



PROJECT PIPELINE

Route 17 (George Washington Memorial Highway)
and Route 171 (Victory Boulevard)

HR-23-10
Final Report





Project Pipeline – York County

HR-23-10 Route 17 (George Washington Memorial Highway) and Route 171 (Victory Boulevard) | August 2024

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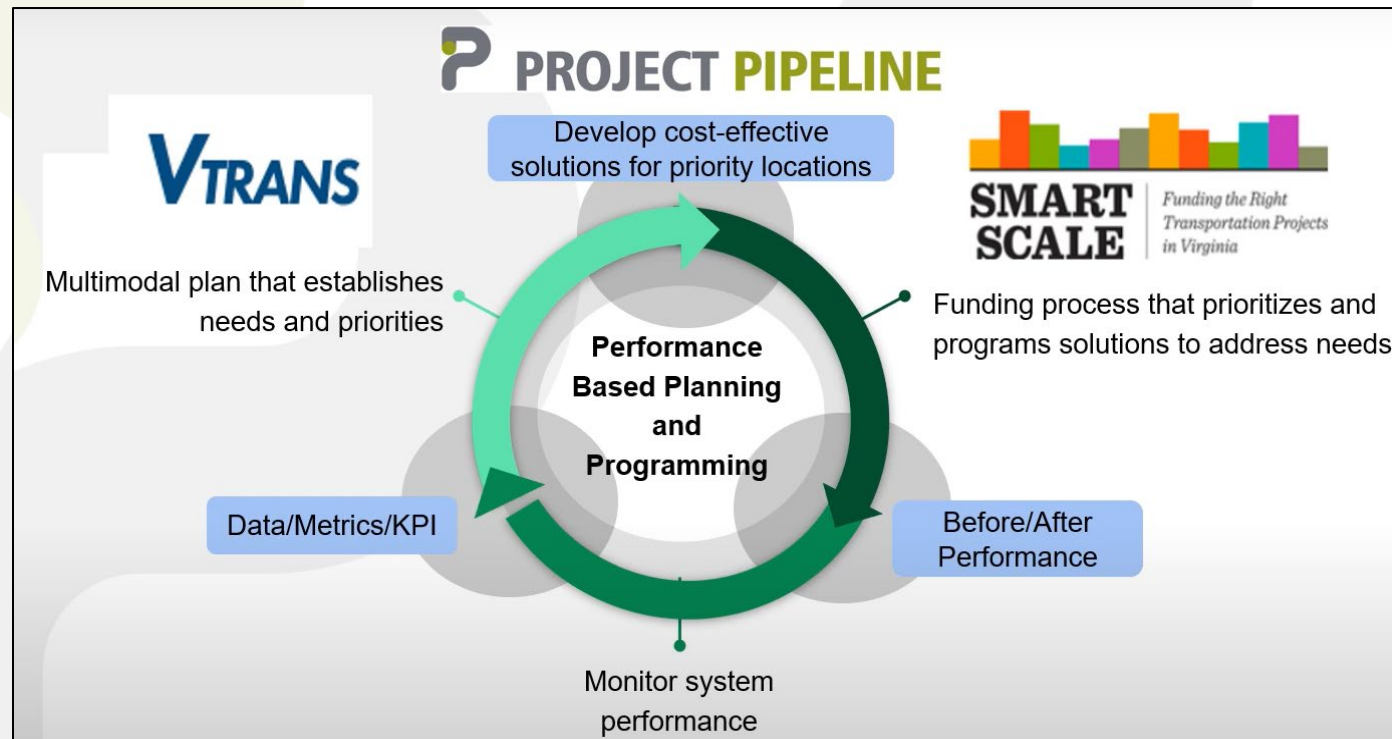
1 Needs Evaluation & Diagnosis

1.1 Introduction

Multimodal Project Pipeline (Project Pipeline) is a performance-based planning program to identify cost-effective solutions to multimodal transportation needs in Virginia. Through this planning process, projects and solutions may be considered for funding through programs, including SMART SCALE, revenue sharing, interstate funding, and others. Visit the Project Pipeline webpage for additional information: vaprojectpipeline.org.

This study is entitled HR-23-10 - Route 17 (George Washington Memorial Highway) and Route 171 (Victory Boulevard) and will be referred to as the Study in this report. This study focuses on concepts targeting identified needs including congestion mitigation, safety, and reliability improvements. The objectives of Project Pipeline are shown in Figure 1.

Figure 1: Project Pipeline Objectives

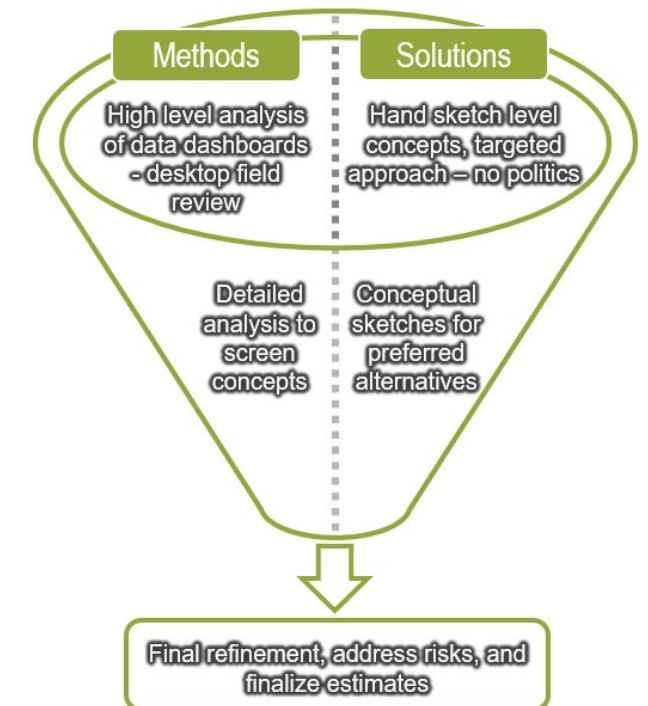
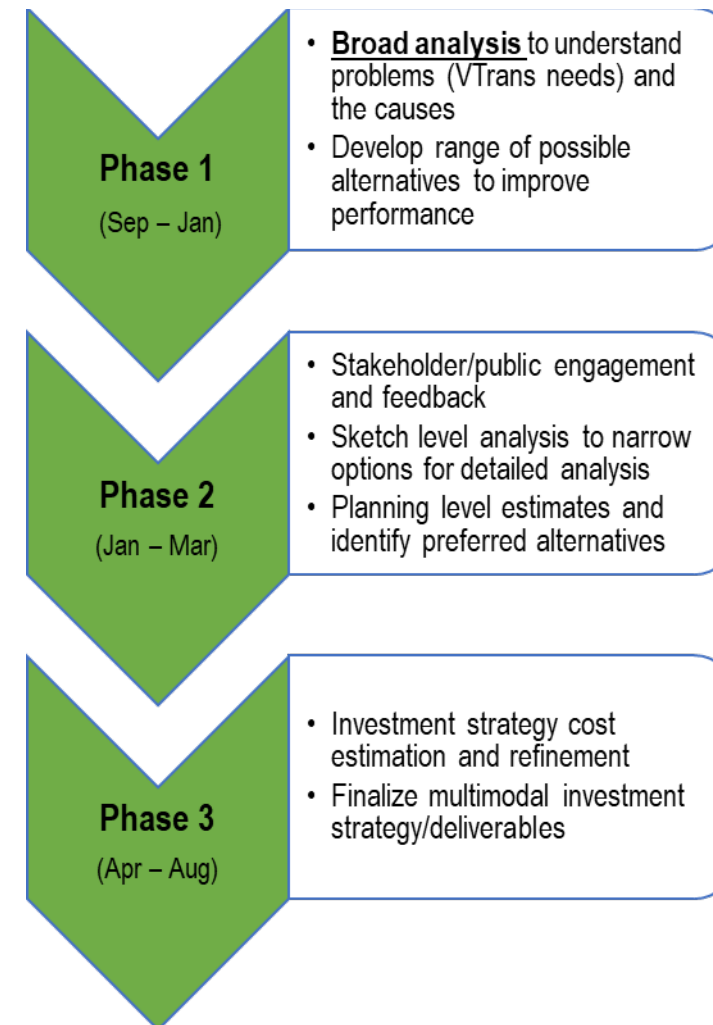


1.2 Methodology

The Project Pipeline study process consists of three phases, further detailed in Figure 2.

- **Phase 1:** Problem Diagnosis and Alternative Brainstorming
- **Phase 2:** Alternative Evaluation and Sketch-Level Analysis
- **Phase 3:** Investment Strategy and Cost Estimate

Figure 2: Study Phase Methods and Solutions



1.3 Study Background

A study work group (SWG) was formed for this Study to capture input from local stakeholders and shape the development of potential improvements. The SWG provided local and institutional knowledge of the corridor, reviewed study methodologies, provided input on key assumptions, and reviewed and approved proposed improvements developed through the study process. The SWG included members representing the following organizations:

- Virginia Department of Transportation (VDOT)
- Office of Intermodal Planning and Investment (OIP)
- York County
- Williamsburg Area Transit Authority (WATA)
- Department of Rail and Public Transportation (DRPT)
- Kimley-Horn

The study area along Route 17 extends between Josephs Drive to the north and Oak Street to the south. The study area along Victory Boulevard extends between Village Avenue/Kiln Creek Parkway to the west and Hampton Highway to the east. Route 17 is a four-lane divided roadway classified as an “Other Principal Arterial,” with a 45-mph posted speed limit within the study area. Victory Boulevard is classified as an “Other Principal Arterial” to the west of Route 17 and “Minor Arterial” to the east of Route 17. It is a six-lane divided roadway between Village Avenue/Kiln Creek Parkway and Route 17, and a five-lane divided roadway (three lanes WB, two lanes EB) between Route 17 and Hampton Highway, with a 45-mph posted speed limit on both segments.

The study area is in the southern part of the York County, Virginia. The roadway network serves as a route for commuter and regional travel between Hampton Roads and Gloucester. Commercial and residential development primarily borders the study area, with residential development southwest of the study intersection.

The study area includes seven at-grade intersections: five signalized intersections and two unsignalized intersections. The seven intersections are listed below and shown in **Figure 3**.

1. Route 17 and Josephs Drive/Walmart Entrance (signalized)
2. Route 17 and Victory Boulevard (signalized)
3. Victory Boulevard and Hampton Highway (signalized)
4. Victory Boulevard and Kiln Creek Parkway/Village Avenue (signalized)
5. Victory Boulevard and Walmart Entrance/Private Drive (signalized)
6. Route 17 and Oak Street (unsignalized)
7. Route 17 and Byrd Lane (unsignalized)

The study team collected data including traffic counts, traffic signal timings, and pedestrian and bicycle counts to assist with the transportation analysis in the study area.

A framework document was developed prior to commencing the study which outlined the study methods and assumptions. The signed framework document is provided in **Appendix A**. A kickoff meeting with the SWG was held on November 16, 2023. The kickoff meeting materials can be found in **Appendix A**.

Figure 3: Project Study Area



1.4 VTrans Needs

Project Pipeline follows a performance-based planning approach to identify solutions that address VTrans Mid-Term needs. VTrans Mid-Term needs were identified from a data-informed process and were used as a primary source for selecting Project Pipeline study corridors. **Table 1** outlines the VTrans needs at the Route 17 and Victory Boulevard study area.

Table 1: VTrans Needs Identified in the Study Area

VTrans 2019 Mid-Term Need	Priority
Bicycle Access	High
Capacity Preservation	Very High
Congestion Mitigation	High
IEDA (UDA) Access	None
Pedestrian Access	Medium
Safety Improvement	High
Pedestrian Safety Improvement	Low
Reliability	Medium
Rail On-Time Performance	None
Transit Access	Low
Transit Access for Equity Emphasis Areas	None
Transportation Demand Management	Very High

The intersection of Route 17 and Victory Boulevard was selected as a Project Pipeline study location due to the presence of overlapping VTrans needs. The project team took the following steps to confirm and evaluate the VTrans needs identified in the study area:

- Reviewed the Project Pipeline data dashboard to identify issues and transportation trends in the study area
- Conducted a field review of the study area to observe issues and document existing conditions
- Collected traffic counts at the study area intersections
- Reviewed relevant studies and plans near the study area to inform the alternative development
- Conducted detailed Existing Conditions and No-Build Conditions traffic operation analyses using Synchro and SimTraffic
- Assessed existing transit service, multimodal infrastructure, and the suitability for additional transit service within the study area

1.5 High-Level Needs Diagnosis

The data dashboard was developed by OIPI and VDOT to centralize data collection and leverage big data sources to streamline VTrans needs and problem diagnosis across all Project Pipeline studies as well as identifying the core issues and patterns identified in the framework document.

The data dashboard contains performance measures including VDOT crash data, travel time index data, level of travel time reliability (LOTTR) data, speed data, and StreetLight data for each study area. The results of this analysis are summarized in the Phase 1 Executive Summary in **Appendix B**.

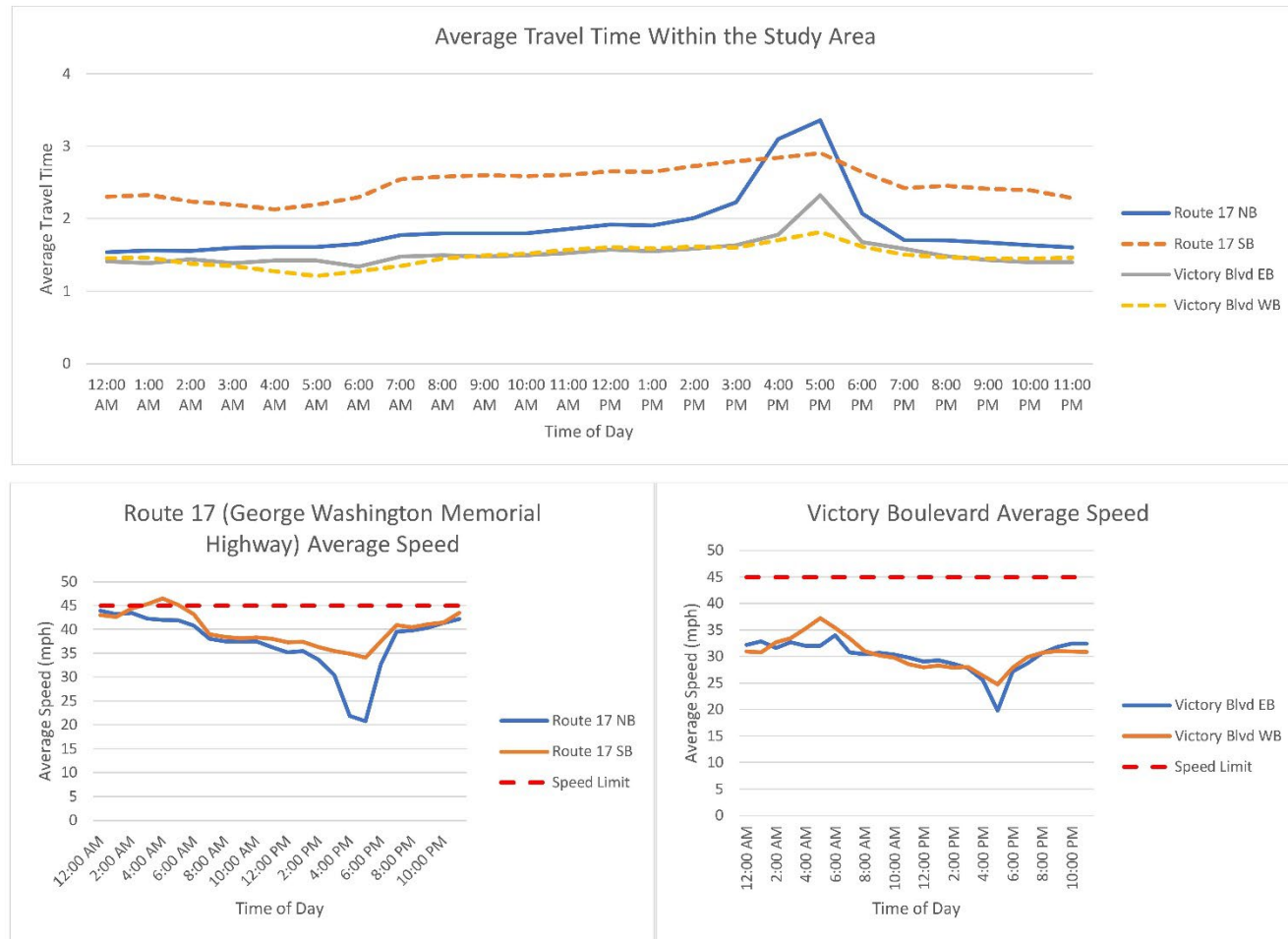
The study team reviewed the dashboard performance measures in addition to other sources to validate the presence of VTrans needs and identify the most effective improvements within the study area.

1.5.1 Operations and Access Needs

The study area has a High Congestion Mitigation VTrans need, which is based on the Travel Time Index (TTI) and the proportion of travel taking place during excessively congested conditions. The study area also has a Very High Capacity Preservation VTrans need, which indicates the necessity to preserve mobility through the Route 17 corridor

The greatest impact to average travel time occurs on northbound Route 17 and eastbound Victory Boulevard during the PM peak hour. Speed data showed that Route 17 and Victory Boulevard both operate more than 20 mph below the speed limit during the PM peak. **Figure 4** includes additional details from the operations needs diagnosis.

Figure 4: High-Level Operations Needs Summary



Typical traffic data from Google Maps showed congestion on Route 17 north of Victory Boulevard during the weekday AM peak period and along Route 17 and Victory Boulevard during the weekday PM peak period. During the AM peak period, congestion begins to form along the southbound approach of the intersection and extends back to the upstream intersection with Josephs Drive.

In the PM peak period, congestion forms along all approaches of the study intersection, with the worst conditions occurring on the eastbound and northbound approaches. On the eastbound approach, congestion extends past the upstream intersections at the Walmart entrance, Kiln Creek Parkway/Village Avenue, and Kiln Creek Parkway/Commonwealth Drive.

The study team used StreetLight data to better understand travel patterns throughout the study corridor. StreetLight is a transportation data analytics platform that leverages anonymized location-based data to provide on-demand insights into travel patterns for various travel modes. The data revealed that very few drivers use any alternate routes to bypass the intersection of Route 17 and Victory Boulevard. Less than three percent of reported daily trips from the StreetLight analysis traveled on Hampton Highway or Yorktown Road to bypass the study intersection, which were the two most popular alternate routes.

The study area also has a high Bicycle Access VTrans need due to the proximity to activity areas including residential and businesses along Route 17 and Victory Boulevard. Bicycle and pedestrian infrastructure is further supported in the York County 2035 Comprehensive Plan with a proposed multi-use path along Victory Parkway. Due to this planned multi-use path, the study team will not pursue additional pedestrian and cyclist improvements.

1.5.2 Safety and Reliability Needs

The study area has High Statewide Safety Improvement and Low Pedestrian Safety Improvement VTrans needs. The study team reviewed the VDOT crash data from 2018-2022 to identify high level crash trends in the study corridor.

In total, 356 crashes were reported in the study area including one fatality, 108 injury crashes, and 247 crashes involving property damage only (PDO). Most crashes in the study area were either rear-end (58%) or angle (26%) crashes. **Figure 5** shows additional details regarding crashes in the study area.

Figure 5: Route 17 and Victory Boulevard Crash Data (2018-2022)



Route 17 and Victory Boulevard are VDOT Pedestrian Safety Action Plan (PSAP) priority corridors with Route 17 in the statewide top 5%, Route 17 south of Victory Boulevard in the district top 5%, and Victory Boulevard west of Kiln Creek Parkway/Village Avenue in statewide top 1%.

The study area has a Medium Reliability VTrans need, which is measured by variability in travel time along a corridor and impacted by factors such as incidents, weather, construction, and changes in demand.

1.5.3 Transit and Transportation Demand Management Needs

The study area has a Low Transit Access VTrans need and no VTrans need for Transit Access for Equity Emphasis Areas. The study team reviewed existing Hampton Roads Transit (HRT) bus services in the study area. There are no transit routes in the study area, as shown in **Figure 6**.

During a meeting on December 14, 2023, WATA staff confirmed that there has been no official outreach or planning to extend service south towards S Military Highway and George Washington Highway. Transportation demand management (TDM) options within or near the study area include commuter and rideshare services through Trafix, and standard Transportation Network Companies (TNC) availability (e.g., Uber, Lyft). There are three park-and-ride lots near the study area as shown in **Figure 6**:

- Denbigh Fringe Park and Ride: 6 miles west of the study intersection
- Lee Hall Commuter Parking Lot: 10 miles northwest of the study intersection
- Hampton Transportation Center Park and Ride: 11 miles southeast of the study intersection

The study area also has a Very High Transportation Demand Management (TDM) VTrans need. This VTrans need informed the development of potential TDM improvements.

