Memorandum

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Date: May 31, 2018

Project #: 38095.10

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Re: Traffic Signal Warrant Analysis at
Waxpool Road and Shellhorn Road Intersection

We hereby submit our Signal Warrant Analysis for the intersection of Waxpool Road and Shellhorn Road in Ashburn, VA. This document presents the Signal Warrant Analysis for 2018 existing and 2020 future traffic conditions.

Executive Summary

This study intersection of Waxpool Road and Shellhorn Road is located approximately 0.6 miles from the future Ashburn Silver Line Metrorail station and will likely play a role in connecting existing and planned transit-oriented development communities to the station.

The objective of this analysis is to determine if a traffic control signal would be suitable at the intersection of Waxpool Road and Shellhorn Road in Ashburn in Loudoun County, Virginia for the following conditions:

- 2018 Existing Condition
- 2020 Future Condition
    - 24-hour turning movement count (TMC) collected in 2018 is used as base to develop the 2020 traffic forecast
    - Trips generated by approved, but incomplete, development projects, regional background traffic growth, and traffic redistribution based on the Silver Line Comprehensive Plan Amendment to the County's long-range travel demand model will be added to 2018 volumes to develop the 2020 volumes

The analysis is based on existing and future traffic volumes, observed physical location characteristics, and reported crash history at the study intersection. The intersection was tested against five of the nine traffic signal warrants in Chapter 4C of the Manual on Uniform Traffic Control Devices *(MUTCD)*, 2009 Edition. The remaining four warrants are briefly discussed to provide the rationale for not conducting further investigation.

Of the five warrants tested, none are satisfied for the existing traffic conditions. Therefore, the findings of this analysis indicate that the installation of signal control is currently not warranted at the study intersection based on existing traffic patterns and volumes.

One of the five warrants tested, one of them (Warrant 2, Four-Hour Vehicular Volume) is satisfied for the 2020 Future Condition. Chapter 3 of Federal Highway Administration's Signalized Intersections Information Guide, 2nd Edition states that Warrant 2: Four-Hour Vehicular Volume is one of two warrants that address, "unusually high, short duration side street volumes," and that, "practitioners should take care when using these warrants." This guidance document explicitly states that, "In most cases, this would not constitute justification for installation of a signal," and that some

agencies place additional emphasis on making sure these warrants are used sparingly compared to Warrant 1: Eight-Hour Vehicular Volume. The Virginia Department of Transportation (VDOT) also emphasizes that satisfying Warrant 1 is a stronger justification of installing a traffic signal than solely satisfying Warrant 2 and/or Warrant 3. Meeting Warrant 2 is generally not considered sufficient justification for installation of a traffic signal on a VDOT-operated roadway.

The findings of this Signal Warrant Analysis indicate that the installation of signal control is warranted (i.e. by satisfying Warrant 2) at the study intersection for 2020 Future Condition. However, based on information cited from the documents above, the satisfaction of Warrant 2 alone does not overcome the disadvantages of installing a traffic signal. Therefore, a follow-up review is recommended in the future, after the construction and opening of the Ashburn Metrorail station. Installation of a traffic signal at the study intersection is not recommended at this time.

Recently, VDOT began emphasizing the need for a stricter requirement on approval for installation of signalized intersections, introducing programs, such as the Arterial Preservation Program, to preserve and enhance the capacity and safety of the critical transportation routes. VDOT has been requiring more stringent thresholds for installing traffic signals at intersections in accordance with IIM-TE-387.0, requiring Signal Justification Reports (SJR) in addition to the traditional Traffic Signal Warrant Analysis. A SJR is composed of the following main components:

- Analyzing Innovative Intersection designs, such as Continuous Green-T, Median U-Turn, and Restricted Crossing U-Turn, in addition to conventional signalized intersection using VDOT Junction Screening Tool (VJuST)
- Completing the traditional Traffic Signal Warrant Analysis and providing additional justification for signalizing the intersection
- Acquiring approvals from the District Traffic Engineer, District Engineer/Administrator, and/or State Traffic Engineer

It is a requirement for the SJR process to consider Innovative Intersection designs as alternatives to the traditional signalized intersection design. However, signalization is not recommended at this study intersection. Since installing a traffic signal at the study intersection is not recommended at this time, no justification could be made for a traffic signal at the study intersection. Therefore, completion of SJR is not recommended at this time. The SJR should be conducted when and if the future follow-up review finds sufficient justification for installing a traffic signal at the study intersection.

A corridor study of the 1.2-mile segment of Waxpool Road between Faulkner Parkway and Demott Drive (this segment includes the study intersection) has been programmed by Loudoun County. As part of this study, pedestrian access along and across the corridor should be examined in the context of the new Silver Line Metrorail station. Although very little pedestrian activity was observed at the study intersection in 2018, pedestrian volumes may increase once the new Metrorail station opens. Therefore, the need for a pedestrian crossing of Waxpool Road to facilitate trips between the housing developments to the north and the Metrorail station to the south is still possible, and the specific location of any such crossing along Waxpool Road can be identified as part of the corridor study.

Existing Conditions

The intersection of Waxpool Road and Shellhorn Road is located in a suburban area of Loudoun County where nearby land uses are mostly residential and commercial. Waxpool Road is the major road, classified as a major collector, with an annual average daily traffic (AADT) of 11,000, and Shellhorn Road is the minor road, also classified as a major collector, with an AADT of 10,000. This AADT information was collected from VDOT's 2017 Official AADT And VMT Publications. The AADT value on Shellhorn Road seems unusually high compared to the 24-hour TMC collected by VHB at the study intersection on Thursday, January 18, 2018. The 24-hour count collected by VHB counted only 5,749 vehicles on Shellhorn Road. VDOT's AADT on Shellhorn spans the 1.74-mile length of Shellhorn Road between Loudoun County Parkway to Waxpool Road and may not represent the AADT on Shellhorn Road at or near the study intersection. There are large trip generators that distribute large amounts of traffic within this segment of Shellhorn Road, including a roadway (i.e. Ashburn Village Boulevard) that feeds into a major freeway (Dulles Greenway Toll Road), large commercial zone, and residential area. The study intersection currently operates under stop-control on the minor street, Shellhorn Road.

Figure 1 shows an aerial view of the study intersection. **Figure 2** shows approximate distance measurements to the adjacent intersections surrounding the study intersection.

Figure 1: Aerial View of the Study Intersection (Source: Loudoun County WebLogis – Online Mapping System)

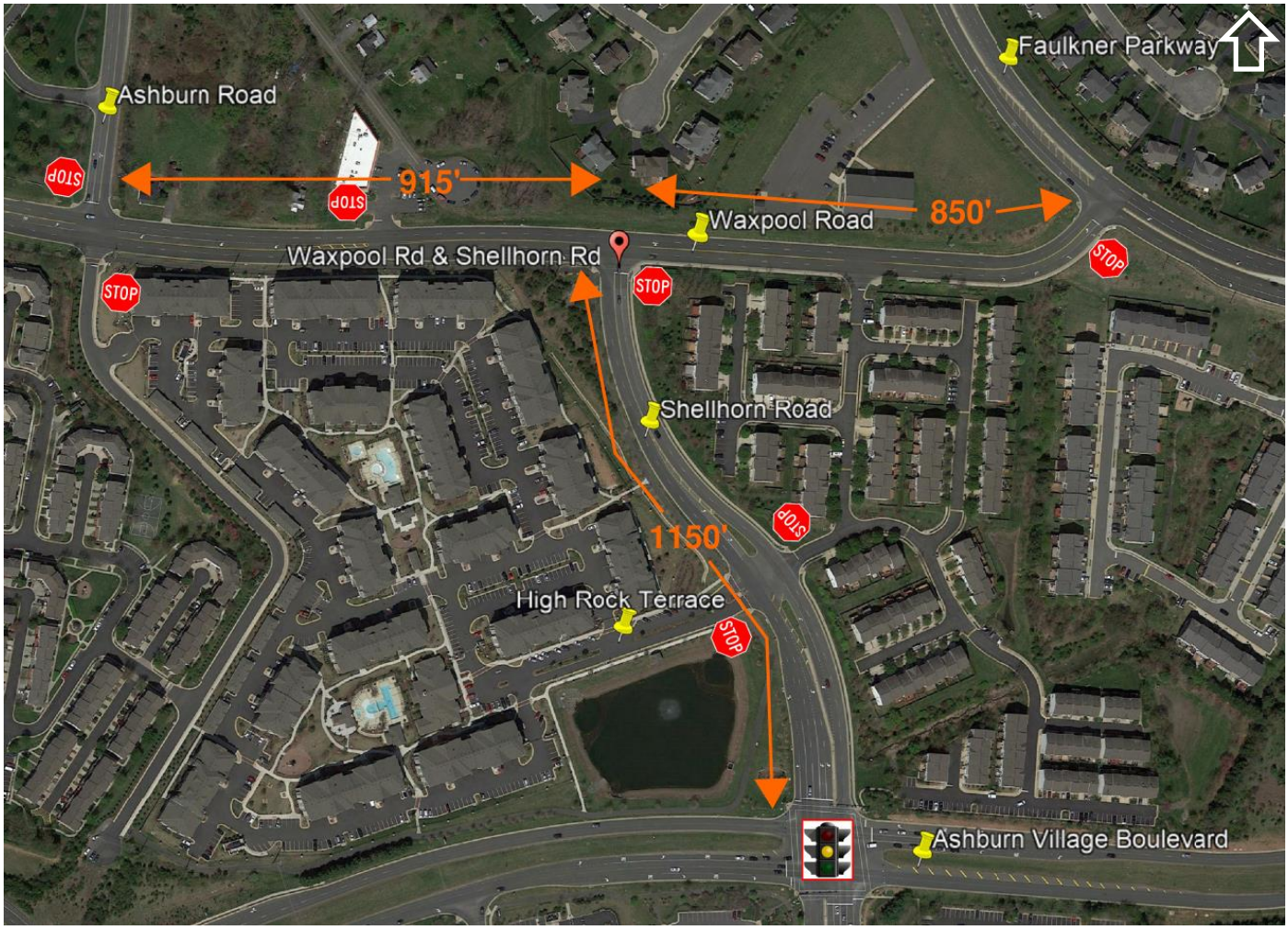


Figure 2: Distances and Traffic Controls of Adjacent Intersections (Source: Google Earth)

Pedestrian Facilities Near the Study Intersection

Marked pedestrian crosswalks are not present at the study intersection. Curb ramps are present on the crossing of the Shellhorn Road approach. Sidewalks are present on both sides of Shellhorn Road and on southern side of Waxpool Road.

Existing pedestrian facilities (i.e., curb ramps, crosswalks, and sidewalks) within 0.25 miles of the study intersection were surveyed during fieldwork. A graphical representation of existing pedestrian facilities is shown in **Attachment A**. Overall, it seems as if there are adequate ADA compliant curb ramps and sidewalks present within the 0.25-mile boundary. However, marked crosswalks are not present at major roadway intersections, such as at the study

intersection of Waxpool Road and Shellhorn Road, or within the 0.25-mile radius except for the Ashburn Village Boulevard and Shellhorn Road intersection.

There is currently no sidewalk along the north side of Waxpool Road, nor are there any direct pedestrian connections to the residential areas north of Waxpool Road. Thus, pedestrians desiring to walk along Shellhorn Road, the most direct route to the new Ashburn Metrorail station, will likely use the existing sidewalk on the south side of Waxpool Road. As a result, pedestrians are more likely to cross Waxpool Road at other locations (i.e. where their northerly approach intersects the Waxpool Road corridor) rather than at Shellhorn Road itself, absent any new pedestrian connectors from residential areas to the north.

A corridor study of the 1.2-mile segment of Waxpool Road between Faulkner Parkway and Demott Drive (this segment includes the study intersection) has been programmed by Loudoun County. This study presents an opportunity to more comprehensively examine pedestrian access along and across the corridor in the context of the new Silver Line Metrorail station. Locations along the entire study corridor should be examined to determine if the best location for a pedestrian crossing is at Shellhorn Road or another nearby location.

Traffic Characteristics of the Study Intersection

The study intersection consists of three approaches. Westbound (WB) and eastbound (EB) approaches of Waxpool Road are four-lane undivided roadways with a posted speed limit of 40 MPH. The EB approach has an exclusive right turn lane with a 100-foot taper and 275 feet of storage along with the two through lanes. There is no WB left-turn lane at the subject intersection. Northbound (NB) Shellhorn Road is a four-lane undivided roadway with a posted speed limit of 35 MPH.

Figure 3 shows lane configurations of each approach along with any turn lane lengths (storage + taper) at the study intersection.

Data Collection

24-Hour Turning Movement Count

VHB collected a 24-hour TMC at the Waxpool Road and Shellhorn Road intersection on a typical, non-holiday weekday (Thursday, January 18, 2018). The TMC consisted of vehicular turning movements by vehicle classification and pedestrian crossings of each approach. The count data is summarized in 15-minute intervals and included as **Attachment B**. The TMC was used to identify AM and PM peak hours of vehicular activity, and the peak hour approach volumes are summarized by turning movement in **Table 1**.

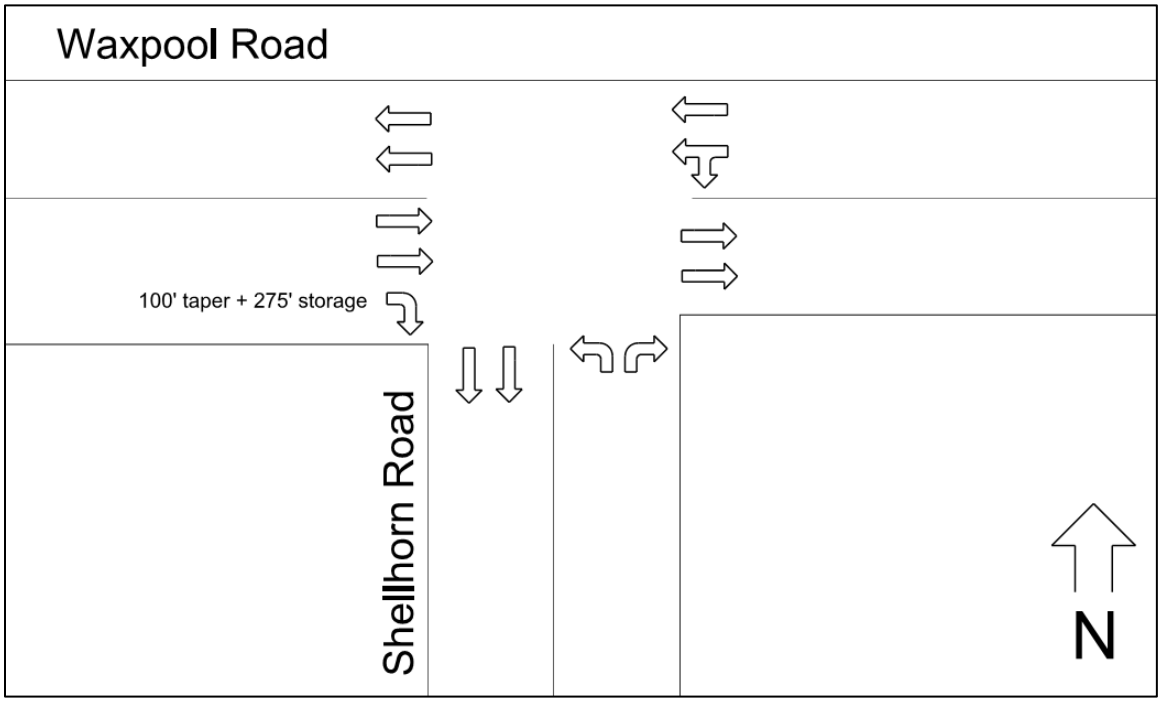


Figure 3: Roadway Lane Configuration of Each Approach at the Study Intersection (Not Drawn to Scale)

Table 1: Peak Hour Approach Volumes for Study Intersection (As Counted in the Field)

Weekday Peak Period	Peak Hour	Waxpool Road Eastbound		Waxpool Road Westbound		Shellhorn Road Northbound		Total Entering Volume
		T	R	L	T	L	R	
AM	7:30 – 8:30	522	301	48	179	106	14	1170
PM	5:15 – 6:15	251	172	56	664	218	37	1398

2020 Future Condition

T3 Design developed the 2020 traffic forecast for the study intersection. A description of the process is presented in **Attachment C**, and summarized below. The 2020 traffic forecast for the study intersection was developed by using the 2030 and 2040 Loudoun County traffic forecasting models and estimated annual traffic growth rate in the area. The 2030 and 2040 traffic forecasting models were developed by Loudoun County, and the models include estimated trips generated by the Ashburn Metrorail Station. **Table 2** shows the AADT values from Loudoun County's 2030 and 2040 traffic forecasting models along with annual traffic growth rate at the study intersection. These values were then used to develop 2020 traffic forecasts by approach at the study intersection.

