PROJECT PIPELINE

NV-23-06
ARLINGTON COUNTY

US ROUTE 50 FROM FILLMORE STREET (US ROUTE 50 RAMP) TO PERSHING DRIVE (US ROUTE 50 RAMP)

DRPT

Office of INTERMODAL Planning and Investment

VDOT

US Route 50 from Fillmore Street to Pershing Drive

Final Report

June 2024

Prepared for

Virginia Department of Transportation

Prepared by

ATCS

13861 Sunrise Valley Drive, Suite 200

Herndon, Virginia 20171

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Chapter 1:

Needs Evaluation and Diagnosis

Introduction:

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 focuses on concepts targeting identified needs including congestion mitigation, safety improvement, pedestrian and bicycle infrastructure along the corridor, and transit access. The objectives of Project Pipeline are shown below in **Figure 1.**

Figure 1. Project Pipeline Objectives

Background

The Office of Intermodal Planning and Investment (OIPI) prepared the VTrans Virginia's statewide transportation plan for the Commonwealth Transportation Board (CTB) in which mid-term needs (0 - 10 years) were identified for different categories listed in **Table 1**. This study focuses on addressing needs identified in VTrans, and those previously identified by the localities.

Table 1: List of VTrans Needs

VTrans Needs
Safety Improvement
Transportation Demand Management
Congestion Mitigation
Pedestrian Safety Improvement
Transit Access
Capacity Preservation
Bicycle Access

Methodology

The study is broken down into three phases. Phase I is the problem diagnosis and brainstorming alternatives, Phase II is the alternative evaluation and sketch level analysis, and Phase III is the investment strategy and cost estimates. Details on methods and solutions for each study phase are outlined below in **Figure 2**.

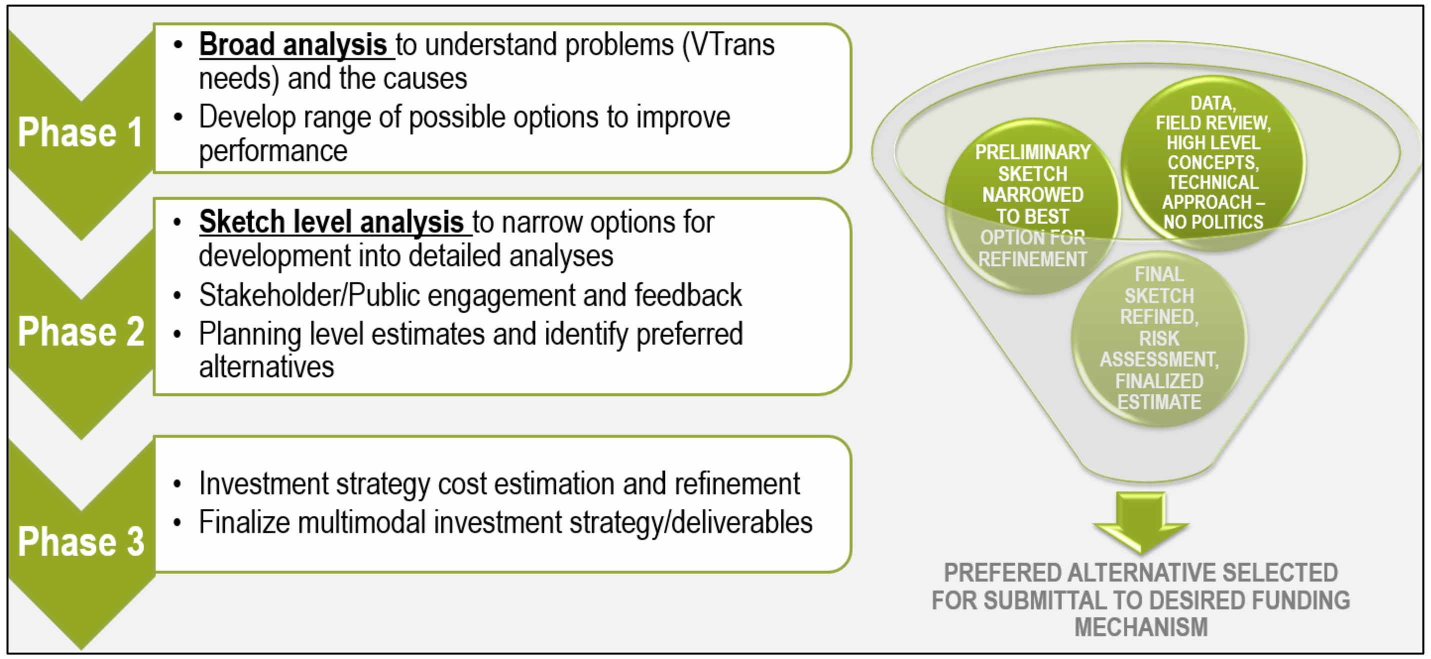


Figure 2. Study Phase Methods and Solutions

The study team is broken down into Technical Teams to improve the efficiency and effectiveness of the study process through extensive collaboration and synchronicity. To achieve the intended efficiency and consistency, it is generally expected that the same Technical Team will be responsible for all studies within a district for the duration of the cycle.

Each Technical Team will include certain leadership and technical roles that will be needed for each study, including the following:

- VDOT District Planning Project Manager – Provides leadership and direction; has overall responsibility for the study progress and outcomes.
- Consultant Team Manager – Provides direct support to the VDOT District Planning Project Manager; coordinates the work and technical efforts of consultant staff.
- District Planning Staff – Provides technical input regarding capacity, forecasting, land use, multimodal, and planning.
- District Traffic Engineering Staff – Provide technical input regarding safety and operations.
- Consultant Team Technical Staff – Provides multidisciplinary input, analysis, technical support, and expertise for the identified VTrans need categories.

A sample organizational chart, including the roles, responsibilities, and structure of a Technical Team is shown below in **Figure 3**.

