Lambs Lane Loop Road Alternatives Analysis

Traffic Impact Analysis

August 2024

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1 EXECUTIVE SUMMARY

This report presents the findings of the traffic impact analysis (TIA) prepared for the proposed new school complex in Albemarle County, Virginia. This report also investigates the impact of completing a loop road through the proposed development that connects between Hydraulic Road (near Georgetown Green) and Lambs Lane (near Journey Middle School).

1.1 PROJECT OVERVIEW

The proposed development will be located in the vacant land surrounding Albemarle High School (AHS), Journey Middle School (JMS), and Greer Elementary School (GES) as shown on Figure 1-1 (all figures are located at the end of their respective chapter).

Excluding the existing three schools on the property, the existing site is undeveloped. Based on coordination with Albemarle County Public Schools (ACPS), the proposed development program is unknown. It was assumed that the proposed development will generate 25% of the existing total traffic entering the existing school complex, as discussed in Chapter 5. The AHS Center II building is currently under design and any new trips associated with it are included in the trip generation discussed in this report. A draft concept plan of the ACPS Lambs Lane campus is shown on Figure 1-2. For purposes of this analysis, the redevelopment was assumed to be complete and occupied by 2033.

As discussed in Chapter 5, the proposed development will generate 335 morning peak hour trips (231 in and 104 out) and 274 afternoon peak hour trips (81 in and 193 out). Average daily weekday trips were estimated to be 1,600 vehicles per day. For the purposes of this analysis, the peak hour of the proposed development is assumed to align with the peak hour of the existing school traffic.

The proposed alignment of the Loop Road will connect to Lambs Lane east of Journey Middle School and continue to the southeast between the Albemarle High School (AHS) football stadium and baseball field. The road will then follow the property line of the school parcel as it approaches Hydraulic Road. The existing Building Services complex is expected to be demolished and relocated to allow construction of the proposed Loop Road.

As discussed in Chapter 9, three scenarios have been identified for where the future intersection of the Proposed Loop Road and Hydraulic Road will be located. To meet access management spacing standards, the existing AHS entrance (intersection 4) and Georgetown Green entrance (intersection 5) may be modified in each scenario.

The scope of this study was developed in conjunction with Albemarle County and coordinated at a scoping meeting on January 20, 2023.

1.2 STUDY AREA LIMITS

As outlined in the scoping agreement, he study limits include the following six existing intersections (see Figure 1-1):

1. Lambs Road and Lambs Lane (unsignalized);
2. Lambs Road and AHS Exit (unsignalized);
3. Hydraulic Road and Lambs Road/Whitewood Road (signalized);
4. Hydraulic Road and AHS Entrance/Hydraulic Ridge Road (unsignalized);
5. Hydraulic Road and Georgetown Green (unsignalized); and
6. Hydraulic Road and Georgetown Road (signalized).

Analyses were completed for the following scenarios:

1. 2023 Existing Traffic Conditions;
2. 2033 Background Traffic Conditions (without development of the site);
3. 2033 Scenario 1 Future Traffic Conditions (with development of the site);
4. 2033 Scenario 2 Future Traffic Conditions (with development of the site);
5. 2033 Scenario 3 Future Traffic Conditions (with development of the site);

The following steps were taken to determine the potential traffic impacts associated with this project:

1. Data Collection – Weekday peak hour traffic counts were collected at the study intersections above in March 2023 when public schools were in session. Based on a comparison of the 2023 traffic counts to available VDOT traffic data, the volumes were not adjusted for the impact of the COVID pandemic.

2. Background Traffic Growth – In order to be conservative, a 2.2% annual growth rate was applied to existing traffic volumes to account for development outside the study area. No background development were identified by the County or VDOT within the vicinity of the proposed development.

3. Trip Generation – Traffic generated by the proposed development was estimated using the total existing traffic entering the school complex. See Chapter 5 for further discussion.

4. Traffic Distributions – The distribution of trips generated by the proposed developed was based on the existing traffic volumes, the nature of the use, and local knowledge.

5. Traffic Projections – Future traffic volumes were determined using the existing traffic counts, a 2.2% annual growth rate on all existing intersection movements, and the trips generated by the site.

6. Peak Hour Factor – To accurately model the congested arrival/departure times of traffic at the school, the existing peak hour factor was used in background and future analysis at intersections adjacent to the school complex.

7. Traffic Capacity Analysis – Level of service calculations for existing, background, and future conditions were performed using SYNCHRO Version 11 for signalized and unsignalized intersections.

8. Queuing Analysis – The 95th percentile (Synchro) and maximum (SimTraffic) queue lengths were reviewed at the intersections listed above.

1.3 PRINCIPAL FINDINGS

- The 2023 existing conditions analysis indicates that all study area intersections operate at acceptable levels of service during both peak hours. Existing queueing challenges exist at the Hydraulic Road/Lambs Road and Hydraulic Road/Georgetown Road intersections as described in Chapter 3.

- Under 2033 background conditions analysis, the study area intersections are able to handle the increase in traffic associated with the 2.2% annual growth rate with minimal changes in delay/operations. Note that the traffic signal timings at the existing signalized study intersections were optimized.

- Five years of crash data were analyzed and found 68 crashes in the study area. A majority of the crashes had minor injury or property damage severity while the most prevalent crash types were angle and rear-end. There was one pedestrian and one bicycle crash. The highest number of crashes occurred at the Hydraulic Road/Georgetown Road intersection, followed by the Hydraulic Road/Lambs Road intersection.

- As discussed in Chapter 6, improvements are recommended for the Hydraulic Road corridor. These improvements include installing a raised median between the Lambs Road/Whitewood Road intersection and the Georgetown Road intersection to improve access management and safety. An alternatives analysis using the VJuST tool was performed at the two existing signalized study intersections. No improvements to intersection control or signal phasing is recommended at Hydraulic Road at Lambs Road/Whitewood Road. A thru-cut intersection is recommended to be implemented at the Hydraulic Road/Georgetown Road intersection along with an overlap phase for the southbound right to improve operations and safety.

- As discussed in Chapter 7, there are several alternatives to improve pedestrian safety and access at the Hydraulic Road and Lambs Road/Whitewood Road intersection. These alternatives range from signal timing changes to constructing new ADA curb ramps and reducing curb radius to slow vehicles. Potential new pedestrian crossings were examined on Hydraulic Road between the Proposed Loop Road and Georgetown Road. Based on the design of the proposed continuous green-T intersection at Hydraulic Road and the Proposed Loop Road, a pedestrian crosswalk across Hydraulic Road is not recommended. At Hydraulic Road and Georgetown Road, the existing ADA curb ramps and pedestrian signals are recommended to be upgraded. In addition, bus stop amenities are recommended for the nearby CAT bus stops.

- As discussed in Chapter 8, a Proposed Loop Road will be constructed between Hydraulic Road (near Georgetown Green) to Lambs Lane (near the football stadium). Three scenarios have been identified for the potential alignment of the New Loop Road and its intersection with Hydraulic Road. The VJuST tool was used to identify the best intersection design at this location for each scenario. The results indicated that an unsignalized continuous-T intersection is the recommended alternative for the short term.

- As discussed in Chapter 9, a signal warrant analysis was conducted for the Hydraulic Road/Proposed Loop Road intersection with the collected 6 hours of traffic data. The results indicate that the traffic volumes meet the Peak Hour Warrant for installation of a traffic signal. Based on the spacing of the adjacent existing traffic signals along Hydraulic Road, an Access Management Exception would be required from VDOT to install a traffic signal at this location.

- The three Loop Road alignment scenarios were evaluated to determine the best location of the future Hydraulic Road/New Loop Road intersection. Based on the geometric design of the

continuous green-T, the only alignment scenario that allows the required spacing between the future Loop Road and the existing Lambs Road/Whitewood Road intersection is Scenario 1. Therefore, the recommended alignment for the new loop road follows the property boundary line to provide the most spacing.

- Capacity analyses were completed in 2033 for the three Loop Road alignment scenarios with the addition of new traffic associated with the proposed development and relocation of existing traffic. The results indicate that the levels of service at the study intersections do not change significantly compared to 2033 background conditions. Delay at the Hydraulic Road/Georgetown Road intersection was considerably reduced by implementing the recommended thru-cut intersection as discussed in Chapter 6. In each of the three alignment scenarios, signalized continuous green-T intersection at Hydraulic Road/Proposed Loop Road is able to handle the projected traffic volumes without excessive delay or major impacts to through traffic along Hydraulic Road.

- Roundabouts were analyzed further at the Hydraulic Road at Lambs Road/Whitewood Road and Hydraulic Road at the Proposed Loop Road intersections. Due to the minimum design requirements of a dual lane roundabout, both locations would require right of way acquisition to install the roundabout. Additionally, since the Proposed Loop Road intersection is only approximately 550 feet away from the existing traffic signal at Georgetown Road, a roundabout at this location is not recommended. From a vehicle operational perspective, installation of a roundabout does improve delay and queue lengths for mainline through movements. However, large bands of through vehicles being produced from a nearby signal could create queuing issues at the roundabout.

- A roundabout is not recommended at the Lambs Road/Whitewood Road intersection due to the high volume of pedestrians crossing there. Per the new Public Rights of Way Accessibility Guidelines (PROWAG) standards for roundabout designs, any pedestrian crossing of two or more lanes requires a traffic signal or pedestrian hybrid beacon for the crosswalk. This would greatly reduce vehicle operations of the roundabout and does not significantly change the way pedestrians would cross Hydraulic Road today with the existing traffic signal.

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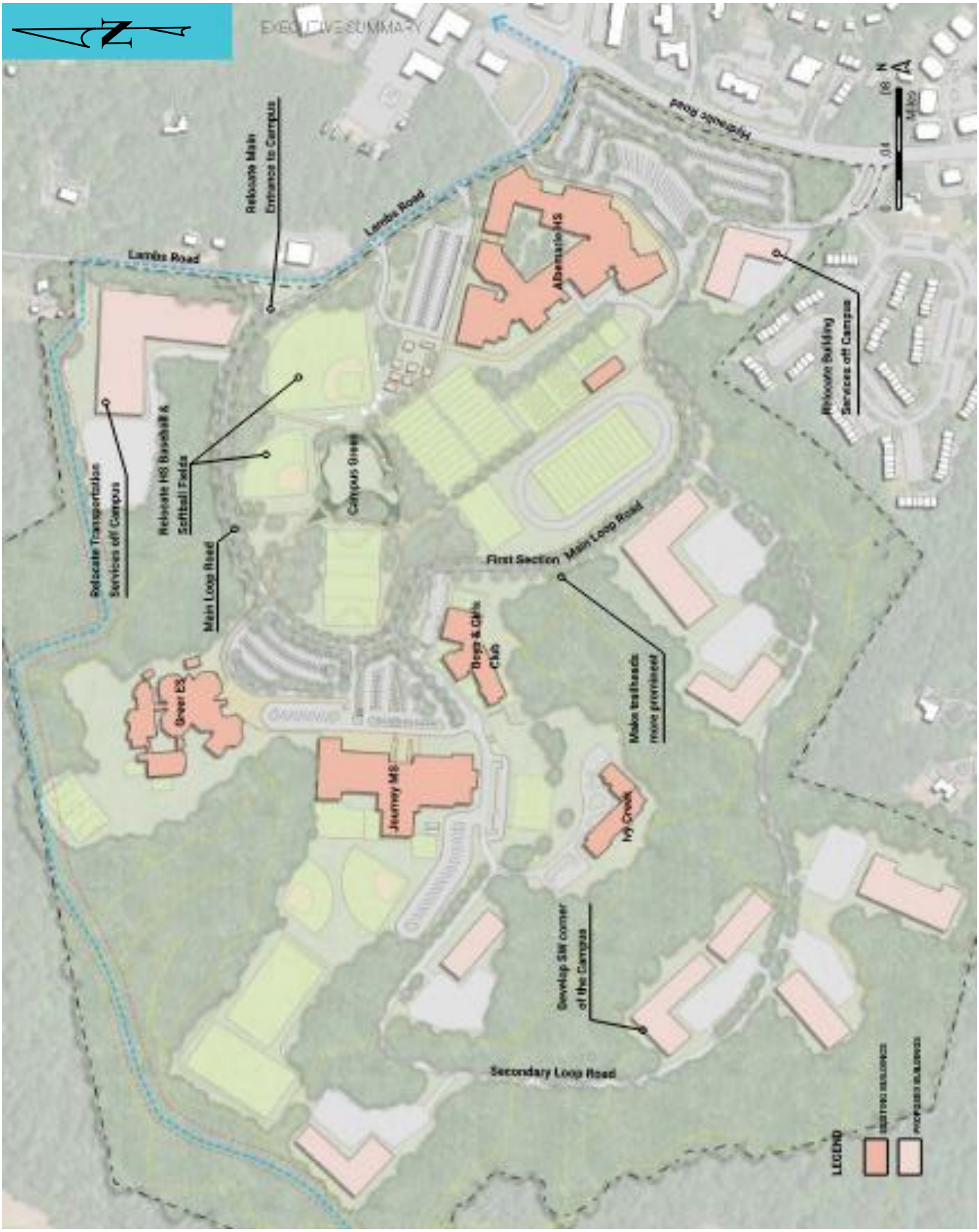
Surrounding Roadway Network
Lambs Lane Loop Road Analysis
Albemarle County, Virginia

Figure 1-1



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Draft Conceptual Plan (Lambs Lane Master Plan)
Lambs Lane Loop Road Analysis
Albemarle County, Virginia

Figure
1-2

2 BACKGROUND INFORMATION

Albemarle County Public Schools are evaluating proposed future uses of the county property that currently encompasses the area surrounding Albemarle High School (AHS), Journey Middle School (JMS), and Greer Elementary School (GES). This report also investigates the impact of completing a loop road through the proposed development that connects between Hydraulic Road (near Georgetown Green) and Lambs Lane (near Journey Middle School).

In order to understand the impact the proposed development will have on the surrounding roadway network, Albemarle County requested Timmons Group to complete an operational analysis in the study area to make recommendations on necessary traffic improvements associated with the proposed development.

2.1 DESCRIPTION OF DEVELOPMENT

Excluding the existing three schools on the property, the existing site is undeveloped. Based on coordination with Albemarle County Public Schools (ACPS), the proposed development program is unknown; however, it will not consist of a new school. It was assumed that the proposed development will generate 25% of the existing total traffic entering the existing school complex, as discussed in Chapter 5. A draft concept plan is shown on Figure 1-2. For purposes of this analysis, the redevelopment was assumed to be complete and occupied by 2033.

2.2 STUDY AREA LIMITS

The study limits include the following existing intersections (see Figure 1-1):

1. Lambs Road and Lambs Lane (unsignalized);
2. Lambs Road and AHS Exit (unsignalized);
3. Hydraulic Road and Lambs Road/Whitewood Road (signalized);
4. Hydraulic Road and AHS Entrance/Hydraulic Ridge Road (unsignalized);
5. Hydraulic Road and Georgetown Green (unsignalized); and
6. Hydraulic Road and Georgetown Road (signalized).

2.3 EXISTING ROADWAY NETWORK

Hydraulic Road (Route 743) is a minor arterial with a posted speed limit of 35 mph. An existing school zone speed limit of 25 mph is present on Hydraulic Road in the area of Albemarle High School (Arbor Crest Drive to 355 ft north of the Hydraulic Road/Lambs Road intersection). The roadway has a five-lane undivided cross section (including two-way left-turn lane) and runs north-south within the study limits. The 2021 VDOT traffic count data shows that Hydraulic Road carries approximately 19,000 vehicles per day within the study area. Hydraulic Road has sidewalks along both sides and on-street bicycle lanes north of the Hydraulic Road/Lambs Road intersection.

Georgetown Road (Route 656) is a two-lane undivided major collector with a posted speed limit of 35 mph. Georgetown Road runs east-west within the study limits. The 2021 VDOT traffic data shows that Georgetown Road carries approximately 14,000 vehicles per day within the study area. Georgetown Road has a sidewalk along the north side and no bicycle lanes.

Lambs Road (Route 657) is a two-lane undivided local road with a posted speed limit of 30 mph and a school zone speed limit of 25 mph. Lambs Road runs east-west within the study limits. The 2021 VDOT traffic data shows that Lambs Road carries approximately 5,000 vehicles per day within the study area. Lambs Road has no bicycle lanes and a sidewalk along the south side Between Hydraulic Road and the AHS Exit.

Lambs Lane (Route 9885) is a two-lane undivided local road with a posted speed limit of 25 mph and runs east-west within the study area. Traffic data published by VDOT was not available. Lambs Lane has no sidewalks or bicycle lanes.

Whitewood Road (Route 1455) is a two-lane undivided major collector with a posted speed limit of 35 mph and a school zone speed limit of 25 mph. The roadway runs east-west within the study area. The 2021 VDOT traffic data shows that Whitewood Road carries approximately 3,600 vehicles per day within the study area. Whitewood Road has sidewalks along both sides and on-street bicycle lanes between Hydraulic Road and Oak Forest Drive.

It was assumed that all school zone speed limits were active in this area during both AM and PM peak hours of this analysis. The existing lane use and intersection control at the study intersections are shown in Figure 2-1.

2.4 Future Improvements

There are no planned or funded roadway improvements within the study area outside of the improvements proposed by this report.

Albemarle County Public Schools (ACPS) developed the *Lambs Lane Master Plan* (included in Appendix A), which includes high-level planning of the overall property and a general description of the Proposed Loop Road.

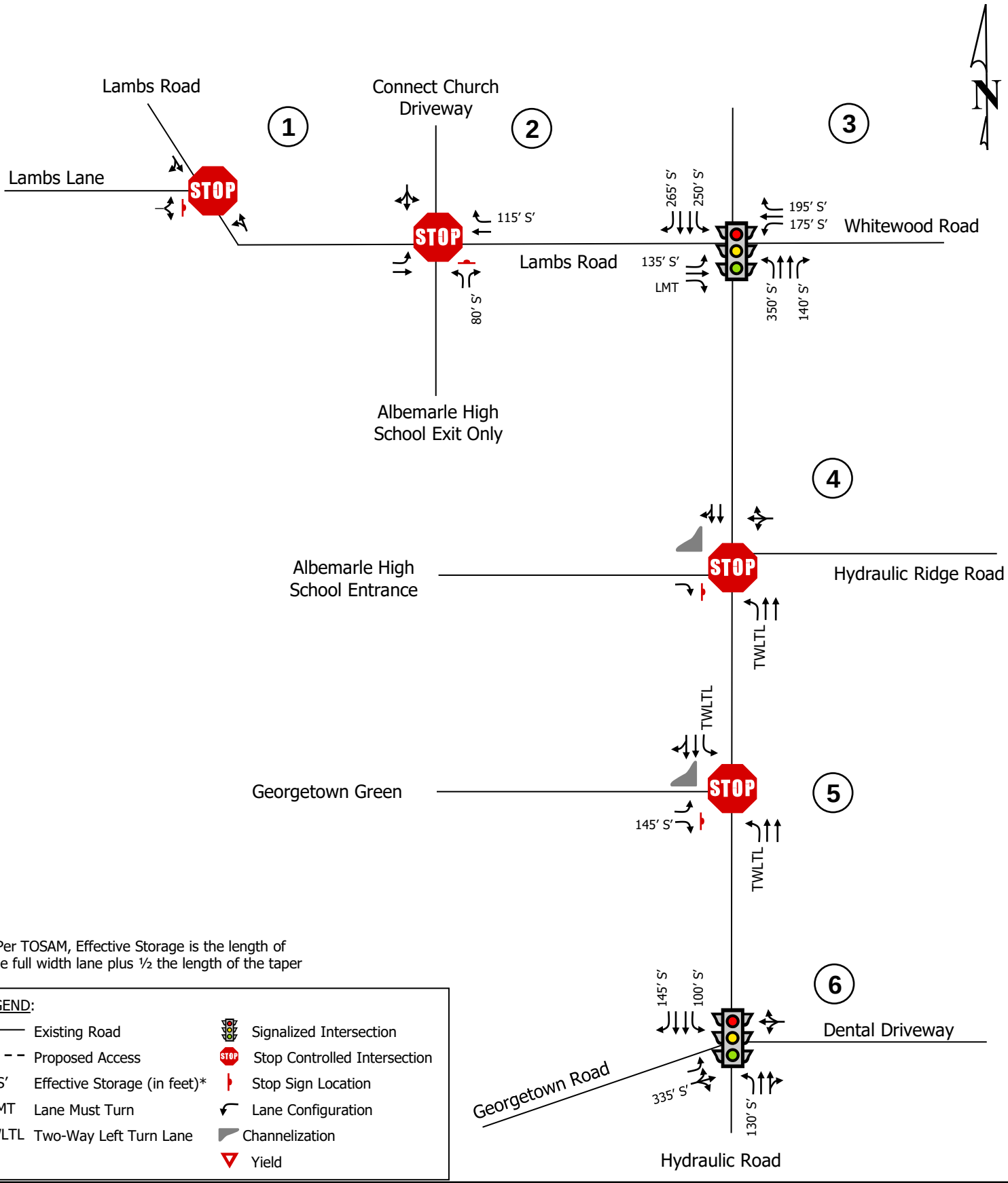
2.5 Site Improvements

The proposed development will construct an internal loop roadway that connects between Hydraulic Road and Lambs Lane, opening up future development potential for the schools campus as well as providing a secondary access point for traffic.

To accommodate the proposed site traffic, an alternative intersection analysis using the VDOT Junction Screening Tool (VJuST) was conducted at the intersections of Hydraulic Road with Lambs Road/Whitewood Road, the Proposed Loop Road, and Georgetown Green. Access management was also examined along the Hydraulic Road corridor from Lambs Road/Whitewood Road to Georgetown Road. The results are discussed further in Chapters 6 and 9.

2.6 Other Modes of Transportation

Currently, there are sidewalks and bicycle lanes in the study area, but only the sidewalk on Hydraulic Road and Georgetown Road extends outside the study area. The Charlottesville Area Transit (CAT) bus route #5 runs along Georgetown Road to Hydraulic Road and does not travel close to Albemarle High School campus. As a result, no reduction in trips was taken for other modes of transportation.



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Existing Geometry and Stop Control
Lambs Lane Loop Road Analysis
Albemarle County, Virginia

Figure 2-1

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3 ANALYSIS OF EXISTING CONDITIONS

3.1 EXISTING TRAFFIC VOLUMES

Directional turning movement counts (TMCs) were taken on March 30, 2023 at the study intersections discussed above during the morning (8:00-10:00 AM) and afternoon (3:00-5:00 PM) peak periods of the school. The TMCs included heavy vehicles by movement, pedestrians, and bicycles.

As noted above, this analysis was conducted during the ongoing COVID-19 pandemic which has impacted typical traffic patterns. As such, all counts used in the analysis were compared to prior counts were found to be similar to pre-pandemic levels. Therefore, no adjustment was made for the COVID-19 pandemic.

The peak hours analyzed in this report align with the highest traffic volumes of the roadway network and occur during the anticipated school arrival/dismissal time periods. The morning peak hour (8:00-9:00 AM) was determined by the highest hour of total traffic on the study area road network. The evening peak hour (3:45-4:45 PM) was determined by the anticipated school dismissal time of 3:45 PM. The existing 2023 peak hour traffic volumes for vehicles and pedestrians are shown on Figures 3-1 and 3-2, respectively.

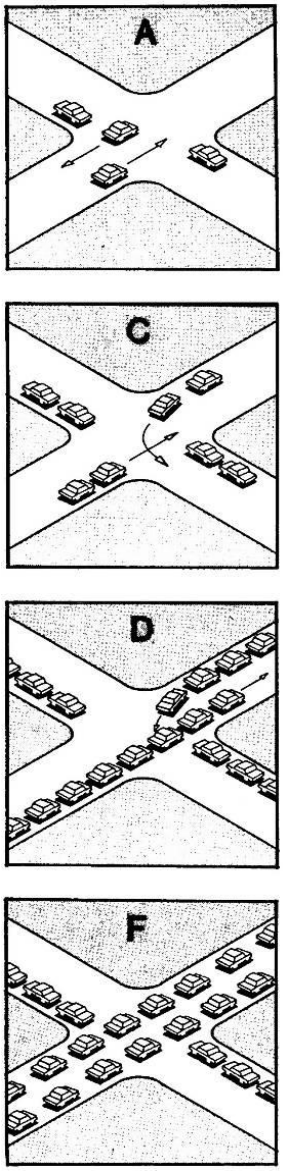
A copy of the count data is included in Appendix B. Existing traffic signal timings were provided by VDOT and are included in Appendix C.

3.2 CAPACITY ANALYSES

Capacity analysis allows traffic engineers to determine the impacts of traffic on the surrounding roadway network. The Highway Capacity Manual methodologies govern how the capacity analyses are conducted and how the results are interpreted. Levels of service (LOS) are determined for each part of the roadway network. The general standard for an overall intersection is LOS D representing acceptable results and the standard for individual traffic movements is LOS E. Table 3-1 shows in detail how each of these levels of service are interpreted.

Table 3-1: Level of Service Definitions

Level of Service	Roadway Segments or Controlled Access Highways	Intersections
A	Free flow, low traffic density.	No vehicle waits longer than one signal indication.
B	Delay is not unreasonable, stable traffic flow.	On a rare occasion motorists wait through more than one signal indication.
C	Stable condition, movements somewhat restricted due to higher volumes, but not objectionable for motorists.	Intermittently drivers wait through more than one signal indication, and occasionally backups may develop behind left turning vehicles, traffic flow still stable and acceptable.
D	Movements more restricted, queues and delays may occur during short peaks, but lower demands occur often enough to permit clearing, thus preventing excessive backups.	Delays at intersections may become extensive with some, especially left-turning vehicles waiting two or more signal indications, but enough cycles with lower demand occur to permit periodic clearance, thus preventing excessive backups.
E	Actual capacity of the roadway invloves delay to all motorists due to congestion.	Very long queues may create lengthly delays, especially for left-turning vehicles.
F	Forced flow with demand volumes greater than capacity resulting in complete congestion. Volumes drop to zero in extreme cases.	Backups from locations downstream restrict or prevent movement of vehicles out of approach creating a storage ares during part or all of an hour.



SOURCE: *"A Policy on Design of Design of Urban Highways and Arterial Streets"* - AASHTO, 1973 based upon material published in *"Highway Capacity Manual"*, National Academy of Sciences, 1965.

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For both unsignalized and signalized intersections, level of service is defined in terms of delay, a measure of driver discomfort, frustration, fuel consumption, and lost travel time. Table 3-2 summarizes the delay associated with each LOS category:

Table 3-2: Unsignalized and Signalized Intersection Level of Service Criteria

Signalized Intersections		Unsignalized Intersections	
Level of Service	Control Delay per Vehicle (sec/veh)	Level of Service	Average Control Delay (sec/veh)
A	≤ 10	A	0 to 10
B	> 10 to ≤ 20	B	> 10 to ≤ 15
C	> 20 to ≤ 35	C	> 15 to ≤ 25
D	> 35 to ≤ 55	D	> 25 to ≤ 35
E	> 55 to ≤ 80	E	> 35 to ≤ 50
F	> 80	F	> 50

Source: Exhibit 16-2 and Exhibit 17-2 from TRB's "Highway Capacity Manual 2000"

Capacity analyses were performed to assess existing (2023), background (2033), and future (2033) operational conditions. These intersections, both signalized and unsignalized, were analyzed using SYNCHRO Version 11 based on HCM 2000 methodologies and SIDRA Version 9 with the following assumptions:

- Level terrain.
- 12-foot lane widths.
- No parking activity or bus stops.
- The higher of the existing peak hour factor as determined by the traffic counts (by intersection) or a peak hour factor of 0.92. The existing peak hour factors at intersections #1-5 will be utilized in all future year analysis scenarios to accurately reflect operations of the adjacent schools nearby.
- Heavy vehicle percentage as determined by the traffic counts (by movement).

Queuing analyses were conducted using both the HCM 2000 methodology (as calculated by SYNCHRO) and SimTraffic simulations. The Synchro 95th percentile queue is the maximum back of queue for a particular lane within a lane group considering 95th percentile traffic volumes. The SimTraffic maximum queues are the average maximum queues after 10 runs of 60 minutes each.

Note that it is possible for the 95th percentile queue to be higher than the SimTraffic maximum queue due to the method in which each software calculates its respective value. The 95th percentile queue is based on an HCM formula and therefore is theoretical while the SimTraffic maximum queue varies based on simulation results.

3.3 2023 EXISTING TRAFFIC CONDITIONS

Table 3-3 summarizes the 2023 existing intersection LOS, delay, 95th percentile (Synchro), and maximum (SimTraffic) queue lengths based on the 2023 existing peak hour traffic volumes shown on Figure 3-1, the existing lane geometry shown on Figure 2-1, and the existing traffic signal timings. The corresponding analysis worksheets are included in Appendix D.

As shown in Table 3-3, the analysis results of 2023 existing conditions indicate:

- At the unsignalized study intersections (#1, 2, 4, 5) all movements operate at a LOS B or better during both peak hours. All turning movements have adequate turn lane storage to accommodate 95th percentile and maximum simulated queue lengths.

- At the signalized intersection of Hydraulic Road at Lambs Road/Whitewood Road, the overall intersection operates at a LOS C during both peak hours.
    - The side street east- and west-bound movements and approaches operate at a LOS D or better during both peak hours. During both peak hours, the EB left maximum queue exceeds the available storage, spilling back into the through lane.
    - The mainline north- and south-bound movements and approaches operate at a LOS C or better during both peak hours. During the AM peak, the SB through maximum queue backs up past the left- and right-turn lanes, blocking them. During the PM peak, the NB through maximum queue backs up to the AHS Entrance/Hydraulic Ridge Road intersection.
    - All other turning movements have adequate turn lane storage to accommodate the 95th percentile and maximum simulated queue lengths.

- At the signalized intersection of Hydraulic Road at Georgetown Road, the overall intersection operates at a LOS C during both peak hours.
    - The east- and west-bound movements and approaches operate at a LOS D or better during both peak hours. The mainline north- and south-bound movements and approaches operate at a LOS C or better during both peak hours. During both peak hours, the SB through maximum queue backs up through the intersection with Georgetown Green.
    - All other turning movements have adequate turn lane storage to accommodate the 95th percentile and maximum simulated queue lengths.