Table 2: Future AADT and Annual Traffic Growth Rates at the Study Intersection

Road Segments	2018 ADT (Field Data)	AADT (From County's Travel Forecasting Model)			Annual Traffic Growth Rate (%)		
		2016	2030	2040	2018-2030	2016-2030	2030-2040
	5,746	8,018	10,819	11,388	5.41%	2.16%	0.51%
Shellhorn Rd - S of Waxpool Rd		8,550	11,835	12,485		2.35%	0.54%
Shellhorn Rd - S of Ashburn Village Blvd		14,985	23,957	26,093		3.41%	0.86%
Waxpool Rd - E of Shellhorn Rd	9,862	18,951	8,971	9,109	-0.79%	-5.20%	0.15%
Waxpool Rd - W of Shellhorn Rd	13,838	24,094	17,483	17,810	1.97%	-2.26%	0.19%
Waxpool Rd - W of Ashburn Rd Rd		17,830	12,413	12,635		-2.55%	0.18%
Ashburn Village Blvd - W of Shellhorn Rd		22,785	24,904	28,999		0.64%	1.53%
Ashburn Village Blvd - W of Shellhorn Rd		22,785	24,904	28,999		0.64%	1.53%
Ashburn Village Blvd - E of Shellhorn Rd		14,828	20,386	23,246		2.30%	1.32%
Ashburn Village Blvd - S of Waxpool Rd		14,828	20,386	23,246		2.30%	1.32%
Ashburn Village Blvd - N of Waxpool Rd		16,338	19,024	20,564		1.09%	0.78%
Faulkner Pkwy		6,540	3,238	3,275		-4.90%	0.11%
Ashburn Rd - S of Waxpool Rd		6,224	7,021	7,048		0.86%	0.04%
Ashburn Rd - N of Waxpool Rd		7,440	7,786	8,742		0.33%	1.16%

Field Observations

Fieldwork at the Waxpool Road and Shellhorn Road intersection was conducted on a typical, non-holiday weekday (Tuesday, January 30th, 2018). The observations were made with regards to intersection operations, particularly traffic flow, queuing, and delay. The observed travel speeds on all approaches generally appeared to be in accordance with the posted speed limit, although a formal speed study was not conducted as part of this analysis. During the site visit, observed traffic activity on the minor street of the study intersection was minimal, and no significant queuing was observed on either roadway.

The field observations also sought to determine if any sight distance restrictions were present on the minor or major street approaches. **Table 3** compares the intersection sight distance measurements observed in the field versus minimum design intersection sight distances from Chapter 9 of AASHTO's *A Policy on Geometric Design of Highways*

and Streets, Sixth Edition[1]. Please note that the design distances are based on an assumed design speed of 45 MPH. The official design speed was sought but was not available at the time of this study submission. The posted speed limit along Waxpool Road within the study area is 40 MPH, and it is generally accepted that the speed limit plus 5 MPH can be used as the design speed if the actual design speed is not known.

Table 3: Intersection Sight Distance Comparison

Case B – Intersections with Stop Control on the Minor Street	**Movement**	**Assumed Design Speed Major Road (MPH)**	**Minimum Intersection Sight Distance (ft) Requirement for Passenger Cars**	**Measured Intersection Sight Distance (ft)**
	NBL	45	530	1,180
	NBR	45	465	790
Case F – Left Turns from the Major Street	**Movement**	**Assumed Design Speed Major Road (MPH)**	**Minimum Intersection Sight Distance (ft) Requirement for Passenger Cars**	**Measured Intersection Sight Distance (ft)**
	WBL	45	430	910

Case B – Intersections with Stop Control on the Minor Street

Field observations showed that most drivers from the minor road (Shellhorn Road) pull forward from the stop bar prior to making a turn onto the major road (Waxpool Road). To reflect this behavior, the field measurements were taken from 14.5 feet behind the edge of the major street's travel lane according to the AASHTO guidelines. The NB minor street approach on Shellhorn Road had adequate sight distance to identify potential conflicts prior to entering Waxpool Road. One item to note is that when stopped at the stop bar on the NB minor street approach, existing vegetation on the right side makes it difficult for the drivers to see the oncoming WB traffic on Waxpool Road. However, as drivers move forward from the stop bar prior to making a left turn onto Waxpool Road, drivers have a

[1] American Association of State Highways and Transportation Officials (AASHTO). *A Policy on Geometric Design of Highways and Streets*. 6th Edition. Washington, DC. 2011.

clear view of the roadway without any sight distance concern. **Figure 4** and **Figure 5** are field photos of the sight lines to the right and left from NB minor street approach.

Case F – Left Turns from the Major Street

Field observations showed that there is adequate sight distance of EB oncoming traffic for WB drivers on Waxpool Road making a left turn onto Shellhorn Road. Field observations showed that most WB left-turning drivers who must stop for oncoming traffic do so after pulling into the center of the intersection. From this position, the sightline for oncoming traffic is clear well beyond the 430-foot minimum distance specified for 45 mph conditions.

Alternative to Signal Control (Roundabout Feasibility)

Per VDOT Policy, a roundabout should be considered as an alternative to signal installation. The VDOT Road Design Manual (RDM) requires analysis to include the conceptual project impacts on safety, land impacts, and construction. VDOT's Roundabout Screening Criteria was used to determine the feasibility of roundabout design at the study intersection location.

Following step 1 described in the Roundabout Screening Criteria, AADT and the left-turn percentage of all legs were used to assess if a single-lane or double-lane roundabout is needed. Traffic volume from VHB's 24-hour TMC (approximately 17,500 vehicles) was used as the total intersection volume. The total intersection volume was reduced by 75% as the study intersection was a three-legged intersection (reduced to approximately 13,000 vehicles). The left-turn percentage at the study intersection was approximately 20%. **Figure 6** shows the result of this assessment, and a one-lane or two-lane roundabout would be acceptable at the study location. One-lane roundabout design will be considered for further analysis.

Figure 4: Sight Distance – Shellhorn Road, Northbound Looking Right

Figure 5: Sight Distance – Shellhorn Road, Northbound Looking Left

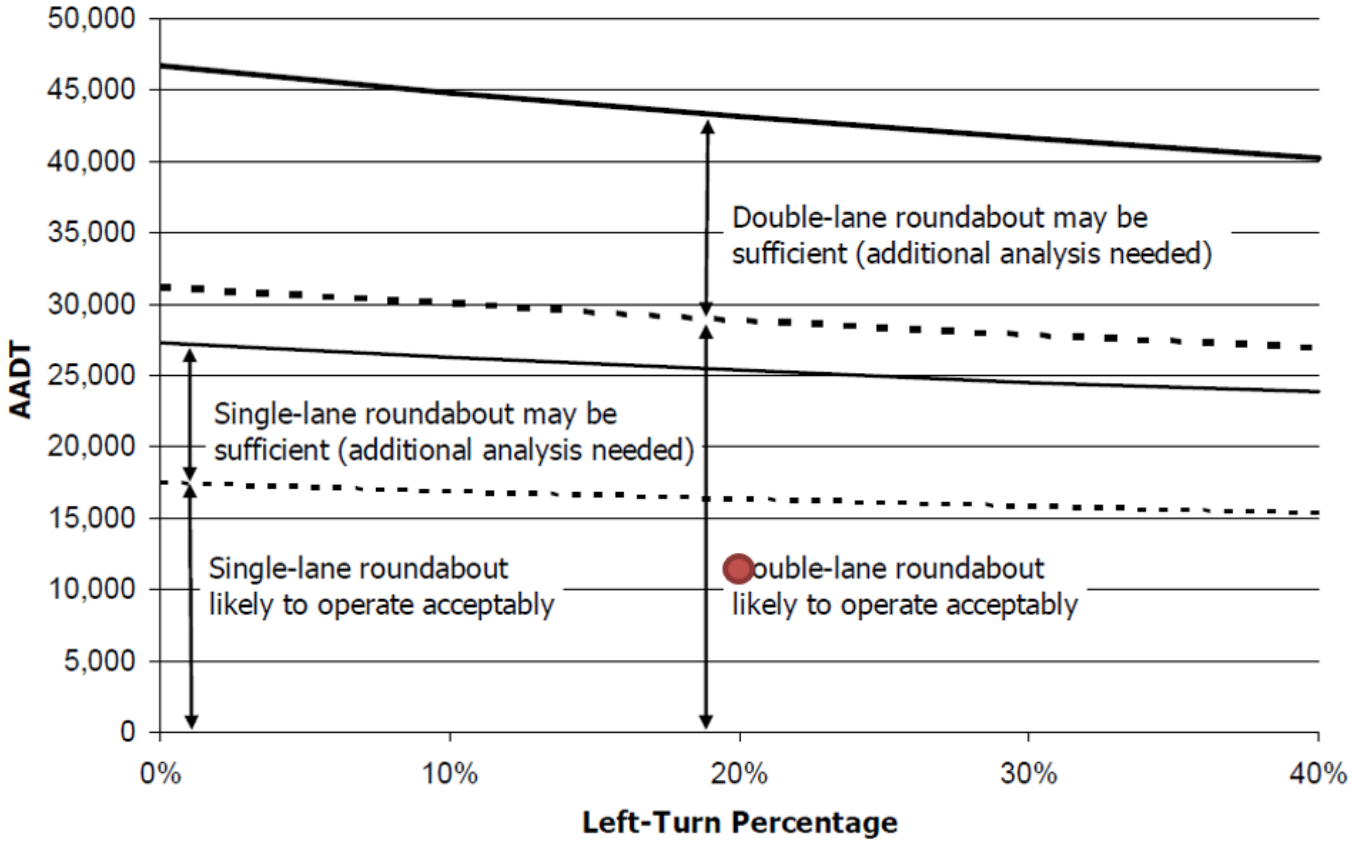


Figure 6: Planning Level Daily Intersection Volume (Source: NCHRP Report 672 Exhibit 3-12)

Step 2 of the Roundabout Screening Criteria states that the typical inscribed circle diameter (ICD) for a one-lane roundabout is between 130-ft to 180-ft for a WB-67 design vehicle. **Figure 7** shows the minimum and maximum ICD of 130-ft and 180-ft, seen in blue, on the Loudoun County GIS aerial of the study intersection. The existing parcel boundaries are shown with red lines that indicate the right-of-way near the study intersection. The ICD boundaries show that for either minimum or maximum footprint of the one-lane roundabout, significant right-of-way acquisition is required for its construction.

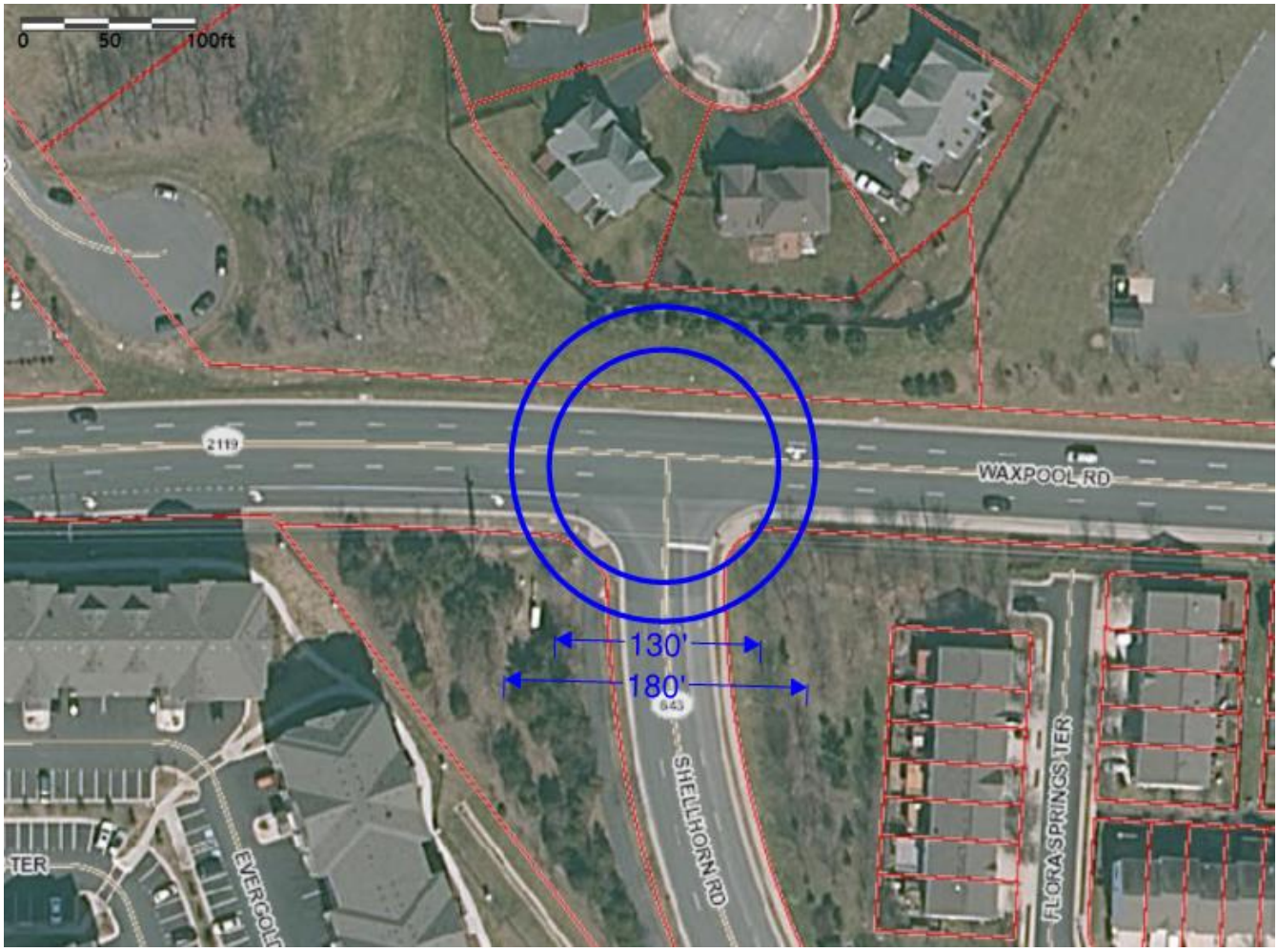


Figure 7: Approximate Impacts of 1-Lane Roundabout with WB-67 Design Vehicle

Step 3 of the Roundabout Screening Criteria was not assessed as the study intersection is not near other intersections.