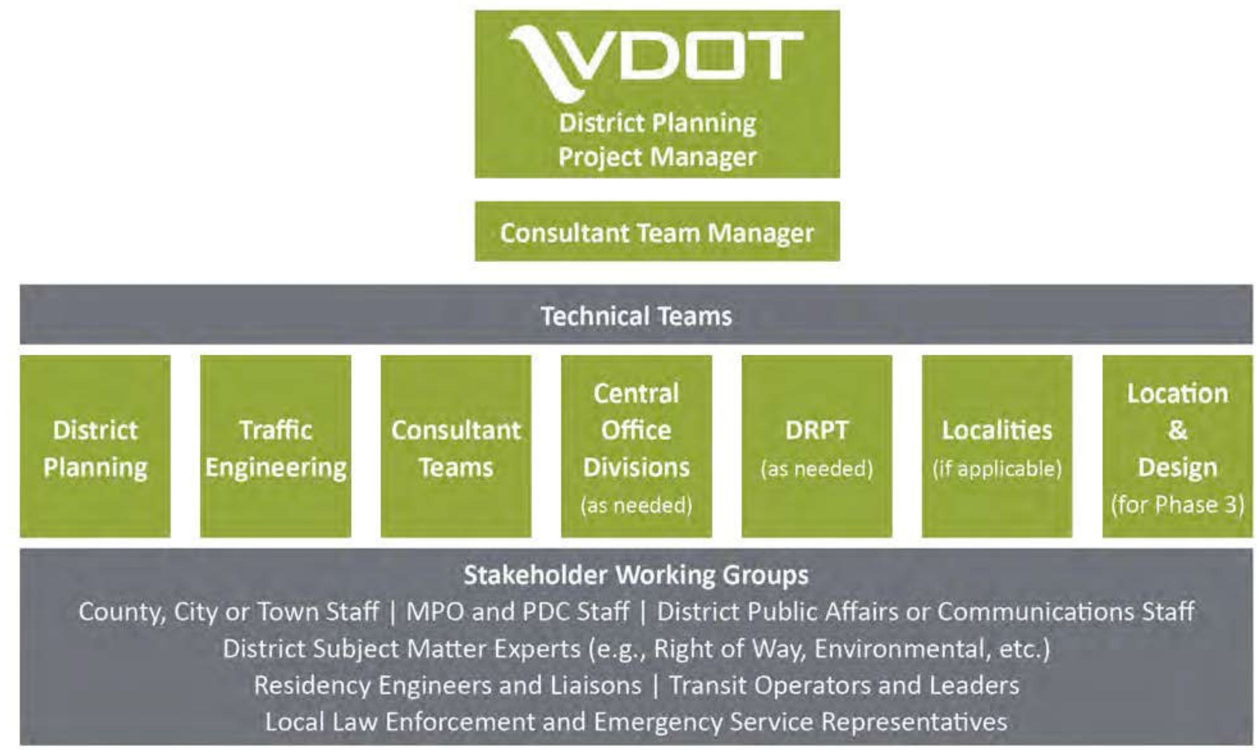


Figure 3. Structure of a Technical Team

Additional team members and roles should be considered where appropriate. Certain roles may not be necessary for all studies. However, the following roles may contribute to study success during different stages and/or for different types of study areas, as shown in **Table 2**.

Table 2. Roles and Responsibilities for the Technical Team and SWGs

Phase	Responsibility	Role					
		OIPI/Program Support	District	Consultant	DRPT	Locality	VDOT Central Office
Study Selection & Initiation	Identify Study Needs and Priorities		X		X	X	
	Coordinate with CTB Members	X	X				
	Approve final study locations	X					
	Data Collection Planning		X				
	Data Dashboards	X					
	Assign Consultants & Issue Consultant Task Orders	X					X
Phase 1	Initiate Study & Hold Kickoff Meeting		X	X	X		
	Prepare Framework Document		X	X			
	Approve Framework Document		X		X	X	
	Provide Existing Data		X		X	X	
	Collect New Data			X			
	Coordinate with local leaders					X	
	Conduct & Support Initial Public Outreach (if desired)	X	X	X		X	X
	Diagnose Existing Needs			X			
	Brainstorm & Develop Preliminary Alternatives		X	X	X		X
	Present Diagnosis & Alternatives to SWG			X			
	Provide Feedback and Input on Analysis & Alternatives					X	
	Develop Phase 2 Scope of Work			X			
	Approve Scope & Issue Consultant Task Orders	X					X
Phase 2	Conduct Detailed Analysis of Alternatives			X			
	Develop Refinements to Alternatives		X	X	X		X
	Present Alternative Analysis Findings to SWG		X	X			
	Provide Feedback on Alternatives				X	X	X
	Prepare Planning Level Cost Estimates			X			
	Conduct & Support Public Outreach on Alternatives	X	X	X		X	
	Concurrence on Preferred Alternative(s)		X		X	X	X
	Develop Phase 3 Scope of Work			X			
	Approve Scope & Issue Consultant Task Orders	X					X
Phase 3	Conduct Alternative Risk Assessment		X	X			X
	Develop Practical Concept Design & Address Risk of Preferred Alternative		X	X			
	Prepare Cost Estimate with Workbook			X			
	Document Assumptions & Basis of Cost			X			
	Review & Concur with Concept & Estimate		X		X		X
Investment, Application, & Closeout	Prepare Final Study Deliverables, Design Packages, and Estimates			X			
	Apply for Funding of Preferred Alternative(s)				X	X	
	Application Support	X	X	X			
	Submit and Documentation and All Related Work			X			
	Review and approve final deliverables for public visibility		X		X		
	Program Closeout and Summary	X					

Study Area

The Arlington Boulevard and Washington Boulevard study area is located in Arlington County, Virginia. The study area includes 0.75 miles of Arlington Boulevard from Filmore Street to Pershing Drive and 1.4 miles of Washington Boulevard from Pershing Drive to Columbia Pike (Route 244).

The Arlington Blvd corridor is classified as Other Principal Arterial, and the posted speed limit is 45 MPH within the study corridor. The Washington Boulevard corridor is classified as Other Principal Arterial, and the posted speed limit is 45 MPH (south of Brookside Drive) and 30 MPH (north of Brookside Drive).

