STAFFORD COUNTY HIGH SCHOOL #6

STAFFORD COUNTY, VIRGINIA

TRAFFIC IMPACT ANALYSIS

April 2023

Prepared for:

Stafford County Public Schools

TIMMONS GROUP
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1 EXECUTIVE SUMMARY

This study presents the findings of a traffic impact analysis (TIA) for the proposed development of Stafford County High School #6 on Truslow Road in Stafford County, VA. The development includes a 2,150-student high school. The site is located north of US Route 17 (Warrenton Road), south of Truslow Road, and west of the extension of Village Parkway/Stafford Plaza Drive. This report addresses the associated traffic impacts on the surrounding roadway network.

The study area shown in Figure 2-1 includes the following two (2) intersections that are adjacent to the site:

1. US Route 17 and Stafford Plaza Drive/Village Parkway (Signalized); and
2. Truslow Road and Summer Breeze Lane (Unsignalized).

The conceptual site plan is shown on Figure 2-2. The site will be serviced by the extension of Stafford Plaza Drive from its current terminus just north of US Route 17 to Truslow Road at the intersection of Summer Breeze Lane.

The purpose of this analysis is to determine the impact of the proposed development on the surrounding roads where the site access points tie into the existing roadway network. Given the lack of administrative zoning action required for the development and the site generating less than 5,000 trips per day, the traffic study was scoped with Stafford County Public Schools to assist in determining any site entrance or frontage improvements required for the development. This traffic impact analysis (TIA) has been prepared in accordance with VDOT TOSAM traffic engineering practices.

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

1. Data Collection – Traffic counts were conducted at the study intersections the week of November 23, 2021 when public school was in session and were compared with past traffic counts on the US Route 17 corridor to identify any changes in traffic due to the ongoing COVID-19 pandemic. No traffic volume discrepancies were identified.

2. Traffic Growth – A 1.0% annual growth rate was applied to the study area road network based on growth on US Route 17 in the study area over the last 5 years. The growth rate was compounded annually for each future scenario. Two (2) background developments were identified within the vicinity of the proposed development and have been included in the analysis.

3. Trip Generation – Traffic generated by the proposed development was estimated using the 11th Edition of the Institute of Transportation Engineers' *Trip Generation Manual*. The number of students was used as the independent variable to determine the trip generation.

4. Traffic Distributions – The distribution of trips generated by the proposed development was based on the existing traffic volumes, the nature of use, the expected student population for the new high school, the density of surrounding residential development, and the roadway network.

5. Traffic Projections – Future traffic volumes were determined using the existing traffic counts, the 1.0% growth rate, and the trips generated by the site.

6. Traffic Analysis – The existing, background, and future traffic volumes at all existing intersections and proposed entrances were analyzed utilizing Synchro.

1.1 PROPOSED DEVELOPMENT

The proposed development includes a high school that services 2,150 students. Stafford County Public Schools intends to pursue construction of the site within the next 5 years and the school will be operational by 2027. Since the exact timeline of construction and operation is not known at this time, a buildout year of 2027 was utilized to provide a conservative estimate.

To evaluate the impacts of the traffic generated by the proposed development, analyses were completed using traffic associated with the weekday AM and PM peak hour of the generator. This is based on the Stafford County Public Schools schedule which starts high schools at 9:35 AM and dismisses at 3:35 PM; these peaks are not consistent with those of the adjacent roadways.

As indicated in Table 1-1, on a typical weekday, the 2,150-student high school is anticipated to generate approximately 4,171 daily trips, 936 AM school peak hour trips, and 601 PM school peak hour trips.

Table 1-1: Trip Generation Summary

LAND USE	ITE CODE	AMOUNT	UNITS	WEEKDAY						
				ADT	SCHOOL AM PEAK HOUR			SCHOOL PM PEAK HOUR		
					IN	OUT	TOTAL	IN	OUT	TOTAL
High School	525	2,150	Students	4,171	636	300	936	192	409	601

SOURCE: Institute of Transportation Engineers' *Trip Generation Manual* 11th Edition (2021)

1.2 PRINCIPAL FINDINGS

Generally, there are no operational issues at the existing unsignalized intersection of Truslow Road and Summer Breeze Lane. At the signalized intersection of US Route 17 and Village Parkway/Stafford Plaza Drive the minor side streets experience poor levels of service and delay, which is expected as the signals are optimized to prioritize the mainline through movements. The individual movements and approaches that are experiencing queuing issues under existing conditions will continue to witness similar conditions with background growth.

With the addition of site traffic, the operational, queuing, and capacity deficiencies observed under existing/background conditions continue, with a limited number or movements absorbing a majority of the new traffic. Overall conditions remain generally the same with a noted need for 2nd eastbound left turn late on US Route 17 at Village Parkway/Stafford Plaza Drive to accommodate site-generated traffic.

The addition of the 2nd eastbound left turn lane on US Route 17 at Village Parkway/Stafford Plaza Drive, as well as the optimized signal timings, will increase the capacity of the intersection, better accommodate traffic queues, and offset the additional site-generated traffic. Although the eastbound left turn lane shows signs of nearing capacity with 300 feet of effective storage, a review of the block percentages and number of vehicles queued outside the turn lane can be accommodated within the underutilized portion of the dual left and continue to move traffic volume through the intersection. As traffic normalizes around the new school operations,- it is expected that traffic patterns will more efficiently work through lane utilization to ensure that no vehicles are left waiting within US Route 17. In addition, given the PHF usage of 0.50 for the eastbound left and other movements at this intersection, it is likely that the worst case scenario is shown and the vast majority of the day will experience queues that fit within the provided dual lane storage. Outside of the 30 minutes of school start and end periods, the school traffic will not warrant more than 300 feet of storage for the eastbound dual left turn lanes and have been designed as such.

The background developments associated with parcels north of US Route 17 along Stafford Plaza Drive will increase queuing and operational delay to the proposed eastbound dual left turn lane that may require additional storage. However, the analysis shown in this report documents that the proposed high school should not be responsible for installing the potential full storage area and only the storage needs that are created by the high school.

Overall, the proposed roadway extension will generate limited cut-through traffic to/from US Route 17 due to the lack of further network connectivity. The future traffic associated with the school will occur during specific peak times and not create additional traffic issues throughout the day along the nearby roadway network.

The preliminary site location of the proposed Stafford High School #6 will draw students from the existing Colonial Forge, Stafford, and Mountain View High Schools. The proposed site location will reduce capacity at all 3 existing schools as well as reducing student drive times for residential areas along the US Route 17 and Truslow Road corridors.

1.3 RECOMMENDATIONS

The installation of recommended roadway improvements will correspond with the traffic generated by the respective development of a 2,150-student high school. The focus of the work within this report is identifying a comprehensive access plan that provides functional access to the site and preserves the capacity of the surrounding roadway network.

To accommodate the anticipated traffic associated with Stafford County High School #6, the recommended improvements plan is as follows:

- Extend Stafford Plaza Drive approximately 2,600' north from its current terminus to form 4th leg of the intersection of Truslow Road and Summer Breeze Lane.
- US Route 17 at Village Parkway/Stafford Plaza Drive
    - Install 2nd left turn lane on EB US Route 17 at Village Parkway/Stafford Plaza Drive, including storage and taper to meet VDOT minimums of 200 feet by 200 feet (300 feet of effective storage).
    - Optimize signal timings for the intersection of US Route 17 at Village Parkway/Stafford Plaza Drive to account for the revised geometry and additional traffic volumes. It is understood that US Route 17 is a coordinated corridor and that the entire corridor may need to be reviewed after installation of the proposed school development.
- Truslow Road at Summer Breeze Lane/Proposed Site Entrance
    - Install a WB left turn lane and EB right turn lane on Truslow Road, including storage and tapers to meet VDOT minimums of 200 feet by 200 feet.
- Install three (3) full access entrances along the proposed extension of Stafford Plaza Drive to serve student, employee, parent/visitor, and bus traffic.
    - At the northern and southern entrances, install a NB left turn lane and SB right turn lane on the proposed extension of Stafford Plaza Drive, including storage and tapers to meet VDOT minimums of 100 feet by 100 feet.
- Install one (1) exit-only access point on Truslow Road.

The existing traffic signal on US Route 17 at Village Parkway/Stafford Plaza Drive has the capacity to accommodate the improvements (2nd EB left turn lane) without replacement as only changes to existing signage and/or signal head placement will be required. The existing traffic signals are not recommended for full replacement as part of this development.

It should be noted that the recommended improvements will require coordination with VDOT to ensure that the traffic signal timings within the study area are reviewed for potential improvements to the overall operations of the US Route 17 corridor.

2 BACKGROUND INFORMATION

2.1 STUDY AREA LIMITS

The study area shown in Figure 2-1 includes the following two (2) intersections:

1. US Route 17 and Stafford Plaza Drive/Village Parkway (Signalized); and
2. Truslow Road and Summer Breeze Lane (Unsignalized).

2.2 DESCRIPTION OF DEVELOPMENT

The proposed development will consist of a 2,150-student high school. The site will be serviced by the extension of Stafford Plaza Drive from its current terminus just north of US Route 17 to Truslow Road at the intersection of Summer Breeze Lane.

The conceptual site layout can be found in Figure 2-2.

2.3 EXISTING ROADWAY NETWORK

The existing intersection geometry for each of the two (2) study intersections is shown on Figure 2-3. This includes the traffic control, lane geometry, and turn lane storage for all approaches.

US Route 17 is a four-lane, divided principal arterial with a posted speed limit of 45 mph. According to 2019 VDOT AADT traffic data (latest data available pre-pandemic), US Route 17 services 73,000 vehicles per day between I-95 and Holly Corner Road and 25,000 vehicles per day between Holly Corner Road and Hartford Road.

Truslow Road is a two-lane, undivided major collector road with a posted speed limit of 35 mph. According to 2019 VDOT AADT data, Truslow Road services 3,100 vehicles per day.

Summer Breeze Lane is a two-lane, undivided local road with a posted speed limit of 25 mph. According to 2019 VDOT AADT data, Summer Breeze Lane services 550 vehicles per day in the vicinity of the site.

Village Parkway is a four-lane, divided minor collector with a posted speed limit of 35 mph. According to 2019 VDOT AADT data, Village Parkway services 8,900 vehicles per day.

2.4 EXISTING TRAFFIC VOLUMES

Existing count data was obtained from a peak hour directional turning movement count at each of the two (2) study intersections noted above. The peak hour counts were collected on Tuesday, November 23, 2021 from 8:30 AM to 10:30 AM and from 2:30 PM to 4:30 PM. Data collection was performed on a typical weekday when schools were in operation and no weather delays were present.

The counts were collected at times that correspond with the current start and release schedule for high schools in Stafford County. High schools begin courses at 9:35 AM and end at 3:35 PM, therefore, the count data was collected one hour before and after those time periods to retrieve the school AM and school PM peak hour volumes.

The peak hour counts included heavy vehicles by movement and pedestrian counts. The complete count data is provided in Appendix A.

The count data was used to develop the 2021 existing peak hour volumes used in the analyses. The 2021 existing AM (9:30 – 10:30) and PM (3:30 – 4:30) peak hour volumes are summarized on Figure 2-4.

The counts were compared against past traffic counts on the US Route 17 corridor to identify any changes in traffic due to the ongoing COVID-19 pandemic. Based on this comparison, no traffic volume issues were identified and therefore the 2021 traffic counts were utilized without adjustment.

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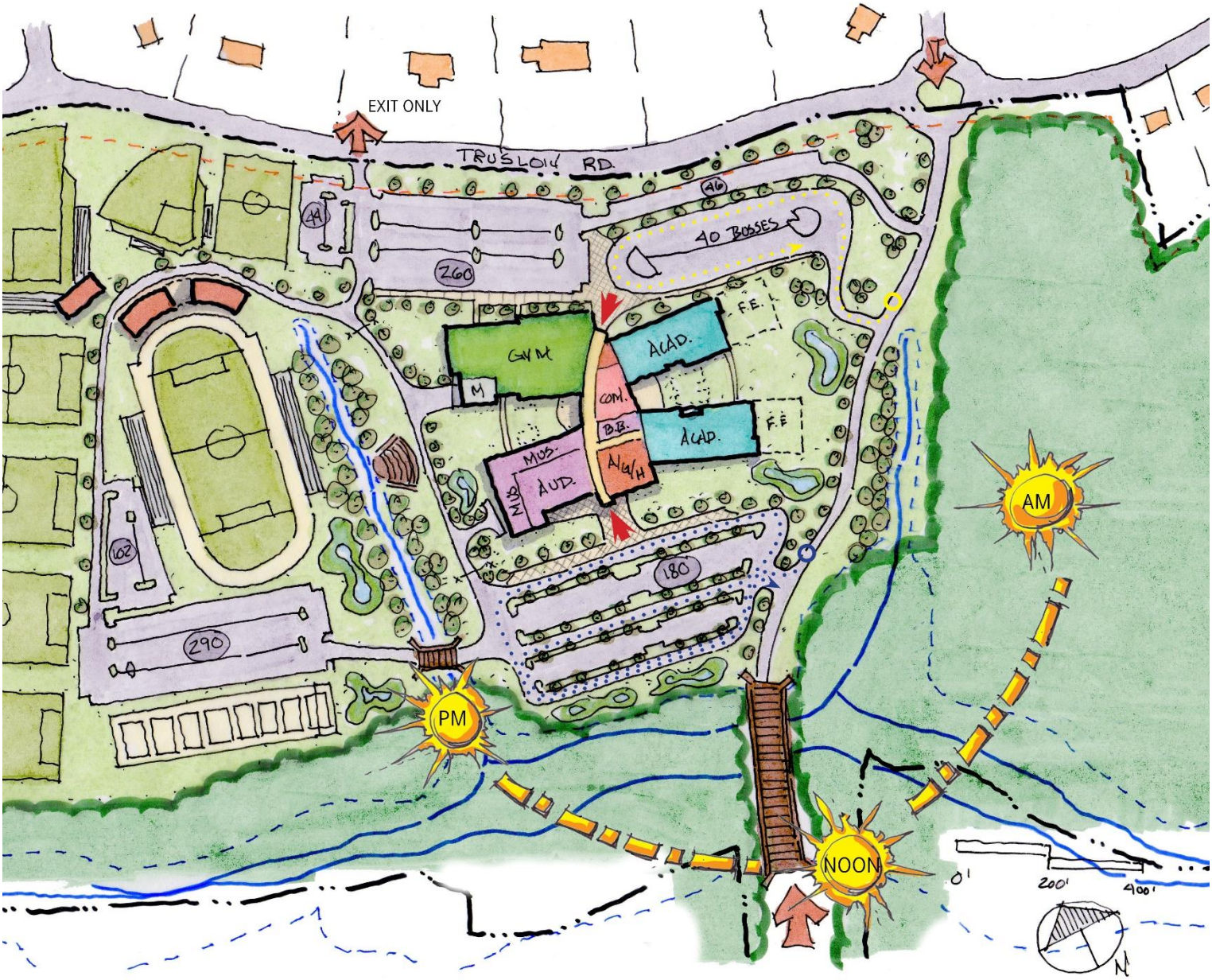
Site Location & Study Area Intersections
Stafford County High School #6

Figure
2-1



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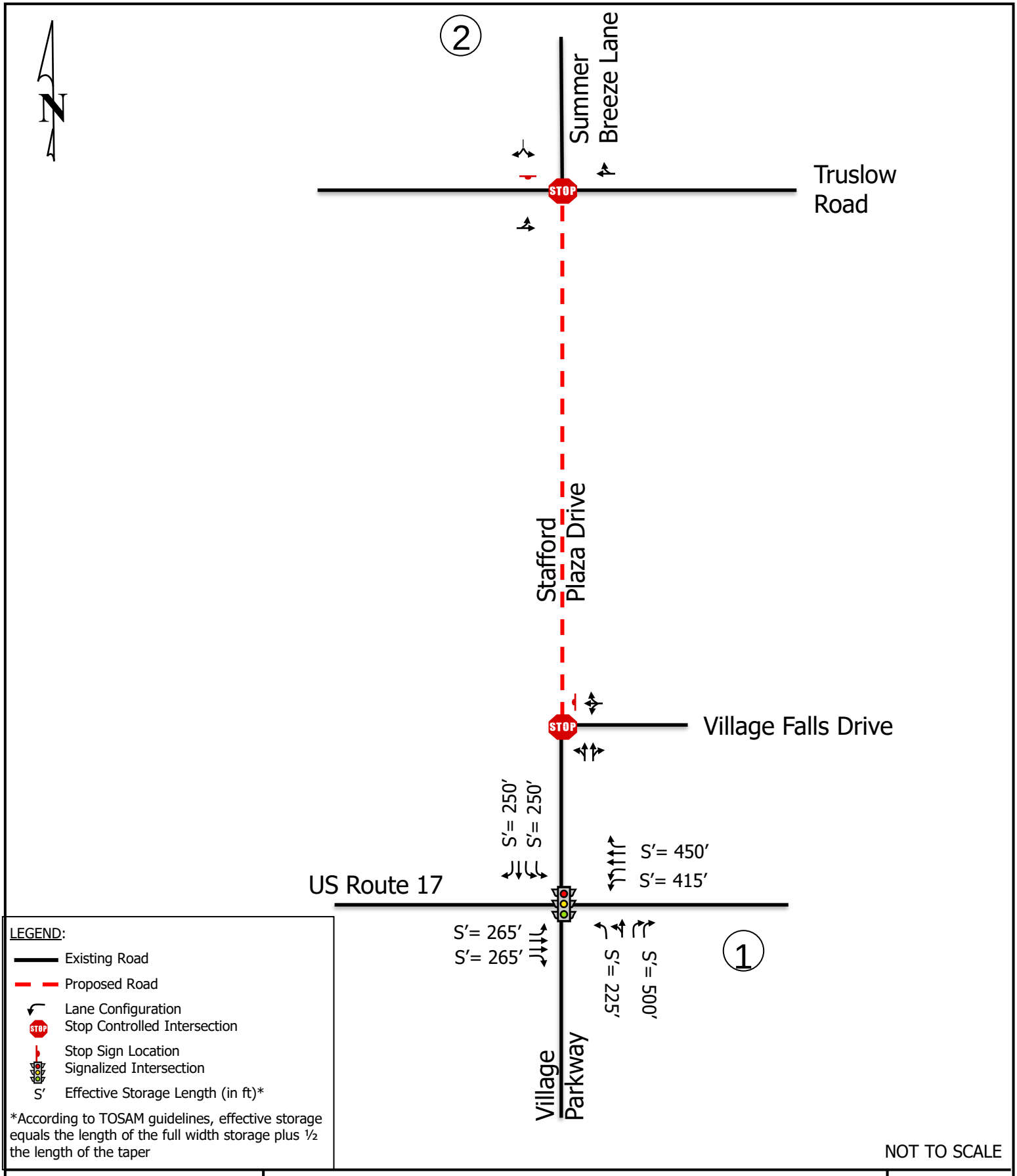
Conceptual Site Plan
Stafford County High School #6

