Traffic Impact Analysis
for
The Pitt & Lippe – Age Restricted Residential Development
Isle of Wight, Virginia

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1 EXECUTIVE SUMMARY

East West Partners of Virginia, Inc. is proposing the development of the Pitt & Lippe parcels as well as the Eagle Harbor, LLC (Tract 11) parcel located in Isle of Wight County, Virginia. It is proposed that the Pitt parcel will consist of age restricted (i.e., 55 years of age or older) townhouse residential units and the Lippe parcel will consist of age restricted (i.e., 55 years of age or older) single family and townhouse residential units. The Eagle Harbor, LLC (Tract 11) parcel with frontage along Carrollton Boulevard (U.S. Route 17), is assumed to be developed with a combination of medical office and general office space. For the purposes of this TIA, the parcels are assumed to be connected and will have cross parcel access. The Pitt parcel is bound by Eagle Harbor, LLC (Tract 11), the Shoppes at Eagle Harbor, and commercial development to the north and west, the Lippe parcel is located to the south, and undeveloped parcels as well as a tributary to Ragged Island Creek to the east. The Lippe parcel is bound by the Pitt parcel to the north, Channell Way to the south, residential housing as well as undeveloped parcels to the east, and undeveloped parcels to the west. The purpose of this report is to satisfy the traffic impact analysis (TIA) requirements of a Zoning Amendment application as required by Appendix B Article 1 Section 1-1015(F)(3) of the County of Isle of Wight Code for amendments to zoning codes.

It is anticipated that the construction of the proposed development will be completed, operational, and at or near full occupancy/build-out by 2026. The following three (3) access points are proposed for the Pitt & Lippe development:

- Carrollton Boulevard (U.S. Route 17) via the Pitt Parcel Access:
  1. Westbound approach of Smiths Neck Road at the Carrollton Boulevard/Smiths Neck Road signalized intersection
  2. Westbound approach of Northgate Drive at the Carrollton Boulevard/Northgate Drive unsignalized intersection
- Carrollton Boulevard (U.S. Route 17) via the Channell Way/Lippe Parcel Access:
  1. Westbound approach at the Channell Way/Whippingham Parkway unsignalized intersection (Channell Way will provide direct access to/from Carrollton Boulevard)

The total amount of traffic generated by these developments is expected to consist of approximately 2,930 daily trips, of which 220 and 244 trips will occur during the AM and PM peak hours, respectively. In addition to the traffic generation associated with the proposed parcels, an annual growth rate of 2% was applied to account for future traffic volume projections per standard practice and guidance as a part of this study. Based on the results of the traffic analysis, the future impacts associated with the proposed development are anticipated to be minimal overall, with minor deteriorations in operations anticipated at the signalized and unsignalized intersections when comparing 2026 and 2032 Build conditions to 2026 and 2032 No-Build and in some cases even Existing operational conditions.

The minimal impacts to operations reflect the relatively small amount of new traffic that is expected to be generated by the proposed development in relationship to the volume of traffic experienced along the corridor today. However, based on the analysis results provided in this traffic study, improvements were identified to help accommodate the additional traffic generated by the proposed site and allows operational conditions to be consistent with those anticipate under a “No Build” scenario (in regard to the proposed development) for this area.

As such, the following recommendations were identified as part of this TIA and are summarized below, as well as shown graphically in **Figure ES – 1**. It is noted that the anticipated phase of implementation for each of these improvements is provided for reference.

Carrollton Boulevard (U.S. Route 17)

- VDOT should continue to monitor and periodically optimize traffic signal phasing and timing plans to accommodate peak hour/off-peak traffic volumes along the Carrollton Boulevard corridor
- VDOT should update signal timing optimization following initial occupancy and full build-out of the development to account for the change in traffic volumes/demand
    - Signal coordination improvements/enhancements should continue to facilitate and emphasize the progression of traffic along Carrollton Boulevard

Carrollton Boulevard (U.S. Route 17) at Smiths Neck Road

- The Developer will modify the existing traffic signal (i.e., install a third signal head on the mast arm serving the westbound approach of Smiths Neck Road) to accommodate the proposed exclusive left-turn lane, through lane, and exclusive right-turn lane. (Phase 1)
    - Implement right-turn overlap phase as a part of traffic signal operations/phasing. (Phase 1)
- The Developer will modify the existing traffic signal (i.e., modify signal heads on the mast arm serving the eastbound approach of Smiths Neck Road) to accommodate the proposed dual exclusive left-turn lanes and a shared through/right-turn lane. (Phase 1)
    - Remove/replace the existing lane control signage on the mast arm to reflect dual left-turn movement. (Phase 1)
- VDOT should continue to periodically optimize traffic signal phasing and timing plans to accommodate peak hour/off peak traffic volumes along the Carrollton Boulevard corridor
- VDOT should update signal timing optimization following initial occupancy and full build-out of the development to account for the change in traffic volumes/demand
    - Signal coordination improvements/enhancements should continue to facilitate and emphasize the progression of traffic along Carrollton Boulevard

Northbound Carrollton Boulevard (Phase 3)

- The Developer will improve/extend the existing exclusive northbound left-turn lane to consist of 400 feet of storage and a 100-foot taper
    - Final design and construction of this improvement shall be coordinated directly with VDOT

Southbound Carrollton Boulevard (Phase 1)

- The Developer will improve/extend the existing exclusive southbound left-turn lane to consist of 400 feet of storage and a 100-foot taper
    - Final design and construction of this improvement shall be coordinated directly with VDOT

Eastbound Smiths Neck Road (Phase 1)

- The Developer will reconfigure the eastbound approach to consist of the following laneage:
    - Two exclusive left-turn lanes
    - One exclusive shared through/right-turn lane
- The Developer will remove/replace the existing lane control signage on the mast arm to reflect the dual left-turn movement
- Eastbound and westbound left-turns will run concurrently

Westbound Smiths Neck Road

- Approach/Outbound laneage (Phase 1)
    - The Developer will construct an exclusive right-turn lane extending from the 7-Eleven entrance driveway to the intersection with Carrollton Boulevard
    - The Developer will restripe the westbound approach to delineate the following laneage (Phase 1):
        - One exclusive left-turn lane
        - One exclusive through lane
        - One exclusive right-turn lane
- Receiving/Inbound Laneage (Phase 1)
    - The Developer will construct a 4' raised concrete median between the 7-Eleven/Bojangles' intersection and the Carrollton Boulevard intersection.
    - The Developer will construct/install two inbound lanes to consist of the following:
        - Inside travel lane to serve as an exclusive left-turn lane (drop lane)
        - Outside travel lane will be designated as a shared through/right-turn lane
        - Improve/modify channelized/right-in only driveway (e.g., driveway entrance width and associated driveway radii) serving the Bojangles'/Shoppes at Eagle Harbor

Smiths Neck Road at 7-Eleven/Bojangles' (Phase 1)

- The Developer will construct/configure the intersection as three-way STOP controlled:
    - The Bojangles', 7-Eleven, and the northbound Driveway 1/Connection from the Pitt property being STOP controlled
    - The southbound Driveway 1/Connection to the Pitt property and thus the southbound left-turn movement to the 7-Eleven entrance driveway will be free-flow operations
- The Developer will install supplemental signage and pavement markings to consist of the following:
    - "DO NOT BLOCK INTERSECTION" signage
    - Intersection pavement markings delineating the area not to block (i.e., the box)
    - Supplement with signage reflecting a potential fine for those observed/caught impeding intersection operations

Carrollton Boulevard (U.S. Route 17) at Northgate Drive

Northbound Carrollton Boulevard (Phase 3)

- The Developer will improve/extend the existing exclusive northbound right-turn lane to consist of 200 feet of storage and a 200-foot taper
    - Final design and construction of this improvement shall be coordinated directly with VDOT

Southbound Carrollton Boulevard (Phase 3)

- The Developer will improve/extend the existing exclusive southbound left-turn lane to consist of 200 feet of storage and a 200-foot taper
    - Final design and construction of this improvement shall be coordinated directly with VDOT

Northgate Drive Interim Improvements

Eastbound Northgate Drive (Phase 3)

- No geometric changes
- Implement site access/movement restrictions via signage during peak periods (i.e. install signage reflecting no left or through movements Monday – Friday 6:00 AM to 9:00 AM and 3:00 PM to 6:00 PM).

Westbound Northgate Drive (Phase 3)

- No geometric changes
- Implement site access/movement restrictions via signage during peak periods (i.e. install signage reflecting no left or through movements Monday – Friday 6:00 AM to 9:00 AM and 3:00 PM to 6:00 PM).

Northgate Drive Permanent Partial Access Improvements

Phase 5 will include the installation of a raised median at the existing full movement Carrollton Boulevard/Northgate Drive intersection to create channelized left-turn lanes along northbound/southbound Carrollton Boulevard and fully restrict side street left-turn and through movements (i.e., right-turn only).

Eastbound Northgate Drive (Phase 5)

- Reconfigure (i.e., restripe and update signage) Northgate Drive approach as a right-turn only at the time the related intersection improvement project noted below in Transportation proffer item 2 is being constructed.

Westbound Northgate Drive (Phase 5)

- Reconfigure (i.e., restripe and update signage) Northgate Drive approach as a right-turn only at the time the related intersection improvement project noted below in Transportation proffer item 2 is being constructed.

Channell Way (Phase 2)

- The Developer will improve the existing 2-lane typical section of Channell Way to consist of the following:
    - Pavement striping to reflect/delineate two (2) 11-foot travel lanes
    - 2-foot graded shoulder in each direction
- The Developer will implement the proposed improvements from the agreed upon eastern limits of the Lippe parcel in the east to the Carrollton Boulevard intersection in the west
- The Developer will coordinate with VDOT on implementation of resurfacing/repaving the defined segment of roadway (i.e., identify when/if VDOT has surfacing activities planned and implement Developer resurfacing improvements prior to/in lieu of those efforts)
    - Coordinate with VDOT to identify/confirm documented pavement section deficiencies and address/mitigate as applicable

Carrollton Boulevard (U.S. Route 17) at Channell Way/Deep Bottom Drive

Northbound Carrollton Boulevard

- No geometric changes

Southbound Carrollton Boulevard (Phase 4)

- The Developer will improve/extend the existing exclusive southbound left-turn lane to consist of 200 feet of storage and a 150-foot taper
    - Final design and construction of this improvement shall be coordinated directly with VDOT to account for the second northbound turn-lane being constructed (i.e., second northbound left-turn lane at Brewers Neck Boulevard) as a part of the VDOT Bartlett Intersection improvement project.

Eastbound Deep Bottom Drive

- No geometric changes

Westbound Channell Way (Phase 4)

- The Developer will improve the westbound approach to consist of the following laneage:
    - One shared through/left-turn lane
    - One exclusive right-turn lane consisting of 150 feet of storage and a 150-foot taper
        - Final design and construction of these improvement shall be coordinated directly with VDOT

Figure ES – 1: Recommended Improvements

2 INTRODUCTION

East West Partners of Virginia, Inc. is proposing the development of the Pitt & Lippe parcels as well as the Eagle Harbor, LLC (Tract 11) parcel located in Isle of Wight, Virginia. It is proposed that the Pitt parcel will consist of age restricted (i.e., 55 years of age or older) townhouse residential units and the Lippe parcel will consist of age restricted (i.e., 55 years of age or older) single family and townhouse residential units. The Eagle Harbor, LLC (Tract 11) parcel with frontage along Carrollton Boulevard (U.S. Route 17), is assumed to be developed with a combination of medical office and general office space. For the purposes of this TIA, the parcels are assumed to be connected and will have cross parcel access. The Pitt parcel is bound by Eagle Harbor, LLC (Tract 11), the Shoppes at Eagle Harbor, and commercial development to the north and west, the Lippe parcel is located to the south, and undeveloped parcels as well as a tributary to Ragged Island Creek to the east. The Lippe parcel is bound by the Pitt parcel to the north, Channell Way to the south, residential housing as well as undeveloped parcels to the east, and undeveloped parcels to the west. **Figure 1** illustrates the proposed parcel locations.

The purpose of this report is to satisfy the traffic impact analysis (TIA) requirements of a Zoning Amendment application as required by Appendix B Article 1 Section 1-1015(F)(3) of the County of Isle of Wight Code for amendments to zoning codes. It is anticipated that the construction of the proposed parcels will be completed, operational, and at or near full occupancy/build-out by 2026. The following three (3) access points are proposed for the Pitt parcel and Lippe parcel, as shown in **Figure 2**:

- Carrollton Boulevard via the Pitt Parcel Access:
  1. Northbound approach at the Carrollton Boulevard/Smiths Neck Road signalized intersection
  2. Northbound approach at the Carrollton Boulevard/Northgate Drive unsignalized intersection
- Carrollton Boulevard via the Channell Way/Lippe Parcel Access:
  3. Westbound approach at the Channell Way/Whippingham Parkway unsignalized intersection (Channell Way will provide access to/from Carrollton Boulevard)

Kimley-Horn has been retained to perform a TIA for the proposed development of the site as a part of the Pitt parcel and Lippe parcel Zoning Amendment application. This report has been prepared for submittal to the County of Isle of Wight to evaluate Existing conditions as well as future traffic conditions that include development related traffic volumes. Assumptions regarding the study area, access, annualized growth rate, and traffic analysis scenarios were discussed with and approved by Isle of Wight County and Virginia Department of Transportation (VDOT) staff prior to the completion of this analysis. The assumptions document is provided in **Appendix A**.

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Figure 1: Study Area

Figure 2: Proposed Site Plan

3 PROJECT BACKGROUND

3.1 STUDY AREA

The study area for this analysis, as illustrated in **Figure 1**, includes the following existing intersections:

- Carrollton Boulevard (U.S. Route 17) at Whippingham Parkway/Harbor Point Lane (signalized)
- Carrollton Boulevard at Eagle Harbor Parkway/Kings Cross Way (signalized)
- Carrollton Boulevard at Smiths Neck Road (signalized)
- Carrollton Boulevard at Northgate Drive (unsignalized)
- Carrollton Boulevard at Brewers Neck Boulevard (U.S. Route 258/State Route 32) (signalized)
- Carrollton Boulevard at Channell Way/Deep Bottom Drive (unsignalized)
- Carrollton Boulevard at Ashby Way/Omera Drive (signalized)

3.2 EXISTING ZONING

The Pitt parcel and the Lippe parcel are a part of the Newport Development Service District and are located on an existing vacant parcel zoned as Rural Agricultural Conservation District (RAC). **Figure 3** illustrates the existing zoning adjacent to the proposed site.

Existing zoning around and adjacent to the proposed parcels consist primarily of the following zoning districts: Rural Agricultural Conservation (RAC) District, Planned Development Residential District (PD-R), General Commercial District (GC), and Suburban Residential District (SR).

3.3 EXISTING CONDITIONS

Carrollton Boulevard is the primary north-south thoroughfare within the study area, providing connections to Brewers Neck Boulevard, the City of Suffolk, and the James River Bridge which provides direct access to/from the City of Newport News. **Figure 4** depicts existing roadway lane conditions for study area roadways and intersections. The following provides a brief description of existing roadway characteristics for each facility:

Carrollton Boulevard (U.S. Route 17) is oriented in a general north-south direction and configured as a four-lane, divided facility with a posted speed of 55 miles per hour (mph) within the study area with the exception of the portion of the corridor between Smiths Neck Road and Whippingham Parkway which is posted at 45 mph. Carrollton Boulevard is classified as an “Other Principal Arterial” by the Virginia Department of Transportation (VDOT). Average weekday traffic counts (AWDT) were collected over a continuous 72-hour period with vehicle classification and speed data for three (3) segments along Carrollton Boulevard in October 2017. **Table 1** displays the AWDT in vehicles per day (vpd), heavy vehicle percentage, and average speed in mph collected for each of the three (3) segments.

Brewers Neck Boulevard (U.S. Route 258/State Route 32) is oriented as an east-west roadway and configured as a four-lane, divided facility with a posted speed limit of 55 mph throughout the study area. Brewers Neck Boulevard is classified as an “Other Principal Arterial” by VDOT. Annual Average Daily Traffic (AADT) volumes were obtained from VDOT’s Daily Traffic Volume Estimates and this data indicated that the segment of Brewers Neck Boulevard between Benns Church Boulevard and Carrollton Boulevard carries approximately 26,000 vehicles per day (vpd) and 4% heavy vehicles.