Figure 6: HRT Transit Route Map

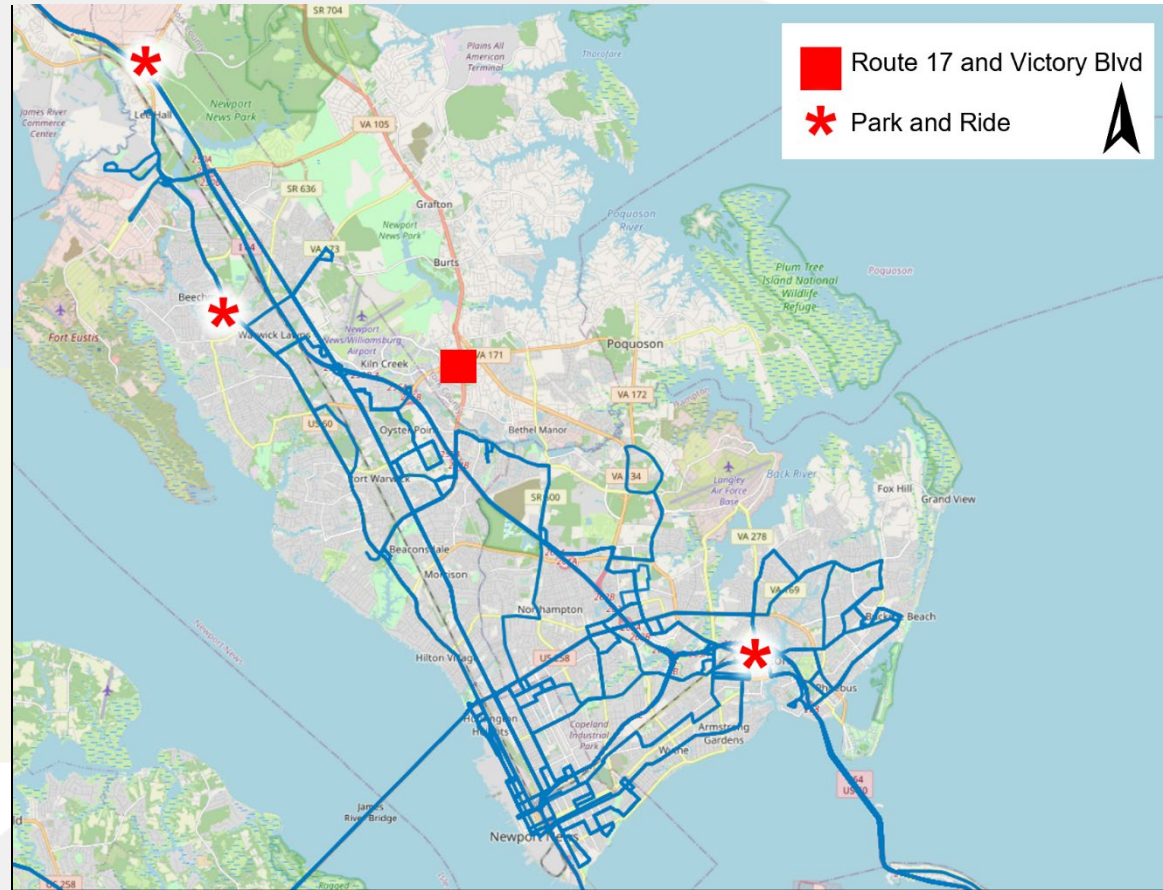
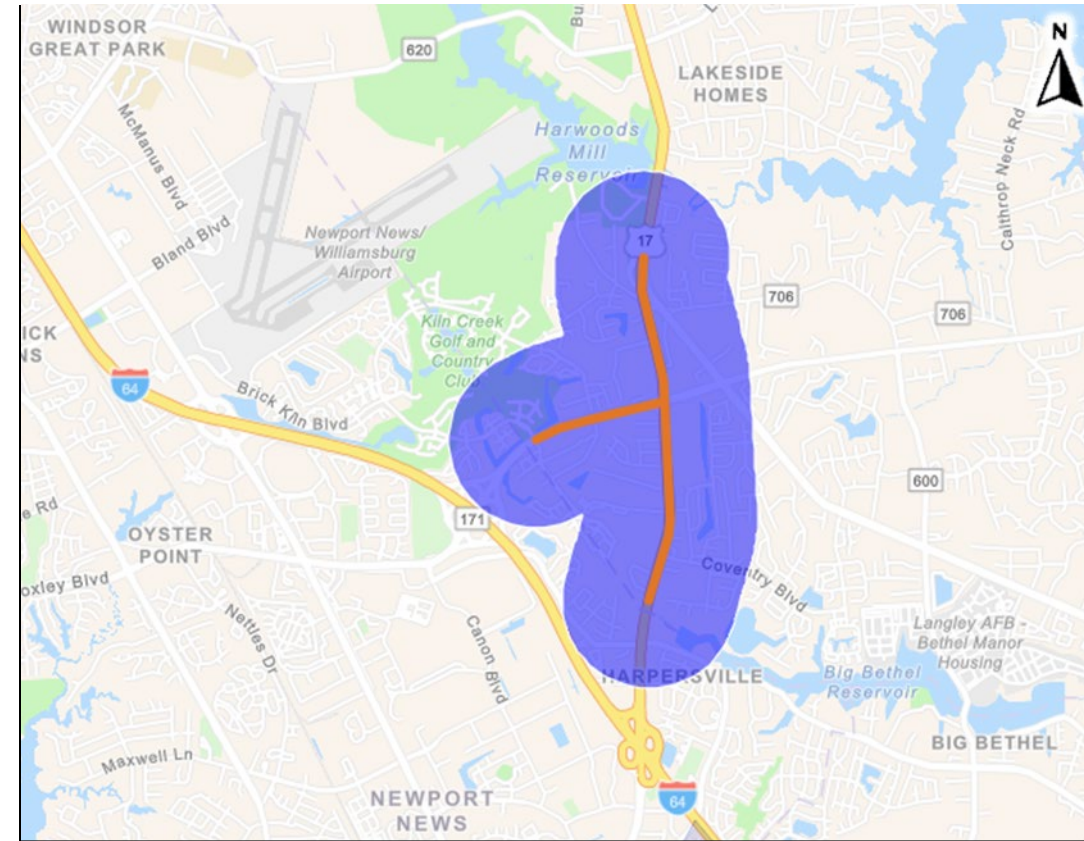


Figure 7: STEAP Analysis Study Area



1.5.4 Environmental Justice

The Screening Tool for Equity Analysis of Projects (STEAP) tool is a web application that permits rapid screening of potential project locations anywhere in the United States to support the analyses of Title VI, environmental justice, and other socioeconomic data. It provides estimates of socioeconomic characteristics of the resident population surrounding a project location, based on the latest American Community Survey (2016-2020) and on the 2020 Decennial Census Redistricting data. An equity analysis project profile report for the study area was generated by selecting the study area corridors and applying a half-mile buffer. The study area is shown in **Figure 7**.

The results show that 29% of the population in the study area is black, compared to 19% in Virginia. Forty-two percent of the study area population is minority, listing their racial status as a race other than white alone. Six percent of the study area is considered low income and considered in poverty. Additionally, 4% of households own zero vehicles and 6% of households report no internet connection. Based on this data, there are low-income and minority populations present that should be considered as environmental justice populations and should be considered when developing and screening transportation improvement concepts.

1.6 Detailed Needs Validation

The study team performed additional traffic operations and safety analyses to further quantify the existing and anticipated needs within the study area. Results from these analyses were used as a baseline when comparing the conditions of proposed improvements to the existing and anticipated no-build conditions.

1.6.1 Existing Conditions Traffic Operations and Safety Analysis

The study team conducted a multifaceted analysis of the existing conditions of the study corridor, which included reviewing previous studies, conducting a safety analysis, conducting a preliminary field review, analyzing traffic operations using Synchro and SimTraffic, and reviewing of pedestrian, bicycle, and transit activity.

Relevant Studies, Plans, and Projects

Information for the following studies, plans, and projects was collected and reviewed to identify previous or ongoing recommendations in and adjacent to the study area:

- Internal VDOT Signal Operations Analysis – dated August 12, 2020
 - Recommended improvements:
 - Construct third eastbound left-turn lane
 - Construct third southbound through lane
 - Restripe third northbound lane north of study intersection to be a shared through-right lane up to Josephs Drive
 - Construct a third northbound through lane south of study intersection
 - Add yield condition to channelized eastbound right-turn lane
 - Design incorporating these recommended improvements as well as other improvements submitted for funding in SMART SCALE Round 4, was not awarded funding
- Harper's Station assisted living community TIA
 - Used 2016 existing year, 2023 future year
 - Proffered second westbound left-turn lane at intersection of Route 17 and Victory Boulevard
 - Projected design completion expected Spring 2024

Safety Analysis

A safety analysis was conducted using crash data from the VDOT Crash Database over a five-year period (January 1, 2018 – December 31, 2022). In total, 356 crashes were reported in the study area, including one fatality. Summaries of crashes in the study area by severity and type are shown in **Table 2** and **Table 3**, respectively. **Appendix C** includes a detailed crash summary for the study area.

Crash severity is coded using the KABCO scale, which is defined using the following classifications.

- K: Fatality
- A: Suspected Serious Injury
- B: Suspected Minor Injury
- C: Possible Injury
- PDO: Property Damage Only

The study team identified congestion as the main contributor to crashes at the Route 17 and Victory Boulevard intersection with 24% of crashes at the intersection involving congestion or stop and go traffic. Of the congestion related crashes, the eastbound approach accounted for 35% and the southbound approach accounted for 30%. Fifteen (16%) of the total crashes at the intersection were related to red light running and eight (8%) of the total crashes were related to the southbound or eastbound channelized right-turn lanes.

Two pedestrian crashes occurred in the study area, both of which resulted in a visible injury. It was unknown who was at fault for both crashes due to conflicting statements. One cyclist crash occurred in the study area, resulting in a serious injury. The cyclist was under the influence of alcohol and did not have proper lighting when traveling at night. A summary of the pedestrian and bicycle crashes is shown in **Figure 8**.

Table 2: Study Area Crashes by Crash Severity

Intersection	# of Crashes: K	# of Crashes: A	# of Crashes: B	# of Crashes: C	# of Crashes: PDO	Total
Route 17 and Josephs Dr/Walmart Entrance	0	1	15	0	26	42
Route 17 and Victory Blvd	1	2	22	2	68	95
Victory Blvd and Hampton Hwy	0	3	9	2	32	46
Victory Blvd and Kiln Creek Pkwy/Village Ave	0	3	12	1	46	62
Victory Blvd and Walmart Entrance/Private Drive	0	1	12	0	34	47
Route 17 and Oak St	0	1	2	0	2	5
Route 17 and Byrd Ln	0		1	0	2	3
Rest of Corridor	0	3	16	0	37	56
Total	1	14	89	5	247	356

Table 3: Study Area Crashes by Crash Type

Intersection	# of Crashes: Rear End	# of Crashes: Angle	# of Crashes: Side swipe	# of Crashes: Fixed Object Off Road	# of Crashes: Head On	# of Crashes: Pedestrian	# of Crashes: Other	# of Crashes: Total
Route 17 and Josephs Dr/Walmart Entr	15	17	5	2	2	0	1	42
Route 17 and Victory Blvd	57	23	7	4	1	1	2	95
Victory Blvd and Hampton Hwy	23	16	2	0	2	0	3	46
Victory Blvd and Kiln Creek Pkwy/Village Ave	35	19	5	1	0	0	2	62
Victory Blvd and Walmart Entr/Private Dr	36	6	3	2	0	0	0	47
Route 17 and Oak Stt	3	2	0	0	0	0	0	5
Route 17 and Byrd Ln	2	0	0	0	0	0	1	3
Rest of Corridor	34	9	4	6	0	1	2	56
Total	205 (58%)	92 (26%)	26 (7%)	15 (4%)	5 (1%)	2 (1%)	11 (3%)	356

Figure 8: 2018 to 2022 Pedestrian and Bicycle Crash Map



All intersection and roadway segments in the VDOT linear referencing system (LRS) are evaluated annually for the potential for safety improvement (PSI) based on the Highway Safety Manual (HSM) methodology by VDOT. The crash frequency, severity of crashes, volume, and length of segment are contributing factors in the predicative analysis. Crash predictions, based on the safety performance function (SPF) crash data files, are made for intersection and segments. The top 100 intersections and 100 miles of segments are published by VDOT for each district on an annual basis. VDOT also identifies Targeted Safety Need (TSN) locations, which are intersections or segments that have been identified as PSI locations for three or more of the last five years.

Route 17 and Victory Boulevard were identified as 2020 PSI segments with total ranks ranging from 211 to 23 within the study area. Route 17 and Josephs Drive was identified as a 2020 PSI intersection with a total rank of 156.

Field Review Observations

A preliminary field review of the study area was conducted on Thursday, October 26, 2023, to verify existing conditions, confirm traffic control devices and lane configurations, and observe peak hour traffic conditions and driver behavior. The existing lane configurations and speed limits in the study area are summarized in **Figure 9** and **Figure 10**.

Study team members made the following study area observations during the AM peak period field review.

Route 17 and Josephs Drive

- Northbound movements traveling on Route 17 from Victory Boulevard to Josephs Drive were well-coordinated
- Southbound movements traveling along Route 17 from Josephs Drive to Victory Boulevard seemed poorly coordinated; motorists had a green light at Josephs Drive then hit a red light at Victory Boulevard
- Motorists did not have sufficient gaps to make a northbound left turn on the flashing yellow arrow, they had to wait for a green ball signal to turn
- Northbound queues were occasionally not fully served by the traffic signal
- Southbound queues extended to the upstream McDonald's driveway

Route 17 and Victory Boulevard

- Southbound queues were not fully served by the traffic signal and extended past the upstream of the Route 17 and Josephs Road intersection
- Southbound left-turn movements had uneven lane utilization that favored the innermost left-turn lane
- Westbound left-turn movements were not fully served by the traffic signal
- A second westbound left-turn lane is being constructed
- There was one occurrence of the westbound traffic signal turning green for less than five seconds around 7:30 AM in which three westbound motorists ran the red after this short phase
- Many motorists exited the southbound channelized right-turn lane and immediately crossed three westbound lanes to turn left at the downstream intersection of Kiln Creek Parkway/Village Avenue
- Motorists exited the eastbound channelized right-turn lane and quickly merged, not using the ample length of the merge lane
- The average speed of the eastbound and southbound channelized right-turn lanes was 30 mph

Route 17 and Oak Street

- Motorists used the median for two-stage turning movements

The following observations were made within the study area during the PM peak period field review:

Route 17 and Victory Boulevard

- Eastbound, westbound, and northbound (except for northbound left-turn) movements were not fully served by the signal
- The northbound left-turn arrow leads, southbound left-turn arrow lags, which cut off northbound movements before they were fully served
- Eastbound queues extended past the upstream entrance to Harper's Station assisted living community
- Eastbound left-turn queues extended past the storage length and into the eastbound through lanes
- Westbound queues extended past the upstream entrance to the WoodSpring Suites Hotel
- Westbound through queues blocked westbound right-turn lane storage
- Northbound queues extended past the upstream intersections with Byrd Lane and Oak Street
- Northbound through queues blocked northbound left-turn lane storage
- Westbound and northbound through movements had uneven lane utilization that favored the right lane
- Two near-misses were observed between southbound U-turn movements and westbound right turns on red

Victory Boulevard and Hampton Highway

- Southbound left-turn queues extended to the end of the storage length
- Northbound through movements had uneven lane utilization that favored the outermost through lane

Victory Boulevard and Kiln Creek Parkway/Village Avenue

- Westbound left-turn movements were occasionally not fully served by the traffic signal

Victory Boulevard and Walmart Entrance/Private Drive

- Average westbound travel speeds were 25 mph

Additional observations in the study area include:

- Vegetation along the median of Route 17 south of Victory Boulevard blocked sight distance
- A sign was missing on Kiln Creek Pkwy that should say "WEST" over 171
- No pedestrian accommodations or activity were observed throughout the study area

Figure 9: 2023 Existing Lane Configurations and Speed Limits (1)

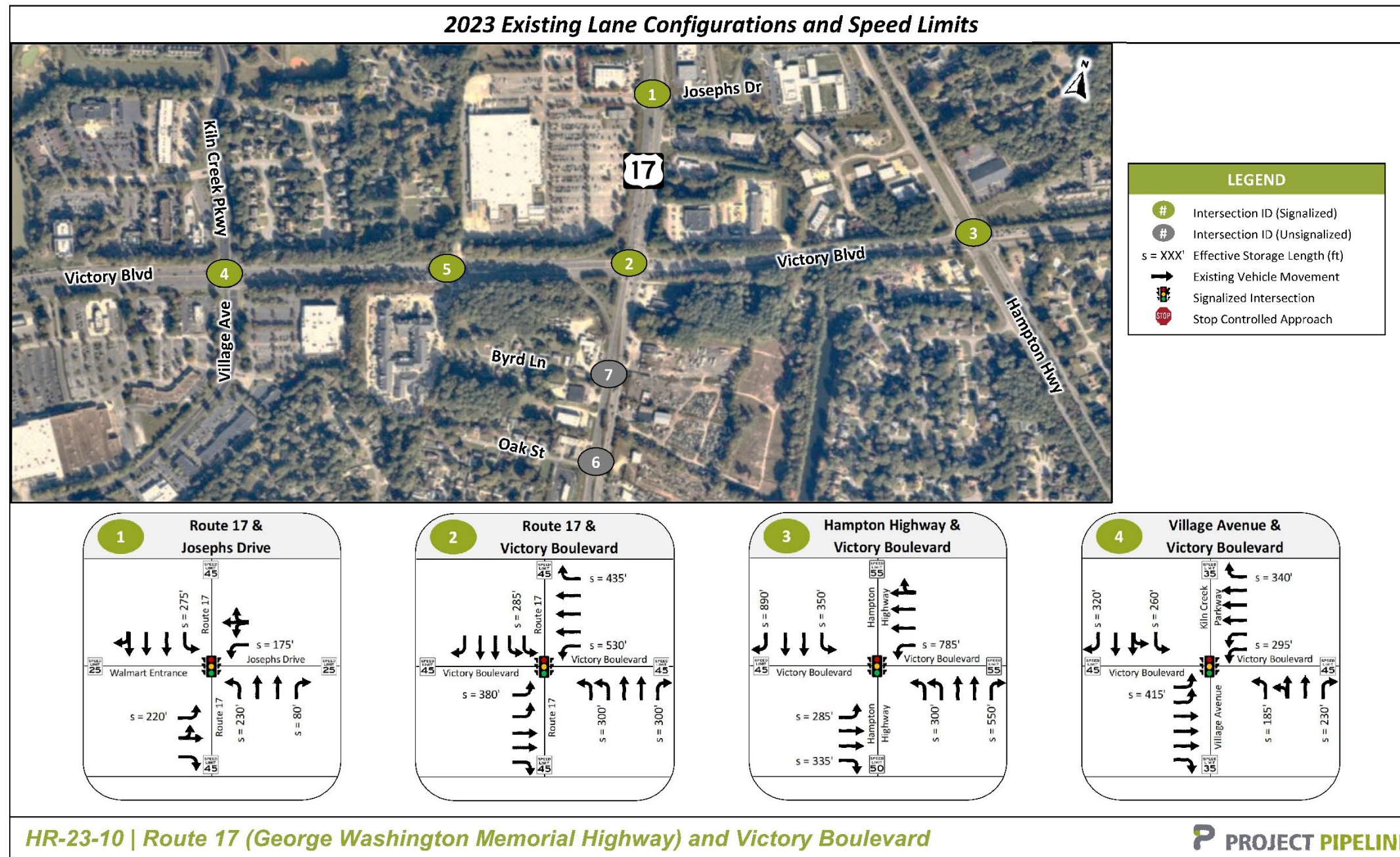
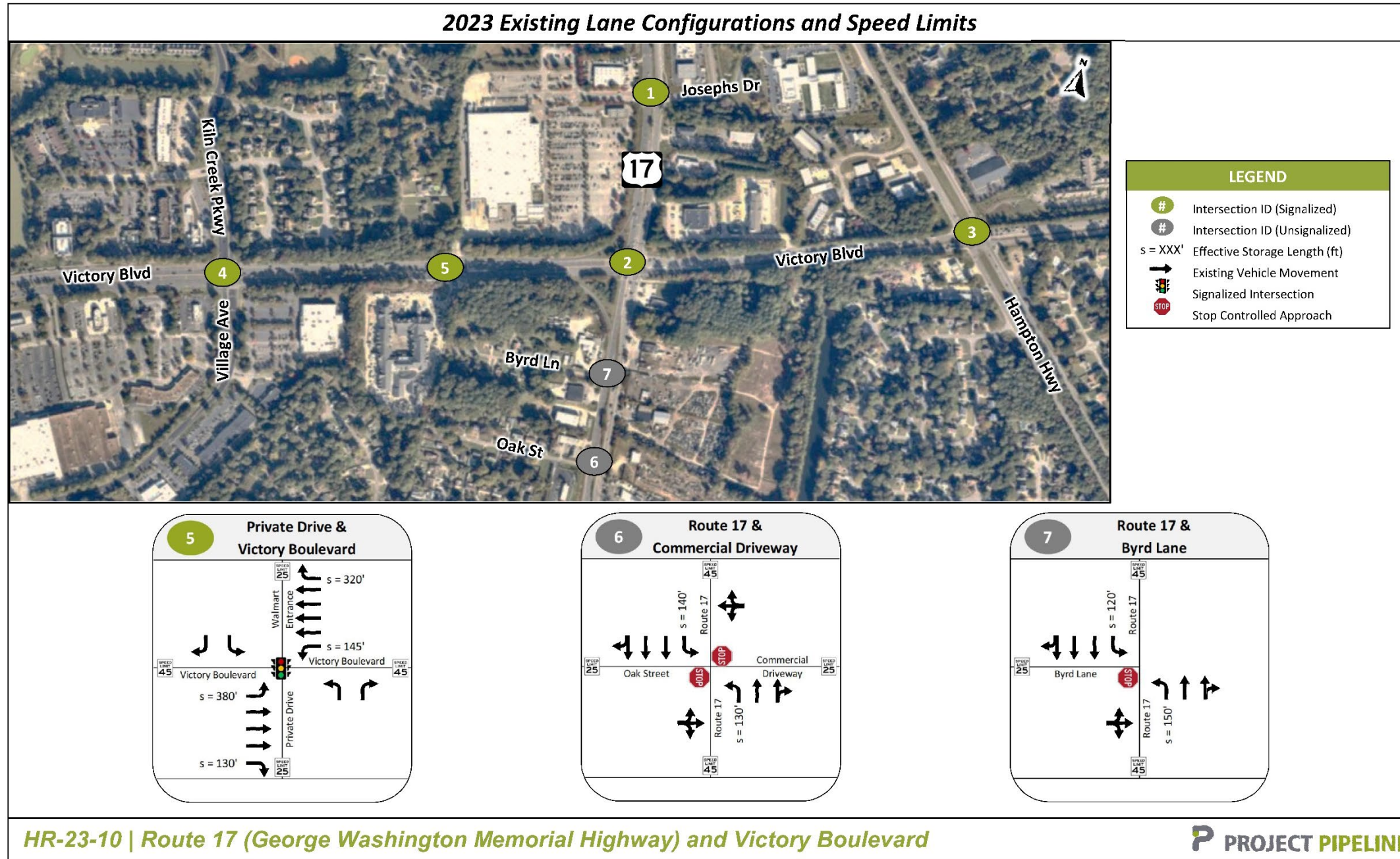


Figure 10: 2023 Existing Lane Configurations and Speed Limits (2)



1.6.2 Synchro and SimTraffic Analysis

A traffic operations analysis was conducted to evaluate the overall performance of the study corridor under existing (2023) AM and PM peak hour conditions. Existing conditions were modeled using Synchro 11 and SimTraffic 11.

The existing AM and PM Synchro models were developed based on the existing roadway geometry and collected traffic count data. Inputs and analysis methodologies were consistent with the VDOT *Traffic Operations and Safety Analysis Manual (TOSAM)*, Version 2.0. Synchro and SimTraffic analysis results and corresponding Calibration Memorandum are included in **Appendix C**.

Traffic Data

Twelve-hour vehicular turning movement, pedestrian, and bicycle count data was collected at 13 locations on Tuesday, October 17, 2023. The AM and PM peak hours were determined to be 7:15 – 8:15 AM and 4:45 – 5:45 PM. Raw traffic data can be found in **Appendix C**.

Volumes were balanced up without exceeding 10% change to any movement. The resulting balanced volumes were used as existing volumes that formed the basis of this study and are shown in **Figure 11** and **Figure 12**. Heavy vehicle percentages and peak hour factors are included in **Figure 13** and **Figure 14**.

Level of Service (LOS) Criteria

The intersection Level of Service (LOS) is a qualitative measure that describes a driver’s perception of the operating conditions. LOS ratings range from A to F. LOS A indicates little or no congestion and LOS F indicates severe congestion, unstable traffic flow, and/or stop-and-go conditions.

Table 4 summarizes the LOS corresponding to the delay at unsignalized and signalized intersections as specified in the HCM. The delay criteria for LOS differs slightly for unsignalized and signalized intersections due to driver expectations and behavior. For signalized intersections, LOS is calculated as the lost travel time caused by vehicles waiting at a traffic signal. For unsignalized intersections, LOS and corresponding delay is calculated by determining the number of gaps that are available in the conflicting traffic stream, since the LOS analysis assumes that the traffic on the mainline is not affected by the traffic on the side street.