Table 3-3: Intersection Analysis Summary
2023 Existing Traffic Volumes

Intersection and Type of Control	Movement and Approach	Turn Lane Storage (ft)	AM PEAK HOUR				PM PEAK HOUR			
			Delay [1] (sec/veh)	LOS [1]	HCS 95th Percentile Queue Length (ft)	Simulated Maximum Queue Length (ft)	Delay [1] (sec/veh)	LOS [1]	HCS 95th Percentile Queue Length (ft)	Simulated Maximum Queue Length (ft)
1. Lambs Road (E-W) at	EB Thru/Right		†	†	0	--	†	†	0	--
Lambs Lane (N-S)	*SB Approach*		†	†	--	--	†	†	--	--
Unsignalized	WB Left/Thru		9.0	A	52	137	6.5	A	12	69
	NB Approach		9.0	A	--	--	6.5	A	--	--
	NB Left/Right		11.0	B	29	65	12.0	B	63	111
	EB Approach		11.0	B	--	--	12.0	B	--	--
2. Lambs Road (E-W) at	EB Left/Thru		0.0	A	0	--	0.0	A	0	9
AHS Exit Only (N-S)	*EB Approach*		*0.0*	*A*	--	--	*0.0*	*A*	--	--
Unsignalized	WB Thru		†	†	0	--	†	†	0	--
	WB Right		†	†	0	--	†	†	0	--
	WB Approach		†	†	--	--	†	†	--	--
	NB Left		13.6	B	40	66	17.0	B	51	72
	NB Right	80	13.6	B	40	73	17.0	B	51	77
	NB Approach		13.6	B	--	--	17.0	B	--	--
	SB Left/Thru/Right		0.0	A	0	--	0.0	A	0	--
	SB Approach		*0.0*	*A*	--	--	*0.0*	*A*	--	--
3. Hydraulic Road (N-S) at	EB Left	135	41.9	D	126	144	36.7	D	194	157
Lambs Road/Whitewood	EB Thru		42.1	D	72	136	33.0	C	60	240
Road (E-W)	EB Right		40.9	D	39	136	32.9	C	47	166
Signalized	*EB Approach*		*41.5*	*D*	--	--	*34.7*	*C*	--	--
	WB Left	175	43.7	D	135	158	28.6	C	93	124
	WB Thru		44.3	D	96	192	38.5	D	36	75
	WB Right	195	40.6	D	0	69	38.2	D	0	107
	WB Approach		*43.2*	*D*	--	--	*34.1*	*C*	--	--
	NB Left	350	21.1	C	109	256	16.7	B	45	205
	NB Thru		19.7	B	158	243	27.8	C	304	368
	NB Right	140	17.2	B	8	140	20.0	B	0	140
	NB Approach		*19.6*	*B*	--	--	*26.1*	*C*	--	--
	SB Left	250	13.0	B	53	250	26.7	C	43	128
	SB Thru		27.5	C	342	792	24.1	C	211	323
	SB Right	265	19.0	B	14	265	19.8	B	0	105
	SB Approach		*25.3*	*C*	--	--	*23.9*	*C*	--	--
	Overall		**27.7**	**C**	**--**	**--**	**28.0**	**C**	--	--
4. Hydraulic Road (N-S) at	EB Right		9.4	A	0	30	10.3	B	17	121
Hydraulic Ridge Road (WB) /	*EB Approach*		*9.4*	*A*	--	--	*10.3*	*B*	--	--
AHS Entrance (EB)	WB Left/Thru/Right		18.0	B	5	53	14.9	B	5	45
Unsignalized	*WB Approach*		*18.0*	*B*	--	--	*14.9*	*B*	--	--
	NB Left	200	9.5	A	15	140	9.5	A	4	62
	NB Thru		†	†	0	--	†	†	0	3
	NB Thru/Right		†	†	0	--	†	†	0	11
	NB Approach		*1.5*	*A*	--	--	*0.4*	*A*	--	--
	SB Left/Thru		0.0	A	0	265	0.1	A	0	56
	SB Thru/Right		†	†	0	370	†	†	0	116
	SB Approach		*0.0*	*A*	--	--	*0.1*	*A*	--	--
5. Hydraulic Road (N-S) at	EB Left		11.4	B	12	62	13.5	B	14	116
Georgetown Green (E-W)	EB Right	145	11.4	B	12	99	13.5	B	14	115
Unsignalized	*EB Approach*		*11.4*	*B*	--	--	*13.5*	*B*	--	--
	NB Left	200	9.7	A	7	82	10.5	B	7	72
	NB Thru		†	†	0	2	†	†	0	--
	NB Approach		*0.7*	*A*	--	--	*0.6*	*A*	--	--
	SB Thru		†	†	0	16	†	†	0	17
	SB Thru/Right		†	†	0	143	†	†	0	80
	SB Approach		†	†	--	--	†	†	--	--
6. Hydraulic Road (N-S) at	EB Left		35.0	C	#414	311	35.7	D	#462	336
Georgetown Road (E-W)	EB Left/Thru/Right	335	32.8	C	#384	271	31.7	C	#406	298
Signalized	*EB Approach*		*33.9*	*C*	--	--	*33.8*	*C*	--	--
	WB Left/Thru/Right		42.7	D	15	24	43.4	D	18	21
	WB Approach		*42.7*	*D*	--	--	*43.4*	*D*	--	--
	NB Left	130	20.3	C	47	113	23.3	C	80	128
	NB Thru		15.6	B	121	188	16.5	B	124	217
	NB Thru/Right		15.6	B	121	139	16.5	B	124	181
	NB Approach		*16.2*	*B*	--	--	*18.0*	*B*	--	--
	SB Left	100	21.5	C	9	61	22.6	C	12	69
	SB Thru		24.9	C	156	414	26.6	C	170	412
	SB Right	145	24.1	C	80	145	26.0	C	92	145
	SB Approach		*24.5*	*C*	--	--	*26.2*	*C*	--	--
	Overall		**25.7**	**C**	--	--	**26.7**	**C**	--	--

[1] *Overall intersection LOS and delay reported for signalized intersections and roundabouts only.*

† SYNCHRO does not provide level of service or delay for unsignalized movements with no conflicting volumes.

- 95th percentile volume exceeds capacity, queue may be longer. Queue shown is maximum after two cycles.

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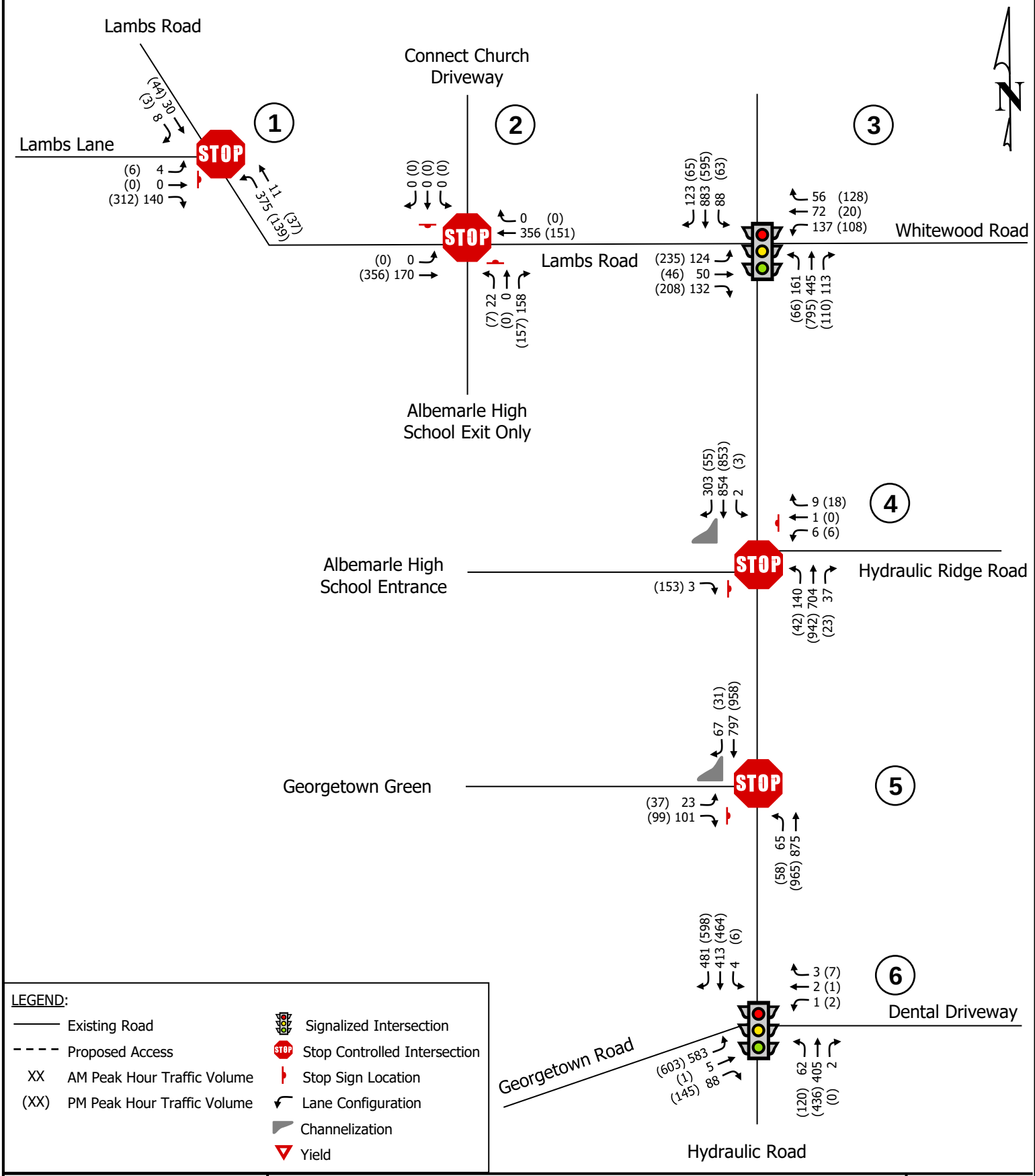

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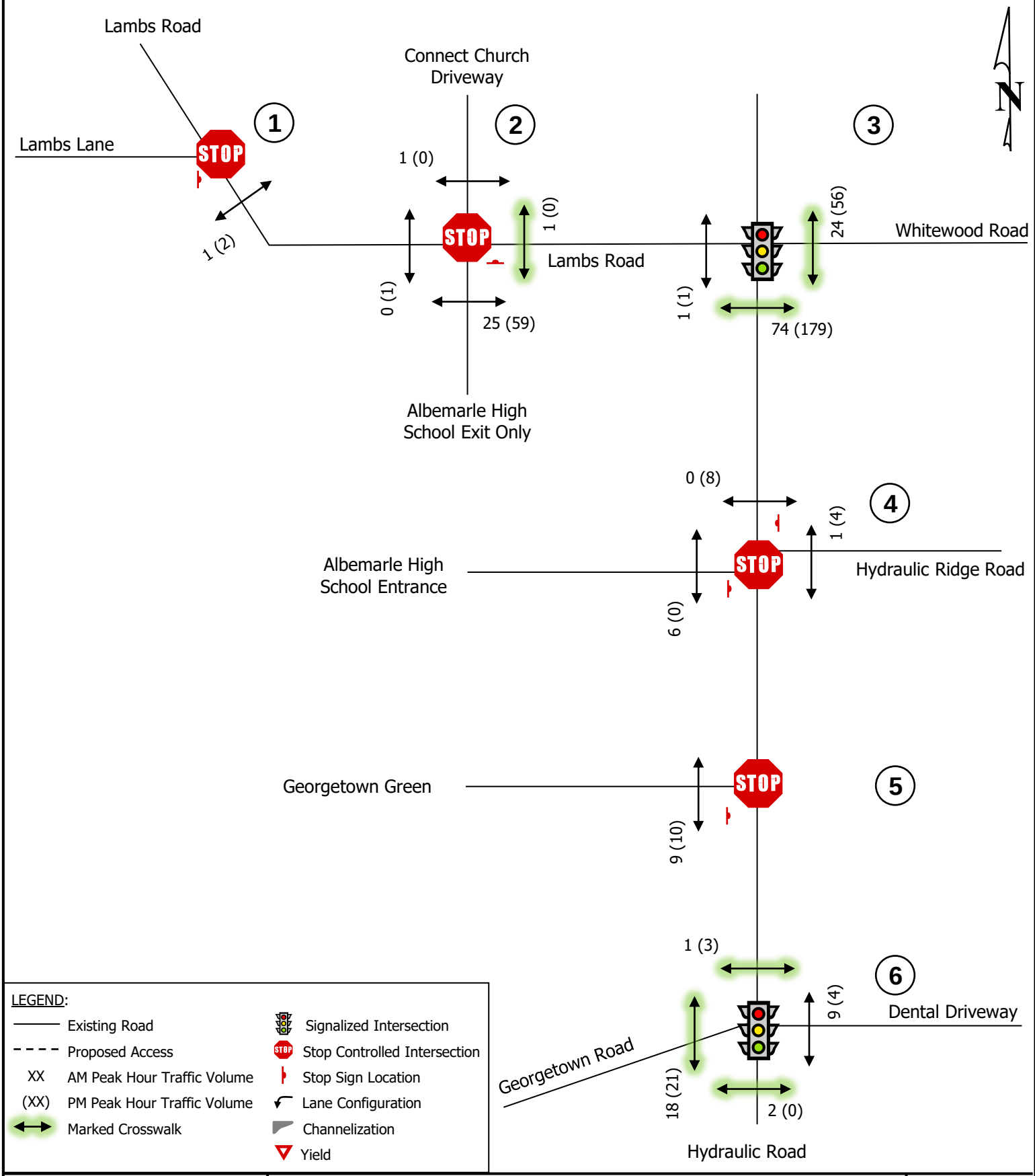
2023 Existing Peak Hour Traffic Volumes
Lambs Lane Loop Road Analysis
Albemarle County, Virginia

Figure 3-1



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2023 Existing Peak Hour Pedestrian Volumes
Lambs Lane Loop Road Analysis
Albemarle County, Virginia

Figure 3-2

4 CRASH HISTORY AND ANALYSIS

A crash analysis was completed using five years of publicly available crash data in the study area from February 28, 2018 to February 28, 2023 as published by VDOT. All crash data was downloaded via the VDOT Crash Analysis Tool (Virginia Roads). Data selections excluded work zone related crashes. Generally, a 500-foot radius from each intersection was used to capture and screen any intersection-related crashes on the side-street approaches. A copy of the complete crash data is included in Appendix E.

4.1 Comparison to Statewide Average

The total number of crashes along Hydraulic Road were compared to the Virginia statewide percentages for roadways of the same functional classification and area type. Hydraulic Road is considered an urban minor arterial. Table 4-1 shows the percentage of crash severity in Virginia for the February 28, 2018 to February 29, 2023 time period for urban, minor arterial roadways. Table 4-2 shows the percentage of each crash type under the same conditions.

Table 4-1: Virginia Statewide Percentage – Summary by Crash Severity

Crash Severity	Hydraulic Road % N=68	Statewide % N=108,520
"K" Fatal Crash	0%	0%
"A" Severe Injury Crash	3%	4%
"B" Moderate Injury Crash	7%	21%
"C" Nonvisible Injury Crash	38%	10%
"O" Property Damage Only Crash	51%	64%
Total	*100%*	*100%*

Table 4-2: Virginia Statewide Percentage Comparison by Crash Type

Crash Type	Hydraulic Road % N=68	Statewide % N=108,520
Angle	41%	39%
Rear End	41%	32%
Fixed Object – Off Road	1%	9%
Sideswipe – Same Direction	10%	7%
Other	1%	3%
Head On	0%	3%
Deer	0%	2%
Ped	1%	2%
Sideswipe – Opposite Direction	1%	1%
Non-Collision	1%	1%
Fixed Object in Road	0%	1%
Backed Into	0%	0%
Other Animal	0%	0%
Train	0%	0%
Bicyclist	0%	0%
Motorcyclist	0%	0%
Total	*100%*	*100%*

Based on the statewide data shown in Tables 4-1 and 4-2, the Hydraulic Road corridor experiences similar crash type patterns compared to other urban minor arterial roadways in Virginia. Angle and rear end are the most frequent crash types in both data sets. However, regarding crash severity, the Hydraulic Road corridor trended toward less severe crashes compared to the statewide data.

4.1 Summary of Study Area Crashes

Within the study area, there were 68 total crashes. Analyzing the crash year, there is no conclusive upward or downward trend in the number of crashes per year (excluding the outlier of 2020). However, there have been zero "A" severe injury crashes since 2018.

The highest concentration of crashes occurs at the Hydraulic Road/Georgetown Road (27 crashes) and Hydraulic Road/Lambs Road (22 crashes) intersections, followed by Georgetown Green (10 crashes) and the remainder of the Hydraulic Corridor (9 crashes). For reference, "Elsewhere" is defined as the areas outside a 500' radius from the three main intersections. A heat map of the crashes is shown on Figure 4-1.

The majority of the crashes (51%) were property damage only, followed by nonvisible injury "C" crashes (38%). Table 4-3 shows the number of each crash severity type at each intersection within the study area. Crash severity is represented using the KABCO scale, with the following classifications:

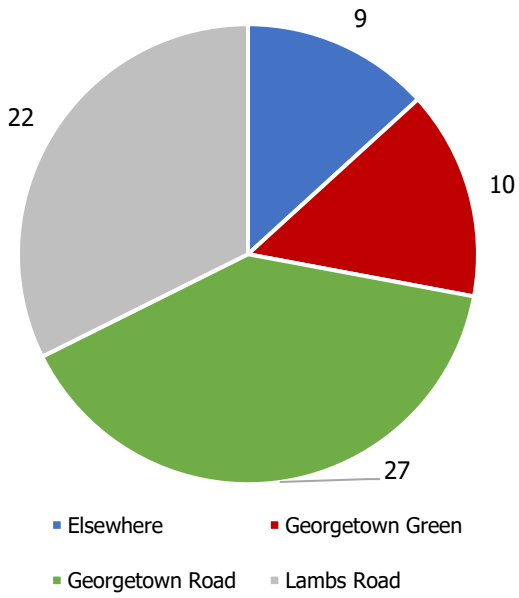
- K – Fatality
- A – Severe/Incapacitating Injury
- B – Minor Injury
- C – Nonvisible Injury
- O – Property Damage Only

One "A" severe injury crash occurred at each the Hydraulic Road/Lambs Road and Hydraulic Road/Georgetown Road intersections.

At Lambs Road, the "A" crash was an angle crash where an eastbound left turning vehicle who was a young driver disregarded the traffic signal and collided with a northbound through vehicle.

At Georgetown Road, the "A" crash was a westbound rear-end crash occurring at night during rain. The driver who hit the stopped vehicle was aged 65+ and had consumed alcohol (coded as "obviously drunk").

Total Crashes by Intersection



Hydraulic Road Corridor Crash Severity

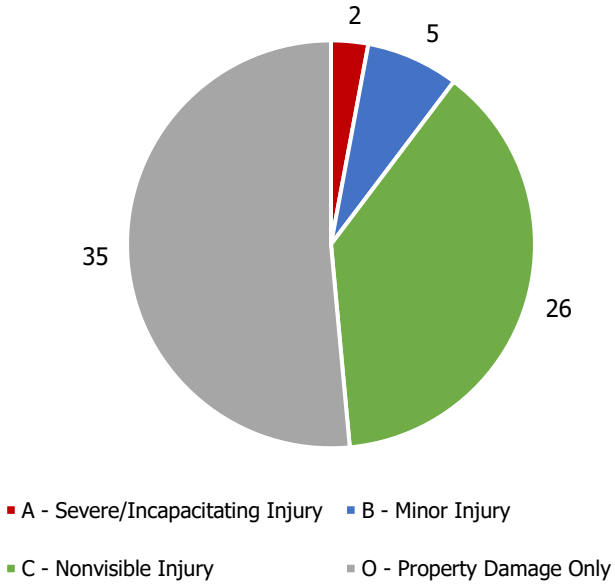
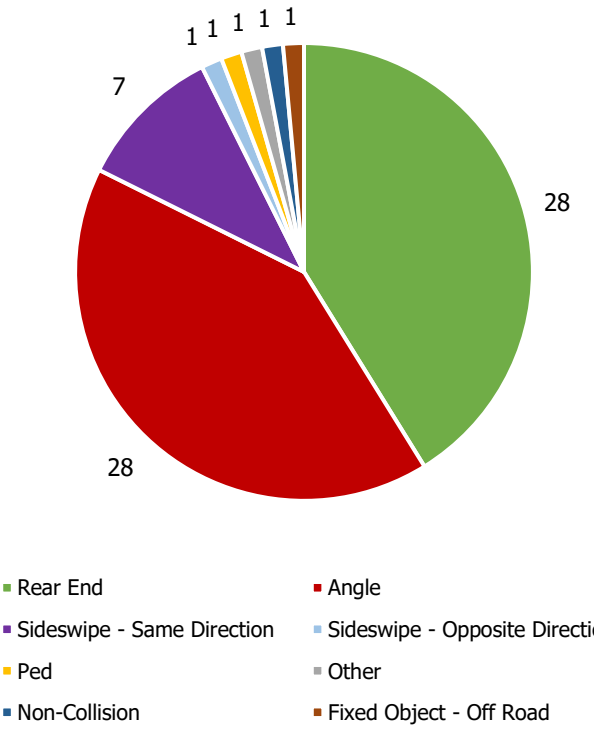


Table 4-3: Crash Severity by Intersection

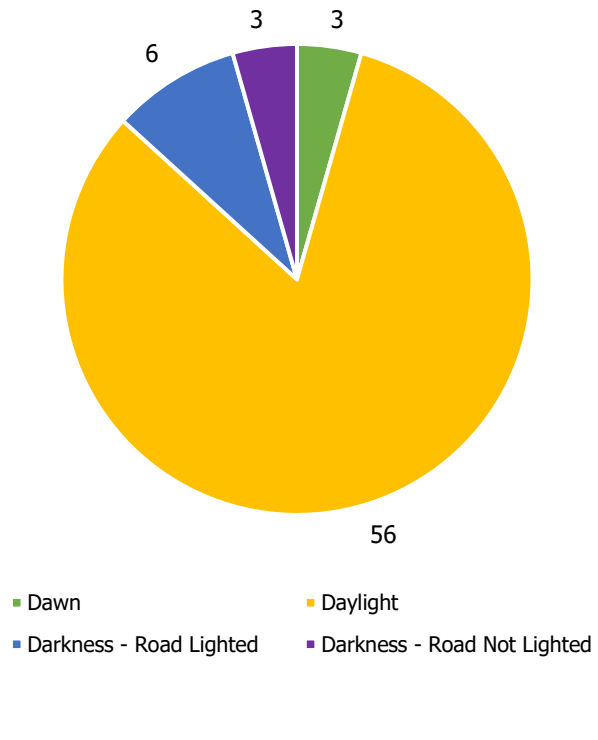
Intersection	Crash Severity			
	"A" - Severe/ Incapacitating Injury	"B" Minor Injury	"C" Nonvisible Injury	"O" Property Damage Only
Lambs Road	1	3	3	12
Georgetown Green			6	7
Georgetown Road	1	2	13	11
Elsewhere			4	5

Across the study area, the predominant crash type is angle crashes (41%) and rear-end crashes (41%). The majority of the crashes (82%) occurred during daylight. There was one pedestrian crash and one bicycle crash in the study area. Both occurred at the Hydraulic Road/Georgetown Road intersection. The pedestrian crash involved a westbound through vehicle colliding with a pedestrian who sustained a "B" minor injury and who was crossing the intersection diagonally. The driver's view was obstructed by other vehicles. The bicycle crash occurred between an eastbound through vehicle with a young driver and a westbound left turning bicyclist, who sustained a "C" nonvisible injury. Both persons disregarded the traffic signal.

Hydraulic Road Corridor Crash Type



Hydraulic Road Corridor Lighting Condition



Other key crash attributes include: 17 crashes (25%) involved a senior driver (age 65+); 24 crashes (35%) involved a young driver (age 15-21); 10 crashes (15%) involved a distracted driver; 5 crashes (7%) crashes occurred during rain; and 24 crashes (26%) occurred at night. Twenty-eight (41%) crashes occurred within a school zone; of those, 9 (13%) occurred when the school zone was active.

Maps including the approximate location of each of the crashes were generated for the three intersections along Hydraulic Road with Lambs/Whitewood Road, Georgetown Green, and Georgetown Road. Crash severity maps are shown on Figures 4-2 to 4-4. Crash type maps are shown on Figures 4-5 to 4-7.

Table 4-4 shows the number of each crash type at each intersection within the study area. For reference, "Elsewhere" is defined as the areas outside a 500' radius from the three main intersections.

Table 4-4: Crash Type by Intersection

Intersection	Crash Type							
	Angle	Rear-End	Pedestrian	Sideswipe-Same Direction	Sideswipe-Opposite Direction	Non-Collision	Fixed Object Off Road	Other
Lambs Road	5	16		1				
Georgetown Green	9	1						
Georgetown Road	14	3	1	9	1	1	1	
Elsewhere		8						1

Note: The crash type coded in the crash report may not represent all attributes of the crash. For example, one angle crash in the data set involved a bicycle.

4.2 VDOT Safety Improvement Plans

The VDOT Potential Safety Improvement (PSI) Map was analyzed for the Hydraulic Road study area. The map is available at this link: http://bit.ly/3MkJYhT. The map analyzes crashes between 2018 and 2022 and ranks roadway segments and intersections for each VDOT district.

The Hydraulic Road/Georgetown Road intersection is recommended for improvement and is ranked #96 in the Culpeper District. Between 2018 and 2022, there were a total of 23 crashes, with 13 of them being fatal and injury crashes.

Two roadway segments which are adjacent to the study area are recommended for improvement:

- Hydraulic Road from Lambs Road to Unity Church Entrance – District Rank #106
- Georgetown Road from Hydraulic Road to Court Place – District Rank #109

The VDOT Pedestrian and Bicycle Safety Action Plan (PBSAP) Map was analyzed for the Hydraulic Road study area. The map is available at this link: https://bit.ly/46XC07K. The map analyzes crashes between 2018 and 2022 and ranks roadway segments for each VDOT district and statewide.

Several roadway segments are listed in the top 5% statewide:

- Hydraulic Road (US 29 to Rio Road)
- Georgetown Road (Court Place to Hydraulic Road)
- Whitewood Road (Oak Forest Drive to Hydraulic Road)

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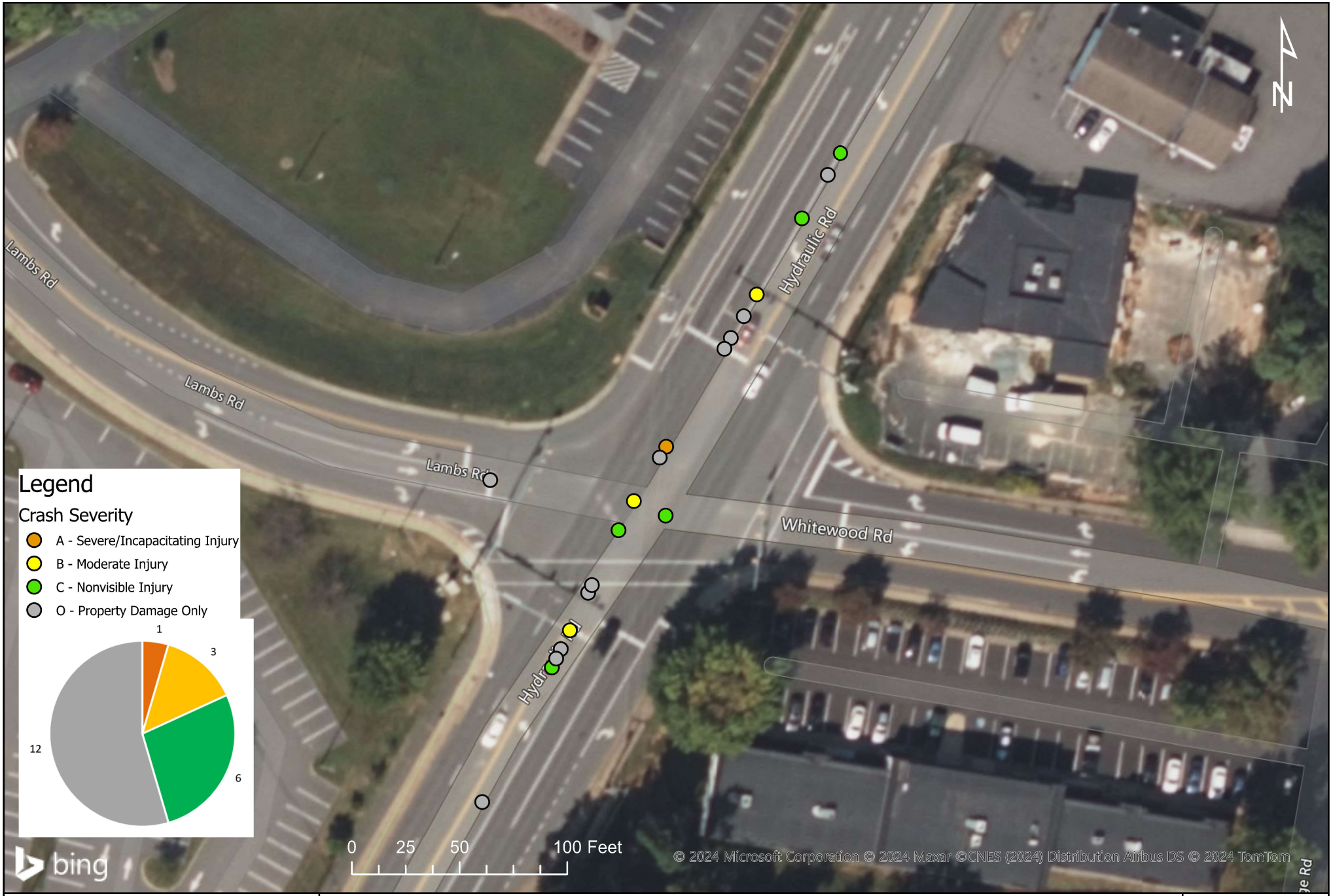
Crash Heat Map
Lambs Lane Loop Road Analysis
Albemarle County, Virginia

Figure 4-1



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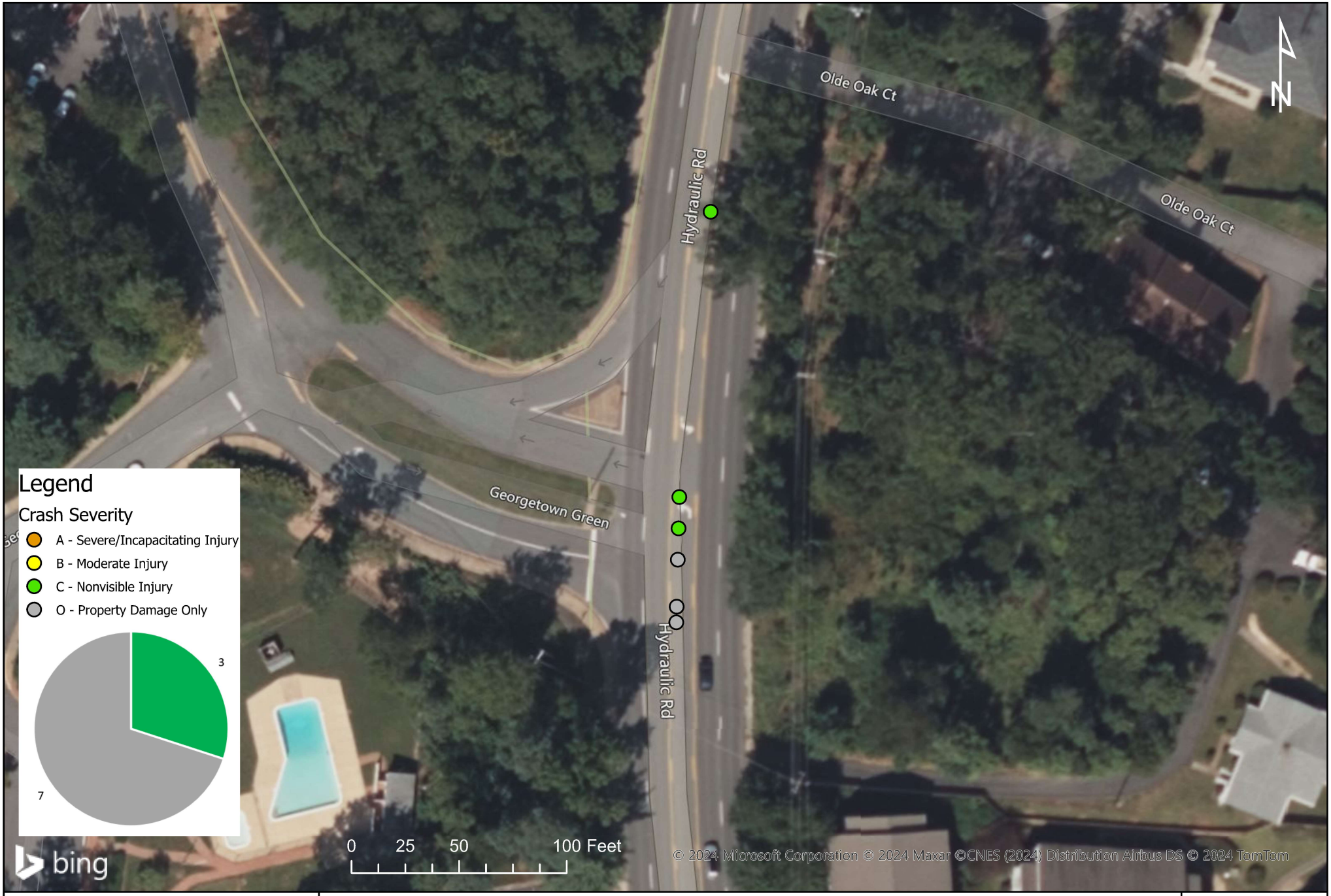
Crash Severity - Hydraulic Rd & Lambs Rd
Lambs Lane Loop Road Analysis
Albemarle County, Virginia