Table 1: Carrollton Boulevard Average Weekday Daily Traffic Data

Roadway	From	To	AWDT (vpd)		Heavy Vehicle %		Average Speed (mph)	
			NB	SB	NB	SB	NB	SB
			Bi-Directional		Bi-Directional		Bi-Directional	
Carrollton Boulevard	Whippingham Parkway	Eagle Harbor Parkway	16,150	16,150	3%	4%	48.9	46.7
			32,300		3%		47.8	
Carrollton Boulevard	Northgate Drive	Brewers Neck Boulevard	13,600	13,700	4%	7%	58.1	56.0
			27,300		6%		57.0	
Carrollton Boulevard	Brewers Beck Boulevard	Channell Way	10,800	10,500	4%	4%	59.2	57.2
			21,300		4%		58.2	

Channell Way (Route 663) is oriented in a general east-west direction and configured as a two-lane, undivided roadway that connects to Carrollton Boulevard. A speed limit is not posted on Channell Way but for the purposes of this study, a speed of 25 mph was used for analysis. A 72-hour weekday traffic count was collected from October 16, 2018 to October 18, 2018. This traffic count indicated that the segment of Channell Way between Baltimore Lane and Whippingham Parkway carries approximately 550 vpd.

3.4 EXISTING PEDESTRIAN AND BICYCLE ACCOMMODATIONS

Existing pedestrian accommodations in the study area consist of a sidewalk provided from Smiths Neck Road to Fiddler Lane, with plans to extend to Northgate Drive on the west side of Carrollton Boulevard. Sidewalk is provided along the south side of Smiths Neck Road from Carrollton Boulevard to Chickahominy Loop.

Pedestrian accommodations are also located along the east side of Carrollton Boulevard from the southern site access driveway serving The Shoppes at Eagle Harbor, to the right-in/right-out only site access driveway serving the 7-Eleven to the north.

Additionally, a short segment of multi-use path is provided along the west side Carrollton Boulevard, extending to the south of the Eagle Harbor Parkway intersection (i.e., across the frontage of the Dunkin Donuts). Sidewalk is also provided along the south side of Eagle Harbor Parkway from the intersection with Carrollton Boulevard to the Eagle Harbor Parkway/Marsh Drive intersection.

Sidewalk is located on the east side of Carrollton Boulevard from the Eagle Harbor Parkway/Kings Cross intersection to Whippingham Parkway/Harbor Point Lane intersection. At this intersection sidewalk is provided along the south side of Harbor Point Lane as well as along the north side of Whippingham Parkway.

Figure 3: Existing Zoning

Figure 4: Existing Roadway Conditions

3.5 EXISTING TRAFFIC

Based on initial discussions with Isle of Wight County, AM and PM peak hour conditions were analyzed to evaluate potential impacts of the proposed development. To coincide with these times, turning movement counts (TMC) were collected for the study area intersections.

AM and PM vehicular TMC data were collected at the following study area intersections on October 5, 2017 with the exception of the intersection of Carrollton Boulevard at Ashby Way/Omera Drive which was added to the study area at the request of Isle of Wight County and counted on November 15, 2017:

- Carrollton Boulevard (U.S. Route 17) at Whippingham Parkway/Harbor Point Lane (signalized)
- Carrollton Boulevard at Eagle Harbor Parkway/Kings Cross (signalized)
- Carrollton Boulevard at Smiths Neck Road (signalized)
- Carrollton Boulevard at Northgate Drive (unsignalized)
- Carrollton Boulevard at Brewers Neck Boulevard (U.S. Route 258/State Route 32) (signalized)
- Carrollton Boulevard at Channell Way/Deep Bottom Drive (unsignalized)
- Carrollton Boulevard at Ashby Way/Omera Drive (signalized)

The uniform peak periods for these intersections were found to be 7:00 AM to 8:00 AM and 4:45 PM to 5:45 PM for the AM and PM peak hours, respectively. The resulting AM and PM peak hour turning movement volumes from the abovementioned data sources are shown in **Figure 5.** Detailed count data is also provided in **Appendix B**.

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Figure 5: 2017 Existing AM and PM Peak Hour Traffic Volumes

4 PROJECTED TRAFFIC VOLUMES

Based on discussions with the East West Partners of Virginia, Inc, the following horizon years were analyzed to determine future impacts of the proposed development based on the anticipated schedule for construction and opening:

- Scenario 1 – Existing Conditions
- Scenario 2 – 2026 No Build Conditions (i.e., future traffic volumes based on the application of a 2% background growth rate but *without* traffic from the proposed Pitt & Lippe development)
- Scenario 3 – 2026 Build Conditions (i.e., future traffic volumes based on the application of a 2% background growth rate *plus* traffic from the proposed Pitt & Lippe development)
- Scenario 4 – 2032 No Build Conditions (i.e., future traffic volumes based on the application of a 2% background growth rate but *without* traffic from the proposed Pitt & Lippe development)
- Scenario 5 – 2032 Build Conditions (i.e., future traffic volumes based on the application of a 2% background growth rate *plus* traffic from the proposed Pitt & Lippe development)

4.1 BACKGROUND TRAFFIC GROWTH

Historical traffic data was obtained from VDOT along Carrollton Boulevard and Brewers Neck Boulevard within the study areas, as shown in **Table 2**. Based on a review of this data, volumes are varied with traffic experiencing times of both growth and decline. On average, a historic growth of approximately 1.5% has occurred on these study roadways.

Table 2: Study Area Historic ADTs

Roadway	Location	2012	2013	2014	2015	2016	Average
Carrollton Boulevard	Suffolk City Limits to Brewers Neck Boulevard	15,000	15,000	15,000	15,000	15,000	**0.00%**
	Growth Rate to 2016	*0.0%*	*0.0%*	*0.0%*	*0.0%*	-	
Carrollton Boulevard	Brewers Neck Boulevard to Ragged Island	29,000	28,000	28,000	29,000	29,000	**0.74%**
	Growth Rate to 2016	*0.0%*	*1.2%*	*1.8%*	*0.0%*	-	
Brewers Neck Boulevard	Benns Church Boulevard to Carrollton Boulevard	24,000	24,000	24,000	25,000	26,000	**3.2%**
	Growth Rate to 2016	*2.0%*	*2.7%*	*4.1%*	*4.0%*	-	
Overall Average Growth Rate							**1.3%**

Source: VDOT Traffic Engineering Division – Annual Average Daily Traffic Volume Estimates By Section of Route

In addition to the natural/historical trend of growth of 1.5%, there are other approved developments that are not yet constructed within the study area. In conversations with Isle of Wight County staff it was determined, that to account for these approved, but unbuilt developments an additional 0.5% should be added to the historical growth rate. This results in a growth rate of 2% that will be applied exponentially to calculate background traffic volumes for future analysis years (i.e., 2026 and 2032)

Additionally, diverted trips from Nike Park Extension and traffic related to the Crossings development were also considered when determining the future No Build volumes.

4.2 TRIP GENERATION

The *ITE Trip Generation 10th Edition* (2017) Trip Generation Rates and relevant Land Use Codes were used to develop the trip generation estimates for the Pitt and Lippe development. Land uses for the proposed Pitt and Lippe development include Senior Adult Housing (Attached and Detached – ITE Land Use Codes 251 and 252). In addition, there are two outparcels identified in the master plan located to the south/east of Carrollton Boulevard between Northgate Drive and the southern site access driveway serving the Shoppes at Eagle Harbor. These outparcels are anticipated to have 1.7 and 2.0 acres of developable land area. For the purposes of this TIA, the outparcels were assumed to develop as general office building (Land Use Code: 710) and medical-dental office building (Land Use Code: 720) land uses. The building square footage was estimated by applying a 0.2 floor-to-area ratio (FAR) to the outparcel size. No pass-by or internal capture rate reductions were included in this analysis. Initial trip generation calculations based on published ITE rates for the proposed development are shown in **Table 3**.

Table 3: Proposed Trip Generation

ITE Code	ITE Description	Density	Unit	Daily	AM Peak Hour			PM Peak Hour		
					Total	Enter	Exit	Total	Enter	Exit
251	Senior Adult Housing – Detached	165	Dwelling Units	874	60	20	40	71	43	37
252	Senior Adult Housing - Attached	175	Dwelling Units	678	35	12	23	44	24	20
			Total Residential	*1,552*	*95*	*32*	*63*	*115*	*68*	*47*
710	General Office Building (0.2 FAR)	17,400	Square Feet	195	43	37	6	22	4	17
720	Medical-Dental Office Building (0.2 FAR)	14,800	Square Feet	481	41	32	8	52	15	38
			Out Parcels	*676*	*84*	*69*	*14*	*74*	*18*	*55*
			Total	**2,228**	**178**	**101**	**77**	**189**	**86**	**101**

However, on conversations with Isle of Wight County and VDOT, it was discussed and agreed to that the ITE Trip Generation rates presented may be low, compared to what is likely anticipated for the proposed Age Restricted Residential land use. Based on consensus among the group, Kimley-Horn reviewed two independent studies that documented the trip generation characteristics of a 55+ (Age Restricted) Communities in comparison to both traditional single family and 55+/Unrestricted Residential Communities. Data from these reports indicated that Age Restricted/Senior Housing Communities generate approximately 2/3 of the amount of daily traffic when compared to a typical single-family development. The data also suggested that based on income and vehicle ownership as well as non-residential traffic activity, that a factor of 1.5 (i.e., 50%) should be applied to peak hour trip generation rates to better account for the non-household travel. The results of these proposed adjustments to Senior Adult Housing – Detached and Attached trip generation rates in comparison to Single Family Detached Housing are shown in **Table 3**. Reference documents and adjustment calculations are provided as an attachment to this assumptions document. Study data references and documentation can be found in **Appendix C**. These proposed adjusted trip generation rates were applied to the Pitt & Lippe development intensities and resulted in the overall trip generation potential as shown in **Table 5**.

Table 4:Adjusted Trip Generation for the Pitt & Lippe Age Restricted Development

210 – Single Family Detached Housing			251 – Senior Adult Housing Detached			252 – Senior Housing Attached		
Original Trip Rates per ITE								
Daily	**AM**	**PM**	**Daily**	**AM**	**PM**	**Daily**	**AM**	**PM**
9.44	0.74	0.99	4.27	0.24	0.30	3.70	0.20	0.26
Adjusted Trip Rates								
Daily	**AM**	**PM**	**Daily**	**AM**	**PM**	**Daily**	**AM**	**PM**
			7.12	0.40	0.50	6.17	0.40	0.50

Table 5: Revised Trip Generation

ITE Code	ITE Description	Density	Unit	Daily	AM Peak Hour			PM Peak Hour		
					Total	Enter	Exit	Total	Enter	Exit
251	Senior Adult Housing – Detached	165	Dwelling Units	1,174	66	22	44	83	51	30
252	Senior Adult Housing - Attached	175	Dwelling Units	1,079	70	24	46	88	47	40
	Total Residential			*2,253*	*136*	*46*	*90*	*170*	*98*	*70*
710	General Office Building (0.2 FAR)	17,400	Square Feet	195	43	37	6	22	4	17
720	Medical-Dental Office Building (0.2 FAR)	14,800	Square Feet	481	41	32	8	52	15	38
	Out Parcels			*676*	*84*	*69*	*14*	*74*	*19*	*55*
	Total			**2,929**	**220**	**115**	**104**	**244**	**117**	**125**

4.3 TRAFFIC DISTRIBUTION AND ASSIGNMENT

The directional distribution and assignment of trips generated by the proposed parcels were identified for the development. The directional distribution and assignment of trips were determined by reviewing existing travel patterns, proposed site access, and population densities. From this review, the following global traffic distributions were derived and applied to the analysis of the study area:

- 50% of the trips generated will travel to/from the north on Carrollton Boulevard
- 35% of the trips generated will travel to/from the south on Carrollton Boulevard
- 5% of the trips generated will travel to/from the west on Smiths Neck Road
- 10% of the trips generated will travel to/from the west on Brewers Neck Boulevard

The global traffic distributions were applied to both parcels. Separate traffic assignments were developed for the residential and office uses, due to their proximity to proposed access locations.

As shown previously in **Figure 2**, the proposed parcels will not introduce any new access points to existing roadways. The Pitt & Lippe development will feature three (3) direct access points to Carrollton Boulevard. For the purposes of this study, the two direct access points to Carrollton Boulevard (i.e., via Smiths Neck Road and Northgate Drive) and the connection of Channell Way to Carrollton Boulevard were modeled and analyzed under existing and future conditions.

It should also be noted that a future connection will be added as part of another development that provides access between Channell Way to the signal at Brewers Neck Boulevard and Carrollton Boulevard. Detailed peak hour trip distribution and trip assignment for the proposed parcels are shown in **Figure 6** and **Figure 7**, respectively.

4.4 TOTAL TRAFFIC

Peak hour site trip assignments were developed by multiplying the proposed trips by the agreed-to trip distributions as discussed previously in **Sections 4.2** and **4.3**. Trip assignments associated with the proposed development were then added to future background traffic volumes (i.e., No Build) to develop total 2026 Build and 2032 Build traffic volumes.

All future traffic volumes used in this analysis are illustrated in **Figure 8** through **Figure 11**.

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Figure 6: Trip Distribution and Assignment (Residential Uses)

Figure 7: Trip Distribution and Assignment (Office Uses)

Figure 8: 2026 AM Peak Hour Volumes

Figure 9: 2026 PM Peak Hour Volumes

Figure 10: 2032 AM Peak Hour Volumes

Figure 11: 2032 PM Peak Hour Volumes

5 FUTURE ROADWAY GEOMETRY

The following proposed roadway and intersection improvement projects are currently under design and will be implemented by VDOT or others. It is anticipated that these other roadway projects will be completed by the opening year of the Pitt & Lippe parcels. Both improvements have funds allocated to the design and construction through the VDOT SMART Scale funding program and will be administered through VDOT.

- Nike Park Road Extension
- Carrollton Boulevard at Brewers Neck Boulevard Intersection Improvements

5.1 NIKE PARK ROAD EXTENSION

The Nike Park Road Extension is a VDOT improvement project that is administered and fully funded through the VDOT SMART Scale Program. From the Preliminary Field Inspection (PFI) plans provided by VDOT, the Nike Park Road Extension includes the extension of Nike Park Road from the existing intersection of Nike Park Road at Reynolds Drive to a proposed intersection of Carrollton Boulevard at Nike Park Road Extension, as shown in **Figure 12**.