Figure
2-2



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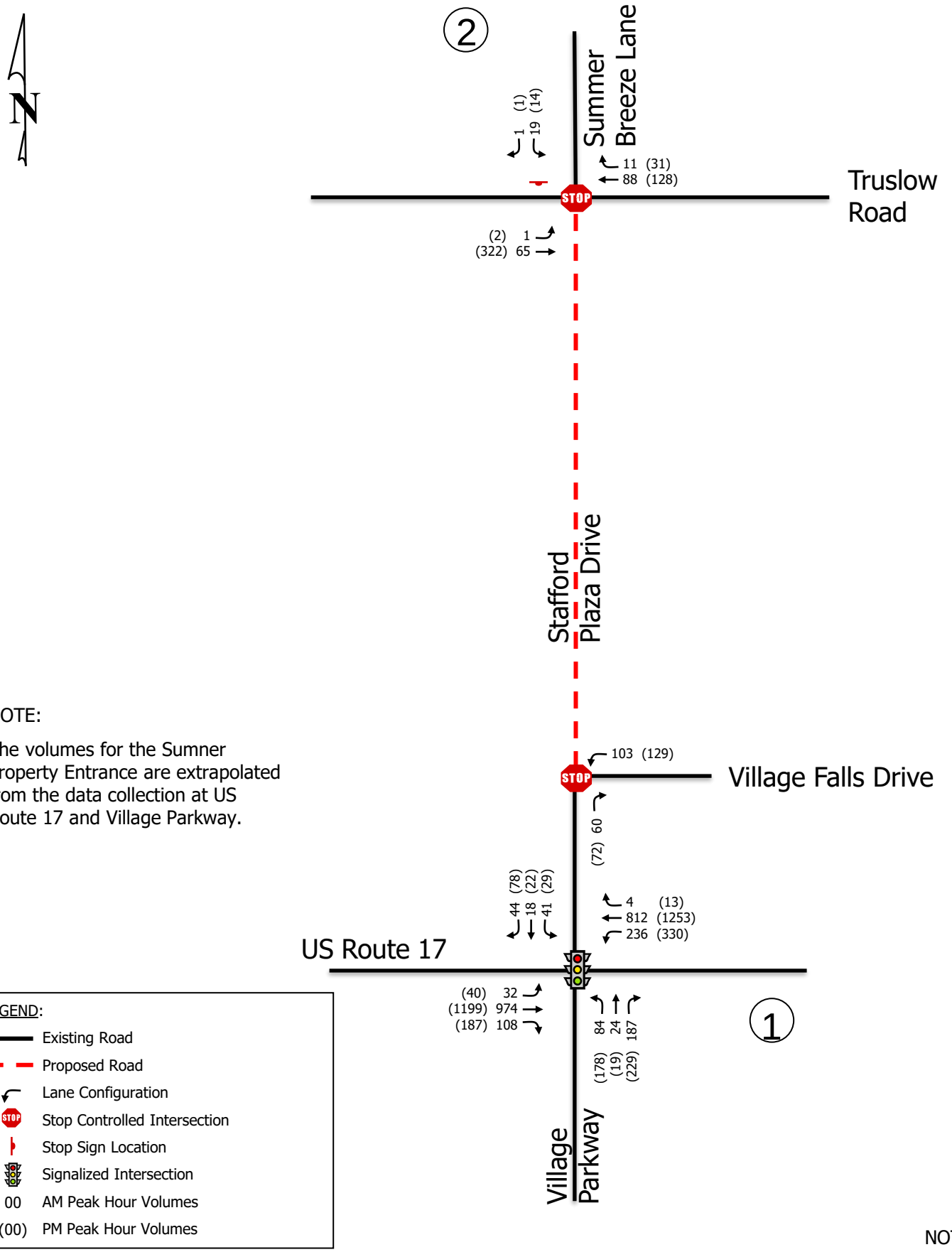
2021 Existing Geometry
Stafford County High School #6

Figure 2-3



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2021 Existing Volumes
Stafford County High School #6

Figure
2-4

3 ANALYSIS OF EXISTING CONDITIONS

3.1 CAPACITY ANALYSES

Level of service calculations for the intersections within the study area were performed using SYNCHRO Version 10. SYNCHRO calculates delay based on techniques outlined in the 2000 Highway Capacity Manual. HCM 2000 methodologies were utilized for analysis as opposed to the latest HCM 6th Edition or HCM 2010 methodologies due to the non-standard NEMA phasing that is present with the lane geometry for the signalized intersections within the study area.

The two (2) existing study intersections were analyzed using the 2021 existing volumes shown on Figure 2-4. These intersections, both signalized and unsignalized, were analyzed using SYNCHRO Version 10 based on 2000 HCM methodologies with the following assumptions:

- 12-foot lane widths;
- No parking activity or bus stops;
- Peak hour factor (PHF) by total intersection was determined from the traffic counts for existing conditions analysis;
- For background analysis, the existing PHF was utilized or a PHF of 0.92, whichever was higher;
- For total analysis, the existing PHF was utilized or a PHF of 0.92, whichever was higher, with the exception of all movements entering or exiting the proposed site access road to the proposed school development. A PHF of 0.50 was utilized for these movements at the intersection of US Route 17 at Stafford Plaza Drive/Village Parkway and the intersection of Truslow Road/Summer Breeze Lane/Proposed Access Road due to the condensed nature of school traffic.
- Signal timing data provided by VDOT in November 2021; and
- Heavy vehicle (HV) percentages by movement as determined from the collected traffic data.

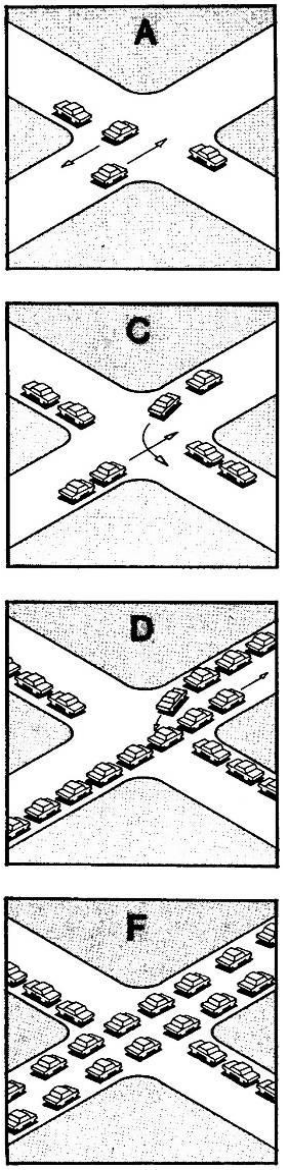
It should be noted that all references to AM and PM peak hour in this report refer to the school AM and the school PM peak hours, respectively, and not the overall roadway AM and PM peak hours.

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.



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"

3.2 2021 Existing Traffic Volumes Analysis

Table 3-3 summarizes the 2021 existing intersection LOS, delay, 95th percentile queue lengths (Synchro), and maximum queue lengths (SimTraffic) based on the 2021 existing intersection geometry (Figure 2-3) and 2021 existing peak hour traffic volumes shown on Figure 2-4. The corresponding SYNCHRO and SimTraffic reports are included in Appendix B. Note that the intersection numbers shown on the LOS, delay, and queue lengths summary tables correspond with the intersection numbers used in the SYNCHRO models and report figures.

The signalized intersection of Village Parkway/Stafford Plaza Drive and US Route 17 operates at an overall LOS C in both the AM and PM peaks. The eastbound approach operates at LOS C in the AM peak and at LOS D in the PM peak. The westbound approach operates at LOS C in the AM peak and at LOS D in the PM peak. The northbound approach operates at LOS D in the AM peak and at LOS F in the PM peak. The southbound approach operates at LOS E in the AM peak and at LOS F in the PM peak. All queues are shown to fit within the existing storage, however, the eastbound approach in the AM and PM peaks has through movement queues that may limit access to the turn lane.

At the unsignalized intersection of Truslow Road and Summer Breeze Lane the eastbound and westbound mainline approaches operate at LOS A in both the AM and PM peaks. The southbound approach operates at LOS A in the AM peak and a maximum queue of 50 feet. The southbound approach operates at LOS B in the PM peak and a maximum queue of 34 feet.

Table 3-3: Intersection Level of Service, Delay, and Queue Summary
2021 Existing Traffic and Existing Geometry

Intersection and Type of Control	Movement and Approach	Effective Turn Lane Storage (ft)	AM PEAK HOUR				PM PEAK HOUR			
			Delay [1] (sec/veh)	LOS [1]	SYNCHRO 95th Percentile Queue Length (ft)	SimTraffic Maximum Queue Length (ft)	Delay [1] (sec/veh)	LOS [1]	SYNCHRO 95th Percentile Queue Length (ft)	SimTraffic Maximum Queue Length (ft)
1. US Route 17 (E-W) at	EB Left	265	57.8	E	m61	249	76.2	F	#91	246
Village Parkway/Stafford Plaza Drive	EB Thru		31.4	C	563	458	33.9	D	642	541
Signalized	EB Right	265	17.2	B	m34	265	20.1	C	11	265
	EB Approach		*30.8*	*C*	--	--	*33.3*	*D*	--	--
	WB Left (2)	415	63.6	E	#157	208	96.3	F	238	251
	WB Thru		18.6	B	325	365	8.3	A	82	427
	WB Right	450	9.8	A	0	16	10.1	B	m0	20
	WB Approach		*28.7*	*C*	--	--	*26.5*	*D*	--	--
	NB Left	225	61.3	E	97	102	78.4	F	#197	163
	NB Left-Thru		60.9	E	98	150	77.5	F	#198	195
	NB Right (2)	500	44.5	D	38	123	47.9	E	60	159
	NB Approach		*50.6*	*D*	--	--	*61.8*	*F*	--	--
	SB Left (2)	250	60.5	E	39	79	69.6	F	32	71
	SB Thru		60.8	E	43	57	71.7	F	54	70
	SB Right	250	53.2	D	0	64	62.6	F	0	112
	SB Approach		*57.5*	*E*	--	--	*65.7*	*F*	--	--
	Overall		**33.3**	**C**	**--**	**--**	**34.8**	**C**	**--**	**--**
2. Truslow Road (E-W) at	EB Left-Thru		0.1	A	0	3	0.1	A	0	17
Summer Breeze Lane (S)	*EB Approach*		*0.1*	*A*	--	--	*0.1*	*A*	--	--
Unsignalized	WB Thru-Right		0.0	A	0	0	0.0	A	0	0
	WB Approach		*0.0*	A	--	--	*0.0*	*A*	--	--
	SB Left-Right		9.6	A	2	50	11.8	B	2	34
	SB Approach		*9.6*	*A*	--	--	*11.8*	*B*	--	--

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

[2] *Dual turn lanes; average storage is provided.*

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

m - Volume for 95th percentile queue is metered by upstream signal.

4 ANALYSIS OF BACKGROUND CONDITIONS

To complete the analysis of the future background conditions (without development), the existing volumes were projected to 2027 using an annual growth rate.

4.1 FUTURE BACKGROUND TRAFFIC VOLUMES

An annual compounded growth rate of 1.0% was applied to the 2021 existing traffic volumes for the anticipated buildout period. This growth rate is based on a review of available VDOT traffic data over 5 years (2015-2019), which shows this section of US Route 17 has seen an increase of approximately 0.8%. A 1% growth rate was chosen to be conservative.

The 2027 background AM and PM peak hour volumes used in the analyses are shown on Figure 4-1.

4.2 BACKGROUND DEVELOPMENTS

There are two (2) approved background developments in the vicinity of the high school. The approved traffic studies are included in Appendix C. The site trips from the Sumner Parcel are summarized in Figure 4-2 and the site trips from the E & A parcel are summarized in Figure 4-3. The combined background development site trips are shown in Figure 4-4.

4.3 CAPACITY ANALYSES

Capacity analysis allows traffic engineers to determine the impacts of traffic on the surrounding roadway network. The general standard for the overall intersection is LOS D representing acceptable results and the standard for individual traffic movements is LOS E. For detailed information about level of service definitions and criteria for unsignalized and signalized intersections, see Chapter 3 on capacity analysis.

It should be noted that all references to AM and PM peak hour in this report refer to the school AM and the school PM peak hours, respectively, and not the overall roadway AM and PM peak hours.

The two (2) existing intersections used in the 2021 analysis above were analyzed using the 2027 background volumes shown on Figure 4-1. These intersections, both signalized and unsignalized, were analyzed using SYNCHRO Version 10 based on 2000 HCM methodologies using the assumptions listed in Chapter 3. For all the future background analyses, the minimum peak hour factor is the existing PHF or 0.92, whichever is higher.

4.4 2027 BACKGROUND TRAFFIC VOLUMES ANALYSIS – WITHOUT BACKGROUND DEVELOPMENTS (GROWTH ONLY)

Table 4-1 summarizes the 2027 background intersection LOS, delay, 95th percentile queue lengths (Synchro), and maximum queue lengths (SimTraffic) based on the 2021 existing intersection geometry (Figure 2-3) and 2027 background peak hour traffic volumes shown on Figure 4-1. The corresponding SYNCHRO and SimTraffic reports are included in Appendix D. Note that the intersection numbers shown on the LOS, delay, and queue lengths summary tables correspond with the intersection numbers used in the SYNCHRO models and report figures.

The signalized intersection of Village Parkway/Stafford Plaza Drive and US Route 17 continues to operate at an overall LOS C in the AM peak but worsens to operate at LOS D in the PM peak hour. The eastbound approach continues to operate at LOS C in the AM peak and worsens to operate at LOS E in the PM peak. The westbound approach continues to operate at LOS C in the AM peak and at LOS D in the PM peak. The northbound approach continues to operate at LOS D in the AM peak and at LOS F in the PM peak. The southbound approach continues to operate at LOS E in the AM peak and at LOS F in the PM peak. All queues are shown to fit within the existing storage, however, the eastbound approach in the AM and PM peaks continue to have through movement queues that may limit access to the turn lane.

At the unsignalized intersection of Truslow Road and Summer Breeze Lane the mainline eastbound and westbound approaches continue to operate at LOS A in both the AM and PM peaks. The southbound approach continues to operate at LOS A in the AM peak and a maximum queue of 46 feet. The southbound approach continues to operate at LOS B in the PM peak and a maximum queue of 30 feet.

Overall, any operational, queuing, and capacity deficiencies observed under existing conditions will continue under the 2027 background conditions. There are no significant differences in the operations of the study intersections during the 2027 background conditions.

Table 4-1: Intersection Level of Service, Delay, and Queue Summary
2027 Background Traffic Volumes – Without Background Developments (Growth Only)

Intersection and Type of Control	Movement and Approach	Effective Turn Lane Storage (ft)	AM PEAK HOUR				PM PEAK HOUR			
			Delay [1] (sec/veh)	LOS [1]	SYNCHRO 95th Percentile Queue Length (ft)	SimTraffic Maximum Queue Length (ft)	Delay [1] (sec/veh)	LOS [1]	SYNCHRO 95th Percentile Queue Length (ft)	SimTraffic Maximum Queue Length (ft)
1. US Route 17 (E-W) at	EB Left	265	58.6	E	m64	264	78.1	F	#95	235
Village Parkway/Stafford Plaza Drive	EB Thru		32.9	C	593	527	37	E	706	594
Signalized	EB Right	265	17.5	B	m37	265	20.6	C	19	265
	EB Approach		*32.1*	*C*	--	--	*36.0*	*E*	--	--
	WB Left (2)	415	65.0	E	#177	264	96.6	F	#259	295
	WB Thru		19.2	B	353	397	9.3	A	116	388
	WB Right	450	9.8	A	0	21	10.1	B	m0	24
	WB Approach		*29.5*	*C*	--	--	*27.4*	*D*	--	--
	NB Left	225	61.8	E	102	118	81.5	F	#214	184
	NB Left-Thru		61.5	E	104	160	81.2	F	#217	212
	NB Right (2)	500	44.8	D	51	84	48.0	E	74	153
	NB Approach		*51.0*	*D*	--	--	*63.4*	*F*	--	--
	SB Left (2)	250	60.6	E	41	79	69.6	F	34	75
	SB Thru		60.7	*E*	45	63	71.7	F	55	78
	SB Right	250	53.2	D	0	65	62.3	F	0	114
	SB Approach		*57.5*	*E*	--	--	*65.7*	*F*	--	--
	Overall		**34.2**	**C**	**--**	**--**	**36.5**	**D**	**--**	**--**
2.. Truslow Road (E-W) at	EB Left-Thru		0.1	A	0	3	0.1	A	0	13
Summer Breeze Lane (S)	*EB Approach*		*0.1*	*A*	--	--	*0.1*	*A*	--	--
Unsignalized	WB Thru-Right		0.0	A	0	0	0.0	A	0	0
	WB Approach		*0.0*	*A*	--	--	*0.0*	*A*	--	--
	SB Left-Right		9.6	A	2	46	12.1	B	3	30
	SB Approach		*9.6*	*A*	--	--	*12.1*	*B*	--	--

4.5 2027 BACKGROUND TRAFFIC VOLUMES ANALYSIS – WITH BACKGROUND DEVELOPMENTS

Table 4-2 summarizes the 2027 background intersection LOS, delay, 95th percentile queue lengths (Synchro), and maximum queue lengths (SimTraffic) based on the 2021 existing intersection geometry (Figure 2-3) and 2027 background peak hour traffic volumes shown on Figure 4-5. The corresponding SYNCHRO and SimTraffic reports are included in Appendix E. Note that the intersection numbers shown on the LOS, delay, and queue lengths summary tables correspond with the intersection numbers used in the SYNCHRO models and report figures.

The signalized intersection of Village Parkway/Stafford Plaza Drive and US Route 17 operates at LOS D in both the AM and PM peaks. The eastbound approach continues to operate at LOS D in the AM peak and worsens to operate at LOS E in the PM peak. The westbound approach continues to operate at LOS C in the AM peak and at LOS D in the PM peak. The northbound approach continues to operate at LOS D in the AM peak and at LOS F in the PM peak. The southbound approach continues to operate at LOS E in the AM peak and at LOS F in the PM peak. All queues are shown to fit within the existing storage, however, the eastbound approach in the AM and PM peaks continue to have through movement queues that may limit access to the turn lane.