Figure
4-2



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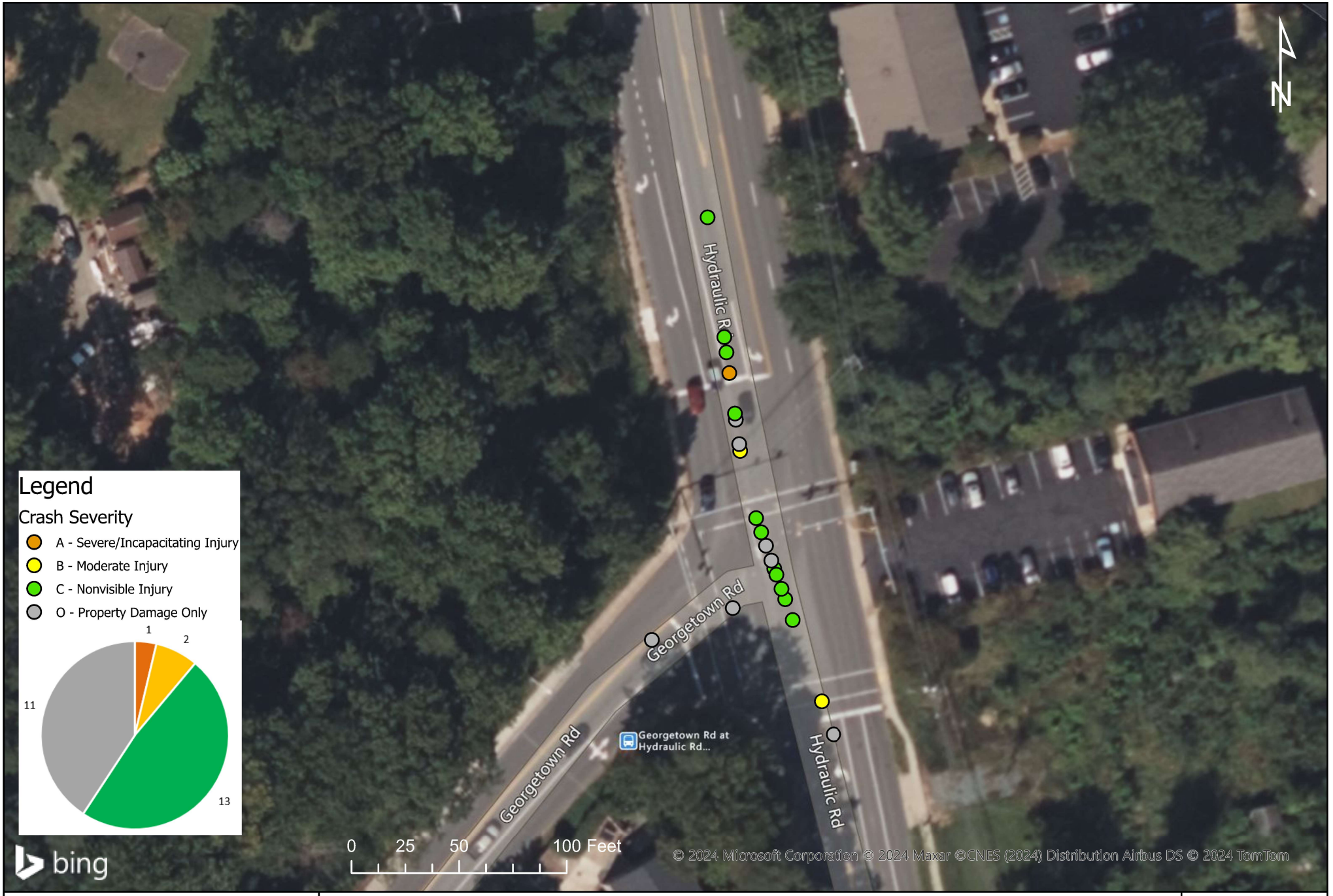
Crash Severity - Hydraulic Rd & Georgetown Green
Lambs Lane Loop Road Analysis
Albemarle County, Virginia

Figure 4-3



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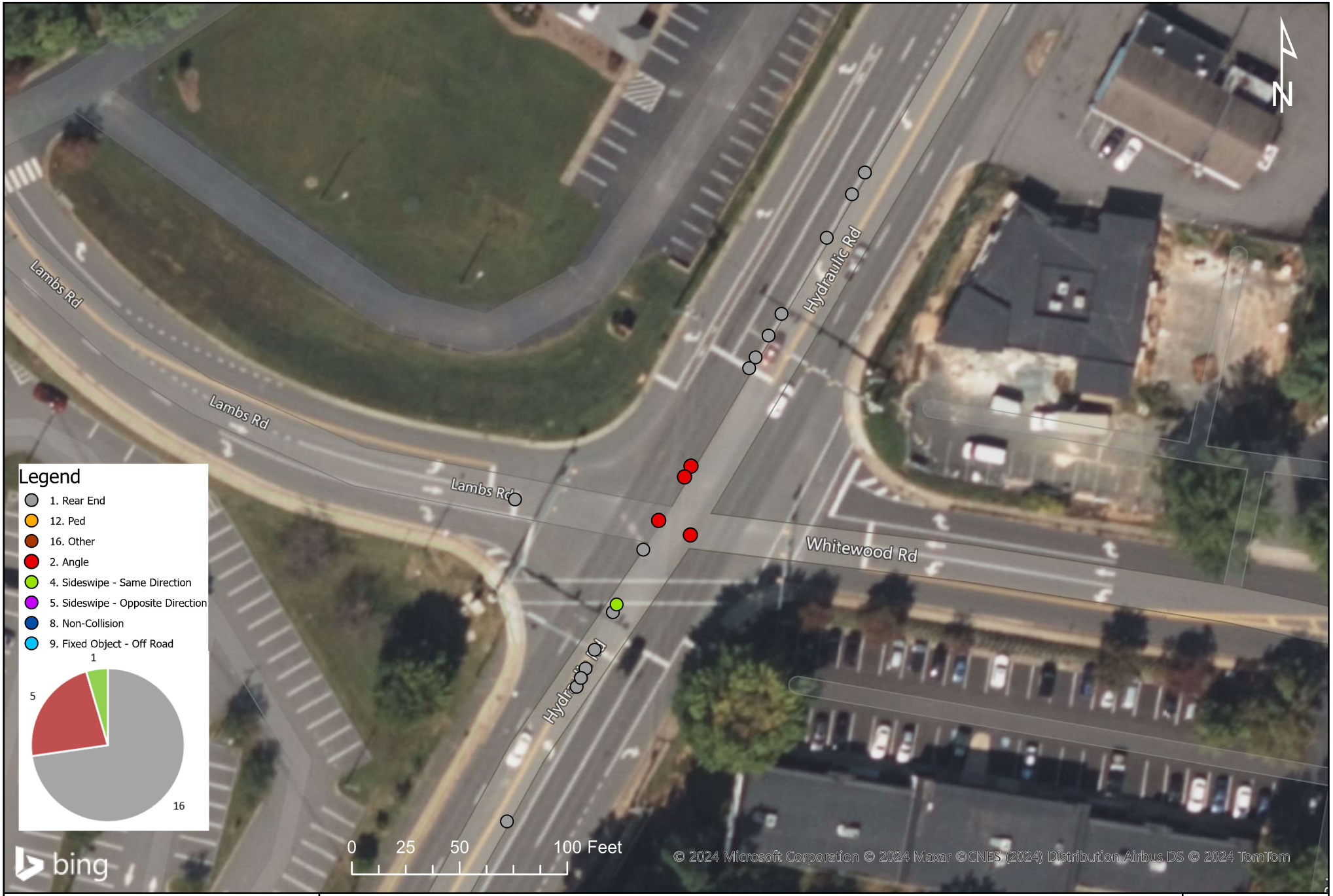
Crash Severity - Hydraulic Rd & Georgetown Rd
Lambs Lane Loop Road Analysis
Albemarle County, Virginia

Figure 4-4



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Crash Type - Hydraulic Rd & Lambs Rd
Lambs Lane Loop Road Analysis
Albemarle County, Virginia

Figure 4-5

TIMMONS GROUP
YOUR VISION ACHIEVED THROUGH OURS.

Crash Type - Hydraulic Rd & Georgetown Green
Lambs Lane Loop Road Analysis
Albemarle County, Virginia

Figure 4-6

TIMMONS GROUP
YOUR VISION ACHIEVED THROUGH OURS.

Crash Type - Hydraulic Rd & Georgetown Rd
Lambs Lane Loop Road Analysis
Albemarle County, Virginia

Figure 4-7

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5 ANALYSIS OF 2033 BACKGROUND CONDITIONS

The background 2033 volumes were analyzed assuming existing intersection geometry in conjunction with projected background traffic volumes. There are no approved developments in the study area, therefore, the background traffic volumes were developed based on a 2.2% annual growth rate.

5.1 FUTURE BACKGROUND TRAFFIC VOLUMES

Existing traffic entering or exiting the school complex at intersections 1-5 were not grown from 2023 to 2033 (including all movements at intersections 1-2). The 2.2% annual growth rate was compounded annually for the ten-year period from 2023 to 2033 and applied to the through movements on Hydraulic Road at intersections 3-5 and all movements at intersection 6. The resulting 2033 background traffic volumes are shown on Figure 5-1.

5.2 2033 BACKGROUND TRAFFIC CONDITIONS

Table 4-1 summarizes the 2033 background intersection LOS, delay, 95th percentile (Synchro), and maximum (SimTraffic) queue lengths based on the 2023 existing pedestrian volumes (Figure 3-2), the 2033 background peak hour traffic volumes shown on Figure 5-1, the existing lane geometry shown on Figure 2-1, and optimized traffic signal timings. The analysis worksheets are included in Appendix F.

The signal phasing and turning lane arrangement at the Hydraulic Road and Lambs Road/Whitewood Road was analyzed for future improvements. See detailed discussion in section 7.2 of the report. As shown in Table 5-1, under 2033 background conditions, the study intersections generally operate at similar LOS and queueing compared to 2023 existing conditions.

- At the unsignalized study intersections (#1, 2, 4, 5) all movements operate at a LOS C or better during both peak hours. All turning movements have adequate turn lane storage to accommodate 95th percentile and maximum simulated queue lengths.

- At the signalized intersection of Hydraulic Road at Lambs Road/Whitewood Road, the overall intersection operates at a LOS C during both peak hours.
  - The side street east- and west-bound movements and approaches operate at a LOS D or better during both peak hours. During both peak hours, the EB left maximum queue exceeds the available storage, spilling back into the through lane.
  - The mainline north- and south-bound approaches operate at a LOS C during both peak hours. During the AM peak, the SB through maximum queue backs up past the left- and right-turn lanes, blocking them. During the PM peak, the NB through maximum queue backs up to the AHS Entrance/Hydraulic Ridge Road intersection.
  - All other turning movements have adequate turn lane storage to accommodate the 95th percentile and maximum simulated queue lengths.

- At the signalized intersection of Hydraulic Road at Georgetown Road, the overall intersection operates at a LOS C during both peak hours.
  - The east- and west-bound movements and approaches operate at a LOS D or better during both peak hours. During both peak hours, the EB maximum queue exceeds the available storage.
  - The mainline north- and south-bound movements and approaches operate at a LOS C or better during both peak hours. During the PM peak, the SB through maximum queue backs up through the intersection with Georgetown Green.
  - All other turning movements have adequate turn lane storage to accommodate the 95th percentile and maximum simulated queue lengths.

Table 5-1: Intersection Analysis Summary
2033 Background Traffic Volumes

Intersection and Type of Control	Movement and Approach	Turn Lane Storage (ft)	AM PEAK HOUR				PM PEAK HOUR			
			Delay [1] (sec/veh)	LOS [1]	HCS 95th Percentile Queue Length (ft)	Simulated Maximum Queue Length (ft)	Delay [1] (sec/veh)	LOS [1]	HCS 95th Percentile Queue Length (ft)	Simulated Maximum Queue Length (ft)
1. Lambs Road (E-W) at	EB Thru/Right		†	†	0	6	†	†	0	0
Lambs Lane (N-S)	*EB Approach*		†	†	--	--	†	†	--	--
Unsignalized	WB Left/Thru		9.0	A	52	171	6.5	A	12	72
	EB Approach		*9.0*	*A*	--	--	*6.5*	*A*	--	--
	NB Left/Right		11.0	B	29	*138*	12.0	B	63	123
	NB Approach		*11.0*	*B*	--	--	*12.0*	*B*	--	--
2. Lambs Road (E-W) at	EB Left/Thru		0.0	A	0	2	0.0	A	0	30
AHS Exit Only (N-S)	*EB Approach*		*0.0*	*A*	--	--	*0.0*	*A*	--	--
Unsignalized	WB Thru		†	†	0	--	†	†	0	--
	WB Right		†	†	0	--	†	†	0	--
	WB Approach		†	†	--	--	†	†	--	--
	NB Left		13.6	B	40	58	17.0	C	51	62
	NB Right	80	13.6	B	40	70	17.0	C	51	75
	NB Approach		*13.6*	*B*	--	--	*17.0*	*C*	--	--
	SB Left/Thru/Right		0.0	A	0	--	0.0	A	0	--
	SB Approach		*0.0*	*A*	--	--	*0.0*	*A*	--	--
3. Hydraulic Road (N-S) at	EB Left	135	40.6	D	124	150	38.7	D	195	170
Lambs Road/Whitewood	EB Thru		41.5	D	37	148	34.8	C	60	246
Road (E-W)	EB Right		41.5	D	39	135	34.8	C	46	185
Signalized	*EB Approach*		*41.1*	*D*	--	--	*36.7*	*D*	--	--
	WB Left	175	42.2	D	135	161	30.6	*C*	93	126
	WB Thru		47.1	D	98	182	41.7	*D*	37	71
	WB Right	195	42.6	D	0	109	41.3	D	0	106
	WB Approach		*43.6*	*D*	--	--	*36.8*	*D*	--	--
	NB Left	350	33.1	C	#163	211	17.0	B	47	329
	NB Thru		21.2	C	207	308	32.1	C	#461	681
	NB Right	140	17.6	B	8	140	19.8	B	0	140
	NB Approach		*23.0*	*C*	--	--	*30.1*	*C*	--	--
	SB Left	250	13.7	B	55	250	33.3	C	45	170
	SB Thru		37.7	D	#487	858	25.4	C	284	371
	SB Right	265	19.7	B	14	265	19.5	B	0	241
	SB Approach		*34.4*	*C*	--	--	*25.5*	*C*	--	--
	Overall		**32.5**	**C**	**--**	**--**	**30.5**	**C**	--	--
4. Hydraulic Road (N-S) at	EB Right		10.1	B	0	24	10.5	B	18	149
Hydraulic Ridge Road (WB) /	*EB Approach*		*10.1*	*B*	--	--	*10.5*	*B*	--	--
AHS Entrance (EB)	WB Left/Thru/Right		22.1	C	6	57	17.5	C	6	63
Unsignalized	*WB Approach*		*22.1*	*C*	--	--	*17.5*	*C*	--	--
	NB Left	200	10.1	B	17	143	10.4	B	5	115
	NB Thru		†	†	0	--	†	†	0	268
	NB Thru/Right		†	†	0	--	†	†	0	276
	NB Approach		*1.3*	*A*	--	--	0.4	*A*	--	--
	SB Left/Thru		0.1	A	0	214	0.1	A	0	91
	SB Thru/Right		†	†	0	312	†	†	0	170
	SB Approach		*0.0*	*A*	--	--	*0.1*	*A*	--	--
5. Hydraulic Road (N-S) at	EB Left		11.6	B	12	72	15.5	C	16	285
Georgetown Green (E-W)	EB Right	145	11.6	B	12	110	15.5	C	16	141
Unsignalized	*EB Approach*		*11.6*	*B*	--	--	*15.5*	*C*	--	--
	NB Left	200	10.0	A	7	102	12.0	B	9	76
	NB Thru		†	†	0	--	†	†	0	27
	NB Approach		*0.6*	*A*	--	--	*0.6*	*A*	--	--
	SB Thru		†	†	0	14	†	†	0	152
	SB Thru/Right		†	†	0	181	†	†	0	267
	SB Approach		†	†	--	--	†	†	--	--
6. Hydraulic Road (N-S) at	EB Left		39.9	D	#522	403	46.1	D	#573	412
Georgetown Road (E-W)	EB Left/Thru/Right	335	36.6	D	#486	327	42.0	D	#533	334
Signalized	*EB Approach*		*38.3*	*D*	--	--	*44.1*	*D*	--	--
	WB Left/Thru/Right		46.7	D	15	21	52.2	D	19	28
	WB Approach		*46.7*	*D*	--	--	*52.2*	*D*	--	--
	NB Left	200	23.3	C	61	119	32.9	C	#117	196
	NB Thru		18.7	B	164	206	19.6	B	182	349
	NB Thru/Right		18.7	B	164	171	19.6	B	182	295
	NB Approach		*19.3*	*B*	--	--	*22.5*	*C*	--	--
	SB Left	100	23.7	C	10	35	25.2	C	13	71
	SB Thru		29.1	C	208	512	31.4	C	243	771
	SB Right	145	27.4	C	102	145	30.8	C	132	145
	SB Approach		*28.2*	*C*	--	--	*31.1*	*C*	--	--
	Overall		**29.5**	**C**	--	--	**33.2**	**C**	--	--

[1] *Overall intersection LOS and delay reported for signalized intersections and roundabouts only.*

† SYNCHRO does not provide level of service or delay for unsignalized movements with no conflicting volumes.

- 95th percentile volume exceeds capacity, queue may be longer. Queue shown is maximum after two cycles.

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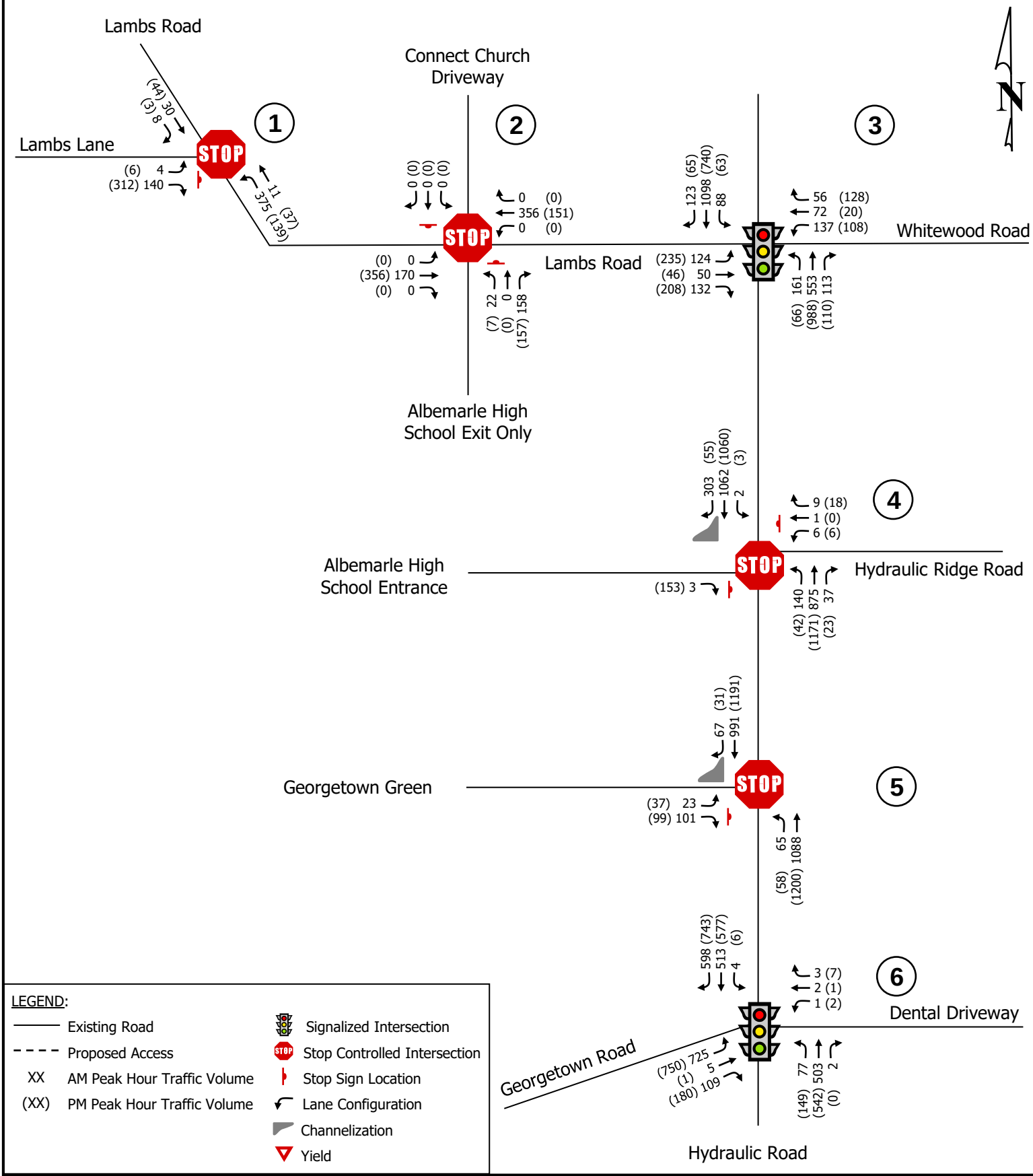

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2033 Background Peak Hour Traffic Volumes
Lambs Lane Loop Road Analysis
Albemarle County, Virginia

Figure 5-1

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6 TRIP GENERATION

The proposed development program of the expansion of the school complex is currently unknown. Based on coordination with Albemarle County Public Schools, the proposed development will not consist of a new school. As shown in Table 5-1, the proposed development site trips were estimated to be 25% of the total existing traffic counted entering and exiting the school complex.

The Albemarle High School Center II building currently under design by ACPS, and any new trips associated with the proposed campus, are accounted for in the trip generation discussed in this report.

As shown in Step 1 in Table 6-1, the total existing trips accessing the school complex were observed via turning movement counts at intersections 1 and 3-5. Note that intersection 5 provides access to both Albemarle High School and Georgetown Green Townhomes. Traffic data was not collected at the entrance to the townhomes. As shown in Step 2 in Table 6-1, it was assumed that 25 vehicles per hour would be entering and exiting the townhomes during each the AM and PM peak hours. This was subtracted from the traffic counted at intersection 5 to isolate the traffic associated with the high school. ITE Trip Generation was not used to estimate the trips associated with the townhomes because the trip generation was higher than the counts collected at intersection 5, which includes high school traffic.

To generate the average daily traffic associated with the proposed development, ITE Trip Generation was computed using the estimated number of students for the existing Elementary, Middle, and High Schools (500, 650, and 2000, respectively). The existing total average daily traffic was computed to be 6,400 vehicles per day. Then, following the same methodology, the proposed development was estimated to be 25% of the existing average daily trips.

As shown in Table 6-1, the proposed development will generate 335 morning peak hour trips (231 in and 104 out) and 274 afternoon peak hour trips (81 in and 193 out). Average daily weekday trips were estimated to be 1,600 vehicles per day. For the purposes of this analysis, the peak hour of the proposed development is assumed to align with the peak hour of the existing school traffic.

Table 6-1: Trip Generation Summary

Buildout - Lambs Lane Loop Alternatives Analysis ITE Trip Generation Manual, 11th Edition	Weekday AM Peak Hour			PM Peak Hour			Average
	In	Out	Total	In	Out	Total	Daily Trips[1]
1. Existing Traffic at Study Intersections							
Intersection 1	19	8	27	12	20	32	-
Intersection 3	356	306	662	151	489	640	-
Intersection 4	443	3	446	97	153	250	-
Intersection 5	132	124	256	89	136	225	-
Total Existing Traffic at Study Intersections	***950***	***441***	***1,391***	***349***	***798***	***1,147***	***-***
2. Existing Traffic for Georgetown Green Townhomes[2]	25	25	50	25	25	50	-
Net Existing School Traffic at Intersection 5	107	99	206	64	111	175	-
Total NET Existing Traffic Entering School Complex	***925***	***416***	***1,341***	***324***	***773***	***1,097***	***6,400***
3. Trip Generation - Proposed Development[3]							
25% of Total from Step 2	231	104	335	81	193	274	1,600
Total Generated Trips, Proposed Development	***231***	***104***	***335***	***81***	***193***	***274***	***1,600***
Total Net Existing School Traffic	**925**	**416**	**1,341**	**324**	**773**	**1,097**	**6,400**
Total Trips Generated	**231**	**104**	**335**	**81**	**193**	**274**	**1,600**
Total External Primary Trips	**1,156**	**520**	**1,676**	**405**	**966**	**1,371**	**8,000**

Notes:

(1) Average daily trips were generated using ITE Trip Generation and the estimated enrollment of the three existing schools on-site.

(2) Trips accessing the existing Georgetown Green Townhomes were assumed to be 25 vehicles in and out during each the AM and PM peak hours. It was assumed that most residents would not enter/exit during school arrival and dissmissal times to avoid traffic congestion.

(3) Per coordination with Albemarle County Public Schools, the future development program is unknown, but will not consist of a new school facility. The trips generated by the proposed development was assumed to be 25% of the total net existing trips generated by the existing school complex.

6.1 EXISTING TRIP DISTRIBUTIONS

The distribution of site trips generated by the existing school complex was based on the existing travel patterns demonstrated by the 2023 existing peak hour traffic volumes. The directional distributions were assumed to be:

- To/from the north on Hydraulic Road: 50% southbound; 35% northbound
- To/from the south on Hydraulic Road: 35% southbound; 25% northbound
- To/from the west on Georgetown Road: 25% westbound; 20% eastbound
- To/from the east on Whitewood Road: 5% both eastbound and westbound

The 2023 existing directional distributions were then applied to the study intersections as shown on Figure 6-1.

6.2 PROPOSED SITE TRIP DISTRIBUTIONS

In order to distribute the proposed and existing site traffic to the roadway network according to the three Loop Road scenarios described in Chapter 6, the existing trip distributions shown in Figure 6-1 were used as a baseline and modified to reflect new travel patterns in each scenario.

The distribution for existing and new traffic with Loop Road Scenarios 1 and 2 are shown on Figures 6-2 and 6-3, respectively. The distribution for all traffic with Loop Road Scenario 3 are shown on Figure 6-4.

Because existing traffic is already counted on the roadway network, a net (proposed minus existing) distribution was created for these trips for each scenario. To create the Scenarios 1 and 2 net existing traffic distribution as shown on Figure 6-5, the 2023 existing traffic distribution (Figure 6-1) was subtracted from the Scenario 1 and 2 proposed existing traffic distribution (Figure 6-2).

To create the Scenario 3 net existing traffic distribution as shown on Figure 6-6, the 2023 existing traffic distribution (Figure 6-1) was subtracted from the Scenario 3 proposed existing traffic distribution (Figure 6-4).

6.3 PROPOSED SITE TRIP ASSIGNMENT

The trip distribution percentages for the site trips shown on Figures 6-3, 6-5, 6-6, and 6-7 were applied to the trip generation shown in Table 6-1 to distribute the site trips to the surrounding roadway network.

For Scenarios 1 and 2, the net existing and new site trips are shown on Figures 6-7 and 6-8, respectively. For Scenario 3, the net existing and new site trips are shown on Figures 6-9 and 6-10, respectively.

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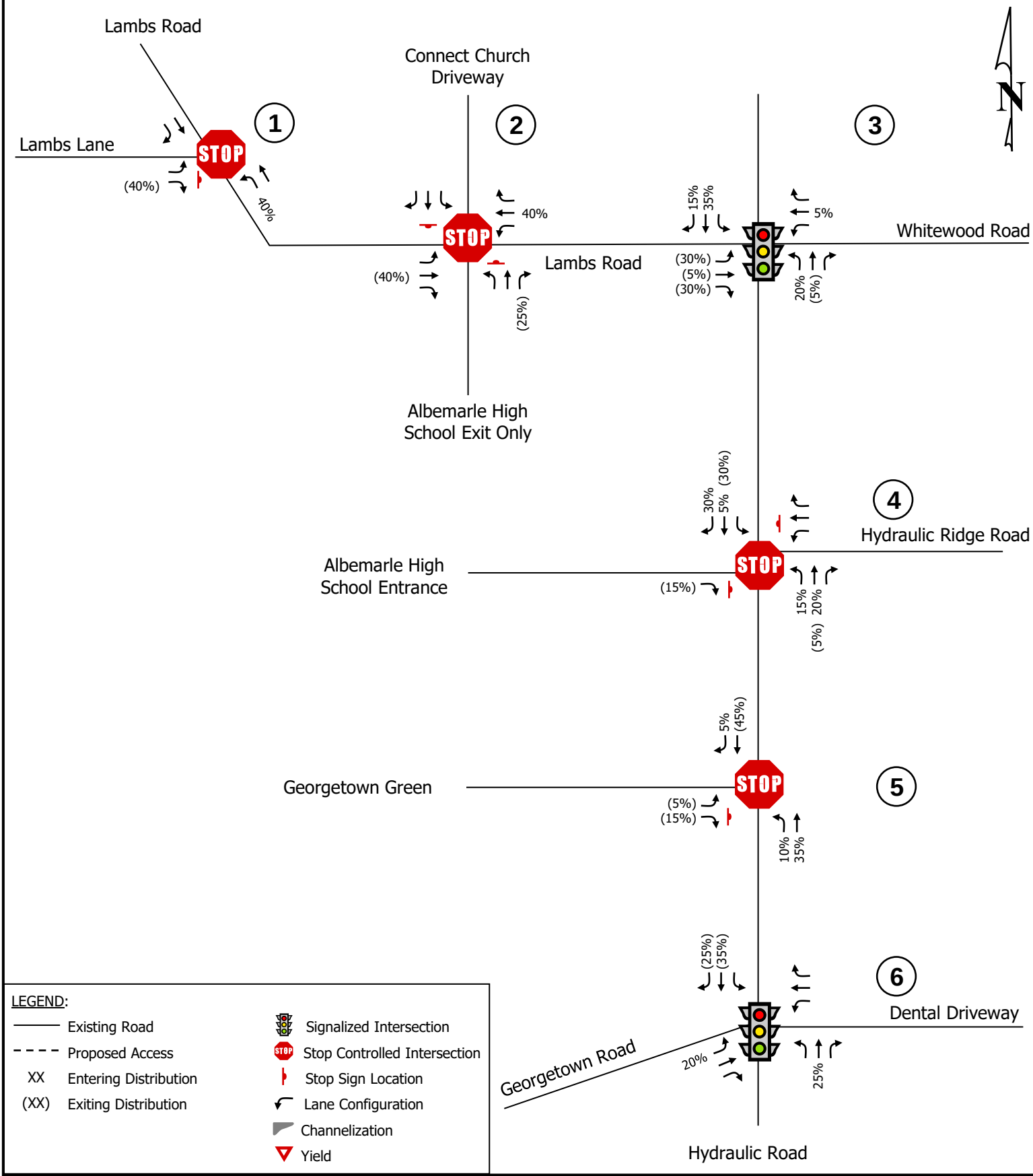

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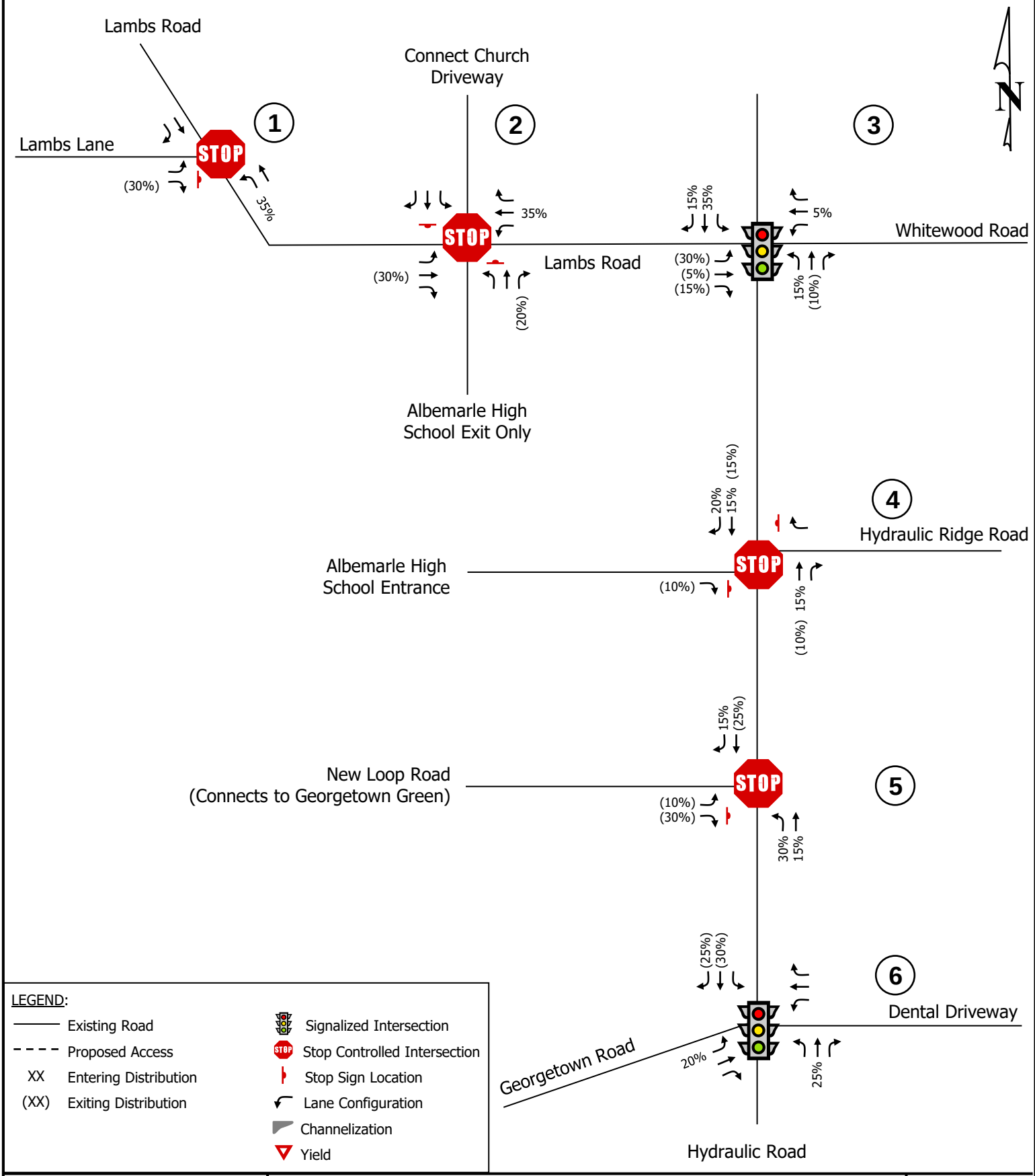
2023 Existing School Traffic Distribution
Lambs Lane Loop Road Analysis
Albemarle County, Virginia