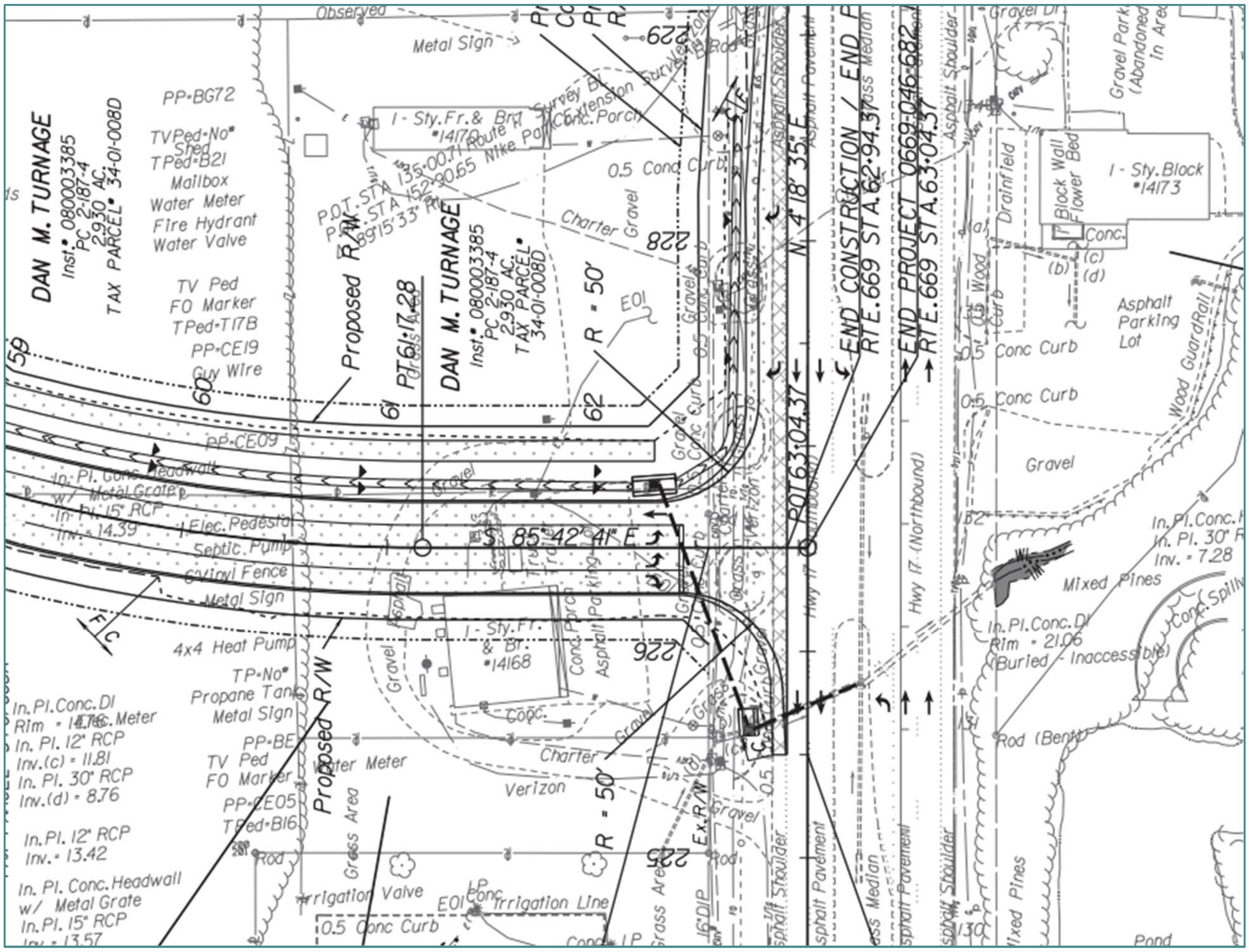
This extension consists of approximately 1 mile of new two-lane roadway with a shared-use path on one side. This proposed intersection is located approximately 1,150 feet north of Brewers Neck Boulevard and will be signalized under future conditions. The Nike Park Road Extension, eastbound approach, will have two exclusive eastbound left-turn lanes and one exclusive eastbound right-turn lane at the intersection with Carrollton Boulevard. Additionally, there will be an exclusive northbound left-turn lane and an exclusive southbound right-turn lane to serve the Nike Park Road Extension.

As part of the future traffic operational analysis, consideration was given to a portion of the background traffic being diverted from Smiths Neck Road with the additional of Nike Park Road Extension. Based on model simulations conducted as part of the Isle of Wight County *Brewers Neck Corridor Study* (2014), it was shown that approximately 30% of traffic on Smiths Neck Road diverted onto the proposed Nike Park Road Extension. For the purposes of this TIA, 40% of the background traffic on Smiths Neck Road will be shifted onto Nike Park Road Extension for the 2026 and 2032 future scenarios. These roadway and intersection improvements have been included in the 2026 and 2032 No Build and Build analysis.

5.2 CARROLLTON BOULEVARD AT BREWERS NECK BOULEVARD INTERSECTION IMPROVEMENTS

The intersection improvements at the intersection of Carrollton Boulevard at Brewers Neck Boulevard are a VDOT improvements project that is being administered and partially funded through the VDOT SMART Scale Program. From the PFI plans provided by VDOT, these improvements involve construction of an additional northbound left-turn lane onto Brewers Neck Boulevard, as shown in **Figure 13**. An additional receiving lane will be constructed from the median on Brewers Neck Boulevard for the proposed northbound left-turn lane.

Figure 12: Nike Park Road Extension



Source: VDOT

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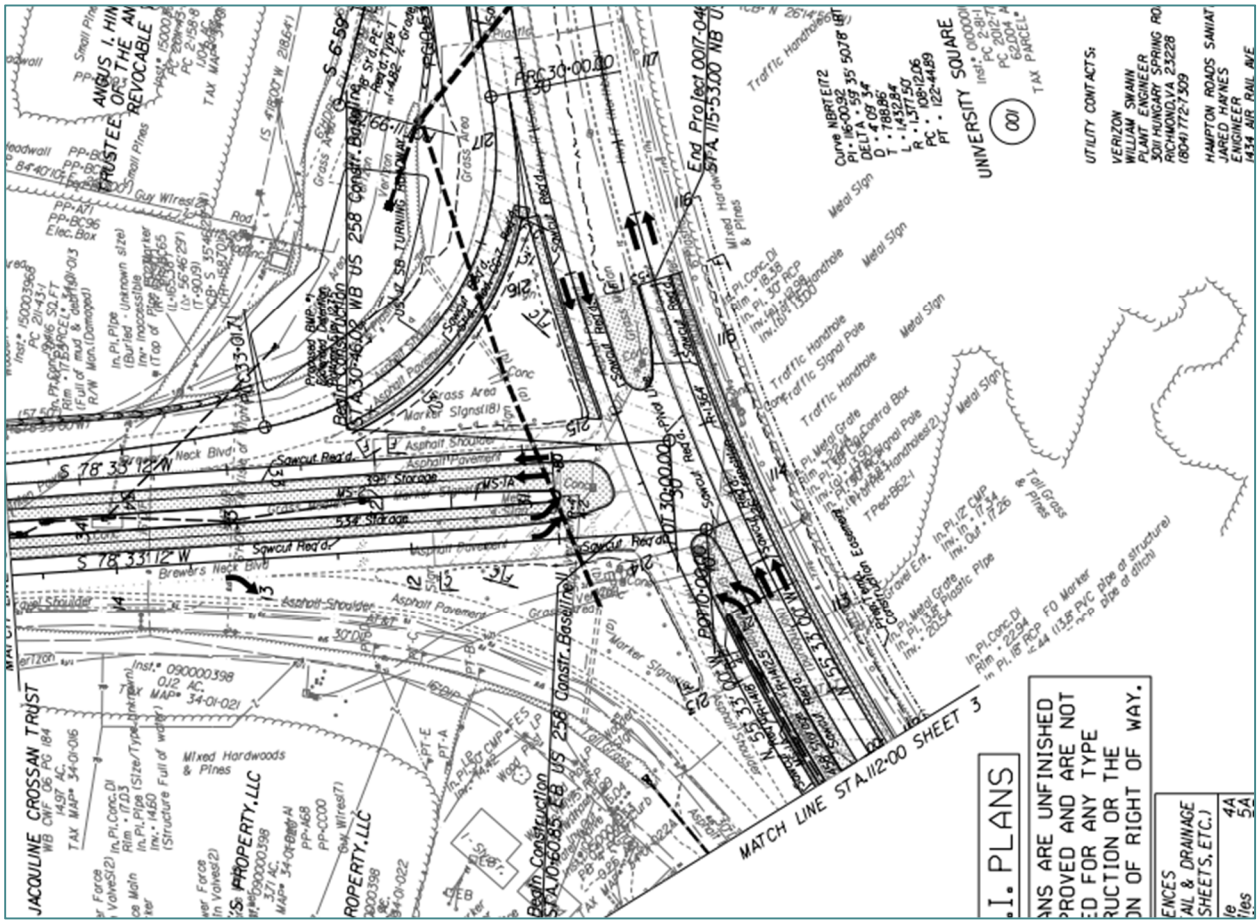
Figure 13: Carrollton Boulevard at Brewers Neck Boulevard Intersection Improvements



Source: VDOT

5.2.1 THE CROSSINGS INTERSECTION IMPROVEMENTS

In addition to the VDOT SMART Scale funded Carrollton Boulevard at Brewers Neck Boulevard intersection improvements, additional improvements for this intersection were proposed as part of the approved traffic study associated with the Crossings development. The additional laneage includes the construction of the westbound approach which consists of an exclusive left-turn lane, one dedicated through lane, and a shared through-/right-turn lane at the intersection. Two exclusive southbound left-turn lanes and a dedicated northbound right-turn lane were also proposed to accommodate traffic destined to the Crossings development through this intersection. These roadway and intersection improvements have been included in the 2026 and 2032 No Build and Build analysis as well.

Traffic volumes associated with the Crossings development was also obtained from the approved TIA (*December 28, 2010)* and were included in the background traffic volumes used for just the intersection of Carrollton Boulevard at Brewers Neck Boulevard in this study.

6 SIGNAL WARRANT ANALYSIS

Traffic signal warrant analysis was performed for the unsignalized intersection of Carrollton Boulevard at Northgate Drive to check whether an existing proffer for the proposed installation of a traffic signal would be triggered at this location. Traffic signal warrants were conducted that were consistent with the methodologies provided in the *Manual on Uniform Traffic Control Devices* (MUTCD), to evaluate the need for traffic signalization under existing and future traffic conditions. These warrants are based on mainline and minor street traffic volumes, the number of travel lanes, approach turn-lanes, and mainline posted speed limit. According to the MUTCD, a traffic control signal should not be installed unless one or more of the signal warrants are met. The warrants used in this analysis are as follows:

- **Warrant 1 (Eight-Hour Vehicular Volume)** - is satisfied if ONE of the following conditions exists for any eight hours of an average day:
  - Condition A (Minimum Vehicular Volume) - volumes meet or exceed the necessary hourly thresholds for any eight hours of an average day. Thresholds may be modified based on vehicle speeds and population of the local community.
  - Condition B (Interruption of Continuous Traffic) - volumes meet or exceed the necessary hourly thresholds for any eight hours of an average day. Thresholds may be modified based on vehicle speeds and population of the local community.
  - Combination of Condition A and B - intended to be used where Conditions A and B are not individually met and where volume thresholds may be reduced based on anticipated traffic delay at the intersection.
- **Warrant 2 (Four-Hour Vehicular Volume)** - volumes meet or exceed the necessary hourly thresholds for any four hours of an average day. Thresholds are typically higher than those for Warrant 1 and may be applicable when high traffic volumes are concentrated over a shorter time period (less than eight hours). The thresholds may also be modified based on vehicle speeds and population of the local community

Under each warrant analysis, existing turning movement volumes were used to determine if the volume thresholds provided in the MUTCD were met. This provides a baseline to establish the potential for needing a signal under current traffic loads. For future No-Build and Build conditions, the signal warrant analysis was performed accounting for future growth in traffic associated with and without the proposed development traffic.

To assign the hourly site traffic for the future warrant analysis at Northgate Drive, all assumptions and methods (i.e., trip generation, distribution, background traffic growth) were followed, with an additional step of applying hourly variations to the daily trip generation total. The hourly variation breakdown for the combined Residential uses (i.e., Senior-Oriented Facilities) as provided in the *Hourly Variation in Trip Generation for Office and Residential Land Uses* article published in the ITE Journal (January 2015), as shown in **Table 6**. It is noted that the hourly variation for residential land uses is proposed since it is a similar land use and ITE does not provide an applicable hourly variation breakdown for the proposed land uses of Senior Adult Housing.

Table 6: Hourly Variations in Residential Land Uses

Time	Average Weekday	
	Percent of 24-Hour Entering Traffic	Percent of 24-Hour Exiting Traffic
7 AM – 8 AM	5.4	4.5
8 AM – 9 AM	6.5	5.8
9 AM – 10 AM	6.0	7.5
10 AM – 11 AM	7.3	8.0
11 AM – 12 PM	8.2	6.8
12 PM – 1 PM	8.2	7.7
1 PM – 2 PM	7.7	8.0
2 PM – 3 PM	8.8	8.0
3 PM – 4 PM	9.9	9.6
4 PM – 5 PM	6.7	7.6
5 PM – 6 PM	4.7	6.5
6 PM – 7 PM	3.9	4.4

In addition, hourly trip generations for office and land uses were also used for the outparcels as provided in the *Hourly Variation in Trip Generation for Office and Residential Land Uses* article published in the ITE Journal (January 2015), as shown in **Table 7**.

Table 7: Hourly Variations in Office Land Uses

Time	Average Weekday	
	Percent of 24-Hour Entering Traffic	Percent of 24-Hour Exiting Traffic
7 AM – 8 AM	14.9	1.9
8 AM – 9 AM	20.7	3.0
9 AM – 10 AM	8.2	3.2
10 AM – 11 AM	5.0	3.9
11 AM – 12 PM	5.1	8.6
12 PM – 1 PM	8.7	10.5
1 PM – 2 PM	10.0	6.6
2 PM – 3 PM	5.9	6.6
3 PM – 4 PM	4.3	9.5
4 PM – 5 PM	3.4	15.4
5 PM – 6 PM	2.5	16.5
6 PM – 7 PM	1.4	5.5

The results of the signal warrant analyses are provided in **Table 8** with complete tables outlining the traffic volumes used, in **Appendix D**.

Table 8: Summary of Warrant Analysis for Carrollton Boulevard at Northgate Drive

Scenario	Warrants Analysis			
	Warrant 1 (8 Hour)			Warrant 2 (4 Hour)
	Condition A	Condition B	Combination (A & B)	
Existing (2017)	✗ (0 out of 8)	✗ (1 out of 8)	✗ (0 out of 8)	✗
No Build (2026)	✗ (0 out of 8)	✗ (1 out of 8)	✗ (0 out of 8)	✗
Build (2026)	✗ (0 out of 8)	✗ (5 out of 8)	✗ (0 out of 8)	✗
No Build (2032)	✗ (0 out of 8)	✗ (2 out of 8)	✗ (1 out of 8)	✗
Build (2032)	✗ (0 out of 8)	✗ (5 out of 8)	✗ (0 out of 8)	✗

Notes: ✗ *- Warrant not met*
✓ *- Warrant met*
(# out of 8) – Number of hours that could meet the 8-hour warrant requirements

The signal is not warranted under the existing or future scenarios for both Warrant 1 and Warrant 2. However, the reality for this intersection is that due to the heavy flow of traffic along Carrollton Boulevard, vehicles traveling on the side/minor approaches at unsignalized intersections are likely diverting their trips to other existing signalized intersections along the corridor. In the case of Northgate Drive, existing vehicles divert to Smiths Neck Road and utilize that signal. As a result of this, the intersection of Northgate Drive will not meet the necessary volume thresholds to warrant signalization. Similarly, with the proposed Pitt and Lippe development, trips that could utilize Northgate Drive will likely make routing decisions to use the signal at the Smiths Neck Boulevard intersection. It is expected that waiting at an existing signalized intersection is a much more viable option than enduring the excessive delays projected at the Northgate Drive unsignalized intersection, as discussed further in **Section 7.1.4**.

As noted previously, a proffer is currently in place for the signalization of the Carrollton Boulevard at Northgate Drive signal. However, since this proffer was established, VDOT has modified the posted speed limit along this segment of Carrollton Boulevard from 45 mph to 55 mph, which now results in the Northgate Drive intersection not able to meet signalized intersection spacing requirements (i.e., the distance between the Northgate Drive intersection and the Smiths Neck Road intersection is approximately 1,320 feet and the spacing requirement for signalized intersections at 55 mph is 2,640 feet per *Appendix F - Access Management Design Standards for Entrances and Intersections*).

Ultimately, it is unlikely that enough vehicles will use Northgate Drive to make lefts onto Carrollton Boulevard, resulting in the necessary volume thresholds never being met. Justification could be made that if Northgate Drive was signalized regardless, vehicles would then opt to reroute from Smiths Neck Road. However, due to the spacing requirements for signalized intersections on Carrollton Boulevard, this does not seem to be a feasible option at this time. Therefore, the existing proffers for signalizing Northgate Drive should be modified and a partial access intersection be considered to accommodate left-in, right-in, and right-out movements only.