A map of the study intersections is shown below in **Figure 4.**

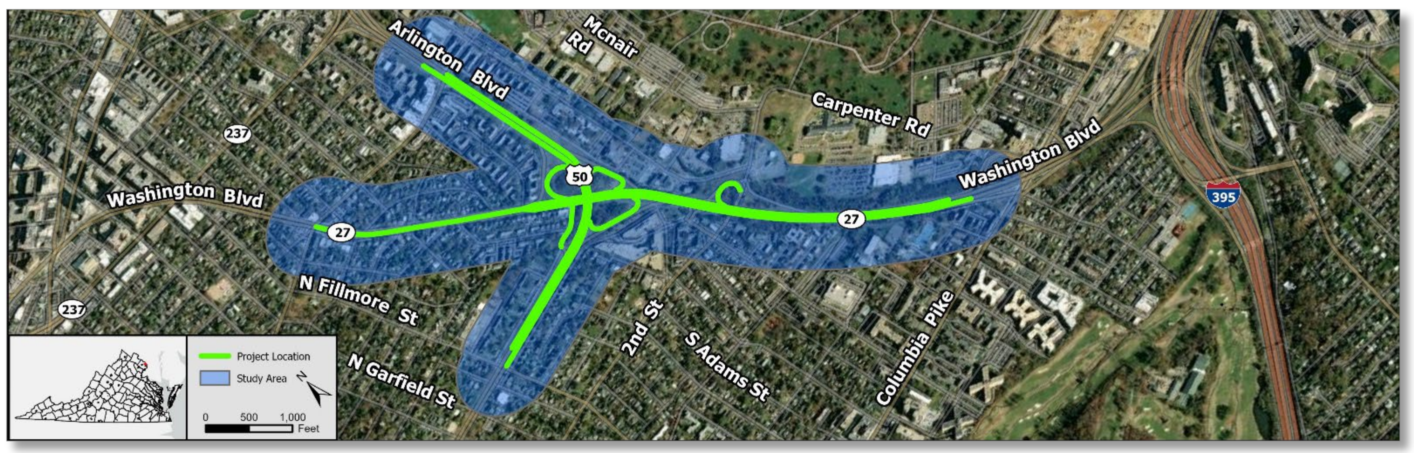


Figure 4. Study Area Map

VTrans is Virginia's statewide transportation plan. It identifies and prioritizes locations with transportation needs using data-informed transparent processes. The policy for identifying VTrans mid-term needs establishes multimodal need categories that correspond to the Commonwealth Transportation Board-adopted VTrans visions, goals, and objectives.[1] Each need category has one or more performance measures and thresholds to identify one or more needs. Visit the VTrans policy guide for additional information: https://vtrans.org/resources/VTrans_Policy_Guide_v6.pdf.

The mid-term needs, as identified in VTrans for the study corridor, were identified as 'Very High' for Bicycle Access, Pedestrian Access, and Transportation Demand Management, 'High' for Capacity Preservation, Congestion Mitigation, and Transit Access., 'Medium' for Pedestrian Safety Improvement, and 'Low' for Safety Improvement, as presented in **Table 3.**

Table 3. VTrans Needs in Study Area

VTRANS IDENTIFIED NEEDS	PRIORITIES
Bicycle Access	Very High
Capacity Preservation	High
Congestion Mitigation	High
IEDA (UDA) Access	None
Pedestrian Access	Very High
Safety Improvement	Low
Pedestrian Safety Improvement	Medium
Reliability	None
Rail On-time Performance	None
Transit Access	High
Transit Access for Equity Emphasis Areas	None
Transportation Demand Management	Very High

These mid-term needs, identified in VTrans, are prioritized on a tier from 1 to 4, with 1 being the most critical and 4 being the least critical. The segments ranked as "Priority 1" represent those with multiple categories identified as high in need. **Figure 5** presents a map of the study area with the 2019 VTrans mid-term needs prioritized for District construction. **Figure 6** provides an overview of the project.

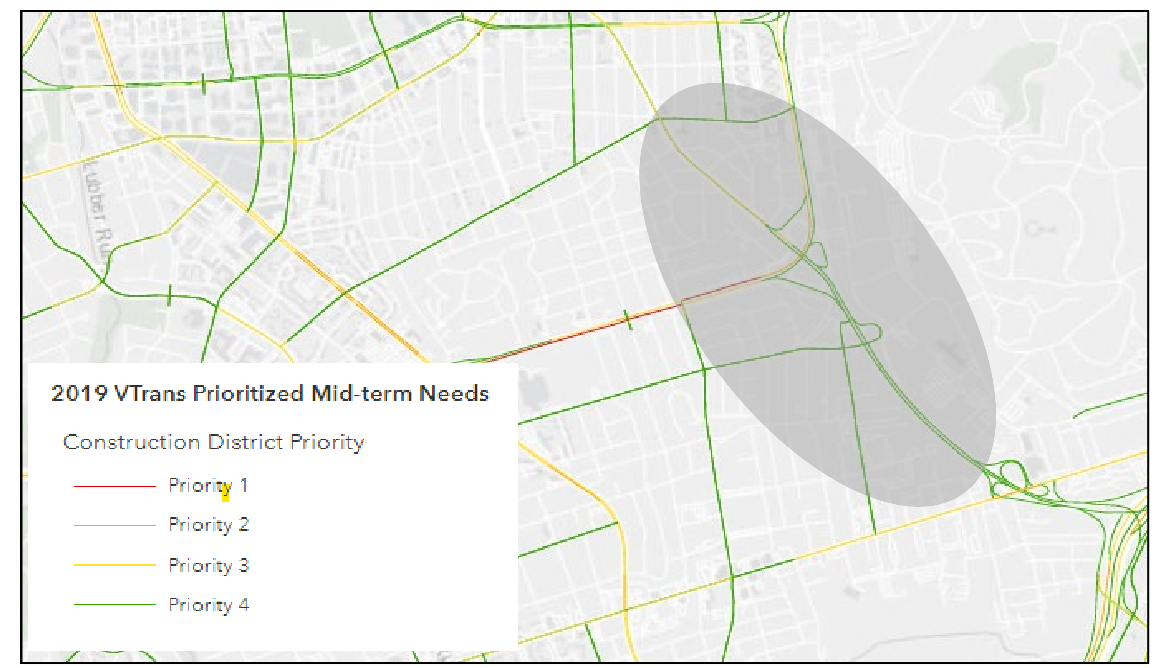
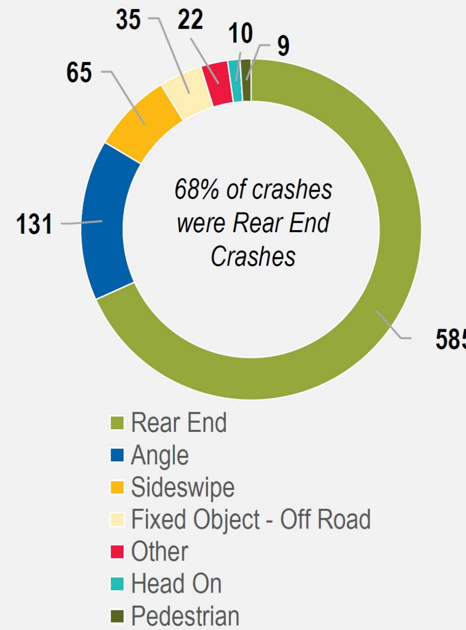


Figure 5. 2019 VTrans Prioritized Mid-term Needs in the Study Area

[1] Commonwealth Transportation Board, Actions to Approve the 2019 VTrans Vision, Goals, Objectives, Guiding Principles and the 2019 Mid-term Needs Identification Methodology and Accept the 2019 Mid-term Needs, January 15, 2020



Project Fact Sheet	
VDOT District	Northern Virginia
Locality	Arlington County
Corridor Length	0.75 mile
Transit Routes	Arlington Transit Bus Routes (42, 45, & 77); WMATA Bus Route 16Y; WMATA Metro Stops nearby (*Orange, Silver, Blue, & Yellow Lines*)
Bikeways	Shared-Use-Path on the west side of Washington Blvd, south of Arlington Blvd & on the north side of Arlington Blvd
Functional Classification	Other Principal Arterial
Speed Limit	45 mph (south of Brookside Dr); 30 mph (north of Brookside Dr)