Based on the amount of right-of-way acquisition required with the construction of the roundabout, the roundabout alternative is not recommended as a feasible alternative to traffic signal control at the study intersection.

Signal Warrant Analysis

The Signal Warrant Analysis was conducted in accordance with the methodology presented in Chapter 4C of the *Manual on Uniform Traffic Control* Devices (MUTCD), 2009 Edition[2]. The *MUTCD* specifies nine warrants, or requirements, to be evaluated for a new traffic control signal installation. A traffic control signal should not be installed unless at least one of these warrants is met; however, the satisfaction of a single warrant or warrants shall not in itself require the installation of a traffic control signal. Engineering judgement should also be used in the evaluation of the warrants to ensure that a traffic control signal will improve the overall safety and/or operation of the intersection.

The nine warrants outlined in the *MUTCD* are as follows:

- Warrant 1, Eight-Hour Vehicular Volume
- Warrant 2, Four-Hour Vehicular Volume
- Warrant 3, Peak Hour
- Warrant 4, Pedestrian Volume
- Warrant 5, School Crossing
- Warrant 6, Coordinated Signal System
- Warrant 7, Crash Experience
- Warrant 8, Roadway Network
- Warrant 9, Intersection Near a Grade Crossing

For the purpose of this analysis, Warrants 1, 2, 3, 4, and 7 were tested for further examination. A description of each warrant (adopted from the *MUTCD*) is included within the specific sections that follow.

The *MUTCD* suggests reducing some or all of the right-turning volumes for minor street approaches having an exclusive right-turn lane (Section 4C.01, paragraphs 08 and 10). Paragraph 10 recommends that for approaches with lane use, such as the NB approach to the subject intersection: "*The approach should be evaluated as a one-lane approach with only the traffic volume in the through/left-turn lane considered.*" The basis for such a justification is the degree of conflict between minor street right-turning traffic with traffic on the major street. If the minor street right-turning traffic enters the major street with minimal conflict, then the *MUTCD* recommends not including this volume in the analysis total. For the study intersection, the NB approach of Shellhorn Road utilizes an exclusive right-turn lane. The NB right-turn vehicle volumes at the subject intersection are relatively low, and a minimal degree of conflict between those right turning vehicles and EB through traffic on Waxpool Road was observed in the field. The vast majority of vehicles could find an acceptable gap in a reasonable about of time. As a result of this minimal conflict, and in accordance with the MUTCD, all of the NB right-turning vehicles were eliminated from the warrant analysis, and the NB approach was analyzed as one lane only. The vehicular volumes used in the analysis with the 100% right-turn reduction applied can be found in **Attachment D**.

[2] U.S. Department of Transportation. Federal Highway Administration (FHWA). *Manual on Uniform Traffic Control Devices*. 2009 Edition. Washington, DC. 2009.

Warrant 1, Eight-Hour Vehicular Volume

Warrant 1, Eight-Hour Vehicular Volume, consists of two separate conditions: Condition A – Minimum Vehicular Volume and Condition B – Interruption of Continuous Traffic. The Minimum Vehicular Volume condition is intended for application at locations where a large volume of intersecting traffic is the principal reason to consider installing a traffic control signal. The Interruption of Continuous Traffic condition is intended for use at locations where Condition A is not satisfied and where the volume of traffic on a major street is so heavy that traffic on a minor intersecting street suffers excessive delay when attempting to cross or enter the major street. Assessment of a combination of Conditions A and B, which is a requirement to meet 80% volume thresholds for both conditions, is also tested in Warrant 1. Warrant 1 is intended to be treated as a single warrant. If Condition A is satisfied, then the criteria for Warrant 1 are satisfied. Therefore, Condition B and the combination of Conditions A and B are not needed. Similarly, if Condition B is satisfied, then the criteria for Warrant 1 are satisfied and the combination of Conditions A and B is not needed. **Table 4** presents the minimum hourly volume thresholds that need to be satisfied for eight distinct hours for Warrant 1. Please note that the *MUTCD* allows for the minimum volume threshold to be adjusted to 70% of the actual value if the major street speed exceeds 40 mph or if the intersection is within an isolated community of less than 10,000. The speed limit on Waxpool Road is 40 mph; therefore, the 70% adjusted minimum was not applicable to the evaluation of Warrant 1.

Table 4: Eight-Hour Vehicular Volume Thresholds

Warrant 1	**Eight-Hour Vehicular Volume**			**Minimum Hourly Volume (VPH)**
Condition A	*Minimum Vehicular Volume*			
	Major Street (total of both approaches)	2 or more	Lane(s) on each approach	600
	Minor Street (higher volume approach)	1	Lane(s) on each approach	150
Condition B	*Interruption of Continuous Traffic Flow*			
	Major Street (total of both approaches)	2 or more	Lane(s) on each approach	900
	Minor Street (higher volume approach)	1	Lane(s) on each approach	75

Table 5 (2018 Existing Condition) and **Table 6** (2020 Future Condition) summarize the evaluation of Warrant 1 for the existing and future conditions at the study intersection.

Of the required minimum of eight hours of the day for each of the Warrant 1 conditions, both 2018 Existing Condition 2020 Future Condition met six distinct hours for Condition A, five distinct hours for Condition B, and four distinct hours for combination of A and B Conditions.

Therefore, **Warrant 1 is not satisfied** for both 2018 Existing and 2020 Future Conditions.

Table 5: Warrant 1 Evaluation Summary for 2018 Existing Condition

Hour	Entering Vol.	Entering Vol. on Major Road		Tot. Ent. Vol.	Warrant 1 Met?		
	Minor Road+	Eastbound	Westbound	On Major Rd	Condition A	Condition B	80%(1A&1B)
1:00 AM - 2:00 AM	7	13	16	29	No	No	No
2:00 AM - 3:00 AM	6	9	13	22	No	No	No
3:00 AM - 4:00 AM	2	17	9	26	No	No	No
4:00 AM - 5:00 AM	3	59	8	67	No	No	No
5:00 AM - 6:00 AM	15	186	26	212	No	No	No
6:00 AM - 7:00 AM	40	393	98	491	No	No	No
7:00 AM - 8:00 AM	79	728	198	926	No	**Yes**	No
8:00 AM - 9:00 AM	107	821	189	1010	No	**Yes**	No
9:00 AM - 10:00 AM	123	514	163	677	No	No	No
10:00 AM - 11:00 AM	104	345	163	508	No	No	No
11:00 AM - 12:00 PM	106	305	185	490	No	No	No
12:00 PM - 1:00 PM	158	341	210	551	No	No	No
1:00 PM - 2:00 PM	131	307	250	557	No	No	No
2:00 PM - 3:00 PM	171	319	302	621	**Yes**	No	No
3:00 PM - 4:00 PM	183	313	309	622	**Yes**	No	No
4:00 PM - 5:00 PM	212	418	506	924	**Yes**	**Yes**	**Yes**
5:00 PM - 6:00 PM	218	424	682	1106	**Yes**	**Yes**	**Yes**
6:00 PM - 7:00 PM	223	417	618	1035	**Yes**	**Yes**	**Yes**
7:00 PM - 8:00 PM	196	316	480	796	**Yes**	No	**Yes**
8:00 PM - 9:00 PM	130	183	282	465	No	No	No
9:00 PM - 10:00 PM	110	185	241	426	No	No	No
10:00 PM - 11:00 PM	55	69	138	207	No	No	No
11:00 PM - 12:00 AM	27	40	65	105	No	No	No

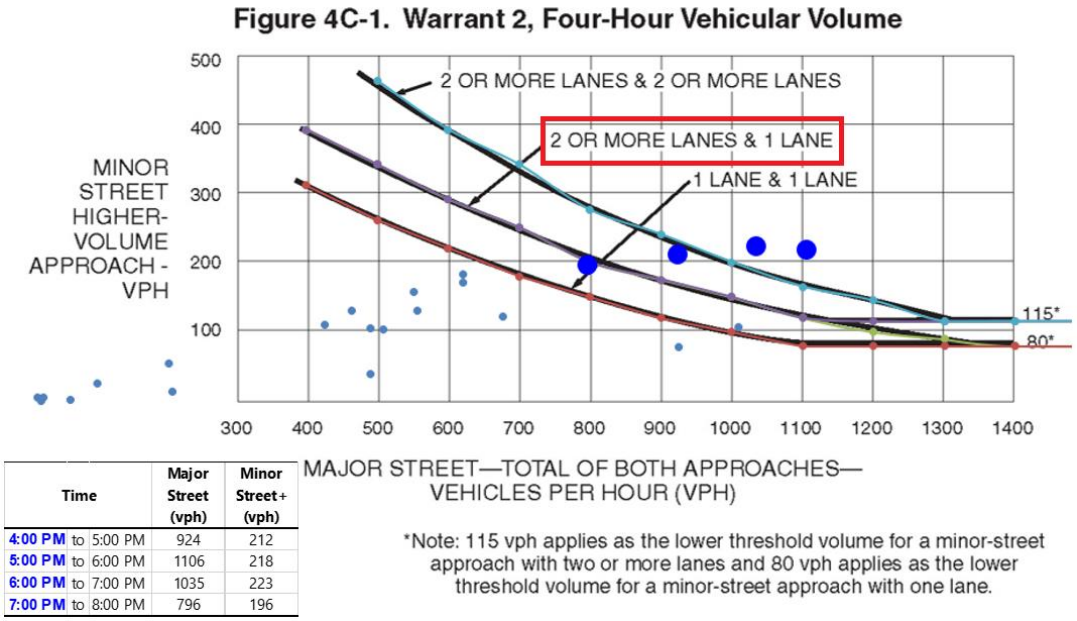
Table 6: Warrant 1 Evaluation Summary for 2020 Future Condition

Hour	Entering Vol.	Entering Vol. on Major Road		Tot. Ent. Vol.	Warrant 1 Met?		
	Minor Road+	Eastbound	Westbound	On Major Rd	Condition A	Condition B	80%(1A&1B)
1:00 AM - 2:00 AM	8	13	16	29	No	No	No
2:00 AM - 3:00 AM	7	9	13	22	No	No	No
3:00 AM - 4:00 AM	2	17	9	26	No	No	No
4:00 AM - 5:00 AM	3	60	8	68	No	No	No
5:00 AM - 6:00 AM	17	192	27	219	No	No	No
6:00 AM - 7:00 AM	45	406	101	507	No	No	No
7:00 AM - 8:00 AM	88	762	204	966	No	**Yes**	No
8:00 AM - 9:00 AM	119	856	195	1051	No	**Yes**	No
9:00 AM - 10:00 AM	137	536	167	703	No	No	No
10:00 AM - 11:00 AM	115	363	167	530	No	No	No
11:00 AM - 12:00 PM	118	320	191	511	No	No	No
12:00 PM - 1:00 PM	176	358	215	573	No	No	No
1:00 PM - 2:00 PM	146	322	255	577	No	No	No
2:00 PM - 3:00 PM	190	336	308	644	**Yes**	No	No
3:00 PM - 4:00 PM	204	327	315	642	**Yes**	No	No
4:00 PM - 5:00 PM	236	438	516	954	**Yes**	**Yes**	**Yes**
5:00 PM - 6:00 PM	243	446	693	1139	**Yes**	**Yes**	**Yes**
6:00 PM - 7:00 PM	248	439	630	1069	**Yes**	**Yes**	**Yes**
7:00 PM - 8:00 PM	218	334	488	822	**Yes**	No	**Yes**
8:00 PM - 9:00 PM	145	193	287	480	No	No	No
9:00 PM - 10:00 PM	121	195	245	440	No	No	No
10:00 PM - 11:00 PM	61	72	140	212	No	No	No
11:00 PM - 12:00 AM	30	42	66	108	No	No	No

Warrant 2, Four-Hour Vehicular Volume

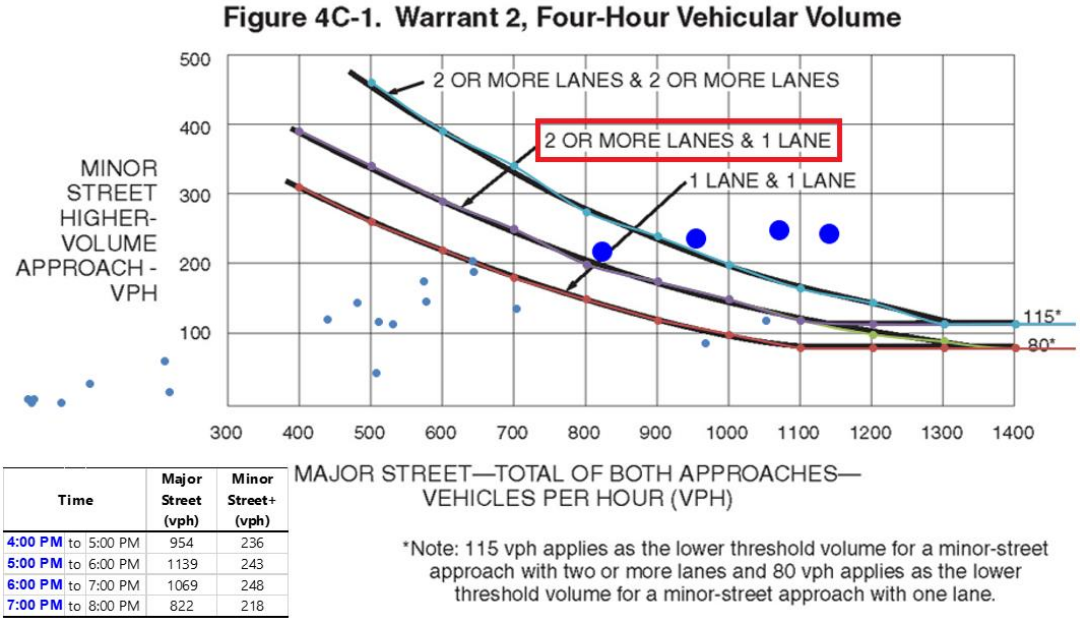
Warrant 2, Four-Hour Vehicular Volume, is intended to be applied where a large volume of intersecting traffic is the principal reason to consider the installation of a traffic control signal. The need for a traffic control signal shall be considered if an engineering study finds that, for each of any four distinct hours of an average day, the plotted points representing the vehicles per hour on the major street (total of both approaches) and the corresponding vehicles per hour on the higher volume minor street all fall above the applicable curve in MUTCD Figure 4C-2. Dots representing hourly volumes across the day are shown in **Figure 8** (2018 Existing Condition) and **Figure 9** (2020 Future Condition).