Figure 6-1



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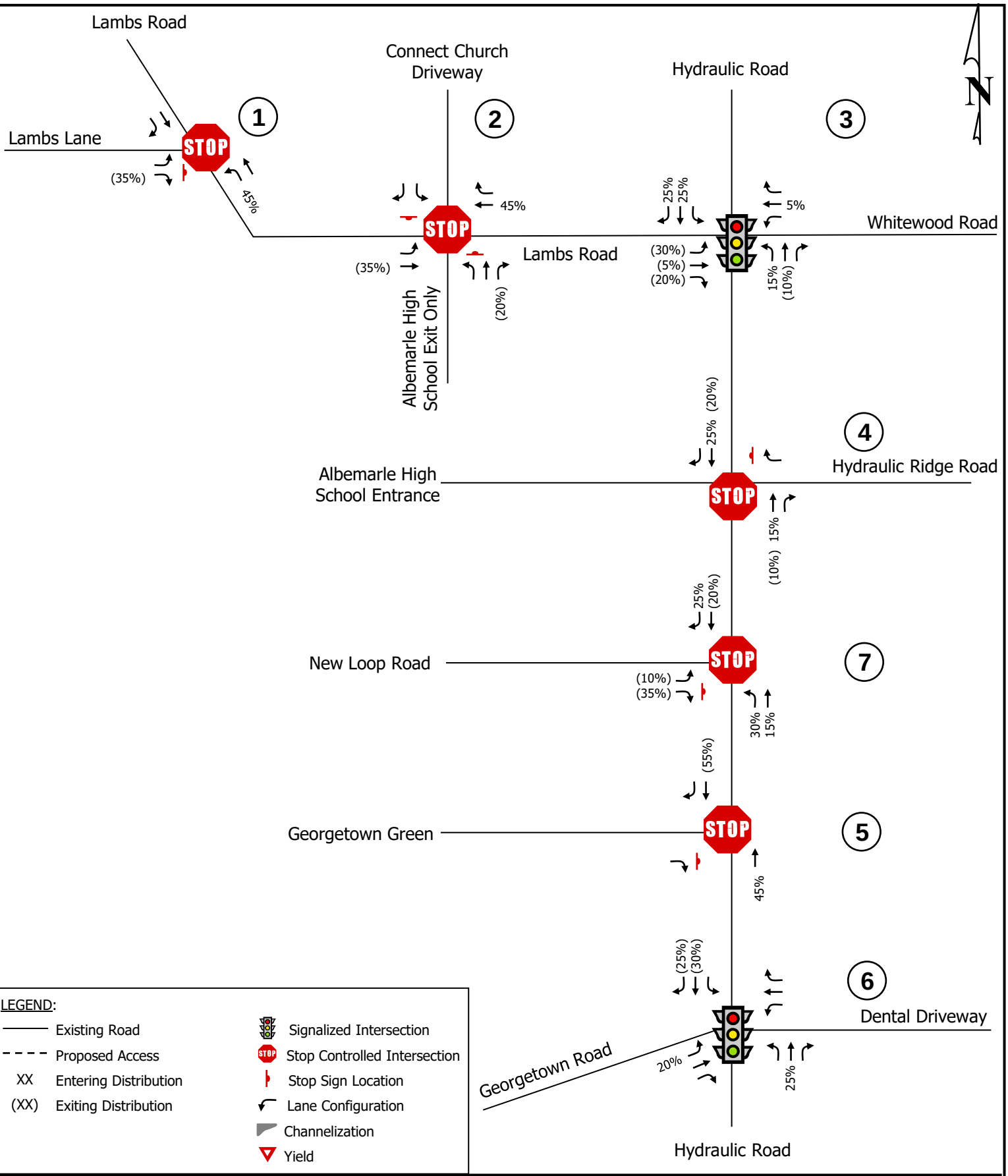
Scenario 1 & 2 Trip Distribution (Existing Traffic)
Lambs Lane Loop Road Analysis
Albemarle County, Virginia

Figure 6-2



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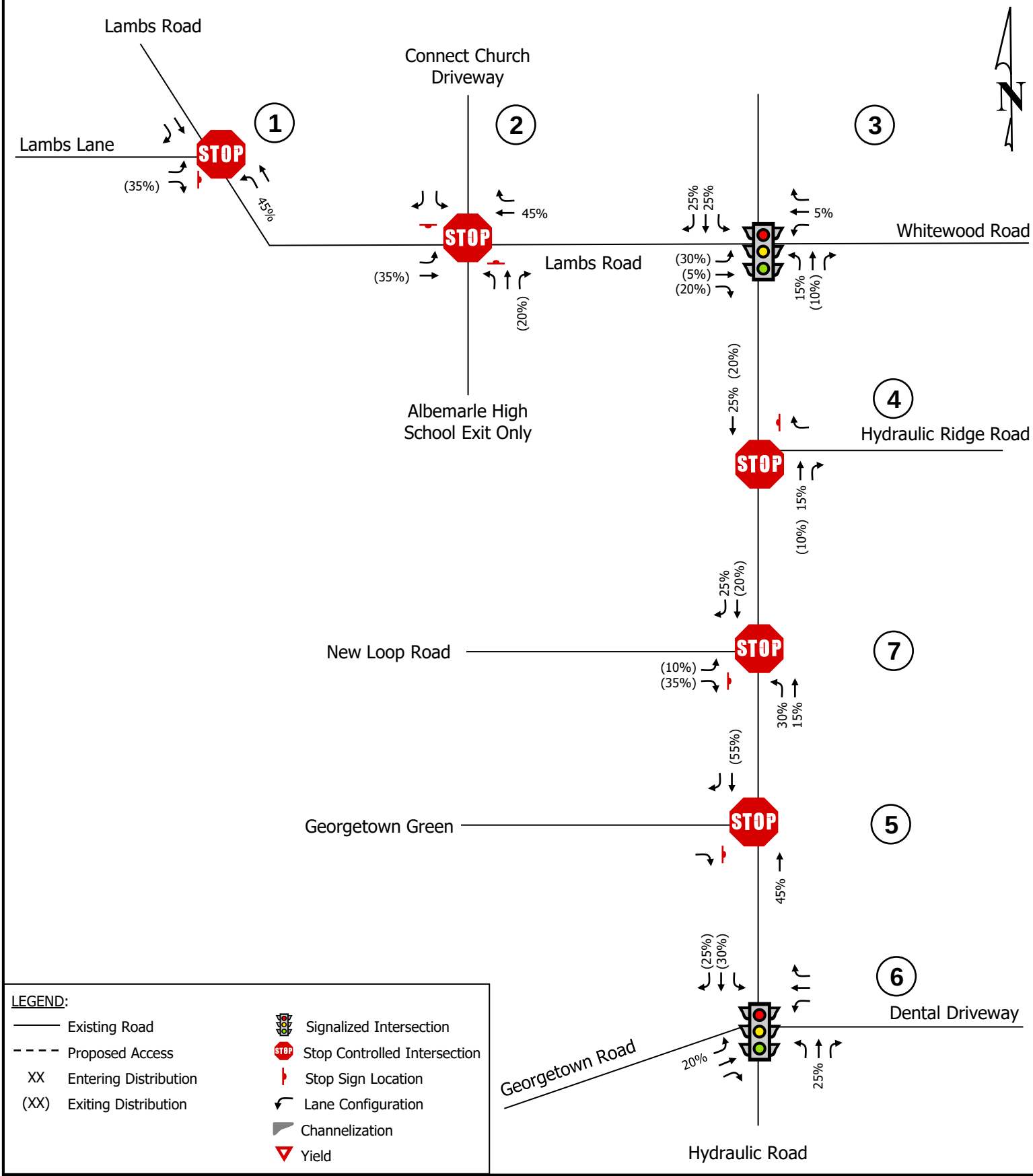
Scenario 1 & 2 Trip Distribution (New Traffic)
Lambs Lane Loop Road Analysis
Albemarle County, Virginia

Figure 6-3



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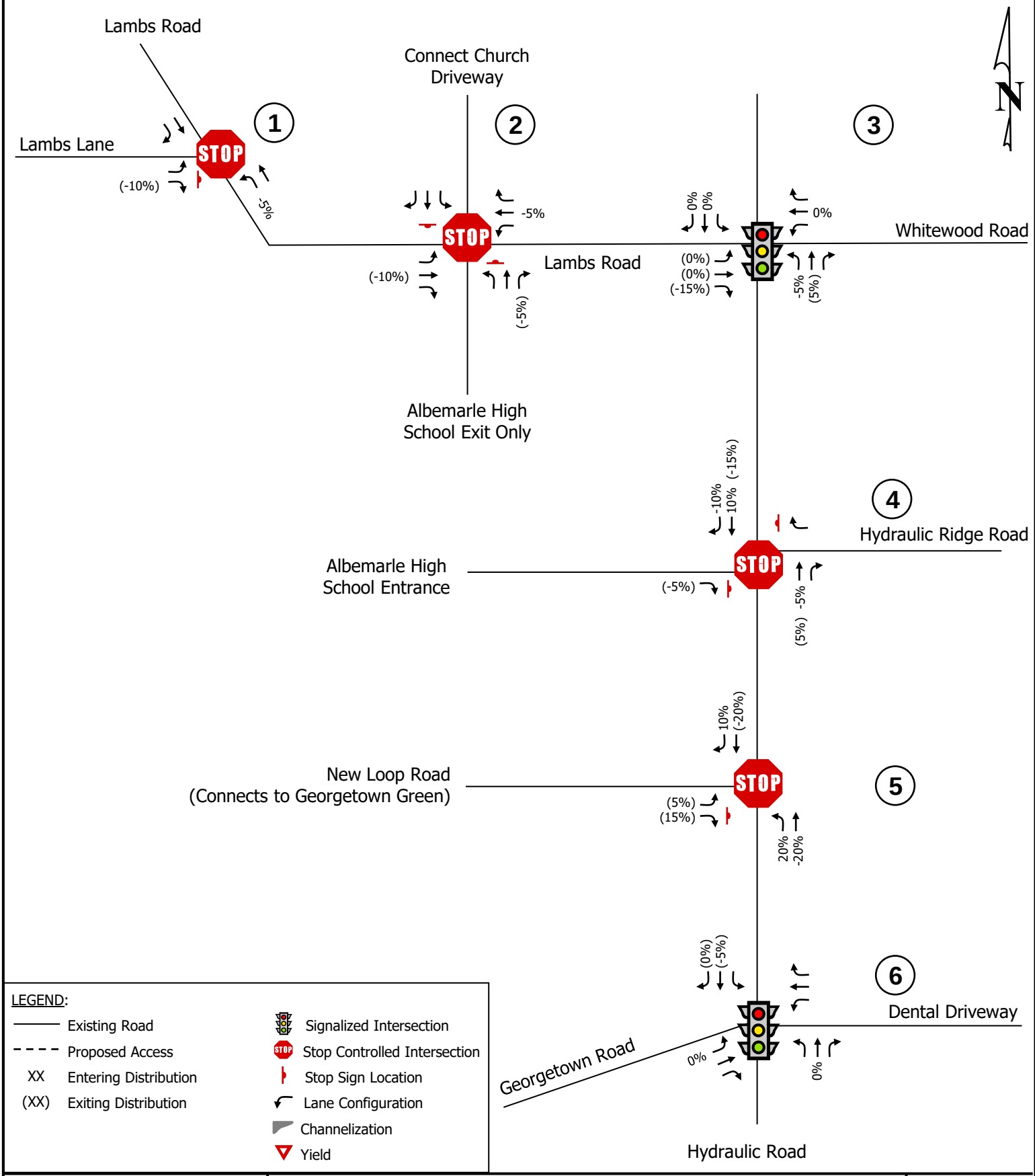
Scenario 3 Trip Distribution (All Traffic)
Lambs Lane Loop Road Analysis
Albemarle County, Virginia

Figure 6-4



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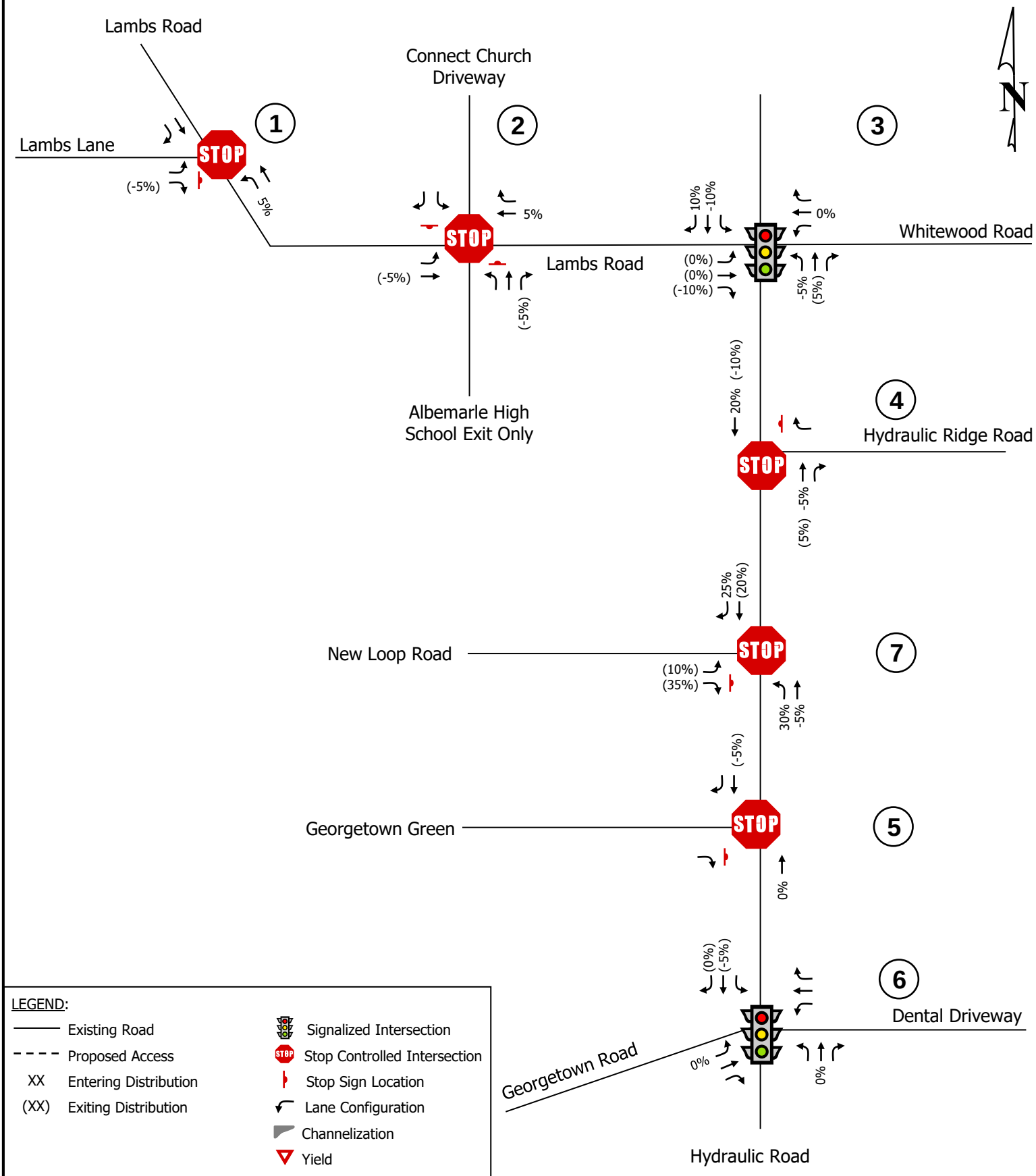
Scenario 1 & 2 **NET** Trip Distribution (Existing Traffic)
Lambs Lane Loop Road Analysis
Albemarle County, Virginia

Figure 6-5



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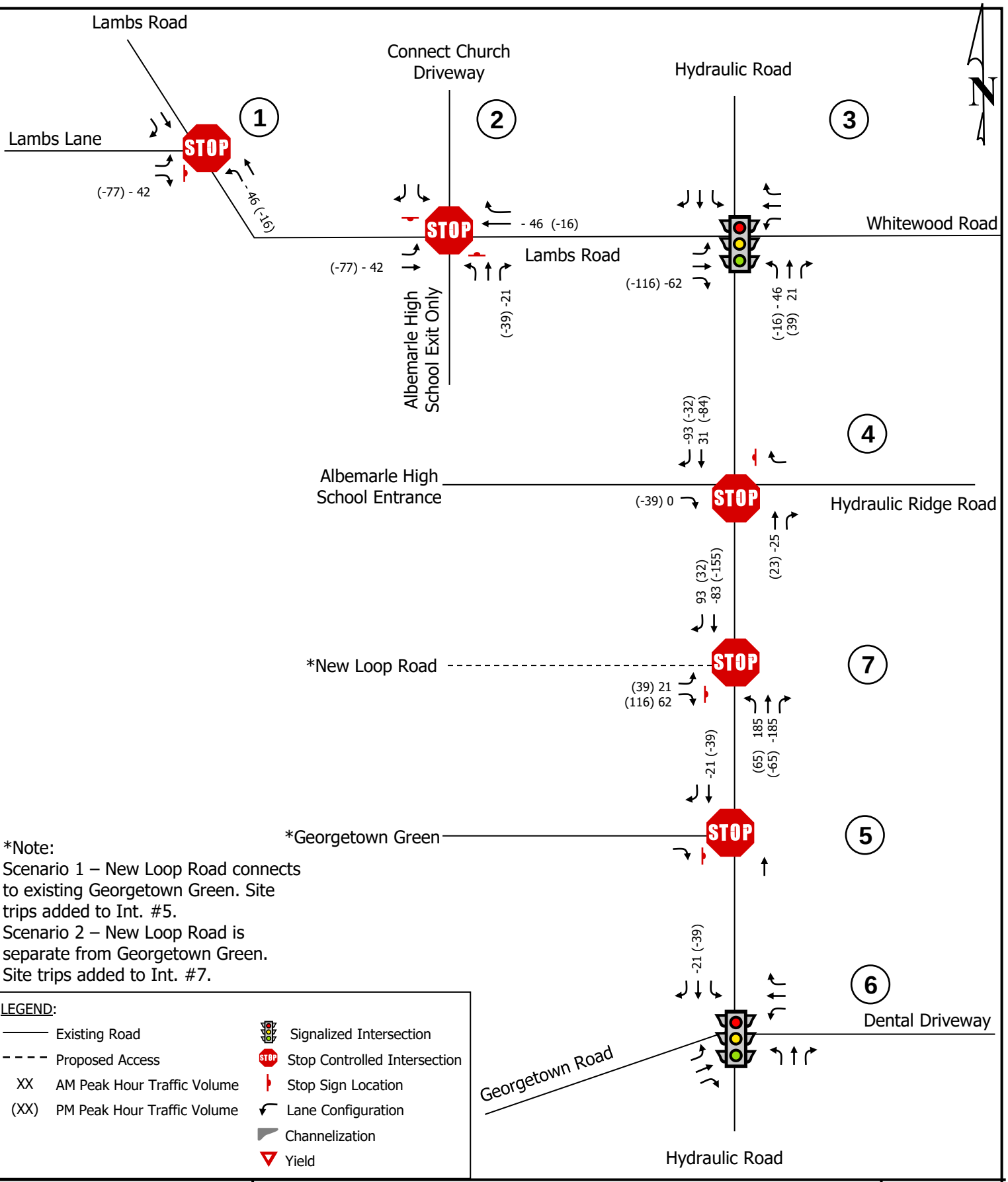
Scenario 3 **NET** Trip Distribution (Existing Traffic)
Lambs Lane Loop Road Analysis
Albemarle County, Virginia

Figure 6-6



*Note:
Scenario 1 – New Loop Road connects to existing Georgetown Green. Site trips added to Int. #5.
Scenario 2 – New Loop Road is separate from Georgetown Green. Site trips added to Int. #7.

LEGEND:

- Existing Road
- Proposed Access
- XX AM Peak Hour Traffic Volume
- (XX) PM Peak Hour Traffic Volume
- Signalized Intersection
- Stop Controlled Intersection
- Stop Sign Location
- Lane Configuration
- Channelization
- Yield

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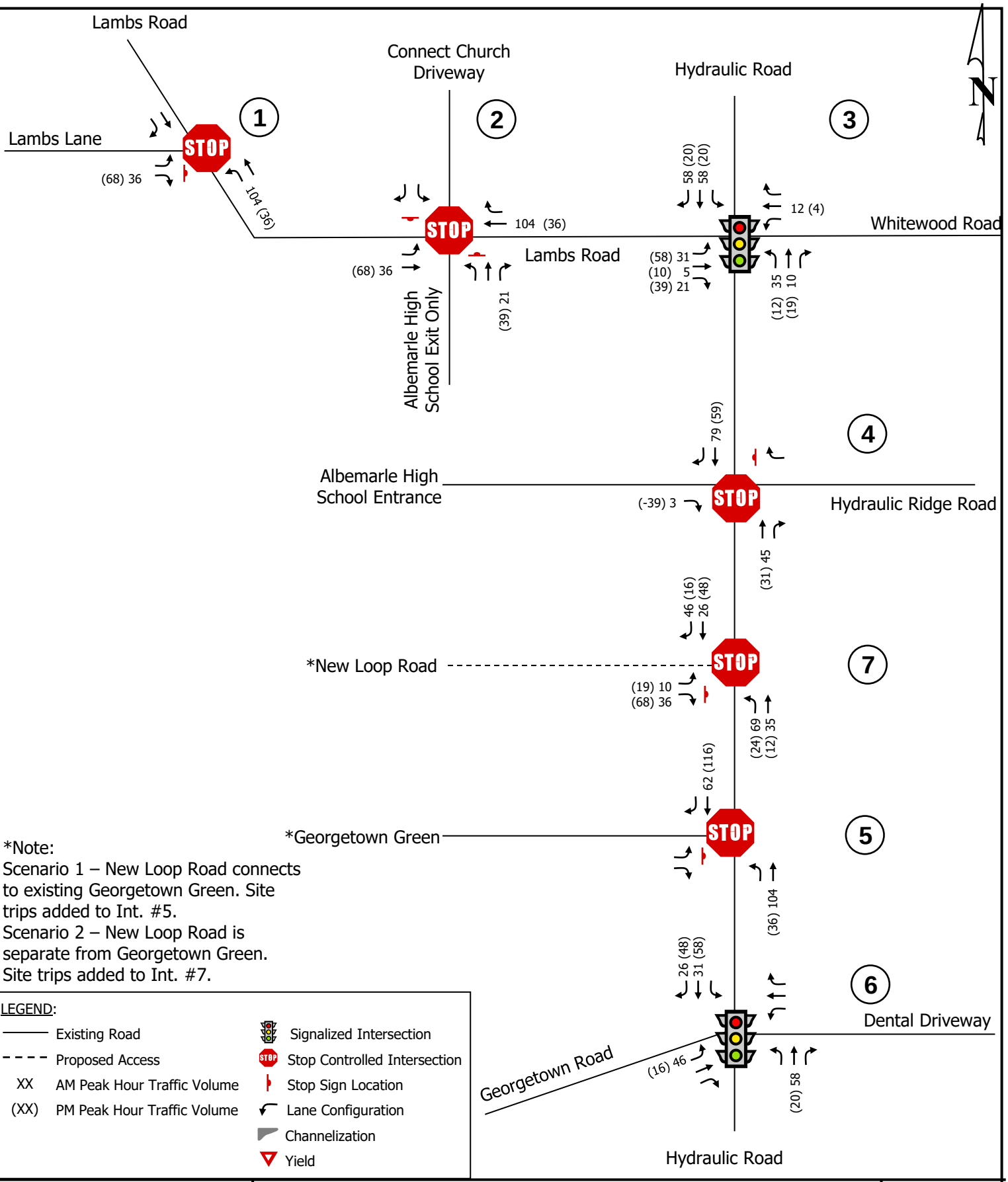
Scenarios 1 & 2 **NET** Existing Site Trips
Lambs Lane Loop Road Analysis
Albemarle County, Virginia

Figure 6-7



*Note:
Scenario 1 – New Loop Road connects to existing Georgetown Green. Site trips added to Int. #5.
Scenario 2 – New Loop Road is separate from Georgetown Green. Site trips added to Int. #7.

LEGEND:

- Existing Road
- Proposed Access
- XX AM Peak Hour Traffic Volume
- (XX) PM Peak Hour Traffic Volume
- Signalized Intersection
- Stop Controlled Intersection
- Stop Sign Location
- Lane Configuration
- Channelization
- Yield

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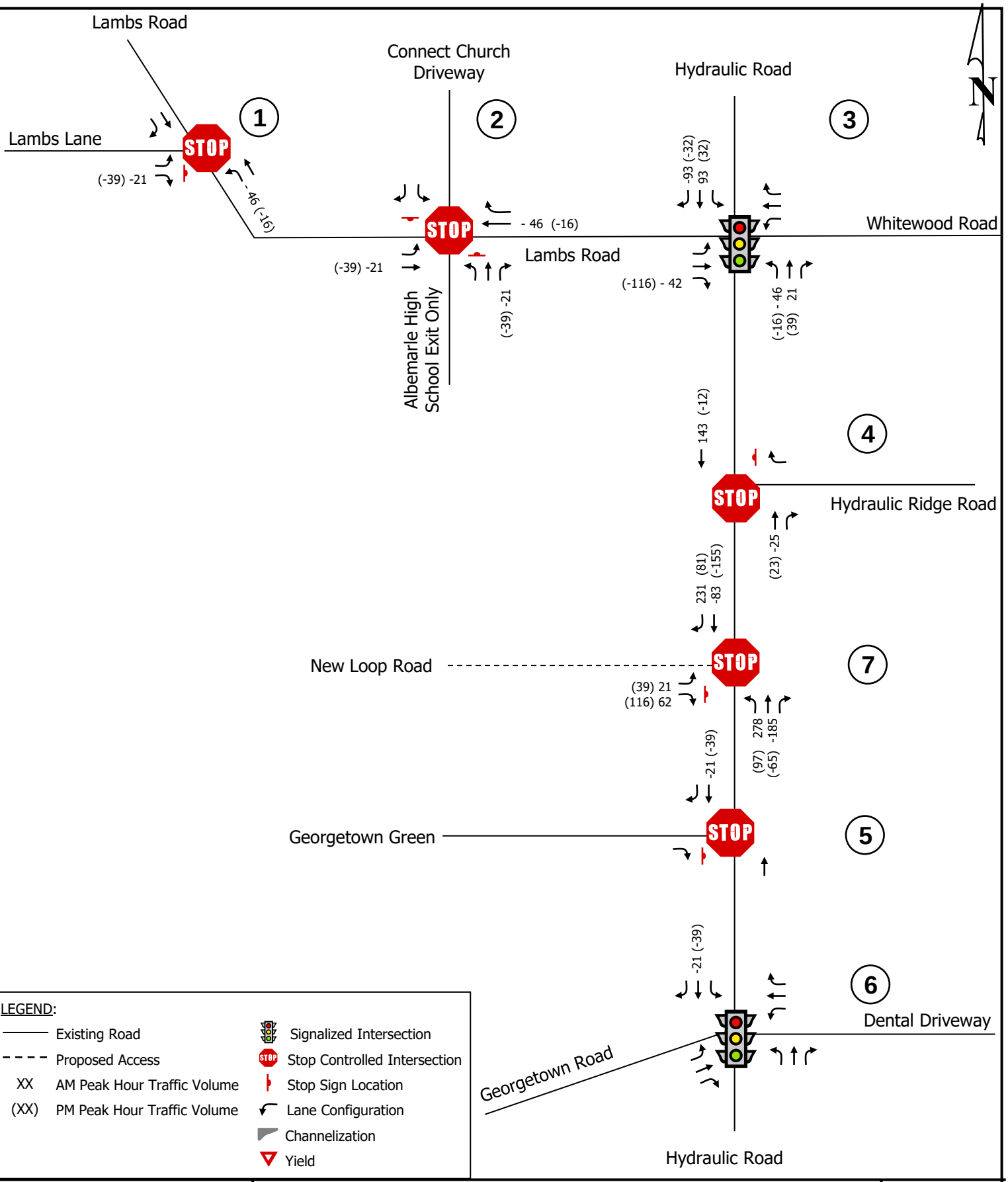
Scenarios 1 & 2 New Site Trips
Lambs Lane Loop Road Analysis
Albemarle County, Virginia

Figure 6-8



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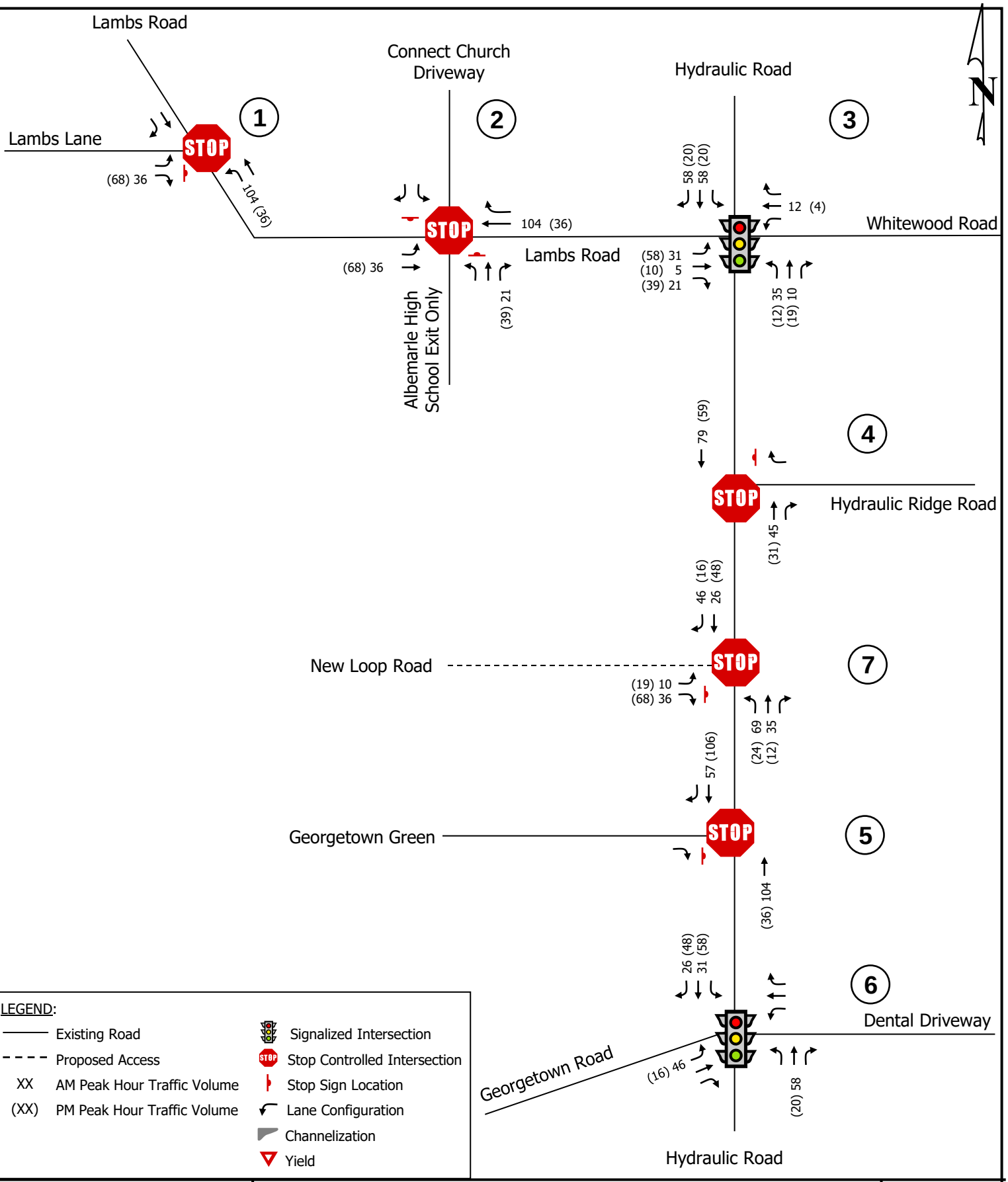
Scenario 3 **NET** Existing Site Trips
Lambs Lane Loop Road Analysis
Albemarle County, Virginia

Figure 6-9



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Scenario 3 New Site Trips
Lambs Lane Loop Road Analysis
Albemarle County, Virginia

Figure 6-10

7 HYDRAULIC ROAD CORRIDOR IMPROVEMENTS

The Hydraulic Road corridor between was evaluated for future improvements that would improve safety, access management, and provide better traffic operations. The existing signalized intersections on Hydraulic Road at Lambs Road/Whitewood Road and Georgetown Road were analyzed with the VDOT Junction Screening Tool (VJuST) using the 2033 background volumes shown on Figure 4-1. See Chapter 7 for improvements along Hydraulic Road specific to pedestrians and bicyclists.

