SEE GRAPHIC SCALE	DESIGNED BY: DD DRAFTED BY: MP CHECKED BY: BB	SHEET 4

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

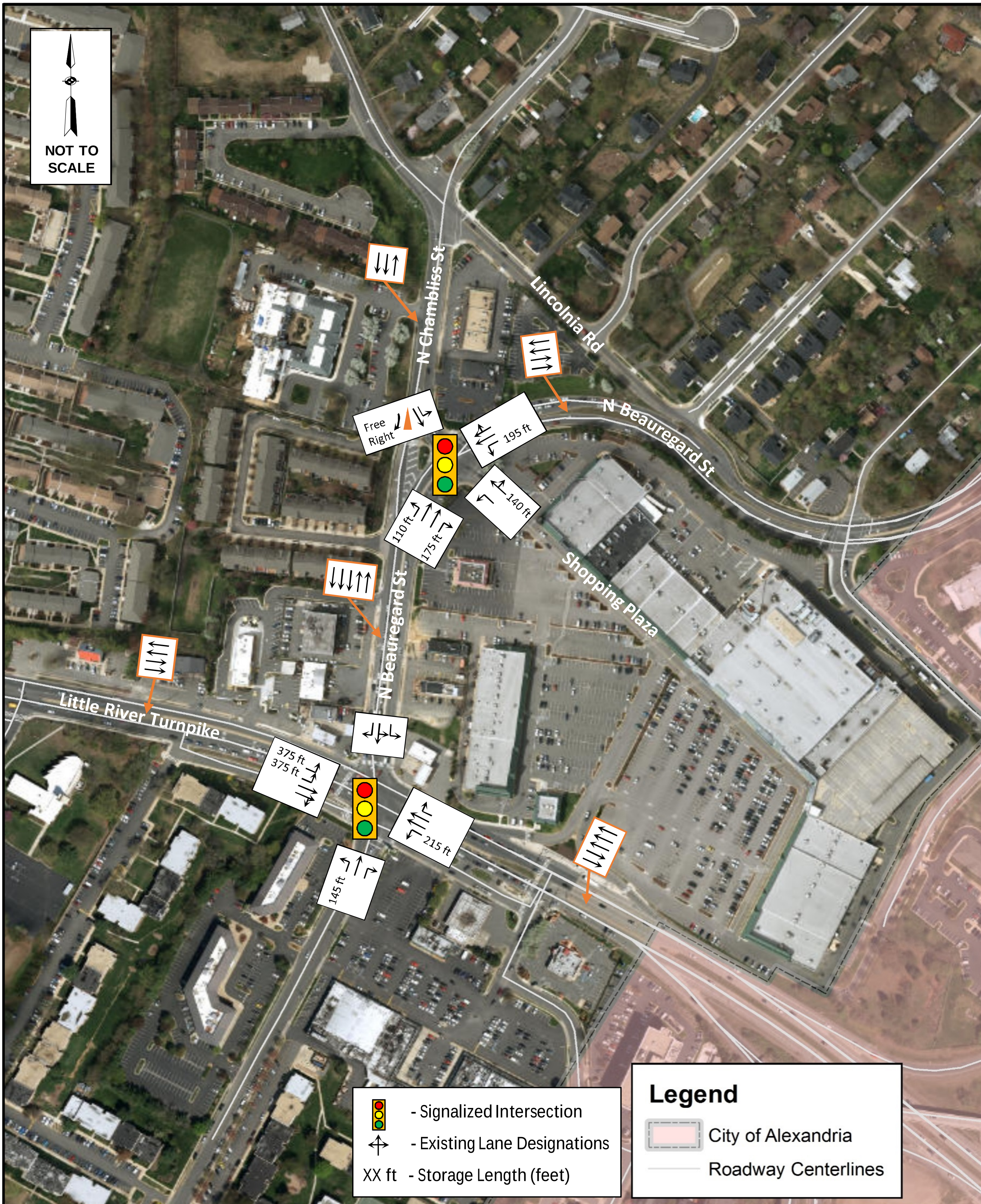
The local intersection peak hours differed during the AM peak hour and Saturday peak hour. The representative peak hours noted above reflect the hour during which the highest combined volume of traffic was traveling through the two intersections. **Figure 3** illustrates the existing roadway network 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.