Issues in the Study Area

- **The existing Shared Use Path (SUP) is on the west side of Washington Blvd, south of Arlington Blvd & on the north side of Arlington Blvd (passing over the overpass); SUP conditions & markings are inconsistent. Capital Bikeshare at Washington Blvd & Walter Reed Dr.**
- **Sidewalks are continuous along Washington Blvd, north of Arlington Blvd. Sidewalk conditions are inconsistent along Arlington Blvd. Crosswalks are present in the vicinity of the interchange.**
- **The current existing bus stops along Washington Blvd serve ART Routes 42, 45, & 77 and WMATA Bus route 16Y. The WMATA Metro Orange/Silver Line is 1.5 miles NW, and the Blue/Yellow Line is 2 miles SE.**
- **Very long queues were observed along the ramp from NB Washington Blvd to WB Arlington Blvd, spilling onto mainline WB Washington Blvd, during the AM & PM peaks.**
- **10 pedestrian incidents in the surrounding areas (2015-2022), all resulted in an injury.**
- **127 rear end incidents (2015-2022) along the ramp from NB Washington Blvd to WB Arlington Blvd. 361 incidents associated with the interchange of Washington Blvd at Arlington Blvd.**

Project Purpose, Goals, & Objectives

Analyze the operational and safety issues identified along Arlington Blvd & Washington Blvd, with a focus on providing enhanced pedestrian & bicycle access and transportation demand management.

Identify cost-effective preferred improvement alternatives that address the deficient conditions and prioritize safety and accessibility.

Figure 6. Project Overview for the Arlington Blvd Interchange

Previous Study Efforts

Three other studies were performed that may impact the roads in the study area.

Route 50 STARS Safety and Operational Improvements Study - Glebe Rd to Fillmore St

This study includes transit improvements, shared-used-path reconstruction, raised median, left turn lanes, and new streetlighting along Arlington Boulevard from Glebe Road to S Fillmore Street, as shown in **Figure 7**.

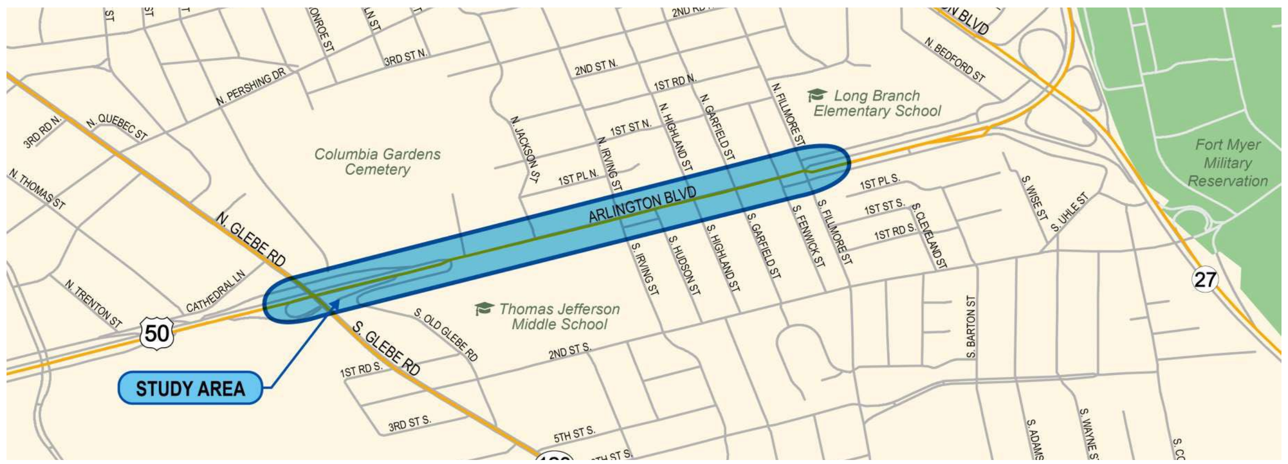


Figure 7. Route 50 STARS Study Area

Master Transportation Plan – Bicycle Element

The Master Transportation Plan Bicycle Element 2019 proposed on-street and off-street routes to enhance cycling throughout Arlington County. In the study area, there are proposed facilities along several segments, as shown **Figure 8.** On Arlington Boulevard from N Fillmore Street to Washington Boulevard, bike lanes are planned, shown with a dashed blue line.

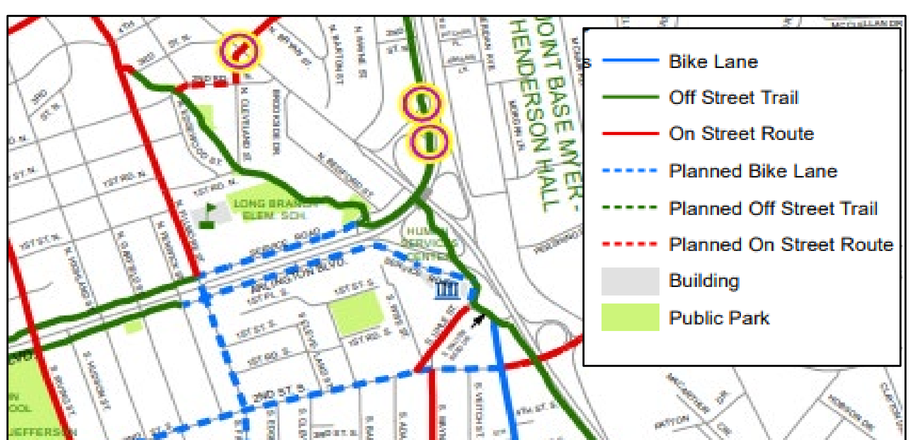


Figure 8. Planned Bike and Trail Network Map (Study Area)

Columbia Pike Multimodal Street Improvements 2012

This transportation study for the Columbia Pike Multimodal Street Improvements project provides recommendations that support the revitalization of this corridor, which is critical to sustain the growth of south Arlington and to provide the desired multimodal links between the County limits and S. Joyce Street north of Pentagon City, as shown in **Figure 9**. Sections A, B, and C are in the vicinity of Washington Boulevard in this study area. Construction for Segment A, South Joyce Street, started in 2022. Segment B, the Washington Boulevard Bridge over Columbia Pike, has been completed. Segment C will be constructed in the future.

Figure 9. Columbia Pike Roadway and Sidewalk Improvements

Columbia Pike Transit Corridor Study

This study was initiated in 2016 with a vision for the corridor to revitalize town and neighborhood centers, create a pedestrian-friendly "main street" served by high-quality transit, preserve the pike's character, diversity, and affordability, invest in infrastructure for a more vibrant, sustainable community, and manage growth. The transit stations are shown in **Figure 9.** Project construction started in 2022 and construction of the last two pairs of stations near Washington Blvd, South Rolfe Street, and South Orme Street may affect this project.