For the 2018 Existing Condition, only three of the four highest dots in **Figure 8** fall above the applicable curve for 2 major street and 1 minor street approach lanes. Therefore, **Warrant 2 is not satisfied** as the Warrant 2 criteria is not satisfied for at least four distinct hours of the day. However, for the 2020 Future Condition, four highest dots in **Figure 9** fall above the applicable curve for 2 major street and 1 minor street approach lanes. Therefore, **Warrant 2 is satisfied** as the Warrant 2 criteria is satisfied for at least four distinct hours of the day.



Time			Major Street (vph)	Minor Street+ (vph)
4:00 PM	to	5:00 PM	924	212
5:00 PM	to	6:00 PM	1106	218
6:00 PM	to	7:00 PM	1035	223
7:00 PM	to	8:00 PM	796	196

Figure 8: Analysis of Warrant 2 for 2018 Existing Condition



Time			Major Street (vph)	Minor Street+ (vph)
4:00 PM	to	5:00 PM	954	236
5:00 PM	to	6:00 PM	1139	243
6:00 PM	to	7:00 PM	1069	248
7:00 PM	to	8:00 PM	822	218

Figure 9: Analysis of Warrant 2 for 2020 Future Condition

Warrant 3, Peak Hour

Warrant 3, Peak Hour, is intended for use at a location where traffic conditions are such that for a minimum of one hour of an average day, the minor street traffic suffers undue delay when entering or crossing the major street. This signal warrant shall be applied only in unusual cases, such as office complexes, manufacturing plants, industrial complexes, or high-occupancy vehicle facilities, specifically for land uses that attract or discharge large numbers of vehicles over a short time. The need for a traffic control signal shall be considered if an engineering study finds that the criteria in either of the following two categories are met:

A. If all three of the following conditions exist for the same one hour (any four consecutive 15-minute periods) of an average day:

    1. The total stopped time delay experienced by the traffic on one minor street approach (one direction only) controlled by a STOP sign equals or exceeds four vehicle-hours for a one-lane approach or five vehicle-hours for a two-lane approach, and

    2. The volume on the same minor street approach (one direction only) equals or exceeds 100 vehicles per hour for one moving lane of traffic or 150 vehicles per hour for two moving lanes, and

    3. The total entering volume serviced during the hour exceeds 650 vehicles per hour for intersections with three approaches or 800 vehicles per hour for intersections with four or more approaches.

B. The plotted point representing the vehicles per hour on the major street (total of both approaches) and the corresponding vehicles per hour on the higher volume minor street approach (one direction only) for one hour (any four consecutive 15-minute periods) of an average day falls above the applicable curve in **Figure 10** for the existing combination of approach lanes.

It should be noted that the MUTCD states the use of this warrant is only for "unusual cases" with regards to facilities that "attract or discharge large numbers of vehicles over a short time." The land uses surrounding the study intersection are not considered as special traffic generators based on the MUTCD's definition in Section 4C.04, Paragraph 2, as it does not generate unusually high side street traffic volumes in short durations.

Warrant 3 is further investigated for informational purposes to determine if the numerical thresholds are satisfied. However, if the numerical values in Warrant 3 are met for any of the scenarios, the warrant will still not be satisfied, as the special traffic generator is a Standard (requirement) in the MUTCD, and Warrant 3 can only be applicable for special traffic generators.

<u>2018 Existing Condition</u>

A. Category A requires that all three conditions be met.

    1. The first condition requires stop-delay to exceed a threshold of four vehicle-hours for a one-lane approach. A stop-delay study was not conducted as part of the original traffic data collection effort and was not pursued further since the study intersection is not near a special generator.

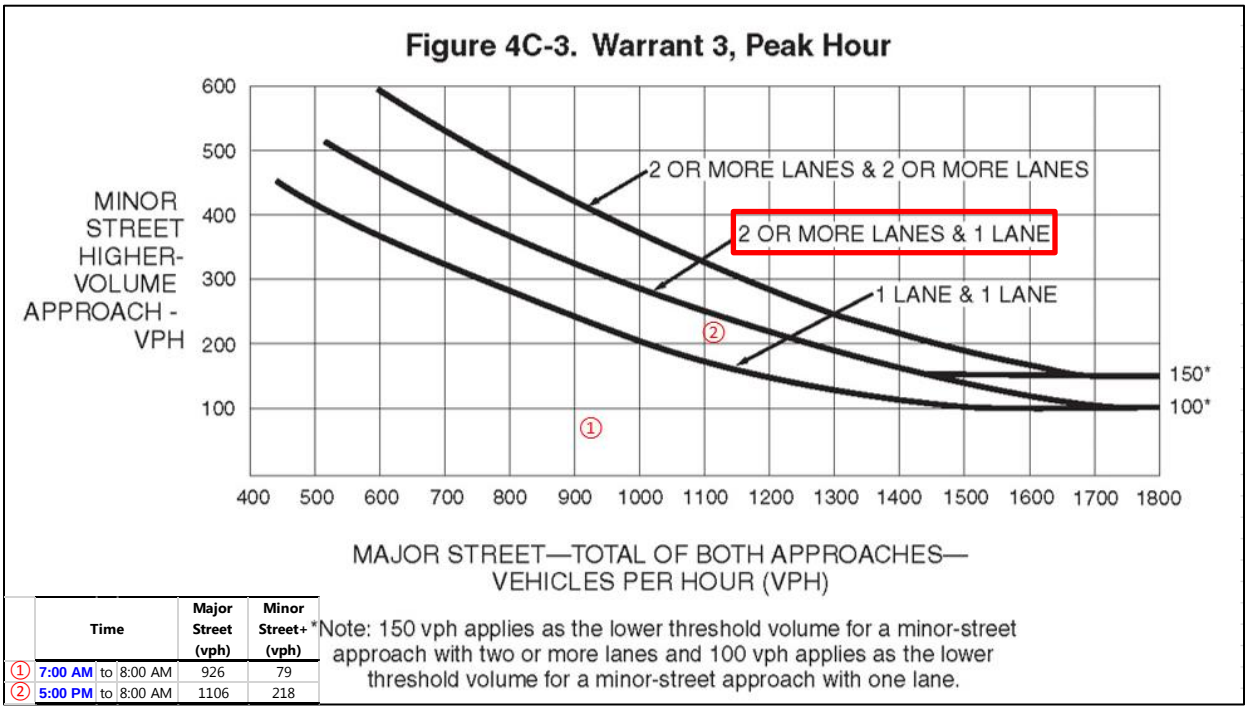
    2. The second condition requires that the volumes on the minor street equal or exceed 100 vehicles per hour for one lane of traffic. The volumes on minor street exceed 100 vehicles per hour during

many hours of the day.

3. The third condition requires that at least 650 vehicles per hour are serviced by three approaches of the intersection during the same one hour. The volumes on the intersection exceed 650 vehicles per hour during many hours of the day.

B. In total, there are no distinct hours that meet the peak hour thresholds. The dots representing the weekday AM and PM peak hours are shown on **Figure 10** (2018 Existing Condition). Both dots are below the applicable curve for 2 major street and 1 minor street approach lanes. Therefore, category B is not satisfied.

Warrant 3 is further investigated for informational purposes to determine if the numerical thresholds are satisfied. The special traffic generator requirement is a Standard (requirement) in the MUTCD, and Warrant 3 can only be applicable for special traffic generators. Therefore, **Warrant 3 is not satisfied**.



	Time			Major Street (vph)	Minor Street+ (vph)
①	7:00 AM	to	8:00 AM	926	79
②	5:00 PM	to	8:00 AM	1106	218

Figure 10: Analysis of Warrant 3 for 2018 Existing Condition

2020 Future Condition

A. Category A requires that all three conditions be met.

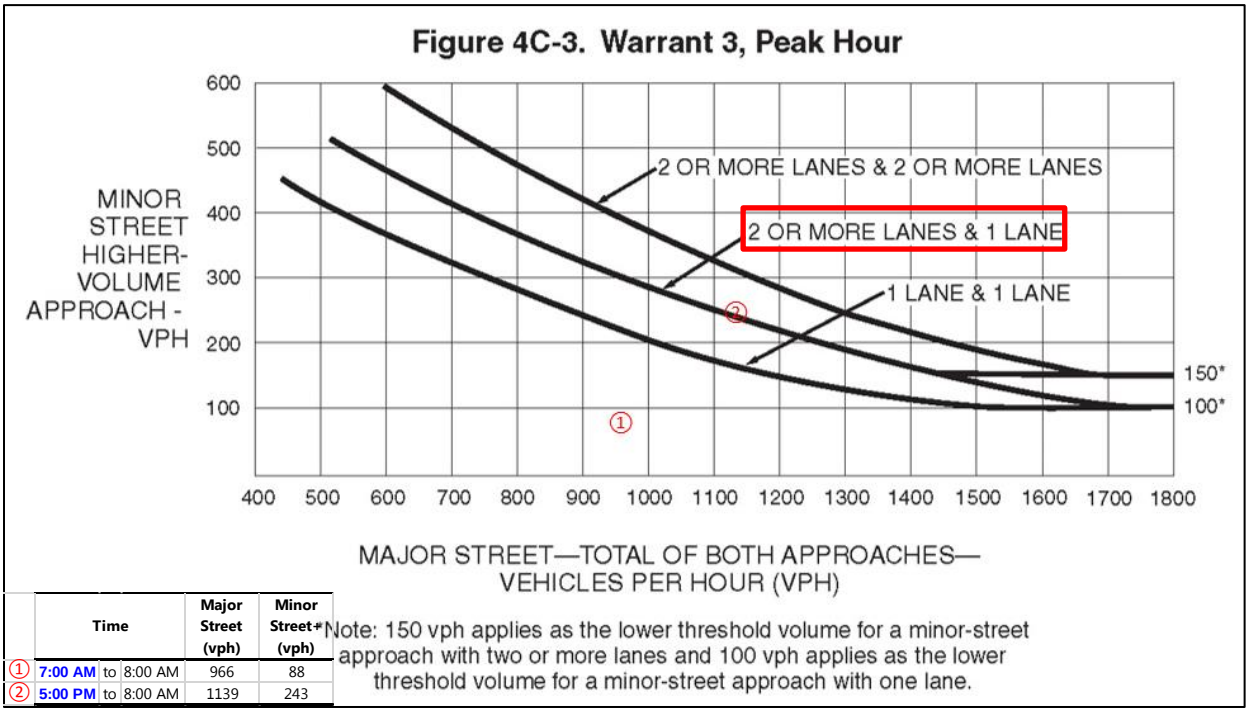
1. The first condition requires stop-delay exceed a threshold of four vehicle-hours for a one-lane approach. A stop-delay study must be conducted in the field, and cannot be conducted for future conditions. Therefore, this condition cannot be met for the 2020 Future Condition.

2. The second condition requires that the volumes on the minor street equal or exceed 100 vehicles per hour for one lane of traffic. The volumes on the minor street exceed 100 vehicles per hour during many hours of the day.

3. The third condition requires that at least 650 vehicles per hour are serviced by three approaches of the intersection during the same one hour. The volumes on the intersection exceed 650 vehicles per hour during many hours of the day.

B. In total, there is one distinct hour that met the peak hour thresholds. The dots representing the weekday AM and PM peak hours are shown on **Figure 11** (2020 Future Condition). The dot representing PM peak hour is above the applicable curve for 2 major street and 1 minor street approach lanes. Therefore, category B is satisfied.

Warrant 3 was investigated for informational purposes to determine if the numerical thresholds are satisfied. The special traffic generator requirement is a Standard (requirement) in the MUTCD, and Warrant 3 can only be satisfied with a special traffic generator. Therefore, **Warrant 3 is not satisfied**.



	Time	Major Street (vph)	Minor Street* (vph)
①	7:00 AM to 8:00 AM	966	88
②	5:00 PM to 8:00 AM	1139	243

Figure 11: Analysis of Warrant 3 for 2020 Future Condition

Warrant 4, Pedestrian Volume

Warrant 4, Pedestrian Volume, is intended for application where the traffic volume on the major street is so heavy that pedestrians experience excessive delay in crossing the major street.

For each of any four hours of an average day, the minimum pedestrian volume threshold is 107 pedestrians per hour. For one hour (any four consecutive 15-minute periods) of an average day, the minimum pedestrian volume threshold is 133 pedestrians per hour.

There were total of three pedestrians crossing the major street and two pedestrians crossing the minor street during the entire data collection period on Thursday, January 18, 2018. **Table 7** compares the observed pedestrian volumes during the peak hours to the thresholds. Due to the lack of any pedestrian significant activity crossing the major roadway, **Warrant 4 is not satisfied**.

Table 7: Pedestrian Volume Summary for Warrant 4

Time	Pedestrian Volume (Crossing Major Street)	Minimum Required Pedestrian Volume (4-Hour)	Minimum Required Pedestrian Volume (1-Hour)
10:00 AM – 11:00 AM	2	107	133
5:00 PM – 6:00 PM	1		

Warrant 5, School Crossing (2018 Existing Condition Only)

Warrant 5, School Crossing, is intended for application where the principal reason to consider installing a traffic control signal is the fact that school children cross the street. This intersection is not used by school children crossing the street. Therefore, **Warrant 5 is not applicable**.

Warrant 6, Coordinated Signal System (2018 Existing Condition Only)

Warrant 6, Coordinated Signal System, is considered when an intersection would be a part of a coordinated signal system to maintain progression of traffic through the area. Based on existing traffic flow and the long distance to the nearest traffic signals to the study area, **Warrant 6 is not applicable**.

Warrant 7, Crash Experience (2018 Existing Condition Only)

Warrant 7, Crash Experience, is intended for application where the severity and frequency of crashes are the major reasons for installing a traffic control signal. The need for a traffic control signal shall be considered if an engineering study finds that all the following criteria are met:

A. Adequate trial of alternatives with satisfactory observance and enforcement has failed to reduce the crash frequency; and

B. Five or more reported crashes, of types susceptible to correction by a traffic control signal, have occurred within a 12-month period, each crash involving personal injury or property damage apparently exceeding the applicable requirements for a reportable crash; and

C. For each of any 8 hours of an average day, the vehicles per hour (VPH) given in both of the 80% columns of Condition A in Table 4C-1 or the VPH in both of the 80% columns of Condition B in Table 4C-1 exist on the major street and the higher volume minor street approach, respectively, to the intersection, or the volume of pedestrian traffic is not less than 80% of the requirements specified in the Pedestrian Volume Warrant. These major and minor street volumes shall be for the same 8 hours. On the minor street, the higher volume shall not be required to be on the same approach during each of the 8 hours.

In consideration of these criteria:

A. The study intersection does not seem to be a high-crash location based on crash summary collected from the VDOT Crash Analysis Tool and field observations. As a result, no alternative measures have been tried at the location, and thus Condition A is not met.