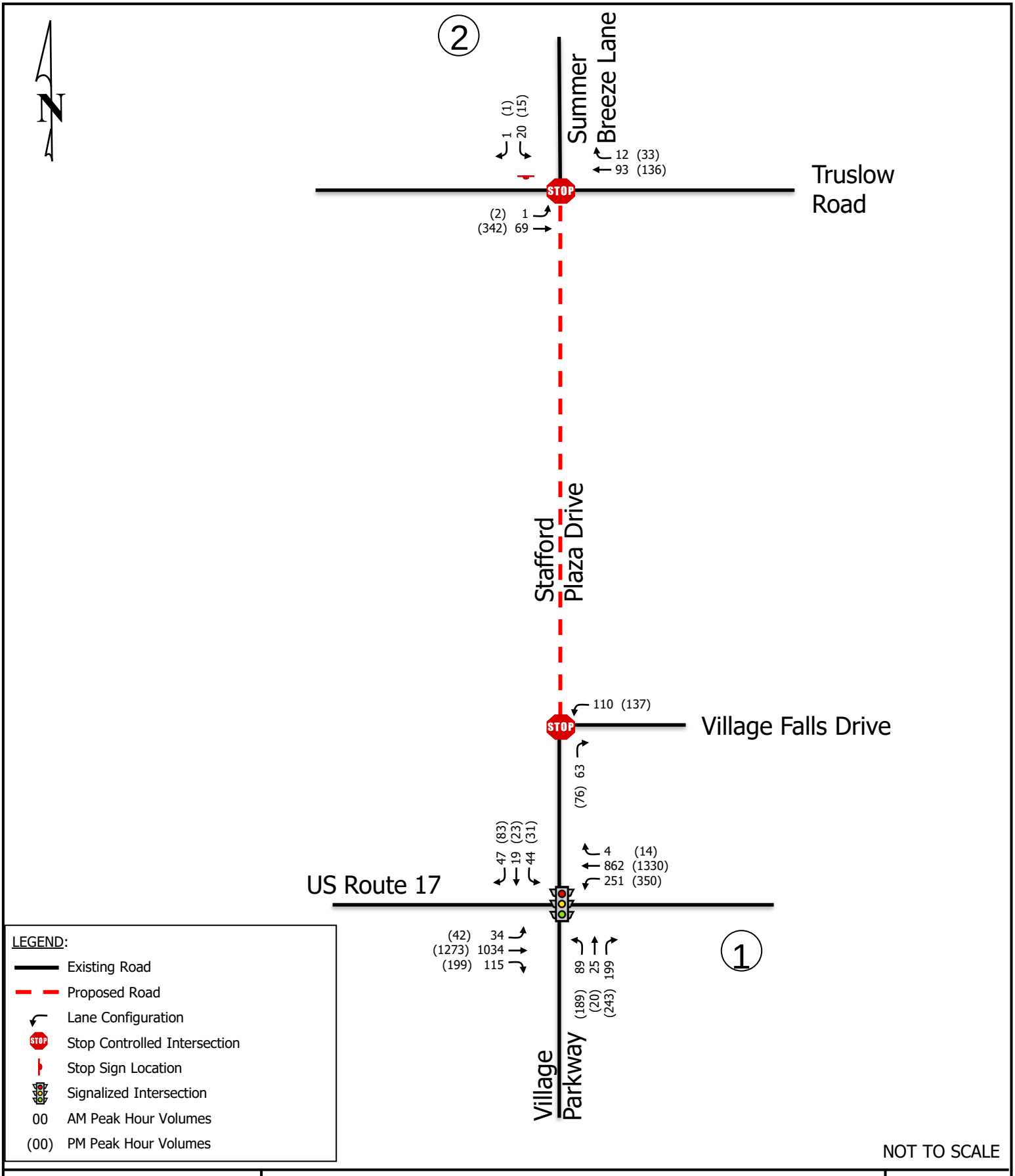
At the unsignalized intersection of Truslow Road and Summer Breeze Lane the mainline eastbound and westbound approaches continue to operate at LOS A in both the AM and PM peaks. The southbound approach continues to operate at LOS A in the AM peak and a maximum queue of 44 feet. The southbound approach continues to operate at LOS A in the PM peak and a maximum queue of 35 feet.

Overall, any operational, queuing, and capacity deficiencies observed under existing conditions will continue under the 2027 background conditions. There are no significant differences in the operations of the study intersections during the 2027 background conditions. The individual movements and approaches that experience queuing issues will continue.

The additional eastbound left turn volumes associated with the approved background developments will increase the queuing for the single left turn lane beyond its capacity in the AM peak hour. Given that the analysis is focused on the school peaks only, it is reasonable to assume that the overall corridor PM peak hour analysis will also have queuing concerns for the background traffic in a single left turn lane. This is considered a background condition issue and should be addressed upon the development of the approved sites associated with Stafford Plaza Drive.

Table 4-2: Intersection Level of Service, Delay, and Queue Summary
2027 Background Traffic Volumes – With Background Developments

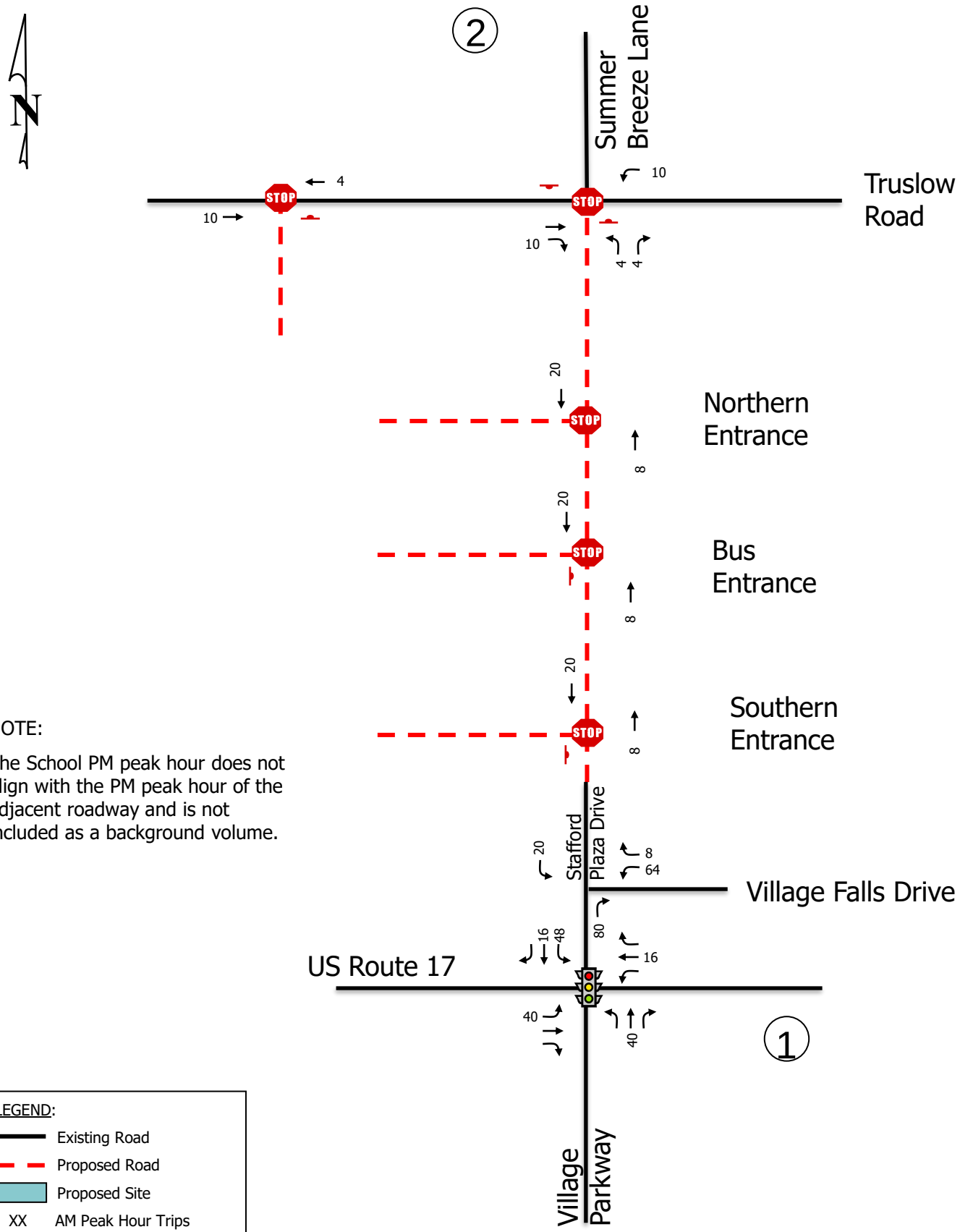
Intersection and Type of Control	Movement and Approach	Effective Turn Lane Storage (ft)	AM PEAK HOUR				PM PEAK HOUR			
			Delay [1] (sec/veh)	LOS [1]	SYNCHRO 95th Percentile Queue Length (ft)	SimTraffic Maximum Queue Length (ft)	Delay [1] (sec/veh)	LOS [1]	SYNCHRO 95th Percentile Queue Length (ft)	SimTraffic Maximum Queue Length (ft)
1. US Route 17 (E-W) at	EB Left	265	114.8	F	m#319	265	78.1	F	#95	264
Village Parkway/Stafford Plaza Drive	EB Thru		34.1	C	582	938	37	E	706	557
Signalized	EB Right	265	18.6	B	m34	265	20.6	C	19	265
	EB Approach		*41.6*	*D*	--	--	*36.0*	*E*	--	--
	WB Left (2)	415	68.1	E	#177	249	96.6	F	#259	289
	WB Thru		26.2	C	370	430	9.3	A	116	352
	WB Right	450	12.6	B	9	141	10.1	B	m0	17
	WB Approach		*33.9*	*C*	--	--	*27.4*	*D*	--	--
	NB Left	225	61.8	E	102	105	81.5	F	#214	193
	NB Left-Thru		61.5	E	104	138	81.2	F	#217	215
	NB Right (2)	500	46.1	D	71	124	48.0	E	74	160
	NB Approach		*51.8*	*D*	--	--	*63.4*	*F*	--	--
	SB Left (2)	250	73.1	E	#138	164	69.6	F	34	65
	SB Thru		57.3	*E*	45	53	71.7	F	55	88
	SB Right	250	45.8	D	1	87	62.3	F	0	110
	SB Approach		*66.1*	*E*	--	--	*65.7*	*F*	--	--
	Overall		**41.5**	**D**	**--**	**--**	**36.5**	**D**	**--**	**--**
2. Truslow Road (E-W) at	EB L-T-R		0.1	A	0	8	0.1	A	0	0
Summer Breeze Lane (S)	*EB Approach*		*0.1*	*A*	--	--	*0.1*	*A*	--	--
Unsignalized	WB L-T-R		0.7	A	1	0	0.0	A	0	0
	WB Approach		*0.7*	*A*	--	--	*0.0*	*A*	--	--
	NB L-T-R		9.3	A	1	22	0.0	A	0	0
	NB Approach		*9.3*	*A*	--	--	*0.0*	*A*	--	--
	SB L-T-R		10.1	B	2	44	12.9	B	3	35
	SB Approach		*10.1*	*B*	--	--	*12.9*	*B*	--	--



TIMMONS GROUP
YOUR VISION ACHIEVED THROUGH OURS.

2027 Background Volumes (Growth Only)
Stafford County High School #6

Figure 4-1

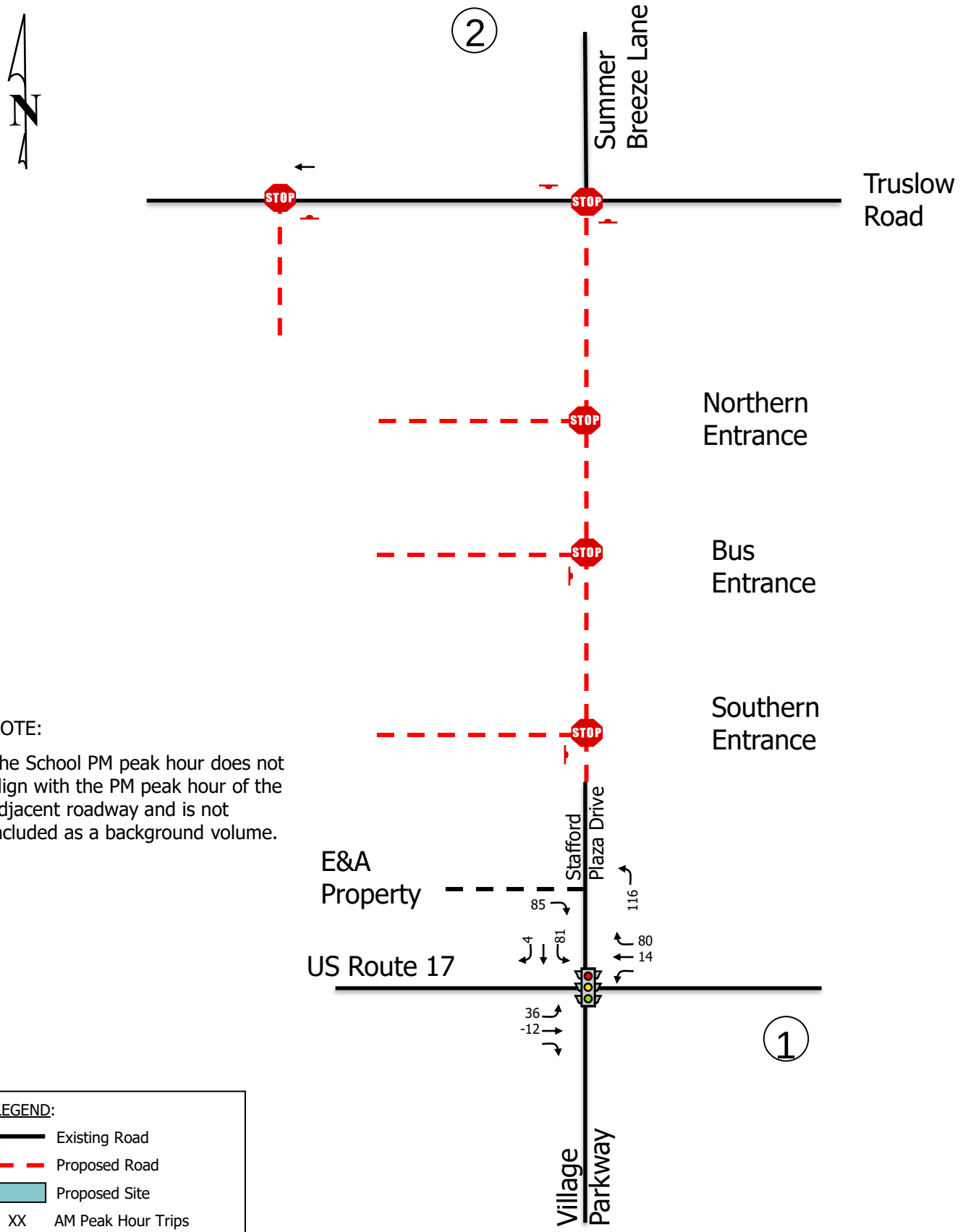


NOT TO SCALE

TIMMONS GROUP
YOUR VISION ACHIEVED THROUGH OURS.

Background Development Trips
Sumner Parcel
Stafford County High School #6

Figure 4-2

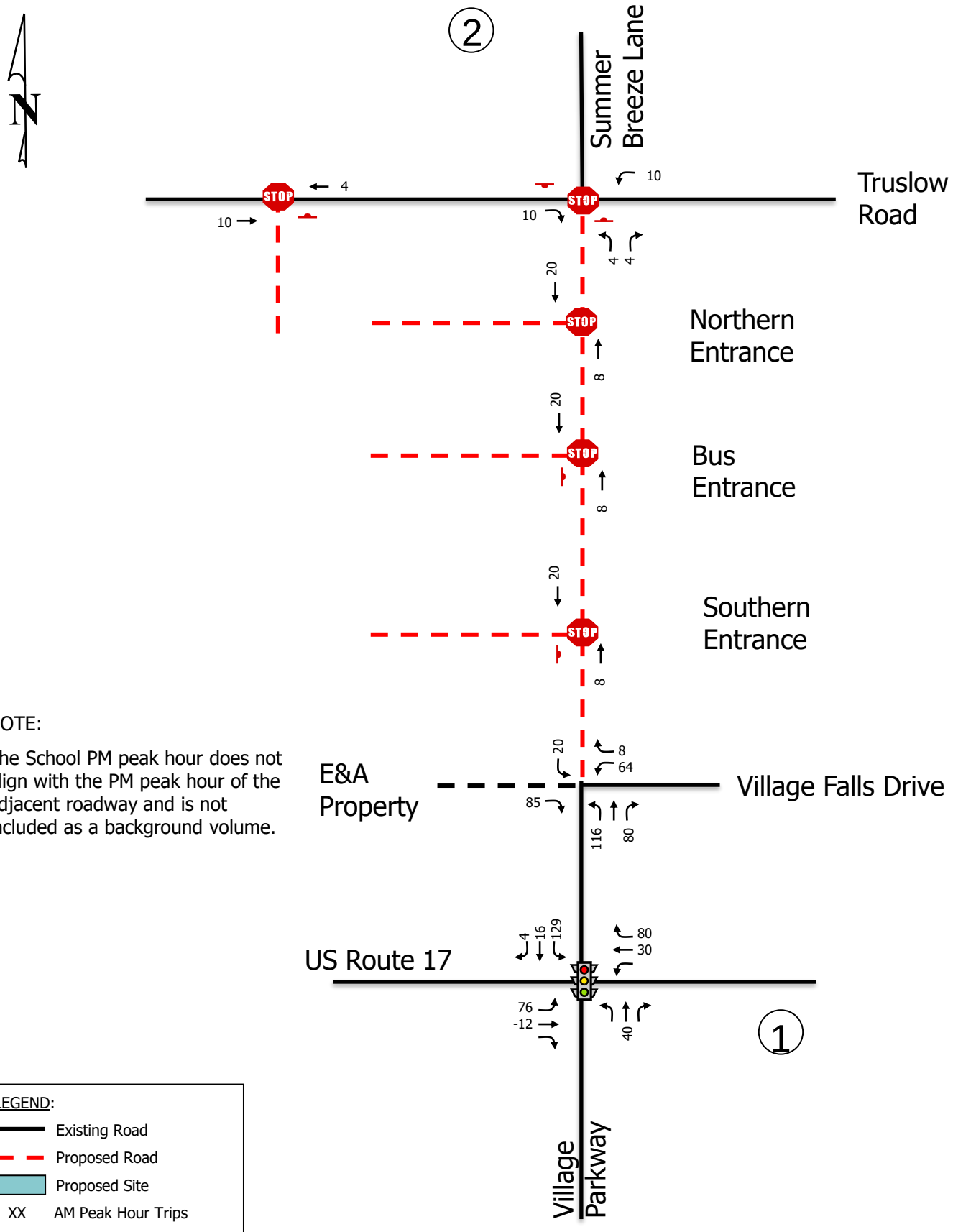


NOT TO SCALE

TIMMONS GROUP
YOUR VISION ACHIEVED THROUGH OURS.

Background Development Trips
E&A Parcel
Stafford County High School #6

Figure 4-3



NOTE:

The School PM peak hour does not align with the PM peak hour of the adjacent roadway and is not included as a background volume.