CRASH DATA REVIEW

A high-level review of crash data was completed using the Virginia Roads website, an interactive mapping portal for transportation data published by the state of Virginia. The crash data module displays the approximate location of recorded crashes along with the date, type of crash, lighting conditions, and the number of injuries or fatalities that occurred for each crash record. The following information was gathered from the review of crashes that occurred in the vicinity of the intersection of N. Beauregard Street and N. Chambliss Street:

- 19 crashes were documented between 2010 and 2015
- 18 of the crashes were angle crashes
- 9 of the crashes resulted in one or more injuries; no fatalities occurred
- 10 of the crashes occurred under darkness; however, intersection lighting was functioning at the time of the crash

This information was used to complete a left-turn phasing evaluation (outlined in a later section of this report). Note that the available data from the Virginia Roads website does not indicate the direction of travel for each crash record. For this reason, without a detailed review of the complete crash records, an evaluation of crash patterns could not be completed.



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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

TRAFFIC OPERATIONS 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 95th percentile queue lengths for all approaches and lane groups were also evaluated in Synchro.

Table *1* 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. 95th 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. 95th 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 1: Summary of LOS, Delay, Queues (Existing Conditions)

Approach	Movement	Available Storage (ft)	AM LOS	AM Queue (ft)	PM LOS	PM Queue (ft)	SAT LOS	SAT Queue (ft)
1. Little River Turnpike & N. Beauregard Street								
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								
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)**	

Intersection: Existing Conditions (2016)

\# 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

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 2** 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 2: 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 3**. The resultant 24-hour daily traffic volumes are summarized in **Table 4**. “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 3: 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. Figure 4 summarizes the future weekday AM and PM peak hour traffic volumes as well as the Saturday peak hour conditions.

TRAFFIC OPERATIONS ANALYSIS

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.

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 on **Table 5.** The Synchro HCM and queuing reports can be found in **Appendix B.**

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

Figure 5

Table 4: 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

2026 Build Conditions

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 1) 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.

Figure 6 illustrates the proposed geometry and signal operations of the base scenario and scenario 1. **Table 5** and **Table 6** summarize the results of the operational analysis in Synchro for LOS, delay, and 95th 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**.

Kimley»Horn

N Beauregard Street at N Chambliss Street Intersection

Proposed Traffic Control for the Base Scenario and Scenario 1

Figure 6

Table 5: Summary of LOS, Delays, and 95th Percentile Queues

(Existing, No-Build, Base Scenario, and Scenario 1, 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 1 (2026): Protected/Permissive left-turn phasing for the N Chambliss Street and Plaza at Landmark Shopping Center approaches					
Approach	Movement	Average Storage (ft)	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)
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
	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
	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)	
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
	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
	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
	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)	
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
	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
	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
	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)	
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
	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
	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
	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)	
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)	

\# 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 6: Summary of LOS, Delays, and 95th Percentile Queues
(Existing, No-Build, Base Scenario, and Scenario 1, 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 1 (2026) Protected/Permissive left-turn phasing for the N Chambliss Street and Plaza at Landmark Shopping Center approaches					
Approach	Movement	Average Storage (ft)	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)
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
	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
	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
	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)	
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
	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
	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)	
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
	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
	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
	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)	
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
	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
	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)	
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)**	

* 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 1, 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 (highlighted in yellow (LOS E) or red (LOS F) in **Table 6** and **Table 7**) 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.

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. The slight increase in delay can be attributed to changes in vehicle progression between the two signals.

LEFT-TURN PHASE EVALUATION

As part of the design of the intersection improvements, a left-turn phase evaluation was completed using the VDOT Traffic Engineering Left-Turn Phase Selection Engineering Assessment Workbook. This tool includes seven evaluation factors to consider in the identification of the appropriate left-turn phase treatment, such as geometry, crossing distance, critical crossing gaps, and display consistency. These factors, while relevant to the evaluation of left-turn phasing, do not carry the same causal recommendations as correctable left-turn crashes and sight distance. According to the VDOT tool, if three to five correctable left-turn crashes occur within a single year, protected left-turn phasing should be considered. In addition, if intersection sight distance (ISD) criteria are not satisfied, protected left-turn phasing should be considered.