Table 4: Level of Service Criteria

Level of Service	Control Delay (seconds/vehicle) - Signalized Intersection	Control Delay (seconds/vehicle) - Unsignalized Intersection
A	≤ 10.0	≤ 10.0
B	> 10.0 to 20.0	> 10.0 to 15.0
C	> 20.0 to 35.0	> 15.0 to 25.0
D	> 35.0 to 55.0	> 25.0 to 35.0
E	> 55.0 to 80.0	> 35.0 to 50.0
F	≥ 80.0	≥ 50.0

Figure 11: 2023 Existing Peak Hour Vehicle Volumes (1)

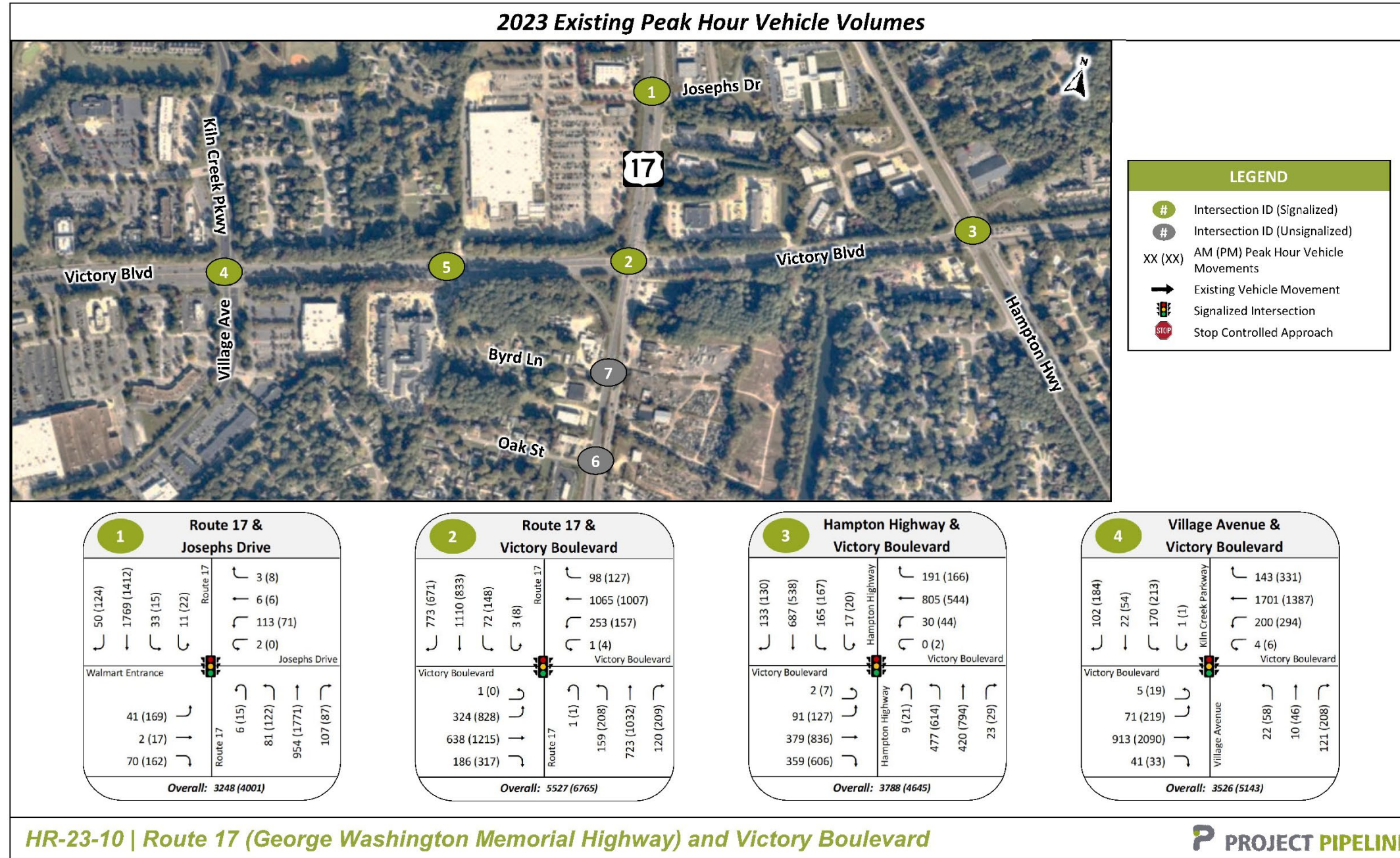


Figure 12: 2023 Existing Peak Hour Vehicle Volumes (2)

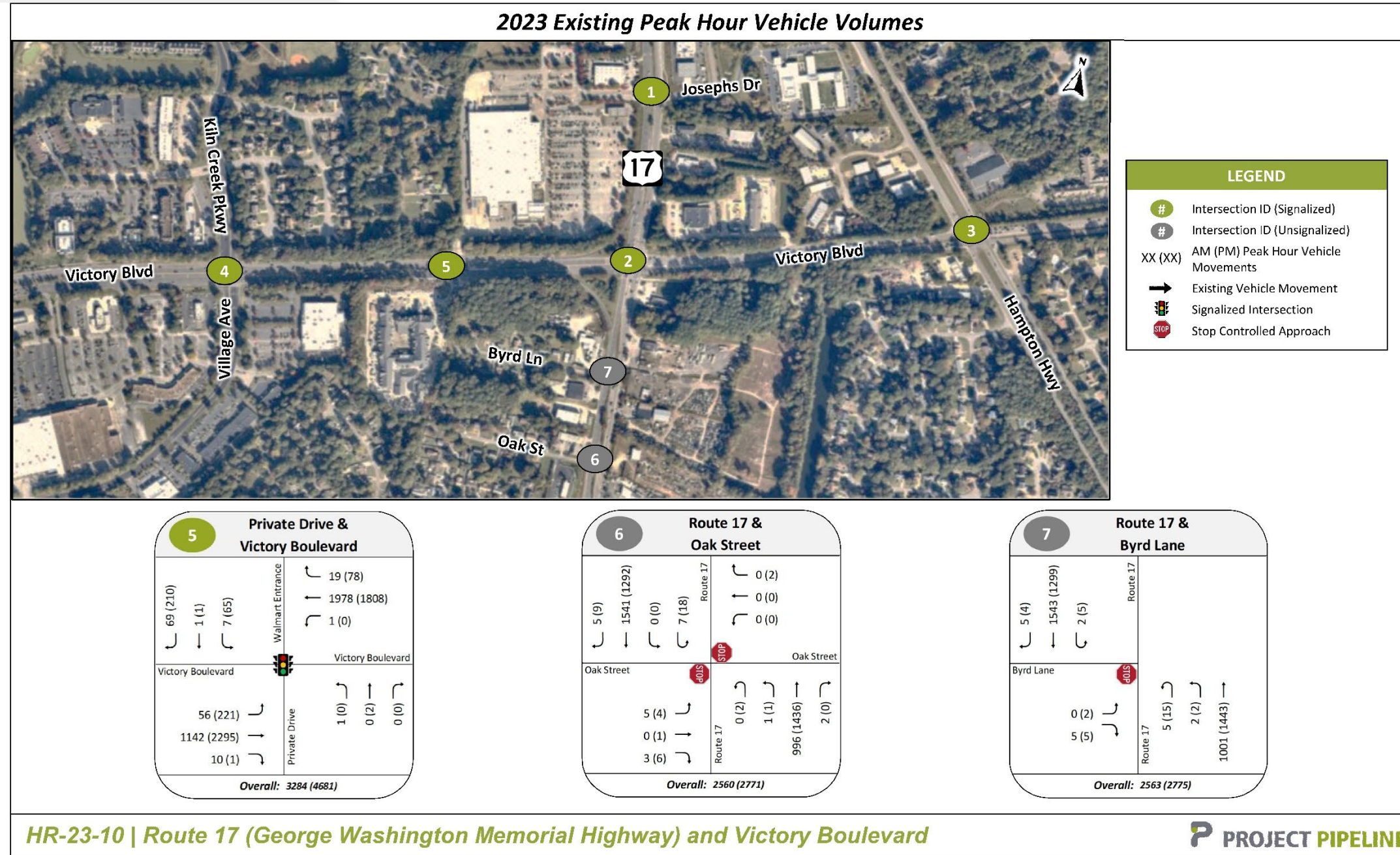


Figure 13: 2023 Existing Heavy Vehicle Percentages and Peak Hour Factors (1)

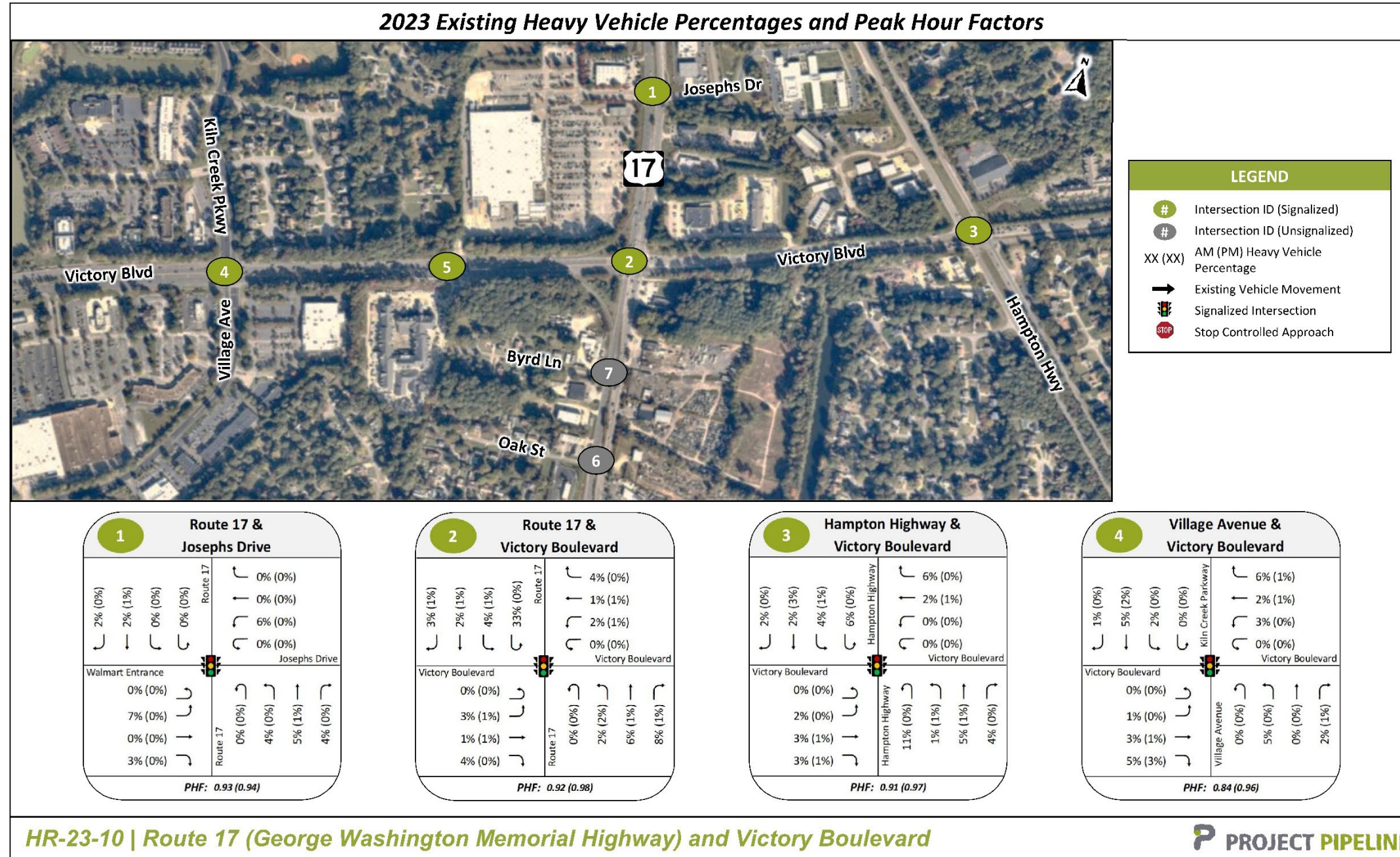
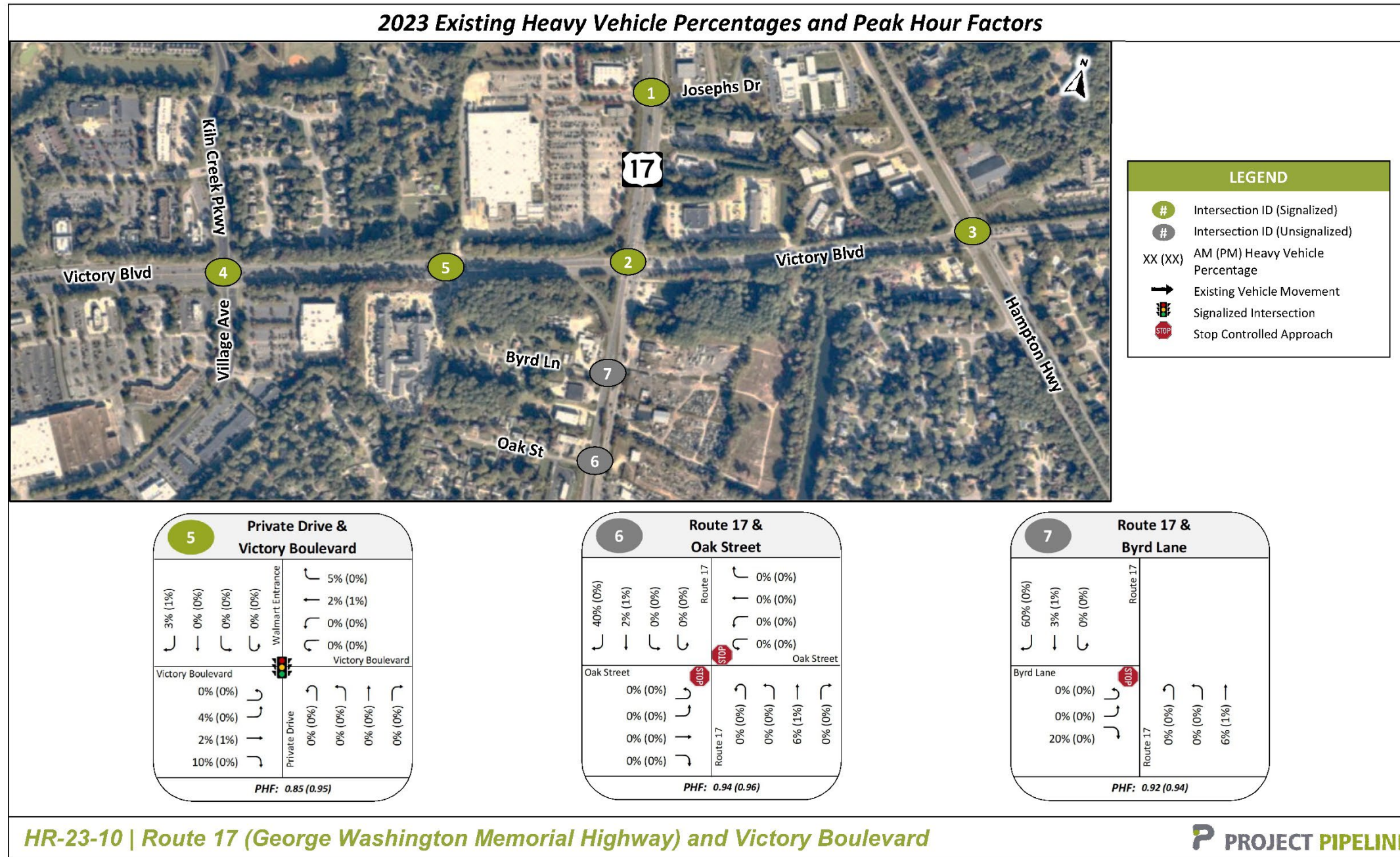


Figure 14: 2023 Existing Heavy Vehicle Percentages and Peak Hour Factors (2)



Traffic Analysis Results

Control delay (seconds per vehicle) and maximum simulated queue length (feet) were selected as measures of effectiveness to quantitatively report the performance of each study intersection. The control delay was determined using the HCM 2000 Signalized report for all signalized intersections and HCM6th TWSC for all two-way stop-controlled intersections. Synchro and SimTraffic results for the Existing Condition models are included in **Table 5** and **Table 6**.

Under existing conditions, the intersection of Route 17 and Victory Boulevard operates at LOS D in the AM and PM peak hours. Multiple individual movements also operate at LOS E and F in both AM and PM peak hours; the greatest delays were 108.6 seconds per vehicle for the eastbound left-turn movement in the PM peak hour and 80.7 seconds per vehicle for the westbound left-turn movement in the AM peak hour. Queues extend to upstream intersections on the southbound approach in the AM peak hour and the eastbound and northbound approaches in the PM peak hour.

The minor approaches of Victory Boulevard intersections with Hampton Highway, Village Avenue, and the Walmart entrance all operate at LOS D and E in the AM and PM peak hours. Eastbound queues extend from Victory Boulevard's intersection with Route 17 and through intersections with the Walmart Entrance and Village Avenue during the PM peak hour.

The minor approaches of the Route 17 and Josephs Drive intersection operate at LOS E during the AM and PM peak hours, and multiple mainline turning movements operate at LOS E and F due to through movement queues blocking turn lane storage.

The eastbound approach at the two-way stop-controlled intersection of Route 17 and Oak Street operates at LOS E and D in the AM and PM peak hours, respectively. Southbound left-turn movements at the Route 17 two-way stop-controlled intersections with Byrd Lane and Oak Street operate at LOS D due to the heavy northbound volume and queuing on Route 17.

The following trends were observed under existing conditions during the AM and PM peak hours.

AM Peak Hour

- All approaches at the Route 17 and Victory Boulevard intersection operate at LOS D, with the highest delays occurring on the westbound left-turn movement, which operates at 80.7 seconds (LOS F)
- The southbound through queue at the Route 17 and Victory Boulevard intersection blocks the upstream Route 17 and Josephs Drive intersection for 13% of the analysis period
- The minor approaches at the Route 17 and Josephs Drive intersection operate at LOS E. The highest movement delay occurs on the northbound right-turn movement, which operates at 78.3 seconds (LOS E) due to northbound through queues blocking the right-turn lane for 11% of the

analysis period and northbound right-turn queues extending beyond the available storage for 13% of the analysis period.

- The westbound and northbound approaches at the Victory Boulevard and Hampton Highway intersection operate at LOS D and the southbound approach operates at LOS E. The highest movement delay occurs for the southbound through movement, which operates at 85.7 seconds (LOS F).
- The minor approaches at the Victory Blvd and Village Ave intersection operate at LOS D
- The northbound approach at the Victory Boulevard and the Walmart entrance intersection operates at LOS E and the southbound approach operates at LOS D. The highest movement delay occurs on the eastbound left-turn movement, which operates at 66.2 seconds (LOS E).
- The eastbound approach at the Route 17 and Oak Street intersection operates at LOS E

PM Peak Hour

- The eastbound and northbound approaches at the Route 17 and Victory Boulevard intersection operate at LOS E and the westbound approach operates at LOS D. The highest movement delay occurs with the eastbound left-turn movement, which operates at 108.6 seconds (LOS F).
- The eastbound and northbound queues at the Route 17 and Victory Boulevard intersection block upstream intersections for 50% and 10% of the analysis period, respectively
- The minor approaches at the Route 17 and Josephs Drive intersection operate at LOS E. The highest movement delay occurs with the northbound right-turn movement, which operates at 381.4 seconds (LOS F) due to northbound through queues blocking the right-turn lane for 28% of the analysis period.
- The eastbound approach at the Victory Boulevard and Hampton Highway intersection operates at LOS D and all other approaches operate at LOS E. The highest movement delay occurs with the southbound left-turn movement, which operates at 83.1 seconds (LOS F).
- The westbound, northbound, and southbound approaches at the Victory Boulevard and Village Avenue intersection operate at LOS E with the highest movement delay occurring on the westbound right-turn movement, which operates at 132.6 seconds (LOS F) due to westbound through queues blocking the right-turn lane for 8% of the analysis period.
- The eastbound through queues at the Victory Boulevard intersections with Village Avenue and the Walmart entrance blocks the upstream intersection for 9% and 4% of the analysis period, respectively
- The eastbound approach at the intersection of Route 17 and Oak Street operates at LOS E
- The southbound left-turn movements at the Route 17 intersections with Byrd Lane and Oak Street both operate at LOS D due to heavy northbound volume and queuing along Route 17

Table 5: 2023 Existing Conditions Peak Hour Control Delay and LOS

Intersection Number and Description	Type of Control	Lane Group	Eastbound				Westbound				Northbound				Southbound				Overall	
			AM		PM		AM		PM		AM		PM		AM		PM		AM	PM
			Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS		
1 Route 17 and Josephs Drive	Signalized	Walmart Entrance		Josephs Drive				Route 17				Route 17				Intersection				
		Left	56.5	E	66.3	E	56.2	E	70.3	E	24.7	C	56.6	E	9.4	A	71.0	E	Delay	Delay
		Through	56.5*	E*	65.5*	E*	55.2^	E^	64.7^	E^	9.1	A	21.2	C	20.2	C	23.0	C	21.4	35.9
		Right	54.9	D	56.6	E					78.3	E	381.4	F					LOS	LOS
Approach	55.5	E	61.6	E	55.7	E	67.5	E	16.8	B	39.4	D	20.0	B	24.1	C	C	D		
2 Route 17 and Victory Boulevard	Signalized	Victory Boulevard		Victory Boulevard				Route 17				Route 17				Intersection				
		Left	68.7	E	108.6	F	80.7	F	62.6	E	57.5	E	64.3	E	35.0	C	65.9	E	Delay	Delay
		Through	49.7	D	74.3	E	26.7	C	45.4	D	38.6	D	61.4	E	68.6	E	38.7	D	41.0	54.5
		Right	0.2	A	0.2	A	34.4	C	43.2	D	28.6	C	33.6	C	1.0	A	0.7	A	LOS	LOS
Approach	47.0	D	76.4	E	36.9	D	47.3	D	40.4	D	57.8	E	40.7	D	25.9	C	D	D		
3 Victory Boulevard and Hampton Highway	Signalized	Victory Boulevard		Victory Boulevard				Hampton Highway				Hampton Highway				Intersection				
		Left	31.8	C	37.1	D	58.3	E	65.2	E	59.2	E	68.4	E	69.9	E	83.1	F	Delay	Delay
		Through	12.7	B	30.2	C	47.2	D	54.6	D	42.1	D	45.5	D	85.7	F	49.1	D	50.1	49.6
		Right	25.7	C	50.8	D					34.4	C	32.1	C	38.4	D	40.3	D	LOS	LOS
Approach	20.4	C	38.7	D	47.5	D	55.3	E	50.8	D	55.2	E	76.6	E	55.2	E	D	D		
4 Victory Boulevard and Village Avenue	Signalized	Victory Boulevard		Victory Boulevard				Village Avenue				Kiln Creek Parkway				Intersection				
		Left	54.5	D	48.6	D	67.9	E	69.0	E	55.2	E	62.4	E	58.7	E	70.4	E	Delay	Delay
		Through	19.3	B	30.1	C	21.8	C	35.3	D	54.9	D	61.9	E	51.1	D	58.8	E	28.9	45.7
		Right	15.0	B	15.9	B	33.1	C	132.6	F	54.8	D	61.0	E	49.2	D	55.9	E	LOS	LOS
Approach	21.7	C	31.8	C	27.2	C	56.3	E	54.8	D	61.4	E	52.7	D	60.4	E	C	D		
5 Victory Boulevard and Walmart Entrance	Signalized	Victory Boulevard		Victory Boulevard				Private Drive				Walmart Entrance				Intersection				
		Left	66.2	E	72.8	E	4.5	A	0.0	A	59.2	E	0.0	A	64.4	E	67.9	E	Delay	Delay
		Through	3.0	A	1.7	A	9.6	A	19.2	B					9.2	15.0				
		Right					3.9	A	15.6	B	0.0	A	0.0	A	51.7	D	48.0	D	LOS	LOS
Approach	5.9	A	7.9	A	9.5	A	19.1	B	59.2	E	0.0	A	52.8	D	52.7	D	A	B		
6 Route 17 and Oak Street	Unsignalized	Byrd Lane		Private Drive				Route 17				Route 17				Intersection				
		Left	38.2	E	27.6	D	0.0	A	15.1	C	14.0	B	19.6	C	17.0	C	30.3	D	Delay	Delay
		Through									+	+	+	+	+	+	+	-	-	
		Right									+	+	+	+	+	+	+	LOS	LOS	
Approach	38.2	E	27.6	D	0.0	A	15.1	C	0.0	A	0.0	A	0.1	A	0.4	A	-	-		
7 Route 17 and Byrd Lane	Unsignalized	Oak Street						Route 17				Route 17				Intersection				
		Left	20.5	C	22.9	C					18.8	C	14.4	B	17.2'	C'	29.4'	D'	Delay	Delay
		Through									+	+	+	+	+	+	+	+	-	-
		Right	&	&	&	&									+	+	+	+	LOS	LOS
Approach	20.5	C	22.9	C					0.1	A	0.2	A	0.0	A	0.1	A	-	-		