LEGEND:

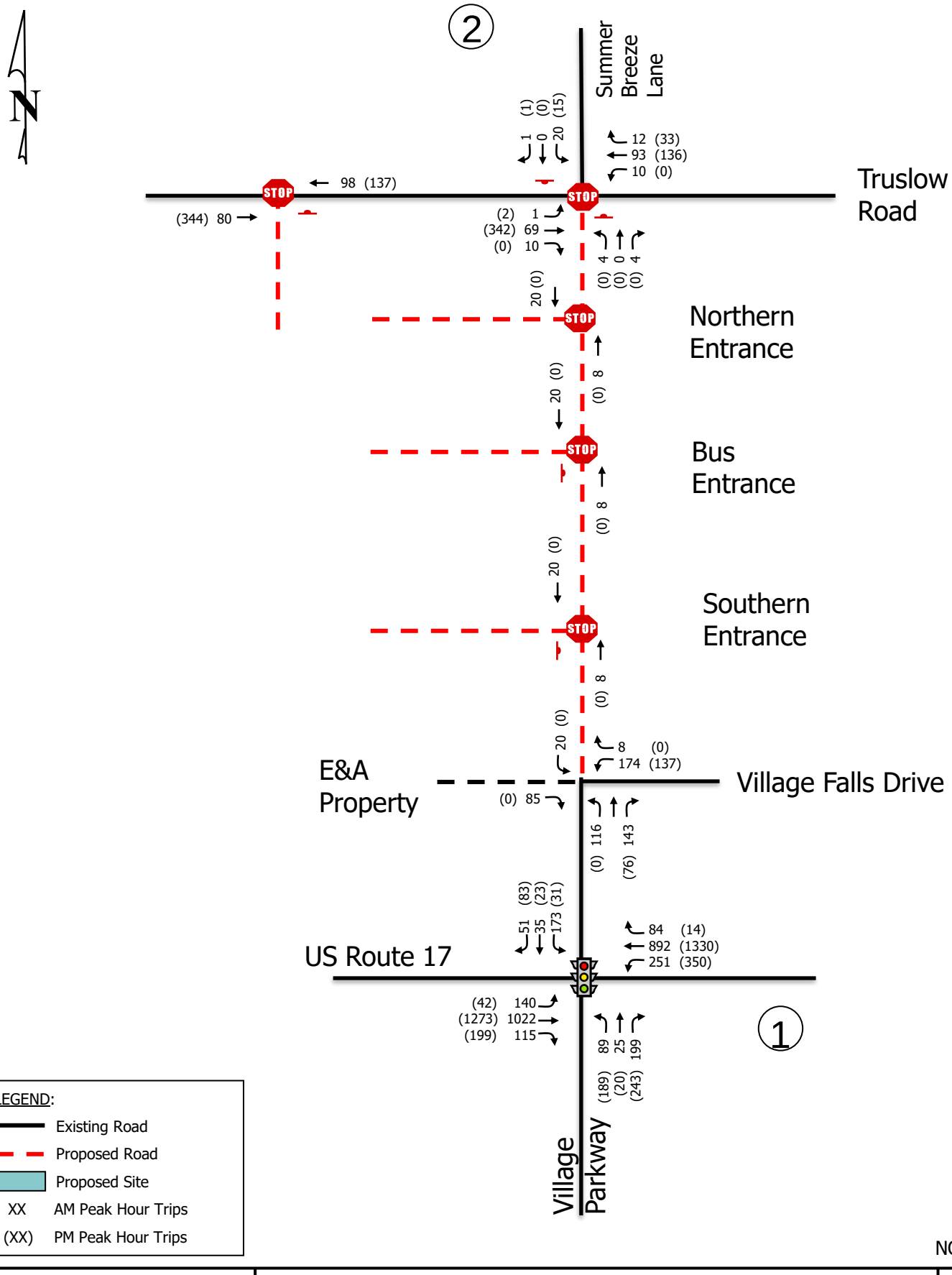
- Existing Road
- Proposed Road
- Proposed Site
- XX AM Peak Hour Trips
- (XX) PM Peak Hour Trips

NOT TO SCALE

TIMMONS GROUP
YOUR VISION ACHIEVED THROUGH OURS.

Background Development Trips Combined Stafford County High School #6

Figure 4-4



TIMMONS GROUP
YOUR VISION ACHIEVED THROUGH OURS.

2027 Background Volumes (Growth + Development) Stafford County High School #6

Figure 4-5

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5 TRIP GENERATION

Site traffic for the proposed Stafford County High School #6 development was estimated based on the site characteristics and subsequently distributed to the surrounding roadway network.

5.1 SITE TRIP GENERATION

The proposed development will be a 2,150-student high school. Stafford County Public Schools intends to pursue construction of the site within the next 5 years and the school will be operational by 2027.

To evaluate the impacts of the traffic generated by the proposed development, analyses were completed using the weekday AM and PM peak hour of the generator. This is based on the Stafford County Public Schools schedule to start high schools at 9:35 AM and end at 3:35 PM, which results in traffic volumes at existing intersections that do not coincide with the adjacent roadway peak hour.

Trip generation was completed using the Institute of Transportation Engineers (ITE) *Trip Generation Manual, 11th edition*. As indicated in Table 5-1, on a typical weekday, the assumed land use listed above are anticipated to generate approximately 4,171 daily trips, 936 AM peak hour trips, and 601 PM peak hour trips.

Table 5-1: Trip Generation Summary

LAND USE	ITE CODE	AMOUNT	UNITS	WEEKDAY						
				ADT	SCHOOL AM PEAK HOUR			SCHOOL PM PEAK HOUR		
					IN	OUT	TOTAL	IN	OUT	TOTAL
High School	525	2,150	Students	4,171	636	300	936	192	409	601

SOURCE: Institute of Transportation Engineers' *Trip Generation Manual* 11th Edition (2021)

5.1 TRIP DISTRIBUTIONS

The distribution of external trips generated by the high school was estimated based on the existing travel patterns, the nature of the use, the 2021 traffic volumes, the expected draw area of the proposed high school, and local knowledge.

The following global distributions were assumed:

- 30% will enter/exit the site to/from the east via US Route 17
- 20% will enter/exit the site to/from the west via US Route 17
- 25% will enter/exit the site to/from the east via Truslow Road
- 15% will enter/exit the site to/from the south via Village Parkway/Stafford Plaza Drive
- 10% will enter/exit the site to/from the north via Poplar Road to Truslow Road

These distributions are shown on Figure 5-1 and Figure 5-2 shows the intersection trip distributions.

5.2 TRAFFIC ASSIGNMENT

The trip distribution percentages for the external trips from Figures 5-1 and 5-2 were applied to the trip generation table (Table 5-1) to distribute the external trips to the surrounding roadway network. The resulting site generated external trips are shown on Figure 5-3 for the proposed high school.

To generate the 2027 total future traffic volumes, the external site trips shown on Figure 5-3 were added to the background 2027 traffic volumes shown on Figure 4-1. The resulting 2027 total future traffic volumes are shown on Figure 5-4.

It should be noted that the future proposed elementary school in the vicinity of this site will not operate at the same times as the proposed high school, therefore, no peak hour trips for the elementary school have been added to this analysis as there would be very minimal crossover.

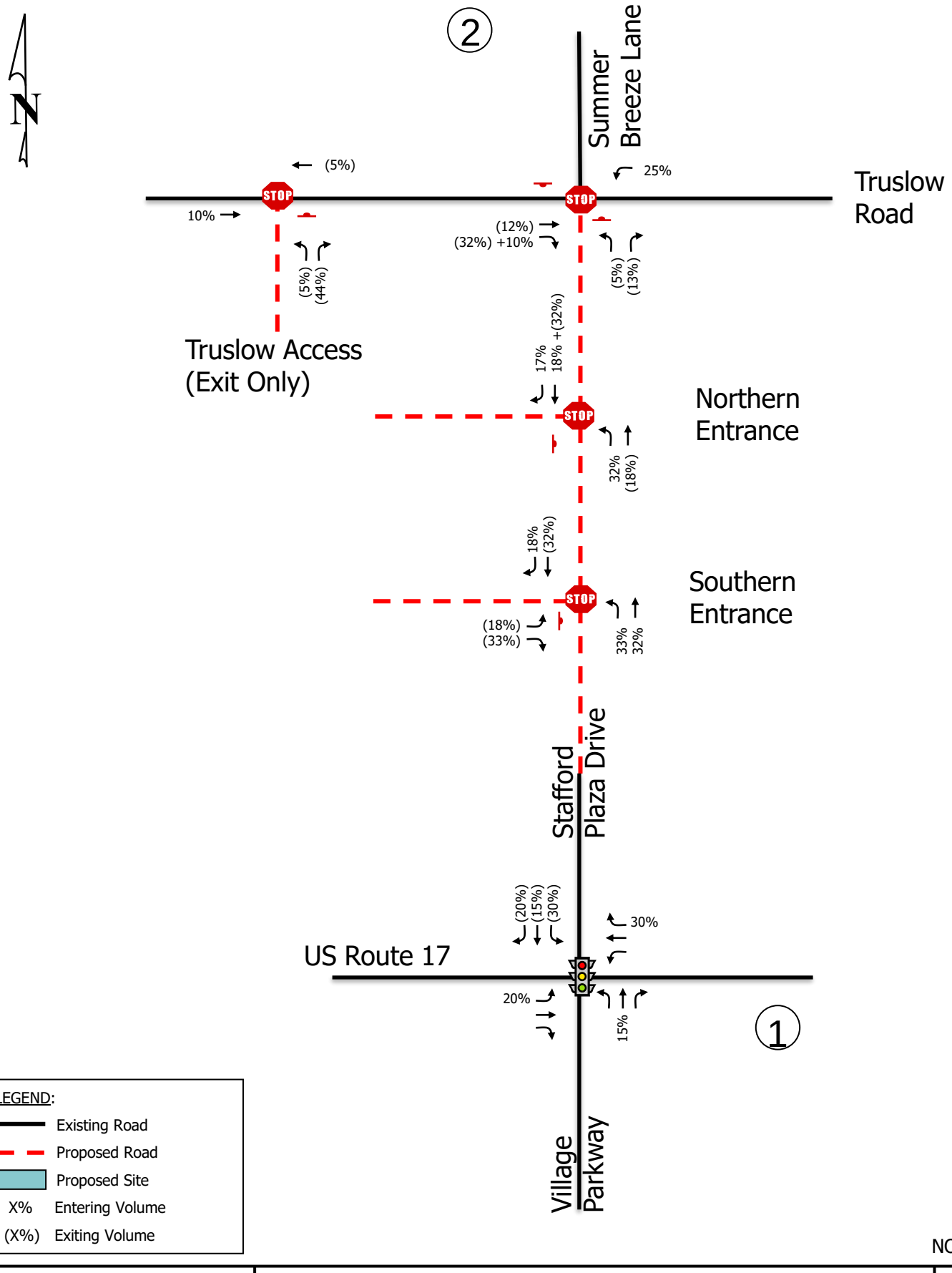
5.3 BUS TRAFFIC

The proposed layout as shown in Figure 2-2 shows the bus loop immediately to the south of the Northern Entrance. It was assumed that the 30 buses that service the site would follow the established distributions and the anticipated bus trips can be found on Figure 5-3. The total future volumes with buses can be found on Figure 5-4.

TIMMONS GROUP
YOUR VISION ACHIEVED THROUGH OURS.

Global Trip Distributions
Stafford County High School #6

Figure
5-1



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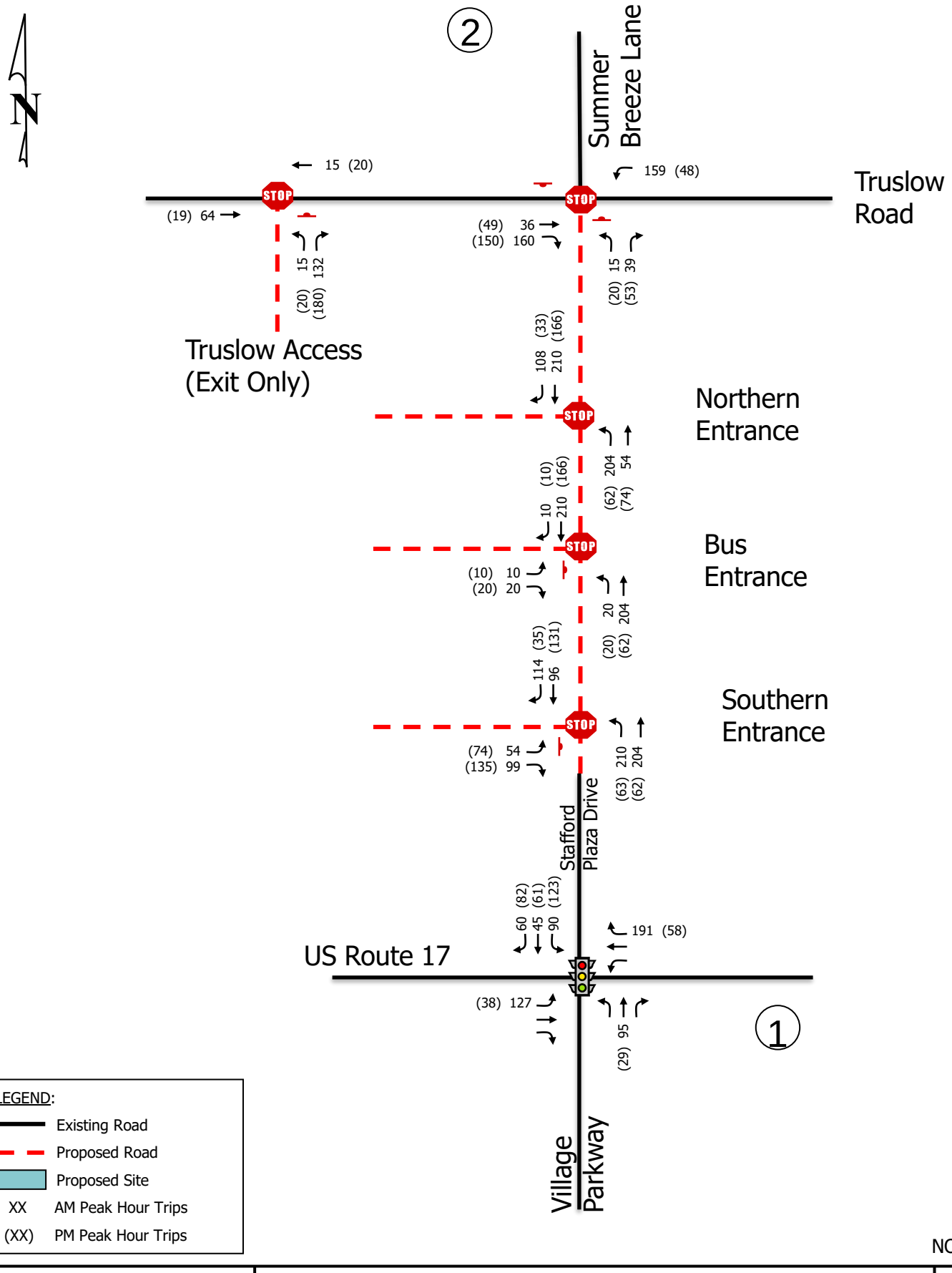
Intersection Trip Distributions
Stafford County High School #6

Figure 5-2

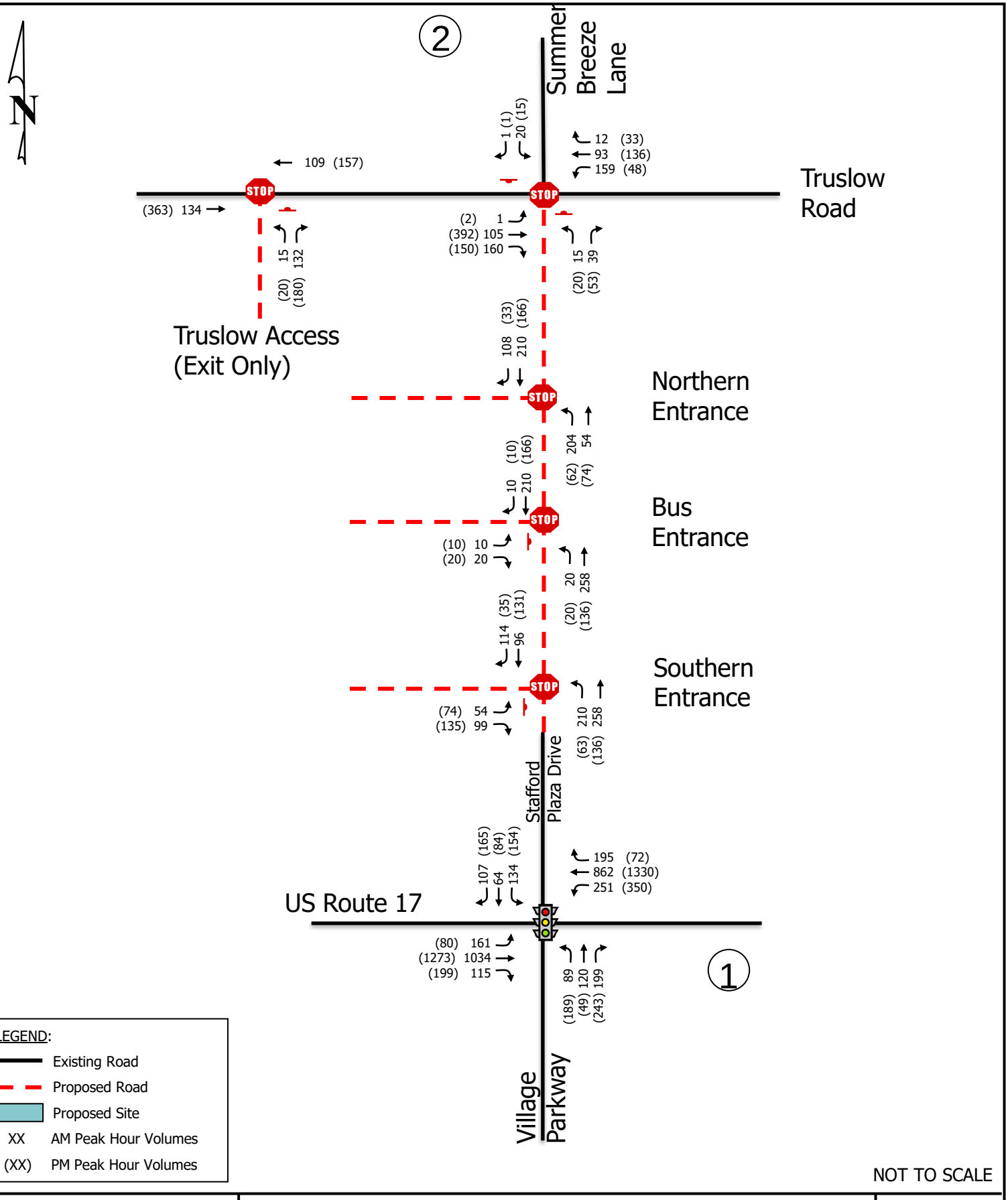


NOT TO SCALE

TIMMONS GROUP
YOUR VISION ACHIEVED THROUGH OURS.