FHWA STEAP Tool Analysis

The FHWA Screening for Equity Analysis of Projects (STEAP) Tool was reviewed for the corridor and surrounding areas. This tool is used to discover the key population metrics and needs of the study area to raise awareness of equity needs in the selection of alternatives. The data source used for the analysis was the American Community Survey 2016 – 2020 and a 0.5-mile radius was used for the analysis buffer. The results of the STEAP Tool analysis are shown in **Figure 10** through **Figure 17** and presented below:

- Most of the population (74%) within the study area is between ages 18 and 64, 18% is children up to age 17, and 8% is over age 65, as shown in **Figure 10**.
- Approximately 47% of the households own only one vehicle. Two vehicle and three or more vehicle households for this study area are below the state average, as shown in **Figure 11**. This pattern is similar when compared to Arlington City and County.
- 73% of the population in the study area consists of 1 or 2 person households, as shown in **Figure 12**.
- The linguistically isolated households or limited English speaking comprise 29% of the study area households (2,136 households), as shown in **Figure 13.**
- The population in poverty makes up 6% of the total population (1,068 people). The largest group is 25- to 64-year-olds and the second highest is the population of 6- to 17-year-olds, as shown in **Figure 14**.
- The population in poverty based on their race presents that white people make up 3% or half of the population in poverty, as presented in **Figure 15.**
- The vulnerable population in the study area is below the state, city, and county average, and includes 6% veterans and 7% people with disabilities, as presented in **Figure 16**.
- The total percentage of households with no computers is 2% of the population and 4% have no access to internet, as presented in and **Figure 17.** These are also below the average for the state, city, and county.