Based on a review of the existing access management along the corridor, it is recommended that the existing two-way left-turn lane (TWLTL) on Hydraulic Road be removed and replaced with a raised median. Removing the TWLTL provides significant safety and access management improvements. The number of conflict points at each intersection will be reduced from 32 (four-way) and 9 (three-way) to 2 with right-in/right-out only access. As a result, access to Hydraulic Ridge Road and the AHS entrance will be via right-in/right-out only. Existing non-school traffic rerouted as a result of the Hydraulic Road geometry changes are shown on Figure 7-1.

Concept schematics were developed showing the proposed improvements discussed in this chapter, as well as the recommendations in Chapter 7 and the Proposed Loop Road intersection location and design in Chapter 8. The exhibits are included in Appendix G.

7.1 VDOT JUNCTION SCREENING TOOL (VJUST)

The VJuST Tool was used to complete an initial, high-level screening of potential intersection treatments. This screening provided a preliminary subset of intersection options based on congestion capabilities, pedestrian accommodations, and anticipated safety benefits. The following sections provide an overview of the grade-separated and at-grade intersection options; these subsets were narrowed down to options that are most applicable and subject to further analysis.

7.1 ALTERNATIVE INTERSECTION SELECTION

It was established through discussions with Albemarle County that the Hydraulic Road corridor is not a candidate for grade-separated intersection options.

In all grade-separated scenarios, right-of-way, utility, construction, and access management issues outweigh the anticipated operational benefits. All scenarios require the closure of existing intersections/crossovers and restrict development along the corridor due to loss of developable land and access. Multiple residential and commercial properties along the corridor would be subject to acquisition. In addition, the installation of a grade-separated alternative Hydraulic Road at either study intersection will not significantly improve operations to offset the costs of the improvements.

The remaining at-grade intersection options included in the VJuST worksheet were eliminated from the analysis due to feasibility for the facility type, intersection spacing, the ability to accommodate traffic volumes, or driver expectation concerns. Since Hydraulic Road is an undivided roadway, the alternative at-grade intersection types that require a downstream U-Turn are not feasible alternatives because extensive right-of-way would need to be purchased, including the possibility of full acquisition of multiple properties.

As such, all grade-separated interchanges, grade-separated intersections, or at-grade intersection alternatives such as the RCUT or MUT were removed from consideration.

7.2 HYDRAULIC ROAD AT LAMBS ROAD/WHITEWOOD ROAD

Using the VJuST worksheet, the alternative at-grade intersection types listed below were identified and evaluated at the Hydraulic Road at Lambs Road/Whitewood Road intersection. The results of the VJuST analysis are summarized in Table 6-1. A copy of the completed VJuST worksheets can be found in Appendix H.

a) Conventional Signal
b) Thru-Cut (through movements removed from east- and west-bound)
c) Two-Way Stop Control
d) Roundabout

Table 7-1: VJuST Results – Hydraulic Road at Lambs Road/Whitewood Road

Intersection Type	AM Peak Hour Maximum v/c	PM Peak Hour Maximum v/c	Weighted Total Conflict Points
Conventional Signal	0.60	0.58	48
Thru-Cut	0.59	0.61	28
Roundabout	0.69	0.61	8
Two-Way Stop Control	N/A	N/A	48

As shown in Table 6-1, the conventional signal and thru-cut alternatives operate at similar levels of service. The roundabout performs the third-best, and a two-way stop control intersection is over capacity and was ruled out as a viable alternative.

The roundabout was ruled out as a viable alternative due to high construction costs and right-of-way impacts. Additionally, one of the pedestrian crossings of Hydraulic Road would most likely need to be signalized to provide students with a safe way to access Albemarle High School and the remainder of the school complex. The results indicated in Table 6-1 does not account for vehicles stopping for pedestrians in the crosswalk.

The thru-cut was ruled out as a viable alternative because it is not able to provide a pedestrian phase that runs concurrently with east- or west-bound through traffic. This intersection experiences large amounts of pedestrian traffic crossing the southern leg of the intersection (74 in the AM and 179 in the PM). Additionally, the thru-cut does not perform markedly better than a conventional signal.

As shown in the 2023 existing and 2033 background capacity analysis, the existing intersection configuration (equivalent to the conventional signal scenario in VJuST) operates at an overall level of service C during both peak hours. To better accommodate traffic exiting the school complex, the existing pavement on Lambs Road could be re-striped to allow for more storage for the eastbound left by removing the westbound right turn lane for the church.

At the Hydraulic Road and Lambs Road/Whitewood Road intersection, different turning lane arrangements and signal phasing were analyzed to determine potential improvements in the background scenario – before construction of the proposed development. It is important to consider that during the peak hours of the school, the high number of pedestrians crossing Hydraulic Road means that the pedestrian phase is called consistently every cycle. Due to the long crossing distance of 110 feet, the pedestrian phase is 32 seconds (assuming standard walking speed of 3.5 ft/sec). Because the Lambs Road and Whitewood

Road vehicle phase runs concurrently with the pedestrian phase, the Lambs Road/Whitewood Road approaches have more green time than is necessary for optimal vehicle operations at the intersection.

The current lane configuration for the Lambs Road approach of (1) left, (1) thru, and (1) right turning lanes is the most optimal for overall operations. Additionally, the current signal phasing with protected (green arrow) and permitted (flashing yellow arrow) left turns is the most optimal phasing option. This phasing design also allows non-conflicting movements to occur at the same time. As previously mentioned, there is excess green time caused by the pedestrian phase which can be utilized by all vehicle movements at the intersection with the existing protected/permitted phasing.

If the Lambs Road approach were reconfigured to have (2) left turn lanes and (1) shared through/right lane, the signal phasing would be changed to protected only. All vehicle movements of Lambs Road would be given the green light, then all movements of Whitewood Road. Combined with the pedestrian phase being called each cycle, this method of signal phasing degrades operations of the intersection, and especially the Lambs Road/Whitewood Road approaches, significantly.

Therefore, aside from routine signal re-timing and re-striping Lambs Road between the AHS entrance and Hydraulic Road, no further intersection improvements are recommended at the Hydraulic Road at Lambs Road/Whitewood Road intersection related to vehicle operations. Chapter 7 discusses potential improvements related to pedestrians and bicyclists.

7.3 HYDRAULIC ROAD AT GEORGETOWN ROAD

Using the VJuST worksheet, the alternative at-grade intersection types listed below were identified and evaluated at the Hydraulic Road at Georgetown Road intersection. The results of the VJuST analysis are summarized in Table 6-1. A copy of the completed VJuST worksheets can be found in Appendix I.

e) Conventional Signal
f) Thru-Cut (through movements removed from east- and west-bound)
g) Continuous Green-T
h) Two-Way Stop Control
i) Roundabout

Table 7-2: VJuST Results – Hydraulic Road at Georgetown Road

Intersection Type	AM Peak Hour Maximum v/c	PM Peak Hour Maximum v/c	Weighted Total Conflict Points
Conventional Signal	0.60	0.81	48
Continuous Green-T	0.71	0.79	12
Thru-Cut	0.51	0.66	28
Roundabout	0.91	1.00	8
Two-Way Stop Control	3.74	6.65	48

As shown in Table 6-2, the thru-cut has the best overall performance. The high number of eastbound lefts are not ideal for the conventional signal, continuous green-T, and roundabout. A two-way stop control intersection is over capacity and was ruled out as a viable alternative.

The roundabout was ruled out as a viable alternative due to high construction costs and right-of-way impacts. Additionally, the high number of eastbound lefts during both peak hours would require two circulating lanes through three sides of the roundabout. As noted in the VJuST worksheets, the tool cannot model dual left turn lanes and assumes that left turns are only made from the left-most or inner-most lane.

The continuous green-T was ruled out as a viable alternative due to the high number of eastbound lefts during both peak hours. The existing right-of-way for Hydraulic Road will only allow for one acceleration lane for the eastbound left, which is not adequate for the traffic volumes present.

The conventional signal was ruled out as a viable alternative because it has worse operations and more conflict points compared to the thru-cut. Additionally, the fourth leg of the intersection is a private driveway with low traffic volumes. Retaining full access for the driveway reduces efficiency at the intersection with the existing split phasing for the side street approaches.

The thru-cut provides the best operations and lowest conflict points out of the three signalized intersection alternatives and is recommended to be implemented. This intersection design also retains most of the access for the private driveway, with only east- and west-bound through movements removed. While pedestrians were counted crossing Hydraulic Road, the volume is low and would not be activated very often. A pedestrian phase, most likely pedestrian only, can be provided with minimal impact to operations. In addition to the improvements associated with the thru-cut alternative, an overlap phase is recommended for the southbound right to run concurrently with the eastbound left.

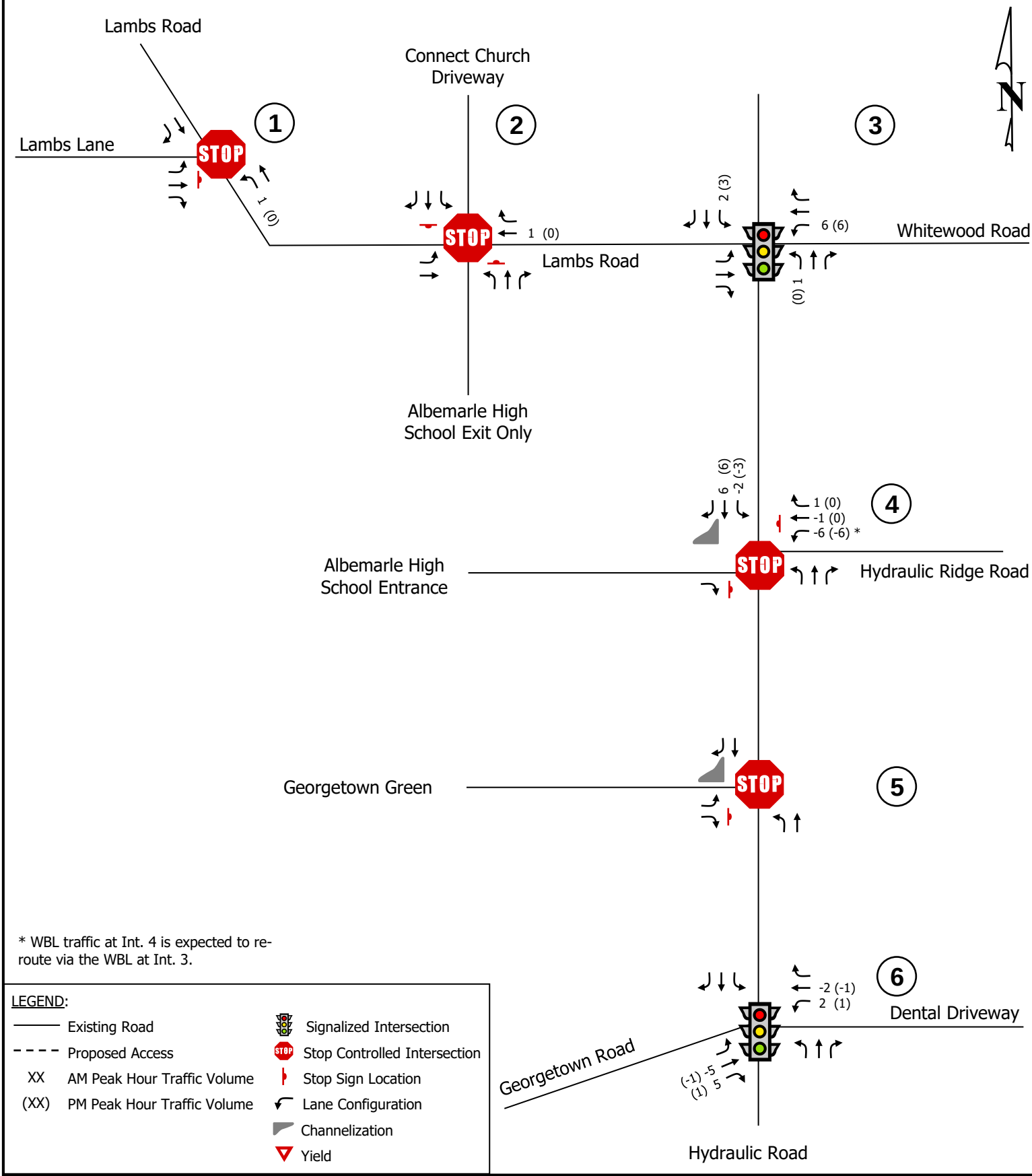
7.1 SUMMARY – HYDRAULIC ROAD CORRIDOR IMPROVEMENTS

Based on a review of the access management and innovative intersection evaluation using the VJuST tool along the Hydraulic Road corridor, the following improvements are recommended:

- Removal of the existing two-way left-turn lane (TWLTL) and replacement with a raised median between Lambs Road/Whitewood Road and Georgetown Road. As a result, access to Hydraulic Ridge Road and the AHS main entrance would be via right-in/right-out only.

- Implementation of a thru-cut intersection alternative with an overlap phase for the southbound right on Hydraulic Road at Georgetown Road. East- and west-bound through movements (to and from the dentist office commercial property) would be removed.

- The existing intersection configuration of Hydraulic Road at Lambs Lane/Whitewood Road provides the best operations for vehicles. Aside from signal re-timing of the overall Hydraulic Road corridor to incorporate the other improvements, no further improvement is recommended related to vehicle operations.



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Rerouted Trips – Corridor Improvements
Lambs Lane Loop Road Analysis
Albemarle County, Virginia

Figure 7-1

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8 PROPOSED PEDESTRIAN AND BICYCLE IMPROVEMENTS

Timmons Group analyzed the existing pedestrian and bicycle facilities within the study area to determine any future improvements to improve safety, access, and the overall experience of pedestrians and bicyclists accessing the project site. Additionally, a review of 5 years of crash data found that there was one pedestrian and one bicycle-related crashes within the study area, both occurred at the Hydraulic Road/Georgetown Road intersection.

As discussed in Chapter 2, sidewalks form a continuous network within a 1/4 mile radius from Albemarle High School along Hydraulic Road, Georgetown Road, Lambs Road, Lambs Lane, and Whitewood Road. Beyond that radius, sidewalks only continue along Hydraulic Road and Georgetown Road.

The ACPS *Lambs Lane Master Plan* details several aspects of pedestrian and bicycle circulation through the project site, as shown on pages 48-51. This report will focus on improvements along the perimeter of the school area along Hydraulic Road.

Concept schematics were developed showing the proposed improvements discussed in this chapter, as well as the recommendations in Chapter 7 and the Proposed Loop Road intersection location and design in Chapter 9. The exhibits are included in Appendix G.

8.1 HYDRAULIC ROAD AT LAMBS ROAD/WHITEWOOD ROAD

As discussed in Chapter 6, this intersection was analyzed for potential vehicle capacity improvements. Based on the operational results, the existing lane geometry and traffic signal phasing were found to be the best option available to also maintain the pedestrian crossing across Hydraulic Road.

As shown in Figure 3-2, there are 74 and 179 pedestrians crossing Hydraulic Road in the AM and PM peak hours, respectively. There are currently 24 and 56 pedestrians crossing Whitewood Road in the AM and PM peak hours, respectively.

Several improvements are presented that have a range of cost and impacts. These improvements can be selected and combined with each other like a menu to find the most desired results.

<u>Option 1 – Install Crosswalk with High-Visibility Markings</u>

Currently both crosswalks only have transverse (parallel) lines which do not stand out and do not meet current VDOT guidance for high use locations. Many research studies indicate that high-visibility or "zebra" crosswalks make pedestrians more visible to drivers, and when placed correctly, the markings wear down at a slower rate compared to transverse lines. High visibility crosswalks can reduce pedestrian injury crashes up to 40% (source: FHWA).

<u>Option 2 – No Turn on Red</u>

No turn on red signs would be added to all approaches of the intersection to provide increased safety for both pedestrians and vehicles. The rule could be implemented during school peak hours only at first to gauge impact. This improvement also strengthens the safety benefits associated with a leading pedestrian interval and improved crosswalks.

Option 3 – Implement a Leading Pedestrian Interval (LPI)

A leading pedestrian interval provides a head start of 3-7 seconds for the pedestrian where all vehicles remain stopped at the beginning of the phase. The head start allows the pedestrian to establish their presence in the crosswalk before the vehicle signal turns green, giving visual confirmation that vehicles are better able to see and respond to the pedestrian. LPIs have been shown to reduce pedestrian-vehicle collisions by up to 60% (source: NACTO).

Option 4 – Reduce Curb Radius at NE & SW Corners

Because Hydraulic Road does not form a 90-degree angle with Lambs Road/Whitewood Road, the NE and SW corners have an excessively wide radius. If the radius is reduced, the crossing length would decrease by 10-15 feet and slow down vehicles making right turns, providing safer crossing for pedestrians. The reduced crossing length will also improve operations for vehicles by reducing the amount of time required to cross the intersection. Reduced crossing lengths can also help to reduce the necessary yellow and red timing provided at the intersection, which could be used as more green time on the corridor.

Option 5 – Relocated Perpendicular Crosswalks

The existing crosswalks both follow a diagonal path across the intersection, lengthening the crossing for pedestrians. If the crossings were shifted slightly to form a 90-degree angle with the curb, the crossing length would be reduced by 40 feet (Hydraulic Road) and 30 feet (Whitewood Road). This improvement is best paired with Option 4 to have the most impact. The reduced crossing length will also improve operations for vehicles by reducing the amount of time required to cross the intersection.

Option 6 – Eliminate Westbound Right Turn Lane

Based on the 2023 existing and 2033 background peak hour traffic volumes, the westbound right turn lane could be removed without a significant impact to operations of the intersection. By removing the turn lane, the crossing length could be reduced by another 10-12 feet. The reduced crossing length will also improve operations for vehicles by reducing the amount of time required to cross the intersection.

8.2 Hydraulic Road at Georgetown Road

At the Hydraulic Road and Georgetown Road intersection, the existing pedestrian push buttons and ADA curb ramps do not meet current VDOT and ADA/PROWAG standards. It is recommended that new ADA-compliant curb ramps and accessible pedestrian signals be installed for all crosswalks. The driveway entrance for the dental office is also sub-standard for ADA-compliance and should be rebuilt. Bus stop amenities such as shelters, benches, or widened sidewalks are recommended to be installed at the nearby CAT bus stops. Additionally, options #1-3 described above for Hydraulic Road at Lambs Road/Whitewood Road could be implemented, to include replacing the existing crosswalks with high-visibility markings, adding signage to remove the right turn on red, and implementing a leading pedestrian interval (LPI) for all crossings.

As shown in Figure 3-2, there are less than 5 pedestrians per hour crossing Hydraulic Road at Georgetown Road (E-W crossing). For the crosswalk across Georgetown Road (N-S crossing), there were 18 and 21 pedestrians per hour in the AM and PM peak hours, respectively.

8.3 HYDRAULIC ROAD – LAMBS ROAD TO GEORGETOWN ROAD

The Hydraulic Road corridor between Lambs Road and Georgetown was examined for potential pedestrian and bicycle improvements. As discussed in Chapter 2, there is an existing 8' shared-use path parallel to the 5' sidewalk along the Albemarle High School frontage from Lambs Road to Georgetown Green. Bicycle lanes are present on Hydraulic Road north of Lambs Road and along Whitewood Road; however, they do not form a connected network.

Bicycle Facility Improvements

In order to provide a more complete bicycle network, it is recommended to extend the existing shared-use path from Georgetown Green to the Georgetown Road intersection. In addition, the existing shared-use path along the AHS property is recommended to be upgraded. Driveway entrances and curb ramps are recommended to be upgraded to prioritize bicycles and pedestrians over vehicles from Lambs Road to Georgetown Road. With the construction of the Proposed Loop Road, which will include sidewalks and shared-use paths, an improvement to the biking and walking facilities on Hydraulic Road would be complimentary for people to access project site.

Along the frontage of the AHS property on Hydraulic Road, a 4' buffer is recommended between the curb/gutter and the improved 10' shared-use path. Other locations along Hydraulic Road should be reviewed for a similar section, however, the right-of-way costs will make the implementation more difficult.

Reference the ACPS Lambs Lane Master Plan page 51 for a conceptual typical section for the Proposed Loop Road.

Hydraulic Road at Proposed Loop Road Crosswalks

Currently within the study area, crosswalks are only provided via the signalized intersections at Lambs Road and at Georgetown Road. These intersections are approximately 1,555' apart. As described in Chapter 6, the proposed intersection of Hydraulic Road and the Proposed Loop Road is expected to be a continuous green-T design. This intersection design is not ideal for having a pedestrian crossing of the major street since the northbound direction of Hydraulic Road would be free-flowing.

A new crosswalk could be installed at the Hydraulic Road and Proposed Loop Road intersection, however special signal design would be required to facilitate the pedestrian crossing of Hydraulic Road. Further, the existing crosswalk at Georgetown Road is approximately 530' south of this location. There are limited pedestrian generators or attractors on the east side of Hydraulic Road directly opposite the Georgetown Green entrance.

Therefore, because there are no major pedestrian attractors/generators on the east side of Hydraulic Road at the Proposed Loop Road intersection, and the geometry of a continuous green-T intersection, a pedestrian crossing of Hydraulic Road at the proposed intersection is not recommended.

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9 PROPOSED LOOP ROAD ALTERNATIVES ANALYSIS

To support the proposed development, a new road (referred to as the Proposed Loop Road) will be constructed between Hydraulic Road and Lambs Lane to provide better site circulation and access to the existing schools and the remainder of the property. Albemarle County Public Schools (ACPS) developed the *Lambs Lane Master Plan* (included in Appendix A), which includes high-level planning of the overall property and a general description of the Proposed Loop Road.

Three scenarios were analyzed to identify the best location for the future intersection of the proposed Loop Road with Hydraulic Road. In addition, an alternative intersection analysis was conducted to find the optimal intersection design for the Hydraulic Road/Proposed Loop Road intersection. All scenarios were analyzed in 2033 to align with buildout of the proposed development.

Concept schematics were developed showing the proposed improvements discussed in this chapter, as well as the recommendations in Chapters 7 and 8. The exhibits are included in Appendix G.

9.1 PROPOSED LOOP ROAD ALIGNMENT SCENARIOS

The proposed alignment of the Loop Road will connect to Lambs Lane east of Journey Middle School and continue to the southeast between the Albemarle High School (AHS) football stadium and baseball field. The road will then follow the property line of the school parcel as it approaches Hydraulic Road. The existing Building Services complex is expected to be demolished and relocated to allow construction of the proposed Loop Road. Three scenarios have been identified for where the future intersection of the Loop Road and Hydraulic Road will be located. To meet access management spacing standards, the existing AHS entrance (intersection 4) and Georgetown Green entrance (intersection 5) may be modified in each scenario.

Scenario 1
As shown in Figure 9-1, the proposed Loop Road will connect to Georgetown Green and will utilize the existing Hydraulic Road/Georgetown Green intersection. The AHS entrance and Hydraulic Ridge Road will have right-in/right-out access only. Northbound left movements at the AHS entrance will be redirected to the Proposed Loop Road.

Scenario 2
As shown in Figure 9-2, the proposed Loop Road will form a new intersection with Hydraulic Road in between Georgetown Green and the AHS entrance. The AHS entrance, Hydraulic Ridge Road, and Georgetown Green will all have right-in/right-out access only. Northbound left movements at the AHS entrance will be redirected to the Proposed Loop Road. Existing non-school traffic rerouted as a result of the Scenario 2 geometry changes are shown on Figure 9-3.

Scenario 3
As shown in Figure 9-4, the proposed Loop Road will form a new intersection with Hydraulic Road just west of the AHS entrance (650 feet south of Lambs Road). The AHS entrance will be closed. Hydraulic Ridge Road and Georgetown Green will have right-in/right-out access only. All traffic associated with the AHS entrance will be redirected to the Proposed Loop Road. Existing non-school traffic rerouted as a result of the Scenario 3 geometry changes are shown on Figure 9-5.

9.2 2033 Future Traffic Volumes

To generate the Scenario 1 total future traffic volumes, the site trips (Figures 5-10 and 5-11) and the rerouted non-school traffic (Figure 7-1) were added to the background 2033 traffic volumes shown on Figure 4-1. The resulting 2033 Scenario 1 total future volumes are shown on Figure 9-6.

To generate the Scenario 2 total future traffic volumes, the site trips (Figures 5-12 and 5-13) and the rerouted non-school traffic (Figures 6-1 and 9-3) were added to the background 2033 traffic volumes shown on Figure 4-1. The resulting 2033 Scenario 2 total future volumes are shown on Figure 9-7.

To generate the Scenario 3 total future traffic volumes, the site trips (Figures 5-10 and 5-11) and the rerouted non-school traffic (Figures 6-1 and 9-5) were added to the background 2033 traffic volumes shown on Figure 4-1. The resulting 2033 Scenario 3 total future volumes are shown on Figure 9-8.

9.3 VDOT Junction Screening Tool (VJuST)

The VJuST Tool was used to complete an initial, high-level screening of potential intersection treatments. This screening provided a preliminary subset of intersection options based on congestion capabilities, pedestrian accommodations, and anticipated safety benefits. The following sections provide an overview of the grade-separated and at-grade intersection options; these subsets were narrowed down to options that are most applicable and subject to further analysis.

9.4 Alternative Intersection Selection

In all grade-separated scenarios, right-of-way, utility, construction, and access management issues outweigh the anticipated operational benefits. All scenarios require the closure of existing intersections/crossovers and restrict development along the corridor due to loss of developable land and access. Multiple residential and commercial properties along the corridor would be subject to acquisition. In addition, the installation of a grade-separated alternative Hydraulic Road at either study intersection will not significantly improve operations to offset the costs of the improvements.

The remaining at-grade intersection options included in the VJuST worksheet were eliminated from the analysis due to feasibility for the facility type, intersection spacing, the ability to accommodate traffic volumes, or driver expectation concerns. Since Hydraulic Road is an undivided roadway, the alternative at-grade intersection types that require a downstream U-Turn are not feasible alternatives because extensive right-of-way would need to be purchased, including the possibility of full acquisition of multiple properties.

As such, all grade-separated interchanges, grade-separated intersections, or at-grade intersection alternatives such as the RCUT or MUT were removed from consideration.

For each of the three intersection scenarios described above, the alternative at-grade intersection types listed below were identified and evaluated at the future Hydraulic Road/Proposed Loop Road intersection. Note that for the unsignalized continuous green-T, the two-way stop control option in VJuST was selected and the volume entered for the northbound through was 1 vehicle. This was done to re-create the conflicting volumes present with the geometry associated with the continuous green-T.

a) Conventional Signal
b) Signalized Continuous Green-T
c) Unsignalized Continuous Green-T
d) Roundabout
e) Two-Way Stop Control

9.5 SCENARIO 1 – HYDRAULIC ROAD AND PROPOSED LOOP ROAD

As previously mentioned, the proposed alignment of the Proposed Loop Road in Scenario 1 will connect to the existing Hydraulic Road/Georgetown Green intersection. The AHS entrance and Hydraulic Ridge Road will have right-in/right-out access only. Using the 2023 Scenario 1 and 2 total future traffic volumes (Figure 9-6), the results of the VJuST analysis are shown in Table 8-1. Copies of the VJuST worksheets are included in Appendix J.

Table 9-1: VJuST Results – Scenario 1 – Hydraulic Road and Proposed Loop Road

Intersection Type	AM Peak Hour Maximum v/c	PM Peak Hour Maximum v/c	Weighted Total Conflict Points
Conventional Signal	0.56	0.56	48
Signalized Continuous Green-T	0.56	0.56	12
Roundabout	0.67	0.57	8
Unsignalized Continuous Green-T	1.16	0.92	12
Two-Way Stop Control	2.40	2.22	48

As shown in Table 8-1, the two signalized alternatives and the roundabout show the best operations out of the alternatives considered. However, the spacing between the existing adjacent signals along Hydraulic Road is 1,625 feet, which does not allow the required 880 feet spacing for a traffic signal at the Proposed Loop Road. A new signal at this location would require approval of an Access Management Exception by VDOT.

The roundabout was ruled out due to high construction and right-of-way costs. Additionally, roundabouts generally do not function optimally when located close to signalized intersections. The two-way stop control intersection is over capacity during both peak hours and was ruled out as a viable alternative because it results in high delays and no reduction in safety.

The continuous green-T was analyzed both as signalized and as a stop-controlled intersection because of the improved safety and operations of this intersection design. The VJuST results indicate that the unsignalized continuous green-T is over capacity in the AM peak hour and nearing capacity in the PM peak hour. However, compared to the traditional two-way stop controlled intersection, the operations are much improved. The VJuST results indicate that the signalized continuous green-T is the next best intersection design, however the location of the Proposed Loop Road does not have adequate spacing to adjacent signals.

9.6 SCENARIO 2 – HYDRAULIC ROAD AND PROPOSED LOOP ROAD

As previously mentioned, the proposed Loop Road will form a new intersection with Hydraulic Road in between Georgetown Green and the AHS entrance. The AHS entrance, Hydraulic Ridge Road, and Georgetown Green will all have right-in/right-out access only. Using the 2023 Scenario 1 and 2 total future traffic volumes (Figure 9-6), the results of the VJuST analysis are shown in Table 8-2. Copies of the VJuST worksheets are included in Appendix K.

Table 9-2: VJuST Results – Scenario 2 – Hydraulic Road and Proposed Loop Road

Intersection Type	AM Peak Hour Maximum v/c	PM Peak Hour Maximum v/c	Weighted Total Conflict Points
Conventional Signal	0.55	0.55	48
Signalized Continuous Green-T	0.55	0.55	12
Roundabout	0.65	0.55	8
Unsignalized Continuous Green-T	0.84	0.77	12
Two-Way Stop Control	1.75	1.85	48

As shown in Table 8-2, the two signalized alternatives and the roundabout show the best operations out of the alternatives considered. However, the spacing between the existing adjacent signals along Hydraulic Road is 1,625 feet, which does not allow the required 880 feet spacing for a traffic signal at the Proposed Loop Road. A new signal at this location would require approval of an Access Management Exception by VDOT.

The roundabout was ruled out due to high construction and right-of-way costs. Additionally, roundabouts generally do not function optimally when located close to signalized intersections. The two-way stop control intersection is over capacity during both peak hours and was ruled out as a viable alternative because it results in high delays and no reduction in safety.

The continuous green-T was analyzed both as signalized and as a stop-controlled intersection because of the improved safety and operations of this intersection design. The VJuST results indicate that the unsignalized continuous green-T is nearing capacity in the AM peak hour. However, compared to the traditional two-way stop controlled intersection, the operations are much improved. The VJuST results indicate that the signalized continuous green-T is the next best intersection design, however the location of the Proposed Loop Road does not have adequate spacing to adjacent signals.

9.7 SCENARIO 3 – HYDRAULIC ROAD AND PROPOSED LOOP ROAD

As previously mentioned, the proposed Loop Road will form a new intersection with Hydraulic Road just west of the AHS entrance (650 feet south of Lambs Road). The AHS entrance will be closed. Hydraulic Ridge Road and Georgetown Green will have right-in/right-out access only. Using the 2023 Scenario 1 and 2 total future traffic volumes (Figure 9-6), the results of the VJuST analysis are shown in Table 8-3. Copies of the VJuST worksheets are included in Appendix L.