Site Generated Trips (with Bus Entrance)
Stafford County High School #6

Figure 5-3

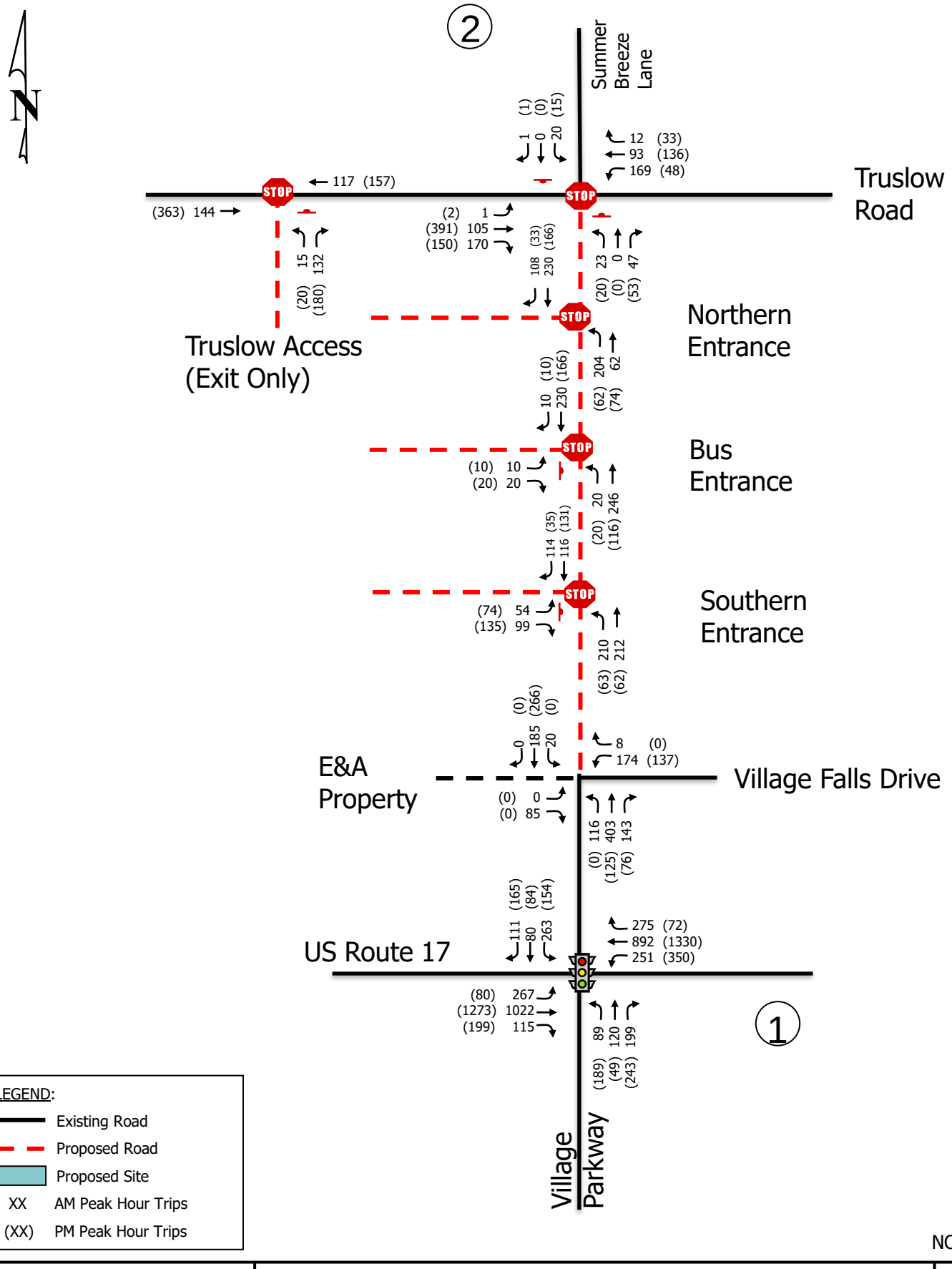


NOT TO SCALE

TIMMONS GROUP
YOUR VISION ACHIEVED THROUGH OURS.

2027 Total Future Volumes Without Background Developments Stafford County High School #6

Figure 5-4



NOT TO SCALE

TIMMONS GROUP
YOUR VISION ACHIEVED THROUGH OURS.

2027 Total Future Volumes With Background Developments Stafford County High School #6

Figure 5-5

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6 TURN LANE WARRANT ANALYSIS

In addition to the capacity analysis for the future site entrances, turn lane warrant analyses were performed for the following intersections/movements:

- Truslow Road and Summer Breeze Lane: EB right and WB left;
- Northern Entrance and Stafford Plaza Drive Extension: NB left and SB right;
- Southern Entrance and Stafford Plaza Drive Extension: NB left and DB right; and
- Bus Entrance and Stafford Plaza Drive Extension: NB left and SB right.

The turn lane warrant analyses were completed using the appropriate turn lane nomographs from Appendix F of the VDOT *Road Design Manual*. The results indicate the following:

- Truslow Road and Summer Breeze Lane: both a WB right turn lane and EB left turn lane are warranted;
- Northern Entrance and Stafford Plaza Drive Extension: both a NB left turn lane and a SB right turn lane are warranted;
- Southern Entrance and Stafford Plaza Drive Extension: both a NB left turn lane and SB right turn lane are warranted; and
- Bus Entrance and Stafford Plaza Drive Extension: no turn lanes are warranted.

Copies of the nomographs can be found in Figures 6-1 through 6-10 and the proposed future geometry can be found in Figure 6-11.

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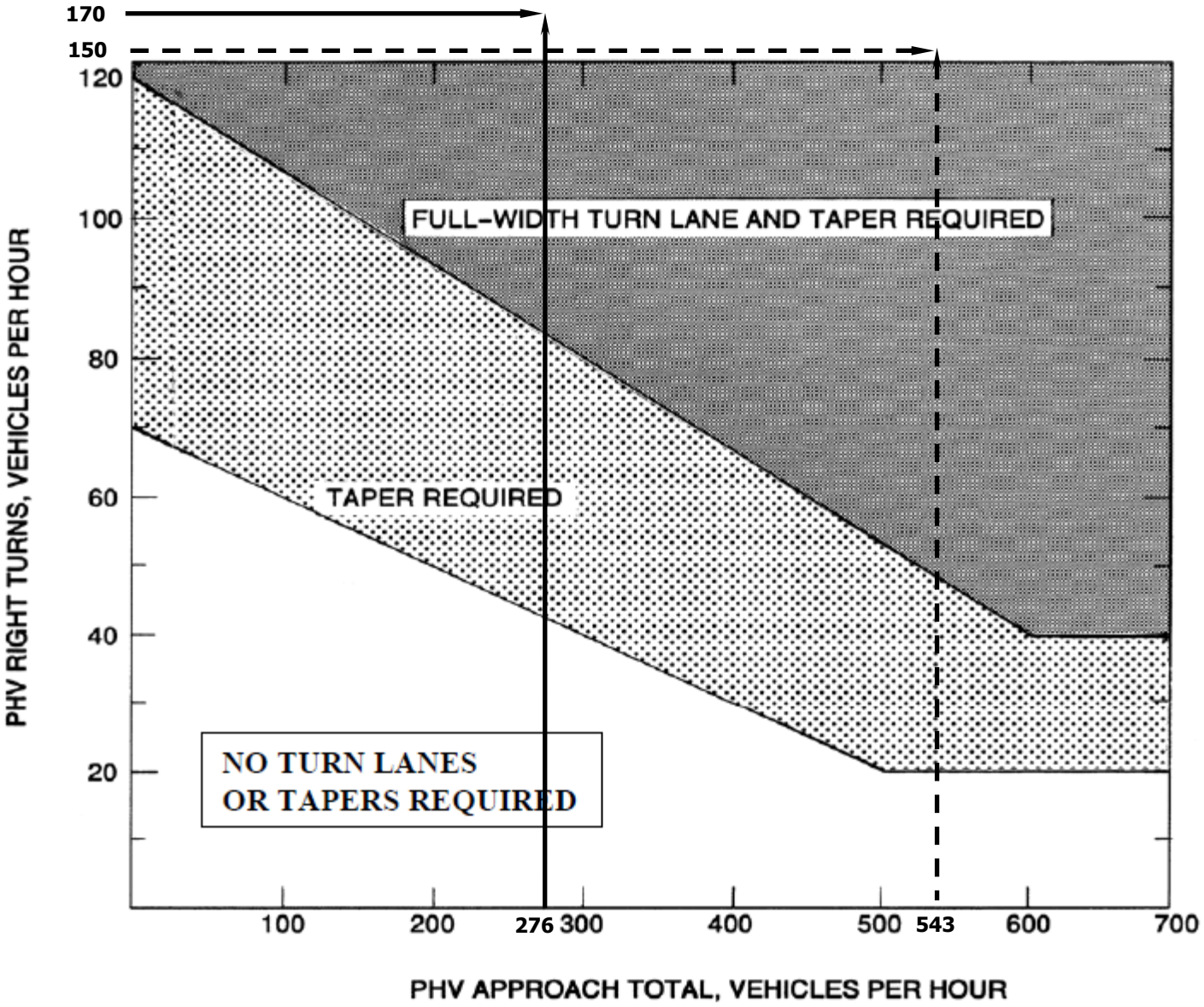
GUIDELINES FOR RIGHT TURN TREATMENT (2-LANE HIGHWAY)
FIGURE 3-26 VDOT ROAD DESIGN MANUAL APPENDIX F



RIGHT TURN LANE AND TAPER WARRANTED

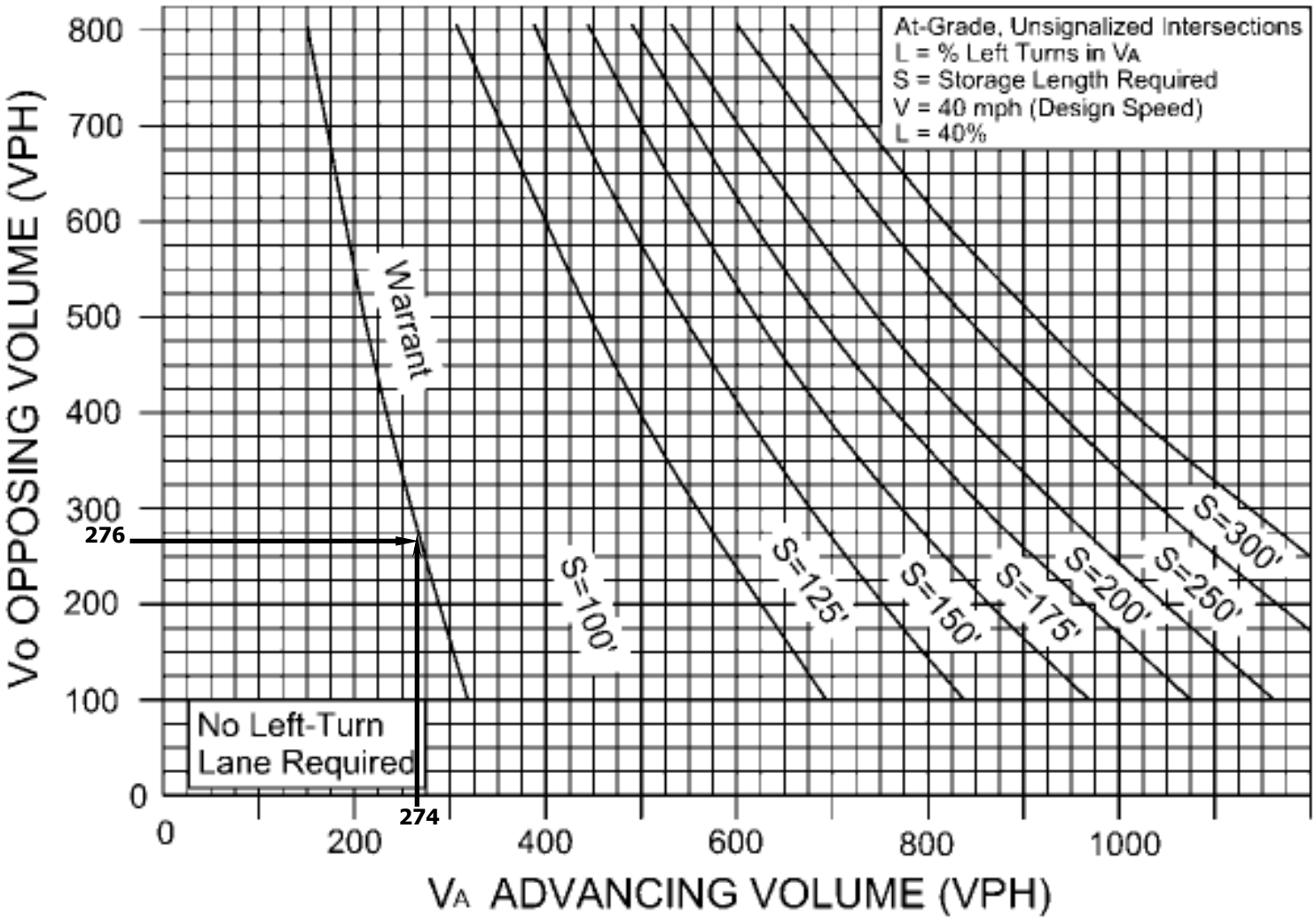
LEGEND
AM Peak Hour
PM Peak Hour

TIMMONS GROUP
YOUR VISION ACHIEVED THROUGH OURS.

Right-Turn Lane Warrant
2027 Total Future Volumes
EB Right on Truslow Rd at Summer Breeze Ln

Figure
6-1

WARRANT FOR LEFT-TURN STORAGE LANES
ON TWO-LANE HIGHWAYS (40 MPH)
FIGURE 3-10 VDOT ROAD DESIGN MANUAL APPENDIX F

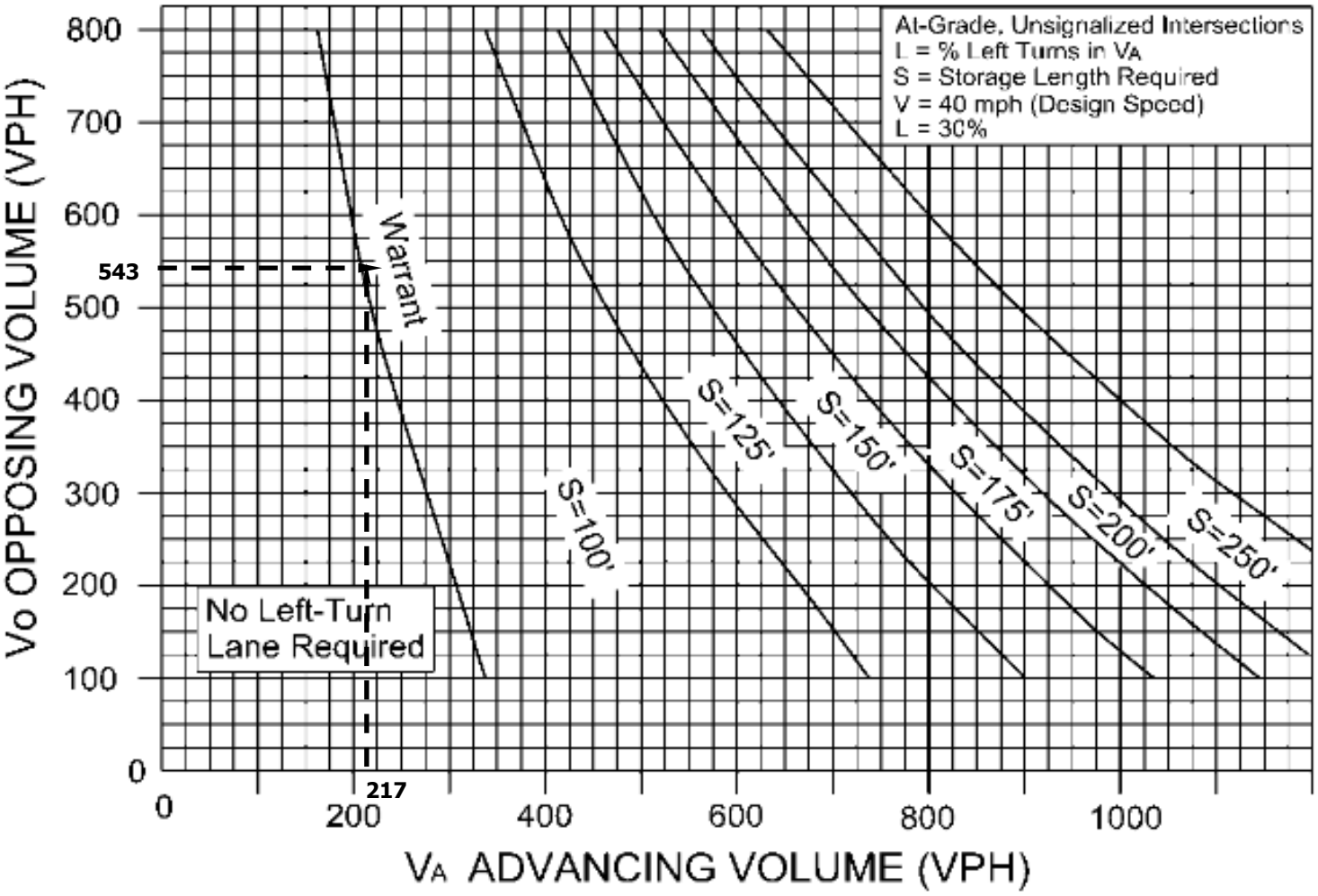


LEFT TURN LANE WARRANTED

LEGEND
AM Peak Hour

TIMMONS GROUP YOUR VISION ACHIEVED THROUGH OURS.	Left-Turn Lane Warrant 2027 Total Future Volumes – AM Peak Hour WB Left on Truslow Rd at Summer Breeze Ln	Figure 6-2

WARRANT FOR LEFT-TURN STORAGE LANES
ON TWO-LANE HIGHWAYS (40 MPH)
FIGURE 3-9 VDOT ROAD DESIGN MANUAL APPENDIX F

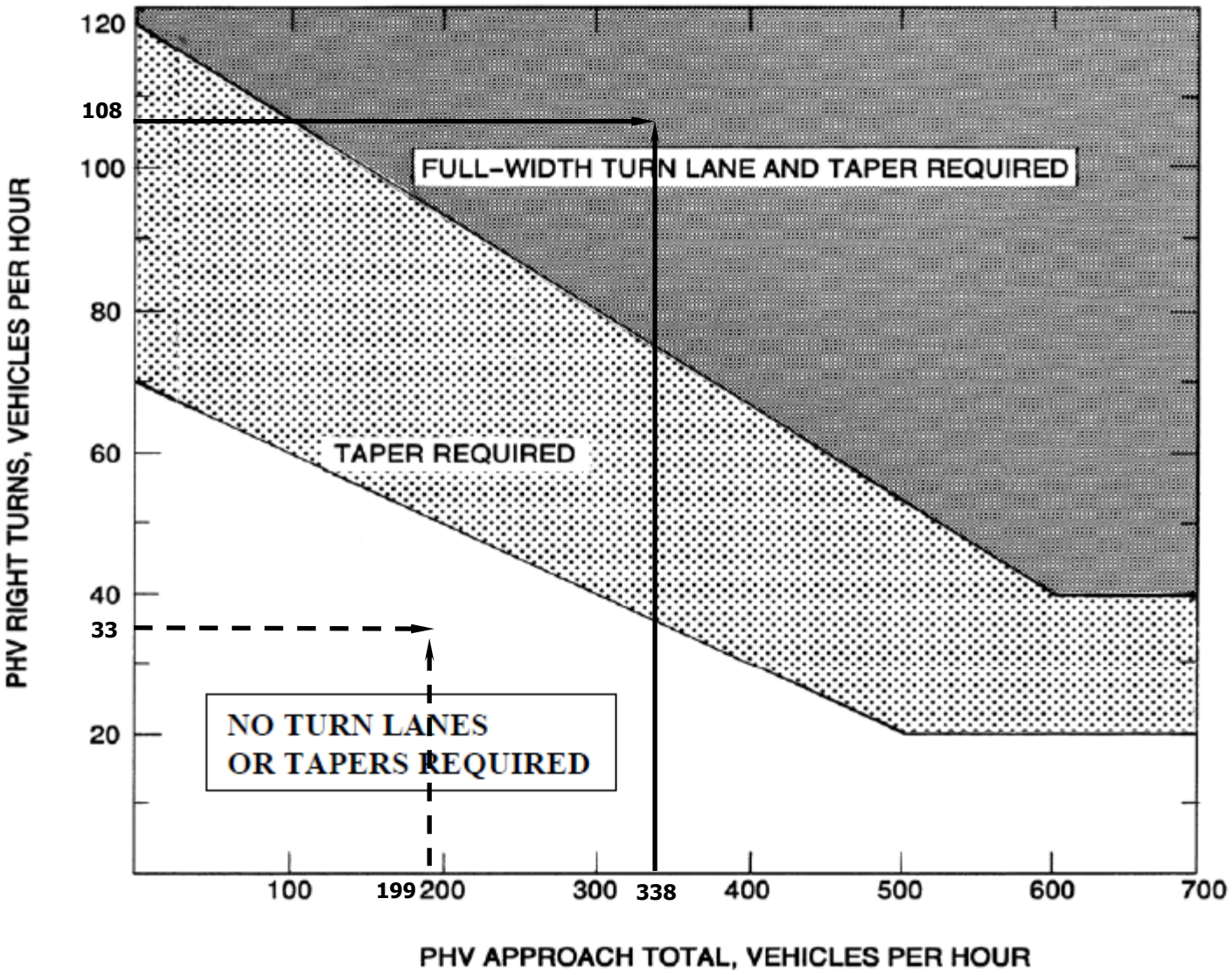


LEFT TURN LANE WARRANTED

LEGEND
- - - - PM Peak Hour

TIMMONS GROUP YOUR VISION ACHIEVED THROUGH OURS.	Left-Turn Lane Warrant 2027 Total Future Volumes – PM Peak Hour WB Left on Truslow Rd at Summer Breeze Ln	Figure 6-3