According to available crash data from the VirginiaRoads.org website, there were 18 angle crashes that occurred between 2010 and 2015. The data does not differentiate between direction of travel; however, the geocoded locations of the crashes suggest that all 18 angle crashes were between vehicles traveling along N. Beauregard Street. This may be attributed to the current protected-permissive left-turn phasing. The average annual number of crashes is three crashes per year, with the highest recorded number of crashes occurring in 2014 (five total). This suggests that protected left-turn phasing could be justified.

ISD was also evaluated for each direction consistent with the procedures outlined in the American Association of State Highway and Transportation Officials (AASHTO) "A Policy on Geometric Design of Highways and Streets" section on sight distance for left-turning vehicles, Case F. The formula below was used to calculate ISD, where V_{major} is the posted speed limit plus 7 mph and t_g is the time gap for left turns. Along N. Beauregard Street, the time gap value was determined to be 7.2 seconds while the time gap for N. Chambliss Street was determined to be 6.5 seconds. The resulting ISD values were calculated as 339 feet and 306 feet, respectively, for these roadways.

$$ISD = 1.47\ V_{major}\ t_g$$

Figure 7 through **Figure 10** illustrate ISD for each direction. As shown in **Figure 7** and **Figure 8**, adequate sight distance is provided considering the existing geometry for the northbound and eastbound left-turn movements. **Figure 9** suggests that sight distance between a southbound left-turn and a vehicle traveling northbound in the right lane is limited by the existing trees. Although a formal crash analysis was not completed, there is a possible correlation between the limited sight distance for this movement and the number of angle crashes. These factors combined indicate that protected only phasing should be considered. As for the westbound left-turn movement, **Figure 10** illustrates that the presence of parked vehicles and shrubbery on the north corner limit the sight distance for the westbound left-turn movement. As with the southbound left-turn, protected only phasing should be considered based on the left-turn phase evaluation.

As part of the left-turn phasing evaluation, the critical crossing gap was evaluated by calculating the cross product for each movement. In general, VDOT guidance suggests some level of protection should be considered if the critical crossing gap value exceeds 50,000. In the eastbound direction, this value was determined to be less than 25,000 for all timing plans evaluated as part of the analysis. This indicates that permissive only left-turn phasing could be considered. To provide for greater operational flexibility, it is recommended that a permissive flashing yellow arrow (FYA) signal be installed for the eastbound right-turn. Doing so would allow for the following:

- Service of the pedestrian phase in the westbound direction earlier in the cycle (no conflicting protected left-turn phase)
- The ability to lag the westbound left-turn movement without creating a yellow trap, a condition where left-turning vehicles become stuck in the intersection during the yellow clearance interval, potentially at risk for a crash. This is due to the misperception that the opposing through movement is also receiving a yellow indication, when in reality a green indication is sustained until the lagging left-turn movement is serviced.
- By lagging the westbound left-turn movement, unused green time from the eastbound approach could be reallocated to the high-volume westbound left-turn movement. This would only be the case if the pedestrian phase in the eastbound direction is not serviced.
- Instead of operating split phase, the signal could service both the eastbound and westbound pedestrian phases simultaneously outside the protected westbound left-turn phase.

Table 7 summaries the existing and proposed left-turn phasing for the intersection. **Appendix C** includes the completed left-turn phasing evaluation worksheets from the VDOT tool.