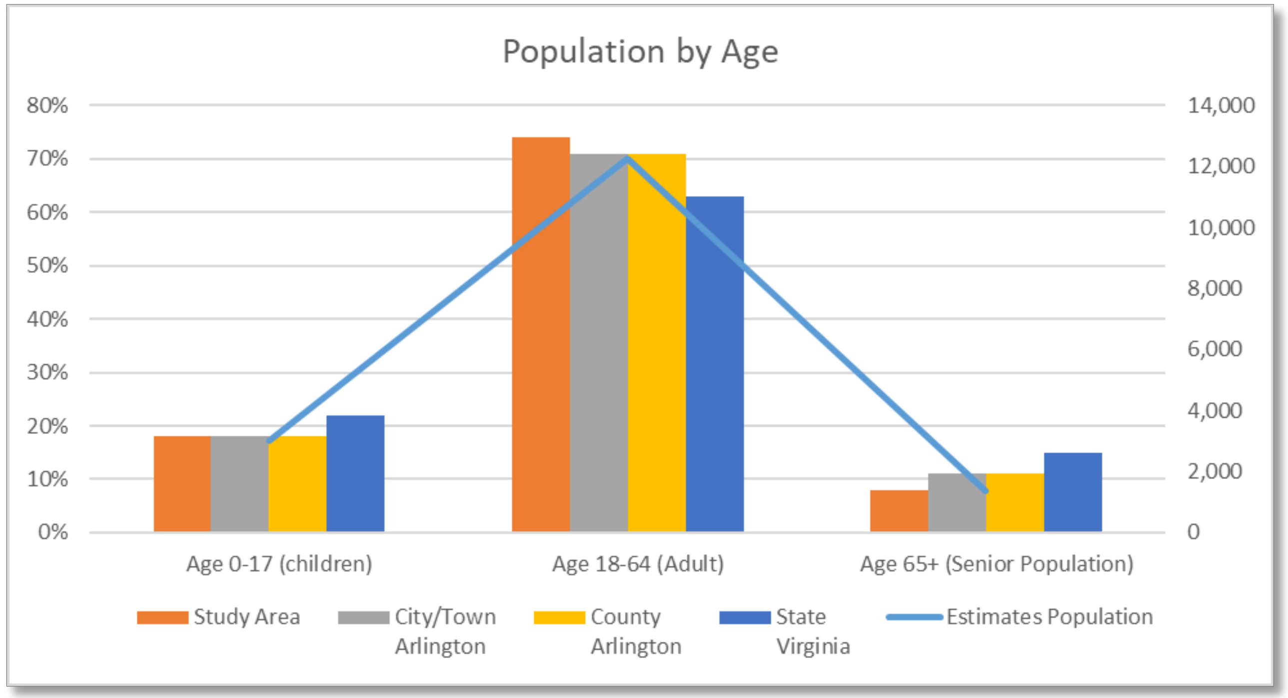


Figure 10. STEAP Tool Analysis Population by Age Group

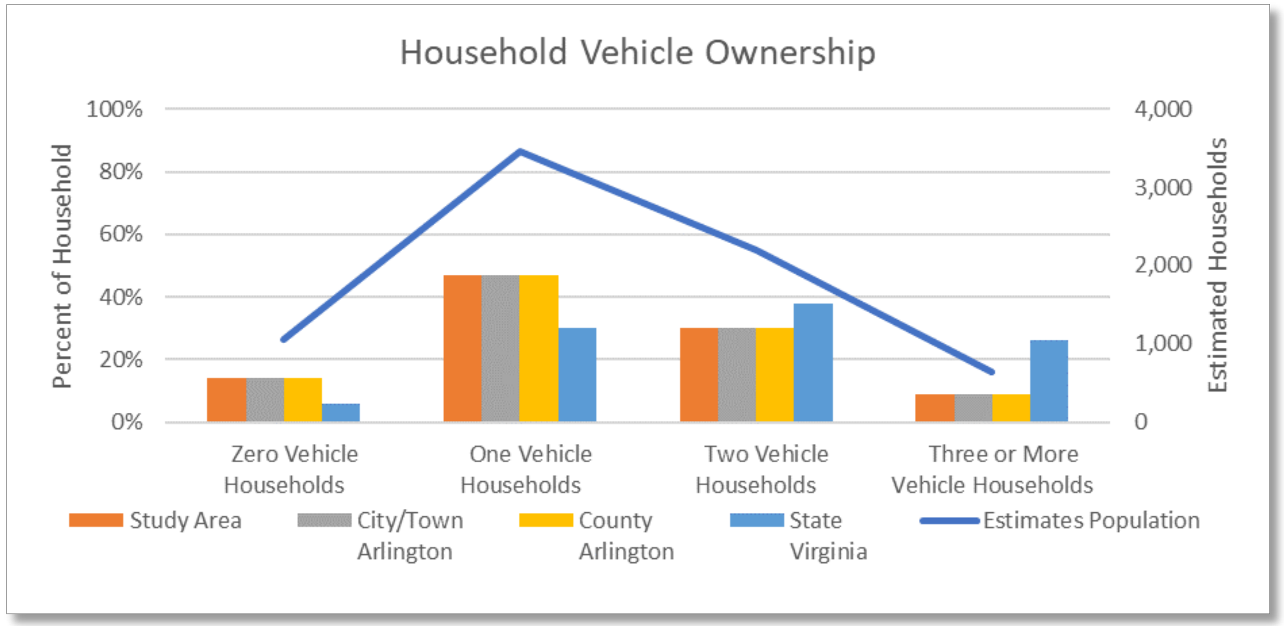


Figure 11. STEAP Tool Analysis Vehicle Ownership

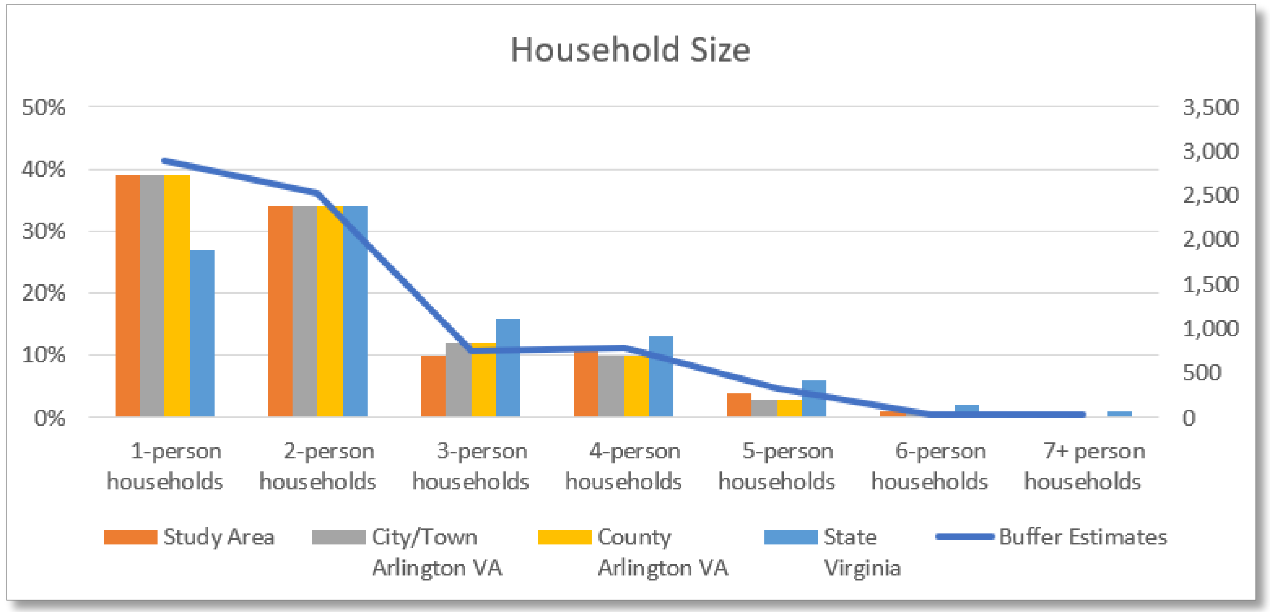


Figure 12. STEAP Tool Analysis Household Size