GUIDELINES FOR RIGHT TURN TREATMENT (2-LANE HIGHWAY)
FIGURE 3-26 VDOT ROAD DESIGN MANUAL APPENDIX F



RIGHT TURN LANE AND TAPER WARRANTED

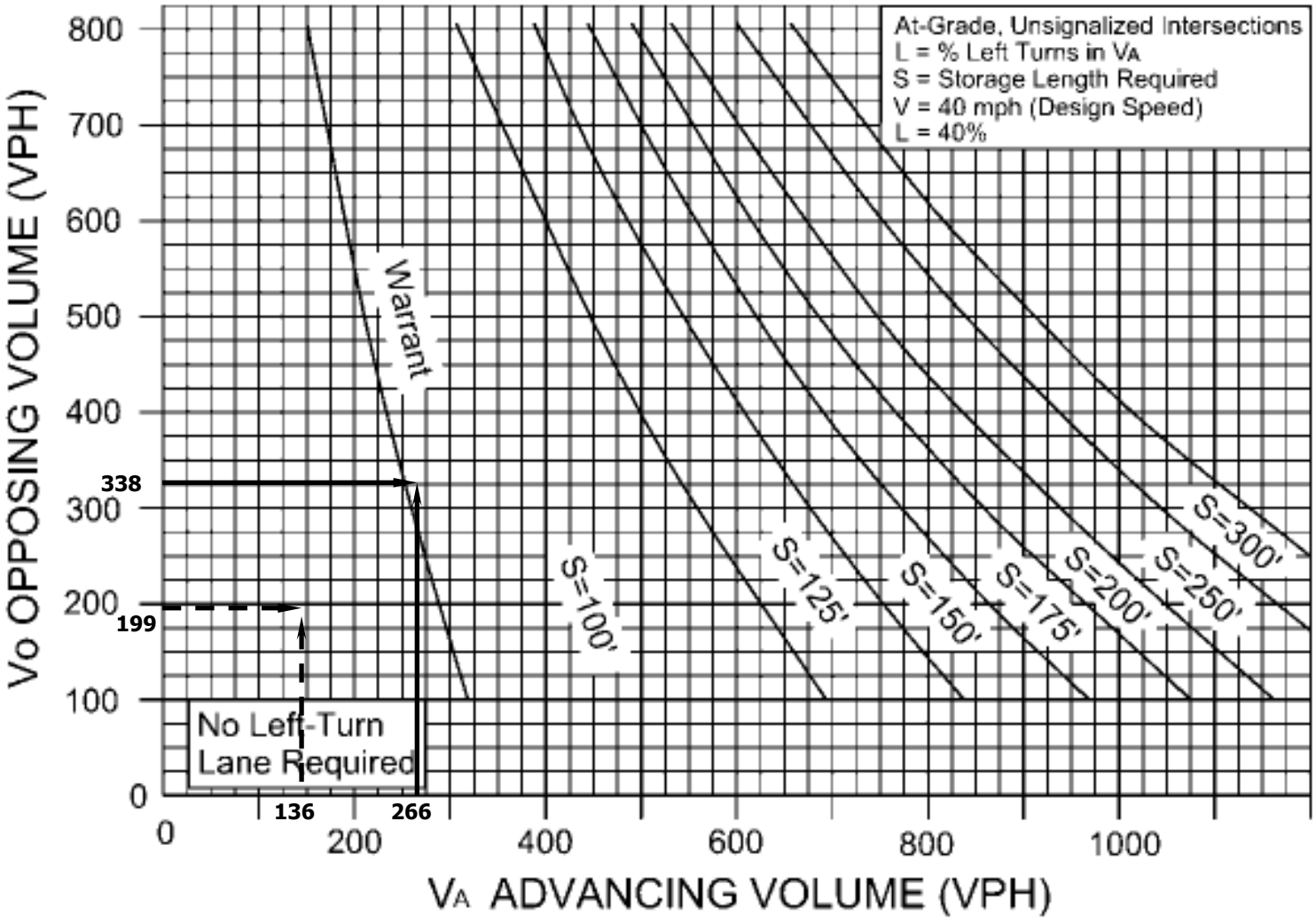
LEGEND
AM Peak Hour
PM Peak Hour

TIMMONS GROUP
YOUR VISION ACHIEVED THROUGH OURS.

Right-Turn Lane Warrant
2027 Total Future Volumes
SB Right at Northern Entrance

Figure
6-4

WARRANT FOR LEFT-TURN STORAGE LANES
ON TWO-LANE HIGHWAYS (40 MPH)
FIGURE 3-10 VDOT ROAD DESIGN MANUAL APPENDIX F



LEGEND
AM Peak Hour
PM Peak Hour

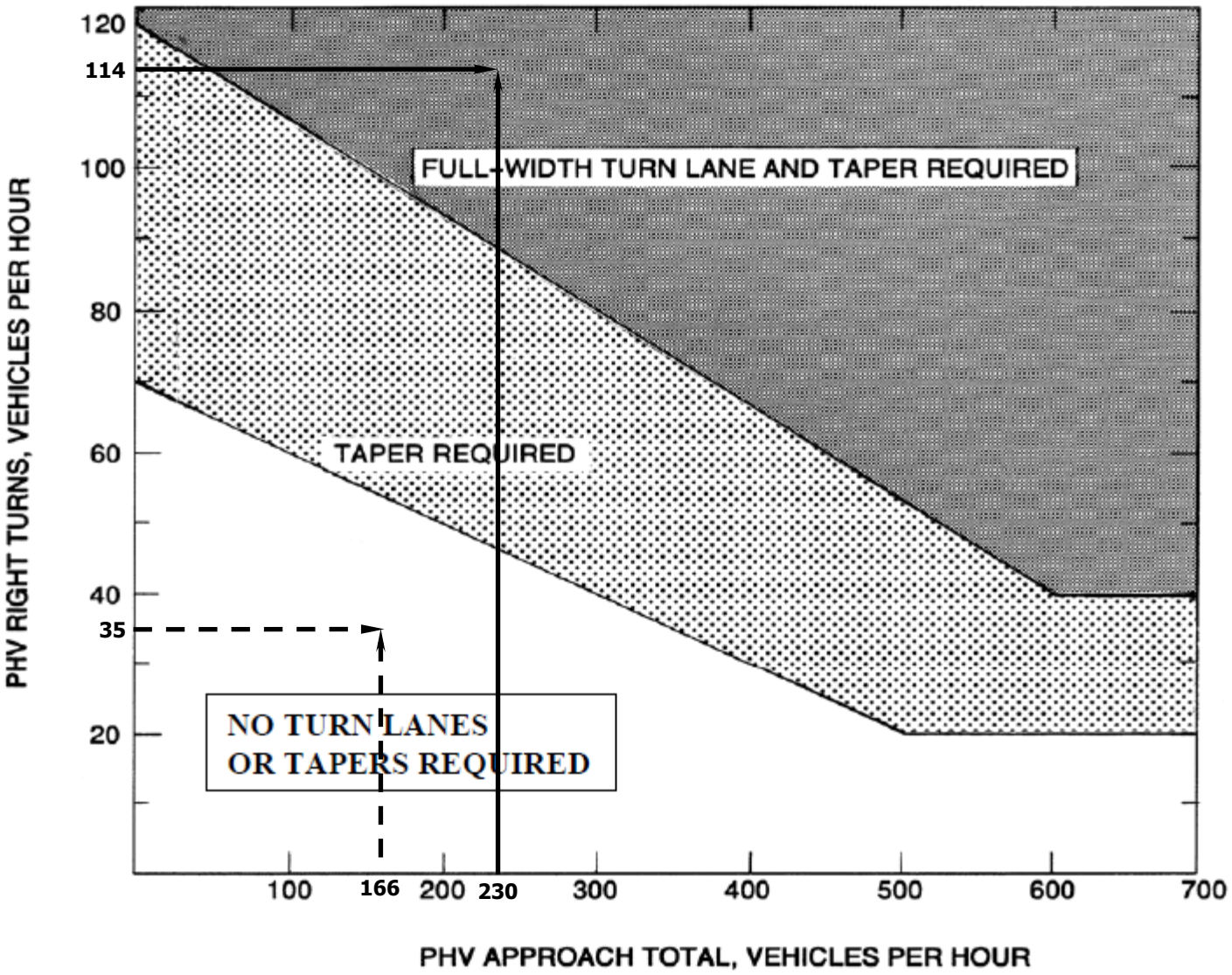
LEFT TURN LANE WARRANTED

TIMMONS GROUP
YOUR VISION ACHIEVED THROUGH OURS.

Left-Turn Lane Warrant
2027 Total Future Volumes
NB Left at Northern Entrance

Figure
6-5

GUIDELINES FOR RIGHT TURN TREATMENT (2-LANE HIGHWAY)
FIGURE 3-26 VDOT ROAD DESIGN MANUAL APPENDIX F



RIGHT TURN LANE AND TAPER WARRANTED

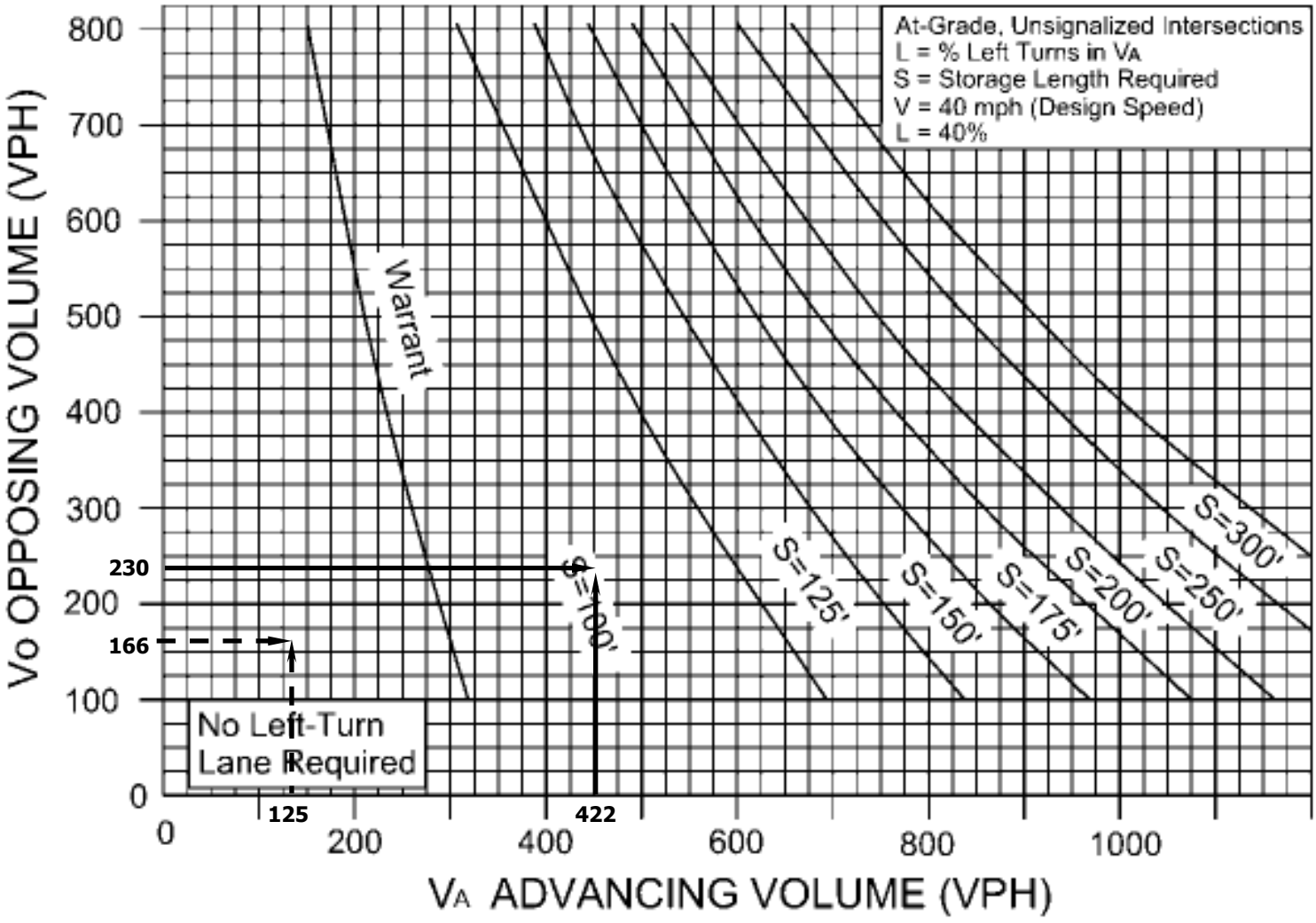
LEGEND
AM Peak Hour
PM Peak Hour

TIMMONS GROUP
YOUR VISION ACHIEVED THROUGH OURS.

Right-Turn Lane Warrant
2027 Total Future Volumes
SB Right at Southern Entrance

Figure
6-6

WARRANT FOR LEFT-TURN STORAGE LANES
ON TWO-LANE HIGHWAYS (40 MPH)
FIGURE 3-10 VDOT ROAD DESIGN MANUAL APPENDIX F



LEFT TURN LANE WARRANTED

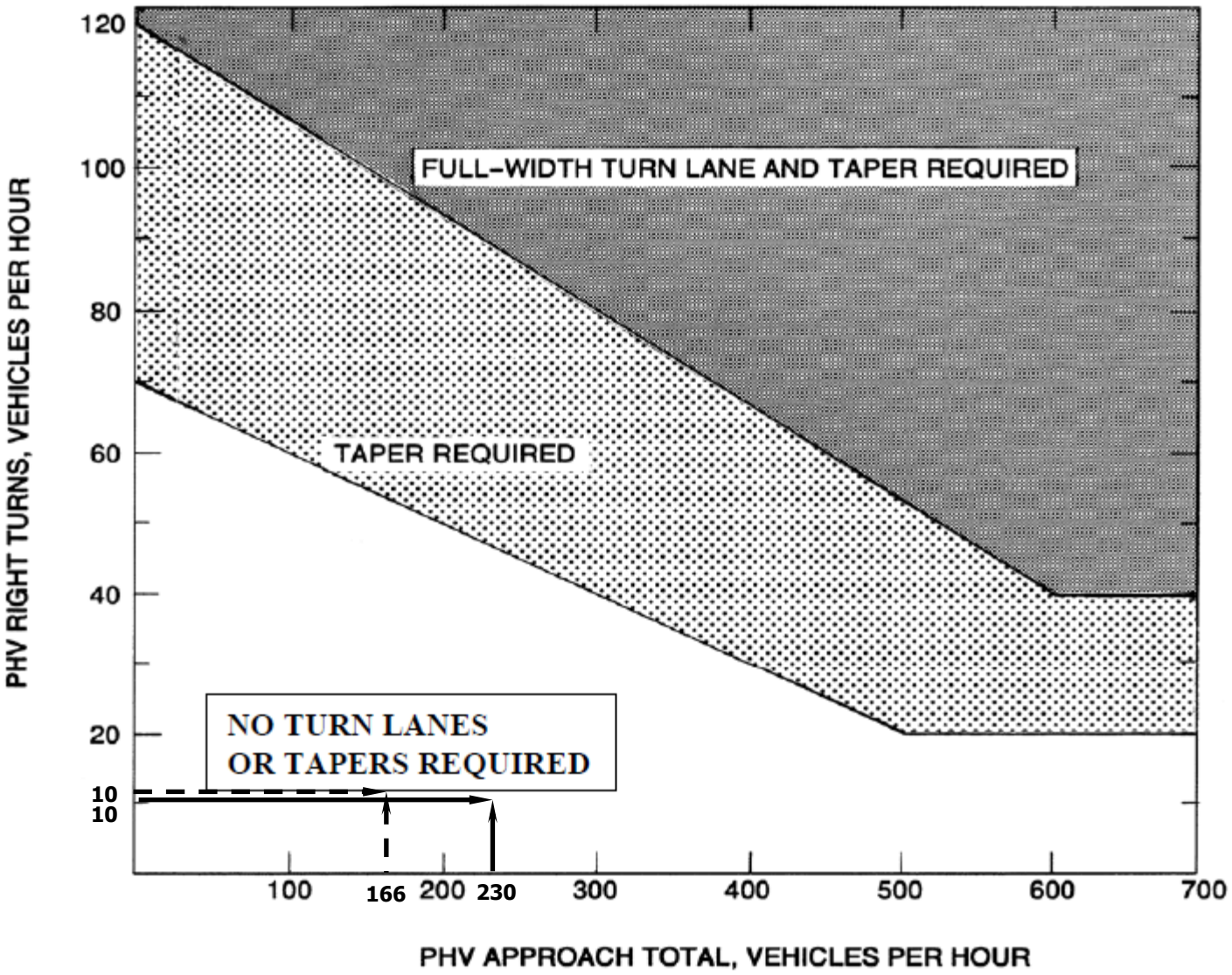
LEGEND
AM Peak Hour
PM Peak Hour

TIMMONS GROUP
YOUR VISION ACHIEVED THROUGH OURS.