- Denotes the overall intersection is stop controlled and no level of service or delay is reported
 † SYNCHRO does not provide level of service or delay for movements with no conflicting volumes
 * Lane group is a shared left/through movement
 ^ Lane group is a shared left/through/right movement
 & Lane group is a shared left/right movement
 ' Level of service or delay is for a U-turn movement

Table 6: 2023 Existing Conditions Peak Hour Maximum Queue

Intersection Number and Description	Type of Control	Lane Group	Maximum Queue							
			Eastbound		Westbound		Northbound		Southbound	
			AM	PM	AM	PM	AM	PM	AM	PM
1 Route 17 and Josephs Drive	Signal		Walmart Entrance		Josephs Drive		Route 17		Route 17	
		Left	25	190	** (2%)	105	*(13%)** (11%)	** (16%)	** (8%)	** (1%)
		Through	110*	235*	200^	150^	470	590	545	410
Right	100	150	** (10%)	** (28%)						
2 Route 17 and Victory Boulevard	Signal		Victory Boulevard		Victory Boulevard		Route 17		Route 17	
		Left	240	^(50%)	*(3%)** (2%)	380	265	*(1%)** (32%)	** (44%)	** (12%)
		Through	445	^(42%)	465	515	340	^(10%)	^(13%)	540
		Right	†	†	90	** (2%)	180	*(1%)** (31%)	†	†
3 Victory Boulevard and Hampton Highway	Signal		Victory Boulevard		Victory Boulevard		Hampton Highway		Hampton Highway	
		Left	165	** (12%)	70	105	270	*(7%)** (6%)	** (1%)	*(1%)
		Through	235	495	310	280	280	635	405	360
Right	275	*(2%)** (2%)	0	55			0	40		
4 Victory Boulevard and Village Avenue	Signal		Victory Boulevard		Victory Boulevard		Village Avenue		Kiln Creek Parkway	
		Left	110	*(1%)** (32%)	** (3%)	** (8%)	25	155	150	205
		Through	210	^(9%)	495	520	80	165	190	245
		Right	60	^(1%)	** (4%)	*(1%)** (7%)	105	*(1%)	†	†
5 Victory Boulevard and Walmart Entrance	Signal		Victory Boulevard		Victory Boulevard		Private Drive		Walmart Entrance	
		Left	100	*(1%)** (50%)	** (1%)	** (22%)	20	0	35	155
		Through	115	^(4%)	365	510				
Right	30	** (2%)			0	0	100	250		
6 Route 17 and Oak Street	Signal		Byrd Lane		Private Drive		Route 17		Route 17	
		Left	35	45	0	35	10	25	30	45
		Through					†	†	†	†
Right	†	†					†	†		
7 Route 17 and Byrd Lane	Signal		Oak Street				Route 17		Route 17	
		Left	45	50			30	75	20	45
		Through					†	†	†	†
		Right	&	&					†	†

† No queue reported. Movement does not have conflicting volumes
*(X%) - Maximum queue extends full length of storage bay for X% of the analysis period
**(Y%) - Queue in lane adjacent to storage bay extends beyond end of storage bay for Y% of the analysis period
^(Z%) - Maximum queue extends back to the upstream intersection for Z% of the analysis period
* Lane group is a shared left/through movement
^ Lane group is a shared left/through/right movement
& Lane group is a shared left/right movement
' Queue is for a U-turn movement

1.6.3 No-Build Conditions Traffic Operations Analysis

No-Build 2045 Volume Development

Traffic operational analyses were conducted to evaluate the overall performance of the study corridor under No-Build (2045) AM and PM peak hour conditions. The intent of the No-Build conditions analyses is to provide a general understanding of the baseline future traffic conditions as a starting point for developing improvement concepts, if only the following programmed improvements were made to the existing configuration:

- An additional westbound left-turn lane at the intersection of Route 17 and Victory Boulevard
- An additional eastbound left-turn lane at the intersection of Victory Boulevard at Hampton Highway
- An extension of the outermost westbound lane of Victory Boulevard between the Walmart Entrance and Village Avenue which connects to the westbound right-turn lane at Village Avenue

These programmed improvements are reflected in the lane configurations used in the No-Build conditions analysis, shown in **Figure 16** and **Figure 17**. The following sources were reviewed to determine the growth rates to apply to existing traffic volumes to forecast future (2045) traffic volumes.

- **Hampton Roads Regional Travel Demand Model (TDM)**

Outputs from the Hampton Roads Regional TDM, which included base year data from 2017 and future year data from 2045, were adjusted using NCHRP-765 methodologies that incorporate VDOT traffic count data to calibrate future volume projections. Using the adjusted future year (2045) TDM output and existing available count data, linear growth rates for the study area were developed.

- **Historical traffic count data**

Historical traffic count data were sourced primarily from official VDOT historical AADT counts. Significant development and regression trends between years were identified, outliers were removed, and a linear regression analysis was performed to produce linear growth rates for segments throughout the study area.

- **Socioeconomic data**

Population and employment data from traffic analysis zones (TAZ) in the 2017-2045 Hampton Roads Regional TDM were reviewed and compared to the linear traffic growth rates developed with the 2017-2045 Richmond TPO Regional TDM.

- **Previous study**

Growth rates from the Harper's Station TIA and the VDOT in-house intersection analysis of Route 17 and Victory Boulevard Intersection Improvement Memo were reviewed and compared to the other sources.

Table 7 and **Figure 15** present recommended linear growth rates and the growth rates determined from historical volume and the HRPTO TDM. Traffic forecasting growth rate development was presented in a stakeholder meeting on December 14, 2023. The full presentation is included in **Appendix D**. The approved growth rates were used to develop 2045 No-Build volumes, which are presented in **Figure 18** and **Figure 19**.

Table 7: Linear Growth Rate Development Summary

Segment	10 Year Linear Growth Rate	20 Year Linear Growth Rate	Projected TDM Linear Growth Rate	Previous Study Growth Rate	Recommended Linear Growth Rate
Route 17 North of Victory Blvd	-1.41%	0.05%	0.35%	1.00%	0.50%
Route 17 South of Victory Blvd	-0.60%	-0.08%	--	1.00%	0.50%
Victory Blvd West of Route 17	-3.21%	-1.02%	-0.04%	1.00%	0.50%
Victory Blvd Between Route 17 and Hampton Hwy	0.45%	1.41%	0.79%	1.00%	0.80%
Victory Blvd East of Hampton Hwy	-0.23%	-0.03%	--	*	0.50%
Hampton Hwy North of Victory Blvd	-2.81%	-3.23%	0.55%	*	0.50%
Hampton Hwy South of Victory Blvd	-0.83%	-0.88%	1.00%	*	1.00%

-- Difference between the 2017 VDOT count book ADT and 2017 travel demand model ADT beyond +-30% range

* No previous studies conducted along the segment

Figure 15: Recommended Growth Rates

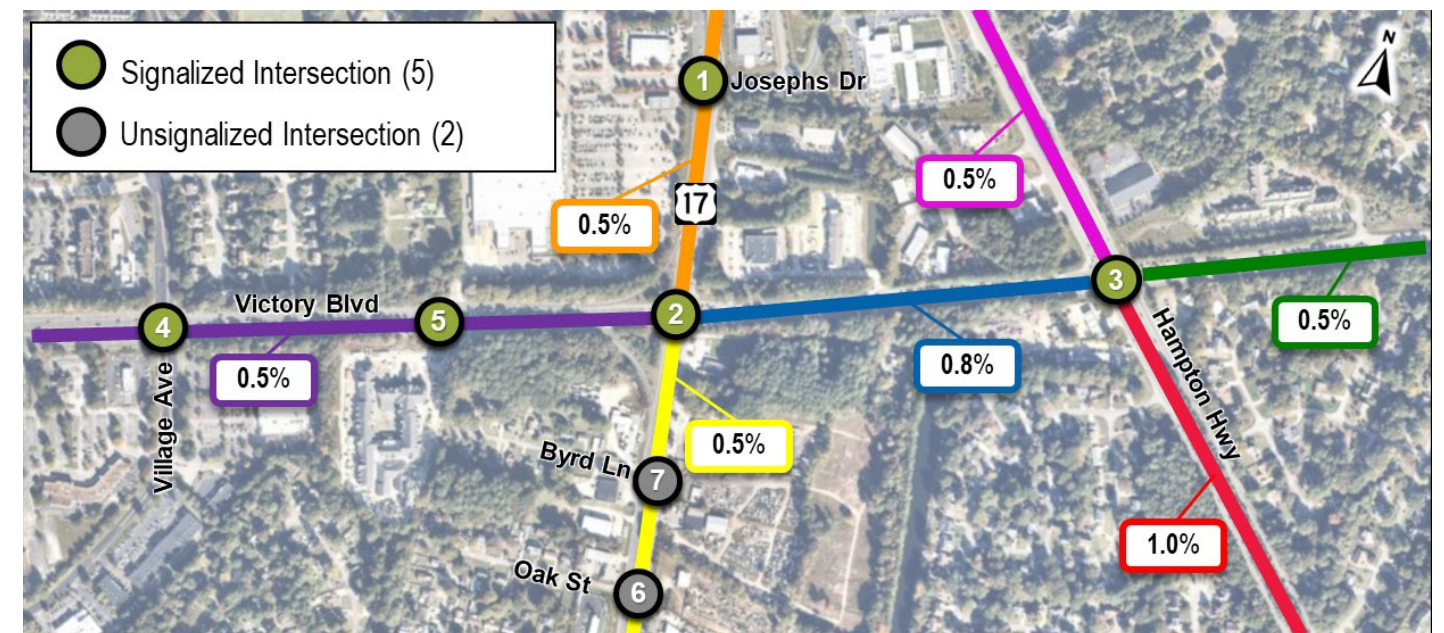


Figure 16: 2045 No-Build Lane Configurations and Speed Limits (1)

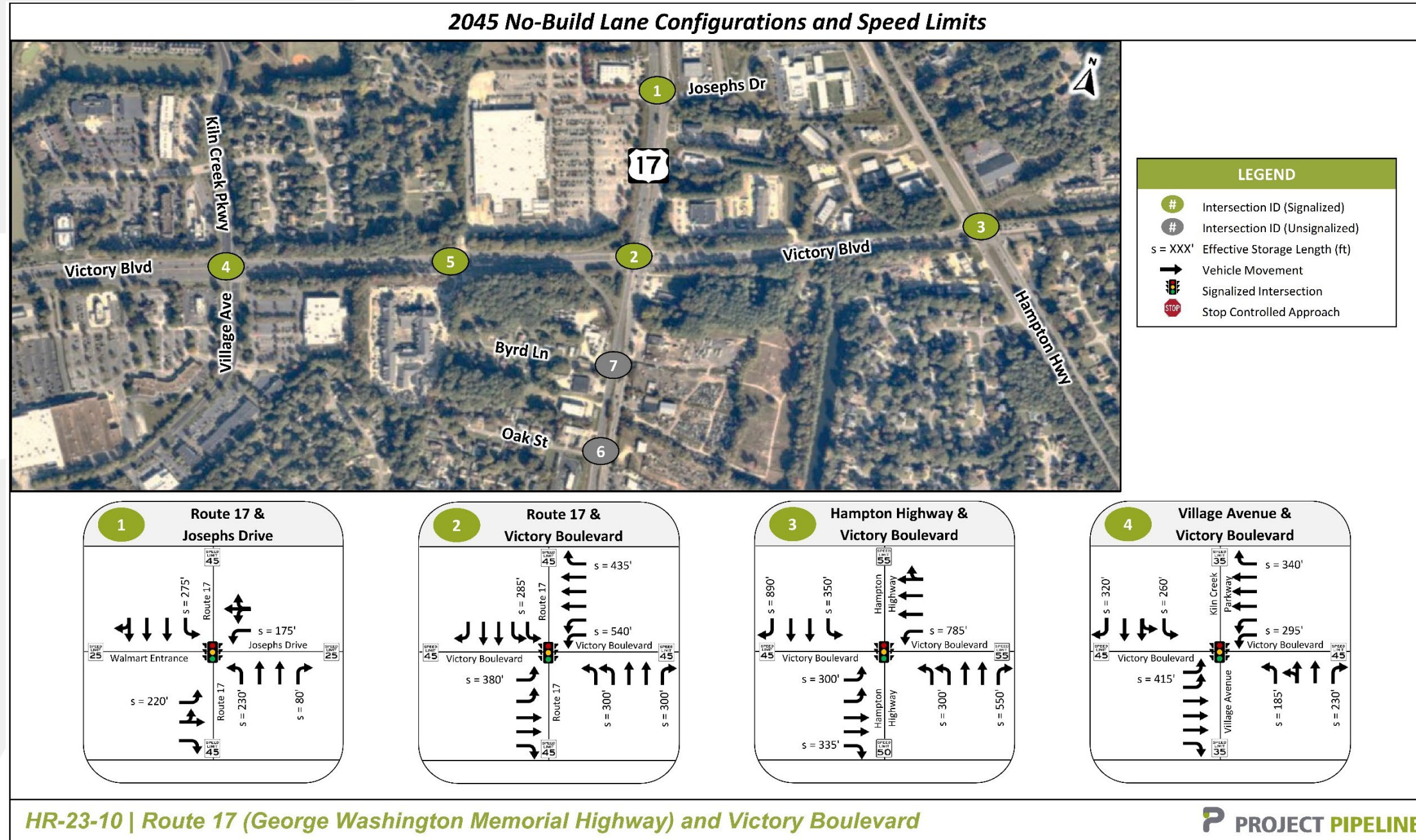


Figure 17: 2045 No-Build Lane Configurations and Speed Limits (2)

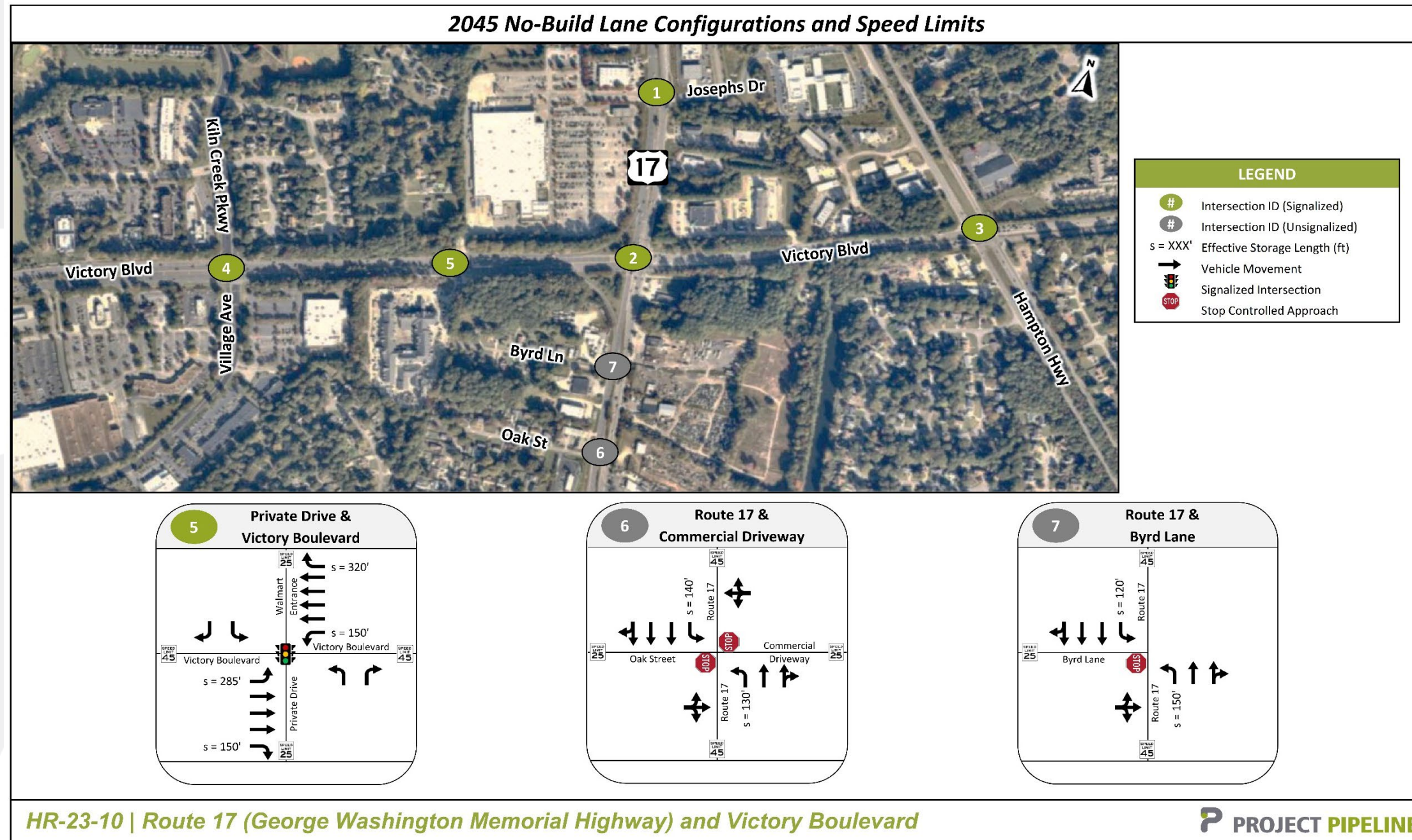


Figure 18: 2045 No-Build Peak Hour Volumes (1)

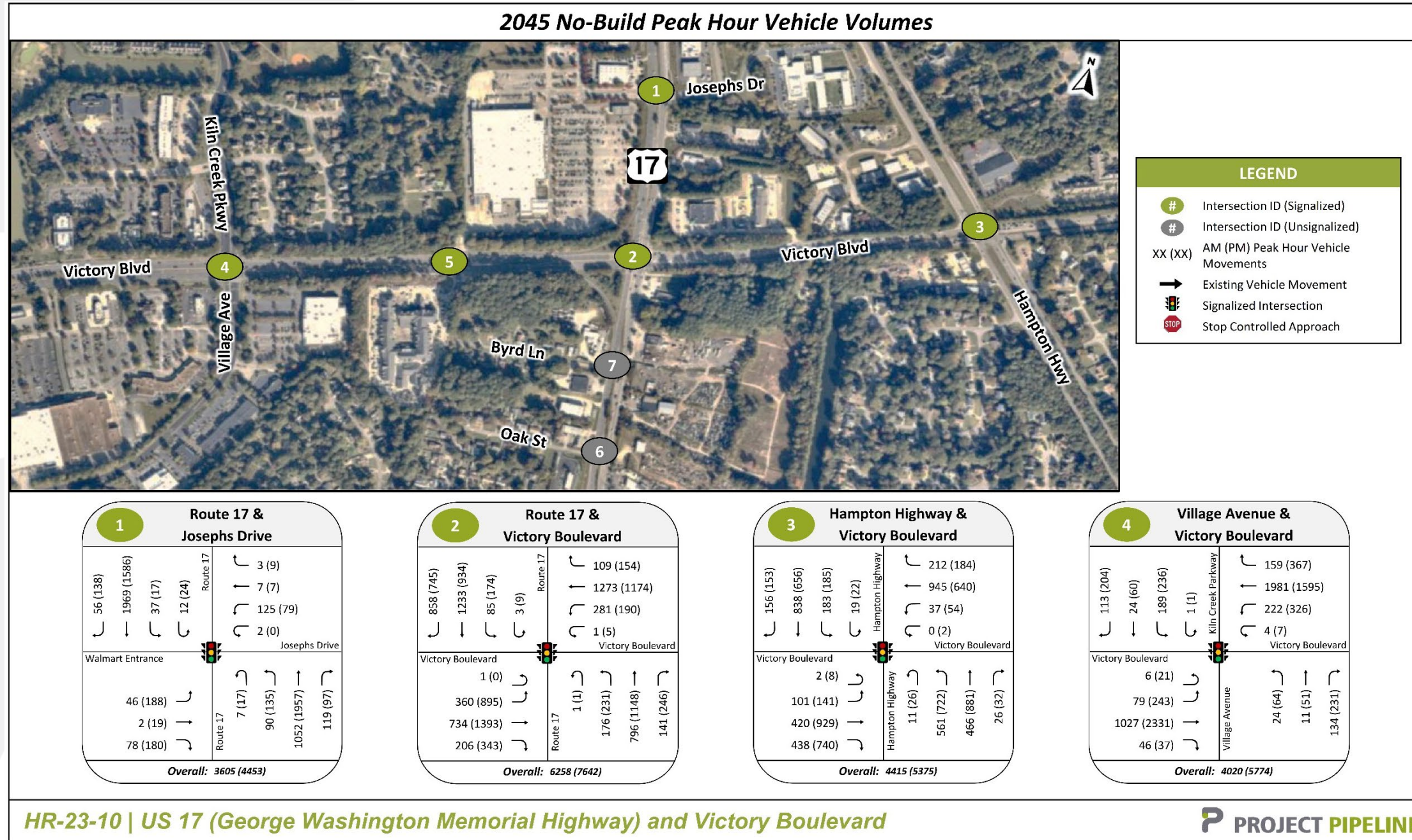
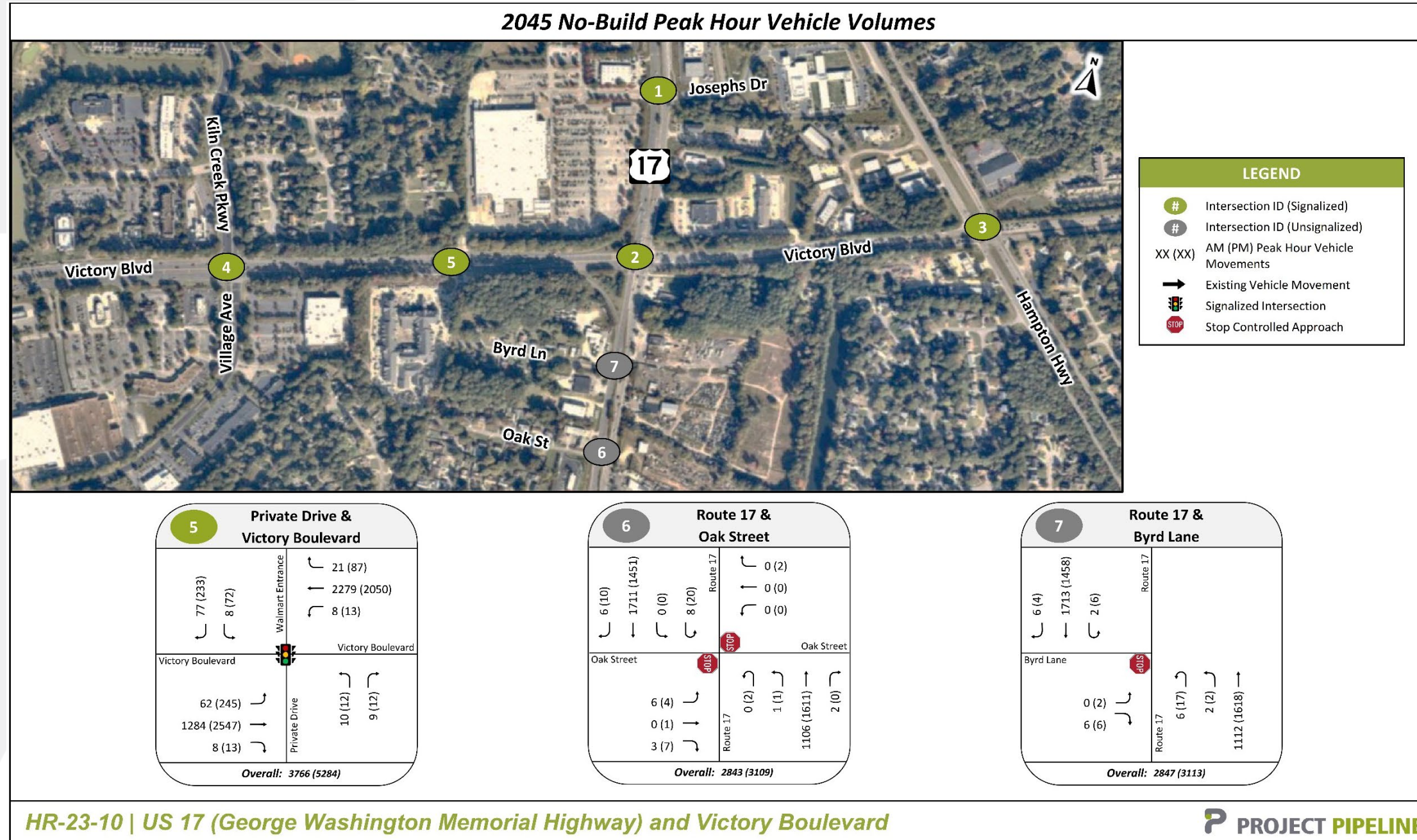


Figure 19: 2045 No-Build Peak Hour Volumes (2)



Synchro and SimTraffic Analysis

Traffic operational analyses were conducted to evaluate the overall performance of the study intersections under No-Build (2045) AM and PM peak hour conditions. The intent of No-Build conditions analyses is to provide a general understanding of the baseline future traffic conditions as a starting point for developing improvement alternatives. No-Build conditions were modeled using Synchro 11 and SimTraffic 11 for the entire study area.