Table 9-3: VJuST Results – Scenario 3 – Hydraulic Road and Proposed Loop Road

Intersection Type	AM Peak Hour Maximum v/c	PM Peak Hour Maximum v/c	Weighted Total Conflict Points
Conventional Signal	0.61	0.55	48
Signalized Continuous Green-T	0.61	0.55	12
Roundabout	0.86	0.58	8
Unsignalized Continuous Green-T	2.25	0.93	12
Two-Way Stop Control	4.68	2.24	48

As shown in Table 8-3, the two signalized alternatives and the roundabout show the best operations out of the alternatives considered. However, the spacing between the existing adjacent signals along Hydraulic Road is 1,625 feet, which does not allow the required 880 feet spacing for a traffic signal at the Proposed Loop Road. A new signal at this location would require approval of an Access Management Exception by VDOT.

The roundabout was ruled out due to high construction and right-of-way costs. Additionally, roundabouts generally do not function optimally when located close to signalized intersections. The two-way stop control intersection is over capacity during both peak hours and was ruled out as a viable alternative because it results in high delays and no reduction in safety.

The continuous green-T was analyzed both as signalized and as a stop-controlled intersection because of the improved safety and operations of this intersection design. The VJuST results indicate that the unsignalized continuous green-T is over capacity in the AM peak hour and nearing capacity in the PM peak hour. However, compared to the traditional two-way stop controlled intersection, the operations are much improved. The VJuST results indicate that the signalized continuous green-T is the next best intersection design, however the location of the Proposed Loop Road does not have adequate spacing to adjacent signals.

9.8 SUMMARY – PROPOSED LOOP ROAD ALTERNATIVE INTERSECTION ANALYSIS

The VJuST Tool was used to complete an initial, high-level screening of potential intersection treatments for the future Hydraulic Road and Proposed Loop Road intersection for each of the three alignment scenarios.

Based on the VJuST results shown in Tables 8-1 through 8-3, the signalized continuous green-T (CGT) has the lowest number of conflict points and the best operations of the alternatives considered. However, the spacing between the existing adjacent signals along Hydraulic Road is 1,625 feet, which does not allow the required 880 feet spacing for a traffic signal at the Proposed Loop Road. Therefore, a new signal at this location will require approval of an Access Management Exception by VDOT.

Therefore, it is recommended that the alternative intersection design for the future intersection of Hydraulic Road and the Proposed Loop Road is an unsignalized continuous green-T intersection. As shown in Figure 9-9, the proposed intersection geometry includes the following lane configuration. Note that based on the *VDOT Road Design Manual*, for an urban, minor arterial like Hydraulic Road with posted speed limit of 35 mph, the minimum turn lane dimensions have a 100 foot storage with 100 foot taper.

Northbound
- One left-turn lane (300 ft effective storage required)
- Two through lanes

Southbound
- One channelized right-turn lane (150 ft effective storage required)
- Two through lanes

Eastbound
- One left-turn lane (200 ft effective storage with associated channelized NB acceleration lane)
- One right-turn lane

9.9 SUMMARY – PROPOSED LOOP ROAD ALIGNMENT SCENARIO SELECTION

To determine the correct alignment of the Proposed Loop Road, the type of intersection must be determined first. As outlined above in section 8.8, an unsignalized continuous green-T is recommended for the future Hydraulic Road/Proposed Loop Road intersection.

For the installation of a continuous green-T, an acceleration lane is needed to allow side street left-turns to merge with mainline traffic. In the case of this project, a northbound acceleration lane is needed for the eastbound left-turning traffic. Design standards for the length of an acceleration lane were used as published in the AASHTO *Policy on Geometric Design of Highways and Streets,* 7th Edition. The two components are the acceleration length and the taper length. Based on Table 10-4, with a left-turning vehicle traveling 15 mph and a 35 mph design speed, the acceleration length must be at least 220 feet. The publication also outlines that a taper of 300 feet is appropriate up to a design speed of 70 mph. Therefore, the total acceleration lane length must be a minimum of 520 feet.

The existing northbound left turn lane at the Hydraulic Road at Lambs Road/Whitewood Road intersection has 350 feet of storage. This length must be maintained in order to have adequate queue storage for left-turning traffic at the signal. Therefore, the minimum spacing between the Proposed Loop Road intersection and the existing Lambs Road/Whitewood Road intersection is the sum of the acceleration lane length and the storage lane length – 870 feet.

As shown in Figures 8-1 through 8-3, the only scenario that provides the 870 feet of required spacing is Scenario 1. Therefore, the recommended Loop Road alignment is Scenario 1, where the Proposed Loop Road will connect to the existing Georgetown Green intersection.

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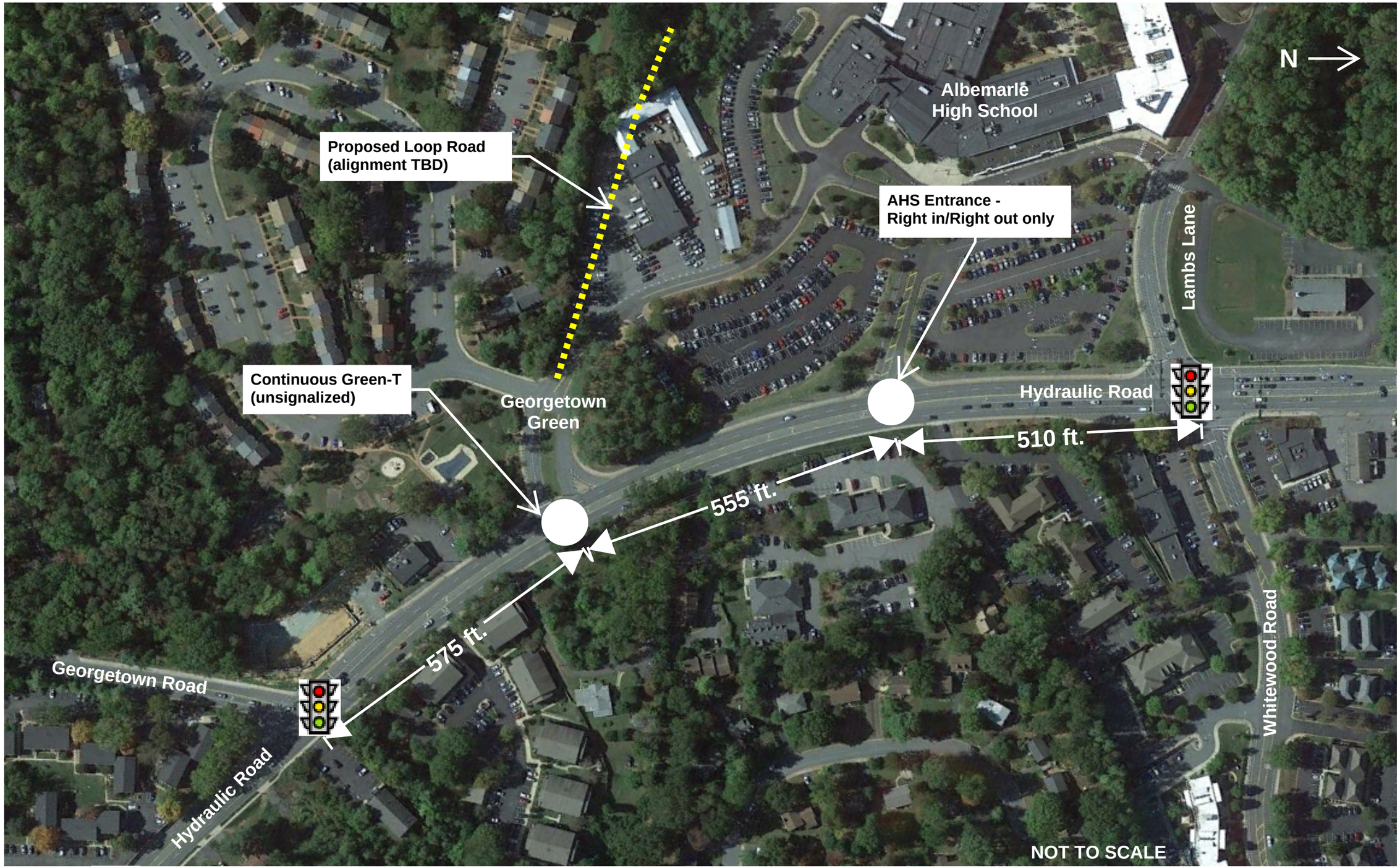

Figure 9-1
New Loop Road Alignment - Scenario 1
Lambs Lane Loop Road Analysis

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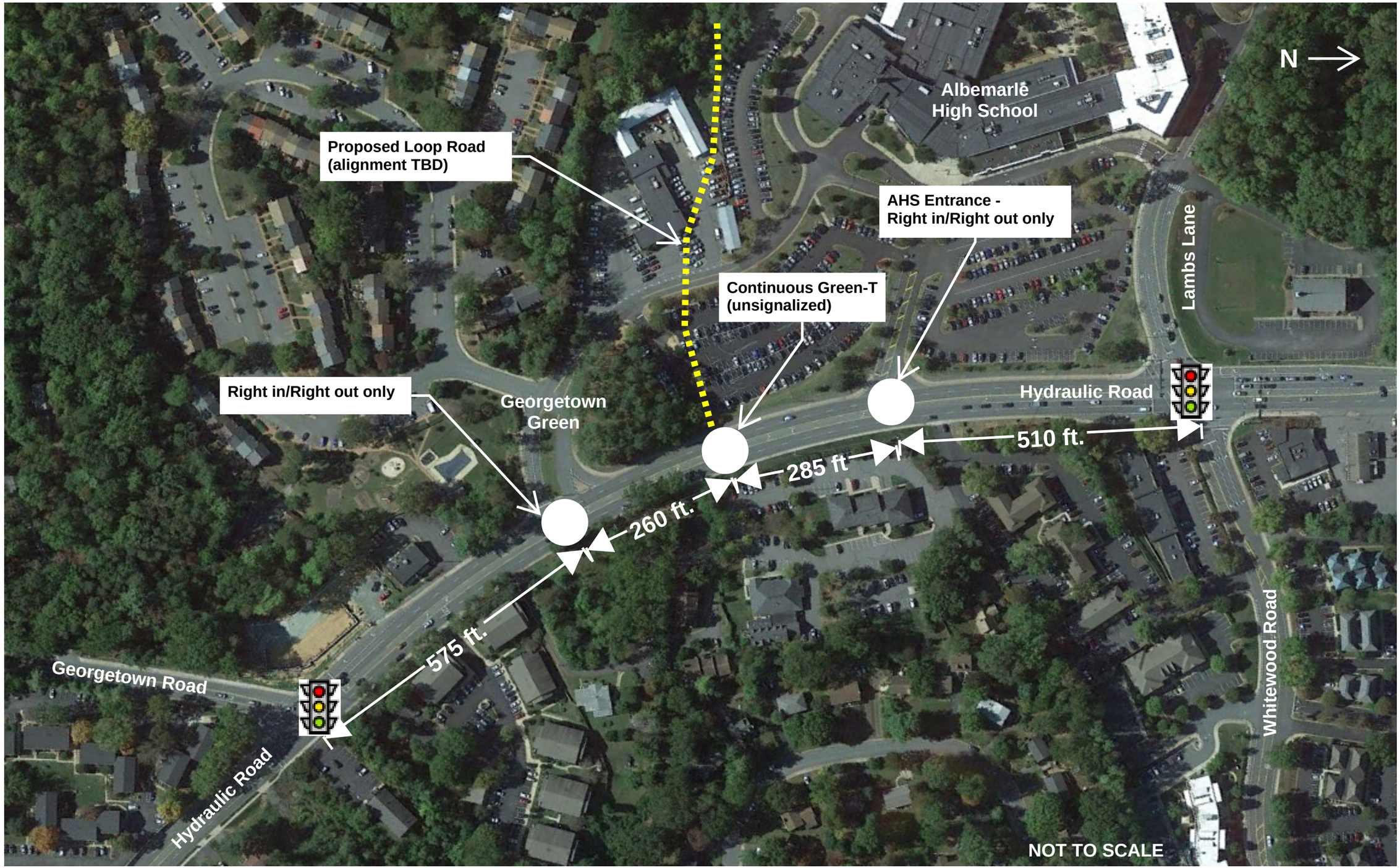

Figure 9-2
New Loop Road Alignment - Scenario 2
Lambs Lane Loop Road Analysis

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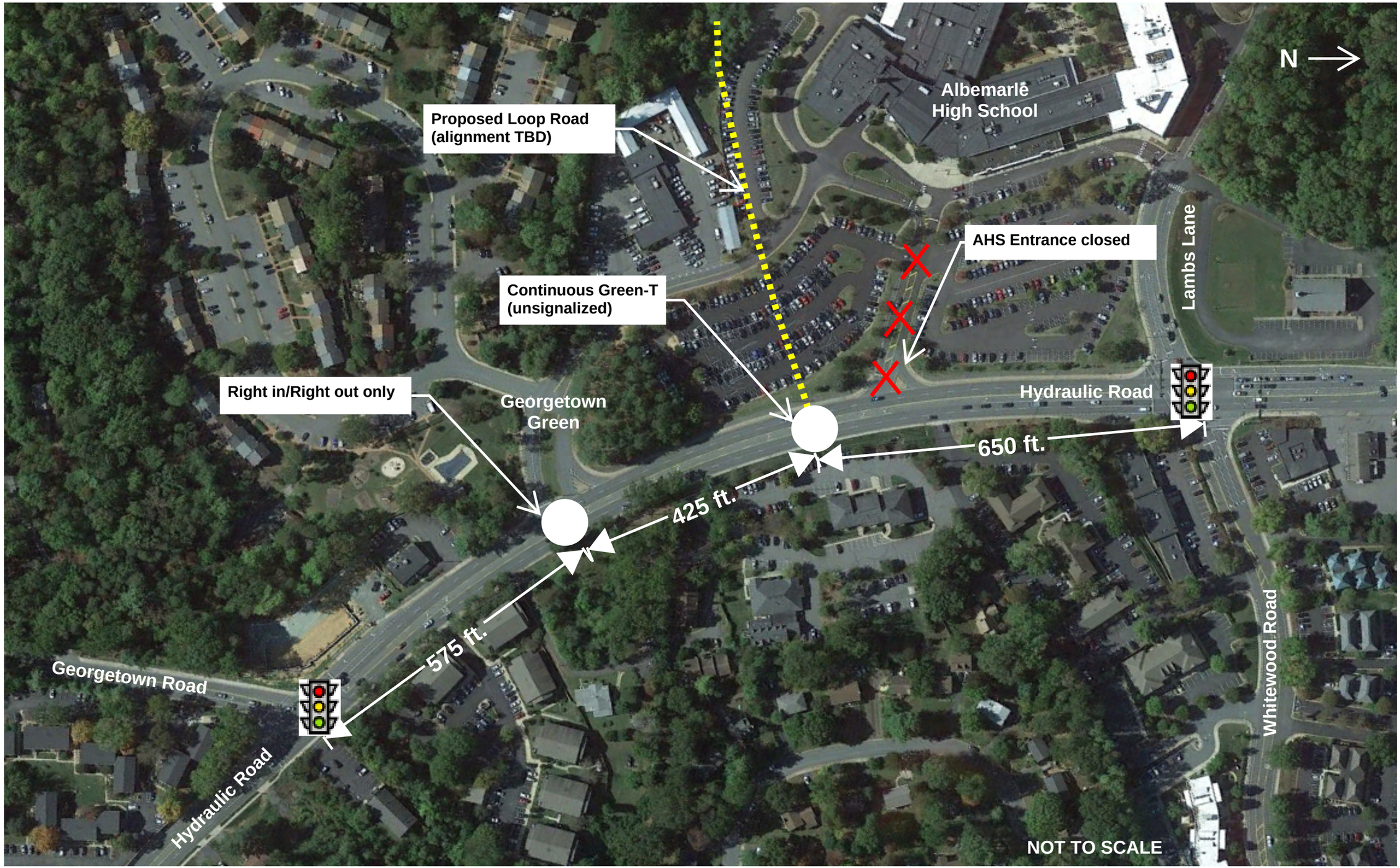

Figure 9-3
New Loop Road Alignment - Scenario 3
Lambs Lane Loop Road Analysis

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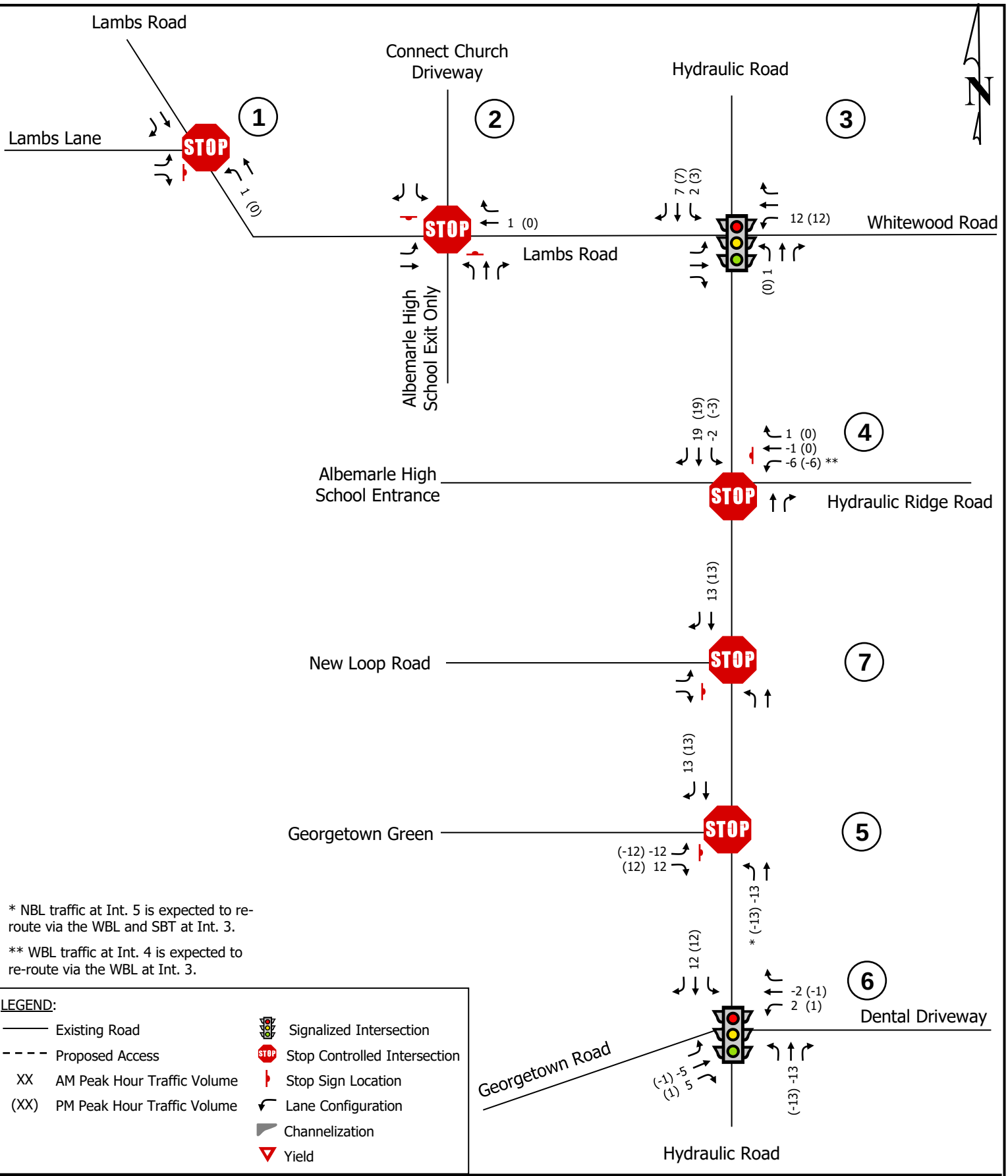

* NBL traffic at Int. 5 is expected to re-route via the WBL and SBT at Int. 3.

** WBL traffic at Int. 4 is expected to re-route via the WBL at Int. 3.

LEGEND:

- Existing Road
- Proposed Access
- XX AM Peak Hour Traffic Volume
- (XX) PM Peak Hour Traffic Volume
- Signalized Intersection
- Stop Controlled Intersection
- Stop Sign Location
- Lane Configuration
- Channelization
- Yield

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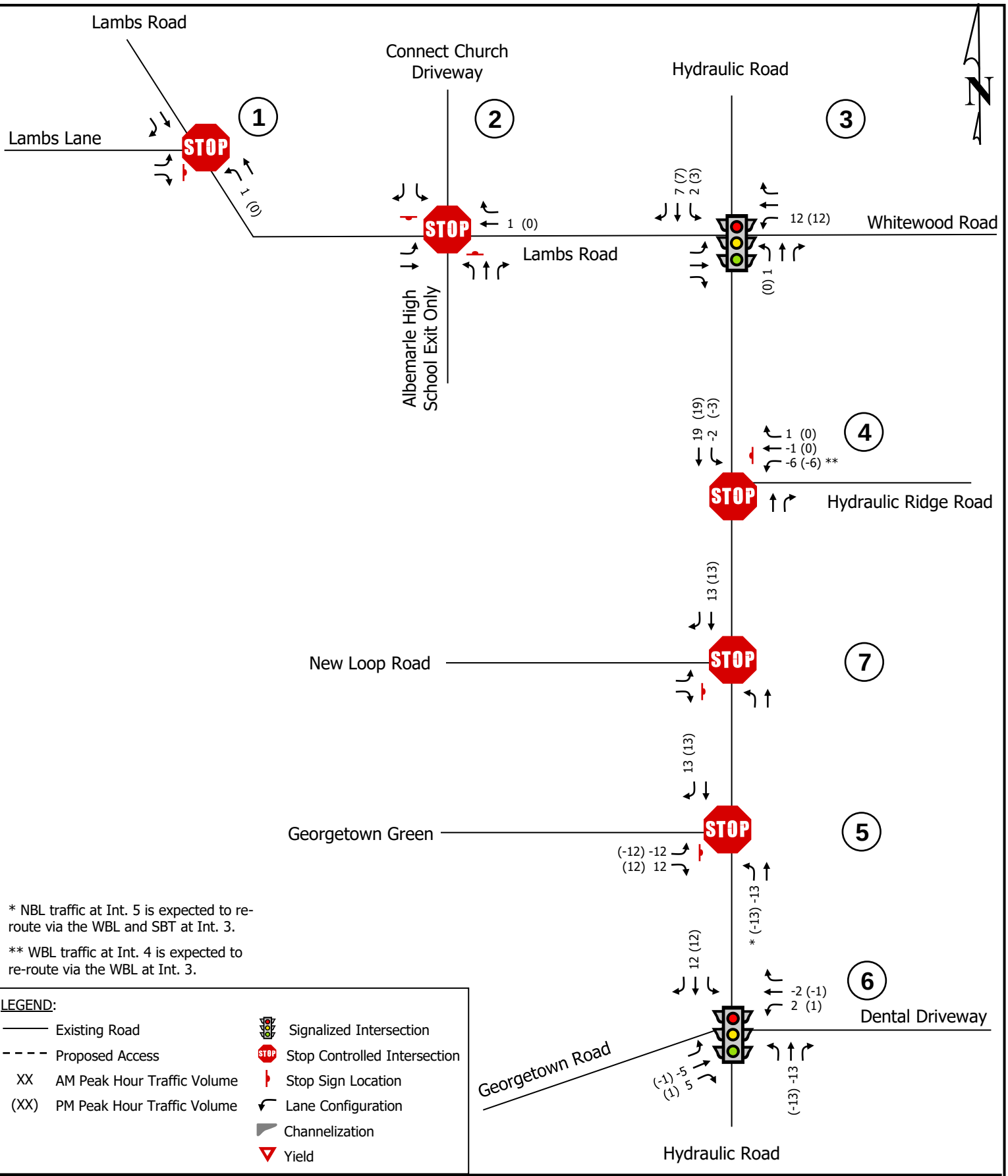
Rerouted Trips – Scenario 2
Lambs Lane Loop Road Analysis
Albemarle County, Virginia

Figure 9-4



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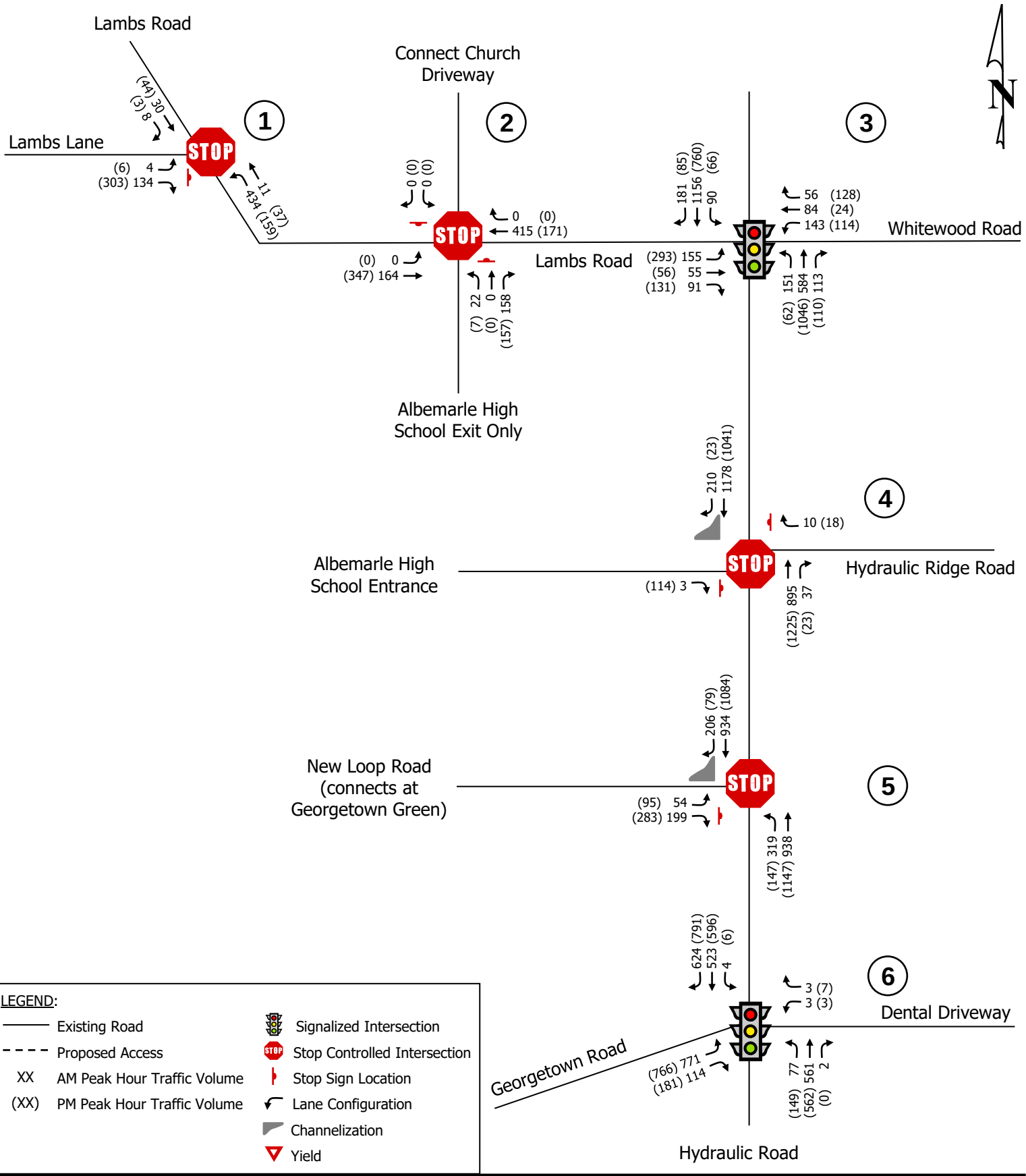
Rerouted Trips – Scenario 3
Lambs Lane Loop Road Analysis
Albemarle County, Virginia

Figure 9-5



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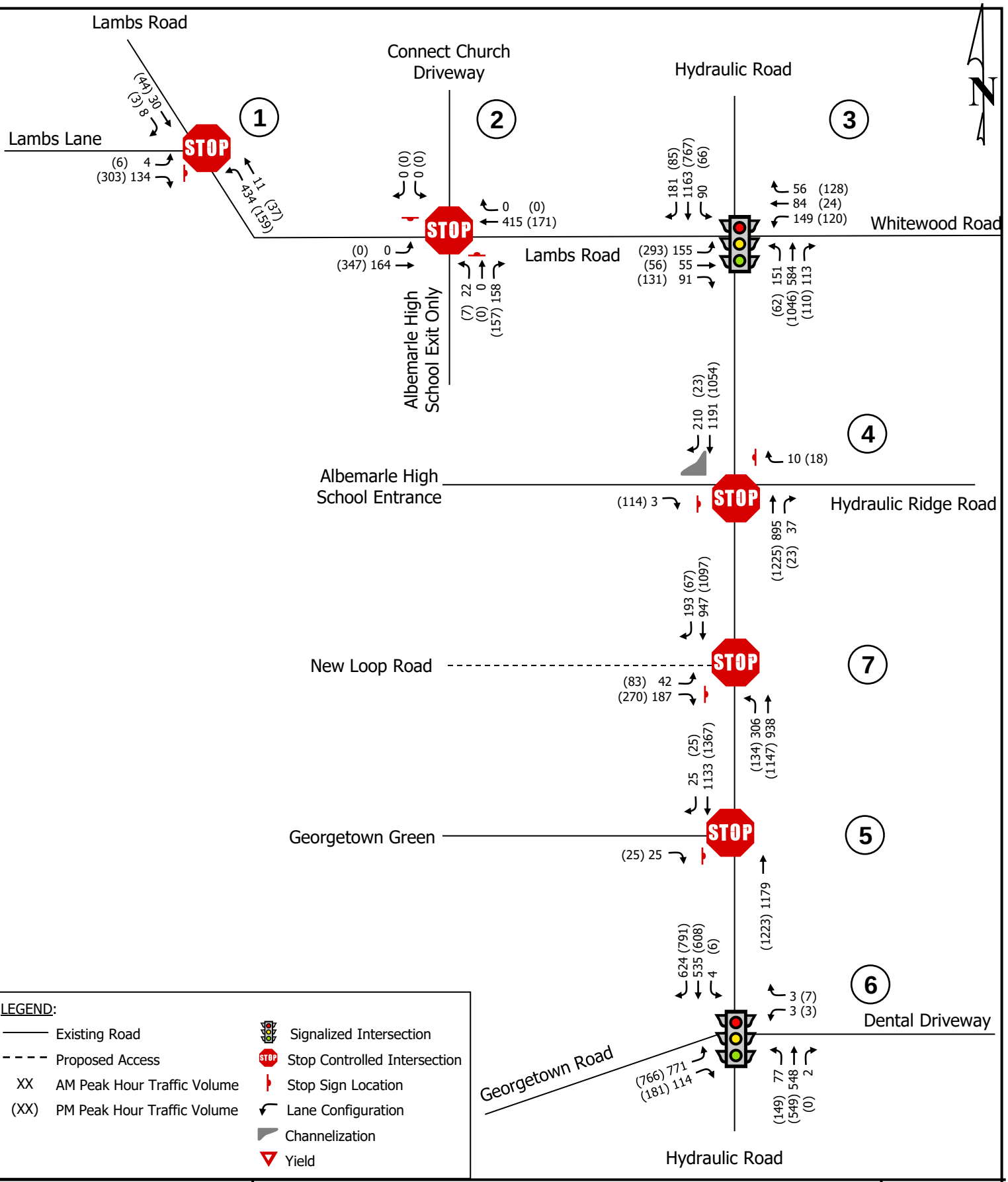
2033 Scenario 1 Total Peak Hour Volumes
Lambs Lane Loop Road Analysis
Albemarle County, Virginia