7 TRAFFIC ANALYSIS

The traffic analysis for the proposed parcels consisted of analyzing intersection operations (i.e., delay and queuing). Analyses for study area intersections for AM and PM peak hours were performed for the following scenarios:

- Scenario 1 – 2017 Existing Conditions
- Scenario 2 – 2026 No Build Conditions (i.e., future traffic volumes based on the application of a 2% background growth rate but ***without*** traffic from the proposed Pitt & Lippe development)
- Scenario 3 – 2026 Build Conditions (i.e., future traffic volumes based on the application of a 2% background growth rate ***plus*** traffic from the proposed Pitt & Lippe development)
- Scenario 4 – 2032 No Build Conditions (i.e., future traffic volumes based on the application of a 2% background growth rate but ***without*** traffic from the proposed Pitt & Lippe development)
- Scenario 5 – 2032 Build Conditions (i.e., future traffic volumes based on the application of a 2% background growth rate ***plus*** traffic from the proposed Pitt & Lippe development)

The following sections summarize the results for each analysis.

7.1 INTERSECTION OPERATIONAL ANALYSIS

Operational analyses were conducted for the study area intersections for the AM and PM peak hours under the existing and future scenarios. The existing signal timings, including cycle lengths, clearance intervals, and splits, were provided by VDOT for this study's existing/base. For future year analysis, all cycle lengths, signal timings, coordination offsets, and phasing were optimized to account for future traffic volumes. As such, given the amount of future volume projected for this area for both No Build and Build scenarios, large cycle lengths (i.e., 140 to 160 seconds) were used to help maintain a level of progression along Carrollton Boulevard during the peak hours. It is acknowledged that a down side to using larger cycle lengths is that the side streets will result in higher delays, as they generally have to wait longer for their phases. It should be noted that a previous analysis was completed that had originally considered utilizing higher cycle lengths (i.e., 180 to 200 seconds) for the future year analyses to be consistent with timing strategies currently implemented along the corridor (See **Appendix G** for reference). However, it is acknowledged that using such high cycle lengths was resulting in higher delays and longer queues for a majority of the side streets and turning movements along the corridor. This is ultimately lead to lower cycle length(s) (i.e., AM and PM) being evaluated and applied as a part of the revised analysis.

Analyses were completed to determine the operating characteristics of the study area intersections using *Synchro Professional 10.1* modeling software, which uses methodologies contained in the 2010 Highway Capacity Manual (HCM) [TRB Special Report 209, 2000]. The intersection operational analysis inputs and analysis methodologies were consistent with VDOT's Traffic Operations and Safety Analysis Manual (TOSAM). Intersection turning movement counts were used with information about the number of lanes, current traffic control, and signal timings to determine the operational conditions of each study area intersection. Four (4) main steps were completed for each of the AM and PM model simulations used in this study:

1. Network Development, Coding, and Model Inspection
2. Network Calibration
3. Inspection and Sample Size Determination
4. Analysis and Reporting

To calibrate the existing models, simulated volumes and speeds were compared with counted volumes (i.e., intersection turning movement count data) and average vehicle speeds (i.e., at the three locations where speed data was collected).

Detailed summary sheets of the simulated volume and speed calibration process are provided in **Appendix E**. For the calibration process, 85 percent of the network links (i.e., based on volume) must meet the following threshold:

- Simulated average speed needs to be within:
  - ± 5 mph (for arterials) of detected speeds
- Simulated volumes must be within:
  - ± 20% for < 100 vph
  - ± 15% for ≥ 100 vph to < 300 vph
  - ± 10% for ≥ 300 vph to < 1,000 vph
  - ± 5% for ≥ 1,000 vph

The results of the calibration effort indicate that the existing traffic models were validated and are able to simulate the study areas volumes and speeds adequately to meet the criteria set forth by the TOSAM. Any differences within the calibration results were only minor and justification and/or reasoning for these discrepancies is provided in **Appendix E.**

Level of service (LOS) was reported for the study area intersections. LOS describes the amount of traffic congestion at an intersection or on a roadway and ranges from A to F (i.e., A indicating a condition of little to no congestion and F a condition with severe congestion, unstable traffic flow, and stop-and-go conditions). LOS is based on the average delay experienced by all traffic using the intersection during the busiest (peak) 15-minute period. Generally, LOS A through LOS D are considered acceptable. Delay and associated LOS for both signalized and unsignalized intersections are reported from the Synchro analysis. In the LOS/delay tables for each of the study area intersections, values highlighted in "bold" represent movements operating at LOS E or worse. **Table 9** shows the corresponding thresholds in delay for unsignalized and signalized intersections.

The queuing results represent the maximum simulated queues for each movement as they compare to the effective storage lengths. Effective storage lengths represent the amount of distance available for vehicles to queue without generally impacting the adjacent lanes and consists of the full width storage length, plus half of the taper distance. By using the effective storage, vehicles that can use this portion of the taper length as additional room for storage can be counted as being accommodated. All traffic models were developed and analyzed with the effective storage lengths coded into the network.

As part of the queuing analysis, "percent blocking" was noted in instances where queues impact adjacent turn- and/or through-lanes. This percentage represents the approximate amount of time during the peak hour when a lane was observed to be blocked (e.g., "10% blocking" indicates that during the peak hour, the turn-lane storage was exceeded and impacted 10 percent of the adjacent lane volume). The results are presented in the following summaries and supporting calculations are presented in **Appendix F**.

The following sections summarize each study area intersection's operations as it relates to vehicle traffic for the analysis scenarios. Results are presented in **Table 10** through **Table 27**.

Table 9: LOS Control Delay Thresholds

LOS	Signalized Intersections Control Delay Per Vehicle [sec/veh]	Unsignalized Intersections Average Control Delay [sec/veh]	Relative Delay
A	≤ 10	≤ 10	Short Delays
	Free-flow traffic operations at average travel speeds. Vehicles completely unimpeded in ability to maneuver. Minimal delay at signalized intersections.		
B	> 10 – 20	> 10 – 15	
	Reasonably unimpeded traffic operations at average travel speeds. Vehicle maneuverability slightly restricted. Low traffic delays.		
C	> 20 – 35	> 15 – 25	
	Stable traffic operations. Lane changes becoming more restricted. Travel speeds reduced to half of average free flow travel speeds. Longer intersection delays.		
D	>35 – 55	> 25 – 35	Moderate Delays
	Small increases in traffic flow can cause increased delays. Delays likely attributable to increase traffic, reduced signal progression and adverse timing.		
E	>55 – 80	> 35 – 50	
	Significant delays. Travel speeds reduced to one third of average free flow travel speed.		
F	> 80	> 50	Long Delays
	Extremely low speeds. Intersection congestion. Long delays. Extensive traffic queues at intersections.		

Source: Highway Capacity Manual, Transportation Research Board, Washington, D.C., 2010

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7.1.1 CARROLLTON BOULEVARD AT WHIPPINGHAM PARKWAY/HARBOR POINT LANE

This signalized intersection consisted of the following geometry for the existing and future scenarios:

- Carrollton Boulevard (northbound)
  - One exclusive left-turn lane
  - Two exclusive through lanes
  - One exclusive right-turn lane
- Carrollton Boulevard (southbound)
  - One exclusive left-turn lane
  - Two exclusive through lanes
  - One exclusive right-turn lane
- Harbor Point Lane (eastbound)
  - One shared left/through lane
  - One exclusive right-turn lane
- Whippingham Parkway (westbound)
  - One shared left/through lane
  - One exclusive right-turn lane

Results of the capacity and queuing analysis for this signalized intersection are shown in **Table 10** and **Table 11**, respectively. Under Existing conditions, the AM and PM peak hours experienced an overall LOS D and LOS A, respectively. Additionally, many of the side street movements currently operate at LOS F during the PM peak hour.

Under the future 2026 and 2032 No Build conditions, the increase in traffic volume associated with the background traffic (i.e., annualized/natural growth) and approved developments results in the minor street approaches to experiences high levels of delay during the AM and PM peak hours. Priority is given to sustaining traffic progression along Carrollton Boulevard, which contributes to the minor/side street approaches (i.e., Harbor Point Lane and Whippingham Parkway) projected to experience LOS E/F under the future scenarios.

These congestion conditions are expected to continue under the 2026 and 2032 Build conditions, as well. Generally, the addition of the Pitt & Lippe development related traffic has a minimal impact on the intersection operations during the AM and PM peak hours when compared to the corresponding No Build conditions. It is noted that the overall LOS during the AM peak period under the 2032 scenario increases from a LOS D to a LOS E. This increase is still relatively minor, as the increase in delay only exceeds the LOS delay threshold by 1.9 seconds.

Overall, the addition of the site traffic only makes up 3% of this intersection's total volume. Significant queueing in the northbound and southbound through movements are expected to occur under the future AM and PM peak hours, respectively. This reflect this corridor's directional traffic flows tied to peak period commuter patterns. These through queues will likely spill back and block vehicles from entering the adjacent storage lanes. Regardless, queues for the Build conditions are still projected to be comparable to those anticipated under No Build conditions without significant increases.

Overall, future Build conditions at this intersection can be maintained to those experienced under No Build with continual monitoring and modifications to existing traffic signal timings and coordination offsets.

Table 10: Carrollton Boulevard at Whippingham Parkway/Harbor Point Lane Intersection Level of Service

Scenario	Overall LOS	Level of Service per Movement by Approach (Delay in sec/veh)											
		Eastbound			Westbound			Northbound			Southbound		
		LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
AM Peak Hour													
2017 Existing	D (35.4)	D (43.8)		D (40.7)	D (45.0)		D (43.3)	A (9.2)	D (43.5)	A (7.5)	C (22.3)	A (10.0)	A (7.6)
		D (42.8)			D (43.9)			D (43.1)			B (10.1)		
2026 No Build	C (28.3)	**E (71.6)**		**E (61.8)**	**E (66.7)**		**E (64.1)**	A (7.0)	C (32.5)	A (6.0)	D (38.3)	A (8.8)	A (6.4)
		E (68.3)			**E (65.1)**			C (32.3)			A (9.0)		
2026 Build	C (33.9)	**E (71.6)**		**E (61.8)**	**E (66.7)**		**E (64.1)**	A (7.1)	D (40.8)	A (6.0)	D (38.3)	A (9.0)	A (6.4)
		E (68.3)			**E (65.1)**			D (40.5)			A (9.2)		
2032 No Build	D (50.3)	**F (81.1)**		**E (69.9)**	**E (77.7)**		**E (73.9)**	A (1.1)	**E (62.5)**	A (5.9)	D (45.7)	A (9.3)	A (6.5)
		E (77.3)			**E (75.3)**			**E (62.0)**			A (9.6)		
2032 Build	**E (56.9)**	**F (81.1)**		**E (69.9)**	**E (77.7)**		**E (73.9)**	A (1.1)	**E (72.4)**	A (5.9)	D (45.7)	A (9.6)	A (6.5)
		E (77.3)			**E (75.3)**			**E (71.7)**			A (9.8)		
PM Peak Hour													
2017 Existing	A (9.9)	**F (99.5)**		**F (95.6)**	**F (97.9)**		**F (93.1)**	B (17.9)	A (1.4)	A (4.1)	A (3.9)	B (11.6)	A (4.4)
		F (97.2)			**F (96.6)**			A (2.0)			B (11.4)		
2026 No Build	B (18.7)	**E (79.0)**		**E (75.6)**	**E (77.3)**		**E (73.3)**	**F (91.7)**	A (4.4)	A (5.1)	A (5.3)	C (23.5)	A (5.6)
		E (77.0)			**E (76.2)**			A (7.1)			C (22.9)		
2026 Build	C (20.4)	**E (79.0)**		**E (75.6)**	**E (77.3)**		**E (73.3)**	**F (99.7)**	A (4.5)	A (5.1)	A (5.5)	C (26.3)	A (5.6)
		E (77.0)			**E (76.2)**			A (7.3)			C (25.7)		
2032 No Build	D (39.0)	**E (76.5)**		**E (74.1)**	**E (77.6)**		**E (73.1)**	**F (104.8)**	A (4.0)	A (5.6)	A (6.4)	**E (55.6)**	A (6.1)
		E (75.1)			**E (76.3)**			A (7.1)			D (54.1)		
2032 Build	D (44.1)	**E (76.5)**		**E (74.1)**	**E (77.6)**		**E (73.1)**	**F (102.0)**	A (4.0)	A (5.6)	A (6.8)	**E (64.2)**	A (6.1)
		E (75.1)			**E (76.3)**			A (7.0)			**E (62.4)**		

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Table 11: Carrollton Boulevard at Whippingham Parkway/Harbor Point Lane Intersection Maximum Queuing

Scenario	Maximum Queue Length by Movement (feet)											
	Eastbound			Westbound			Northbound			Southbound		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Effective Storage Length (Existing/Build)	352		170	1,197		550	280	490	215	220	4,237	230
AM Peak Hour												
2017 Existing	90		42	46		54	50	343	43	26	117	< 25
2026 No Build	132		84	64		65	167	429 ***(9%)*	137	32	147	< 25
2026 Build	137		72	63		74	76	462 ***(10%)*	153	32	147	< 25
2032 No Build	162		109	67		89	51	356 ***(4%)*	36	35	143	< 25
2032 Build	167		90	81		92	125	410 ***(6%)*	101	31	178	< 25
PM Peak Hour												
2017 Existing	52		60	71		34	105	103	< 25	105	536 ***(9%)*	143
2026 No Build	60		68	72		38	98	146	34	181	2,542 ***(28%)*	230
2026 Build	49		95	78		35	115	174	46	219	1,276 ***(14%)*	230
2032 No Build	66		69	86		38	83	145	32	219	4,285 ***(41%)*	230
2032 Build	66		62	88		32	96	179	53	201	4,285 ***(36%)*	230

7.1.2 CARROLLTON BOULEVARD AT EAGLE HARBOR PARKWAY/KINGS CROSS WAY

This signalized intersection consisted of the following geometry for the existing and future scenarios:

- Carrollton Boulevard (northbound)
  - One exclusive left-turn lane
  - Two exclusive through lanes
  - One exclusive right-turn lane
- Carrollton Boulevard (southbound)
  - One exclusive left-turn lane
  - Two exclusive through lanes
  - One exclusive right-turn lane
- Eagle Harbor Parkway (eastbound)
  - One shared left/through lane
  - One exclusive right-turn lane
- King's Cross (westbound)
  - One shared left/through lane
  - One exclusive right-turn lane

Results of the capacity and queuing analysis for this signalized intersection, which are shown in **Table 12** and **Table 13,** respectively. Under Existing conditions, the AM and PM peak hours experienced an overall LOS E and LOS B, respectively. Movements that currently experiences significant periods of delay include the northbound through movement, which operates at LOS F during the AM peak periods. Additionally, many of the side street movements currently operate at LOS F during the PM peak hour.

Under the future 2026 and 2032 No Build conditions, the increase in traffic volume associated with the background traffic (i.e., annualized/natural growth) and approved developments results in the minor street approaches to experiences high levels of delay during the AM and PM peak hours. As noted previously, priority is given to sustaining traffic progression along Carrollton Boulevard, which contributes to the minor/side street approaches (i.e., Eagle Harbor Parkway/Kings Cross Way) projected to experience LOS E/F under the future scenarios.

These congestion conditions are expected to continue under the 2026 and 2032 Build conditions, as well. Generally, the addition of the Pitt & Lippe development related traffic has a minimal impact on the intersection operations during the AM and PM peak hours when compared to the corresponding No Build conditions. It is noted that the overall LOS during the PM peak period under the 2032 scenario increases from a LOS D to a LOS E. This increase is negligible, as the increase in delay only exceeds the LOS delay threshold by 0.2 seconds. Overall, the addition of the site traffic only makes up 3% of this intersection's total volume.

Significant queueing in the northbound and southbound through movements are expected to occur under the future AM and PM peak hours, respectively. This reflect this corridor's directional traffic flows tied to peak period commuter patterns. These through queues will likely spill back and block vehicles from entering the adjacent storage lanes and extend to upstream intersections. Regardless, queues for the Build conditions are still projected to be comparable to those anticipated under No Build conditions without significant increases.

Overall, future Build conditions at this intersection can be maintained to those experienced under No Build with continual monitoring and modifications to existing traffic signal timings and coordination offsets.