Left-Turn Lane Warrant
2027 Total Future Volumes
NB Left at Southern Entrance

Figure
6-7

GUIDELINES FOR RIGHT TURN TREATMENT (2-LANE HIGHWAY)
FIGURE 3-26 VDOT ROAD DESIGN MANUAL APPENDIX F



NO TURN LANE OR TAPER REQUIRED

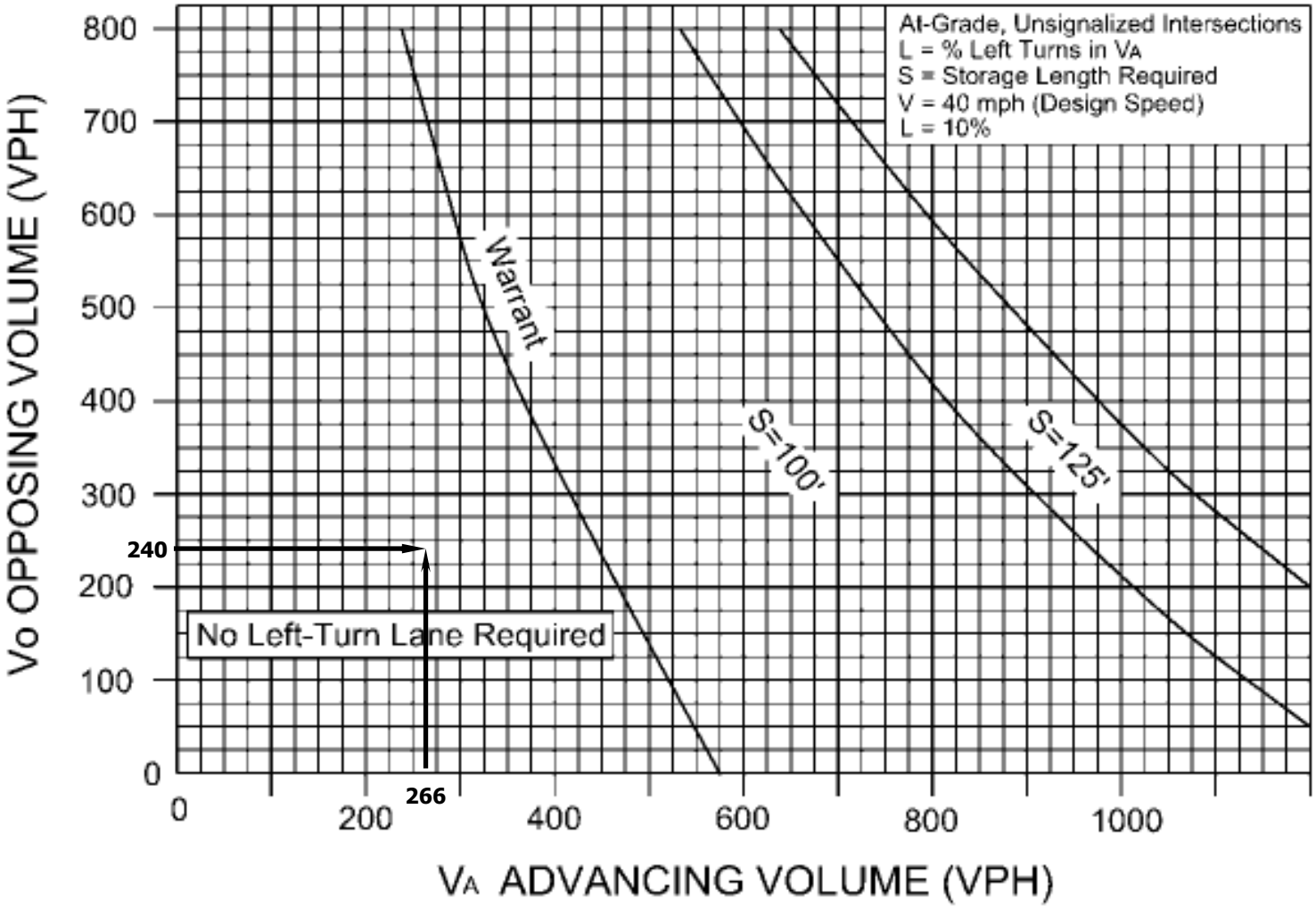
LEGEND
AM Peak Hour
PM Peak Hour

TIMMONS GROUP
YOUR VISION ACHIEVED THROUGH OURS.

Right-Turn Lane Warrant
2027 Total Future Volumes
SB Right at Bus Entrance

Figure
6-8

WARRANT FOR LEFT-TURN STORAGE LANES
ON TWO-LANE HIGHWAYS (40 MPH)
FIGURE 3-6 VDOT ROAD DESIGN MANUAL APPENDIX F



NO LEFT TURN LANE REQUIRED

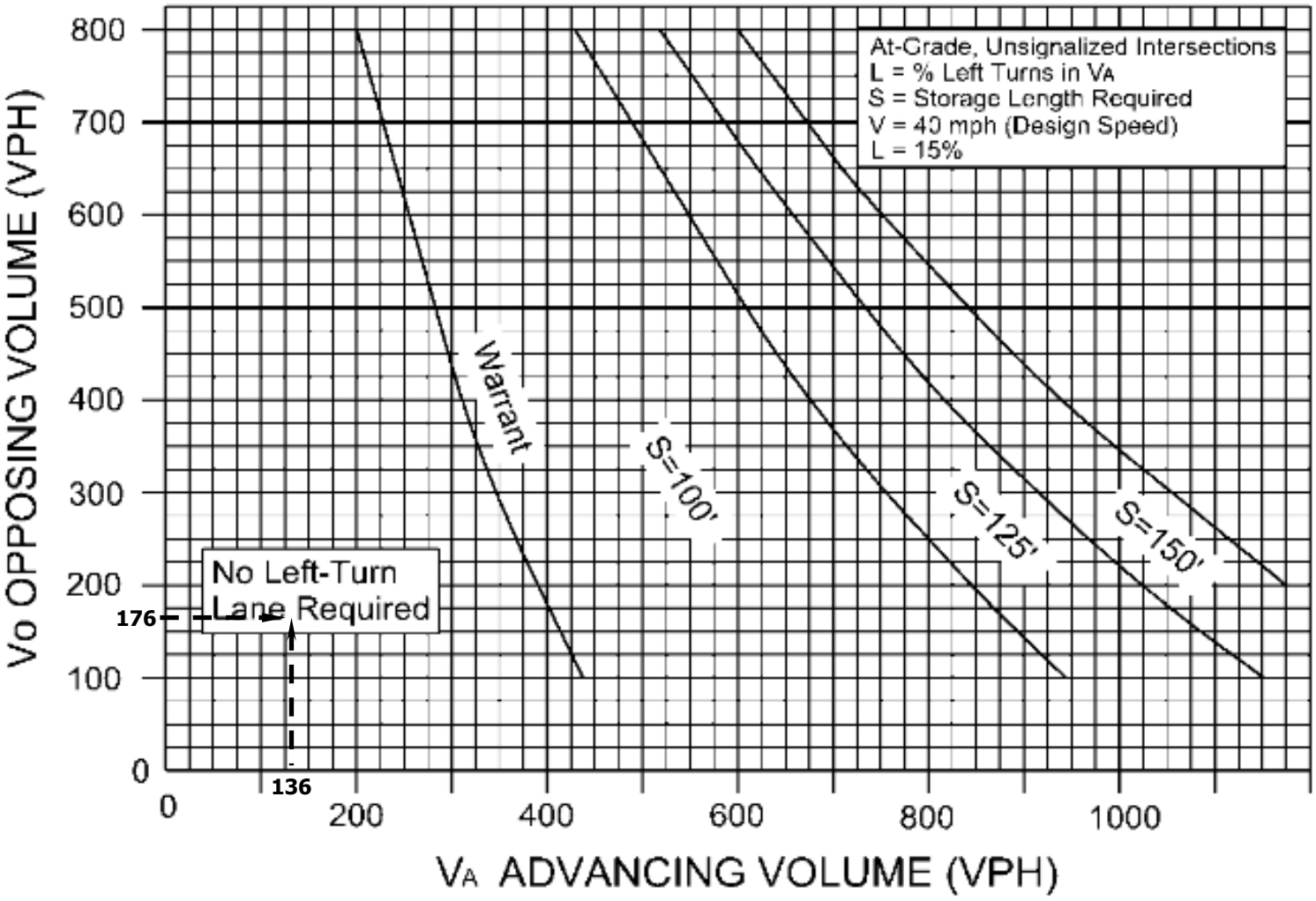
LEGEND
AM Peak Hour

TIMMONS GROUP
YOUR VISION ACHIEVED THROUGH OURS.

Left-Turn Lane Warrant
2027 Total Future Volumes
NB Left at Bus Entrance

Figure
6-9

WARRANT FOR LEFT-TURN STORAGE LANES
ON TWO-LANE HIGHWAYS (40 MPH)
FIGURE 3-7 VDOT ROAD DESIGN MANUAL APPENDIX F



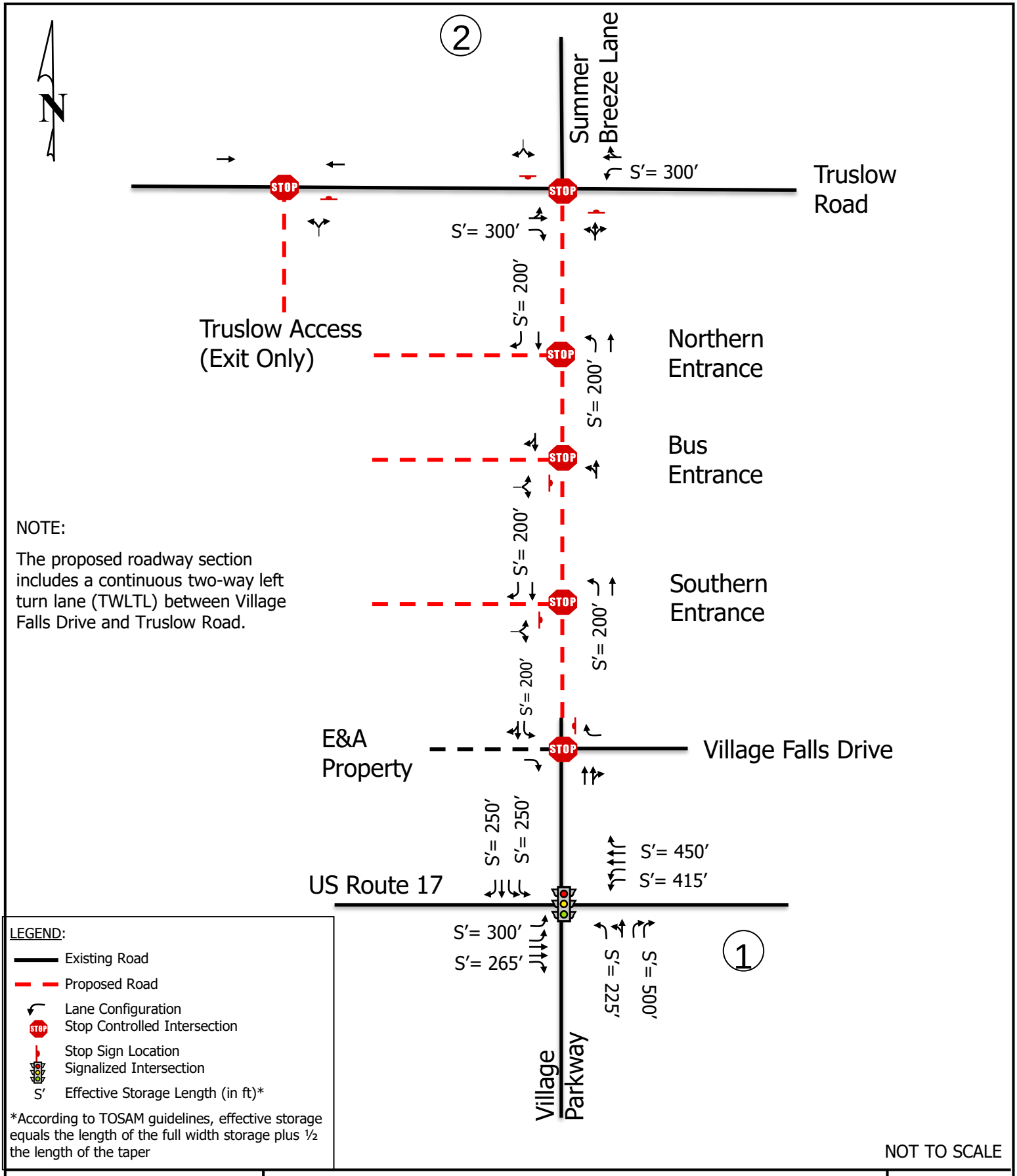
NO LEFT TURN LANE REQUIRED

LEGEND
PM Peak Hour

TIMMONS GROUP
YOUR VISION ACHIEVED THROUGH OURS.

Left-Turn Lane Warrant
2027 Total Future Volumes
NB Left at Bus Entrance

Figure
6-10



TIMMONS GROUP
YOUR VISION ACHIEVED THROUGH OURS.

2027 Proposed Future Geometry
Stafford County High School #6

Figure 6-11

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7 ANALYSIS OF FUTURE CONDITIONS WITH DEVELOPMENT & NO BACKGROUND DEVELOPMENTS

To complete the analysis of 2027 future conditions (with the proposed development), the estimated site trips were added to the background 2027 traffic volumes. The projected volumes were then used to complete the capacity analysis. Given the noted concerns for the eastbound left turn movement, the first set of analysis was completed with none of the approved background developments and only the background growth. This is provide insight into the requirements for the proposed high school.

7.1 CAPACITY ANALYSES

Capacity analysis allows traffic engineers to determine the impacts of traffic on the surrounding roadway network. Levels of service (LOS) are determined for each part of the roadway network. The general standard for the overall intersection is LOS D representing acceptable results and the standard for individual traffic movements is LOS E. For detailed information about level of service definitions and criteria for unsignalized and signalized intersections, see Chapter 3 on capacity analyses.

The two (2) existing intersections used in the existing 2021 and background 2027 analysis above were analyzed using the 2027 total future volumes shown on Figure 5-4 and the future geometry shown in Figure 6-11. These intersections, both signalized and unsignalized, were analyzed using SYNCHRO Version 10 based on 2000 HCM methodologies using the assumptions listed in Chapter 3.

It should be noted that all references to AM and PM peak hour in this report refer to the school AM and the school PM peak hours, respectively, and not the overall roadway AM and PM peak hours.

For all the future analyses, the minimum peak hour factor is the existing PHF or 0.92, whichever is higher, with the exception of the following movements that directly correlate to traffic entering the school site and were analyzed with a PHF of 0.50 to simulate the condensed school peak:

- The NB through, EB left, WB right, and all SB movements at intersection 1;
- Movements exiting the Truslow Road Access at Intersection 3;
- All movements at the Northern Entrance/Intersection 4;
- All movements at the Southern Entrance/Intersection 5; and
- All movements entering/exiting the Bus Entrance/Intersection 6.

7.2 2027 TOTAL FUTURE TRAFFIC VOLUMES ANALYSIS – NO BACKGROUND DEVELOPMENT

Table 7-1 summarizes the 2027 total future intersection LOS, delay, 95th percentile queue lengths (Synchro), and maximum queue lengths (SimTraffic) based on the proposed intersection geometry and 2027 total future traffic volumes shown on Figure 5-4 and the geometry shown on Figure 6-11. The corresponding SYNCHRO and SimTraffic reports are included in Appendix F. Note that the intersection numbers shown on the LOS, delay, and queue length summary tables correspond with the intersection numbers used in the SYNCHRO models and report figures.

The proposed intersection geometry includes the following improvements:

- A 2nd left turn lane on EB US Route 17 at Village Parkway/Stafford Plaza Drive with storage and taper lengths to meet VDOT minimums of 200 feet by 200 feet.
- The extension of Stafford Plaza Drive approximately 2,600 north from its current terminus to the intersection of Truslow Road and Summer Breeze Lane.
- Optimized signal timings for the intersection of US Route 17 at Village Parkway/Stafford Plaza Drive to account for the revised geometry and additional traffic volumes. It is understood that US Route 17 is a coordinated corridor and that the entire corridor will need to be reviewed after installation of the proposed school development.

The signalized intersection of Village Parkway/Stafford Plaza Drive and US Route 17 operates at an overall LOS D in the AM peak and at LOS E in both the PM peak. The eastbound approach operates at LOS D in the AM peak and at LOS E in the PM peak. The westbound approach operates at LOS D in both the Am and PM peak hours. The northbound approach operates at LOS E in the AM peak and at LOS F in the PM peak. The southbound approach continues to operate at LOS E in the AM peak and at LOS F in the PM peak. All queues are shown to fit within the existing storage, however, the eastbound dual left turn movement shows signs of being at capacity at 300 feet of effective storage during the AM peak only. However, the analysis shows that the lane utilization is not fully efficient and the slight block percentage time can be accommodated within the underutilized portion of the dual left and continue to move traffic volume through the intersection. The larger concern is the mainline queues in both the eastbound and westbound directions that will reduce the effectiveness of the turn lanes due to lack of access.

At the unsignalized, stop-controlled intersection of Truslow Road and Summer Breeze Lane/Stafford Plaza Drive, the eastbound and westbound approaches operate at LOS A in both the AM and PM peaks. The northbound approach operates at LOS B during both peak hours. The southbound approach operates at LOS D in the AM peak and at LOS C in the PM peak.

At all three (3) of the proposed entrance points to the high school along the access road, all movements and approaches operate at LOS C or better during both peak hours. The proposed turn lane geometry is adequate to handle all queues shown in the analysis.

At the proposed exit-only point to Truslow Road, the northbound approach operates at LOS B in the AM peak and LOS C in the PM peak. There are no queuing concerns on the mainline and the site has enough capacity to handle all queues shown in the analysis.

Overall, most operational, queuing, and capacity deficiencies observed under existing/background conditions will continue under the 2027 total conditions. The individual movements and approaches that are experiencing queuing issues will continue do so.

The addition of the 2nd eastbound left turn lane on US Route 17 at Village Parkway/Stafford Plaza Drive, as well as the optimized signal timings, will increase the capacity of the intersection and help accommodate the additional site traffic. Although the eastbound left turn lane shows signs of nearing capacity with 300 feet of effective storage, a review of the block percentages and number of vehicles queued outside the turn lane can be accommodated within the underutilized portion of the dual left and continue to move traffic volume through the intersection. As traffic normalizes around the new school operations,- it is expected that traffic patterns will more efficiently work through lane utilization to ensure that no vehicles are left waiting within US Route 17. In addition, given the PHF usage of 0.50 for the eastbound left and other movements at this intersection, it is likely that the worst case scenario is shown and the vast majority of the day will experience queues that fit within the provided dual lane storage. Outside of the 30 minutes of school start and end periods, the school traffic will not warrant more than 300 feet of storage for the eastbound dual left turn lanes and have been designed as such.