B. A crash summary for study intersection was collected from the VDOT Crash Analysis Tool for the most recent five-year period (2013 to 2017) and included as **Attachment E**. **Figure 12** shows crashes that occurred at the study intersection in the 2012-2017 period. Out of 3 crashes in the past 5 years, there were 2 Angle (1 B-Injury crash, 1 PDO crash) and 1 Sideswipe (1 B-Injury crash) crashes. It was determined that only the 2 Angle crashes are considered to be crash events susceptible to correction by a traffic control signal. Condition B is not met.

C. **Table 8** (2018 Existing Condition) and **Table 9** (2020 Future Condition) show that 80% columns of Condition A in Table 4C-1 are satisfied for both existing and future conditions, meeting 9 and 10 distinct hours, respectively. Condition C is met.

In order for Warrant 7 to be satisfied, all of the criteria mentioned under its warrant must be met. Since only Condition C of the criteria is satisfied, **Warrant 7 is not satisfied**.

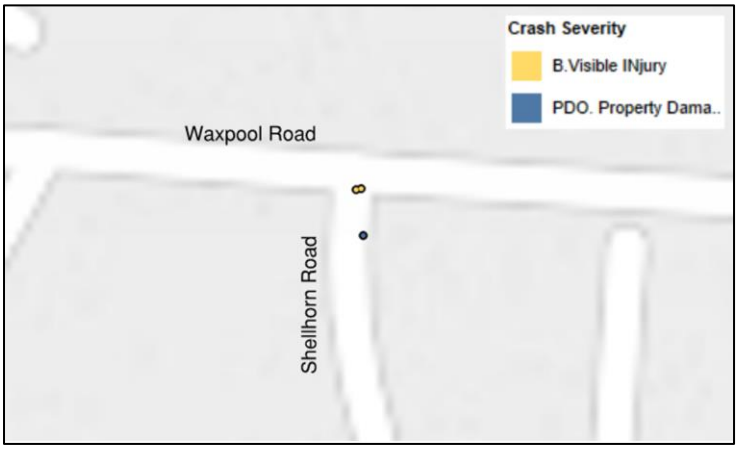


Figure 12: Location of Most Recent 5-Year Crash Events at the Study Intersection

Table 8: Warrant 7 Evaluation Summary for 2018 Existing Condition

Hour	Entering Vol.	Entering Vol. on Major Road		Tot. Ent. Vol.	Warrant 7 Met?	
	Minor Road+	Eastbound	Westbound	On Major Rd	Condition A	Condition B
1:00 AM - 2:00 AM	7	13	16	29	No	No
2:00 AM - 3:00 AM	6	9	13	22	No	No
3:00 AM - 4:00 AM	2	17	9	26	No	No
4:00 AM - 5:00 AM	3	59	8	67	No	No
5:00 AM - 6:00 AM	15	186	26	212	No	No
6:00 AM - 7:00 AM	40	393	98	491	No	No
7:00 AM - 8:00 AM	79	728	198	926	No	Yes
8:00 AM - 9:00 AM	107	821	189	1010	No	Yes
9:00 AM - 10:00 AM	123	514	163	677	Yes	No
10:00 AM - 11:00 AM	104	345	163	508	No	No
11:00 AM - 12:00 PM	106	305	185	490	No	No
12:00 PM - 1:00 PM	158	341	210	551	Yes	No
1:00 PM - 2:00 PM	131	307	250	557	Yes	No
2:00 PM - 3:00 PM	171	319	302	621	Yes	No
3:00 PM - 4:00 PM	183	313	309	622	Yes	No
4:00 PM - 5:00 PM	212	418	506	924	Yes	Yes
5:00 PM - 6:00 PM	218	424	682	1106	Yes	Yes
6:00 PM - 7:00 PM	223	417	618	1035	Yes	Yes
7:00 PM - 8:00 PM	196	316	480	796	Yes	Yes
8:00 PM - 9:00 PM	130	183	282	465	No	No
9:00 PM - 10:00 PM	110	185	241	426	No	No
10:00 PM - 11:00 PM	55	69	138	207	No	No
11:00 PM - 12:00 AM	27	40	65	105	No	No

Table 9: Warrant 7 Evaluation Summary for 2020 Future Condition

Hour	Entering Vol.	Entering Vol. on Major Road		Tot. Ent. Vol.	Warrant 7 Met?	
	Minor Road+	Eastbound	Westbound	On Major Rd	Condition A	Condition B
1:00 AM - 2:00 AM	8	13	16	29	No	No
2:00 AM - 3:00 AM	7	9	13	22	No	No
3:00 AM - 4:00 AM	2	17	9	26	No	No
4:00 AM - 5:00 AM	3	60	8	68	No	No
5:00 AM - 6:00 AM	17	192	27	219	No	No
6:00 AM - 7:00 AM	45	406	101	507	No	No
7:00 AM - 8:00 AM	88	762	204	966	No	Yes
8:00 AM - 9:00 AM	119	856	195	1051	No	Yes
9:00 AM - 10:00 AM	137	536	167	703	Yes	No
10:00 AM - 11:00 AM	115	363	167	530	No	No
11:00 AM - 12:00 PM	118	320	191	511	No	No
12:00 PM - 1:00 PM	176	358	215	573	Yes	No
1:00 PM - 2:00 PM	146	322	255	577	Yes	No
2:00 PM - 3:00 PM	190	336	308	644	Yes	No
3:00 PM - 4:00 PM	204	327	315	642	Yes	No
4:00 PM - 5:00 PM	236	438	516	954	Yes	Yes
5:00 PM - 6:00 PM	243	446	693	1139	Yes	Yes
6:00 PM - 7:00 PM	248	439	630	1069	Yes	Yes
7:00 PM - 8:00 PM	218	334	488	822	Yes	Yes
8:00 PM - 9:00 PM	145	193	287	480	Yes	No
9:00 PM - 10:00 PM	121	195	245	440	No	No
10:00 PM - 11:00 PM	61	72	140	212	No	No
11:00 PM - 12:00 AM	30	42	66	108	No	No

Warrant 8, Roadway Network

Warrant 8, Roadway Network, is intended for application where the study location is the intersection of two or more major routes. The study intersection does not constitute the intersection of two or more major routes. **Therefore, Warrant 8 is not applicable**.

Warrant 9, Intersection Near a Grade Crossing

Warrant 9, Intersection Near a Grade Crossing, is intended for application where a traffic control signal is not justified by any of the first eight warrants, but the proximity of the study intersection to a grade crossing on an approach controlled by a STOP or YIELD sign is the principal reason to consider installing a traffic control signal. There are no grade crossings across or within close proximity to any approach of the study intersection. Therefore, **Warrant 9 is not applicable**.

Conclusions

The intersection of Waxpool Road and Shellhorn Road was analyzed to determine if the installation of a traffic control signal is warranted. Currently, the intersection operates under stop control on the minor roadway.

The Signal Warrant Analysis was conducted in accordance with the methodology presented in Chapter 4C of the *Manual on Uniform Traffic Control Devices (MUTCD), 2009 Edition*. **Table 10** provides a summary of the warrant analysis results.

Table 10: Warrant Analysis Results Summary

Warrant	Warrant Met for 2018 Existing Condition	Warrant Met for 2020 Future Condition
Warrant 1, Eight-Hour Vehicular Volume	No	No
Warrant 2, Four-Hour Vehicular Volume	No	**Yes**
Warrant 3, Peak Hour	No	No
Warrant 4, Pedestrian Volume	No	No
Warrant 5, School Crossing	Not Applicable	Not Applicable
Warrant 6, Coordinated Signal System	Not Applicable	Not Applicable
Warrant 7, Crash Experience	No	No
Warrant 8, Roadway Network	Not Applicable	Not Applicable
Warrant 9, Intersection Near a Grade Crossing	Not Applicable	Not Applicable

According to the MUTCD, a traffic signal should not be installed unless one or more of the warrants are met. Of the five warrants tested, none are satisfied for the existing traffic conditions. ***Therefore, the findings of this analysis indicate that the installation of signal control is currently not warranted at the study intersection at this time.***

For the 2020 Future Condition, one of the five warrants (Warrant 2: Four-Hour Vehicular Volume) tested is satisfied. However, Chapter 3 of FHWA's *Signalized Intersections Information Guide,* 2nd Edition states that Warrant 2: Four-Hour Vehicular Volume is one of two warrants that address, "unusually high, short duration side street volumes," and that, "practitioners should take care when using these warrants." This guidance document explicitly states that, "In most cases, this would not constitute justification for installing a signal," and that some agencies place additional emphasis on making sure these warrants are used sparingly compared to Warrant 1: Eight-Hour Vehicular Volume. VDOT also emphasizes satisfying Warrant 1 to be a better justification of installing a traffic signal than satisfying Warrant 2 and/or Warrant 3. Solely meeting Warrant 2 is generally not considered sufficient justification for installation of a traffic signal on a VDOT-operated roadway.

Chapter 1 of the Texas Transportation Institute Guidelines for Conducting a Traffic Signal Warrant Analysis, 2nd Edition lays out the advantages and disadvantages of installing a new traffic signal and states that, "traffic signals have often been installed at intersections where less restrictive traffic control would have been more appropriate and effective." According to the document, if a traffic signal is not properly justified or ineffectively placed, the following disadvantages may occur:

- Increase delay for all traffic movements.
- Lead to an increase in traffic violations at the intersection.
- Increase the frequency of traffic crashes at the intersection (primarily rear-end crashes).
- Cause road users to increase the use of alternative routes to avoid the signal (often, these alternative routes travel through neighborhoods or other less adequate roads).

Also, the document states that traffic crashes are included in both the advantages and disadvantages of traffic signals. This is because a properly installed traffic signal often results in an increase in certain types of crashes, most notably rear-end collisions.

The findings of this analysis indicate that the installation of signal control is warranted (i.e. by satisfying Warrant 2) at the study intersection for the 2020 Future Condition. However, based on information cited from the documents above, the satisfaction of Warrant 2 alone does not overcome the disadvantages of installing a traffic signal. **Therefore, a follow-up review is recommended in the future, after the construction and opening of the Ashburn Metrorail station. Installation of a traffic signal at the study intersection is not recommended at this time.**

Recently, VDOT began emphasizing the need for a stricter requirement on approval of installation of signalized intersections, introducing programs, such as the Arterial Preservation Program, to preserve and enhance the capacity and safety of the critical transportation highways. VDOT has been requiring more stringent thresholds for installing traffic signals at intersections in accordance with IIM-TE-387.0, requiring Signal Justification Reports (SJR) in addition to the traditional Traffic Signal Warrant Analysis. SJR is composed of the following main components:

- Analyzing Innovative Intersection designs, such as Continuous Green-T, Median U-Turn, and Restricted Crossing U-Turn instead of conventional signalized intersection using VDOT Junction Screening Tool (VJuST)
- Completing the traditional Traffic Signal Warrant Analysis and providing additional justification for signalizing the intersection

- Acquiring approvals from the District Traffic Engineer, District Engineer/Administrator, and/or State Traffic Engineer

Innovative Intersection designs are required to be considered as alternatives to the traditional signalized intersection design, but signalization is not recommended at this study intersection. Since installing a traffic signal at the study intersection is not recommended at this time, no justification could be made for a traffic signal at the study intersection. **Therefore, completion of SJR is not recommended at this time. The SJR should be conducted when and if the future follow-up review finds sufficient justification for installing a traffic signal at the study intersection.**

There is still a need to consider the topic of how to best accommodate pedestrians crossing Waxpool Road in the vicinity of the study intersection. This may become more important when the Ashburn Silver Line Metrorail station opens. Although the station is more than half a mile walking distance from the study intersection, some Metrorail users from north of Waxpool Road will likely desire to walk to the station. Those users are likely to use Shellhorn Road as their primary walking route to the station, given the roadway network in the area. Although there are several housing developments to the north of Waxpool Road, there are currently no sidewalk along the north side of Waxpool Road, nor are there direct pedestrian connections to the neighborhoods. Therefore, it is not clear if Shellhorn Road is the best location for a pedestrian crossing of Waxpool Road. For example, some residents of the area north of Waxpool Road may find it easier to cross Waxpool Road at Ashburn Road and walk along the south side to Shellhorn Road using existing sidewalks. Thus, while pedestrians would still use Shellhorn Road to access the Metrorail station, the actual crossing point of Waxpool Road could be located at another intersection.

A corridor study of the 1.2-mile segment of Waxpool Road between Faulkner Parkway and Demott Drive (this segment includes the study intersection) has been programmed by Loudoun County. As part of this study, pedestrian access along and across the corridor should be examined in the context of the new Silver Line Metrorail station. Although very little pedestrian activity was observed at the study intersection in 2018, pedestrian volumes may increase once the new Metrorail station opens. Therefore, the need for a pedestrian crossing of Waxpool Road to facilitate trips between the housing developments to the north and the Metrorail station to the south is still possible, and the specific location of any such crossing along Waxpool Road can be identified as part of the corridor study.

Attachment A: Study Area Pedestrian Facilities Map

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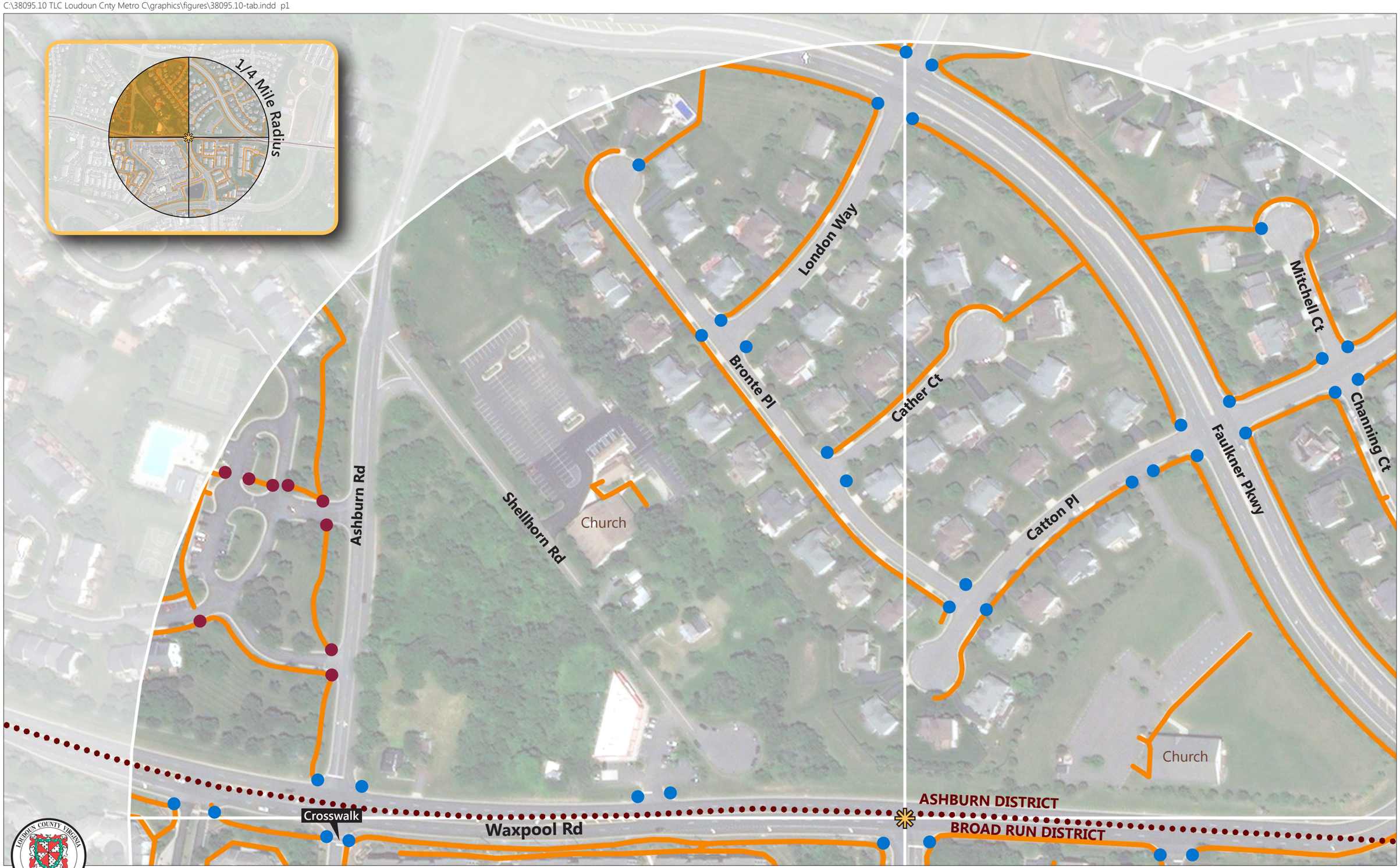