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

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

Figure 7: ISD Summary for the Northbound Left-Turn Movement

Figure 8: ISD Summary for the Eastbound Left-Turn Movement

Figure 9: ISD Summary for the Southbound Left-Turn Movement

Figure 10: ISD Summary for the Westbound Left-Turn Movement

Revised 2026 Build Conditions

Given the recommended changes to left-turn phasing and the impact on signal operations, the Synchro traffic analysis of 2026 build conditions was updated considering the left-turn phasing noted in **Table 7**. As noted, the phase sequencing was adjusted to lead the eastbound through movement from N. Chambliss Street and lag the westbound left-turn movement from the Plaza at Landmark Shopping Center. Anticipating lower demand for the eastbound through movement, green time unused by this movement could be reallocated to the westbound left-turn movement, which experiences higher demand during the PM and Saturday peak hours. Consistent with the other scenarios evaluated in the build condition, the analysis assumed the eastbound right-turn movement would actuate the protected overlap phase only and would not control the eastbound through movement.

Table 8 and **Table 9** summarize the AM, PM, and Saturday peak hour LOS and queues for the revised 2026 build conditions (Scenario 2) in comparison to the initial build condition (Scenario 1) as well as no build and existing conditions. Very little change in operations at the Little River Turnpike and N. Beauregard Street intersection is expected under the revised build condition. The small differences in delay presented in **Table 9** can be attributed to changes in progression between the two signals. Increases in delay at the N. Chambliss Street and N. Beauregard in Scenario 2 as compared to Scenario 1 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 approach to accommodate protected only left-turn phasing, which reduces green time allocated to the mainline 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. The Synchro HCM and queuing reports can be found in **Appendix D**. A comparative tabular summary of the Synchro HCM and queuing reports can also be found at the beginning of **Appendix D**.

Table 8: Summary of LOS, Delays, and 95th Percentile Queues
(Existing, No-Build, Scenario 1, and Scenario 2, N. Beauregard Street at Little River Turnpike)

Intersection			Existing Conditions (2016)						No-Build Scenario (2026)						Scenario 1 (2026) Protected/Permissive left-turn phasing for the N Chambliss Street and Plaza at Landmark Shopping Center approaches						Scenario 2 (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	
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)
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
	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
	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)	
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
	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
	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
	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)	
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 (11.41)	#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
	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
	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)	
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 (93.2)	m#823	F (158.1)	m#1141	F (161.4)	m#925	F 995.6)	m#844	F (154.0)	m#1052	F (151.5)	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 (88.7)	m#893	F (151.8)	m#1217	F (156.9)	m#926	F (90.7)	m#910	F (148.6)	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 (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 (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 (70.1)		F (85.2)		F (83.1)		E (70.3)		F (84.5)		F (81.4)	

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: Summary of LOS, Delays, and 95th Percentile Queues
(Existing, No-Build, Scenario 1, and Scenario 2, N. Beauregard Street at N. Chambliss Street)