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Table 12: Carrollton Boulevard at Eagle Harbor Parkway/Kings Cross Way Intersection Level of Service

Scenario	Overall LOS	Level of Service per Movement by Approach (Delay in sec/veh)											
		Eastbound			Westbound			Northbound			Southbound		
		LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
AM Peak Hour													
2017 Existing	**E (66.9)**	D (42.5)		D (35.7)	D (44.6)		D (43.3)	B (10.4)	**F (91.6)**	B (11.2)	B (17.7)	B (10.9)	B (12.8)
		D (40.4)			D (43.8)			**F (89.9)**			B (11.0)		
2026 No Build	D (43.0)	**E (75.3)**		D (54.3)	**E (68.5)**		**E (65.6)**	A (7.3)	D (53.7)	A (9.1)	C (20.9)	A (7.5)	B (10.8)
		E (69.0)			**E (66.7)**			D (52.7)			A (7.7)		
2026 Build	D (51.4)	**E (75.3)**		D (54.3)	**E (68.5)**		**E (65.6)**	A (8.0)	**E (67.1)**	A (9.1)	C (22.2)	A (7.7)	B (10.8)
		E (69.0)			**E (66.7)**			**E (65.9)**			A (7.8)		
2032 No Build	**E (72.6)**	**F (105.5)**		**E (62.6)**	**E (76.7)**		**E (73.9)**	A (7.3)	**F (94.5)**	A (9.1)	D (40.5)	B (11.0)	B (10.9)
		F (92.6)			**E (75.0)**			**F (92.7)**			B (11.1)		
2032 Build	**F (80.9)**	**F (105.5)**		**E (62.6)**	**E (76.7)**		**E (73.9)**	A (8.3)	**F (107.8)**	A (9.1)	D (38.7)	B (11.1)	B (10.9)
		F (92.6)			**E (75.0)**			**F (105.8)**			B (11.2)		
PM Peak Hour													
2017 Existing	B (16.9)	**F (98.3)**		**F (87.7)**	**F (97.5)**		**F (93.7)**	**E (58.3)**	B (16.6)	A (6.4)	A (5.8)	B (10.6)	A (3.6)
		F (93.9)			**F (95.9)**			B (19.6)			B (10.0)		
2026 No Build	B (19.0)	**E (79.6)**		**E (68.8)**	**E (79.9)**		**E (75.2)**	**F (86.0)**	A (9.7)	A (7.3)	A (5.1)	B (18.3)	A (1.3)
		E (75.0)			**E (78.0)**			B (15.3)			B (16.9)		
2026 Build	C (21.4)	**E (79.6)**		**E (68.8)**	**E (79.9)**		**E (75.2)**	**F (88.1)**	A (9.7)	A (7.3)	A (5.4)	C (22.6)	A (1.3)
		E (75.0)			**E (78.0)**			B (15.3)			C (20.9)		
2032 No Build	D (48.8)	**F (81.3)**		**E (68.3)**	**E (77.0)**		**E (73.6)**	**F (84.0)**	B (11.7)	A (8.0)	A (7.2)	**E (69.1)**	A (2.4)
		E (75.8)			**E (75.6)**			B (17.1)			**E (63.4)**		
2032 Build	**E (55.2)**	**F (81.3)**		**E (68.3)**	**E (77.0)**		**E (73.6)**	**F (85.9)**	B (12.0)	A (8.0)	A (7.5)	**F (80.6)**	A (2.3)
		E (75.8)			**E (75.6)**			B (17.2)			**E (74.1)**		

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Table 13: Carrollton Boulevard at Eagle Harbor Parkway/Kings Cross Way Intersection Maximum Queuing

Scenario	Maximum Queue Length by Movement (feet)											
	Eastbound			Westbound			Northbound			Southbound		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Effective Storage Length (Existing/Build)	1,471		220	1,968		65	265	1,069	240	310	622	240
AM Peak Hour												
2017 Existing	187		66	47		63	180	453 **(3%)	50	< 25	153	31
2026 No Build	308 **(4%)		171	82		64	242	791 **(13%)	23	< 25	195	70
2026 Build	282 **(3%)		201	85		66	182	728 **(13%)	99	< 25	211	54
2032 No Build	442 **(21%)		220	99		65	250	980 **(24%)	26	27	226	38
2032 Build	446 **(20%)		220	104		65	246	948 **(26%)	103	27	214	54
PM Peak Hour												
2017 Existing	156		114	84		61	155	308	64	180	948 **(28%)	240 *(1%)
2026 No Build	152		110	75		60	165	251	42	256	589 **(30%) ^(13%)	240 *(1%)
2026 Build	122		87	68		65	132	236	43	310	594 **(15%) ^(6%)	240
2032 No Build	164		123	76		65	169	254	< 25	260	591 **(31%) ^(15%)	240 *(1%)
2032 Build	183		140	75		64	156	266	90	283	585 **(29%) ^(13%)	240

7.1.3 CARROLLTON BOULEVARD AT SMITHS NECK ROAD

This signalized intersection consisted of the following geometry for the existing and No Build scenarios:

- Carrollton Boulevard (northbound)
  - One exclusive left-turn lane
  - Two exclusive through lanes
  - One exclusive right-turn lane
- Carrollton Boulevard (southbound)
  - One exclusive left-turn lane
  - Two exclusive through lanes
  - One exclusive right-turn lane
- Smiths Neck Road (eastbound)
  - One exclusive left-turn lane
  - One shared through/left lane
  - One exclusive right-turn lane
- Smiths Neck Road (westbound)
  - One exclusive left-turn lane
  - One shared through/right lane

Results of the capacity and queuing analysis for this signalized intersection are shown in **Table 14** and **Table 15,** respectively. Under Existing conditions, the AM and PM peak hours operate at an overall LOS D. During the AM peak hour, the eastbound approach operates at LOS E due to the high volumes (i.e., approach volume greater than 750 vehicles). Likewise, the eastbound and westbound approaches currently operates at LOS F during the PM peak hour with delays greater than 100 seconds.

Under the future 2026 and 2032 No Build conditions, the increase in traffic volume associated with the background traffic (i.e., annualized/natural growth) and approved developments results in the minor street approaches continuing to experience high levels of delay during the AM and PM peak hours. Generally, Overall LOS is maintained at LOS D during No Build conditions, with the PM peak hour experiences LOS E under the 2032 No Build Scenario.

As noted previously, the additional site traffic at this intersection resulted in increased delays and queues directly attributed to the proposed development. As such, specific transportation improvements were identified to help mitigate these increases in operational delays and improve the conditions projected for this intersection. The future Build scenario presented in this analysis includes proposed geometric modifications as defined below:

- Carrollton Boulevard (northbound)
    - One exclusive left-turn lane (Extended to 400 feet of storage, 100-foot taper)
    - Two exclusive through lanes
    - One exclusive right-turn lane
- Carrollton Boulevard (southbound)
    - One exclusive left-turn lane (Extended to 400 feet of storage, 100-foot taper)
    - Two exclusive through lanes
    - One exclusive right-turn lane (Extended to 850 feet of storage)
- Smiths Neck Road (eastbound)
    - Two exclusive left-turn lanes (restriped)
    - One shared through/right lane (restriped)
- Smiths Neck Road (westbound)
    - One exclusive left-turn lane
    - One exclusive through lane
    - One exclusive right turn lane (proposed)

One area that was noted to be deficient was attributed to conditions associated with the eastbound approach. Under existing and No Build conditions, the eastbound approach has a shared left-through lane and an exclusive left-turn lane. As a result, the minor streets (i.e., Smiths Neck Road) must run with split phasing. Due to the heavy volumes on Carrollton Boulevard, concurrent left-turns would significantly improve operations at Smiths Neck Road. For future Build conditions, the geometry of the eastbound and westbound approaches is proposed to be reconfigured to allow concurrent left-turns on Smiths Neck Road. Additionally, a new westbound right-turn lane is proposed to be constructed as part of the Pitt and Lippe development. Finally, the existing northbound left-, the southbound left-, and southbound right-turn lanes are proposed to be extended to provide more room for vehicles to enter the turn lanes and minimize being blocked by queues formed by the adjacent through lanes. Based on the queuing analysis for these turning movements, the instances of vehicles being blocked by the adjacent through movements have been significantly reduced/eliminated with the extra storage lengths being proposed.

Therefore, the proposed turn lane improvements listed above are sufficient to accommodate this intersection's future vehicular demand. Additionally, it should be noted that the projected westbound queues are also improved due to the new geometry and concurrent left-turn phasing on Smiths Neck Road.

Ultimately, with the addition of the Pitt & Lippe development related traffic and proposed improvements, operations during the AM and PM peak hours are projected to be comparable and/or improved when compared to the corresponding No Build conditions. The proposed improvements will help increase this intersection's capacity without negatively impacting the primary flows of traffic along Carrollton Boulevard.

Table 14: Carrollton Boulevard at Smiths Neck Road Intersection Level of Service

Scenario	Overall LOS	Level of Service per Movement by Approach (Delay in sec/veh)											
		Eastbound			Westbound			Northbound			Southbound		
		LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
AM Peak Hour													
2017 Existing	D (42.5)	**E (72.4)**	**E (70.3)**	C (29.0)	D (44.5)	D (41.8)		D (46.0)	D (41.2)	B (18.3)	C (27.1)	C (21.0)	C (28.0)
		E (64.6)			D (43.3)			D (40.0)			C (22.8)		
2026 No Build	D (39.4)	**E (68.6)**	D (47.8)	D (45.8)	**E (58.2)**	**E (63.2)**		**E (65.1)**	D (45.3)	B (16.3)	**E (65.7)**	B (16.6)	A (1.3)
		E (56.2)			**E (60.5)**			D (44.2)			B (16.4)		
2026 Build	D (37.7)	**E (64.0)**	**E (57.7)**		**E (62.7**	**E (71.4)**	**E (57.1)**	**E (65.1)**	D (39.0)	B (15.2)	**E (65.4)**	B (14.1)	A (1.0)
		E (62.5)			**E (61.5)**			D (38.3)			B (16.2)		
2032 No Build	D (51.9)	**F (85.5)**	**E (59.3)**	D (51.7)	**E (69.9)**	**E (73.6)**		**F (81.1)**	**E (63.1)**	C (34.0)	**E (75.2)**	B (17.9)	A (0.9)
		E (69.1)			**E (71.6)**			**E (62.1)**			B (17.8)		
2032 Build	D (49.0)	**F (86.8)**	**E (66.7)**		**E (74.7)**	**E (79.2)**	**E (65.2)**	**E (77.1)**	D (52.0)	C (30.4)	**E (77.7)**	B (16.0)	A (0.8)
		F (82.0)			**E (71.6)**			D (51.4)			B (18.3)		
PM Peak Hour													
2017 Existing	D (43.3)	**F (117.7)**	**F (113.3)**	**E (77.0)**	**F (96.6)**	**F (113.4)**		**F (120.9)**	B (17.5)	B (14.1)	B (18.9)	C (29.4)	A (7.9)
		F (107.5)			**F (106.4)**			D (42.3)			C (23.3)		
2026 No Build	D (43.5)	**F (90.2)**	**E (57.7)**	**E (61.9)**	**E (59.1)**	**F (83.9)**		**F (116.9)**	B (11.3)	B (17.3)	**F (85.4)**	D (51.0)	A (0.6)
		E (71.4)			**E (73.4)**			C (28.3)			D (44.1)		
2026 Build	D (40.6)	**E (75.6)**	**F (80.8)**		**E (62.4)**	**F (86.7)**	D (51.0)	**F (102.2)**	B (11.3)	B (16.7)	**F (88.7)**	D (44.0)	A (0.5)
		E (77.3)			**E (69.7)**			C (25.4)			D (39.4)		
2032 No Build	**E (58.0)**	**F (171.5)**	**F (94.6)**	**E (66.4)**	**E (61.5)**	**F (126.4)**		**F (143.1)**	B (11.7)	B (18.2)	**F (86.7)**	**E (67.5)**	A (0.4)
		F (119.7)			**F (99.1)**			C (32.6)			**E (57.5)**		
2032 Build	**E (58.6)**	**F (109.3)**	**F (98.4)**		**E (73.7)**	**F (97.5)**	D (50.7)	**F (135.3)**	B (13.0)	B (18.9)	**F (88.5)**	**E (73.2)**	A (0.4)
		F (105.7)			**E (79.1)**			C (31.7)			**E (62.6)**		

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Table 15: Carrollton Boulevard at Smiths Neck Road Intersection Maximum Queuing

Scenario	Maximum Queue Length by Movement (feet)											
	Eastbound			Westbound			Northbound			Southbound		
	LT	LT/TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Effective Storage Length (Existing/Build)	465	1,190	1,190	140/ 150	1,613	NA/ 175	280/ 450	1,315	245	310/ 450	1,069	340/ 820
AM Peak Hour												
2017 Existing	405	442	72	94	68		197	350 ***(3%)*	245	66	174	58
2026 No Build	360	395	76	104	97		279	649 ***(17%)*	245	101	261	81
2026 Build	352	277		123	79	86	185	628 ***(18%)*	245	143	243	46
2032 No Build	432	536 ***(2%)*	82	118	109		279	1,119 *^(1%)* ***(30%)*	245	89	266	52
2032 Build	442	383		137 **(1%)*	96	117	416	1,261 *^(6%)* ***(36%)*	245	165	262	38
PM Peak Hour												
2017 Existing	293	336	129	139 **(2%)*	172 ***(8%)*		279 **(16%)*	503 ***(2%)*	124	309	977 *^(3%)* ***(36%)*	240 **(1%)*
2026 No Build	293	326	105	140 **(1%)*	298 ***(10%)*		267 **(3%)*	296	121	310	975 ***(17%)*	340 **(1%)*
2026 Build	198	132		150 **(1%)*	191 *^(4%)* ***(6%)*	64	353	351 ***(4%)*	245	450	530 ***(1%)*	94
2032 No Build	454 **(2%)*	842 ***(25%)*	146	140 **(3%)*	395 ***(21%)*		279 **(10%)*	511 ***(5%)*	244	309	962 ***(22%)*	340 **(1%)*
2032 Build	263	232		150 **(7%)*	194 *^(8%)* ***(8%)*	154	387 **(1%)*	427 ***(6%)*	245	342	779 ***(4%)*	447

7.1.3.1 Smiths Neck Road Modifications to Accommodate Proposed Development

As part of the proposed development, a new roadway will be constructed where Smiths Neck Road currently dead ends just past the Bojangles/7-Eleven Driveways on the east side of Carrollton Boulevard. This roadway will be designed to VDOT standards for a public, local road. The new roadway will be constructed as the fourth leg to the existing T-intersection with the Bojangles/7-Eleven Driveways and Smiths Neck Road. A roundabout at this location was considered initially but was determined to not be feasible due it is proximity to the Carrollton Boulevard traffic signal (i.e., less than 200 feet) and the anticipated level of queuing spilling back into the roundabout, impeding its ability to function efficiently. These queues would enter the roundabout, impeding other vehicles from being able to traverse the intersection, negating any potential benefit. Additionally, the necessary ROW required to accommodate its footprint and impacts to adjacent businesses would in excessive construction costs.

Therefore, it is proposed that this intersection is to be configured as three-way STOP controlled with the Bojangles', 7-Eleven, and the northbound Driveway 1/Connection from the Pitt property being STOP controlled. Additional signage (i.e., "DO NOT BLOCK INTERSECTION) and pavement markings (i.e., "Don't Block the Box") can be provided to mitigate queues from blocking the intersection, with additional notice regarding potential fines for those observed/caught impeding intersection operations, whereas this would not be possible with a roundabout. Under this configuration, inbound traffic would not be required to stop at this proposed intersection, negating instances of any queues forming and possibly impacting traffic flows along Carrollton Boulevard.

A conceptual layout, as shown in **Figure 14**, was developed that illustrates how this new roadway will tie into the existing portion of Smiths Neck Road and proposed modifications to the side entrances. This layout also shows the proposed improvements for the Smiths Neck Road at Carrollton Boulevard signalized intersection, which includes a new dedicated right-turn lane, a 4-foot raised median, driveway modifications, and sidewalk connections.

Conditions at this this proposed intersection were modeled and included as part of the future Build scenarios. Volumes for this intersection were estimated based on previous traffic count data and the TIA conducted as part of the existing 7-Eleven development. Future vehicle delays and queues are presented in **Table 14** and **Table 15**. It should be noted that due to the proposed configuration of the stop-controlled intersection (i.e., 3 of the 4 legs being stopped controlled), Synchro cannot produce LOS results under the HCM methodology. Therefore, simulated delays from the SimTraffic microsimulation models were used to report these operational conditions instead, as is common practice for this situation.