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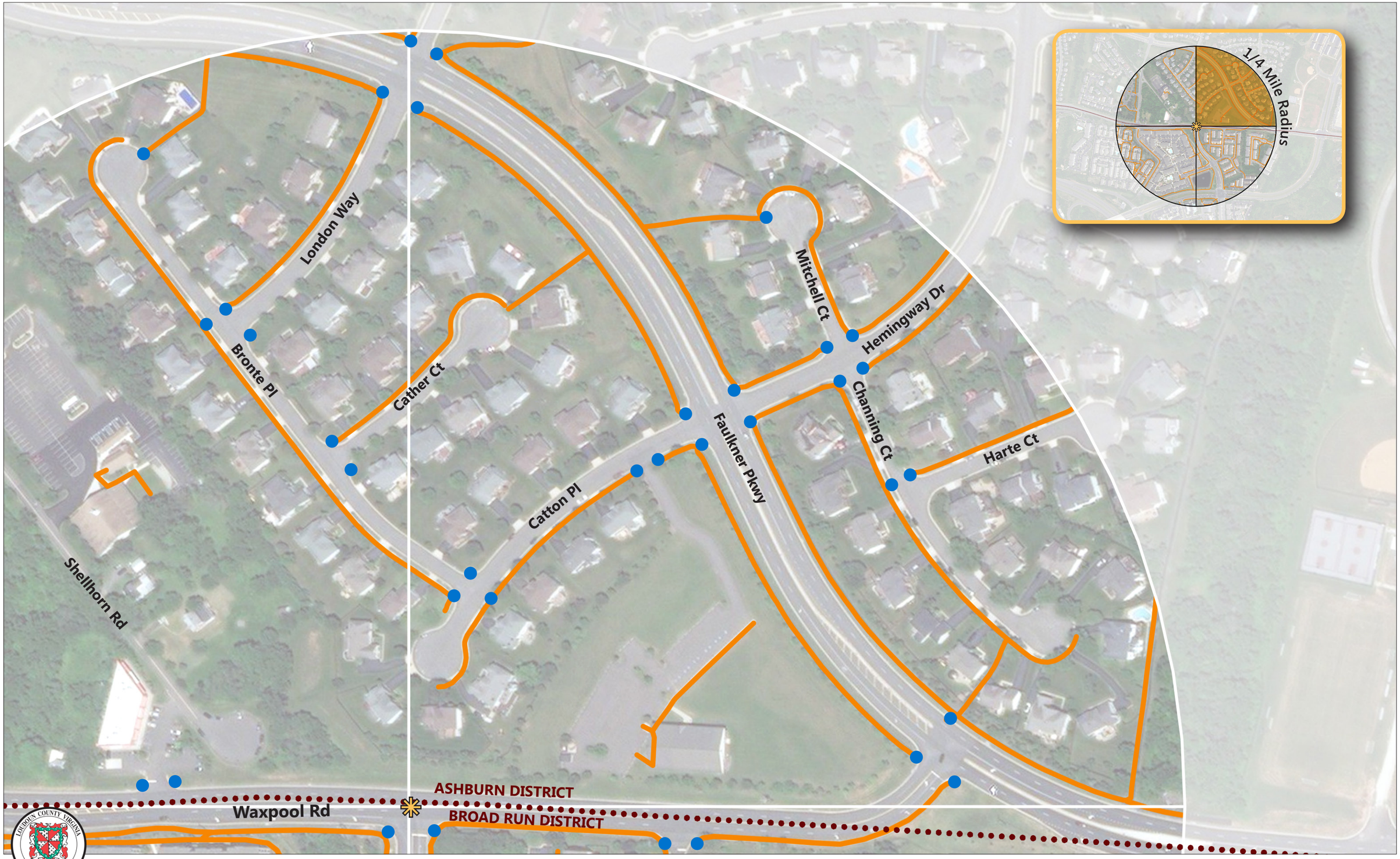

Loudoun County, VA

Sidewalk Curb Ramp Study Intersection

0 75 150 Feet

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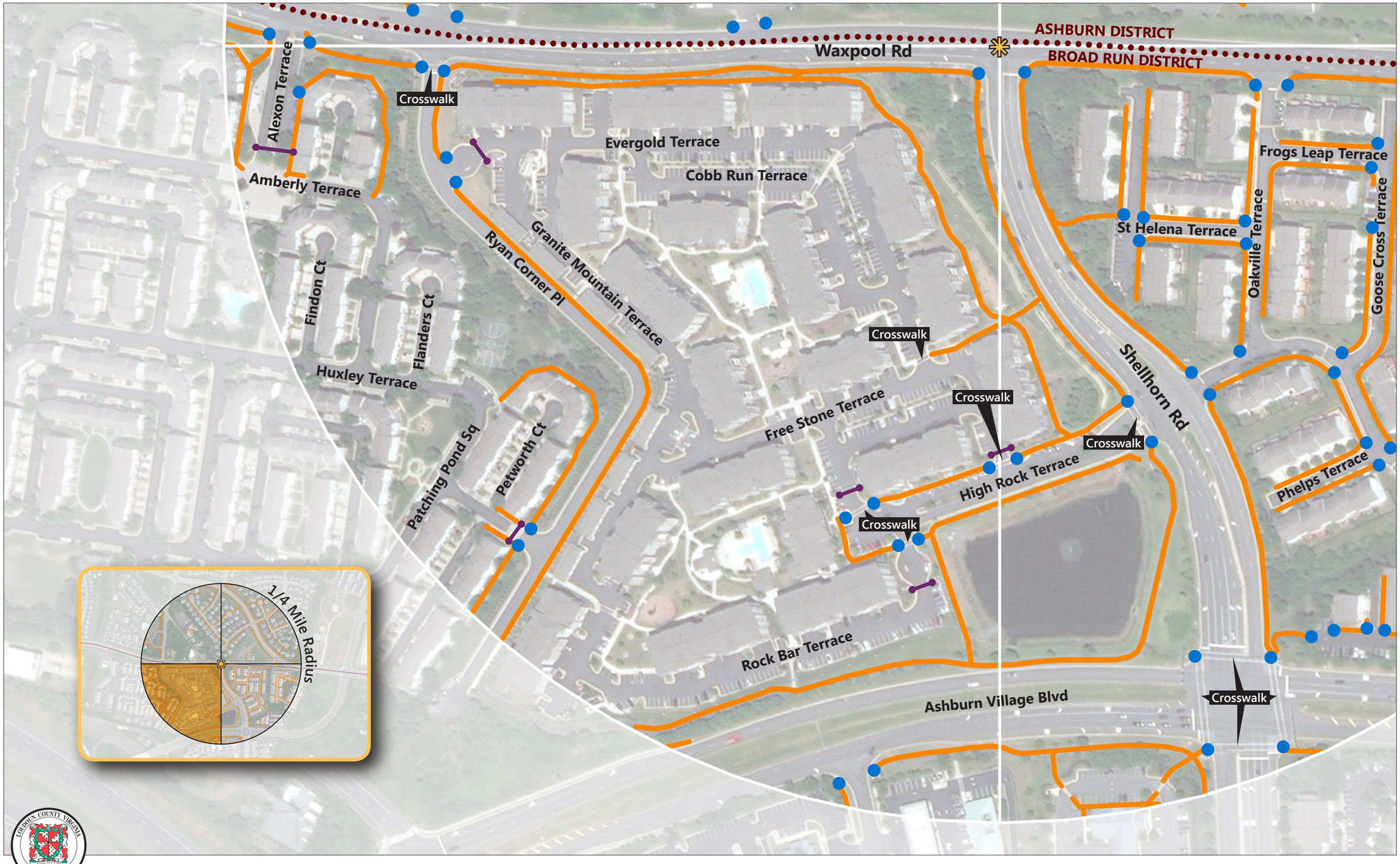

Loudoun County, VA

Sidewalk Curb Ramp Gate Study Intersection

0 75 150 Feet

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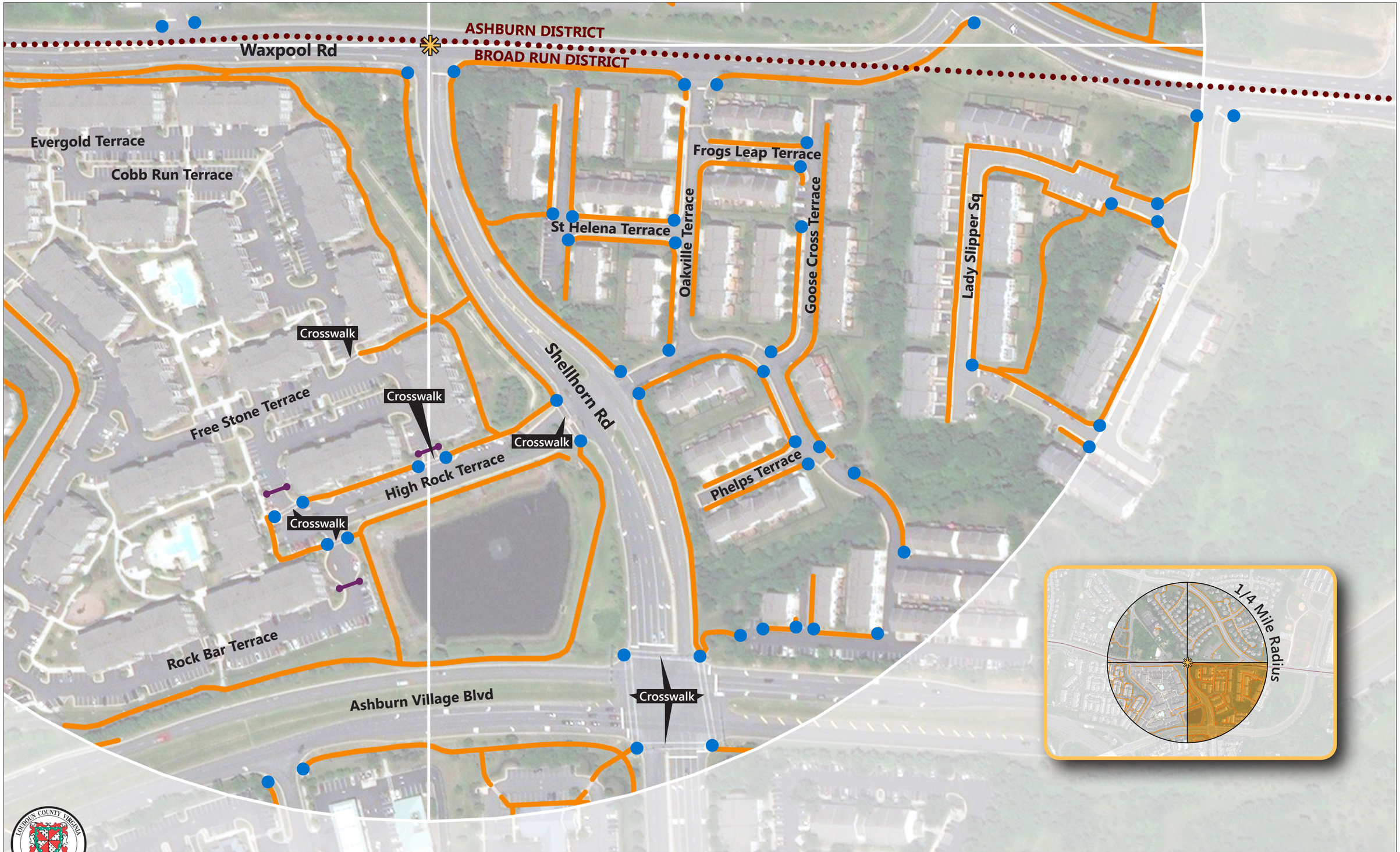

Loudoun County, VA

Sidewalk · Curb Ramp · Gate · Study Intersection

0 75 150 Feet

Attachment B: 2018 Count Data
(Without Right Turn Reductions)

Study Name Waxpool at Shellhorn
Start Date 1/18/2018
Start Time 1:00 AM
Project 38095.10 TLC Loudoun County Metro
Type Road
Classification Totals

	- Southbound				Waxpool Road Westbound				Shellhorn Road Northbound				Waxpool Road Eastbound			
Start Time	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn
1:00 AM	0	0	0	0	0	5	1	0	1	0	6	0	2	1	0	0
1:15 AM	0	0	0	0	0	4	1	0	1	0	1	0	0	2	0	0
1:30 AM	0	0	0	0	0	3	0	0	1	0	0	0	1	4	0	0
1:45 AM	0	0	0	0	0	2	0	0	1	0	0	0	0	3	0	0
2:00 AM	0	0	0	0	0	4	0	0	0	0	1	0	0	1	0	0
2:15 AM	0	0	0	0	0	2	0	0	0	0	1	0	0	2	0	0
2:30 AM	0	0	0	0	0	5	1	0	0	0	0	0	1	3	0	0
2:45 AM	0	0	0	0	0	1	0	0	0	0	4	0	1	1	0	0
3:00 AM	0	0	0	0	0	1	0	0	0	0	1	0	0	1	0	0
3:15 AM	0	0	0	0	0	5	0	0	0	0	0	0	0	1	0	0
3:30 AM	0	0	0	0	0	2	0	0	0	0	1	0	1	7	0	0
3:45 AM	0	0	0	0	0	1	0	0	0	0	0	0	2	5	0	0
4:00 AM	0	0	0	0	0	0	0	0	1	0	1	0	4	5	0	0
4:15 AM	0	0	0	0	0	0	1	0	0	0	0	0	2	4	0	0
4:30 AM	0	0	0	0	0	2	0	0	0	0	0	0	1	16	0	0
4:45 AM	0	0	0	0	0	3	2	0	0	0	2	0	6	21	0	0
5:00 AM	0	0	0	0	0	4	1	0	0	0	4	0	7	24	0	0
5:15 AM	0	0	0	0	0	4	0	0	2	0	2	0	6	30	0	0
5:30 AM	0	0	0	0	0	6	1	0	0	0	4	0	12	42	0	0
5:45 AM	0	0	0	0	0	7	3	0	1	0	5	0	10	55	0	0
6:00 AM	0	0	0	0	0	13	5	0	1	0	8	0	19	70	0	0
6:15 AM	0	0	0	0	0	24	3	0	2	0	8	0	27	66	0	0
6:30 AM	0	0	0	0	0	14	1	0	0	0	10	0	15	84	0	0
6:45 AM	0	0	0	0	0	28	10	0	4	0	14	0	31	81	0	0
7:00 AM	0	0	0	0	0	26	6	0	9	0	13	0	32	84	0	0
7:15 AM	0	0	0	0	0	29	6	0	5	0	11	0	57	123	0	0
7:30 AM	0	0	0	0	0	43	7	0	0	0	30	0	77	145	0	0
7:45 AM	0	0	0	0	0	64	17	0	3	0	25	0	94	116	0	0
8:00 AM	0	0	0	0	0	35	9	0	3	0	24	0	73	113	0	0
8:15 AM	0	0	0	0	0	37	15	0	8	0	27	0	57	148	0	0
8:30 AM	0	0	0	0	0	38	9	0	8	0	28	0	65	152	0	0
8:45 AM	0	0	0	0	0	38	8	0	6	0	28	0	63	150	0	0
9:00 AM	0	0	0	0	0	42	10	0	7	0	29	0	46	107	0	0
9:15 AM	0	0	0	0	0	27	10	0	4	0	32	0	47	105	0	0