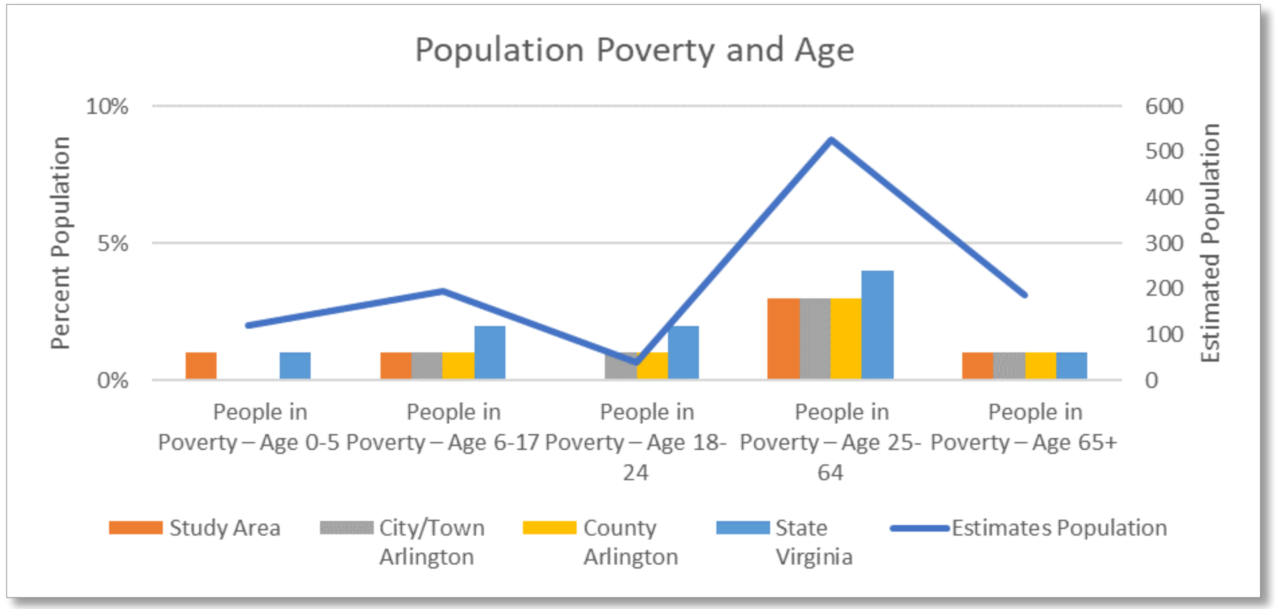


Figure 14. STEAP Tool Analysis Population in Poverty by Age

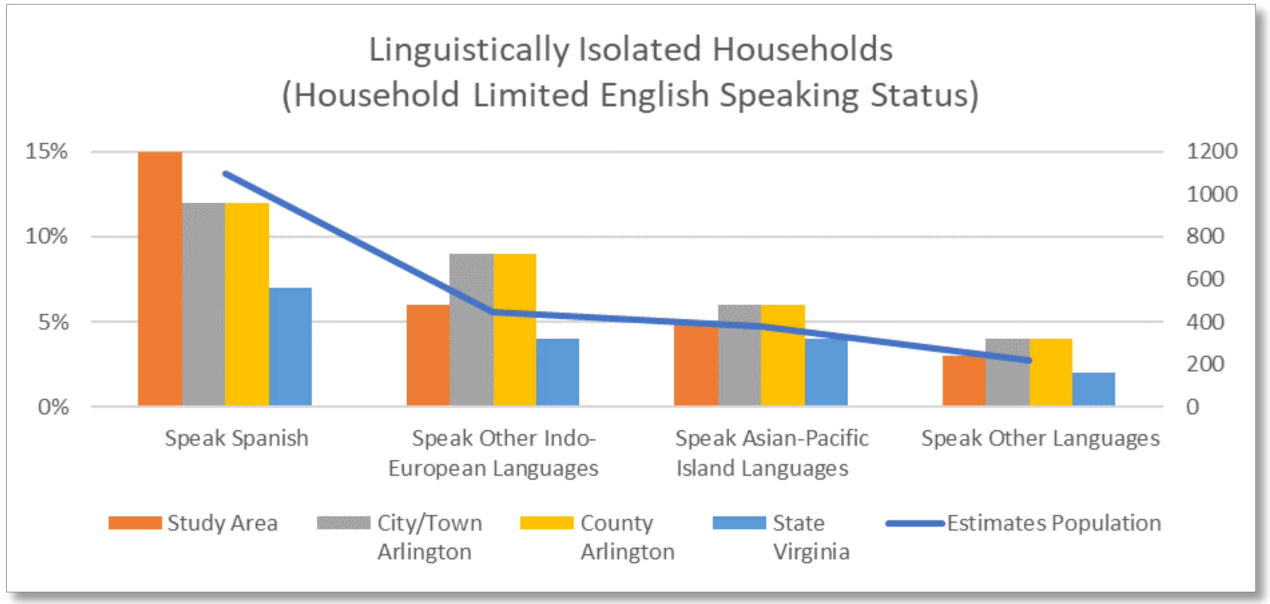


Figure 13. STEAP Tool Analysis Linguistically Isolated Households (Limited English-Speaking Status)