Figure 9-6



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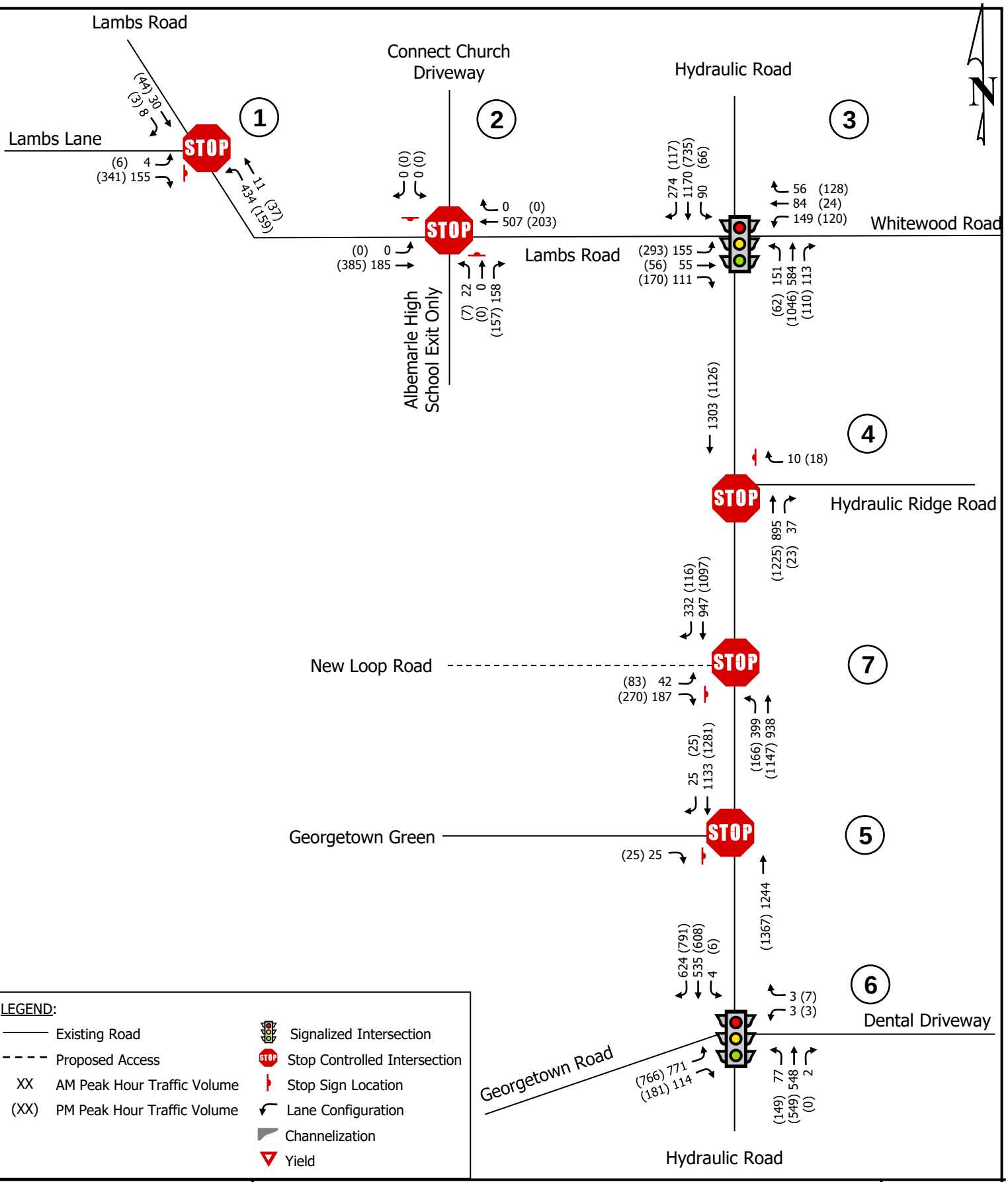
2033 Scenario 2 Total Peak Hour Volumes
Lambs Lane Loop Road Analysis
Albemarle County, Virginia

Figure 9-7



TIMMONS GROUP
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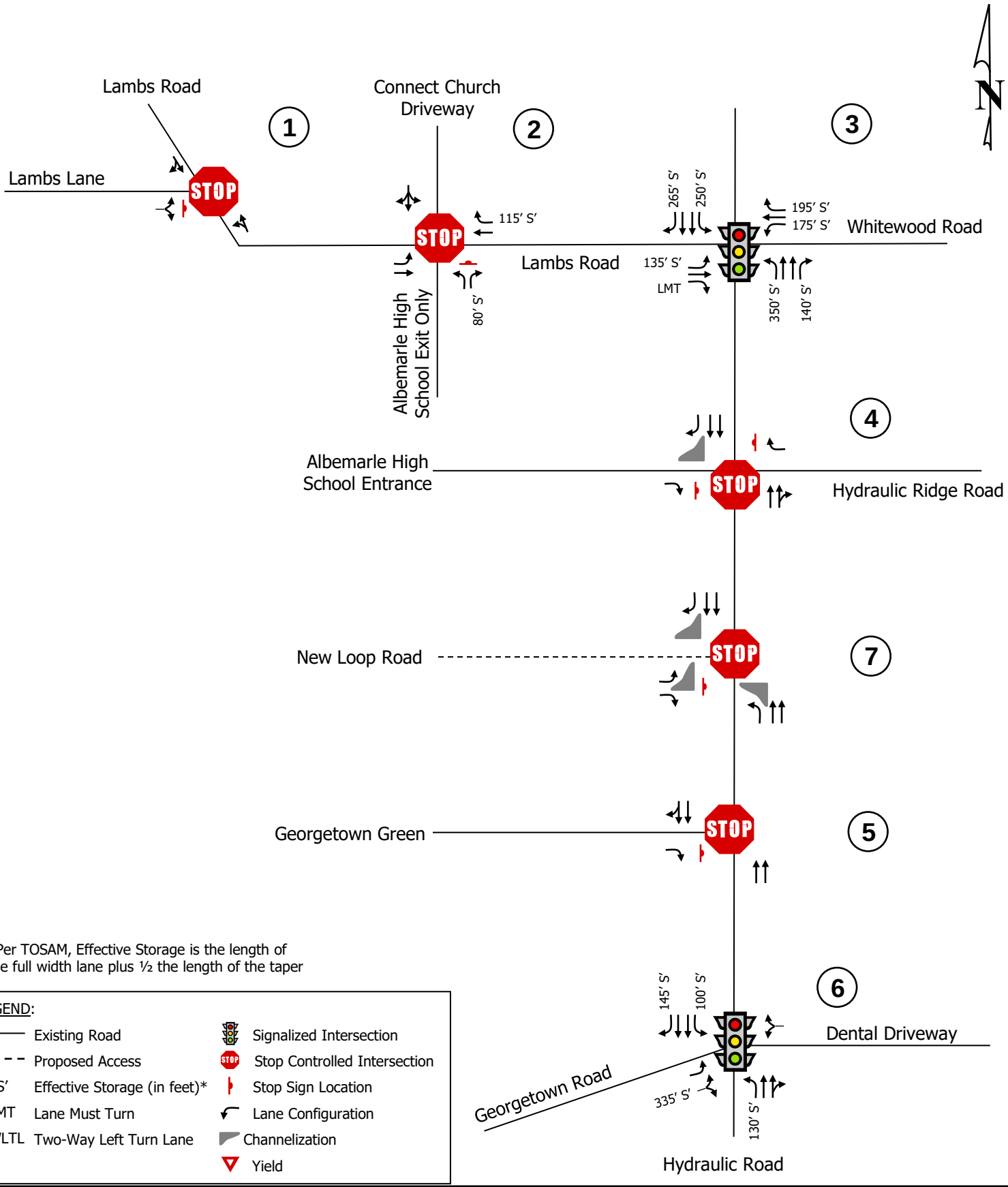
2033 Scenario 3 Total Peak Hour Volumes
Lambs Lane Loop Road Analysis
Albemarle County, Virginia

Figure 9-8



*Per TOSAM, Effective Storage is the length of the full width lane plus ½ the length of the taper

LEGEND:

———	Existing Road		Signalized Intersection
- - - -	Proposed Access	STOP	Stop Controlled Intersection
S'	Effective Storage (in feet)*		Stop Sign Location
LMT	Lane Must Turn		Lane Configuration
TWLTL	Two-Way Left Turn Lane		Channelization
			Yield

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Future Geometry and Stop Control
Lambs Lane Loop Road Analysis
Albemarle County, Virginia

Figure 9-9

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10 SIGNAL WARRANT ANALYSIS

To address the operational issues associated with the proposed new school traffic, a preliminary signal warrant analyses were performed at the intersection of the proposed Loop Road with Hydraulic Road. The lane geometry shown in Figure 9-9 was used for the purposes of this analysis.

Measured from the Proposed Loop Road intersection, the spacing between the existing adjacent signals along Hydraulic Road is 1,070 feet to Lambs Road and 565 feet to Georgetown Road, which does not allow the required 880 feet spacing for a traffic signal at the Proposed Loop Road. As a result, a signal at this location will require approval of an Access Management Exception by VDOT.

A 12-hour traffic count was not conducted for the signal warrant analysis, thus the peak hour directional turning movement (DTM) traffic counts were utilized. These counts included the 7:00 – 10:00 AM and 2:00 – 5:00 PM timeframes (total of 6 hours).

For the proposed development, the ITE *Trip Generation Manual*, 11th Edition Time of Day Distributions for the High School land use were used with the proposed development program. Trip generation, distribution, and assignment procedures were followed as described in Chapter 5. An annual growth rate of 2.2% per year was used to grow the 2023 existing traffic volumes to the 2033 build out year, as described in Chapter 4. Time of day distribution worksheets including background and proposed traffic volume development are attached in Appendix M.

The warrant analyses were conducted following procedures from the 2023 edition of the *Manual on Uniform Traffic Control Devices* (MUTCD) and VDOT signal warrant guidance contained in IIM-TE-387.1 using the traffic volumes. Warrants 1 (Eight-Hour), 2 (Four-Hour), and 3 (Peak Hour) of the nine (9) signal warrants outlined in the 2009 MUTCD were considered for the analyses.

The following six (6) warrants were not in included in this analysis because they are not applicable to the nature/context of the development and/or adjacent roadway infrastructure.

- 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

While the proposed intersection of the Proposed Loop Road and Hydraulic Road is located adjacent to Albemarle High School, as described in Chapter 7, this intersection is expected to be a continuous green-T design. This intersection design is not ideal for having a pedestrian crossing of the major street since the northbound direction of Hydraulic Road would be free-flowing. Therefore, because there are no major pedestrian attractors/generators on the east side of Hydraulic Road at the Proposed Loop Road intersection, and the geometry of a continuous green-T intersection, a pedestrian crossing of Hydraulic Road at the proposed intersection is not recommended and the School Crossing or Pedestrian Volume (Warrants 4 and 5) were not analyzed.

The MUTCD contains both 100% and 70% volume thresholds that can be used in the signal warrant analysis. The 100% volume thresholds were used to complete the analyses since there are no characteristics supporting the use of the 70% volume thresholds.

10.1 Signal Warrant Analysis – Proposed Loop Road at Hydraulic Road

Signal warrants for the intersection of the Proposed Loop Road at Hydraulic Road were analyzed in the buildout year of 2033 with the Scenario 1 intersection location. The total future traffic volumes are shown in Table 9-1 and were generated by the same procedure described in Chapter 9.

Traffic volumes for the signal warrant analysis were adjusted per VDOT methodology. First, based on Pagone's Theorem, because the minor street eastbound approach (Proposed Loop Road) has a dedicated lane, this volume was reduced to be 25% of the original value. Second, the major street southbound right turn volumes (from Hydraulic Road) experiences minimal conflict when entering the minor street. Since there is not a substantial conflict, the major street southbound right turn volumes were excluded from the traffic signal warrant analysis.

Table 10-1: 2033 Total Future Traffic Volumes
Proposed Loop Road at Hydraulic Road

Time	MINOR STREET			MAJOR STREET					
	Proposed Loop Road - EB			Hydraulic Road - NB			Hydraulic Road - SB		
	Left	Through	Right*	Left	Through	Right	Left	Through	Right**
07:00 - 08:00	25		25	128	837			876	75
08:00 - 09:00	61		57	356	926			812	246
09:00 - 10:00	36		27	120	787			772	88
10:00 - 11:00									
11:00 - 12:00									
12:00 - 13:00									
13:00 - 14:00									
14:00 - 15:00	40		21	71	874			879	52
15:00 - 16:00	50		34	131	967			994	86
16:00 - 17:00	97		74	138	1160			1162	82
17:00 - 18:00									
18:00 - 19:00									

* Per Pagone's theorem, side street right turns may be reduced to 25% of the original value.

** Mainline right turns with a dedicated lane are excluded from the analysis.

The eastbound loop road approach will include one left turn lane and one right turn lane. Both directions of Hydraulic Road have two through lanes and one turn lane. Therefore, the lane geometry used in the traffic signal warrant analysis for the major street was assumed to be two (2) lanes and the minor street was analyzed with two (2) lanes.

As shown in Table 10-2, the traffic volumes at the intersection meet the 100% volume thresholds for Warrant 3 (peak hour).

Table 10-2: 2033 Signal Warrant Summary
Proposed Loop Road at Hydraulic Road

Time Period	Major Street Volume	Minor Street Volume (Highest Approach)	100% WARRANTS					
			#1 (8-hour)				#2 (4-hour)	#3 (Peak Hour)
			Condition A	Condition B	Combination			
					Condition A	Condition B		
Threshold	Major		600	900	480	720	See Graph	See Graph
	Minor		200	100	160	80		
07:00 - 08:00	1,797	87	N	N	N	Y	N	N
08:00 - 09:00	2,140	77	N	N	N	N	N	N
09:00 - 10:00	1,695	57	N	N	N	N	N	N
10:00 - 11:00	0	0	N	N	N	N	N	N
11:00 - 12:00	0	0	N	N	N	N	N	N
12:00 - 13:00	0	0	N	N	N	N	N	N
13:00 - 14:00	0	0	N	N	N	N	N	N
14:00 - 15:00	1,816	59	N	N	N	N	N	N
15:00 - 16:00	2,122	188	N	Y	Y	Y	Y	Y
16:00 - 17:00	2,437	89	N	N	N	Y	N	N
17:00 - 18:00	0	0	N	N	N	N	N	N
18:00 - 19:00	0	0	N	N	N	N	N	N
# of Hours Warrant is Met			0	1	1	3	1	1
# of Hours Warrant is Required to be Met			8	8	8	8	4	1
Is Warrant Satisfied?			No	No	No		No	Yes

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11 2033 SCENARIO 1 TOTAL CONDITIONS

Operational analysis was completed in 2033 for buildout of the proposed development and implementation of Scenario 1 of the proposed Loop Road alignment with proposed improvements discussed in Chapters 6 and 9 to understand the impacts that the proposed development will have on the roadway network. Note that the intersection of Hydraulic Road and the Proposed Loop Road was analyzed as a signalized continuous green-T intersection since the 2033 future traffic volumes meet the Peak Hour signal warrant.

11.1 2033 SCENARIO 1 TOTAL TRAFFIC CONDITIONS

Table 10-1 summarizes the 2033 Scenario 1 future intersection LOS, delay, 95th percentile (Synchro) and maximum (SimTraffic) queue lengths based on the 2023 existing pedestrian volumes (Figure 3-2), the 2033 Scenario 1 future peak hour traffic volumes shown on Figure 9-6, and the future lane geometry shown on Figure 9-9. Traffic signal timings were optimized to better accommodate the site traffic. The corresponding Synchro worksheets are included in Appendix N.

Note that in the Synchro model, the Proposed Loop Road is coded as intersection #5 because it will replace the existing Hydraulic Road/Georgetown Green intersection. The Proposed Loop Road intersection was analyzed both as signalized and unsignalized for further context.

As shown in Table 11-1, under 2033 total conditions, the study intersections are anticipated to operate at similar LOS and queueing to background conditions.

- At the unsignalized study intersections (#1, 2, 4) all movements operate at a LOS C or better during both peak hours. All turning movements have adequate turn lane storage to accommodate 95th percentile and maximum simulated queue lengths.

- At the signalized intersection of Hydraulic Road at Lambs Road/Whitewood Road, the overall intersection operates at a LOS C during both peak hours.
    - The side street east- and west-bound movements and approaches operate at a LOS D or better during both peak hours. During both peak hours, the EB left maximum queue exceeds the available storage, spilling back into the through lane. During the PM peak, the EB maximum queue backs up through the intersection with the AHS exit.
    - The mainline north- and south-bound approaches operate at a LOS C during both peak hours. During the AM peak, the SB through maximum queue backs up past the left- and right-turn lanes, blocking them. During the PM peak, the NB through maximum queue backs up through the AHS Entrance/Hydraulic Ridge Road intersection.
    - All other turning movements have adequate turn lane storage to accommodate the 95th percentile and maximum simulated queue lengths.

- At the signalized intersection of Hydraulic Road at the Proposed Loop Road, the overall intersection operates at a LOS B during both peak hours.
    - All approaches and movements will operate at a LOS C or better during both peak hours. During the AM peak hour, the southbound approach maximum queue will back up through the AHS Entrance/Hydraulic Ridge Road intersection. All other turning movements have adequate turn lane storage to accommodate the 95th percentile and maximum simulated queue lengths.
    - Note that since this is a proposed intersection, the effective storage was assumed to be 200 feet for the EB left and 300 feet for the NB left to contain maximum simulated queue lengths.

- At the unsignalized intersection of Hydraulic Road at the New Loop Road, the mainline north- and south-bound movements and eastbound right operate at a LOS B or better during both peak hours. The EB left experiences failing levels of service during both peak hours. However, the simulated maximum queue length is only 68 feet (3 passenger cars) longer during the PM peak under 2033 background conditions. All turning movements have adequate turn lane storage to accommodate the 95th percentile and maximum simulated queue lengths.

- At the signalized intersection of Hydraulic Road at Georgetown Road, the overall intersection operates at a LOS B during both peak hours.
    - The east- and west-bound movements and approaches operate at a LOS C or better during both peak hours. During both peak hours, the EB maximum queue exceeds the available storage.
    - The mainline north- and south-bound movements and approaches operate at a LOS C or better during both peak hours. During the PM peak, the SB through maximum queue backs up through the intersection with Georgetown Green.
    - All other turning movements have adequate turn lane storage to accommodate the 95th percentile and maximum simulated queue lengths.

Table 11-1: Intersection Analysis Summary
2033 Scenario 1 Future Traffic Volumes

Intersection and Type of Control	Movement and Approach	Turn Lane Storage (ft)	AM PEAK HOUR				PM PEAK HOUR			
			Delay [1] (sec/veh)	LOS [1]	HCS 95th Percentile Queue Length (ft)	Simulated Maximum Queue Length (ft)	Delay [1] (sec/veh)	LOS [1]	HCS 95th Percentile Queue Length (ft)	Simulated Maximum Queue Length (ft)
1. Lambs Road (E-W) at Lambs Lane (N-S) *Unsignalized*	EB Thru/Right		†	†	0	6	†	†	0	0
	EB Approach		†	†	--	--	†	†	--	--
	WB Left/Thru		9.5	A	66	241	6.7	A	14	69
	EB Approach		*9.5*	*A*	--	--	*6.7*	*A*	--	--
	NB Left/Right		11.8	B	31	105	11.9	B	60	113
	NB Approach		*11.8*	*B*	--	--	*11.9*	*B*	--	--
2. Lambs Road (E-W) at AHS Exit Only (N-S) *Unsignalized*	EB Left/Thru		0.0	A	0	3	0.0	A	0	54
	EB Approach		*0.0*	*A*	--	--	*0.0*	*A*	--	--
	WB Thru		†	†	0	--	†	†	0	--
	WB Right		†	†	0	--	†	†	0	--
	WB Approach		†	†	--	--	†	†	--	--
	NB Left		13.8	B	39	65	16.7	C	49	85
	NB Right	80	13.8	B	39	72	16.7	C	49	78
	NB Approach		*13.8*	*B*	--	--	*16.7*	*C*	--	--
	SB Left/Thru/Right		0.0	A	0	--	0.0	A	0	--
	SB Approach		*0.0*	*A*	--	--	*0.0*	*A*	--	--
3. Hydraulic Road (N-S) at Lambs Road/Whitewood Road (E-W) *Signalized*	EB Left	135	49.7	D	161	162	49.1	D	#267	177
	EB Thru		44.3	D	79	202	36.2	D	73	268
	EB Right		43.0	D	4	104	35.7	D	0	133
	EB Approach		*46.7*	*D*	--	--	*43.9*	*D*	--	--
	WB Left	175	45.5	D	148	162	32.2	*C*	103	122
	WB Thru		51.4	D	115	198	46.2	*D*	47	80
	WB Right	195	44.5	D	0	84	45.6	D	0	114
	WB Approach		*47.1*	*D*	--	--	*39.9*	*D*	--	--
	NB Left	350	52.9	D	#162	280	17.8	B	48	327
	NB Thru		21.1	C	215	357	33.8	C	#517	780
	NB Right	140	17.5	B	10	140	20.5	C	0	140
	NB Approach		*26.4*	*C*	--	--	*31.8*	*C*	--	--
	SB Left	250	13.7	B	57	250	38.0	D	50	161
	SB Thru		37.0	D	532	1140	26.2	C	306	390
	SB Right	265	20.1	C	54	265	20.3	C	0	264
	SB Approach		*33.4*	*C*	--	--	*26.5*	*C*	--	--
	Overall		**34.2**	**C**	**--**	**--**	**32.9**	**C**	--	--
4. Hydraulic Road (N-S) at Hydraulic Ridge Road (WB) / AHS Entrance (EB) *Unsignalized*	EB Right		10.2	B	0	26	9.9	A	12	125
	EB Approach		*10.2*	*B*	--	--	*9.9*	*A*	--	--
	WB Right		12.3	B	2	29	14.1	B	4	65
	WB Approach		*12.3*	*B*	--	--	*14.1*	*B*	--	--
	NB Thru		†	†	0	32	†	†	0	345
	NB Thru/Right		†	†	0	10	†	†	0	369
	NB Approach		†	†	--	--	†	†	--	--
	SB Thru		†	†	0	100	†	†	0	7
	SB Thru/Right		†	†	0	222	†	†	0	42
	SB Approach		†	†	--	--	†	†	--	--

[1] *Overall intersection LOS and delay reported for signalized intersections and roundabouts only.*

† SYNCHRO does not provide level of service or delay for unsignalized movements with no conflicting volumes.

- 95th percentile volume exceeds capacity, queue may be longer. Queue shown is maximum after two cycles.

Intersection and Type of Control	Movement and Approach	Turn Lane Storage (ft)	AM PEAK HOUR				PM PEAK HOUR			
			Delay [1] (sec/veh)	LOS [1]	HCS 95th Percentile Queue Length (ft)	Simulated Maximum Queue Length (ft)	Delay [1] (sec/veh)	LOS [1]	HCS 95th Percentile Queue Length (ft)	Simulated Maximum Queue Length (ft)
5. Hydraulic Road (N-S) at	EB Left	200	581.7	F	163	221	305.6	F	200	353
Proposed Loop Road (E-W)	EB Right		10.8	B	26	158	14.0	B	56	472
Unsignalized continuous-T	*EB Approach*		*138.2*	*F*	--	--	*97.6*	*F*	--	--
	NB Left	300	13.1	B	58	290	12.4	B	24	164
	NB Thru		†	†	0	220	†	†	0	17
	NB Approach		*3.3*	*A*	0	--	*1.4*	*A*	0	--
	SB Thru		†	†	0	41	†	†	0	54
	SB Right	150	†	†	0	65	†	†	0	0
	SB Approach		†	†	--	--	†	†	--	--
5. Hydraulic Road (N-S) at	EB Left	200	32.7	C	66	110	28.3	C	100	156
Proposed Loop Road (E-W)	EB Right		31.2	C	62	153	25.1	C	200	210
Signalized continuous-T	*EB Approach*		*31.6*	C	--	--	*28.3*	C	--	--
	NB Left	300	23.7	C	#236	257	20.2	C	45	148
	NB Thru		0.2	A	0	76	0.3	A	0	20
	NB Approach		*6.2*	A	--	--	*2.5*	A	--	--
	SB Thru		21.9	C	318	663	19.8	B	335	440
	SB Right	150	14.9	B	50	150	12.1	B	27	150
	SB Approach		*20.6*	*C*	--	--	*18.3*	B	--	--
	Overall		**14.8**	**B**	--	--	**12.8**	**B**	--	--
6. Hydraulic Road (N-S) at	EB Left		21.9	C	236	306	23.6	C	245	432
Georgetown Road (E-W)	EB Left/Right	335	18.7	B	236	291	20.5	C	245	351
Signalized	*EB Approach*		*21.0*	*C*	--	--	*22.4*	*C*	--	--
	WB Left/Right		15.1	B	6	29	16.5	B	7	22
	WB Approach		*15.1*	*B*	--	--	*16.5*	*B*	--	--
	NB Left	200	17.7	B	45	99	24.2	C	74	165
	NB Thru		13.3	B	133	212	12.6	B	123	171
	NB Thru/Right		13.3	B	133	171	12.6	B	123	128
	NB Approach		*13.8*	*B*	--	--	*15.0*	*B*	--	--
	SB Left	100	18.6	B	8	52	19.5	B	10	55
	SB Thru		23.2	C	167	320	25.3	C	186	385
	SB Right	145	7.9	A	25	145	11.7	B	163	145
	SB Approach		*14.9*	*B*	--	--	*17.5*	*B*	--	--
	Overall		**16.7**	**B**	--	--	**18.5**	**B**	--	--

[1] *Overall intersection LOS and delay reported for signalized intersections and roundabouts only.*

† SYNCHRO does not provide level of service or delay for unsignalized movements with no conflicting volumes.

- 95th percentile volume exceeds capacity, queue may be longer. Queue shown is maximum after two cycles.

12 2033 SCENARIO 2 TOTAL CONDITIONS

Operational analysis was completed in 2033 for buildout of the proposed development and implementation of Scenario 2 of the proposed Loop Road alignment with proposed improvements discussed in Chapters 6 and 9 to understand the impacts that the proposed development will have on the roadway network. Note that the intersection of Hydraulic Road and the Proposed Loop Road was analyzed as a signalized continuous green-T intersection since the 2033 future traffic volumes meet the Peak Hour signal warrant.

12.1 2033 SCENARIO 2 TOTAL TRAFFIC CONDITIONS

Table 11-1 summarizes the 2033 Scenario 2 future intersection LOS, delay, 95th percentile (Synchro) and maximum (SimTraffic) queue lengths based on the 2023 existing pedestrian volumes (Figure 3-2), the 2033 Scenario 2 future peak hour traffic volumes shown on Figure 9-7, and the future lane geometry shown on Figure 9-9. Traffic signal timings were optimized to better accommodate the site traffic. The corresponding Synchro worksheets are included in Appendix O.

Note that in the Synchro model, the Proposed Loop Road is coded as intersection #7. The alternate intersection. The Proposed Loop Road intersection was analyzed both as signalized and unsignalized for further context.

As shown in Table 12-1, under 2033 total conditions, the study intersections are anticipated to operate at similar LOS and queueing to background conditions.

- At the unsignalized study intersections (#1, 2, 4, 5) all movements operate at a LOS C or better during both peak hours. All turning movements have adequate turn lane storage to accommodate 95th percentile and maximum simulated queue lengths.

- At the signalized intersection of Hydraulic Road at Lambs Road/Whitewood Road, the overall intersection operates at a LOS C during both peak hours.
    - The side street east- and west-bound movements and approaches operate at a LOS D or better during both peak hours. During both peak hours, the EB left maximum queue exceeds the available storage, spilling back into the through lane. During the PM peak, the EB maximum queue backs up through the intersection with the AHS exit.
    - The mainline north- and south-bound approaches operate at a LOS C during both peak hours. During the AM peak, the SB through maximum queue backs up past the left- and right-turn lanes, blocking them. During the PM peak, the NB through maximum queue backs up through the AHS Entrance/Hydraulic Ridge Road intersection.
    - All other turning movements have adequate turn lane storage to accommodate the 95th percentile and maximum simulated queue lengths.

- At the signalized intersection of Hydraulic Road at the Proposed Loop Road, the overall intersection operates at a LOS B during both peak hours.
    - All approaches and movements will operate at a LOS C or better during both peak hours. During the AM peak hour, the southbound approach maximum queue will back up through the AHS Entrance/Hydraulic Ridge Road intersection. All other turning movements have adequate turn lane storage to accommodate the 95th percentile and maximum simulated queue lengths.
    - Note that since this is a proposed intersection, the effective storage was assumed to be 200 feet for the EB left and 300 feet for the NB left to contain maximum simulated queue lengths.

- At the unsignalized intersection of Hydraulic Road at the New Loop Road, the mainline north- and south-bound movements and eastbound right operate at a LOS B or better during both peak hours. The EB left experiences failing levels of service during both peak hours. However, the simulated maximum queue length is only 15 feet (less than 1 passenger car) longer than the PM peak under 2033 background conditions. All turning movements have adequate turn lane storage to accommodate the 95th percentile and maximum simulated queue lengths.

- At the signalized intersection of Hydraulic Road at Georgetown Road, the overall intersection operates at a LOS B during both peak hours.
    - The east- and west-bound movements and approaches operate at a LOS C or better during both peak hours. During the PM peak, the EB maximum queue exceeds the available storage.
    - The mainline north- and south-bound movements and approaches operate at a LOS C or better during both peak hours. During both peak hours, the SB through maximum queue backs up through the intersection with the Proposed Loop Road.
    - All other turning movements have adequate turn lane storage to accommodate the 95th percentile and maximum simulated queue lengths.

Table 12-1: Intersection Analysis Summary
2033 Scenario 2 Future Traffic Volumes

Intersection and Type of Control	Movement and Approach	Turn Lane Storage (ft)	AM PEAK HOUR				PM PEAK HOUR			
			Delay [1] (sec/veh)	LOS [1]	HCS 95th Percentile Queue Length (ft)	Simulated Maximum Queue Length (ft)	Delay [1] (sec/veh)	LOS [1]	HCS 95th Percentile Queue Length (ft)	Simulated Maximum Queue Length (ft)
1. Lambs Road (E-W) at Lambs Lane (N-S) *Unsignalized*	EB Thru/Right		†	†	0	9	†	†	0	2
	EB Approach		†	†	--	--	†	†	--	--
	WB Left/Thru		9.5	A	66	226	6.7	A	14	84
	EB Approach		*9.5*	*A*	--	--	*6.7*	*A*	--	--
	NB Left/Right		11.8	B	31	114	11.9	B	60	126
	NB Approach		*11.8*	*B*	--	--	*11.9*	*B*	--	--
2. Lambs Road (E-W) at AHS Exit Only (N-S) *Unsignalized*	EB Left/Thru		0.0	A	0	0	0.0	A	0	20
	EB Approach		*0.0*	*A*	--	--	*0.0*	*A*	--	--
	WB Thru		†	†	0	--	†	†	0	--
	WB Right		†	†	0	--	†	†	0	--
	WB Approach		†	†	--	--	†	†	--	--
	NB Left		13.8	B	39	69	16.7	C	49	104
	NB Right	80	13.8	B	39	73	16.7	C	49	78
	NB Approach		*13.8*	*B*	--	--	*16.7*	*C*	--	--
	SB Left/Thru/Right		0.0	A	0	--	0.0	A	0	--
	SB Approach		*0.0*	*A*	--	--	*0.0*	*A*	--	--
3. Hydraulic Road (N-S) at Lambs Road/Whitewood Road (E-W) *Signalized*	EB Left	135	49.7	D	161	166	49.1	D	#267	174
	EB Thru		44.3	D	79	222	36.2	D	73	282
	EB Right		43.0	D	0	108	35.7	D	0	138
	EB Approach		*46.7*	*D*	--	--	*43.9*	*D*	--	--
	WB Left	175	47.0	D	153	170	32.3	*C*	108	137
	WB Thru		51.4	D	115	185	46.2	*D*	47	84
	WB Right	195	44.5	D	0	88	45.6	D	0	114
	WB Approach		*47.8*	*D*	--	--	*39.8*	*D*	--	--
	NB Left	350	53.1	D	#162	264	17.9	B	48	144
	NB Thru		21.1	C	215	319	33.8	C	#517	683
	NB Right	140	17.5	B	10	140	20.5	C	0	140
	NB Approach		*26.4*	*C*	--	--	*31.8*	*C*	--	--
	SB Left	250	13.7	B	57	250	38.0	D	50	210
	SB Thru		37.7	D	538	1160	26.3	C	310	427
	SB Right	265	20.1	C	54	265	20.3	C	0	265
	SB Approach		*34.0*	*C*	--	--	*26.6*	*C*	--	--
	Overall		**34.5**	**C**	**--**	**--**	**32.9**	**C**	--	--
4. Hydraulic Road (N-S) at Hydraulic Ridge Road (WB) / AHS Entrance (EB) *Unsignalized*	EB Right		10.2	B	0	27	10.0	A	12	134
	EB Approach		*10.2*	*B*	--	--	*10.0*	*A*	--	--
	WB Right		10.7	B	1	33	11.5	B	3	49
	WB Approach		*10.7*	*B*	--	--	*11.5*	*B*	--	--
	NB Thru		†	†	0	11	†	†	0	265
	NB Thru/Right		†	†	0	13	†	†	0	269
	NB Approach		†	†	--	--	†	†	--	--
	SB Thru		†	†	0	92	†	†	0	130
	SB Thru/Right		†	†	0	195	†	†	0	227
	SB Approach		†	†	--	--	†	†	--	--

[1] *Overall intersection LOS and delay reported for signalized intersections and roundabouts only.*

† SYNCHRO does not provide level of service or delay for unsignalized movements with no conflicting volumes.