Based on the future Build conditions, this new intersection is projected to operate with minimal delays, with all movements/approaches operating with less than an average of 13 seconds of delay per vehicle (e.g., comparable to LOS B). Likewise, queues are also shown to be minimal, without any instances of blocking or impacts to traffic on Carrollton Boulevard. Therefore, this new intersection is expected to function in this configuration and will be able to serve existing and proposed site traffic volumes without issue.

Table 16: Smiths Neck Road at Bojangles'/7-Eleven Driveways Intersection Delays

Scenario	Overall Delay	Delay per Movement by Approach (Delay in sec/veh)											
		Eastbound			Westbound			Northbound			Southbound		
		LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
AM Peak Hour													
2026 Build	2.9	1.0	1.2	1.1	8.3			5.2			4.4		
2032 Build	3.1	0.9	0.9	0.9	9.2			5.4			4.7		
PM Peak Hour													
2026 Build	4.5	1.2	1.1	1.2	10.7			7.6			6.2		
2032 Build	6.1	1.2	1.2	1.2	12.2			9.8			10.2		

Table 17: Smiths Neck Road at Bojangles'/7-Eleven Driveways Intersection Maximum Queuing

Scenario	Maximum Queue Length by Movement (feet)											
	Eastbound			Westbound			Northbound			Southbound		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Effective Storage Length (Build)	175	270		680			510			460		
AM Peak Hour												
2026 Build	< 25	0		55			51			56		
2032 Build	0	0		50			45			89		
PM Peak Hour												
2026 Build	< 25	0		59			73			79		
2032 Build	< 25	0		66			87			134		

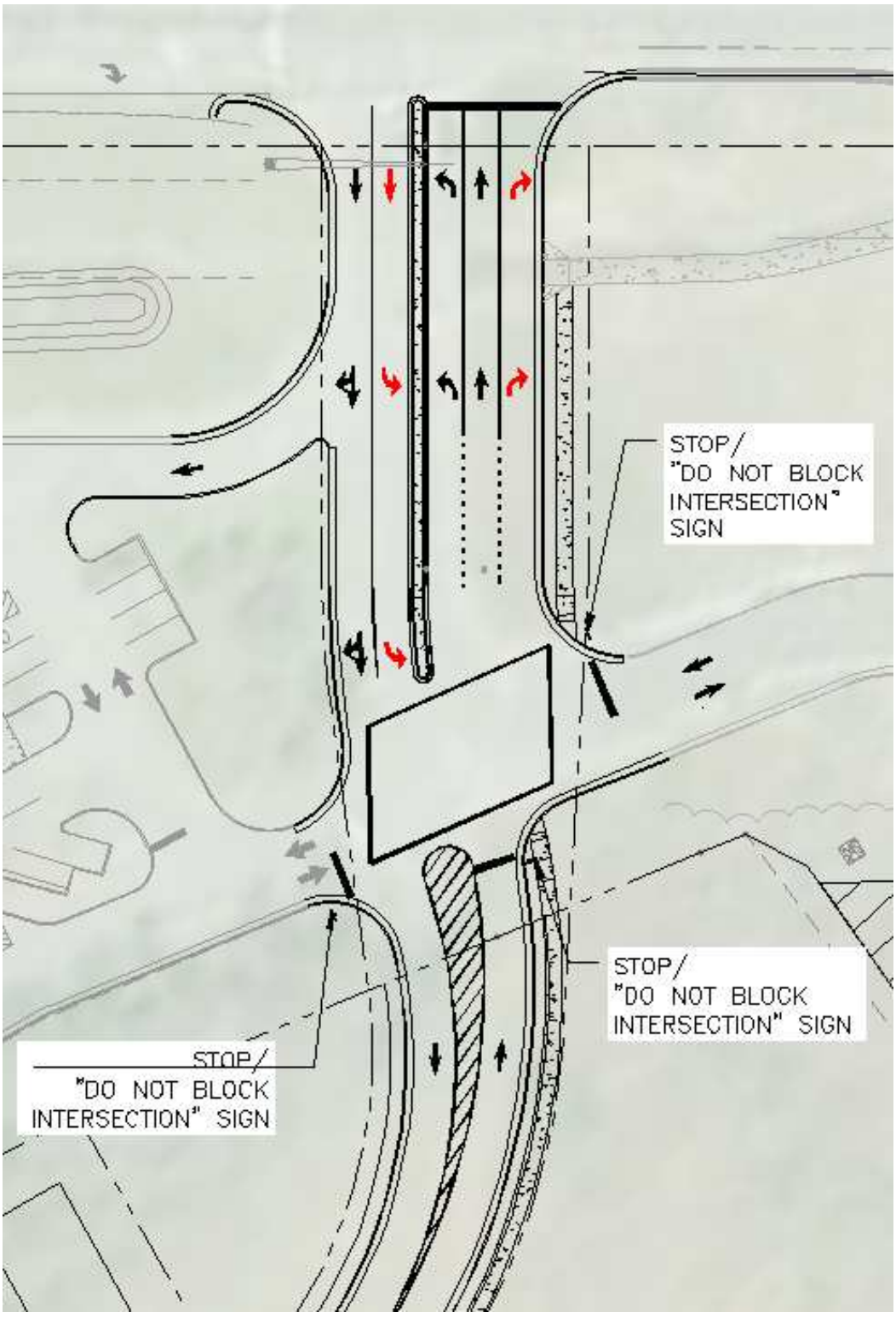

Figure 14: Proposed Modifications to Smiths Neck Road Access to the Pitt and Lippe Development

7.1.4 CARROLLTON BOULEVARD AT NORTHGATE DRIVE

This two-way stop controlled (TWSC) intersection consisted of the following geometry for the existing scenarios:

- Carrollton Boulevard (northbound)
  - One exclusive left-turn lane
  - Two exclusive through lanes
  - One exclusive right-turn lane
- Carrollton Boulevard (southbound)
  - One exclusive left-turn lane
  - Two exclusive through lanes
  - One exclusive right-turn lane
- Northgate Drive (eastbound)
  - One shared left/through lane
  - One exclusive right-turn lane
- Northgate Drive (westbound)
  - One shared left/through/right-turn lane

Results of the capacity and queuing analysis for this unsignalized intersection are shown in **Table 18** and **Table 19,** respectively. Under Existing conditions, the AM and PM peak hours experienced an overall LOS A. During the AM peak hour, the eastbound right-turn movement operates at LOS E. During the PM peak hour, the westbound approach operates at LOS F; however, this approach has low volumes (i.e., less than 5 vehicles).

Under future No Build conditions, the eastbound and westbound approaches experience significant delays. Vehicles are unable to complete their left turn movement due to the high volume of through traffic on Carrollton Boulevard and as such, this intersection operates at an overall LOS F during the 2026 and 2032 No Build conditions.

Based on these operational conditions and the results of the signal warrant analysis, it was determined that modification of how this intersection operates (i.e., modification of access to/from the side streets) would be necessary. As such, it was recommended that this intersection be modified to restrict access and minimize potential conflict points in association with the proposed Pitt and Lippe development. Therefore, this TWSC intersection consists of the following geometry for the future scenarios:

- Carrollton Boulevard (northbound)
  - One exclusive left-turn lane
  - Two exclusive through lanes
  - One exclusive right-turn lane
- Carrollton Boulevard (southbound)
  - One exclusive left-turn lane
  - Two exclusive through lanes
  - One exclusive right-turn lane

- Northgate Drive (eastbound)
    - Remove One shared left/through lane
    - One exclusive right-turn lane
- Northgate Drive (westbound)
    - Provide One exclusive right-turn lane (proposed)

Under Build conditions, the westbound and eastbound approaches are reconfigured to a single right-turn lane that restricts left turning vehicles from Northgate Drive. Vehicles will still be allowed to make lefts onto Northgate Drive from Carrollton Boulevard. As it was previously mentioned, the anticipated impact of this access restriction is that many vehicles will instead choose to utilize the existing signal located at Smiths Neck Road. The operational analysis presented here in this study under Build conditions reflects this, with vehicles rerouted to the signal. Alternatively, vehicles can also choose to make the right-turn from Northgate Drive and instead make U-turns at the next upstream signalized intersection, which in this case would be Smiths Neck Road (i.e., for vehicles destined to the south) and the proposed intersection of Nike Park Extension (i.e., for vehicles destined to the north). By eliminating the left-turns on the minor street, significant reductions in delay are anticipated on the minor street. Under future Build conditions, this intersection operates with an overall LOS A with delays less than 3 seconds. The Build conditions have reduced maximum queues with no queues having a significant impact on the operations of this intersection.

Overall, the proposed site traffic is anticipated to have minimal impact on this intersection's operations for 2026 and 2032 AM and PM peak hour periods with the proposed access modifications. By restricting movements on Northgate Lane, this intersection will operate with minimal delays.

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Table 18: Carrollton Boulevard at Northgate Drive Intersection Level of Service

Scenario	Overall LOS	Level of Service per Movement by Approach (Delay in sec/veh)											
		Eastbound			Westbound			Northbound			Southbound		
		LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
AM Peak Hour													
2017 Existing	A (1.6)	**E (41.1)**		A (0.0)	A (0.0)			A (8.8)	A (0.0)	A (0.0)	A (0.0)	A (0.0)	A (0.0)
		E (41.1)						A (0.1)			A (0.0)		
2026 No Build	A (9.6)	**F (299.1)**		A (0.0)	A (0.0)			A (9.5)	A (0.0)	A (0.0)	A (0.0)	A (0.0)	A (0.0)
		F (299.1)						A (0.1)			A (0.0)		
2026 Build	A (0.4)	-		A (9.9)	-		C (20.6)	A (9.7)	A (0.0)	A (0.0)	C (18.1)	A (0.0)	A (0.0)
		A (9.9)			C (20.6)			A (0.1)			A (0.3)		
2032 No Build	C (27.7)	**F (> 300)**		A (0.0)	A (0.0)			B (10.0)	A (0.0)	A (0.0)	A (0.0)	A (0.0)	A (0.0)
		F (> 300)						A (0.1)			A (0.0)		
2032 Build	A (0.5)	-		B (10.2)	-		C (24.2)	B (10.2)	A (0.0)	A (0.0)	C (21.6)	A (0.0)	A (0.0)
		B (10.2)			C (24.2)			A (0.1)			A (0.3)		
PM Peak Hour													
2017 Existing	A (1.5)	**F (103.0)**		A (0.0)	**F (196.4)**			B (13.2)	A (0.0)	A (0.0)	B (10.7)	A (0.0)	A (0.0)
		F (103.0)						A (0.9)			A (0.0)		
2026 No Build	**F (> 300)**	**F (> 300)**		A (0.0)	**F (> 300)**			C (22.7)	A (0.0)	A (0.0)	B (12.1)	A (0.0)	A (0.0)
		F (> 300)						A (1.5)			A (0.0)		
2026 Build	A (0.9)	-		B (12.5)	-		C (15.2)	C (25.0)	A (0.0)	A (0.0)	B (12.5)	A (0.0)	A (0.0)
		B (12.5)			C (15.2)			A (1.6)			A (0.1)		
2032 No Build	**F (> 300)**	**F (> 300)**		A (0.0)	**F (> 300)**			**E (48.8)**	A (0.0)	A (0.0)	B (13.2)	A (0.0)	A (0.0)
		F (> 300)						A (3.2)			A (0.0)		
2032 Build	A (1.8)	-		B (12.9)	-		C (16.8)	**F (60.6)**	A (0.0)	A (0.0)	B (13.7)	A (0.0)	A (0.0)
		B (12.9)			C (16.8)			A (3.8)			A (0.1)		

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Table 19: Carrollton Boulevard at Northgate Drive Intersection Maximum Queuing

Scenario	Maximum Queue Length by Movement (feet)											
	Eastbound			Westbound			Northbound			Southbound		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Effective Storage Length (Existing/Build)	1,273		160/ 1273	1,575		1,575	245	1,373	215 / 300	80 / 300	1,315	200
AM Peak Hour												
2017 Existing	75		54	0			< 25	0	0	0	0	0
2026 No Build	379 ***(25%)*		160	0			34	0	0	0	0	0
2026 Build	-		54	-		49	36	0	0	36	0	0
2032 No Build	1,154 ***(83%)*		160	0			86	173	0	0	0	0
2032 Build	-		65	-		73	97	589 ***(6%)*	210	59	0	0
PM Peak Hour												
2017 Existing	42		47	< 25			114	< 25	0	< 25	0	0
2026 No Build	44		37	< 25			178	53	0	< 25	0	0
2026 Build	-		39	-		47	146	0	0	23	0	0
2032 No Build	60		58	< 25			176	< 25	0	< 25	117	0
2032 Build	-		58	-		66	174	< 25	0	31	0	< 25

7.1.5 CARROLLTON BOULEVARD AT NIKE PARK ROAD EXTENSION

This signalized intersection consisted of the following geometry for the future scenarios:

- Carrollton Boulevard (northbound)
  - One exclusive left-turn lane
  - Two exclusive through lanes
- Carrollton Boulevard (southbound)
  - Two exclusive through lanes
  - One exclusive right-turn lane
- Nike Park Road Extension (eastbound)
  - Two exclusive left-turn lanes
  - One exclusive right-turn lane

Results of the capacity and queuing analysis for this signalized intersection are shown in **Table 20** and **Table 21,** respectively. This intersection is modeled under the future scenarios.

For the 2026 and 2032 No Build AM and PM peak hours, the overall intersection is anticipated to experience LOS C or better. However, due to emphasis on Carrollton Boulevard progression, the eastbound approach is expected to operate at LOS E during the AM and PM peak hours under all future scenarios. It is noted that the northbound left-turn movement increases from a LOS D to a LOS E in 2026 conditions with the addition of the proposed site traffic. However, this increase is negligible, as the increase in delay only exceeds the LOS delay threshold by 0.1 seconds.

Otherwise, the addition of the proposed site traffic has minimal impact on this intersection's operations during the AM and PM peak hours compared to the corresponding No Build scenarios.

Queues are also projected to be contained within the available storage lengths for all future AM and PM peak hour conditions. The northbound and southbound through movements are anticipated to experience queues during the peak periods that could impact access to adjacent turn lanes during periods of heavy congestion. The queues under Build conditions are comparable to the queues anticipated under No Build conditions.

Based on the results of the future analysis scenarios, this intersection (i.e., Carrollton Boulevard at Nike Park Road Extension has the capacity to serve the estimated 40% of traffic diverted from Smiths Neck Road. Overall, the proposed site traffic is anticipated to have minimal impact on this intersection's operations for 2026 and 2032 AM and PM peak hour periods.