9:30 AM	0	0	0	0	0	30	5	0	4	0	29	0	45	64	0	0
9:45 AM	0	0	0	0	0	36	3	0	4	0	33	0	27	73	0	0
10:00 AM	0	0	0	0	0	41	8	0	5	0	21	0	47	47	0	0
10:15 AM	0	0	0	0	0	23	6	0	3	0	29	1	33	48	0	0
10:30 AM	0	0	0	0	0	42	1	0	4	0	28	0	41	53	0	0
10:45 AM	0	0	0	0	0	34	8	0	6	0	25	0	21	55	0	0
11:00 AM	0	0	0	0	0	43	6	0	2	0	20	0	23	38	0	0
11:15 AM	0	0	0	0	0	36	9	0	6	0	26	0	31	45	0	0
11:30 AM	0	0	0	0	0	39	11	0	4	0	30	0	28	53	0	0
11:45 AM	0	0	0	0	0	34	7	0	7	0	30	0	31	56	0	0
12:00 PM	0	0	0	0	0	50	8	0	6	0	33	0	32	53	0	0
12:15 PM	0	0	0	0	0	49	8	0	7	0	37	0	31	48	0	0
12:30 PM	0	0	0	0	0	46	6	0	5	0	46	0	39	45	0	0
12:45 PM	0	0	0	0	0	41	2	0	7	0	42	0	32	61	0	0
1:00 PM	0	0	0	0	0	54	9	0	9	0	36	0	22	47	0	0
1:15 PM	0	0	0	0	0	61	3	0	7	0	26	0	34	47	0	0
1:30 PM	0	0	0	0	0	55	7	0	4	0	40	0	35	49	0	0
1:45 PM	0	0	0	0	0	56	5	0	2	0	29	0	25	48	0	0
2:00 PM	0	0	0	0	0	49	4	0	2	0	41	0	41	39	0	0
2:15 PM	0	0	0	0	0	72	8	0	6	0	44	0	33	43	0	0
2:30 PM	0	0	0	0	0	88	6	0	7	0	43	0	34	47	0	0
2:45 PM	0	0	0	0	0	67	8	0	6	0	43	0	25	57	0	0
3:00 PM	0	0	0	0	0	56	7	0	10	0	54	0	26	49	0	0
3:15 PM	0	0	0	0	0	80	4	0	4	0	43	0	28	40	0	0
3:30 PM	0	0	0	0	0	74	5	0	6	0	42	0	27	56	0	0
3:45 PM	0	0	0	0	0	73	10	0	11	0	44	0	29	58	0	0
4:00 PM	0	0	0	0	0	99	9	0	7	0	38	0	36	58	0	0
4:15 PM	0	0	0	0	0	108	11	0	12	0	44	0	45	71	0	0
4:30 PM	0	0	0	0	0	124	6	0	7	0	65	0	30	73	0	0
4:45 PM	0	0	0	0	0	135	14	0	11	0	65	0	40	65	0	0
5:00 PM	0	0	0	0	0	145	8	0	7	0	57	0	48	57	0	0
5:15 PM	0	0	0	0	0	155	10	0	4	0	50	0	46	60	0	0
5:30 PM	0	0	0	0	0	172	13	0	10	0	53	0	39	66	0	0
5:45 PM	0	0	0	0	0	163	16	0	11	0	58	0	45	63	0	0
6:00 PM	0	0	0	0	0	174	17	0	12	0	57	0	42	62	0	0
6:15 PM	0	0	0	0	0	131	9	0	8	0	58	0	41	71	0	0
6:30 PM	0	0	0	0	0	146	11	0	11	0	57	0	43	51	0	0
6:45 PM	0	0	0	0	0	117	13	0	12	0	51	0	49	58	0	0
7:00 PM	0	0	0	0	0	116	12	0	3	0	52	0	38	52	0	0
7:15 PM	0	0	0	0	0	110	8	0	8	0	56	0	36	50	0	0
7:30 PM	0	0	0	0	0	111	12	0	3	0	45	0	36	40	0	0
7:45 PM	0	0	0	0	0	105	6	0	4	0	43	0	31	33	0	0
8:00 PM	0	0	0	0	0	75	4	0	4	0	37	0	23	21	0	0
8:15 PM	0	0	0	0	0	62	3	0	4	0	38	0	18	29	0	0

8:30 PM	0	0	0	0	0	64	5	0	2	0	28	0	23	23	0	0
8:45 PM	0	0	0	0	0	61	8	0	2	0	27	0	12	34	0	0
9:00 PM	0	0	0	0	0	76	4	0	1	0	29	0	27	34	0	0
9:15 PM	0	0	0	0	0	73	5	0	4	1	25	0	25	32	0	0
9:30 PM	0	0	0	0	0	45	2	0	3	0	29	0	19	30	0	0
9:45 PM	0	0	0	0	0	30	6	0	3	0	26	0	8	10	0	0
10:00 PM	0	0	0	0	0	43	3	0	2	0	17	0	14	11	0	0
10:15 PM	0	0	0	0	0	34	2	0	3	0	11	0	8	9	0	0
10:30 PM	0	0	0	0	0	25	1	0	2	0	16	0	5	16	0	0
10:45 PM	0	0	0	0	0	28	2	0	1	0	11	0	2	4	0	0
11:00 PM	0	0	0	0	0	22	0	0	0	0	13	0	7	10	0	0
11:15 PM	0	0	0	0	0	17	2	0	2	0	7	0	2	8	0	0
11:30 PM	0	0	0	0	0	7	1	0	1	0	4	0	8	2	0	0
11:45 PM	0	0	0	0	0	16	0	0	0	0	3	0	1	2	0	0
12:00 AM	0	0	0	0	0	16	1	0	1	0	3	0	2	5	0	0

Attachment C: 2020 Forecasting Process Description & 2020 Turning Movement Volumes

Traffic Projection – MWCOG TLC

Waxpool Road at Shellhon Road

- 24-hour turning movement counts were collected for the intersection of Waxpool Road at Shellhorn Road on 01/18/2018. The counts were collected for all modes, including pedestrians and bicycles.

- Table 1 shows 2018 total vehicular counts for each hour of the day approaching the intersection by movement.

Table 1: 2018 Hourly Traffic Volume at Waxpool Road and Shellhorn Road Intersection

Time	Waxpool Rd			Shellhorn Rd			Waxpool Rd		
	WB			NB			EB		
	WBT	WBL	Total	NBR	NBL	Total	EBR	EBT	Total
1:00 AM	14	2	16	4	7	11	3	10	13
2:00 AM	12	1	13	0	6	6	2	7	9
3:00 AM	9	0	9	0	2	2	3	14	17
4:00 AM	5	3	8	1	3	4	13	46	59
5:00 AM	21	5	26	3	15	18	35	151	186
6:00 AM	79	19	98	7	40	47	92	301	393
7:00 AM	162	36	198	17	79	96	260	468	728
8:00 AM	148	41	189	25	107	132	258	563	821
9:00 AM	135	28	163	19	123	142	165	349	514
10:00 AM	140	23	163	18	104	122	142	203	345
11:00 AM	152	33	185	19	106	125	113	192	305
12:00 PM	186	24	210	25	158	183	134	207	341
1:00 PM	226	24	250	22	131	153	116	191	307
2:00 PM	276	26	302	21	171	192	133	186	319
3:00 PM	283	26	309	31	183	214	110	203	313
4:00 PM	466	40	506	37	212	249	151	267	418
5:00 PM	635	47	682	32	218	250	178	246	424
6:00 PM	568	50	618	43	223	266	175	242	417
7:00 PM	442	38	480	18	196	214	141	175	316
8:00 PM	262	20	282	12	130	142	76	107	183
9:00 PM	224	17	241	11	109	120	79	106	185
10:00 PM	130	8	138	8	55	63	29	40	69
11:00 PM	62	3	65	3	27	30	18	22	40
12:00 AM	41	2	43	2	15	17	7	12	19
Total	4678	516	**5194**	378	2420	**2798**	2433	4308	**6741**

- Based on the 24-hour turning movement counts collected at the intersection, the 2018 average daily traffic (ADT) at the intersection roadways is as follows:
    - Waxpool Road – East of Shellhorn Road: 9,800 vehicles/day (vpd)
    - Waxpool Road – West of Shellhorn Road: 13,800 vpd
    - Shellhorn Road – 5,800 vpd

- Loudoun County provided traffic forecasting models (version 4, 2018), for the base year 2016 and future years 2030, and 2040 both for the daily traffic volumes and the AM and PM peak period volumes. The County confirmed that the models included trips generated by the Ashburn Metrorail Station in the 2030 and 2040 models.

- To calculate annual traffic growth rates based on the traffic forecasting models, the AADT provided by the County's models were compared for Shellhorn Road, Waxpool Road and other roadways adjacent to the intersection.

- A comparison of the 2016 and 2030 AADT from traffic forecasting models show a significant reduction in AADT along Waxpool Road from 2016 to 2030.

- Table 2 shows AADT from the Loudoun County's models and 2018 field collected data as well as the annual traffic growth rates calculated based on the models.

Table 2: Existing and Future AADT and Annual Traffic Growth Rates

Road Segments	2018 ADT (Field Data)	AADT (From County's Travel Forecasting Model)			Annual Traffic Growth Rate (%)		
		2016	2030	2040	2018-2030	2016-2030	2030-2040
	5,746	8,018	10,819	11,388	5.41%	2.16%	0.51%
Shellhorn Rd - S of Waxpool Rd		8,550	11,835	12,485		2.35%	0.54%
Shellhorn Rd - S of Ashburn Village Blvd		14,985	23,957	26,093		3.41%	0.86%
Waxpool Rd - E of Shellhorn Rd	9,862	18,951	8,971	9,109	-0.79%	-5.20%	0.15%
Waxpool Rd - W of Shellhorn Rd	13,838	24,094	17,483	17,810	1.97%	-2.26%	0.19%
Waxpool Rd - W of Ashburn Rd Rd		17,830	12,413	12,635		-2.55%	0.18%
Ashburn Village Blvd - W of Shellhorn Rd		22,785	24,904	28,999		0.64%	1.53%
Ashburn Village Blvd - W of Shellhorn Rd		22,785	24,904	28,999		0.64%	1.53%
Ashburn Village Blvd - E of Shellhorn Rd		14,828	20,386	23,246		2.30%	1.32%
Ashburn Village Blvd - S of Waxpool Rd		14,828	20,386	23,246		2.30%	1.32%
Ashburn Village Blvd - N of Waxpool Rd		16,338	19,024	20,564		1.09%	0.78%
Faulkner Pkwy		6,540	3,238	3,275		-4.90%	0.11%
Ashburn Rd - S of Waxpool Rd		6,224	7,021	7,048		0.86%	0.04%
Ashburn Rd - N of Waxpool Rd		7,440	7,786	8,742		0.33%	1.16%

- Table 2 shows a negative growth along Waxpool Road between 2016 and 2030 calculated based on the AADTs from County's traffic forecasting models. While, along Shellhorn Road the annual growth rate is expected to be 2 percent between 2016 and 2030. The annual growth rates calculated based on the 2018 ADT and 2030 model is 5.4 percent along Shellhorn Road and an average 0.5 percent along Waxpool Road.

- Since the 2018 ADT along Shellhorn Road is lower than the 2016 AADT from the model, a 5.5 percent annual growth rate was applied to the traffic volume turning onto and out of Shellhorn Road to consider the increase in future traffic volume along this road due to the construction of the metrorail station. A 0.5 percent annual growth rate was applied to the through traffic volume along Waxpool Road. Table 3 shows the 2020 projected turning movement counts at the intersection.