Table 7-1: Intersection Level of Service, Delay, and Queue Summary
2027 Total Future Traffic Volumes – Without Background Developments

Intersection and Type of Control	Movement and Approach	Effective Turn Lane Storage (ft)	AM PEAK HOUR				PM PEAK HOUR			
			Delay [1] (sec/veh)	LOS [1]	SYNCHRO 95th Percentile Queue Length (ft)	SimTraffic Maximum Queue Length (ft)	Delay [1] (sec/veh)	LOS [1]	SYNCHRO 95th Percentile Queue Length (ft)	SimTraffic Maximum Queue Length (ft)
1. US Route 17 (E-W) at	EB Left (2)	300	86.4	F	103	300	57.5	E	57	300
Village Parkway/Stafford Plaza Drive	EB Thru		47.4	D	595	582	63.2	E	#781	965
Signalized	EB Right	265	24.5	C	m29	265	68.1	E	m83	265
	EB Approach		*53.6*	*D*	--	--	*63.3*	*E*	--	--
	WB Left	415	86.5	F	#201	336	92.0	F	#262	414
	WB Thru		39.8	D	447	468	45.4	D	#748	687
	WB Right	450	22.3	C	66	290	13.5	B	0	370
	WB Approach		*43.5*	*D*	--	--	*52.0*	*D*	--	--
	NB Left	225	51.0	D	127	207	117.5	F	#275	207
	NB Left-Thru		95.1	F	166	326	107.8	F	114	236
	NB Right (2)	500	39.6	D	67	166	43.7	D	91	146
	NB Approach		*66.5*	*E*	--	--	*80.6*	*F*	--	--
	SB Left (2)	250	81.3	F	87	172	81.1	F	97	213
	SB Thru		74.5	*E*	94	173	119.8	F	118	259
	SB Right	250	45.2	D	4	135	73.4	E	73	220
	SB Approach		*67.2*	*E*	--	--	*86.0*	*F*	--	--
	Overall		**53.4**	**D**	**--**	**--**	**64.5**	**E**	**--**	**--**
2. Truslow Road (E-W) at	EB Left-Thru		0.1	A	0	0	0.1	A	0	8
Summer Breeze Lane /Site Entrance	EB Right	300	0.0	A	0	33	0.0	A	0	21
Unsignalized	*EB Approach*		*0.0*	*A*	--	--	*0.0*	*A*	--	--
	WB Left	300	9.5	A	29	124	9.6	A	9	55
	WB Thru-Right		0.0	A	0	0	0.0	A	0	0
	WB Approach		*7.0*	*A*	--	--	*3.3*	*A*	--	--
	NB L-T-R		14.4	B	21	80	15.8	B	32	88
	NB Approach		*14.4*	*B*	--	--	*15.8*	*B*	--	--
	SB L-T-R		28.0	D	11	66	23.4	C	6	34
	SB Approach		*28.0*	*D*	--	--	*23.4*	*C*	--	--
3. Proposed Road (N-S) at	EB Left-Right		0.0	A	0	0	0.0	A	0	0
Northern Entrance (E)	*EB Approach*		0.0	A	--	--	0.0	A	--	--
Unsignalized	NB Left	200	11.6	B	55	167	8.5	A	9	54
	NB Thru		0.0	A	0	0	0.0	A	0	0
	NB Approach		*9.2*	*A*	--	--	*3.9*	*A*	--	--
	SB Thru		0.0	A	0	15	0.0	A	0	2
	SB Right	200	0.0	A	0	33	0.0	A	0	6
	SB Approach		*0.0*	*A*	--	--	*0.0*	*A*	--	--
4. Proposed Road (N-S) at	EB Left-Right		15.1	C	12	55	12.2	B	9	50
Bus Entrance (E)	*EB Approach*		*15.1*	*C*	--	--	*12.2*	*B*	--	--
Unsignalized	NB Left-Thru		1.0	A	3	71	1.3	A	3	58
	NB Approach		*1.0*	*A*	--	--	*1.3*	*A*	--	--
	SB Thru-Right		0.0	A	0	0	0.0	A	0	2
	SB Approach		*0.0*	*A*	--	--	*0.0*	*A*	--	--
5. Proposed Road (N-S) at	EB Left-Right		35.0	D	500	384	34.6	C	192	189
Southern Entrance (E)	*EB Approach*		*335.0*	*F*	--	--	*34.6*	*C*	--	--
Unsignalized	NB Left	200	10.0	A	43	157	8.3	A	9	64
	NB Thru		0.0	A	0	0	0.0	A	0	0
	NB Approach		*4.5*	*A*	--	--	*2.6*	*A*	--	--
	SB Thru		0.0	A	0	7	0.0	A	0	4
	SB Right	200	0.0	A	0	36	0.0	A	0	7
	SB Approach		*0.0*	*A*	--	--	*0.0*	*A*	--	--
7. Truslow Road (E-W) at	EB Thru		0.0	A	0	0	0.0	A	0	0
Truslow Access (Exit Only) (N)	*EB Approach*		*0.0*	*A*	--	--	*0.0*	*A*	--	--
Unsignalized	WB Thru		0.0	A	0	0	0.0	A	0	0
	WB Approach		*0.0*	*A*	--	--	*0.0*	*A*	--	--
	NB Left-Right		11.1	B	37	97	20.0	C	112	143
	NB Approach		*11.1*	*B*	--	--	*20.0*	*C*	--	--

[2] *Dual turn lanes; average storage is provided.*

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

m - Volume for 95th percentile queue is metered by upstream signal.

8 ANALYSIS OF FUTURE CONDITIONS WITH DEVELOPMENT & BACKGROUND DEVELOPMENTS

To complete the analysis of 2027 future conditions (with the proposed development), the estimated site trips were added to the background 2027 traffic volumes. The projected volumes were then used to complete the capacity analysis.

8.1 CAPACITY ANALYSES

The two (2) existing intersections used in the existing 2021 and background 2027 analysis were analyzed using the 2027 total future volumes with background developments shown on Figure 5-5. These intersections, both signalized and unsignalized, were analyzed using SYNCHRO Version 10 based on 2000 HCM methodologies using the assumptions listed in Chapter 3.

It should be noted that all references to AM and PM peak hour in this report refer to the school AM and the school PM peak hours, respectively, and not the overall roadway AM and PM peak hours.

For all the future analyses, the minimum peak hour factor is the existing PHF or 0.92, whichever is higher, with the exception of the following movements that directly correlate to traffic entering the school site and were analyzed with a PHF of 0.50 to simulate the condensed school peak:

- The NB through, EB left, WB right, and all SB movements at intersection 1;
- Movements exiting the Truslow Road Access at Intersection 3;
- All movements at the Northern Entrance/Intersection 4;
- All movements at the Southern Entrance/Intersection 5; and
- All movements entering/exiting the Bus Entrance/Intersection 6.

8.2 2027 Total Future Traffic Volumes Analysis – With Background Development

Table 8-1 summarizes the 2027 total future intersection LOS, delay, 95th percentile queue lengths (Synchro), and maximum queue lengths (SimTraffic) based on the proposed intersection geometry and 2027 total future traffic volumes with background development shown on Figure 5-5. The corresponding SYNCHRO and SimTraffic reports are included in Appendix G. Note that the intersection numbers shown on the LOS, delay, and queue length summary tables correspond with the intersection numbers used in the SYNCHRO models and report figures.

The proposed intersection geometry includes the following improvements:

- A 2nd left turn lane on EB US Route 17 at Village Parkway/Stafford Plaza Drive with storage and taper lengths to meet VDOT minimums of 400 feet by 200 feet.
- The extension of Stafford Plaza Drive approximately 2,600 north from its current terminus to the intersection of Truslow Road and Summer Breeze Lane.
- Optimized signal timings for the intersection of US Route 17 at Village Parkway/Stafford Plaza Drive to account for the revised geometry and additional traffic volumes. It is understood that US Route 17 is a coordinated corridor and that the entire corridor will need to be reviewed after installation of the proposed school development.

The signalized intersection of Village Parkway/Stafford Plaza Drive and US Route 17 operates at LOS E during both of the school peak hours. The eastbound approach operates at LOS E during both peaks. The westbound approach operates at LOS E in the AM peak and at LOS D in the PM peak. The northbound approach operates at LOS F during both peaks. The southbound approach continues to operate at LOS E in the AM peak and at LOS F in the PM peak. All queues are shown to fit within the existing or proposed storage, with the exception of the eastbound and westbound dual left turn lanes. The maximum queues are approximately 500 feet in length and the through movement queues will extend further than the proposed turn lane storage area, blocking access to the dual turn lane and creating further queuing issues.

At the unsignalized, stop-controlled intersection of Truslow Road and Summer Breeze Lane/Stafford Plaza Drive, the eastbound and westbound approaches operate at LOS A in both the AM and PM peaks. The northbound approach operates at LOS C in the AM peak and at LOS B in the PM peak. The southbound approach operates at LOS D in the AM peak and at LOS C in the PM peak. All queues fit within the proposed turn lane storage.

At all three (3) of the proposed entrance points to the high school along the access road, all movements and approaches operate at LOS C or better during both peak hours. The proposed turn lane geometry is adequate to handle all queues shown in the analysis.

At the proposed exit-only point to Truslow Road, the northbound approach operates at LOS B in the AM peak and LOS C in the PM peak. There are no queuing concerns on the mainline and the site has enough capacity to handle all queues shown in the analysis.

At the unsignalized intersection of Village Falls Drive/Stafford Plaza Drive, the eastbound approach operate at LOS B in the AM peak and LOS A in the PM peak. The westbound approach operates at LOS F during both peaks. The northbound and southbound approaches operate at LOS A in both the AM and PM peaks.

Overall, most operational, queuing, and capacity deficiencies observed under existing/background conditions will continue under the 2027 total conditions. The individual movements and approaches that are experiencing queuing issues will continue do so.

The addition of the 2nd eastbound left turn lane on US Route 17 at Village Parkway/Stafford Plaza Drive, as well as the optimized signal timings, will increase the capacity of the intersection and help accommodate the additional site traffic. However, even with an added dual left turn movement and optimized signal timings, the additional background traffic creates major queuing concerns for mainline US Route 17. The eastbound and westbound dual left turn lanes show queues that extend to the maximum of their storage areas, as well as queues in the through movements that extend beyond the access point to the turn lanes.

Given that the analysis is focused on the school peaks only, it is reasonable to assume that the overall corridor PM peak hour analysis will also have queuing concerns for the background traffic with the left turn lanes. This is considered a background condition issue and should be addressed upon the development of the approved sites associated with Stafford Plaza Drive.

Table 8-1: Intersection Level of Service, Delay, and Queue Summary
2027 Total Future Traffic Volumes – with Background Developments

Intersection and Type of Control	Movement and Approach	Effective Turn Lane Storage (ft)	AM PEAK HOUR				PM PEAK HOUR			
			Delay [1] (sec/veh)	LOS [1]	SYNCHRO 95th Percentile Queue Length (ft)	SimTraffic Maximum Queue Length (ft)	Delay [1] (sec/veh)	LOS [1]	SYNCHRO 95th Percentile Queue Length (ft)	SimTraffic Maximum Queue Length (ft)
1. US Route 17 (E-W) at	EB Left (2)	500	118.8	F	161	491	58.4	E	57	500
Village Parkway/Stafford Plaza Drive	EB Thru		59.8	E	#640	661	65.3	E	#785	948
Signalized	EB Right	265	27.4	C	m26	265	68.6	E	m82	265
	EB Approach		*75.3*	*E*	--	--	*65.1*	*E*	--	--
	WB Left	415	109.2	F	#212	415	92.0	F	#262	414
	WB Thru		88.9	F	#602	784	45.4	D	#747	658
	WB Right	450	30.3	C	128	450	13.3	B	0	449
	WB Approach		*74.0*	*E*	--	--	*52.0*	*D*	--	--
	NB Left	225	53.2	D	130	225	117.5	F	#275	212
	NB Left-Thru		130.0	F	169	528	107.8	F	114	255
	NB Right (2)	500	42.1	D	69	349	43.7	D	91	152
	NB Approach		*83.6*	*F*	--	--	*80.6*	*F*	--	--
	SB Left (2)	250	104.1	F	152	228	76.4	E	97	209
	SB Thru		54.3	*D*	106	213	109.3	F	117	222
	SB Right	250	35.1	D	12	158	73.4	E	73	222
	SB Approach		*78.5*	*E*	--	--	*82.0*	*F*	--	--
	Overall		**76.3**	**E**	**--**	**--**	**64.5**	**E**	**--**	**--**
2. Truslow Road (E-W) at	EB Left-Thru		0.1	A	0	0	0.1	A	0	9
Summer Breeze Lane /Site Entrance	EB Right	300	0.0	A	0	33	0.0	A	0	21
(N-S)	*EB Approach*		*0.0*	*A*	--	--	*0.0*	*A*	--	--
Unsignalized	WB Left	300	9.7	A	33	102	9.6	A	9	58
	WB Thru-Right		0.0	A	0	0	0.0	A	0	0
	WB Approach		*7.2*	*A*	--	--	*3.3*	*A*	--	--
	NB L-T-R		17.6	C	36	73	15.7	B	32	67
	NB Approach		*17.6*	*C*	--	--	*15.7*	*B*	--	--
	SB L-T-R		31.7	D	12	51	23.3	C	6	39
	SB Approach		*31.7*	*D*	--	--	*23.3*	*C*	--	--
3. Proposed Road (N-S) at	EB Left-Right		0.0	A	0	0	0.0	A	0	0
Northern Entrance (E)	*EB Approach*		0.0	A	--	--	0.0	A	--	--
Unsignalized	NB Left	200	12.1	B	58	140	8.5	A	9	54
	NB Thru		0.0	A	0	0	0.0	A	0	0
	NB Approach		*9.2*	*A*	--	--	*3.9*	*A*	--	--
	SB Thru		0.0	A	0	7	0.0	A	0	0
	SB Right	200	0.0	A	0	31	0.0	A	0	6
	SB Approach		*0.0*	*A*	--	--	*0.0*	*A*	--	--
4. Proposed Road (N-S) at	EB Left-Right		15.5	C	13	55	12.0	B	9	54
Bus Entrance (E)	*EB Approach*		*15.5*	*C*	--	--	*12.0*	*B*	--	--
Unsignalized	NB Left-Thru		1.0	A	3	56	1.5	A	3	40
	NB Approach		*1.0*	*A*	--	--	*1.5*	*A*	--	--
	SB Thru-Right		0.0	A	0	0	0.0	A	0	0
	SB Approach		*0.0*	*A*	--	--	*0.0*	*A*	--	--
5. Proposed Road (N-S) at	EB Left-Right		308.7	F	483	318	25.7	C	150	156
Southern Entrance (E)	*EB Approach*		*308.7*	*F*	--	--	*25.7*	*C*	--	--
Unsignalized	NB Left	200	10.3	B	45	124	8.3	A	9	63
	NB Thru		0.0	A	0	0	0.0	A	0	0
	NB Approach		*5.1*	*A*	--	--	*4.2*	*A*	--	--
	SB Thru		0.0	A	0	4	0.0	A	0	0
	SB Right	200	0.0	A	0	33	0.0	A	0	4
	SB Approach		*0.0*	*A*	--	--	*0.0*	*A*	--	--
6. Village Falls Drive (E-W) at	EB L-T-R		11.7	B	13	75	0.0	A	0	0
Stafford Plaza Drive	*EB Approach*		*11.7*	*B*	--	--	*0.0*	*A*	--	--
Unsignalized	WB L-T-R		Err		Err	486	38.5	E	86	117
	WB Approach		*Err*		--	--	*38.5*	*E*	--	--
	NB Left-Thru		4.6	A	18	254	0.0	A	0	0
	NB Thru-right		0.0	A	0	203	0.0	A	0	0
	NB Approach		*2.2*	*A*	--	--	*0.0*	*A*	--	--
	SB Left		10.9	B	3	32	0.0	A	0	50
	SB Thru-Right		0.0	A	0	9	0.0	A	0	0
	SB Approach		*0.6*	*A*	--	--	*0.0*	*A*	--	--
7. Truslow Road (E-W) at	EB Thru		0.0	A	0	0	0.0	A	0	0
Truslow Access (Exit Only) (N)	*EB Approach*		*0.0*	*A*	--	--	*0.0*	*A*	--	--
Unsignalized	WB Thru		0.0	A	0	0	0.0	A	0	0
	WB Approach		*0.0*	*A*	--	--	*0.0*	*A*	--	--
	NB Left-Right		11.3	B	38	92	20.0	C	112	167
	NB Approach		*11.3*	*B*	--	--	*20.0*	*C*	--	--

[2] *Dual turn lanes; average storage is provided.*

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

m - Volume for 95th percentile queue is metered by upstream signal.

9 CONCLUSIONS

Analyses were performed for the 2021 existing, the 2027 background growth volumes (with and without background developments), and the 2027 total volumes (with and without background developments), which includes site traffic generated by the Stafford County High School #6 development. The following represents the findings and recommendations.

9.1 PRINCIPAL FINDINGS

Generally, there are no operational issues at the existing unsignalized intersection of Truslow Road and Summer Breeze Lane. At the signalized intersection of US Route 17 and Village Parkway/Stafford Plaza Drive the minor side streets experience poor levels of service and delay, which is expected as the signals are optimized to prioritize the mainline through movements. The individual movements and approaches that are experiencing queuing issues under existing conditions will continue to witness similar conditions with background growth.

With the addition of site traffic, the operational, queuing, and capacity deficiencies observed under existing/background conditions continue, with a limited number or movements absorbing a majority of the new traffic. Overall conditions remain generally the same with a noted need for 2nd eastbound left turn late on US Route 17 at Village Parkway/Stafford Plaza Drive to accommodate site-generated traffic.

The addition of the 2nd eastbound left turn lane on US Route 17 at Village Parkway/Stafford Plaza Drive, as well as the optimized signal timings, will increase the capacity of the intersection, better accommodate traffic queues, and offset the additional site-generated traffic. Although the eastbound left turn lane shows signs of nearing capacity with 300 feet of effective storage, a review of the block percentages and number of vehicles queued outside the turn lane can be accommodated within the underutilized portion of the dual left and continue to move traffic volume through the intersection. As traffic normalizes around the new school operations,- it is expected that traffic patterns will more efficiently work through lane utilization to ensure that no vehicles are left waiting within US Route 17. In addition, given the PHF usage of 0.50 for the eastbound left and other movements at this intersection, it is likely that the worst case scenario is shown and the vast majority of the day will experience queues that fit within the provided dual lane storage. Outside of the 30 minutes of school start and end periods, the school traffic will not warrant more than 300 feet of storage for the eastbound dual left turn lanes and have been designed as such.

The background developments associated with parcels north of US Route 17 along Stafford Plaza Drive will increase queuing and operational delay to the proposed eastbound dual left turn lane that may require additional storage. However, the analysis shown in this report documents that the proposed high school should not be responsible for installing the potential full storage area and only the storage needs that are created by the high school.

Overall, the proposed roadway extension will generate limited cut-through traffic to/from US Route 17 due to the lack of further network connectivity. The future traffic associated with the school will occur during specific peak times and not create additional traffic issues throughout the day along the nearby roadway network.

The preliminary site location of the proposed Stafford High School #6 will draw students from the existing Colonial Forge, Stafford, and Mountain View High Schools. The proposed site location will reduce capacity at all 3 existing schools as well as reducing student drive times for residential areas along the US Route 17 and Truslow Road corridors.

9.2 RECOMMENDATIONS

The installation of recommended roadway improvements will correspond with the traffic generated by the respective development of a 2,150-student high school. The focus of the work within this report is identifying a comprehensive access plan that provides functional access to the site and preserves the capacity of the surrounding roadway network.

To accommodate the anticipated traffic associated with Stafford County High School #6, the recommended improvements plan is as follows:

- Extend Stafford Plaza Drive approximately 2,600' north from its current terminus to form 4th leg of the intersection of Truslow Road and Summer Breeze Lane.
- US Route 17 at Village Parkway/Stafford Plaza Drive
    - Install 2nd left turn lane on EB US Route 17 at Village Parkway/Stafford Plaza Drive, including storage and taper to meet VDOT minimums of 200 feet by 200 feet (300 feet of effective storage).
    - Optimize signal timings for the intersection of US Route 17 at Village Parkway/Stafford Plaza Drive to account for the revised geometry and additional traffic volumes. It is understood that US Route 17 is a coordinated corridor and that the entire corridor may need to be reviewed after installation of the proposed school development.
- Truslow Road at Summer Breeze Lane/Proposed Site Entrance
    - Install a WB left turn lane and EB right turn lane on Truslow Road, including storage and tapers to meet VDOT minimums of 200 feet by 200 feet.
- Install three (3) full access entrances along the proposed extension of Stafford Plaza Drive to serve student, employee, parent/visitor, and bus traffic.
    - At the northern and southern entrances, install a NB left turn lane and SB right turn lane on the proposed extension of Stafford Plaza Drive, including storage and tapers to meet VDOT minimums of 100 feet by 100 feet.
- Install one (1) exit-only access point on Truslow Road.

The existing traffic signal on US Route 17 at Village Parkway/Stafford Plaza Drive has the capacity to accommodate the improvements (2nd EB left turn lane) without replacement as only changes to existing signage and/or signal head placement will be required. The existing traffic signals are not recommended for full replacement as part of this development.

It should be noted that the recommended improvements will require coordination with VDOT to ensure that the traffic signal timings within the study area are reviewed for potential improvements to the overall operations of the US Route 17 corridor.