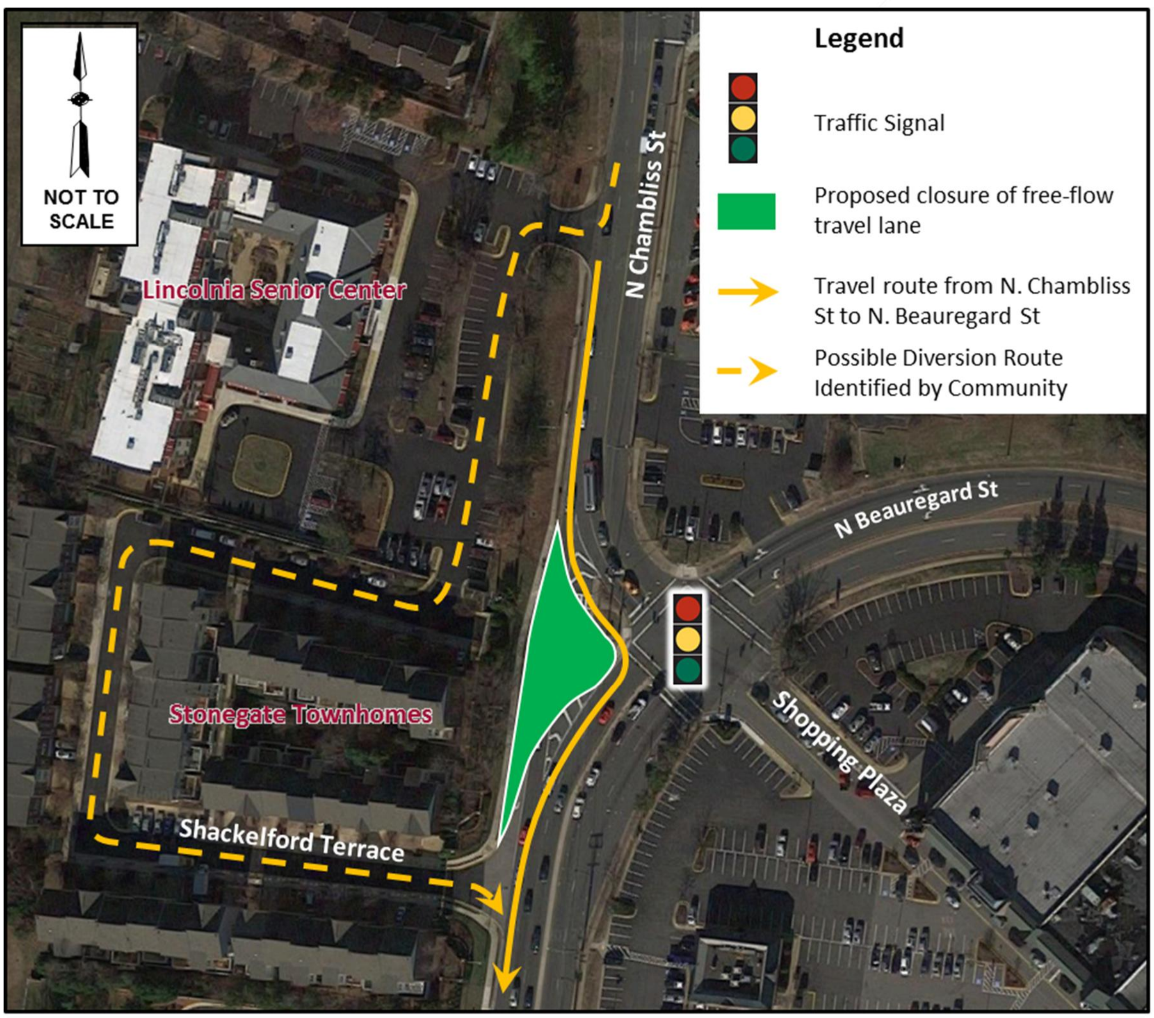
Intersection			Existing Conditions (2016)						No-Build Scenario (2026)						Scenario 1 (2026) Protected/Permissive left-turn phasing for the N Chambliss Street and Plaza at Landmark Shopping Center approaches						Scenario 2 (2026) Protected/Permissive left-turn phasing for NB N Beauregard Street, protected 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	
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)
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 (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 (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 (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 (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	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 (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 (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 (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 (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 (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 (22.5)		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 (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 (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 (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 (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

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 Shackleford 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 11** illustrates the modified travel route through the intersection and the possible diversion route identified by the community on Shackelford Terrace.

Figure 11: 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

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 study evaluated the impacts to signal operations given the change in the configuration of the intersection. The initial evaluation of changes to signal phasing suggested that Scenario 1 resulted in the most favorable overall intersection operations among the AM, PM, and Saturday peak hours with the proposed pedestrian improvements. However, after a review of left-turn phasing was completed, it was determined that protected only left-turn phasing was necessary for the southbound and westbound left-turn movements due to sight distance limitations. In addition, an apparent angle crash pattern was identified along N. Beauregard Street, which could be attributed to the limited sight distance in the southbound direction. As a result, an alternative Scenario 2 was developed that consisted of protected/permissive left-turn phasing for the northbound N. Chambliss 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.

The recommended signal phasing allows the intersection to operate with concurrent side street permissive phase sequences, allowing for simultaneous pedestrian access across N. Beauregard Street on the north and south side of the intersection. The proposed operation will minimize impacts to the traffic signal operations over the base scenario (split phase side street signal operations). For example, 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 2, the mainline delay could be as low as 50 seconds depending upon the vehicular demand for the protected westbound left-turn phase. Scenario 2 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).