Table 3: 2020 Projected Traffic Volume

Time	Waxpool Rd			Shellhorn Rd			Waxpool Rd		
	WB			NB			EB		
	WBT	WBL	Total	NBR	NBL	Total	EBR	EBT	Total
1:00 AM	14	2	16	4	8	12	3	10	13
2:00 AM	12	1	13	0	7	7	2	7	9
3:00 AM	9	0	9	0	2	2	3	14	17
4:00 AM	5	3	8	1	3	4	14	46	61
5:00 AM	21	6	27	3	17	20	39	153	191
6:00 AM	80	21	101	8	45	52	102	304	406
7:00 AM	164	40	204	19	88	107	289	473	762
8:00 AM	149	46	195	28	119	147	287	569	856
9:00 AM	136	31	168	21	137	158	184	352	536
10:00 AM	141	26	167	20	115	135	158	205	363
11:00 AM	154	37	190	21	118	139	126	194	320
12:00 PM	188	27	215	28	176	204	149	209	358
1:00 PM	228	27	255	24	146	170	129	193	322
2:00 PM	279	29	308	23	190	214	148	188	336
3:00 PM	286	29	315	35	204	238	122	205	327
4:00 PM	471	45	515	41	236	277	168	270	438
5:00 PM	641	52	694	36	243	278	198	248	447
6:00 PM	574	56	629	48	248	296	195	244	439
7:00 PM	446	42	489	20	218	238	157	177	334
8:00 PM	265	22	287	13	145	158	85	108	193
9:00 PM	226	19	245	12	121	134	88	107	195
10:00 PM	131	9	140	9	61	70	32	40	73
11:00 PM	63	3	66	3	30	33	20	22	42
12:00 AM	41	2	44	2	17	19	8	12	20
Total	4725	574	**5299**	421	2692	**3113**	2708	4351	**7059**

- Based on the projected turning movement counts, the 2020 average daily traffic (ADT) at the intersection roadways is as follows:
    - Waxpool Road – East of Shellhorn Road: 10,100 vehicles/day (vpd)
    - Waxpool Road – West of Shellhorn Road: 14,500 vpd
    - Shellhorn Road – 6,400 vpd

Study Name Waxpool at Shellhorn
Start Date 2020 TMC Projection
Start Time 1:00 AM
Project 38095.10 TLC Loudoun County Metro
Type Road
Classification Totals

	- Southbound				Waxpool Road Westbound				Shellhorn Road Northbound				Waxpool Road Eastbound			
Start Time	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn
1:00 AM						14	2		4		8		3	10		
2:00 AM						12	1		0		7		2	7		
3:00 AM						9	0		0		2		3	14		
4:00 AM						5	3		1		3		14	46		
5:00 AM						21	6		3		17		39	153		
6:00 AM						80	21		8		45		102	304		
7:00 AM						164	40		19		88		289	473		
8:00 AM						149	46		28		119		287	569		
9:00 AM						136	31		21		137		184	352		
10:00 AM						141	26		20		115		158	205		
11:00 AM						154	37		21		118		126	194		
12:00 PM						188	27		28		176		149	209		
1:00 PM						228	27		24		146		129	193		
2:00 PM						279	29		23		190		148	188		
3:00 PM						286	29		35		204		122	205		
4:00 PM						471	45		41		236		168	270		
5:00 PM						641	52		36		243		198	248		
6:00 PM						574	56		48		248		195	244		
7:00 PM						446	42		20		218		157	177		
8:00 PM						265	22		13		145		85	108		
9:00 PM						226	19		12		121		88	107		
10:00 PM						131	9		9		61		32	40		
11:00 PM						63	3		3		30		20	22		

Attachment D: 2018 & 2020 Turning Movement Volumes (With 100% Right Turn Reduction)

Study Name Waxpool at Shellhorn
Start Date 1/18/2018
Start Time 1:00 AM
Project 38095.10 TLC Loudoun County Metro
Type Road
Classification Totals - 100% RT Reduction

	- Southbound				Waxpool Road Westbound				Shellhorn Road Northbound				Waxpool Road Eastbound			
Start Time	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn
1:00 AM	0	0	0	0	0	5	1	0	0	0	6	0	2	1	0	0
1:15 AM	0	0	0	0	0	4	1	0	0	0	1	0	0	2	0	0
1:30 AM	0	0	0	0	0	3	0	0	0	0	0	0	1	4	0	0
1:45 AM	0	0	0	0	0	2	0	0	0	0	0	0	0	3	0	0
2:00 AM	0	0	0	0	0	4	0	0	0	0	1	0	0	1	0	0
2:15 AM	0	0	0	0	0	2	0	0	0	0	1	0	0	2	0	0
2:30 AM	0	0	0	0	0	5	1	0	0	0	0	0	1	3	0	0
2:45 AM	0	0	0	0	0	1	0	0	0	0	4	0	1	1	0	0
3:00 AM	0	0	0	0	0	1	0	0	0	0	1	0	0	1	0	0
3:15 AM	0	0	0	0	0	5	0	0	0	0	0	0	0	1	0	0
3:30 AM	0	0	0	0	0	2	0	0	0	0	1	0	1	7	0	0
3:45 AM	0	0	0	0	0	1	0	0	0	0	0	0	2	5	0	0
4:00 AM	0	0	0	0	0	0	0	0	0	0	1	0	4	5	0	0
4:15 AM	0	0	0	0	0	0	1	0	0	0	0	0	2	4	0	0
4:30 AM	0	0	0	0	0	2	0	0	0	0	0	0	1	16	0	0
4:45 AM	0	0	0	0	0	3	2	0	0	0	2	0	6	21	0	0
5:00 AM	0	0	0	0	0	4	1	0	0	0	4	0	7	24	0	0
5:15 AM	0	0	0	0	0	4	0	0	0	0	2	0	6	30	0	0
5:30 AM	0	0	0	0	0	6	1	0	0	0	4	0	12	42	0	0
5:45 AM	0	0	0	0	0	7	3	0	0	0	5	0	10	55	0	0
6:00 AM	0	0	0	0	0	13	5	0	0	0	8	0	19	70	0	0
6:15 AM	0	0	0	0	0	24	3	0	0	0	8	0	27	66	0	0
6:30 AM	0	0	0	0	0	14	1	0	0	0	10	0	15	84	0	0
6:45 AM	0	0	0	0	0	28	10	0	0	0	14	0	31	81	0	0
7:00 AM	0	0	0	0	0	26	6	0	0	0	13	0	32	84	0	0
7:15 AM	0	0	0	0	0	29	6	0	0	0	11	0	57	123	0	0
7:30 AM	0	0	0	0	0	43	7	0	0	0	30	0	77	145	0	0
7:45 AM	0	0	0	0	0	64	17	0	0	0	25	0	94	116	0	0
8:00 AM	0	0	0	0	0	35	9	0	0	0	24	0	73	113	0	0
8:15 AM	0	0	0	0	0	37	15	0	0	0	27	0	57	148	0	0
8:30 AM	0	0	0	0	0	38	9	0	0	0	28	0	65	152	0	0
8:45 AM	0	0	0	0	0	38	8	0	0	0	28	0	63	150	0	0
9:00 AM	0	0	0	0	0	42	10	0	0	0	29	0	46	107	0	0
9:15 AM	0	0	0	0	0	27	10	0	0	0	32	0	47	105	0	0

9:30 AM	0	0	0	0	0	30	5	0	0	0	29	0	45	64	0	0
9:45 AM	0	0	0	0	0	36	3	0	0	0	33	0	27	73	0	0
10:00 AM	0	0	0	0	0	41	8	0	0	0	21	0	47	47	0	0
10:15 AM	0	0	0	0	0	23	6	0	0	0	29	1	33	48	0	0
10:30 AM	0	0	0	0	0	42	1	0	0	0	28	0	41	53	0	0
10:45 AM	0	0	0	0	0	34	8	0	0	0	25	0	21	55	0	0
11:00 AM	0	0	0	0	0	43	6	0	0	0	20	0	23	38	0	0
11:15 AM	0	0	0	0	0	36	9	0	0	0	26	0	31	45	0	0
11:30 AM	0	0	0	0	0	39	11	0	0	0	30	0	28	53	0	0
11:45 AM	0	0	0	0	0	34	7	0	0	0	30	0	31	56	0	0
12:00 PM	0	0	0	0	0	50	8	0	0	0	33	0	32	53	0	0
12:15 PM	0	0	0	0	0	49	8	0	0	0	37	0	31	48	0	0
12:30 PM	0	0	0	0	0	46	6	0	0	0	46	0	39	45	0	0
12:45 PM	0	0	0	0	0	41	2	0	0	0	42	0	32	61	0	0
1:00 PM	0	0	0	0	0	54	9	0	0	0	36	0	22	47	0	0
1:15 PM	0	0	0	0	0	61	3	0	0	0	26	0	34	47	0	0
1:30 PM	0	0	0	0	0	55	7	0	0	0	40	0	35	49	0	0
1:45 PM	0	0	0	0	0	56	5	0	0	0	29	0	25	48	0	0
2:00 PM	0	0	0	0	0	49	4	0	0	0	41	0	41	39	0	0
2:15 PM	0	0	0	0	0	72	8	0	0	0	44	0	33	43	0	0
2:30 PM	0	0	0	0	0	88	6	0	0	0	43	0	34	47	0	0
2:45 PM	0	0	0	0	0	67	8	0	0	0	43	0	25	57	0	0
3:00 PM	0	0	0	0	0	56	7	0	0	0	54	0	26	49	0	0
3:15 PM	0	0	0	0	0	80	4	0	0	0	43	0	28	40	0	0
3:30 PM	0	0	0	0	0	74	5	0	0	0	42	0	27	56	0	0
3:45 PM	0	0	0	0	0	73	10	0	0	0	44	0	29	58	0	0
4:00 PM	0	0	0	0	0	99	9	0	0	0	38	0	36	58	0	0
4:15 PM	0	0	0	0	0	108	11	0	0	0	44	0	45	71	0	0
4:30 PM	0	0	0	0	0	124	6	0	0	0	65	0	30	73	0	0
4:45 PM	0	0	0	0	0	135	14	0	0	0	65	0	40	65	0	0
5:00 PM	0	0	0	0	0	145	8	0	0	0	57	0	48	57	0	0
5:15 PM	0	0	0	0	0	155	10	0	0	0	50	0	46	60	0	0
5:30 PM	0	0	0	0	0	172	13	0	0	0	53	0	39	66	0	0
5:45 PM	0	0	0	0	0	163	16	0	0	0	58	0	45	63	0	0
6:00 PM	0	0	0	0	0	174	17	0	0	0	57	0	42	62	0	0
6:15 PM	0	0	0	0	0	131	9	0	0	0	58	0	41	71	0	0
6:30 PM	0	0	0	0	0	146	11	0	0	0	57	0	43	51	0	0
6:45 PM	0	0	0	0	0	117	13	0	0	0	51	0	49	58	0	0
7:00 PM	0	0	0	0	0	116	12	0	0	0	52	0	38	52	0	0
7:15 PM	0	0	0	0	0	110	8	0	0	0	56	0	36	50	0	0
7:30 PM	0	0	0	0	0	111	12	0	0	0	45	0	36	40	0	0
7:45 PM	0	0	0	0	0	105	6	0	0	0	43	0	31	33	0	0
8:00 PM	0	0	0	0	0	75	4	0	0	0	37	0	23	21	0	0
8:15 PM	0	0	0	0	0	62	3	0	0	0	38	0	18	29	0	0

8:30 PM	0	0	0	0	0	64	5	0	0	0	28	0	23	23	0	0
8:45 PM	0	0	0	0	0	61	8	0	0	0	27	0	12	34	0	0
9:00 PM	0	0	0	0	0	76	4	0	0	0	29	0	27	34	0	0
9:15 PM	0	0	0	0	0	73	5	0	0	1	25	0	25	32	0	0
9:30 PM	0	0	0	0	0	45	2	0	0	0	29	0	19	30	0	0
9:45 PM	0	0	0	0	0	30	6	0	0	0	26	0	8	10	0	0
10:00 PM	0	0	0	0	0	43	3	0	0	0	17	0	14	11	0	0
10:15 PM	0	0	0	0	0	34	2	0	0	0	11	0	8	9	0	0
10:30 PM	0	0	0	0	0	25	1	0	0	0	16	0	5	16	0	0
10:45 PM	0	0	0	0	0	28	2	0	0	0	11	0	2	4	0	0
11:00 PM	0	0	0	0	0	22	0	0	0	0	13	0	7	10	0	0
11:15 PM	0	0	0	0	0	17	2	0	0	0	7	0	2	8	0	0
11:30 PM	0	0	0	0	0	7	1	0	0	0	4	0	8	2	0	0
11:45 PM	0	0	0	0	0	16	0	0	0	0	3	0	1	2	0	0
12:00 AM	0	0	0	0	0	16	1	0	0	0	3	0	2	5	0	0

Study Name Waxpool at Shellhorn
Start Date 2020 TMC Projection
Start Time 1:00 AM
Project 38095.10 TLC Loudoun County Metro
Type Road
Classification Totals - 100% RT Reduction

	- Southbound				Waxpool Road Westbound				Shellhorn Road Northbound				Waxpool Road Eastbound			
Start Time	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn
1:00 AM						14	2		0		8		3	10		
2:00 AM						12	1		0		7		2	7		
3:00 AM						9	0		0		2		3	14		
4:00 AM						5	3		0		3		14	46		
5:00 AM						21	6		0		17		39	153		
6:00 AM						80	21		0		45		102	304		
7:00 AM						164	40		0		88		289	473		
8:00 AM						149	46		0		119		287	569		
9:00 AM						136	31		0		137		184	352		
10:00 AM						141	26		0		115		158	205		
11:00 AM						154	37		0		118		126	194		
12:00 PM						188	27		0		176		149	209		
1:00 PM						228	27		0		146		129	193		
2:00 PM						279	29		0		190		148	188		
3:00 PM						286	29		0		204		122	205		
4:00 PM						471	45		0		236		168	270		
5:00 PM						641	52		0		243		198	248		
6:00 PM						574	56		0		248		195	244		
7:00 PM						446	42		0		218		157	177		
8:00 PM						265	22		0		145		85	108		
9:00 PM						226	19		0		121		88	107		
10:00 PM						131	9		0		61		32	40		
11:00 PM						63	3		0		30		20	22		

Attachment E:
2013 – 2017 Intersection Crash Summary

Crash Severity	LATITUDE	LONGITUDE	Collision Type	Crash Dsc	Crash Dt	Direction Of Travel Cd	Document Nbr	Driver Action Type Cd	Driver Distraction Type Cd	Driver Drinking Type Cd	Driver Safety Equip Used	First Harmful Event of Entire Crash	Roadway Surface Cond	Vehicle Maneuver Type Cd	Weather Condition	Work Zone Location	Sum of Crash Military Tm	Persons Injured	Persons Killed
PDO. Property Damage Only	-77.491792	39.01476	5. Sideswipe - Opposite Direction	DRIVER 1 MADE A WIDE RIGHT TURN RESULTING IN HIS VEHICLE CROSSING THE CENTER LINE AND STRIKING VEHICLE 2.	3/27/2013	South,North	130865207	14. Improper Turn - Wide Right Turn,1. No Improper Action	14. No Driver Distraction,14. No Driver Distraction	1. Had Not Been Drinking,1. Had Not Been Drinking	3. Lap and Shoulder Belt,3. Lap and Shoulder Belt	20. Motor Vehicle In Transport	1. Dry	2. Making Right Turn,8. Stopped in Traffic Lane	1. No Adverse Condition (Clear/Cloudy)	Not Provided	1459	0	0
B.Visible INjury	-77.491815	39.014868	2. Angle	V1 DID NOT YIELD TO V2.	5/2/2013	West,East	131265168	11. Did Not Have Right-of-Way,1. No Improper Action	Not Applicable,Not Applicable	1. Had Not Been Drinking,1. Had Not Been Drinking	3. Lap and Shoulder Belt,3. Lap and Shoulder Belt	20. Motor Vehicle In Transport	1. Dry	3. Making Left Turn,1. Going Straight Ahead	1. No Adverse Condition (Clear/Cloudy)	3. Activity Area	2008	2	0
B.Visible INjury	-77.4918	39.01487	2. Angle	VEHICLE 1 STOPPED AT THE STOP SIGN AT SHELLHORN ROAD AND WAXPOOL ROAD. VEHICLE 2 WAS TRAVELING EAST ON WAXPOOL ROAD. VEHICLE 1 MADE A LEFT TURN IN FRONT OF VEHICLE 2 TO TRAVEL WEST ON WAXPOOL ROAD AND STRUCK VEHICLE 2. VEHICLE 1 FLIPPED OVER ON ITS ROOF.	4/18/2016	North,East	161095544	11. Did Not Have Right-of-Way,1. No Improper Action	14. No Driver Distraction,14. No Driver Distraction	1. Had Not Been Drinking,1. Had Not Been Drinking	3. Lap and Shoulder Belt,3. Lap and Shoulder Belt	20. Motor Vehicle In Transport	1. Dry	3. Making Left Turn,1. Going Straight Ahead	1. No Adverse Condition (Clear/Cloudy)	Not Provided	705	3	0