The existing conditions Synchro models were used as a basis to develop the No-Build models for the AM and PM peak hour conditions. The models were updated with the projected 2045 No-Build traffic volumes and the planned improvements throughout the study area. Traffic signal cycle lengths were assumed to be consistent with existing conditions, while splits and offsets were optimized. No-Build inputs and analysis methodologies were applied consistently with *TOSAM*.

Ten simulations were conducted for both the AM and PM No-Build SimTraffic models. Control delay (seconds per vehicle) and maximum queue length (feet) were selected as measures of effectiveness to quantitatively report the performance of each study intersection. The full Synchro and SimTraffic reports are included in **Appendix D** and shown in **Table 8** and **Table 9**.

Similar trends in delay and queuing were observed under No-Build conditions as observed in Existing conditions. Under No-Build conditions, eastbound queuing along Victory Boulevard reduces due to the third eastbound left-turn lane at the Route 17 and Victory Boulevard intersection, however, a larger number of movements operate at LOS E and F than compared to Existing conditions.

The following trends were observed under No-Build conditions during the AM and PM peak hours.

AM Peak Hour

- All approaches at the Route 17 and Victory Boulevard intersection operate at LOS D except for the westbound approach, which operates at LOS E. The highest movement delay occurs with the eastbound left-turn movement, which operates at 95.2 seconds (LOS F).
- The eastbound, northbound, and southbound queues at the Route 17 and Victory Boulevard intersection block upstream intersections for 1%, 4%, and 38% of the analysis period
- The minor approaches at the Route 17 and Josephs Drive intersection operate at LOS E
- The northbound and southbound queues at the Route 17 and Josephs Drive intersection block upstream intersections for 6% and 18% of the analysis period, respectively

- All approaches at the Victory Boulevard and Hampton Highway intersection operate at LOS E with the highest movement delay occurring on the eastbound right-turn movement, which experiences 88.8 seconds (LOS F)
- The minor approaches at the Victory Boulevard and Village Avenue intersection operate at LOS D with the highest movement delay occurring with the westbound left-turn movement, which operates at 67.6 seconds (LOS E)
- The northbound approach at the Victory Boulevard and the Walmart entrance intersection operates at LOS E and the southbound approach operates at LOS D. The highest movement delay occurs with the northbound left-turn movement, which operates at 82.9 seconds (LOS F)
- The eastbound approach at the Route 17 and Oak Street intersection operates at LOS F

PM Peak Hour

- The eastbound and westbound approaches at the Route 17 and Victory Boulevard intersection operate at LOS F with highest movement delay occurring with the westbound right-turn movement, which operates at 158.8 seconds (LOS F)
- The eastbound and northbound queues at the Route 17 and Victory Boulevard intersection block upstream intersections for 5% and 22% of the analysis period, respectively
- The minor approaches at the Route 17 and Josephs Drive intersection operate at LOS E. The highest movement delay occurs with the southbound left-turn movement, which operates at 112.4 seconds (LOS F).
- The eastbound approach at the Victory Boulevard and Hampton Highway intersection operates at LOS C and all other approaches operate at LOS E. The highest movement delay occurs with the westbound left-turn movement, which operates at 108.4 seconds (LOS F).
- The northbound and southbound approaches at the Victory Boulevard and Village Avenue intersection operate at LOS E with the highest movement delay occurring with the southbound left-turn movement, which operates at 93.8 seconds (LOS F)
- The eastbound approach at the Route 17 and Oak Street intersection operates at LOS D
- The southbound left-turn movements at the Route 17 intersections with Byrd Lane and Oak Street both operate at LOS E due to heavy northbound volume and queuing along Route 17

Table 8: 2045 No-Build Conditions Peak Hour Control Delay and LOS

Intersection Number and Description	Type of Control	Lane Group	Eastbound				Westbound				Northbound				Southbound				Overall	
			AM		PM		AM		PM		AM		PM		AM		PM		AM	PM
			Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
1 Route 17 and Josepchs Drive	Signalized	Walmart Entrance				Josepchs Drive				Route 17				Route 17				Intersection		
		Left	57.3	E	89.9	F	59.5	E	86.6	F	27.6	C	50.8	D	9.7	A	112.4	F	Delay	Delay
		Through	57.4*	E*	87.5*	F*	58.9^	E^	73.3^	E^	9.7	A	18.5	B	22.3	C	23.3	C	22.1	30.0
		Right	55.4	E	57.9	E					49.5	D	86.7	F					LOS	LOS
		Approach	56.1	E	74.4	E	59.2	E	80.0	E	14.8	B	23.7	C	22.0	C	25.4	C	C	C
2 Route 17 and Victory Boulevard	Signalized	Victory Boulevard				Victory Boulevard				Route 17				Route 17				Intersection		
		Left	95.2	F	146.1	F	37.4	D	31.8	C	89.8	F	65.8	E	33.1	C	93.9	F	Delay	Delay
		Through	43.0	D	136.5	F	64.5	E	91.4	F	43.6	D	88.9	F	84.7	F	52.3	D	52.0	85.2
		Right	0.2	A	0.2	A	34.4	C	158.8	F	29.6	C	34.5	C	1.2	A	0.8	A	LOS	LOS
		Approach	50.7	D	122.0	F	58.0	E	90.5	F	49.2	D	77.4	E	49.7	D	35.8	D	D	F
3 Victory Boulevard and Hampton Highway	Signalized	Victory Boulevard				Victory Boulevard				Hampton Highway				Hampton Highway				Intersection		
		Left	58.8	E	39.2	D	76.9	E	108.4	F	75.9	E	71.8	E	63.0	E	81.9	F	Delay	Delay
		Through	32.8	C	30.2	C	70.7	E	59.0	E	37.8	D	49.3	D	68.0	E	61.5	E	63.5	52.0
		Right	88.8	F	39.3	D					30.8	C	32.2	C	33.7	C	42.0	D	LOS	LOS
		Approach	61.1	E	34.7	C	70.9	E	62.1	E	58.1	E	59.1	E	62.7	E	62.7	E	E	D
4 Victory Boulevard and Village Avenue	Signalized	Victory Boulevard				Victory Boulevard				Village Avenue				Kiln Creek Parkway				Intersection		
		Left	60.3	E	50.4	D	67.6	E	85.5	F	55.2	E	62.1	E	63.4	E	93.8	F	Delay	Delay
		Through	19.0	B	35.2	D	21.7	C	26.5	C	54.9	D	61.6	E	51.8	D	62.6	E	28.7	42.2
		Right	14.7	B	15.8	B	28.7	C	58.4	E	54.8	D	62.3	E	49.9	D	56.9	E	LOS	LOS
		Approach	21.9	C	36.5	D	26.6	C	40.2	D	54.8	D	62.1	E	54.5	D	67.7	E	C	D
5 Victory Boulevard and Walmart Entrance	Signalized	Victory Boulevard				Victory Boulevard				Private Drive				Walmart Entrance				Intersection		
		Left	64.7	E	63.0	E	4.1	A	15.1	B	82.9	F	60.1	E	65.6	E	76.1	E	Delay	Delay
		Through	1.9	A	7.6	A	11.5	B	14.6	B									10.2	16.0
		Right	3.1	A	3.2	A	3.9	A	8.0	A	54.4	D	66.6	E	51.6	D	50.6	D	LOS	LOS
		Approach	4.8	A	12.4	B	11.4	B	14.4	B	69.3	E	63.3	E	53.0	D	56.7	E	B	B
6 Route 17 and Oak Street	Unsignalized	Byrd Lane				Private Drive				Route 17				Route 17				Intersection		
		Left								15.7	C	23.5	C	19.4	C	40.5	E	Delay	Delay	
		Through	50.3	F	32.4	D	0.0	A	16.6	C	+	+	+	+	+	+	+	+	-	-
		Right																	LOS	LOS
		Approach	50.3	F	32.4	D	0.0	A	16.6	C	0.0	A	0.0	A	0.1	A	0.5	A	-	-
7 Route 17 and Byrd Lane	Unsignalized	Oak Street								Route 17				Route 17				Intersection		
		Left	23.3	C	25.9	D					21.6	C	16.2	C	19.6'	C'	37.8'	E'	Delay	Delay
		Through									+	+	+	+	+	+	+	+	-	-
		Right	&	&	&	&									+	+	+	+	LOS	LOS
		Approach	23.3	C	25.9	D					0.2	A	0.2	A	0.0	A	0.2	A	-	-

- Denotes the overall intersection is stop controlled and no level of service or delay is reported
 † SYNCHRO does not provide level of service or delay for movements with no conflicting volumes
 * Lane group is a shared left/through movement
 ^ Lane group is a shared left/through/right movement
 & Lane group is a shared left/right movement
 ' Level of service or delay is for a U-turn movement

Table 9: 2045 No-Build Conditions Peak Hour Maximum Queue

Intersection Number and Description	Type of Control	Lane Group	Maximum Queue							
			Eastbound		Westbound		Northbound		Southbound	
			AM	PM	AM	PM	AM	PM	AM	PM
1 Route 17 and Josephs Drive	Signal		Walmart Entrance		Josephs Drive		Route 17		Route 17	
		Left	70	** (2%)	** (2%)	** (1%)	*(40%) ** (34%)	*(1%) ** (10%)	** (41%)	** (1%)
		Through	135*	220*	215^	145^	^(6%)	475	^(18%)	365
Right	115	140	** (11%)	** (21%)						
2 Route 17 and Victory Boulevard	Signal		Victory Boulevard		Victory Boulevard		Route 17		Route 17	
		Left	*(12%)	*(25%)	185	120	** (9%)	*(1%) ** (43%)	** (64%)	** (11%)
		Through	^(1%)	^(5%)	450	460	^(4%)	^(22%)	^(38%)	435
	Right	†	†	** (1%)	** (3%)	** (10%)	*(1%) ** (43%)	†	†	
3 Victory Boulevard and Hampton Highway	Signal		Victory Boulevard		Victory Boulevard		Hampton Highway		Hampton Highway	
		Left	95	** (16%)	90	100	*(3%) ** (2%)	*(6%) ** (8%)	** (2%)	** (1%)
		Through	235	390	390	275	445	460	430	320
Right	355	340	0	0			125	80		
4 Victory Boulevard and Village Avenue	Signal		Victory Boulevard		Victory Boulevard		Village Avenue		Kiln Creek Parkway	
		Left	110	** (7%)	** (5%)	** (5%)	15	55	180	215
		Through	235	520	575	420	75	135	215	140
	Right	45	25	35	45	115	*(1%) ** (1%)	†	†	
5 Victory Boulevard and Walmart Entrance	Signal		Victory Boulevard		Victory Boulevard		Private Drive		Walmart Entrance	
		Left	** (2%)	185	** (1%)	** (9%)	55	35	40	90
		Through	430	205	475	270				
	Right	** (3%)	** (3%)	30	45	0	0	130	230	
6 Route 17 and Oak Street	Signal		Byrd Lane		Private Drive		Route 17		Route 17	
		Left	40	20	0	10	** (3%)	5	30	35
		Through					†	†	†	†
Right										
7 Route 17 and Byrd Lane	Signal		Oak Street				Route 17		Route 17	
		Left	50	25			** (4%)	** (6%)	20'	15'
		Through					†	†	†	†
	Right	&	&					†	†	

† No queue reported. Movement does not have conflicting volumes
*(X%) - Maximum queue extends full length of storage bay for X% of the analysis period
**(Y%) - Queue in lane adjacent to storage bay extends beyond end of storage bay for Y% of the analysis period
^(Z%) - Maximum queue extends back to the upstream intersection for Z% of the analysis period
* Lane group is a shared left/through movement
^ Lane group is a shared left/through/right movement
& Lane group is a shared left/right movement
' Queue is for a U-turn movement

2 Alternatives Development & Refinement

The study team developed alternative concepts for the Route 17 and Victory Boulevard intersection to address safety, geometric, and operational deficiencies in the study area.

The study team screened alternatives based on anticipated safety benefits, operational performance, constructability, and input from the SWG. A SWG meeting was held on December 14, 2023 to review preliminary alternatives. The meeting materials can be found in **Appendix E**. The study team selected four alternatives to present to the public and gather feedback. For more information on how the following concepts operate, visit the [VDOT Innovative Intersection website](#).

2.1 Phase 1 Alternative Development

The study team developed preliminary alternatives in parallel with the high-level needs diagnosis efforts documented in **Chapter 1.5**. The proposed Phase 1 alternatives were developed to improve operations and mitigate safety issues at the study intersection. The following sections describe the process used to develop Phase 1 alternatives encompassing various categories of needs.

2.1.1 Alternatives Addressing Traffic Operations and Safety Needs

The study team conducted a high-level traffic operations and safety analysis of the Route 17 and Victory Boulevard intersection using the Virginia Junction Screening Tool (VJuST) and the developed 2045 No-Build peak hour traffic volumes. The VJuST analysis looked at innovative intersection configurations with the potential to reduce congestion and improve safety. **Figure 20** and **Figure 21** show the Stage 1 iCAP results for all alternatives analyzed, including the four alternatives chosen to move forward for further refinement. **Table 10** and **Table 11** summarize VJuST findings for the four alternatives.

In existing conditions, the Route 17 and Victory Boulevard intersection experiences heavy queuing in the southbound direction during the AM peak hour and in the northbound, eastbound, and westbound directions during the PM peak hour. The largest crash contributor between 2018 and 2022 was congestion, with 24% of crashes at the intersection citing congestion or stop and go traffic. Of the congestion-related crashes, the eastbound approach accounted for 35% and the southbound approach accounted for 30%.

Figure 20: 2045 AM Peak Hour Stage 1 iCAP Results

Stage 1: Alternatives Screening Performance Matrix

Alternative	Traffic Operations Metric		Pedestrian Metric		Safety Metric		Stage 1 Cost Metric		Total Stage 1 Score	Selected for Stage 2 Analysis?	
	VJuST Maximum V/C Ratio	Score	Accommodation	Score	Conflict Points	Score	Cost Category	Score			
Base Condition	0.88	--	0.00	--	48	--		--			
Conventional	0.70	1.0	0	0.5	48	0.0	\$	1.0	4.5 out of 8	Yes	Improved traffic operations
Bowtie NB-SB	2.01	0.0	+	1.0	24	0.6	\$\$\$	0.3	3.1 out of 8	No	Traffic operations are not improved
Full Displaced Left Turn	0.83	0.3	-	0.0	40	0.2	\$\$\$	0.3	1.8 out of 8	Yes	Improved traffic operations
Median U-Turn NB-SB	0.82	0.3	+	1.0	20	0.7	\$\$	0.5	4.5 out of 8	No	Traffic operations are not improved in the PM peak hour
Partial Displaced Left Turn NB-SB	0.78	0.6	-	0.0	44	0.1	\$\$\$	0.3	2.4 out of 8	Yes	Improved traffic operations
Partial Median U-Turn NB-SB	0.75	0.7	+	1.0	28	0.5	\$\$	0.5	5.1 out of 8	Yes	Improved traffic operations
Quadrant Roadway N-W	1.01	0.0	0	0.5	40	0.2	\$\$\$	0.3	1.4 out of 8	No	Extensive ROW impacts
Single Loop	0.79	0.5	-	0.0	28	0.5	\$\$\$	0.3	3.3 out of 8	No	Extensive ROW impacts
Split Intersection	0.89	0.0	0	0.5	36	0.3	\$\$\$	0.3	1.7 out of 8	No	Extensive ROW impacts
Roundabout	2.93	0.0	0	0.5	8	1.0	\$\$	0.5	4 out of 8	No	Traffic operations are not improved
Metric Weighting	3		1		3		1				

Figure 21: 2045 PM Peak Hour Stage 1 iCAP Results

Stage 1: Alternatives Screening Performance Matrix

Alternative	Traffic Operations Metric		Pedestrian Metric		Safety Metric		Stage 1 Cost Metric		Total Stage 1 Score	Selected for Stage 2 Analysis?	
	VJuST Maximum V/C Ratio	Score	Accommodation	Score	Conflict Points	Score	Cost Category	Score			
Base Condition	1.09	--	0.00	--	48	--		--			
Conventional	0.75	1.0	0	0.5	48	0.0	\$	1.0	4.5 out of 8	Yes	Improved traffic operations
Bowtie NB-SB	1.62	0.0	+	1.0	24	0.6	\$\$\$	0.3	3.1 out of 8	No	Traffic operations are not improved
Full Displaced Left Turn	0.80	0.9	-	0.0	40	0.2	\$\$\$	0.3	3.6 out of 8	Yes	Improved traffic operations
Median U-Turn NB-SB	1.17	0.0	+	1.0	20	0.7	\$\$	0.5	3.6 out of 8	No	Traffic operations are not improved
Partial Displaced Left Turn NB-SB	0.81	0.8	-	0.0	44	0.1	\$\$\$	0.3	3 out of 8	Yes	Improved traffic operations
Partial Median U-Turn NB-SB	0.92	0.5	+	1.0	28	0.5	\$\$	0.5	4.5 out of 8	Yes	Improved traffic operations
Quadrant Roadway N-W	0.93	0.5	0	0.5	40	0.2	\$\$\$	0.3	2.9 out of 8	No	Extensive ROW impacts
Single Loop	0.83	0.8	-	0.0	28	0.5	\$\$\$	0.3	4.2 out of 8	No	Extensive ROW impacts
Split Intersection	0.87	0.6	0	0.5	36	0.3	\$\$\$	0.3	3.5 out of 8	No	Extensive ROW impacts
Roundabout	5.92	0.0	0	0.5	8	1.0	\$\$	0.5	4 out of 8	No	Traffic operations are not improved
Metric Weighting	3		1		3		1				

Conventional

Figure 22 shows the addition of a northbound, southbound, and eastbound through lane as well as a third eastbound left-turn lane. A second westbound left-turn lane has been previously planned for the intersection. All other approach laneage will remain the same.

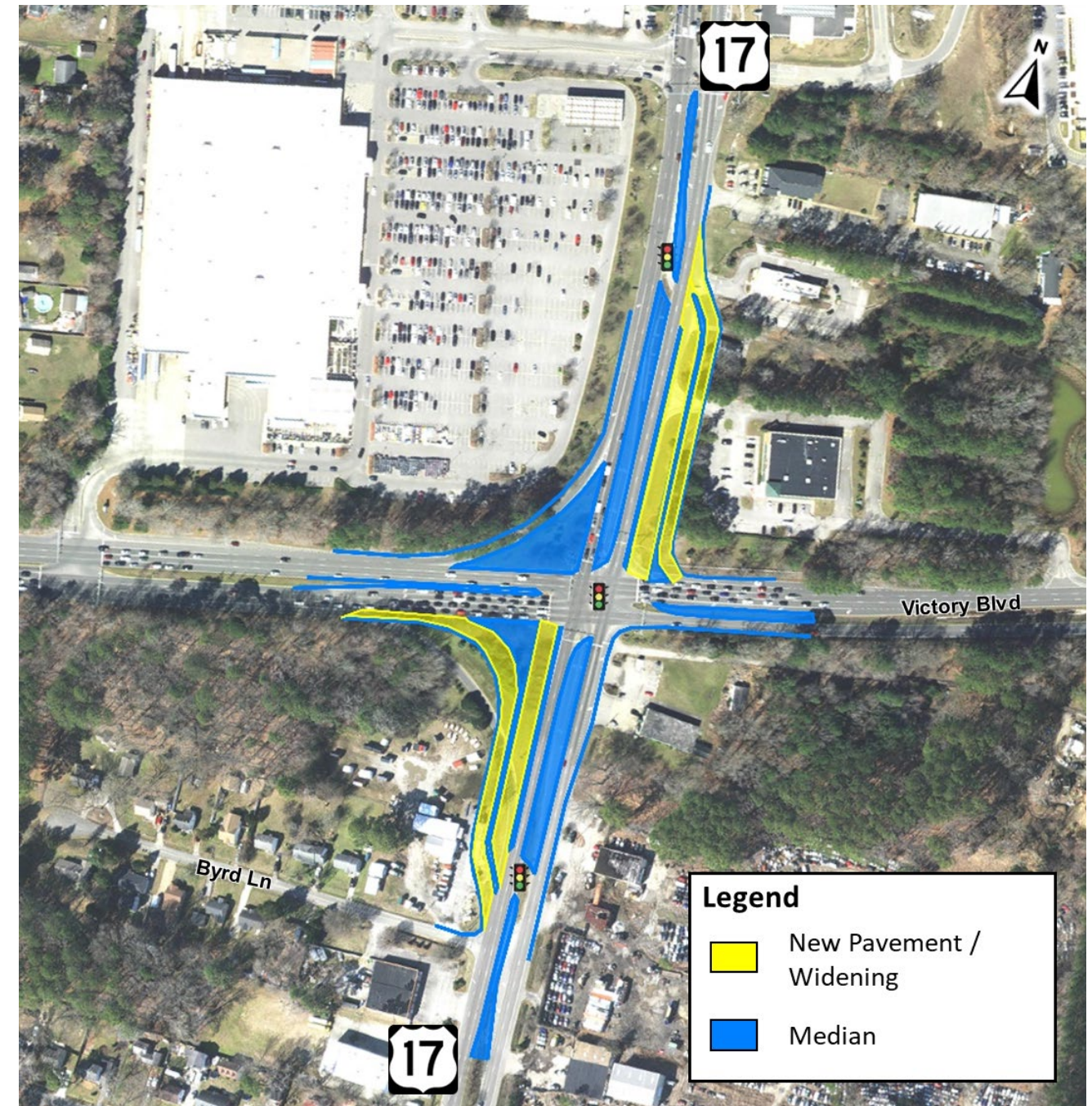
Figure 22: Phase 1 Alternative – Conventional



Partial Displaced Left Turns

Figure 23 shows the north- and southbound left-turn movements being displaced to the two additional signalized intersections in advance of the main intersection.