Table 20: Carrollton Boulevard at Nike Park Extension Intersection Level of Service

Scenario	Overall LOS	Level of Service per Movement by Approach (Delay in sec/veh)											
		Eastbound			Westbound			Northbound			Southbound		
		LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
AM Peak Hour													
2017 Existing	-	-			-			-			-		
2026 No Build	B (16.9)	**E (63.7)**	-	D (53.4)	-			A (7.7)	A (7.7)	-	-	B (16.2)	A (1.0)
		E (61.9)						A (7.7)			B (14.9)		
2026 Build	B (15.9)	**E (63.7)**	-	D (53.4)	-			A (7.7)	A (7.9)	-	-	B (13.1)	A (1.0)
		E (61.9)						A (7.9)			B (12.9)		
2032 No Build	C (20.5)	**E (73.0)**	-	**E (59.8)**	-			A (9.3)	B (10.7)	-	-	B (18.5)	A (4.6)
		E (70.7)						B (10.7)			B (17.3)		
2032 Build	B (19.5)	**E (73.0)**	-	**E (59.8)**	-			A (9.3)	B (11.0)	-	-	B (15.2)	A (4.3)
		E (70.7)						B (10.9)			B (14.2)		
PM Peak Hour													
2017 Existing	-	-			-			-			-		
2026 No Build	B (10.5)	**E (74.4)**	-	**E (67.9)**	-			D (52.4)	A (3.6)	-	-	A (6.6)	A (2.4)
		E (72.9)						A (7.9)			A (6.1)		
2026 Build	B (10.9)	**E (74.4)**	-	**E (67.9)**	-			**E (55.1)**	A (3.6)	-	-	A (7.4)	A (2.3)
		E (72.9)						A (8.0)			A (6.8)		
2032 No Build	B (10.8)	**E (74.0)**	-	**E (66.8)**	-			**E (65.0)**	A (6.7)	-	-	A (4.4)	A (0.5)
		E (72.4)						B (11.8)			A (3.9)		
2032 Build	B (11.3)	**E (74.0)**	-	**E (66.8)**	-			**E (65.4)**	A (6.8)	-	-	A (5.8)	A (0.5)
		E (72.4)						B (11.8)			A (5.1)		

Table 21: Carrollton Boulevard at Nike Park Extension Intersection Maximum Queuing

Scenario	Maximum Queue Length by Movement (feet)											
	Eastbound			Westbound			Northbound			Southbound		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Effective Storage Length (Existing/Build)	NA / 650	-	NA / 430	-			NA / 75	NA / 1,281	-	-	NA / 707	NA / 200
AM Peak Hour												
2017 Existing	-			-			-			-		
2026 No Build	221	-	48	-			65	337 **(14%)	-	-	316 **(2%)	169
2026 Build	218	-	52	-			67	352 **(14%)	-	-	267 **(1%)	156
2032 No Build	261	-	71	-			69	430 **(15%)	-	-	394 **(3%)	200
2032 Build	261	-	76	-			68 *(1%)	425 **(15%)	-	-	338 **(3%)	182
PM Peak Hour												
2017 Existing	-			-			-			-		
2026 No Build	153	-	83	-			74 *(32%)	361 **(8%)	-	-	576 **(17%)	200
2026 Build	128	-	101	-			74 *(16%)	415 **(9%)	-	-	347 **(4%)	200
2032 No Build	149	-	78	-			74 *(34%)	565 **(13%)	-	-	524 **(17%)	200
2032 Build	168	-	87	-			74 *(37%)	644 **(15%)	-	-	597 **(19%)	200 *(1%)

7.1.6 CARROLLTON BOULEVARD AT BREWERS NECK BOULEVARD

This signalized intersection consisted of the following geometry for the existing scenarios:

- Carrollton Boulevard (northbound)
  - One exclusive left-turn lane
  - Two exclusive through lanes
- Carrollton Boulevard (southbound)
  - Two exclusive through lanes
  - One exclusive right-turn lane
- Brewers Neck Boulevard (eastbound)
  - Two exclusive left-turn lanes
  - One exclusive right-turn lane

With the noted improvements (by others) for this intersection, the following geometry was used in the analysis of the future scenarios:

- Carrollton Boulevard (northbound)
  - Two exclusive left-turn lanes
  - Two exclusive through lanes
  - One exclusive right-turn lane (proposed by others)

- Carrollton Boulevard (southbound)
    - Two exclusive left-turn lanes (proposed by others)
    - Two exclusive through lanes
    - One exclusive right-turn lane
- Brewers Neck Boulevard (eastbound)
    - Two exclusive left-turn lanes
    - One exclusive through lane (proposed by others)
    - One exclusive right-turn lane
- The Crossings Driveway (westbound)
    - One exclusive left-turn lane (proposed by others)
    - One exclusive through lane (proposed by others)
    - One shared through/right lane (proposed by others)

Results of the capacity and queuing analysis for this signalized intersection are shown in **Table 22** and **Table 23**, respectively. Under Existing conditions this intersection currently operates at overall LOS C and all individual movements operating at LOS D or better during the AM and PM peak hours.

As note previously, the approved Crossings TIA (*December 28, 2010)* was used to determine the future turning movement volumes associated with that development in regard to the proposed future geometry of the intersection. Under the future 2026 and 2032 No Build conditions, the increase in traffic volume associated with the background traffic and approved developments is anticipated to significantly degrade intersection operations, even with the signal retiming and proposed capacity enhancements. This in results in many movements projected to operate at LOS E or worse.

Additionally, a new connection to this signal from Channel Way is proposed as part of the Crossings Development. This connection was presented in that TIA as a means to help alleviate excessive delays that will occur at the Channel Way and Carrollton Boulevard intersection during peak periods. As such, it was assumed that traffic associated with the Pitt and Lippe would also benefit from this connection to the signal via Channell Way. To account for this anticipated shift, the westbound approach will have 30% of the residential site traffic exiting on Brewers Neck Boulevard. Under the 2026 and 2032 Build conditions, the addition of the site traffic diverted to this intersection is expected to have minimal impact on its operations during the AM and PM peak hours when compared to the corresponding No Build scenarios.

During the AM and PM peak hours, this intersection is expected to experience significant queuing, resulting in instances of vehicles being blocked for all future scenarios. During the future AM and PM peak hour conditions, the northbound through movement is anticipated to experience queuing that could impede access for vehicles attempting to make a left-turn movement. In addition, the westbound approach is anticipated to experience significant queues under all scenarios. Regardless, queues for the Build conditions are still projected to be comparable to those anticipated under No Build conditions without significant increases.

Overall, the proposed site traffic is anticipated to have minimal impact on this intersection's operations for 2026 and 2032 AM and PM peak hour periods. No additional geometric improvements are recommended for this intersection.

Table 22: Carrollton Boulevard at Brewers Neck Boulevard Intersection Level of Service

Scenario	Overall LOS	Level of Service per Movement by Approach (Delay in sec/veh)											
		Eastbound			Westbound			Northbound			Southbound		
		LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
AM Peak Hour													
2017 Existing	C (22.5)	D (36.3)	-	A (0.6)	-			D (45.7)	B (12.6)	-	-	D (39.8)	A (0.6)
		C (23.3)						C (27.5)			B (16.1)		
2026 No Build	C (32.8)	**E (55.3)**	D (38.4)	A (0.8)	D (47.8)	**E (63.8)**		D (54.6)	C (31.5)	C (30.0)	**F (88.4)**	C (29.2)	A (0.7)
		D (35.6)			**E (59.6)**			D (41.7)			B (15.4)		
2026 Build	C (33.7)	**E (55.4)**	C (30.8)	A (0.8)	**E (58.5)**	**E (64.0)**		**E (55.8)**	C (31.9)	C (30.1)	**F (84.9)**	C (34.3)	A (0.7)
		D (35.4)			**E (62.2)**			D (42.0)			B (17.6)		
2032 No Build	D (39.0)	**E (65.5)**	C (31.4)	A (0.9)	**E (66.9)**	**E (72.6)**		**E (63.3)**	D (41.5)	C (34.1)	**F (106.0)**	D (36.5)	A (0.9)
		D (41.5)			**E (71.1)**			D (51.0)			B (18.6)		
2032 Build	D (40.7)	**E (68.4)**	C (32.1)	A (0.9)	**E (67.3)**	**E (72.7)**		**E (62.7)**	D (41.0)	C (33.9)	**F (102.3)**	D (44.6)	A (0.9)
		D (43.5)			**E (70.9)**			D (50.2)			C (22.0)		
PM Peak Hour													
2017 Existing	C (21.6)	D (45.3)	-	A (0.6)	-			D (46.5)	A (9.0)	-	-	D (41.3)	A (2.2)
		C (24.8)						C (27.6)			B (15.6)		
2026 No Build	D (46.2)	**E (71.6)**	**D (48.1)**	A (0.9)	**E (57.7)**	**F (94.4)**		**F (93.5)**	D (42.1)	D (37.1)	**F (91.5)**	**E (55.5)**	A (3.2)
		D (40.2)			**F (82.8)**			**E (66.0)**			C (31.2)		
2026 Build	D (46.9)	**E (72.2)**	**D (48.9)**	A (0.9)	**E (57.6)**	**F (96.9)**		**F (92.5)**	D (44.5)	D (37.5)	**F (91.1)**	**E (56.4)**	A (3.3)
		D (40.7)			**F (84.0)**			**E (66.3)**			C (31.9)		
2032 No Build	D (50.8)	**F (84.1)**	D (46.9)	**A (1.1)**	**E (58.4)**	**F (100.5)**		**F (100.7)**	D (48.7)	D (38.0)	**F (89.0)**	**E (66.3)**	A (5.6)
		D (46.1)			**F (87.3)**			**E (72.8)**			C (34.5)		
2032 Build	D (52.3)	**F (86.1)**	D (47.9)	A (1.1)	**E (58.7)**	**F (105.9)**		**F (99.4)**	D (51.9)	D (38.2)	**F (89.0)**	**E (69.7)**	A (5.8)
		D (47.4)			**F (90.4)**			**E (73.4)**			D (36.1)		

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Table 23: Carrollton Boulevard at Brewers Neck Boulevard Intersection Maximum Queuing

Scenario	Maximum Queue Length by Movement (feet)											
	Eastbound			Westbound			Northbound			Southbound		
	LT	TH	RT	LT	TH	TH/RT	LT	TH	RT	LT	TH	RT
Effective Storage Length (Existing/Build)	NA / 585	NA	575	NA / 150	NA / 1361	NA / 150	560 / 650	1,134	NA / 300	NA / 262	1,281	550/ 300
AM Peak Hour												
2017 Existing	362	-	0		-		367	193	-	-	169	0
2026 No Build	488	130	170	65	102	86	301	265	81	83	227	0
2026 Build	532	173	20	94	93	108	299	276	133	82	210	29
2032 No Build	578 ***(3%)*	816	310	68	89	95	352	325	84	79	275	60
2032 Build	685 ***(9%)*	692	305	98	110	109	336	349 ***(9%)*	224	154	297	89
PM Peak Hour												
2017 Existing	307	-	0		-		436	245	-	-	258	0
2026 No Build	529	408	282	150 **(4%)*	332 ***(20%)*	290	438	298	200	300	508 ***(2%)*	210
2026 Build	551	241	298	150 **(14%)*	655 ***(48%)*	564	354	330 ***(2%)*	225	262	561 ***(5%)*	300
2032 No Build	686 ***(6%)*	735	471	150 **(8%)*	402 ***(25%)*	354	560 **(26%)*	1,000 *^(10%) **(17%)*	79	300	536 ***(7%)*	298
2032 Build	688 ***(14%)*	924 ***(1%)*	470	150 **(9%)*	373 ***(24%)*	323	649 **(19%)*	959 *^(11%) **(15%)*	207	262	721 ***(19%)*	300 **(1%)*

7.1.7 CARROLLTON BOULEVARD AT CHANNELL WAY/DEEP BOTTOM DRIVE

This two-way stopped controlled intersection consisted of the following geometry for the existing scenarios:

- Carrollton Boulevard (northbound)
  - One exclusive left-turn lane
  - Two exclusive through lanes
  - One exclusive right-turn lane (unmarked)
- Carrollton Boulevard (southbound)
  - One exclusive left-turn lane
  - One exclusive through lane
  - One shared through/right-turn lane
- Deep Bottom Drive (eastbound)
  - One shared left/through/right-turn lane
- Channell Way (westbound)
  - One shared left/through/right-turn lane

Future improvements were identified for this intersection to better accommodate the Pitt and Lippe traffic. As such, the following geometry conditions were analyzed as part of the future Build scenarios:

- Carrollton Boulevard (northbound)
    - One exclusive left-turn lane
    - Two exclusive through lanes
    - One exclusive right-turn lane (unmarked)
- Carrollton Boulevard (southbound)
    - One exclusive left-turn lane
    - One exclusive through lane
    - One shared through/right-turn lane
- Deep Bottom Drive (eastbound)
    - One shared left/through/right-turn lane
- Channell Way (westbound)
    - One shared left/through lane
    - One exclusive right-turn lane (proposed)

Results of the capacity and queuing analysis for this unsignalized intersection are shown in **Table 24** and **Table 25**, respectively. Under Existing conditions, the AM and PM peak hour operate at an overall LOS A with minimal delays. However, during the PM peak hour, the westbound approach is noted to currently operate at LOS E.

Under the future 2026 and 2032 No Build and Build conditions, this intersection is expected to operate at an overall LOS A with minimal delays on the major street. However, the minor approaches are anticipated to experience failing operations due to the increased traffic volumes along Carrollton Boulevard and the decrease in frequency and length of gaps associated with oncoming traffic.

Overall, the 2026 and 2032 Build conditions show that the addition of the site traffic to this intersection results in minimal impact on the intersection operations during the AM and PM peak hours compared to the corresponding No Build conditions. However, it is expected that any site traffic that cannot complete their turning movement (i.e., left-turn) from the minor street approaches will instead reroute to other intersections (i.e., Brewers Neck Boulevard, Smiths Neck Road, or Whippingham Parkway), rather than wait through excessive delays. Therefore, it is anticipated that actual delays experienced at this intersection will be less than what is report in **Table 24** and **Table 25**.

During the Existing AM and PM peak hours, queues were not shown to exceed the available storage or impact adjacent intersections. Under the 2032 No Build and Build scenarios, the northbound through movement is expected to experience queues that originate from the downstream signalized intersection of Brewers Neck Boulevard. As such, it is expected that these queues will further result in upstream blocking and blocking of the adjacent storage lanes. Queues for the Build conditions are still projected to be comparable to those anticipated under No Build conditions without significant increases. Additionally, the proposed turn lane enhancements at this intersection help minimize the length of queues and instances of blocking compared to the No Build conditions.

Similar to the other unsignalized intersections along Carrolton Boulevard, vehicles will be challenged to make left-turn movements during the peak periods due to a lack of gaps in approaching traffic volumes as well as anticipated periods of significant congestion. Ultimately, it is anticipated that other routing options will be utilized for vehicles accessing Carrollton Boulevard through the Pitt and Lippe parcels.

Table 24: Carrollton Boulevard at Channell Way/Deep Bottom Drive Intersection Level of Service

Scenario	Overall LOS	Level of Service per Movement by Approach (Delay in sec/veh)											
		Eastbound			Westbound			Northbound			Southbound		
		LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
AM Peak Hour													
2017 Existing	A (1.0)	B (10.9)			C (21.8)			A (9.2)	A (0.0)	A (0.0)	A (9.6)	A (0.0)	
								A (0.1)			A (0.2)		
2026 No Build	A (1.5)	B (11.3)			D (34.7)			A (9.7)	A (0.0)	A (0.0)	B (10.3)	A (0.0)	A (0.0)
								A (0.1)			A (0.2)		
2026 Build	A (1.6)	B (11.4)			D (33.1)	A (0.0)		A (9.9)	A (0.0)	A (0.0)	B (10.6)	A (0.0)	A (0.0)
					D (33.1)			A (0.1)			A (0.2)		
2032 No Build	A (2.5)	B (11.6)			**F (59.5)**			B (10.3)	A (0.0)	A (0.0)	B (11.0)	A (0.0)	A (0.0)
								A (0.1)			A (0.2)		
2032 Build	A (2.6)	B (11.6)			**F (54.8)**	A (0.0)		B (10.4)	A (0.0)	A (0.0)	B (11.3)	A (0.0)	A (0.0)
					F (54.8)			A (0.1)			A (0.2)		
PM Peak Hour													
2017 Existing	A (1.2)	D (26.3)			**E (36.6)**			B (10.0)	A (0.0)	A (0.0)	B (10.5)	A (0.0)	
								A (0.1)			A (0.5)		
2026 No Build	A (2.5)	**E (48.8)**			**F (92.4)**			B (11.1)	A (0.0)	A (0.0)	B (11.7)	A (0.0)	A (0.0)
								A (0.1)			A (0.5)		
2026 Build	A (3.2)	**F (53.4)**			**F (103.3)**	A (0.0)		B (11.3)	A (0.0)	A (0.0)	B (12.1)	A (0.0)	A (0.0)
					F (103.3)			A (0.1)			A (0.6)		
2032 No Build	A (6.5)	**F (81.1)**			**F (271.8)**			B (12.0)	A (0.0)	A (0.0)	B (12.8)	A (0.0)	A (0.0)
								A (0.1)			A (0.6)		
2032 Build	A (7.0)	**F (92.4)**			**F (248.6)**	A (0.0)		B (12.3)	A (0.0)	A (0.0)	B (13.4)	A (0.0)	A (0.0)
					F (248.6)			A (0.1)			A (0.7)		

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Table 25: Carrollton Boulevard at Channell Way/Deep Bottom Drive Intersection Maximum Queuing

Scenario	Maximum Queue Length by Movement (feet)											
	Eastbound			Westbound			Northbound			Southbound		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	TH/RT
Effective Storage Length (Existing/Build)	777			479		479/ 250	140	648	60	140 / 250	1,134	1,134
AM Peak Hour												
2017 Existing	50			70			< 25	0	0	31	0	< 25
2026 No Build	57			101			< 25	0	0	29	0	0
2026 Build	55			58		64	< 25	0	< 25	39	0	0
2032 No Build	59			145			< 25	0	0	35	0	0
2032 Build	51			79		71	< 25	0	< 25	36	0	0
PM Peak Hour												
2017 Existing	35			67			26	0	< 25	63	0	0
2026 No Build	59			124			28	0	< 25	76	0	0
2026 Build	28			92		51	< 25	0	27	80	0	0
2032 No Build	75			282			99	502 *^(6%)* ***(12%)*	< 25	84	< 25	< 25
2032 Build	54			131		125	90	479 *^(6%)* ***(12%)*	27	108	0	0

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7.1.8 CARROLLTON BOULEVARD AT ASHBY WAY/OMERA DRIVE

This two-way stop controlled intersection consisted of the following geometry for the existing and future scenarios:

- Carrollton Boulevard (northbound)
  - One exclusive left-turn lane
  - Two exclusive through lanes
  - One exclusive right-turn lane
- Carrollton Boulevard (southbound)
  - One exclusive left-turn lane
  - Two exclusive through lanes
  - One exclusive right-turn lane
- Ashby Way (eastbound)
  - One exclusive left-turn lane
  - One shared through/right-turn lane
- Omera Drive (westbound)
  - One shared left/through/right-turn lane

Results of the capacity and queuing analysis for this unsignalized intersection are shown in **Table 26** and **Table 27**, respectively. Under Existing conditions, the AM and PM peak hour operate at an overall LOS B with minor delays.