- 95th percentile volume exceeds capacity, queue may be longer. Queue shown is maximum after two cycles.

Intersection and Type of Control	Movement and Approach	Turn Lane Storage (ft)	AM PEAK HOUR				PM PEAK HOUR			
			Delay [1] (sec/veh)	LOS [1]	HCS 95th Percentile Queue Length (ft)	Simulated Maximum Queue Length (ft)	Delay [1] (sec/veh)	LOS [1]	HCS 95th Percentile Queue Length (ft)	Simulated Maximum Queue Length (ft)
5. Hydraulic Road (N-S) at	EB Right		9.6	A	3	57	9.8	A	3	57
Georgetown Green (E-W)	*EB Approach*		*9.6*	*A*	--	--	*9.8*	*A*	--	--
Unsignalized	NB Thru		†	†	0	35	†	†	0	12
	NB Approach		†	†	--	--	†	†	--	--
	SB Thru		†	†	0	0	†	†	0	0
	SB Thru/Right		†	†	0	3	†	†	0	121
	SB Approach		†	†	--	--	†	†	--	--
6. Hydraulic Road (N-S) at	EB Left		21.9	C	237	313	23.8	C	247	380
Georgetown Road (E-W)	EB Left/Right	335	18.8	B	237	294	20.6	C	247	364
Signalized	*EB Approach*		*21.1*	*C*	--	--	*22.5*	*C*	--	--
	WB Left/Right		15.1	B	6	24	16.6	B	7	25
	WB Approach		*15.1*	*B*	--	--	*16.6*	*B*	--	--
	NB Left	200	19.9	B	45	110	19.2	B	74	144
	NB Thru		13.2	B	130	193	12.5	B	120	161
	NB Thru/Right		13.2	B	130	167	12.5	B	120	122
	NB Approach		*14.0*	*B*	--	--	*13.9*	*B*	--	--
	SB Left	100	18.5	B	8	48	19.4	B	10	64
	SB Thru		23.2	C	172	315	25.2	C	190	506
	SB Right	145	7.4	A	26	145	15.2	B	167	145
	SB Approach		*14.7*	*B*	--	--	*19.5*	*B*	--	--
	Overall		**16.7**	**B**	--	--	**19.2**	**B**	--	--
7. Hydraulic Road (N-S) at	EB Left	200	581.7	F	163	126	221.1	F	159	300
Proposed Loop Road (E-W)	EB Right		11.0	B	26	138	13.5	B	50	379
Unsignalized continuous-T	*EB Approach*		*138.2*	*F*	--	--	*72.5*	*F*	--	--
	NB Left	300	12.4	B	51	250	12.7	B	29	191
	NB Thru		†	†	0	143	†	†	0	82
	NB Approach		*3.0*	*A*	--	--	*1.6*	*A*	--	--
	SB Thru		†	†	0	72	†	†	0	89
	SB Right	150	†	†	0	111	†	†	0	0
	SB Approach		†	†	--	--	†	†	--	--
7. Hydraulic Road (N-S) at	EB Left	200	42.2	D	58	89	39.0	D	92	152
Proposed Loop Road (E-W)	EB Right		22.5	C	120	145	32.9	C	192	230
Signalized continuous-T	*EB Approach*		*26.1*	C	--	--	*34.3*	C	--	--
	NB Left	300	22.1	C	168	251	9.8	A	75	155
	NB Thru		0.2	A	0	67	0.3	A	0	61
	NB Approach		*5.6*	A	--	--	*1.5*	A	--	--
	SB Thru		18.1	B	302	565	19.2	B	333	616
	SB Right	150	12.4	B	41	150	11.9	B	32	150
	SB Approach		*17.1*	*B*	--	--	*18.5*	B	--	--
	Overall		**12.4**	**B**	--	--	**12.7**	**B**	--	--

[1] *Overall intersection LOS and delay reported for signalized intersections and roundabouts only.*

† SYNCHRO does not provide level of service or delay for unsignalized movements with no conflicting volumes.

- 95th percentile volume exceeds capacity, queue may be longer. Queue shown is maximum after two cycles.

13 2033 SCENARIO 3 TOTAL CONDITIONS

Operational analysis was completed in 2033 for buildout of the proposed development and implementation of Scenario 3 of the proposed Loop Road alignment with proposed improvements discussed in Chapters 6 and 9 to understand the impacts that the proposed development will have on the roadway network. Note that the intersection of Hydraulic Road and the Proposed Loop Road was analyzed as a signalized continuous green-T intersection since the 2033 future traffic volumes meet the Peak Hour signal warrant.

13.1 2033 SCENARIO 3 TOTAL TRAFFIC CONDITIONS

Table 13-1 summarizes the 2033 Scenario 3 future intersection LOS, delay, 95th percentile (Synchro) and maximum (SimTraffic) queue lengths based on the 2023 existing pedestrian volumes (Figure 3-2), the 2033 Scenario 3 future peak hour traffic volumes shown on Figure 9-8, and the future lane geometry shown on Figure 9-9. Traffic signal timings were optimized to better accommodate the site traffic. The corresponding Synchro worksheets are included in Appendix P.

Note that in the Synchro model, the Proposed Loop Road is coded as intersection #5 because it will replace the existing Hydraulic Road/Georgetown Green intersection. The Proposed Loop Road intersection was analyzed both as signalized and unsignalized for further context.

As shown in Table 12-1, under 2033 total conditions, the study intersections are anticipated to operate at similar LOS and queueing to background conditions.

- At the unsignalized study intersections (#1, 2, 4, 5) all movements operate at a LOS C or better during both peak hours. All turning movements have adequate turn lane storage to accommodate 95th percentile and maximum simulated queue lengths.

- At the signalized intersection of Hydraulic Road at Lambs Road/Whitewood Road, the overall intersection operates at a LOS C during both peak hours.
    - The side street east- and west-bound movements and approaches operate at a LOS D or better during both peak hours. During both peak hours, the EB left maximum queue exceeds the available storage, spilling back into the through lane. During the PM peak, the EB maximum queue backs up through the intersection with the AHS exit.
    - The mainline north- and south-bound approaches operate at a LOS C during both peak hours. During the AM peak, the SB through maximum queue backs up past the left- and right-turn lanes, blocking them. During both peak hours, the NB through maximum queue backs up through the AHS Entrance/Hydraulic Ridge Road intersection.
    - All other turning movements have adequate turn lane storage to accommodate the 95th percentile and maximum simulated queue lengths.

- At the signalized intersection of Hydraulic Road at the Proposed Loop Road, the overall intersection operates at a LOS B during both peak hours.
    - The eastbound left will operate at LOS D during both peak hours. All other approaches and movements will operate at LOS C or better. During the AM peak hour, the southbound approach maximum queue will back up through the AHS Entrance/Hydraulic Ridge Road intersection. All other turning movements have adequate turn lane storage to accommodate the 95th percentile and maximum simulated queue lengths.
    - Note that since this is a proposed intersection, the effective storage was assumed to be 200 feet for the EB left and 300 feet for the NB left to contain maximum simulated queue lengths.

- At the unsignalized intersection of Hydraulic Road at the New Loop Road, the mainline north- and south-bound movements and eastbound right operate at a LOS B or better during both peak hours. The EB left experiences failing levels of service during both peak hours. However, the simulated maximum queue length is only 43 feet (2 passenger cars) longer than the PM peak under 2033 background conditions. All turning movements have adequate turn lane storage to accommodate the 95th percentile and maximum simulated queue lengths.

- At the signalized intersection of Hydraulic Road at Georgetown Road, the overall intersection operates at a LOS B during both peak hours.
    - The east- and west-bound movements and approaches operate at a LOS C or better during both peak hours. During the PM peak, the EB maximum queue exceeds the available storage.
    - The mainline north- and south-bound movements and approaches operate at a LOS C or better during both peak hours. During both peak hours, the SB through maximum queue backs up through the intersection with the Proposed Loop Road.
    - All other turning movements have adequate turn lane storage to accommodate the 95th percentile and maximum simulated queue lengths.

Table 13-1: Intersection Analysis Summary
2033 Scenario 3 Future Traffic Volumes

Intersection and Type of Control	Movement and Approach	Turn Lane Storage (ft)	AM PEAK HOUR				PM PEAK HOUR			
			Delay [1] (sec/veh)	LOS [1]	HCS 95th Percentile Queue Length (ft)	Simulated Maximum Queue Length (ft)	Delay [1] (sec/veh)	LOS [1]	HCS 95th Percentile Queue Length (ft)	Simulated Maximum Queue Length (ft)
1. Lambs Road (E-W) at Lambs Lane (N-S) *Unsignalized*	EB Thru/Right		†	†	0	6	†	†	0	0
	EB Approach		†	†	--	--	†	†	--	--
	WB Left/Thru		9.5	A	66	169	6.7	A	14	71
	EB Approach		*9.5*	*A*	--	--	*6.7*	*A*	--	--
	NB Left/Right		11.9	B	36	130	12.6	B	74	125
	NB Approach		*11.9*	*B*	--	--	*12.6*	*B*	--	--
2. Lambs Road (E-W) at AHS Exit Only (N-S) *Unsignalized*	EB Left/Thru		0.0	A	0	0	0.0	A	0	42
	EB Approach		*0.0*	*A*	--	--	*0.0*	*A*	--	--
	WB Thru		†	†	0	--	†	†	0	--
	WB Right		†	†	0	--	†	†	0	--
	WB Approach		†	†	--	--	†	†	--	--
	NB Left		15.3	C	41	65	18.1	C	55	99
	NB Right	80	15.3	C	41	75	18.1	C	55	77
	NB Approach		*15.3*	*C*	--	--	*18.1*	*C*	--	--
	SB Left/Thru/Right		0.0	A	0	--	0.0	A	0	--
	SB Approach		*0.0*	*A*	--	--	*0.0*	*A*	--	--
3. Hydraulic Road (N-S) at Lambs Road/Whitewood Road (E-W) *Signalized*	EB Left	135	49.9	D	161	154	49.1	D	#267	174
	EB Thru		44.5	D	79	201	36.2	D	73	305
	EB Right		43.2	D	23	138	35.9	D	22	170
	EB Approach		*46.7*	*D*	--	--	*43.4*	*D*	--	--
	WB Left	175	47.3	D	153	161	32.3	*C*	108	135
	WB Thru		51.6	D	115	204	46.2	*D*	47	99
	WB Right	195	44.7	D	0	110	45.6	D	0	113
	WB Approach		*48.0*	*D*	--	--	*39.8*	*D*	--	--
	NB Left	350	35.3	D	#162	246	17.7	B	48	135
	NB Thru		21.2	C	224	344	33.8	C	#517	712
	NB Right	140	17.5	B	10	140	20.5	C	0	140
	NB Approach		*23.2*	*C*	--	--	*31.8*	*C*	--	--
	SB Left	250	13.8	B	57	250	38.0	D	50	243
	SB Thru		32.7	C	477	1172	25.9	C	295	369
	SB Right	265	21.7	C	96	265	20.5	C	0	265
	SB Approach		*29.4*	*C*	--	--	*26.1*	*C*	--	--
	Overall		**31.4**	**C**	**--**	**--**	**32.8**	**C**	--	--
4. Hydraulic Road (N-S) at Hydraulic Ridge Road (WB) *Unsignalized*	WB Right		10.7	B	1	30	11.5	B	3	66
	WB Approach		*10.7*	*B*	--	--	*11.5*	*B*	--	--
	NB Thru		†	†	0	0	†	†	0	238
	NB Thru/Right		†	†	0	6	†	†	0	257
	NB Approach		†	†	--	--	†	†	--	--
	SB Thru		†	†	0	270	†	†	0	184
	SB Approach		†	†	--	--	†	†	--	--

[1] *Overall intersection LOS and delay reported for signalized intersections and roundabouts only.*

† SYNCHRO does not provide level of service or delay for unsignalized movements with no conflicting volumes.

- 95th percentile volume exceeds capacity, queue may be longer. Queue shown is maximum after two cycles.

Intersection and Type of Control	Movement and Approach	Turn Lane Storage (ft)	AM PEAK HOUR				PM PEAK HOUR			
			Delay [1] (sec/veh)	LOS [1]	HCS 95th Percentile Queue Length (ft)	Simulated Maximum Queue Length (ft)	Delay [1] (sec/veh)	LOS [1]	HCS 95th Percentile Queue Length (ft)	Simulated Maximum Queue Length (ft)
5. Hydraulic Road (N-S) at	EB Right		9.6	A	3	47	9.8	A	3	58
Georgetown Green (E-W)	*EB Approach*		*9.6*	*A*	--	--	*9.8*	*A*	--	--
Unsignalized	NB Thru		†	†	0	16	†	†	0	0
	NB Approach		†	†	--	--	†	†	--	--
	SB Thru		†	†	0	0	†	†	0	30
	SB Thru/Right		†	†	0	0	†	†	0	114
	SB Approach		†	†	--	--	†	†	--	--
6. Hydraulic Road (N-S) at	EB Left		21.9	C	237	306	23.8	C	247	576
Georgetown Road (E-W)	EB Left/Right	335	18.8	B	237	290	20.6	C	247	388
Signalized	*EB Approach*		*21.1*	*C*	--	--	*22.5*	*C*	--	--
	WB Left/Right		15.1	B	6	23	16.6	B	7	29
	WB Approach		*15.1*	*B*	--	--	*16.6*	*B*	--	--
	NB Left	200	17.7	B	45	92	19.2	B	74	162
	NB Thru		13.2	B	130	200	12.5	B	120	178
	NB Thru/Right		13.2	B	130	148	12.5	B	120	133
	NB Approach		*13.8*	*B*	--	--	*13.9*	*B*	--	--
	SB Left	100	18.5	B	8	58	19.4	B	10	60
	SB Thru		23.2	C	172	275	25.2	C	190	501
	SB Right	145	7.9	A	26	145	15.2	B	167	145
	SB Approach		*15.0*	*B*	--	--	*19.5*	*B*	--	--
	Overall		**16.7**	**B**	--	--	**19.2**	**B**	--	--
7. Hydraulic Road (N-S) at	EB Left	200	906.4	F	151	212	324.4	F	184	328
Proposed Loop Road (E-W)	EB Right		10.8	B	25	166	13.8	B	50	277
Unsignalized continuous-T	*EB Approach*		*181.3*	*F*	--	--	*96.8*	*F*	--	--
	NB Left	300	15.0	B	86	278	12.8	B	29	182
	NB Thru		†	†	0	317	†	†	0	62
	NB Approach		4.5	*A*	--	--	1.6	*A*	--	--
	SB Thru		†	†	0	195	†	†	0	68
	SB Right	150	†	†	0	143	†	†	0	60
	SB Approach		†	†	--	--	†	†	--	--
7. Hydraulic Road (N-S) at	EB Left	200	46.4	D	58	99	39.0	D	92	139
Proposed Loop Road (E-W)	EB Right		22.9	C	117	144	32.9	C	192	196
Signalized continuous-T	*EB Approach*		*27.2*	C	--	--	*34.3*	C	--	--
	NB Left	300	27.7	C	#305	266	9.8	A	75	151
	NB Thru		0.2	A	0	149	0.3	A	0	44
	NB Approach		*8.4*	A	--	--	*1.5*	A	--	--
	SB Thru		21.1	C	323	684	19.2	B	333	589
	SB Right	150	15.1	B	68	150	11.9	B	32	150
	SB Approach		*19.5*	*B*	--	--	*18.5*	B	--	--
	Overall		**14.9**	**B**	--	--	**12.7**	**B**	--	--

[1] *Overall intersection LOS and delay reported for signalized intersections and roundabouts only.*

† SYNCHRO does not provide level of service or delay for unsignalized movements with no conflicting volumes.

- 95th percentile volume exceeds capacity, queue may be longer. Queue shown is maximum after two cycles.

14 SUPPLEMENTAL ROUNDABOUT ANALYSIS

As requested by Albemarle County, Timmons Group completed additional operational analysis of a roundabout at the Hydraulic Road at Lambs Road/Whitewood Road and Hydraulic Road at Proposed Loop Road intersections. As discussed in Chapter 6, a potential roundabout at Hydraulic Road and Georgetown Road was not recommended due to the additional ROW costs and potential operational challenges of installing a roundabout on a signalized corridor.

Both intersections were analyzed using the 2033 Scenario 1 total future traffic volumes shown on Figure 9-6. The corresponding SIDRA worksheets are included in Appendix Q.

The geometry for both roundabouts, shown on Figure 14-1, includes two through lanes in each direction for NB and SB Hydraulic Road. Therefore, based on industry standard practice, the minimum inscribed diameter for the roundabout with two circulating lanes is 150 feet. When adding sidewalks, the total minimum diameter is in the range of 160-180 feet.

Based on an initial review of GIS property boundary data, significant additional right of way will need to be purchased to accommodate the proposed roundabout at Lambs Road. With the high number of pedestrians crossing Hydraulic Road at this intersection, a Pedestrian Hybrid Beacon (PHB) or similar type of control is expected to be installed to provide a safe crossing. The PHB will dramatically reduce the operations of the roundabout, and its application at a roundabout is generally less efficient for all road users compared to a traditional traffic signal.

At the Proposed Loop Road, property impacts can be minimized by using the existing public R/W along Georgetown Green and the Albemarle High School property. Additionally, in general roundabouts do not perform well when located close to a traffic signal. The proposed roundabout at the Proposed Loop Road will be approximately 550 feet away from the Georgetown Road signal, which is not ideal.

14.1 2033 SCENARIO 1 TOTAL ROUNDABOUT ANALYSIS

Table 14-1 summarizes the 2033 Scenario 1 future intersection LOS, delay, 95th percentile (SIDRA) queue lengths based on the 2023 existing pedestrian volumes (Figure 3-2), and the 2033 Scenario 1 future peak hour traffic volumes shown on Figure 9-6. For reference, the proposed layout of both roundabouts is shown on Figure 14-1.

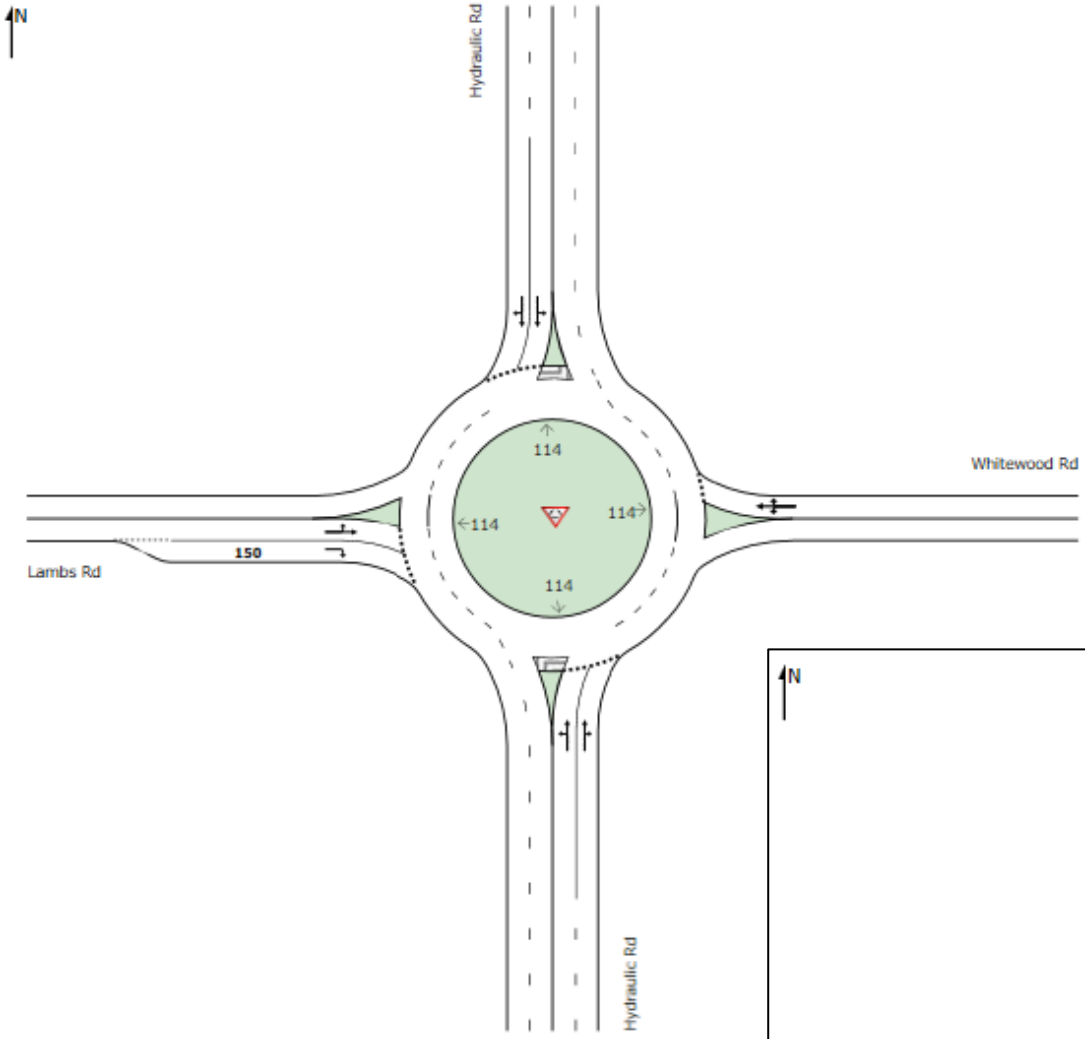
At the Lambs Road intersection, the overall delay of the roundabout is slightly worse compared to a traditional signal. In the northbound and eastbound directions, delay changed minimally during both AM and PM peak hours (less than 10 seconds). In the southbound direction, delay increased by 15 seconds in the AM peak hour and decreased by 17 seconds in the PM peak hour. In the westbound direction, delay decreased by 22 seconds during the AM peak hour and increased by 41 seconds in the PM peak hour. 95th percentile queue lengths generally follow the same patterns as with a traditional traffic signal.

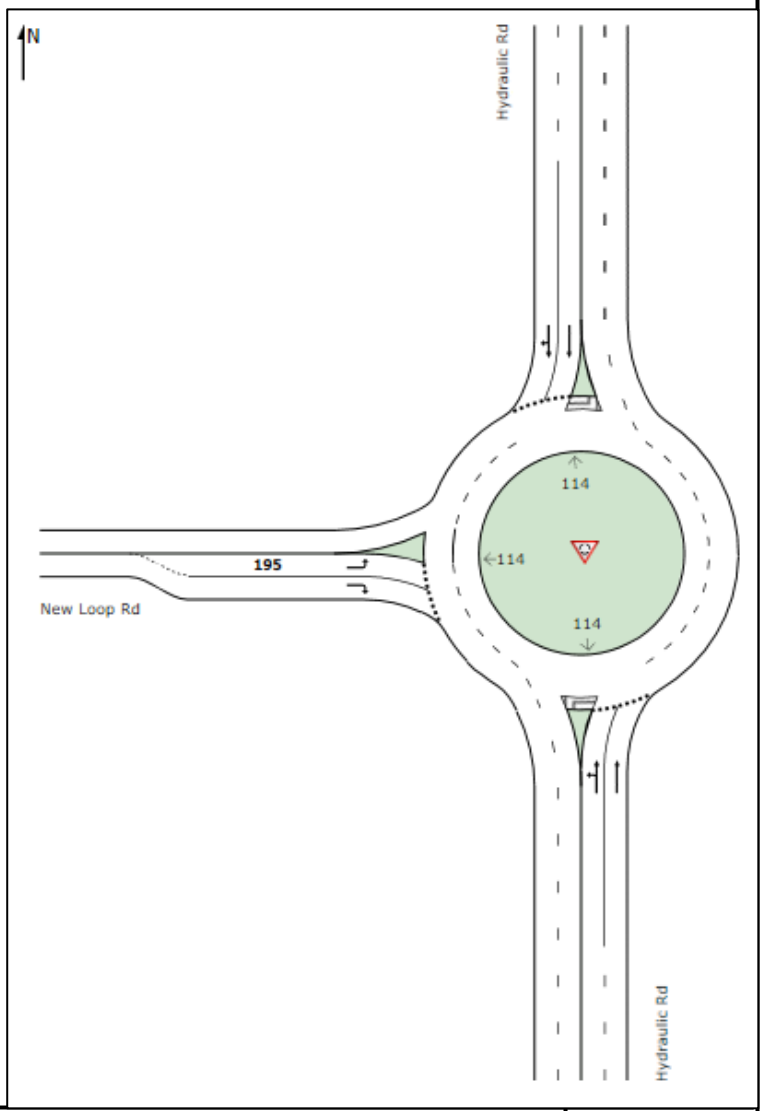
At the Proposed Loop Road intersection, overall delay of the roundabout is mostly the same as operations with a traffic signal. Mainline north- and south-bound movements operate at a LOS B during both peak hours. Compared to a stop-controlled continuous-T intersection, delay for the Loop Road approach is drastically lower with a roundabout. The 95th percentile queue lengths for the mainline through movements are improved with a roundabout compared to a traffic signal.

Table 14-1: Intersection Analysis Summary
2033 Scenario 1 Future Traffic Volumes (Roundabout)

Intersection and Type of Control	Movement and Approach	Turn Lane Storage (ft)	AM PEAK HOUR			PM PEAK HOUR		
			Delay [1] (sec/veh)	LOS [1]	HCS 95th Percentile Queue Length (ft)	Delay [1] (sec/veh)	LOS [1]	HCS 95th Percentile Queue Length (ft)
3. Hydraulic Road (N-S) at Lambs Road/Whitewood Road (E-W) Roundabout	EB Left/Thru		51.3	D	110	38.9	D	188
	EB Right	180	46.1	D	80	14.9	B	34
	EB Approach		*48.9*	*D*	--	*32.3*	*C*	--
	WB Left/Thru/Right		26.1	C	110	81.5	*F*	238
	WB Approach		*25.5*	*C*	--	*80.5*	*F*	--
	NB Left/Thru		14.0	B	140	41.8	D	529
	NB Thru/Right		13.7	B	140	41.2	D	530
	NB Approach		*13.9*	*B*	--	*41.5*	*D*	--
	SB Left/Thru		50.9	D	827	9.3	A	72
	SB Thru/Right		51.6	D	821	9.4	A	72
	SB Approach		*51.0*	*D*	--	*9.3*	*A*	--
	Overall		**36.9**	**D**	**--**	**33.4**	**C**	--
5. Hydraulic Road (N-S) at Proposed Loop Road (E-W) Roundabout	EB Left	200	12.9	B	15	15.5	B	26
	EB Right		19.9	B	68	29.7	C	114
	EB Approach		*18.5*	B	--	*26.1*	C	--
	NB Left/Thru		12.0	B	145	12.0	B	137
	NB Thru		12.0	B	148	12.0	B	137
	NB Approach		*12.0*	B	--	*12.0*	B	--
	SB Thru		20.6	C	322	11.2	B	103
	SB Thru/Right		20.6	C	322	11.3	B	102
	SB Approach		*20.6*	*C*	--	*11.2*	B	--
	Overall		**16.3**	**B**	--	**13.6**	**B**	--

[1] *Overall intersection LOS and delay reported for signalized intersections and roundabouts only.*





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Proposed Roundabout Geometry
Lambs Lane Loop Road Analysis
Albemarle County, Virginia

Figure
14-1

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15 CONCLUSIONS

Analyses were performed for 2023 existing volumes and 2033 background volumes. The 2033 total future volumes were analyzed for each of the three scenarios of the future Hydraulic Road and Proposed Loop Road intersection, which includes relocated existing traffic and new traffic associated with the buildout of the proposed development. A crash analysis was performed with 5 years of crash data in the study area. Several improvements are recommended for safety and operational benefits at the other intersections in the study area.

15.1 PRINCIPAL FINDINGS

- The 2023 existing conditions analysis indicates that all study area intersections operate at acceptable levels of service during both peak hours. Existing queueing challenges exist at the Hydraulic Road/Lambs Road and Hydraulic Road/Georgetown Road intersections as described in Chapter 3.

- Under 2033 background conditions analysis, the study area intersections are able to handle the increase in traffic associated with the 2.2% annual growth rate with minimal changes in delay/operations. Note that the traffic signal timings at the existing signalized study intersections were optimized.

- Five years of crash data were analyzed and found 68 crashes in the study area. A majority of the crashes had minor injury or property damage severity while the most prevalent crash types were angle and rear-end. There was one pedestrian and one bicycle crash. The highest number of crashes occurred at the Hydraulic Road/Georgetown Road intersection, followed by the Hydraulic Road/Lambs Road intersection.

- As discussed in Chapter 7, improvements are recommended for the Hydraulic Road corridor. These improvements include installing a raised median between the Lambs Road/Whitewood Road intersection and the Georgetown Road intersection to improve access management and safety. An alternatives analysis using the VJuST tool was performed at the two existing signalized study intersections. No improvements to intersection control or signal phasing is recommended at Hydraulic Road at Lambs Road/Whitewood Road. A thru-cut intersection is recommended to be implemented at the Hydraulic Road/Georgetown Road intersection along with an overlap phase for the southbound right to improve operations and safety.

- As discussed in Chapter 8, there are several alternatives to improve pedestrian safety and access at the Hydraulic Road and Lambs Road/Whitewood Road intersection. These alternatives range from signal timing changes to constructing new ADA curb ramps and reducing curb radius to slow vehicles. Potential new pedestrian crossings were examined on Hydraulic Road between the Proposed Loop Road and Georgetown Road. Based on the design of the proposed continuous green-T intersection at Hydraulic Road and the Proposed Loop Road, a pedestrian crosswalk across Hydraulic Road is not recommended. At Hydraulic Road and Georgetown Road, the existing ADA curb ramps and pedestrian signals are recommended to be upgraded. In addition, bus stop amenities are recommended for the nearby CAT bus stops.

- As discussed in Chapter 9, a Proposed Loop Road will be constructed between Hydraulic Road (near Georgetown Green) to Lambs Lane (near the football stadium). Three scenarios have been identified for the potential alignment of the New Loop Road and its intersection with Hydraulic Road. The VJuST tool was used to identify the best intersection design at this location for each scenario. The results indicated that an unsignalized continuous-T intersection is the recommended alternative for the short term.

- As discussed in Chapter 10, a signal warrant analysis was conducted for the Hydraulic Road/Proposed Loop Road intersection with the collected 6 hours of traffic data. The results indicate that the traffic volumes meet the Peak Hour Warrant for installation of a traffic signal. Based on the spacing of the adjacent existing traffic signals along Hydraulic Road, an Access Management Exception would be required from VDOT to install a traffic signal at this location.

- The three Loop Road alignment scenarios were evaluated to determine the best location of the future Hydraulic Road/New Loop Road intersection. Based on the geometric design of the continuous green-T, the only alignment scenario that allows the required spacing between the future Loop Road and the existing Lambs Road/Whitewood Road intersection is Scenario 1. Therefore, the recommended alignment for the new loop road follows the property boundary line to provide the most spacing.

- Capacity analyses were completed in 2033 for the three Loop Road alignment scenarios with the addition of new traffic associated with the proposed development and relocation of existing traffic. The results indicate that the levels of service at the study intersections do not change significantly compared to 2033 background conditions. Delay at the Hydraulic Road/Georgetown Road intersection was considerably reduced by implementing the recommended thru-cut intersection as discussed in Chapter 6. In each of the three alignment scenarios, signalized continuous green-T intersection at Hydraulic Road/Proposed Loop Road is able to handle the projected traffic volumes without excessive delay or major impacts to through traffic along Hydraulic Road.

- Roundabouts were analyzed further at the Hydraulic Road at Lambs Road/Whitewood Road and Hydraulic Road at the Proposed Loop Road intersections. Due to the minimum design requirements of a dual lane roundabout, both locations would require right of way acquisition to install the roundabout. Additionally, since the Proposed Loop Road intersection is only approximately 550 feet away from the existing traffic signal at Georgetown Road, a roundabout at this location is not recommended. From a vehicle operational perspective, installation of a roundabout does improve delay and queue lengths for mainline through movements. However, large bands of through vehicles being produced from a nearby signal could create queuing issues at the roundabout.

- A roundabout is not recommended at the Lambs Road/Whitewood Road intersection due to the high volume of pedestrians crossing there. Per the new Public Rights of Way Accessibility Guidelines (PROWAG) standards for roundabout designs, any pedestrian crossing of two or more lanes requires a traffic signal or pedestrian hybrid beacon for the crosswalk. This would greatly reduce vehicle operations of the roundabout and does not significantly change the way pedestrians would cross Hydraulic Road today with the existing traffic signal.