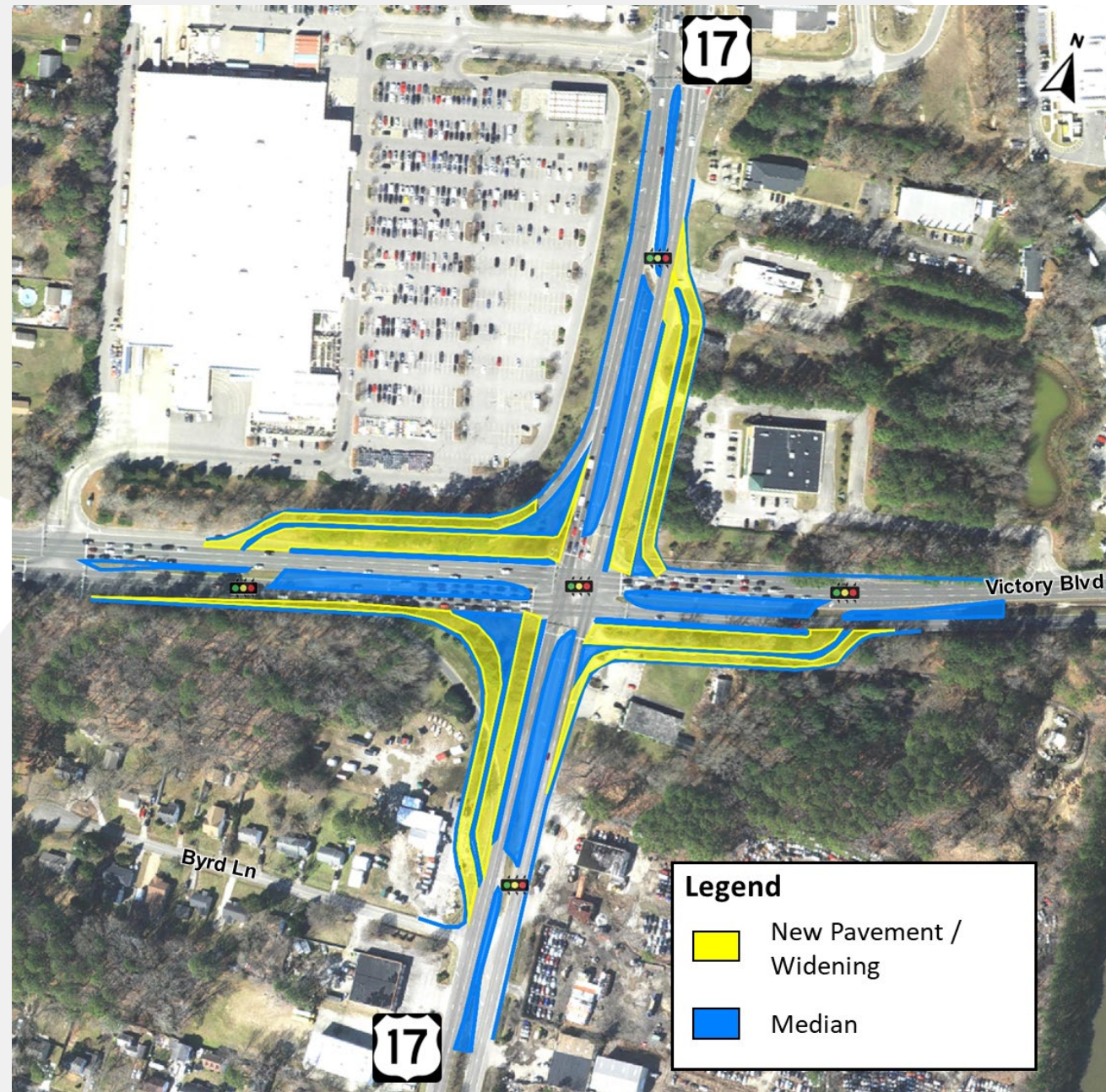
Figure 23: Phase 1 Alternative – Partial Displaced Left-Turns



Full Displaced Left Turns

Figure 24 shows all left-turn movements being displaced to the four additional signalized intersections in advance of the main intersection.

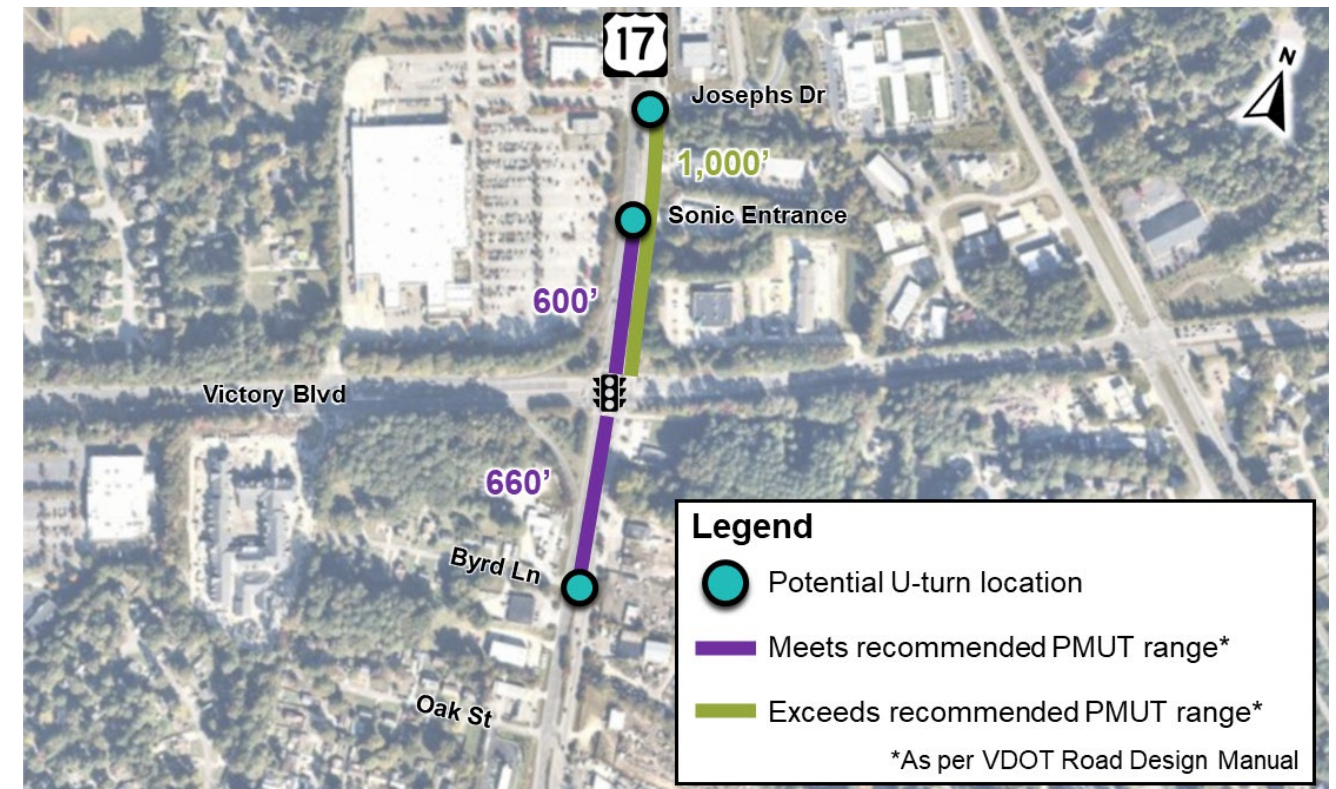
Figure 24: Phase 1 Alternative – Full Displaced Left Turns



Partial Median U-Turn

Figure 25 shows north- and southbound left-turn movements rerouted to u-turn movements downstream of the main intersection. Two potential northbound u-turn locations were considered; the Sonic entrance is within the distance from the main intersection recommended in the VDOT Road Design Manual, but the impact of the rerouted u-turn vehicles on the Sonic make it a challenging u-turn location. The existing Josephs Drive intersection presents fewer conflicting traffic volume challenges but exceeds the recommended distance from the main intersection.

Figure 25: Phase 1 Alternative – Partial Median U-Turn



2.1.2 Phase 1 Alternatives Summary

The study team discussed further details of the Phase 1 improvement alternatives during the Existing Volumes, Traffic Forecasting, and Concept Development meeting held with the SWG on December 14, 2023. The SWG agreed to advance all four alternatives to Phase 2.

Table 10: 2045 AM Peak Hour VJuST Results

Concept	Maximum V/C	Weighted Total Conflict Points	Planning Level Cost Category
Conventional	0.70	48	\$
Partial Displaced Left Turn	0.78	44	\$\$\$
Full Displaced Left Turn	0.83	40	\$\$\$
Partial Median U-Turn	0.75	28	\$\$

Table 11: 2045 PM Peak Hour VJuST Results

Concept	Maximum V/C	Weighted Total Conflict Points	Planning Level Cost Category
Conventional	0.75	48	\$
Partial Displaced Left Turn	0.81	44	\$\$\$
Full Displaced Left Turn	0.80	40	\$\$\$
Partial Median U-Turn	0.92	28	\$\$

2.2 Phase 2 Alternatives Analysis and Refinement

The study team conducted a screening-level traffic operations analysis using Synchro 11 on the four intersection concepts mentioned previously. The concepts were also evaluated using the Intersection and Interchange Control Assessment Program (iCAP) tool. A SWG meeting was held on February 9, 2024 to review the revised concepts and to share the concept screening results before the public outreach. During the concept screening results meeting, the study team discussed each alternative based on impacts to safety, traffic operations, cost, and right-of-way impacts. The presentation and detailed concept benefits are included in **Appendix E**.

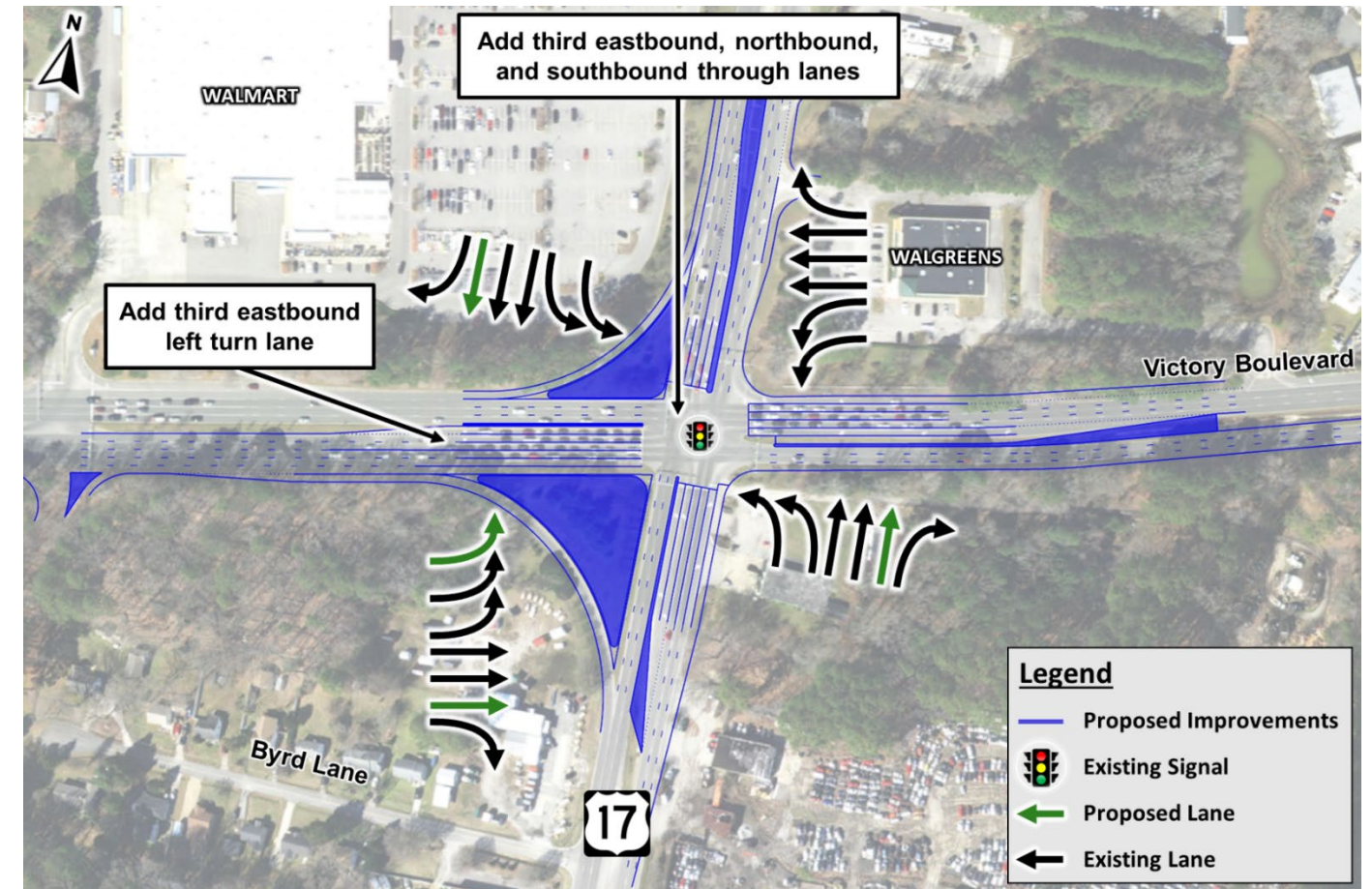
2.2.1 Intersection Alternatives Analysis

The following report sections present the details for each analyzed alternative.

Conventional

The Conventional concept will add a through lane to the eastbound, northbound, and southbound approaches and a third eastbound left-turn lane at the Route 17 and Victory Boulevard intersection. **Figure 26** presents a conceptual sketch of the alternative.

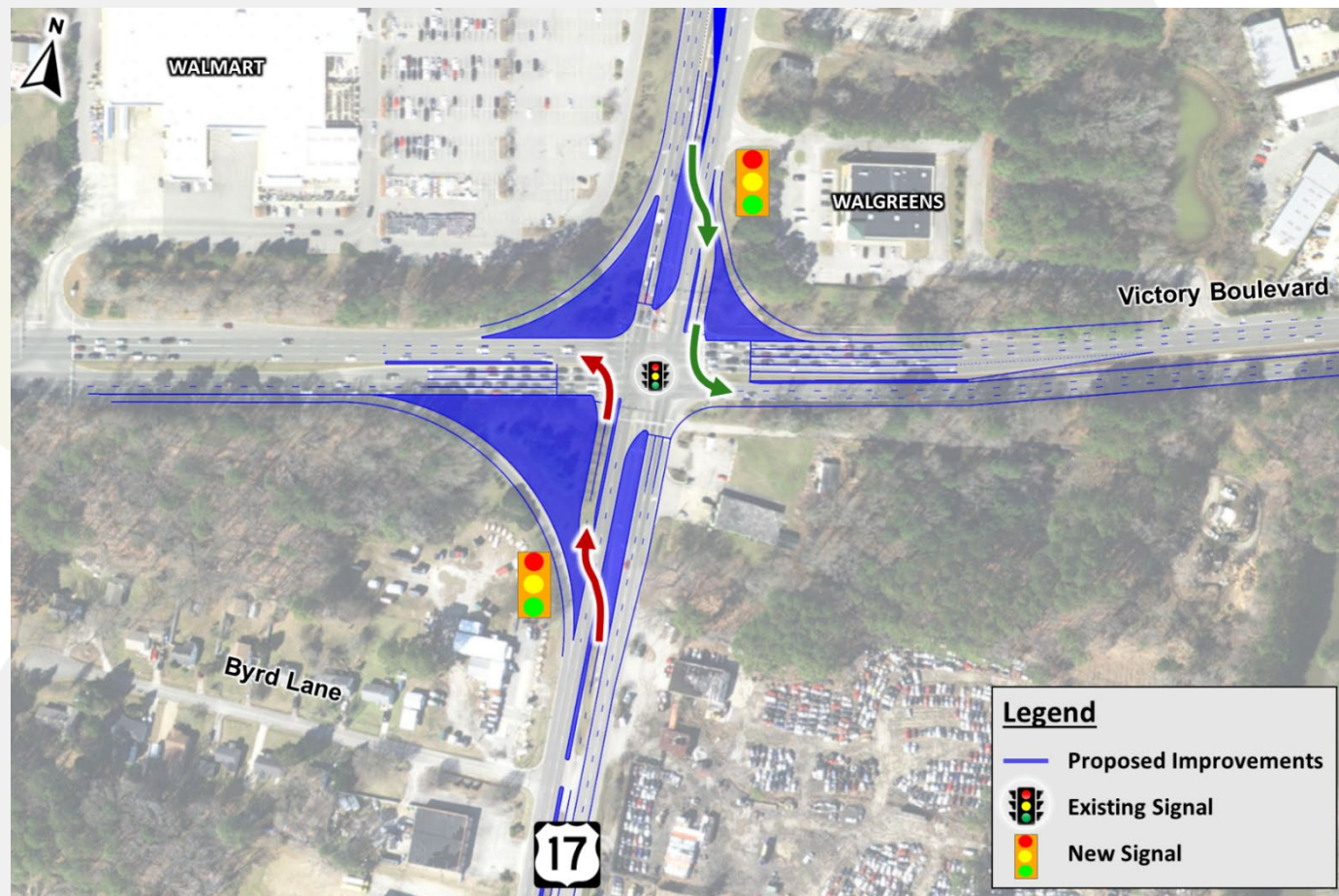
Figure 26: Phase 2 Alternative – Conventional



Partial Displaced Left Turns

The Partial Displaced Left Turns concept will allow left turns and through movements on Route 17 to occur simultaneously by displacing the left-turn movements upstream of the main intersection. Two additional traffic signals will be constructed on Route 17 to accommodate the left-turn movements. Left turns from Victory Boulevard will still be permitted. **Figure 27** presents a conceptual sketch of the alternative.

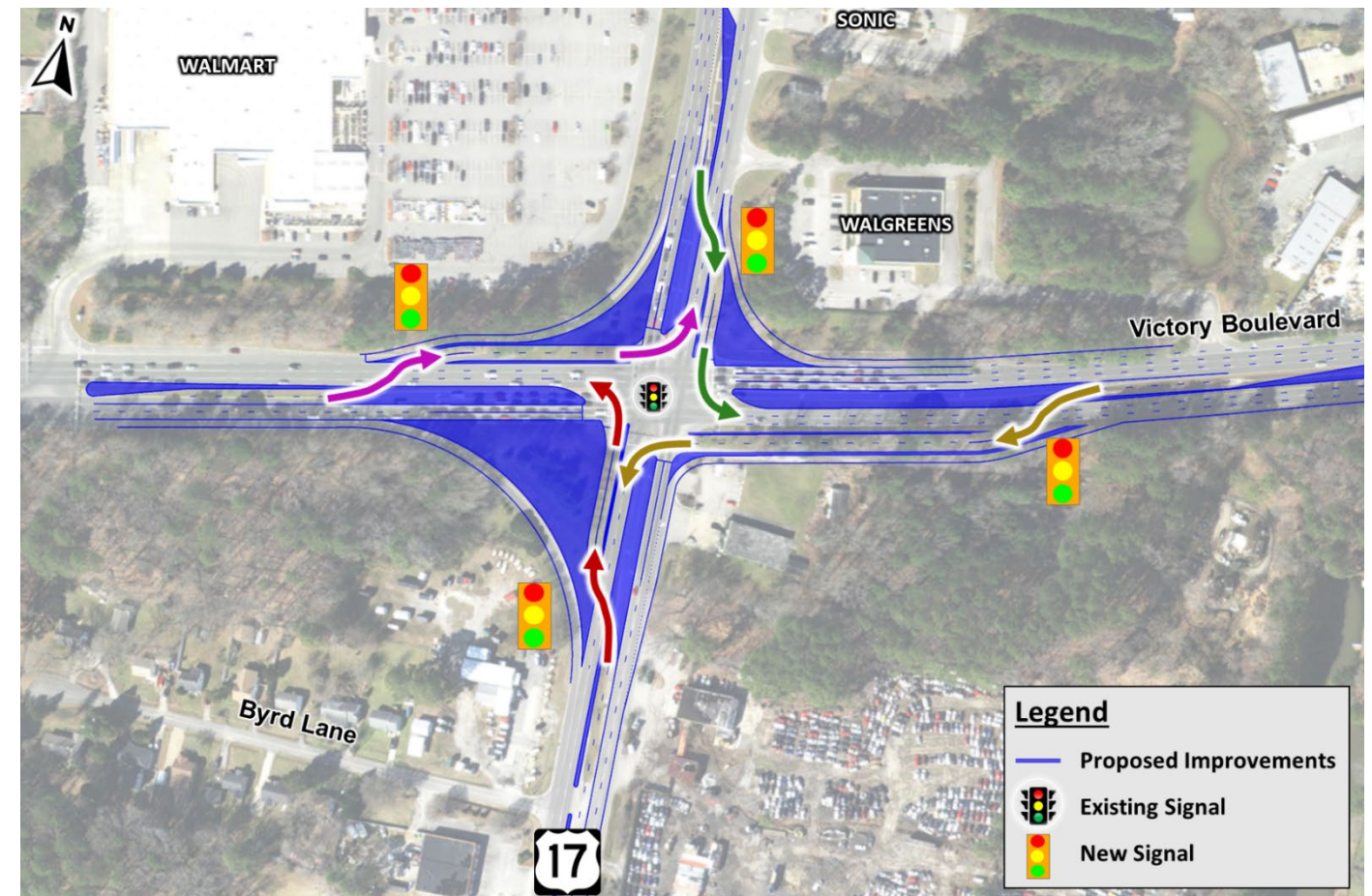
Figure 27: Phase 2 Alternative – Partial Displaced Left Turns



Full Displaced Left Turns

The Full Displaced Left Turns concept will allow left turns and through movements on Route 17 and Victory Boulevard to occur simultaneously by displacing the left-turn movements upstream of the main intersection. Four additional traffic signals will be constructed along Route 17 and Victory Boulevard to accommodate the left-turn movements. **Figure 28** presents a conceptual sketch of the alternative.