Under the future 2026 and 2032 No Build conditions, the increase in traffic volume associated with the background traffic and approved developments is anticipated to degrade operations along the minor street. The minor street approaches are anticipated to experience failing operations due to the increased traffic volumes along Carrollton Boulevard and decrease in gaps of oncoming traffic.

Under the 2026 and 2032 Build conditions, the addition of the site traffic has minimal impact on the intersection operations during the AM and PM peak hours compared to the corresponding No Build conditions.

During the Existing AM and PM peak hours, moderate queues are experienced; however, none of the queues exceed the available storage. Under the future scenarios, all of the queues are anticipated to be contained within the available storage length. The northbound through movement queue is anticipated to result in blocking of the adjacent storage lane under the future PM peak scenarios. This blocking will have a minimal impact on the operations of the intersection and the queues experienced under the Build conditions are comparable to the No Build conditions.

Overall, the proposed site traffic is anticipated to have minimal impact on this intersection's operations for 2026 and 2032 AM and PM peak hour periods.

Table 26: Carrollton Boulevard at Ashby Way/Omera Drive Intersection Level of Service

Scenario	Overall LOS	Level of Service per Movement by Approach (Delay in sec/veh)											
		Eastbound			Westbound			Northbound			Southbound		
		LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
AM Peak Hour													
2017 Existing	B (16.8)	D (40.7)	C (32.1)		C (31.3)			B (11.7)	B (15.7)	B (12.1)	A (9.9)	B (14.3)	B (10.8)
		D (38.1)						B (15.6)			B (14.0)		
2026 No Build	B (17.7)	**E (69.5)**	**E (61.1)**		**E (63.4)**			B (10.6)	B (15.7)	B (11.4)	A (5.7)	A (9.4)	B (10.0)
		E (67.0)						B (15.6)			A (9.2)		
2026 Build	B (17.8)	**E (69.5)**	**E (61.1)**		**E (63.4)**			B (10.7)	B (16.0)	B (11.4)	A (5.9)	A (9.8)	B (10.0)
		E (67.0)						B (15.9)			A (9.6)		
2032 No Build	C (20.5)	**E (76.1)**	**E (68.4)**		**E (77.6)**			B (12.1)	B (18.2)	B (12.6)	A (6.5)	B (10.6)	B (10.6)
		E (73.8)						B (18.1)			B (10.4)		
2032 Build	C (20.9)	**E (76.1)**	**E (68.4)**		**E (77.6)**			B (12.3)	B (18.6)	B (12.6)	A (7.2)	B (11.5)	B (10.6)
		E (73.8)						B (18.5)			B (11.3)		
PM Peak Hour													
2017 Existing	B (17.0)	D (35.0)	C (33.2)		C (32.5)			B (11.4)	B (15.7)	B (11.9)	B (10.3)	B (16.1)	B (11.3)
		C (34.3)						B (15.5)			B (15.6)		
2026 No Build	C (27.1)	**E (77.3)**	**E (73.4)**		**E (76.5)**			B (11.2)	B (16.5)	B (11.6)	B (19.3)	C (29.3)	B (10.1)
		E (75.7)						B (16.2)			C (27.8)		
2026 Build	C (27.6)	**E (77.3)**	**E (73.4)**		**E (76.5)**			B (11.5)	B (16.8)	B (11.6)	C (20.1)	C (30.2)	B (10.1)
		E (75.7)						B (16.5)			C (28.8)		
2032 No Build	C (30.3)	**E (77.7)**	**E (73.3)**		**E (73.1)**			B (13.8)	B (19.7)	B (13.2)	C (23.9)	C (33.3)	B (12.0)
		E (76.0)						B (19.4)			C (31.8)		
2032 Build	C (30.2)	**E (77.7)**	**E (73.3)**		**E (73.1)**			B (14.3)	C (20.1)	B (13.2)	C (25.0)	C (33.0)	B (12.0)
		E (76.0)						B (19.8)			C (31.7)		

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Table 27: Carrollton Boulevard at Ashby Way/Omera Drive Intersection Maximum Queuing

Scenario	Maximum Queue Length by Movement (feet)											
	Eastbound			Westbound			Northbound			Southbound		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Effective Storage Length (Existing/Build)	135	709		775			275	1,480	350	300	1,077	630
AM Peak Hour												
2017 Existing	80	41		101			38	209	27	69	167	28
2026 No Build	125	102		160			54	248	26	69	149	29
2026 Build	110	56		183			31	241	31	77	156	31
2032 No Build	120	110		213			40	324	31	95	197	35
2032 Build	125	107		204			32	296	28	76	199	41
PM Peak Hour												
2017 Existing	58	39		105			42	195	< 25	65	211	33
2026 No Build	80	58		226			119	305	< 25	119	218	27
2026 Build	87	68		299			66	299	41	107	290	30
2032 No Build	93	60		259			73	366	25	215	340	30
2032 Build	96	75		246			144	348 **(2%)	< 25	223	372	37

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8 CONCLUSIONS AND RECOMMENDATIONS

This traffic study examined the potential impacts associated with the proposed Pitt & Lippe development parcels, as well as the Eagle Harbor, LLC (Tract 11) parcel located along Carrollton Boulevard and Channell Way in Isle of Wight County, Virginia. It is anticipated that the construction of the proposed development will be completed, operational, and at or near full occupancy/build-out by 2026. The following three (3) access points are proposed for the parcels:

- Carrollton Boulevard (U.S. Route 17) via the Pitt Parcel Access:
  1. Westbound approach of Smiths Neck Road at the Carrollton Boulevard/Smiths Neck Road signalized intersection
  2. Westbound approach of Northgate Drive at the Carrollton Boulevard/Northgate Drive unsignalized intersection
- Carrollton Boulevard (U.S. Route 17) via the Channell Way/Lippe Parcel Access:
  1. Westbound approach of Channell Way at the Channell Way/Whippingham Parkway unsignalized intersection (Channell Way will provide direct access to/from Carrollton Boulevard)

The total amount of traffic generated by these developments is expected to consist of approximately 2,930 daily trips, of which 220 and 244 trips will occur during the AM and PM peak hours, respectively. In addition to the traffic generation associated with the proposed parcels, an annual growth rate of 2% was applied to account for future traffic volume projections per standard practice and guidance as a part of this study. Based on the results of the traffic analysis, the future impacts associated with the proposed development are anticipated to be minimal overall, with minor deteriorations in operations anticipated at the signalized and unsignalized intersections when comparing 2026 and 2032 Build conditions to 2026 and 2032 No-Build and in some cases even Existing operational conditions.

The following recommendations were identified as part of this TIA and are summarized below as well as shown graphically in **Figure 15**: It is noted that the anticipated phase of implementation for each of these improvements is provided for reference.

Carrollton Boulevard (U.S. Route 17)

- VDOT should continue to monitor and periodically optimize traffic signal phasing and timing plans to accommodate peak hour/off-peak traffic volumes along the Carrollton Boulevard corridor
- VDOT should update signal timing optimization following initial occupancy and full build-out of the development to account for the change in traffic volumes/demand
  - Signal coordination improvements/enhancements should continue to facilitate and emphasize the progression of traffic along Carrollton Boulevard

Carrollton Boulevard (U.S. Route 17) at Smiths Neck Road

- The Developer will modify the existing traffic signal (i.e., install a third signal head on the mast arm serving the westbound approach of Smiths Neck Road) to accommodate the proposed exclusive left-turn lane, through lane, and exclusive right-turn lane. (Phase 1)
  - Implement right-turn overlap phase as a part of traffic signal operations/phasing. (Phase 1)
- The Developer will modify the existing traffic signal (i.e., modify signal heads on the mast arm serving the eastbound approach of Smiths Neck Road) to accommodate the proposed dual exclusive left-turn lanes and a shared through/right-turn lane. (Phase 1)

- Remove/replace the existing lane control signage on the mast arm to reflect dual left-turn movement. (Phase 1)

- VDOT should continue to periodically optimize traffic signal phasing and timing plans to accommodate peak hour/off peak traffic volumes along the Carrollton Boulevard corridor
- VDOT should update signal timing optimization following initial occupancy and full build-out of the development to account for the change in traffic volumes/demand
    - Signal coordination improvements/enhancements should continue to facilitate and emphasize the progression of traffic along Carrollton Boulevard

Northbound Carrollton Boulevard (Phase 3)

- The Developer will improve/extend the existing exclusive northbound left-turn lane to consist of 400 feet of storage and a 100-foot taper
    - Final design and construction of this improvement shall be coordinated directly with VDOT

Southbound Carrollton Boulevard (Phase 1)

- The Developer will improve/extend the existing exclusive southbound left-turn lane to consist of 400 feet of storage and a 100-foot taper
    - Final design and construction of this improvement shall be coordinated directly with VDOT

Eastbound Smiths Neck Road (Phase 1)

- The Developer will reconfigure the eastbound approach to consist of the following laneage:
    - Two exclusive left-turn lanes
    - One exclusive shared through/right-turn lane
- The Developer will remove/replace the existing lane control signage on the mast arm to reflect the dual left-turn movement
- Eastbound and westbound left-turns will run concurrently

Westbound Smiths Neck Road

- Approach/Outbound laneage (Phase 1)
    - The Developer will construct an exclusive right-turn lane extending from the 7-Eleven entrance driveway to the intersection with Carrollton Boulevard
    - The Developer will restripe the westbound approach to delineate the following laneage (Phase 1):
        - One exclusive left-turn lane
        - One exclusive through lane
        - One exclusive right-turn lane
- Receiving/Inbound Laneage (Phase 1)
    - The Developer will construct a 4' raised concrete median between the 7-Eleven/Bojangles' intersection and the Carrollton Boulevard intersection.
    - The Developer will construct/install two inbound lanes to consist of the following:
        - Inside travel lane to serve as an exclusive left-turn lane (drop lane)
        - Outside travel lane will be designated as a shared through/right-turn lane

- Improve/modify channelized/right-in only driveway (e.g., driveway entrance width and associated driveway radii) serving the Bojangles'/Shoppes at Eagle Harbor

Smiths Neck Road at 7-Eleven/Bojangles' (Phase 1)

- The Developer will construct/configure the intersection as three-way STOP controlled:
  - The Bojangles', 7-Eleven, and the northbound Driveway 1/Connection from the Pitt property being STOP controlled
  - The southbound Driveway 1/Connection to the Pitt property and thus the southbound left-turn movement to the 7-Eleven entrance driveway will be free-flow operations
- The Developer will install supplemental signage and pavement markings to consist of the following:
  - "DO NOT BLOCK INTERSECTION" signage
  - Intersection pavement markings delineating the area not to block (i.e., the box)
  - Supplement with signage reflecting a potential fine for those observed/caught impeding intersection operations

Carrollton Boulevard (U.S. Route 17) at Northgate Drive

Northbound Carrollton Boulevard (Phase 3)

- The Developer will improve/extend the existing exclusive northbound right-turn lane to consist of 200 feet of storage and a 200-foot taper
  - Final design and construction of this improvement shall be coordinated directly with VDOT

Southbound Carrollton Boulevard (Phase 3)

- The Developer will improve/extend the existing exclusive southbound left-turn lane to consist of 200 feet of storage and a 200-foot taper
  - Final design and construction of this improvement shall be coordinated directly with VDOT

Northgate Drive Interim Improvements

Eastbound Northgate Drive (Phase 3)

- No geometric changes
- Implement site access/movement restrictions via signage during peak periods (i.e. install signage reflecting no left or through movements Monday – Friday 6:00 AM to 9:00 AM and 3:00 PM to 6:00 PM).

Westbound Northgate Drive (Phase 3)

- No geometric changes
- Implement site access/movement restrictions via signage during peak periods (i.e. install signage reflecting no left or through movements Monday – Friday 6:00 AM to 9:00 AM and 3:00 PM to 6:00 PM).

Northgate Drive Permanent Partial Access Improvements

Phase 5 will include the installation of a raised median at the existing full movement Carrollton Boulevard/Northgate Drive intersection to create channelized left-turn lanes along northbound/southbound Carrollton Boulevard and fully restrict side street left-turn and through movements (i.e., right-turn only).

Eastbound Northgate Drive (Phase 5)

- Reconfigure (i.e., restripe and update signage) Northgate Drive approach as a right-turn only at the time the related intersection improvement project noted below in Transportation proffer item 2 is being constructed.

Westbound Northgate Drive (Phase 5)

- Reconfigure (i.e., restripe and update signage) Northgate Drive approach as a right-turn only at the time the related intersection improvement project noted below in Transportation proffer item 2 is being constructed.

Channell Way (Phase 2)

- The Developer will improve the existing 2-lane typical section of Channell Way to consist of the following:
    - Pavement striping to reflect/delineate two (2) 11-foot travel lanes
    - 2-foot graded shoulder in each direction
- The Developer will implement the proposed improvements from the agreed upon eastern limits of the Lippe parcel in the east to the Carrollton Boulevard intersection in the west
- The Developer will coordinate with VDOT on implementation of resurfacing/repaving the defined segment of roadway (i.e., identify when/if VDOT has surfacing activities planned and implement Developer resurfacing improvements prior to/in lieu of those efforts)
    - Coordinate with VDOT to identify/confirm documented pavement section deficiencies and address/mitigate as applicable

Carrollton Boulevard (U.S. Route 17) at Channell Way/Deep Bottom Drive

Northbound Carrollton Boulevard

- No geometric changes

Southbound Carrollton Boulevard (Phase 4)

- The Developer will improve/extend the existing exclusive southbound left-turn lane to consist of 200 feet of storage and a 150-foot taper
    - Final design and construction of this improvement shall be coordinated directly with VDOT to account for the second northbound turn-lane being constructed (i.e., second northbound left-turn lane at Brewers Neck Boulevard) as a part of the VDOT Bartlett Intersection improvement project.

Eastbound Deep Bottom Drive

- No geometric changes

Westbound Channell Way (Phase 4)

- The Developer will improve the westbound approach to consist of the following laneage:
    - One shared through/left-turn lane
    - One exclusive right-turn lane consisting of 150 feet of storage and a 150-foot taper
        - Final design and construction of these improvement shall be coordinated directly with VDOT

Figure 15: Recommended Improvements

Appendix A
Assumptions Document

Appendix B
Traffic Count Data

Appendix C
Volume Worksheets

Appendix D
Signal Warrant Worksheets

Appendix E
Model Calibration

Appendix F
Synchro and SimTraffic Reports

Appendix G
200 Second Cycle Length Analysis