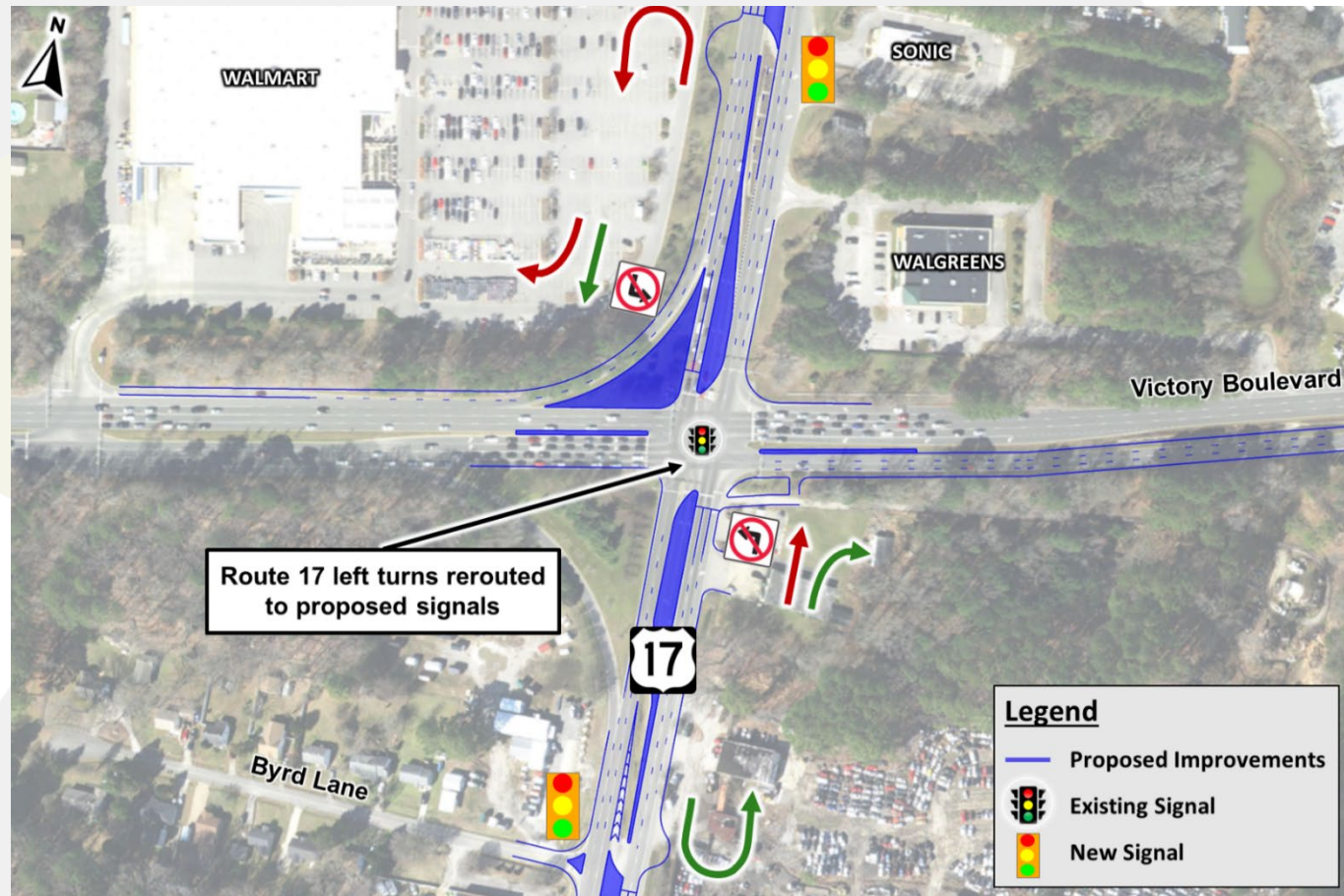
Figure 28: Phase 2 Alternative – Full Displaced Left Turns



Partial Median U-Turn

The Partial Median U-Turn concept will reroute north- and southbound left-turn movements to signalized u-turns along Route 17 downstream of the main intersection. Two additional signals will be constructed along Route 17 to accommodate the u-turn movements. Left turns from Victory Boulevard will still be permitted. **Figure 29** presents a conceptual sketch of the alternative.

Figure 29: Phase 2 Alternative –Partial Median U-Turn



2.2.2 Phase 2 Alternative Screening Summary

The primary goal of the Phase 2 alternatives development effort was to prepare a refined set of alternatives to present to the public and solicit feedback. The study team used the iCAP tool to compare each alternative across several metrics including traffic operations, pedestrian access, safety, and cost to determine the refined list of concepts to present to the public. The Stage 2 iCAP results are shown in **Figure 30** and **Figure 31**.

Figure 30: 2045 AM Peak Hour Stage 2 iCAP Results

Stage 2: Alternatives Assessment Performance Matrix

MOE 1: Control Delay

MOE 2: 95th Percentile Queue Length

Alternative	Traffic Operations Metric			Pedestrian Metric Score	Safety Metric		Stage 2 Cost Metric		Total Stage 2 Score	Preferred Alternative?
	MOE 1 Score	MOE 2 Score	Total Score		Annual F+I Crash Reduction	Score	VJuST-C Cost Estimate	Score		
Conventional	0.8		0.8	0.5	1.18	1.0	\$ 5,750,000	1.0	6.9 out of 8	Yes: Improves operations and safety for the lowest cost
Full Displaced Left Turn	1.0		1.0	0.0	0.68	0.6	\$ 26,500,000	0.2	5 out of 8	No: Most expensive
Partial Displaced Left Turn NB-SB	0.9		0.9	0.0	0.51	0.4	\$ 19,500,000	0.3	4.2 out of 8	No: Lowest safety improvement
Partial Median U-Turn NB-SB	0.6		0.6	1.0	1.01	0.9	\$ 10,750,000	0.5	6 out of 8	No: Lowest operational improvement
Metric Weighting	3			1	3		1			

Figure 31: 2045 PM Peak Hour Stage 2 iCAP Results

Stage 2: Alternatives Assessment Performance Matrix

MOE 1: Control Delay

MOE 2: 95th Percentile Queue Length

Alternative	Traffic Operations Metric			Pedestrian Metric Score	Safety Metric		Stage 2 Cost Metric		Total Stage 2 Score	Preferred Alternative?
	MOE 1 Score	MOE 2 Score	Total Score		Annual F+I Crash Reduction	Score	VJuST-C Cost Estimate	Score		
Conventional	1.0		1.0	0.5	1.18	1.0	\$ 5,750,000	1.0	7.5 out of 8	Yes: Improves operations and safety for the lowest cost
Full Displaced Left Turn	0.9		0.9	0.0	0.68	0.6	\$ 26,500,000	0.2	4.7 out of 8	No: Most expensive, queues are not acceptable
Partial Displaced Left Turn NB-SB	0.7		0.7	0.0	0.51	0.4	\$ 19,500,000	0.3	3.6 out of 8	No: Lowest safety improvement, queues are not acceptable
Partial Median U-Turn NB-SB	0.5		0.5	1.0	1.01	0.9	\$ 10,750,000	0.5	5.7 out of 8	No: Lowest operational improvement
Metric Weighting	3			1	3		1			

3 Public & Stakeholder Outreach & Feedback

The Project Pipeline process involved targeted outreach and stakeholder input for the alternative concepts in the study area. The study team developed concept sketches, prepared presentation materials, and created a public survey to receive feedback from project stakeholders.

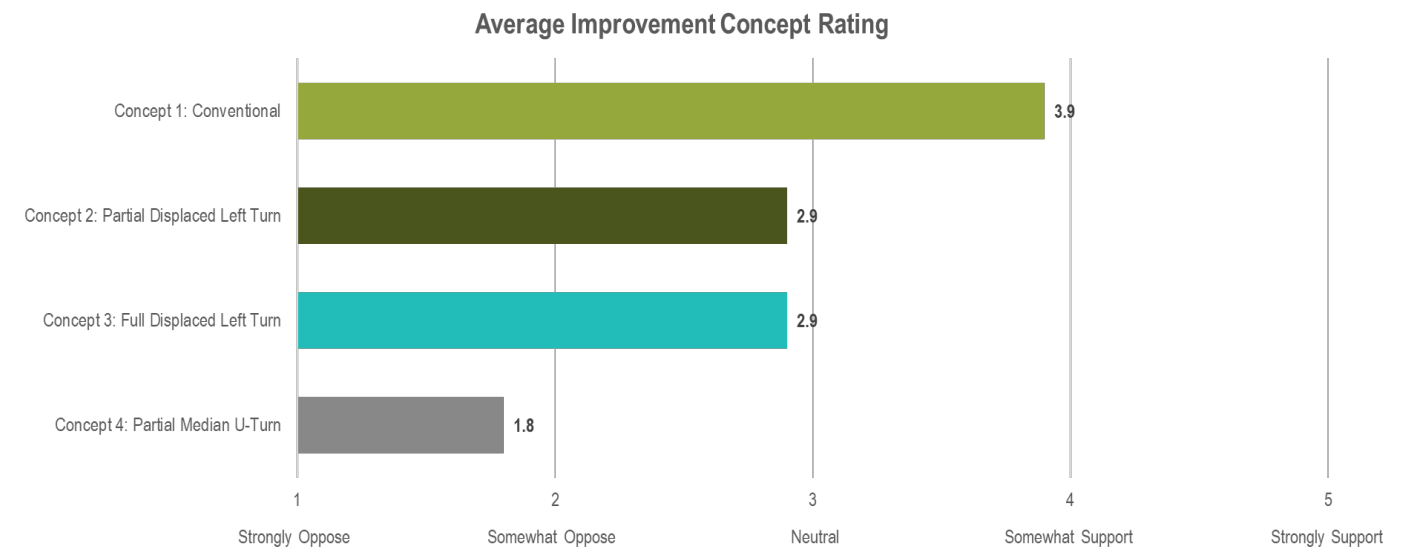
3.1 Stakeholder Coordination

Stakeholder coordination and engagement is important when creating and refining the study recommendations from more than a traffic operation standpoint. The stakeholders provide regional and local knowledge about the study area and help guide the study direction. The project stakeholders identified in **Chapter 1.3** were involved in all steps of the Project Pipeline process and assisted in making decisions about which concepts to advance to public engagement.

3.2 Public Involvement

A PublicInput survey was open from March 8 to March 22, 2024 to collect public feedback on potential improvements within the study corridor. The survey provided York County, VDOT, and Kimley-Horn with an understanding of how the public viewed each concept before selecting a preferred option. **Figure 32** summarizes the average ranking for each alternative at the intersection of Route 17 and Victory Boulevard. A rating of 5.0 represents a strongly supported concept and a rating of 1.0 represents a strongly opposed concept.

Figure 32: Public Engagement – Average Rating of Alternatives



As shown in **Figure 32**, the public most highly supported the conventional concept with an average rating of 3.9. **Figure 33** summarizes the public rating on the conventional concept. Of the 1,922 respondents, 72% were in support of this concept. Some respondents expressed concern for widening Route 17 and Victory Boulevard. Additionally, many respondents expressed support for the concept because of its simplicity and expressed concern with innovative intersection concepts due to their complexity and possible confusion for roadway users. Detailed survey results are shown in **Appendix E**.

The study team incorporated input from the survey to finalize the preferred alternative. Rankings from the public involvement survey were consistent with the study work group preferences.

Kimley-Horn presented the PublicInput survey results to the study work group on March 25, 2024. During this meeting, Kimley-Horn suggested a set of alternatives to advance to the development of a preferred alternative as outlined in **Chapter 2.2**. After reviewing the survey results and further discussing the concepts, the study group decided to advance the conventional concept, shown in **Figure 34**, as the preferred alternative. **Appendix E** includes presentation materials from the Preferred Alternatives meeting.

Figure 33: Public Engagement – Conventional Concept Ratings

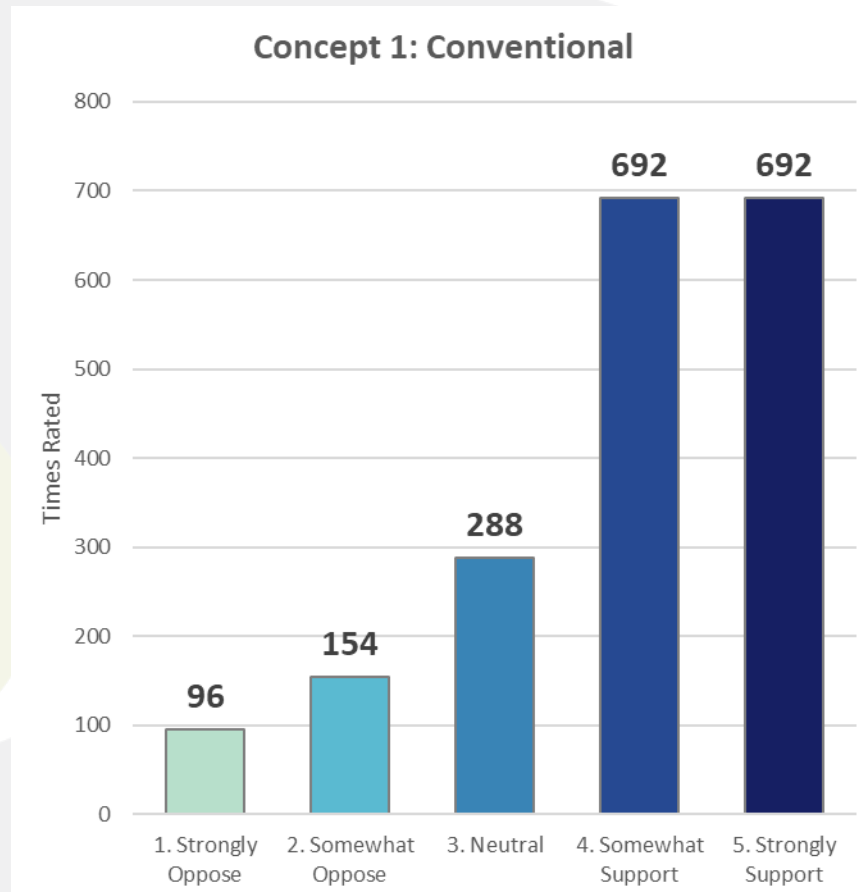
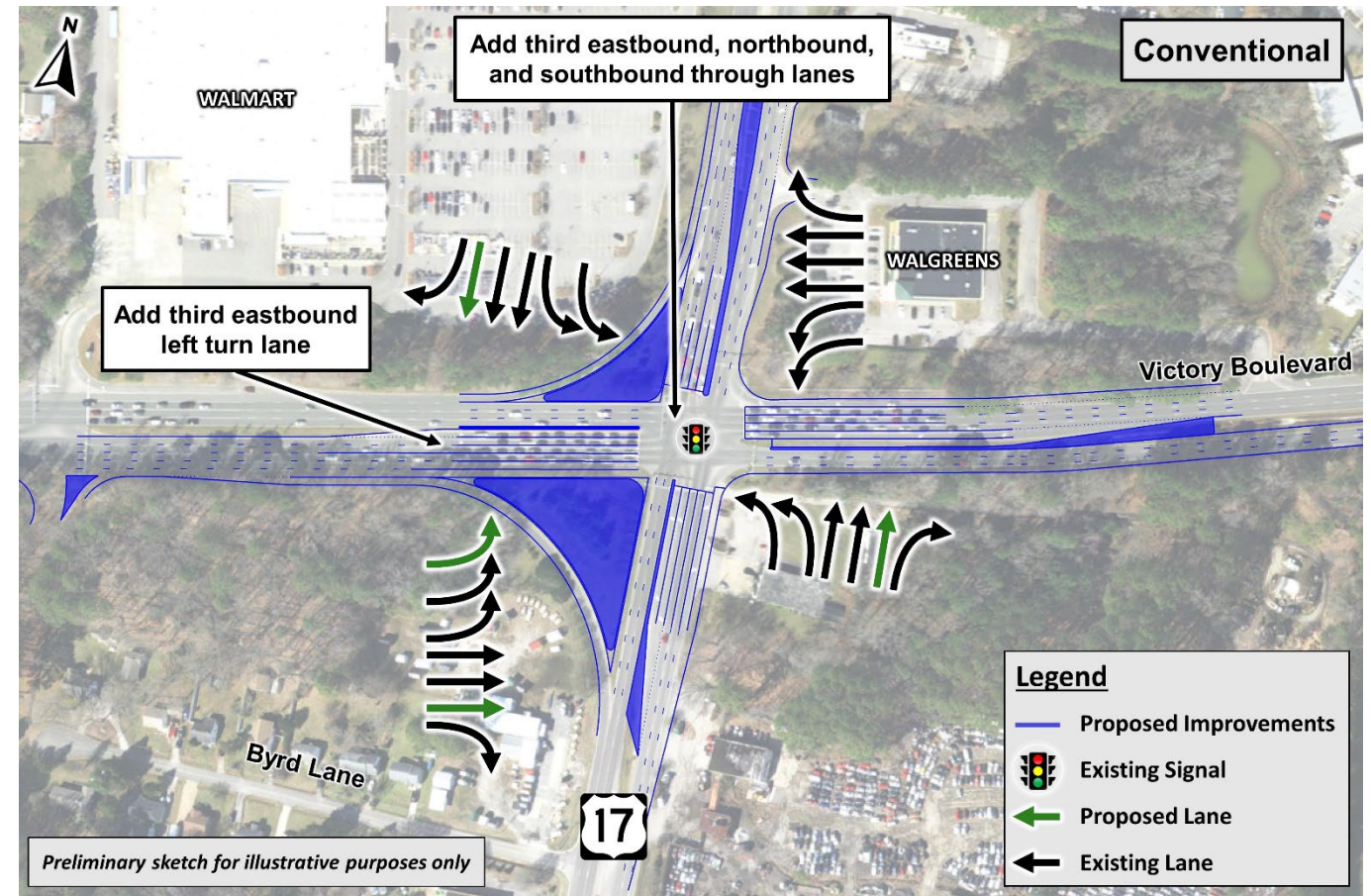


Figure 34: Conventional Concept – Preferred Alternative



4 Preferred Alternative & Investment Strategy

Phase 3 of the study included a detailed design, cost estimate, risk assessment, and further operations assessment of the selected preferred alternative.

4.1 Preferred Alternative Selection

The study work group selected the preferred alternative during the PublicInput Survey Results meeting. Following the meeting, the study team made several refinements to the preferred alternative informed by a second field visit conducted on June 4, 2024, a Phase 3 Risk Workshop held on June 12, 2024, and a concept refinement meeting held on June 24, 2024. The study team evaluated several alignment and laneage options for eastbound Victory Boulevard as it approaches Route 17.

The initial concept included the conversion of two of the four eastbound Victory Boulevard lanes into left-turn lanes at the Route 17 and Victory Boulevard intersection, which could potentially cause challenging merging and weaving maneuvers and uneven lane utilization for vehicles destined for eastbound Victory Boulevard beyond the Route 17 intersection. The study team refined the concept to add a shared through-right lane at the Victory Boulevard and the Walmart entrance/Assisted Living Community intersection to provide additional through capacity and reduce the need for vehicles to change lanes between the Walmart entrance/Assisted Living Community and Route 17. The updated concept would also convert the existing eastbound right-turn only lane at the Victory Boulevard and Kiln Creek Parkway/Village Avenue intersection to a shared through-right lane that would convert to the proposed additional through lane between Kiln Creek Parkway/Village Avenue and the Walmart Entrance/Assisted Living Community.

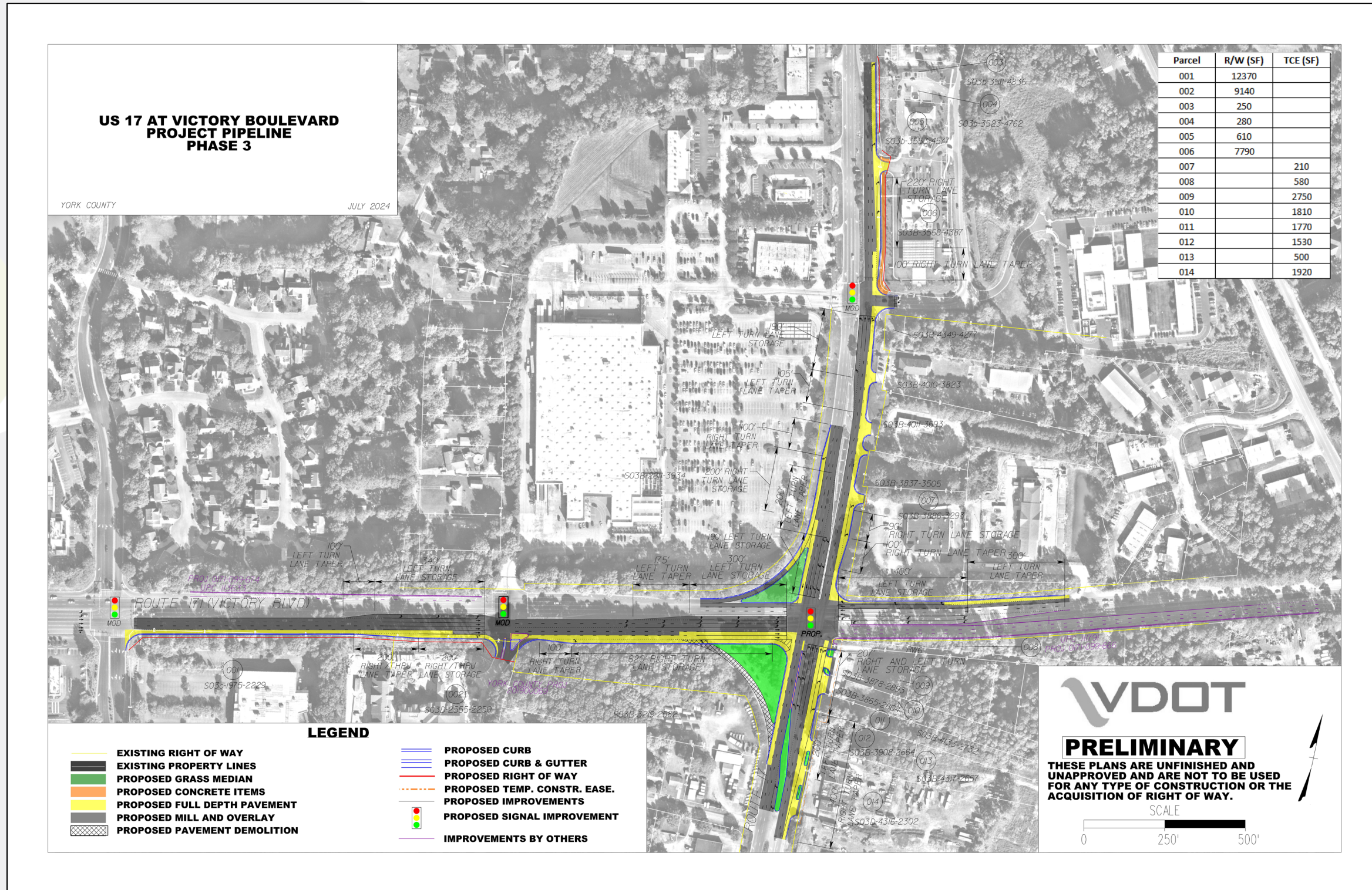
The study team also made refinements to the eastbound channelized right-turn lane geometry at the Route 17 and Victory Boulevard intersection. The originally proposed intersection configuration did not address the potential for higher speeds within the channelized lane and forced motorists to look over their shoulder when yielding to southbound traffic after completing the turn. Tightening the turn radius, removing the raised channelization island, and making the movement yield controlled would improve safety in the area by reducing speeds and the merging angle onto southbound Route 17. The study team validated that the revised right-turn lane configuration would not adversely impact operations and queuing of the movement.

Some study work group members expressed concern over northbound left-turn queues occasionally extending past the storage length at the Route 17 and Josephs Drive intersection in existing conditions. The study team investigated adding a second northbound left-turn lane at the intersection

but did not advance it due to extensive drainage and right-of-way impacts with lesser operational benefits. Improvements to address northbound left-turn queuing at the Route 17 and Josephs Drive intersection are not included in the preferred alternative but should be explored in future studies.

Figure 35 presents the refined preferred alternative.

Figure 35: Refined Preferred Alternative Concept



4.2 Operational Analysis

Once the preferred alternative was selected, the study team completed Synchro and SimTraffic analyses to confirm the recommended geometry of the preferred alternative and quantify the anticipated future traffic operations.

Aside from the preferred alternative geometry and optimization of traffic signal timings, the Build Synchro and SimTraffic models were kept consistent with the No-Build models, as applicable. Results from the Build conditions operational analysis informed the proposed design of the preferred alternative, specifically turn lane storage lengths and proper lane utilization for upstream and downstream intersections.

Future Build conditions analyses were conducted for the AM and PM peak periods. **Table 12** through **Table 15** summarize the HCM 2000 control delay and SimTraffic Maximum Queue lengths and compare the Build conditions results against No-Build conditions models.

With the proposed capacity enhancements at the Route 17 and Victory Boulevard intersection, traffic is projected to flow more efficiently through the intersection with reduced impacts to delays and queues. The HCM 2000 control delay results for the AM peak period show improvements on all four approaches at the study intersection between the No-Build and Build models. The westbound approach improves from LOS E to LOS C and the southbound approach improves from LOS D to LOS B. The overall intersection delay improves from LOS D (52.0 seconds/vehicle) to LOS C (31.6 seconds/vehicle); overall intersection delay also improves at the other study area intersections.

Slight increases in delay between the No-Build and Build models occur on the northbound and southbound approaches at the Victory Boulevard and Hampton Highway intersection, and on the eastbound approach at the Victory Boulevard and the Walmart Entrance/Assisted Living Community intersection. The delay increases at Hampton Highway can be attributed to the prioritization of eastbound and westbound movements along the Victory Boulevard corridor through capacity improvements and timing changes. Additionally, the LOS reduces from C to D for the northbound left-turn movement at the Route 17 and Josephs Drive intersection due to an increase in the movement's Synchro-calculated progression factor. The offsets between the Josephs Drive and Victory Boulevard intersections were adjusted in the Build model to prioritize traffic flow that would result in excessive southbound queues at Victory Boulevard observed in the existing conditions, which increased in the No-Build conditions.

In the PM peak period, the delay would improve on all four approaches at the Route 17 and Victory Boulevard intersection. The eastbound approach improves from LOS F to LOS C, the northbound approach improves from LOS E to LOS D, and the southbound approach improves from LOS D to LOS C. The overall intersection improves from LOS F (85.2 seconds/vehicle) to LOS D (44.8 seconds/vehicle).

Delay in the PM peak period increases slightly on the southbound approaches at the intersections of Route 17 and Josephs Drive, Victory Boulevard and Hampton Highway, and Victory Boulevard and Kiln Creek Parkway. Additionally, movement delay increases for the westbound right turn at the Route 17 and Victory Boulevard intersection and the northbound left turn at the Route 17 and Josephs Drive intersection due to an increase in the progression factor. The approach delay (and corresponding LOS) increases more significantly on the eastbound approach at Victory Boulevard and Hampton Highway from LOS C in the No-Build to LOS F in the Build. This change contributes to an increase in overall delay at the intersection. This change in projected operations is due to the proposed increase in upstream capacity on Victory Boulevard, which results in a greater volume of eastbound traffic more efficiently traveling toward Hampton Highway in the future Build conditions. It is projected that this condition will result in a new potential traffic bottleneck without more downstream improvements on Victory Boulevard, including improvements at the Hampton Highway at Victory Boulevard intersection. Just as the capacity improvements at the Route 17 intersection led to downstream congestion at Hampton Highway, any capacity improvements at Hampton Highway will result in greater eastbound throughput and similar downstream capacity issues. However, major improvements to downstream roadway facilities were outside of the scope of this study but should continue to be monitored and investigated by VDOT and York County.

The SimTraffic maximum queue results primarily show reductions in anticipated queuing. At the Route 17 and Victory Boulevard intersection, the amount of time that intersections upstream are blocked by the queues on the eastbound, northbound, and southbound approaches is reduced and the queue length is reduced on the westbound approach in the AM peak period. In the PM peak period, the upstream block time decreases on the northbound approach but increases on the eastbound approach. This difference can be attributed to the fact that the lane configuration changes in the Build scenario along Victory Boulevard on the eastbound approach at Route 17 as well as at the Walmart Entrance/Assisted Living Community. Eastbound lane utilization and driver behavior differ from No-Build due to an increase in the number of through lanes at the Walmart entrance intersection as well as the fact that the proposed eastbound right-turn lane at Route 17 includes a taper length, so the queue does not extend to the Walmart Entrance/Assisted Living Community. The queue lengths decrease on the southbound approach but increase on the westbound approach. The queue lengths are also expected to increase on the eastbound approach at the Victory Boulevard and Hampton Highway intersection due to aforementioned capacity limitations. **Appendix F** includes the full Synchro and SimTraffic results for the Build analysis.

Overall, the proposed improvements address the performance issues at the Route 17 and Victory Boulevard intersection shown in the No-Build models. The addition of a third eastbound left-turn lane and additional through lanes on the eastbound, northbound, and southbound approaches provide the additional needed capacity to handle the projected future traffic volumes and reduce approach delays during both the AM and PM peak periods.

Table 12: AM Peak Hour Control Delay and LOS 2045 No-Build and Build Condition Comparison

Intersection Number and Description	Type of Control	Lane Group	Eastbound				Westbound				Northbound				Southbound				Overall	
			No-Build		Build		No-Build		Build		No-Build		Build		No-Build		Build		No-Build	Build
			Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
1 Route 17 and Josephs Drive	Signalized	Walmart Entrance		Josephs Drive				Route 17				Route 17				Intersection				
		Left	57.3	E	57.3	E	59.5	E	59.5	E	27.6	C	40.5	D	9.7	A	8.9	A	Delay	Delay
		Through	57.4*	E*	57.4*	E*	58.9^	E^	58.9^	E^	9.7	A	12.6	B	22.3	C	22.3	C	22.1	22.0
		Right	55.4	E	55.4	E					49.5	D	s	s					LOS	LOS
		Approach	56.1	E	56.1	E	59.2	E	59.2	E	14.8	B	14.8	B	22.0	C	22.0	C	C	C
2 Route 17 and Victory Boulevard	Signalized	Victory Boulevard		Victory Boulevard				Route 17				Route 17				Intersection				
		Left	95.2	F	71.2	E	37.4	D	28.8	C	89.8	F	62.8	E	33.1	C	35.0	C	Delay	Delay
		Through	43.0	D	46.7	D	64.5	E	26.7	C	43.6	D	43.3	D	84.7	F	30.7	C	52.0	31.6
		Right	0.2	A	0.2	A	34.4	C	31.4	C	29.6	C	35.0	C	1.2	A	1.2	A	LOS	LOS
		Approach	50.7	D	46.1	D	58.0	E	27.3	C	49.2	D	45.4	D	49.7	D	19.2	B	D	C
3 Victory Boulevard and Hampton Highway	Signalized	Victory Boulevard		Victory Boulevard				Hampton Highway				Hampton Highway				Intersection				
		Left	58.8	E	37.5	D	76.9	E	76.9	E	75.9	E	77.0	E	63.0	E	62.1	E	Delay	Delay
		Through	32.8	C	15.8	B	70.7	E	70.7	E	37.8	D	38.4	D	68.0	E	71.4	E	63.5	63.1
		Right	88.8	F	97.8	F					30.8	C	31.3	C	33.7	C	34.0	C	LOS	LOS
		Approach	61.1	E	55.5	E	70.9	E	70.9	E	58.1	E	59.0	E	62.7	E	65.0	E	E	E
4 Victory Boulevard and Village Avenue	Signalized	Victory Boulevard		Victory Boulevard				Village Avenue				Kiln Creek Parkway				Intersection				
		Left	60.3	E	60.3	E	67.6	E	69.2	E	55.2	E	55.2	E	63.4	E	63.4	E	Delay	Delay
		Through	19.0	B	17.9	B	21.7	C	8.8	A	54.9	D	54.9	D	51.8	D	51.8	D	28.7	21.3
		Right	14.7	B	s	s	28.7	C	6.0	A	54.8	D	54.8	D	49.9	D	49.9	D	LOS	LOS
		Approach	21.9	C	21.0	C	26.6	C	14.4	B	54.8	D	54.8	D	54.5	D	54.5	D	C	C
5 Victory Boulevard and Walmart Entrance	Signalized	Victory Boulevard		Victory Boulevard				Private Drive				Walmart Entrance				Intersection				
		Left	64.7	E	44.7	D	4.1	A	2.2	A	82.9	F	82.9	F	65.6	E	65.6	E	Delay	Delay
		Through					11.5	B	3.9	A									10.2	6.6
		Right	1.9	A	5.6	A	3.9	A	3.9	A	54.4	D	51.6	D	51.6	D	51.6	D	LOS	LOS
		Approach	4.8	A	7.4	A	11.4	B	3.9	A	69.3	E	68.0	E	53.0	D	53.0	D	B	A
6 Route 17 and Oak Street	Unsignalized	Byrd Lane		Private Drive				Route 17				Route 17				Intersection				
		Left									15.7	C	15.7	C	19.4	C	19.4	C	Delay	Delay
		Through	50.3	F	50.3	F	0.0	A	0.0	A	†	†	†	†	†	†	†	†	-	-
		Right																	LOS	LOS
		Approach	50.3	F	50.3	F	0.0	A	0.0	A	0.0	A	0.0	A	0.1	A	0.1	A	-	-
7 Route 17 and Byrd Lane	Unsignalized	Oak Street		Route 17				Route 17				Intersection								
		Left	23.3	C	23.3	C					21.6	C	21.6	C	19.6'	C'	19.6'	C'	Delay	Delay
		Through									†	†	†	†	†	†	†	†	-	-
		Right	&	&	&	&									†	†	†	†	LOS	LOS
		Approach	23.3	C	23.3	C					0.2	A	0.2	A	0.0	A	0.0	A	-	-

- Denotes the overall intersection is stop controlled and no level of service or delay is reported
 † SYNCHRO does not provide level of service or delay for movements with no conflicting volumes
 * Lane group is a shared left/through movement
 ^ Lane group is a shared left/through/right movement
 & Lane group is a shared left/right movement
 ' Level of service or delay is for a U-turn movement

Table 13: PM Peak Hour Control Delay and LOS 2045 No-Build and Build Condition Comparison

Intersection Number and Description	Type of Control	Lane Group	Eastbound				Westbound				Northbound				Southbound				Overall	
			No-Build		Build		No-Build		Build		No-Build		Build		No-Build		Build		No-Build	Build
			Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
1 Route 17 and Josephs Drive	Signalized	Walmart Entrance		Josephs Drive				Route 17				Route 17				Intersection				
		Left	89.9	F	67.1	E	86.6	F	67.9	E	50.8	D	69.9	E	112.4	F	63.9	E	Delay	Delay
		Through	87.5*	F*	66.2*	E*	73.3^	E^	62.4^	E^	18.5	B	12.1	B	23.3	C	26.4	C	30.0	25.4
		Right	57.9	E	54.2	D					86.7	F	s	s					LOS	LOS
		Approach	74.4	E	60.9	E	80.0	E	65.2	E	23.7	C	16.1	B	25.4	C	27.3	C	C	C
2 Route 17 and Victory Boulevard	Signalized	Victory Boulevard		Victory Boulevard				Route 17				Route 17				Intersection				
		Left	146.1	F	43.5	D	31.8	C	69.1	E	65.8	E	69.9	E	93.9	F	73.6	E	Delay	Delay
		Through	136.5	F	20.4	C	91.4	F	61.4	E	88.9	F	51.6	D	52.3	D	44.1	D	85.2	44.8
		Right	0.2	A	9.8	A	158.8	F	300.6	F	34.5	C	37.7	D	0.8	A	0.8	A	LOS	LOS
		Approach	122.0	F	26.8	C	90.5	F	86.6	F	77.4	E	52.1	D	35.8	D	29.7	C	F	D
3 Victory Boulevard and Hampton Highway	Signalized	Victory Boulevard		Victory Boulevard				Hampton Highway				Hampton Highway				Intersection				
		Left	39.2	D	81.4	F	108.4	F	91.8	F	71.8	E	73.3	E	81.9	F	99.7	F	Delay	Delay
		Through	30.2	C	75.3	E	59.0	E	50.7	D	49.3	D	47.9	D	61.5	E	67.0	E	52.0	76.5
		Right	39.3	D	152.9	F					32.2	C	31.1	C	42.0	D	41.8	D	LOS	LOS
		Approach	34.7	C	107.4	F	62.1	E	53.3	D	59.1	E	59.0	E	62.7	E	69.9	E	D	E
4 Victory Boulevard and Village Avenue	Signalized	Victory Boulevard		Victory Boulevard				Village Avenue				Kiln Creek Parkway				Intersection				
		Left	50.4	D	62.6	E	85.5	F	56.0	E	62.1	E	59.4	E	93.8	F	99.5	F	Delay	Delay
		Through	35.2	D	25.6	C	26.5	C	5.9	A	61.6	E	59.0	E	62.6	E	61.5	E	42.2	27.9
		Right	15.8	B	s	s	58.4	E	3.6	A	62.3	E	59.1	E	56.9	E	55.1	E	LOS	LOS
		Approach	36.5	D	29.3	C	40.2	D	12.8	B	62.1	E	59.1	E	67.7	E	67.9	E	D	C
5 Victory Boulevard and Walmart Entrance	Signalized	Victory Boulevard		Victory Boulevard				Private Drive				Walmart Entrance				Intersection				
		Left	63.0	E	72.9	E	15.1	B	67.0	E	60.1	E	57.2	E	76.1	E	66.9	E	Delay	Delay
		Through	7.6	A	1.0	A	14.6	B	4.8	A									16.0	9.3
		Right					8.0	A	9.1	A	66.6	E	61.4	E	50.6	D	47.1	D	LOS	LOS
		Approach	12.4	B	7.3	A	14.4	B	5.4	A	63.3	E	59.3	E	56.7	E	51.8	D	B	A
6 Route 17 and Oak Street	Unsignalized	Byrd Lane		Private Drive				Route 17				Route 17				Intersection				
		Left									23.5	C	23.5	C	40.5	E	40.5	E	Delay	Delay
		Through	32.4	D	32.4	D	16.6	C	16.6	C	†	†	†	†	†	†	†	†	-	-
		Right																	LOS	LOS
		Approach	32.4	D	32.4	D	16.6	C	16.6	C	0.0	A	0.0	A	0.5	A	0.5	A	-	-
7 Route 17 and Byrd Lane	Unsignalized	Oak Street		Route 17				Route 17				Intersection								
		Left	25.9	D	25.9	D					16.2	C	16.2	C	37.8'	E'	37.8'	E'	Delay	Delay
		Through									†	†	†	†	†	†	†	†	-	-
		Right	&	&	&	&									†	†	†	†	LOS	LOS
		Approach	25.9	D	25.9	D					0.2	A	0.2	A	0.2	A	0.2	A	-	-

- Denotes the overall intersection is stop controlled and no level of service or delay is reported
† SYNCHRO does not provide level of service or delay for movements with no conflicting volumes
* Lane group is a shared left/through movement
^ Lane group is a shared left/through/right movement
& Lane group is a shared left/right movement
' Level of service or delay is for a U-turn movement

Table 14: AM Peak Hour Maximum Queue 2045 No-Build and Build Condition Comparison

Intersection Number and Description	Type of Control	Lane Group	Maximum Queue							
			Eastbound		Westbound		Northbound		Southbound	
			No-Build	Build	No-Build	Build	No-Build	Build	No-Build	Build
1 Route 17 and Josephs Drive	Signal		Walmart Entrance		Josephs Drive		Route 17		Route 17	
		Left	70	40	** (2%)	** (2%)	* (40%) ** (34%)	165	** (41%)	** (1%)
		Through	135*	125*	215^	220^	^(6%)	225	^(18%)	920
		Right	115	110			** (11%)	s		
2 Route 17 and Victory Boulevard	Signal		Victory Boulevard		Victory Boulevard		Route 17		Route 17	
		Left	* (12%)	245	185	165	** (9%)	215	** (64%)	** (11%)
		Through	^(1%)	315	450	440	^(4%)	300	^(38%)	600
		Right	†	95	** (1%)	165	** (10%)	135	†	** (1%)
3 Victory Boulevard and Hampton Highway	Signal		Victory Boulevard		Victory Boulevard		Hampton Highway		Hampton Highway	
		Left	95	180	90	90	* (3%) ** (2%)	* (4%) ** (3%)	** (2%)	** (3%)
		Through	235	280	390	380	445	460	430	480
		Right	355	365			0	0	125	130
4 Victory Boulevard and Village Avenue	Signal		Victory Boulevard		Victory Boulevard		Village Avenue		Kiln Creek Parkway	
		Left	110	115	** (5%)	** (4%)	15	80	180	** (1%)
		Through	235	240	575	515	75	10	215	255
		Right	45	s	35	45	115	95	†	†
5 Victory Boulevard and Walmart Entrance	Signal		Victory Boulevard		Victory Boulevard		Private Drive		Walmart Entrance	
		Left	** (2%)	125	** (1%)	25	55	50	40	40
		Through	430	210	475	390				
		Right	** (3%)	s	30	35	0	0	130	140
6 Route 17 and Oak Street	Signal		Byrd Lane		Private Drive		Route 17		Route 17	
		Left	40	50	0	0	** (3%)	10	30	30
		Through					†	†	†	†
		Right								
7 Route 17 and Byrd Lane	Signal		Oak Street				Route 17		Route 17	
		Left	50	45			** (4%)	35	20'	25'
		Through					†	†	†	†
		Right	&	&						

† No queue reported. Movement does not have conflicting volumes
 *(X%) - Maximum queue extends full length of storage bay for X% of the analysis period
 **(Y%) - Queue in lane adjacent to storage bay extends beyond end of storage bay for Y% of the analysis period
 ^(Z%) - Maximum queue extends back to the upstream intersection for Z% of the analysis period
 * Lane group is a shared left/through movement
 ^ Lane group is a shared left/through/right movement
 & Lane group is a shared left/right movement
 ' Queue is for a U-turn movement

Table 15: PM Peak Hour Maximum Queue 2045 No-Build and Build Condition Comparison

Intersection Number and Description	Type of Control	Lane Group	Maximum Queue							
			Eastbound		Westbound		Northbound		Southbound	
			No-Build	Build	No-Build	Build	No-Build	Build	No-Build	Build
1 Route 17 and Josephs Drive	Signal		Walmart Entrance		Josephs Drive		Route 17		Route 17	
		Left	** (2%)	** (1%)	** (1%)	80	*(1%)** (10%)	** (1%)	** (1%)	** (2%)
		Through	220*	240*	145^	165^	475	855	365	1125
Right	140	205	** (21%)	s						
2 Route 17 and Victory Boulevard	Signal		Victory Boulevard		Victory Boulevard		Route 17		Route 17	
		Left	*(25%)	*(4%)	120	** (3%)	*(1%)** (43%)	** (19%)	** (11%)	** (3%)
		Through	^(5%)	^(14%)	460	595	^(22%)	^(3%)	435	375
	Right	†	*(1%)** (15%)	** (3%)	*(1%)** (14%)	*(1%)** (43%)	** (1%)	†	†	
3 Victory Boulevard and Hampton Highway	Signal		Victory Boulevard		Victory Boulevard		Hampton Highway		Hampton Highway	
		Left	** (16%)	*(1%)** (75%)	100	105	*(6%)** (8%)	*(19%)** (18%)	** (1%)	*(2%)** (10%)
		Through	390	^(5%)	275	315	460	965	320	590
Right	340	^(1%)	0	** (1%)			80	70		
4 Victory Boulevard and Village Avenue	Signal		Victory Boulevard		Victory Boulevard		Village Avenue		Kiln Creek Parkway	
		Left	** (7%)	285	** (5%)	** (1%)	55	105	215	** (7%)
		Through	520	445	420	400	135	155	140	375
	Right	25	s	45	190	*(1%)** (1%)	*(1%)	†	†	
5 Victory Boulevard and Walmart Entrance	Signal		Victory Boulevard		Victory Boulevard		Private Drive		Walmart Entrance	
		Left	185	*(2%)	** (9%)	** (6%)	35	65	90	185
		Through	205	^(1%)	270	620				
	Right	** (3%)	s	45	125	0	0	230	245	
6 Route 17 and Oak Street	Signal		Byrd Lane		Private Drive		Route 17		Route 17	
		Left	20	65	10	30	5	30	35	50
		Through					†	†	†	†
Right										
7 Route 17 and Byrd Lane	Signal		Oak Street				Route 17		Route 17	
		Left	25	45			** (6%)	60	15'	40'
		Through					†	†	†	†
	Right	&	&							

† No queue reported. Movement does not have conflicting volumes
*(X%) - Maximum queue extends full length of storage bay for X% of the analysis period
**(Y%) - Queue in lane adjacent to storage bay extends beyond end of storage bay for Y% of the analysis period
^(Z%) - Maximum queue extends back to the upstream intersection for Z% of the analysis period
* Lane group is a shared left/through movement
^ Lane group is a shared left/through/right movement
& Lane group is a shared left/right movement
' Queue is for a U-turn movement

4.3 Planning-Level Sketch and Cost Estimates

Appendix F includes a planning-level sketch of the preferred alternative and a Basis of Design Memorandum detailing the established project design criteria, field review notes, risk assessment, and design assumptions.

The study team developed an engineer’s preliminary opinion of probable cost for construction costs, right of way acquisition costs, and utility relocation costs for the preferred alternative. These cost opinions established the project budget, in FY2024 dollars, as shown in Table 16. Appendix F includes detailed cost estimates.

Table 16: HR-23-10 Preferred Alternative Improvements

Phase Description	Budget (FY2024)
Preliminary Engineering	\$ 2,747,500
Right of Way and Utility Relocation	\$ 3,687,500
Construction	\$ 21,958,125
Total Project Budget	\$ 28,393,125

4.4 Schedule Estimates

The study team developed schedule estimates for the preliminary engineering (PE), right of way (RW), and construction (CN) phases, which are summarized in Table 17.

Table 17: Schedule Estimate

Estimated Schedule by Phase (months)	PE	RW	CN	Total
Preferred Concept	27	4	24	55

4.5 Project Risks

All projects have risks; however, some projects may have more significant risks than others due to technical complexity, funding, financing, and stakeholder acceptance. Risk management generally involves the process of anticipating what risks a project may face, mitigating them to the extent reasonably possible, and having a plan to react to them if and when they occur. This is recognized in VDOT guidance regarding the analysis of and mitigation of risks.

The following is a list of the most notable potential issues that may affect project development, risks faced by the project, and risk mitigation strategies to be applied to manage and minimize risks throughout project development. Appendix F includes the risk analysis matrix with details on the risk assessment and mitigation strategy.

Risk/Issue: Roadway Design

The posted speed limit of 45 is used as the proposed design speed to align with adjacent County widening projects.

Risk/Issue: Right of Way

Fourteen parcels will be impacted along Route 17 and Victory Blvd. for access improvements. All impacts will require a temporary construction easement to tie in the proposed improvements to the existing conditions.

Risk/Issue: Environmental

Based on the desk top environmental review, the following areas may require additional studies or data analysis: (1) the study area is located within NLEB year-round preservation area; however, there is no tree clearing anticipated based on the proposed improvements; (2) active registered petroleum tanks are located within the study area that may require Phase I and Phase II testing; and (3) a noise analysis may be required.

Risk/Issue: Utilities

There were above ground appurtenances observed during the field visit signifying the presence of underground utilities such as fiber optic communication lines, gas, water, and sewer (force main and gravity). Based on observed above ground appurtenances and available GIS data, there are areas of fiber optic communication lines, overhead power poles, light poles, water, sewer force main, and gravity sewer identified to be relocated to avoid impacts with proposed widening, storm drain system, curb and gutter, and shared use path.

Risk/Issue: Geotechnical

Areas of unsuitable material have been assumed and are undefined without a geotechnical report.

Risk/Issue: Drainage

There were several junction boxes observed within the widening footprint that will need to be modified and/or replaced in addition to several drop inlet tops will need to be reset.

Risk/Issue: Coordination with other Ongoing Projects

The proposed improvements will likely require coordination with York County and VDOT based on plans currently under within the limits of the preferred alternative.

4.6 Possible Funding Sources

The preferred alternative documentation prepared through this Project Pipeline study can be leveraged to apply for funding from available sources such as Revenue Sharing and future SMART SCALE rounds. As this study was being prepared, York County elected to submit the preferred alternative for Round 6 of SMART SCALE funding.