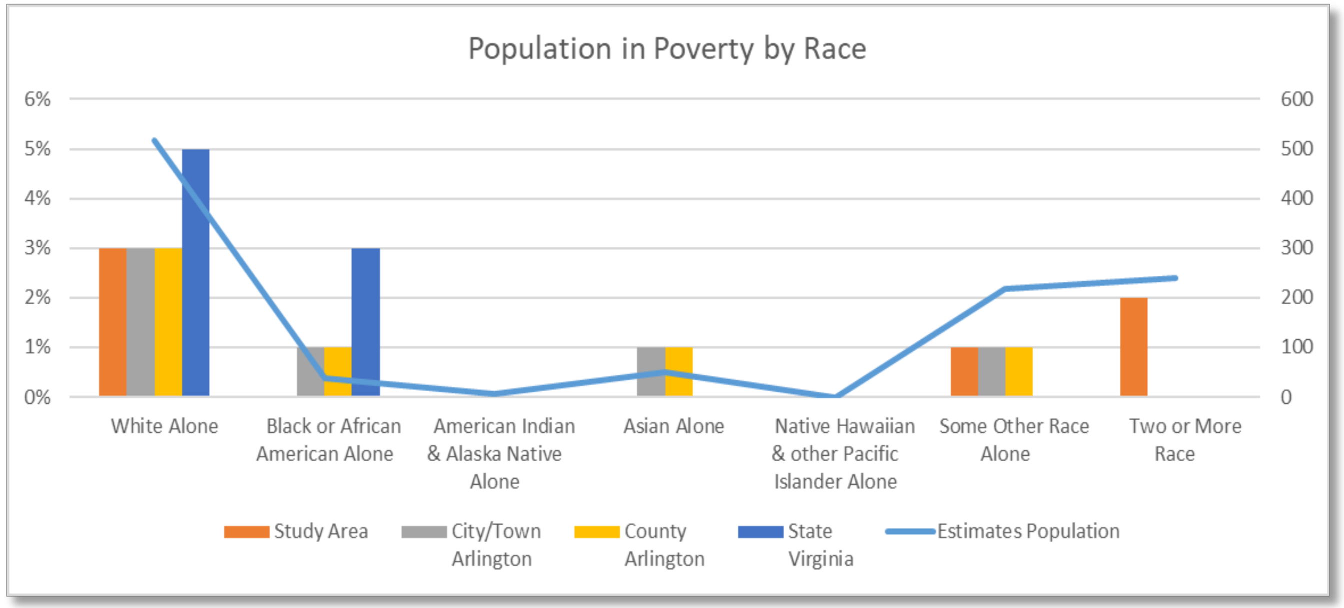


Figure 15. STEAP Tool Analysis Population in Poverty by Race

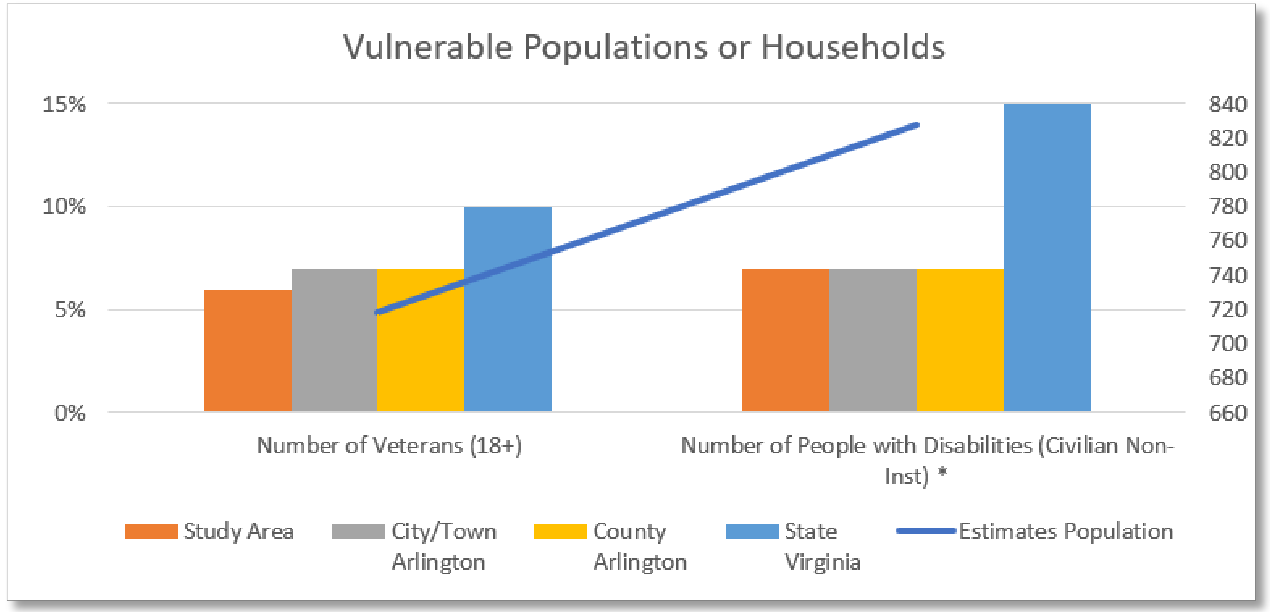


Figure 16. STEAP Tool Analysis Vulnerable Populations or Households – Disability

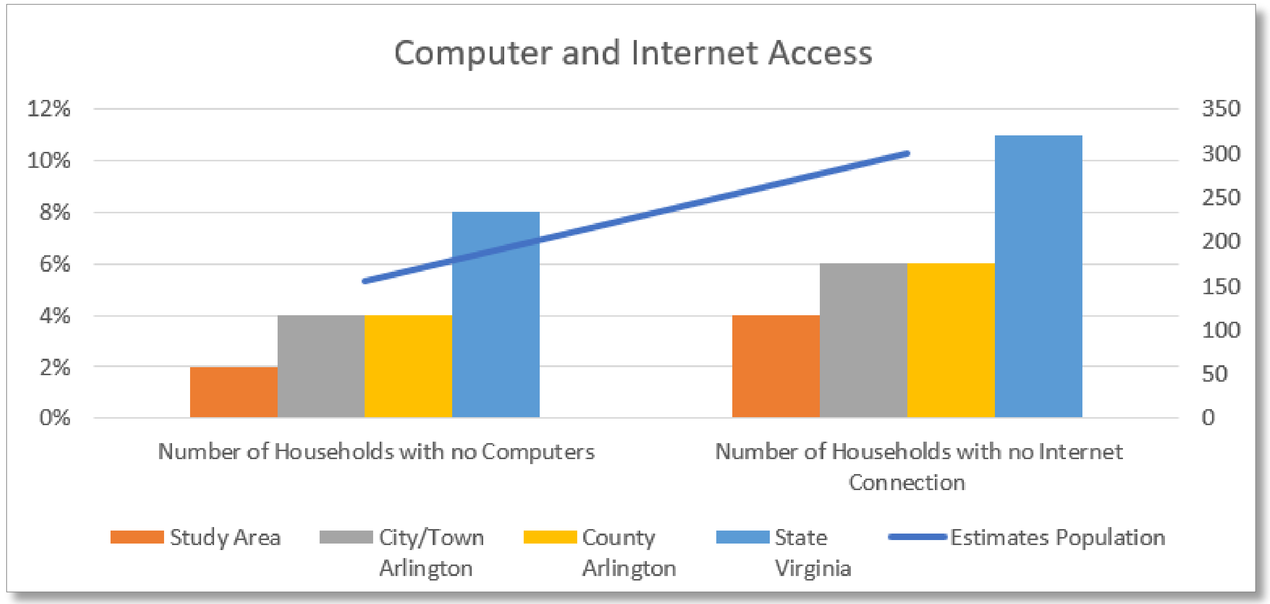


Figure 17. STEAP Tool Analysis Vulnerable Populations or Households - Computer and Internet Access

Existing Traffic Operations and Accessibility:

Traffic operational analysis was performed using Vissim Microsimulation for existing operations and mobility. Inputs and analysis methodologies follow the VDOT Traffic Operations and Safety Analysis Manual (TOSAM). Both AM and PM peak hour analyses were performed for the existing year 2023. The model will be utilized to test improvements.

Traffic Data

Twelve-hour intersection traffic turning movement counts (TMC), including pedestrians, bicycles, heavy vehicles, and U-turns in 15-minute intervals, were collected on Thursday, May 11th, and May 18th, 2023. The AM and PM peak hours were determined to be 7:45 – 8:45 AM and 4:45 – 5:45 PM. The intersection volumes are shown in **Figure 21**.

Measures of Effectiveness (MOEs)

For this study, guidance for reporting MOEs for signalized and unsignalized intersections was obtained from Chapter 4 of the VDOT TOSAM 2.0. A summary of the MOEs evaluated for the study intersections is presented below:

- Delay (seconds per vehicle – sec/veh)
- Average Queue Length (feet)
- Maximum Queue Length (feet)
- Level of Service (LOS)

Traffic Operations Analysis Results

The Vissim models under the existing AM and PM peak hours conditions were coded and calibrated following the guidelines and thresholds stated in the VDOT TOSAM Version 2.0. The models represent the existing conditions and can be carried forward to develop the future no-build and build conditions.

The analysis shows that all study intersections operate at an acceptable Level of Service (LOS) during the AM and PM peak hours for 2023. Nevertheless, some of the movements operate at LOS E or worse, as summarized below:

- Arlington Boulevard (US 50) and Irving Street (**Table 4**)
    - The northbound left turn and through movements operate at LOS F during the AM peak. The northbound right turn operates at LOS E during the AM peak.
    - The northbound left turn, through, and right turn movements operate at LOS E during the PM peak.
    - The southbound left turn movement operates at LOS E during the AM peak. The southbound through movement operates at LOS F during the AM peak.
    - The southbound left turn and through movements operate at LOS E during the PM peak.
- Arlington Boulevard (US 50) and Highland Street (**Table 4**)
    - The northbound left turn movement operates at LOS F during the AM peak. The northbound through movement operates at LOS E during the AM peak.
    - The northbound through movement operates at LOS F during the PM peak.
    - The southbound left turn and through movements operate at LOS F during the AM peak.
    - The southbound through movement operates at LOS F during the PM peak.
- Arlington Boulevard (US 50) and Garfield Street (**Table 5**)
    - The northbound left turn and through movements operate at LOS F during the AM peak. The northbound right turn movement operates at LOS E during the AM peak.
    - The northbound left turn movement operates at LOS F during the PM peak. The northbound right turn movement operates at LOS E during the PM peak.
- Arlington Boulevard (US 50) and Fillmore Street (**Table 5**)
    - The eastbound left turn movement operates at LOS F during the AM peak.
    - The westbound left turn movement operates at LOS F during the AM peak and PM peaks.
    - The eastbound left turn movement operates at LOS E during the PM peak.
- Arlington Boulevard (US 50) and Pershing Street (**Table 7**)
    - The eastbound left turn movement operates at LOS F during the AM and PM peaks.
    - The southbound left turn movement operates at LOS E during the AM and PM peaks.
- N Fillmore Street and N Service Road (**Table 8**)
    - The westbound left turn movement operates at LOS F during the AM peak and LOS E during the PM peak.
    - The southbound left turn movement operates at LOS E during the AM peak and LOS F during the PM peak.
    - The southbound through movement operates at LOS F during the AM peak and LOS E during the PM peak.
- S Fillmore Street and S Service Road (**Table 8**)
    - The westbound left turn, through, and right turn movements operate at LOS F during the AM peak.
    - The westbound left turn and right turn movements operate at LOS F during the PM peak.
    - The northbound left turn, through, and right turn movements operate at LOS F during the AM peak.

- The northbound through and right turn movements operate at LOS F during the PM peak.

Table 4 through **Table 8** presents the AM and PM peak hour Vissim analysis results summary for the existing conditions in 2023.

Traffic Operations and Mobility

The analysis shows that there are three key locations that present notable traffic and mobility issues, and a summary is presented below. Additionally, **Table 9** shows the existing queue lengths as observed in the field compared to Vissim.

The ramp from northbound Washington Boulevard to westbound Arlington Boulevard

This is a challenging merge area with no merge area and limited sight distance. There is a pedestrian crossing prior to the merge onto Arlington Boulevard which presents safety issues for pedestrians and delays for the queues. Additionally, the queue extends along Washington Boulevard past the on ramp from eastbound Arlington Boulevard, as shown in **Figure 18**.

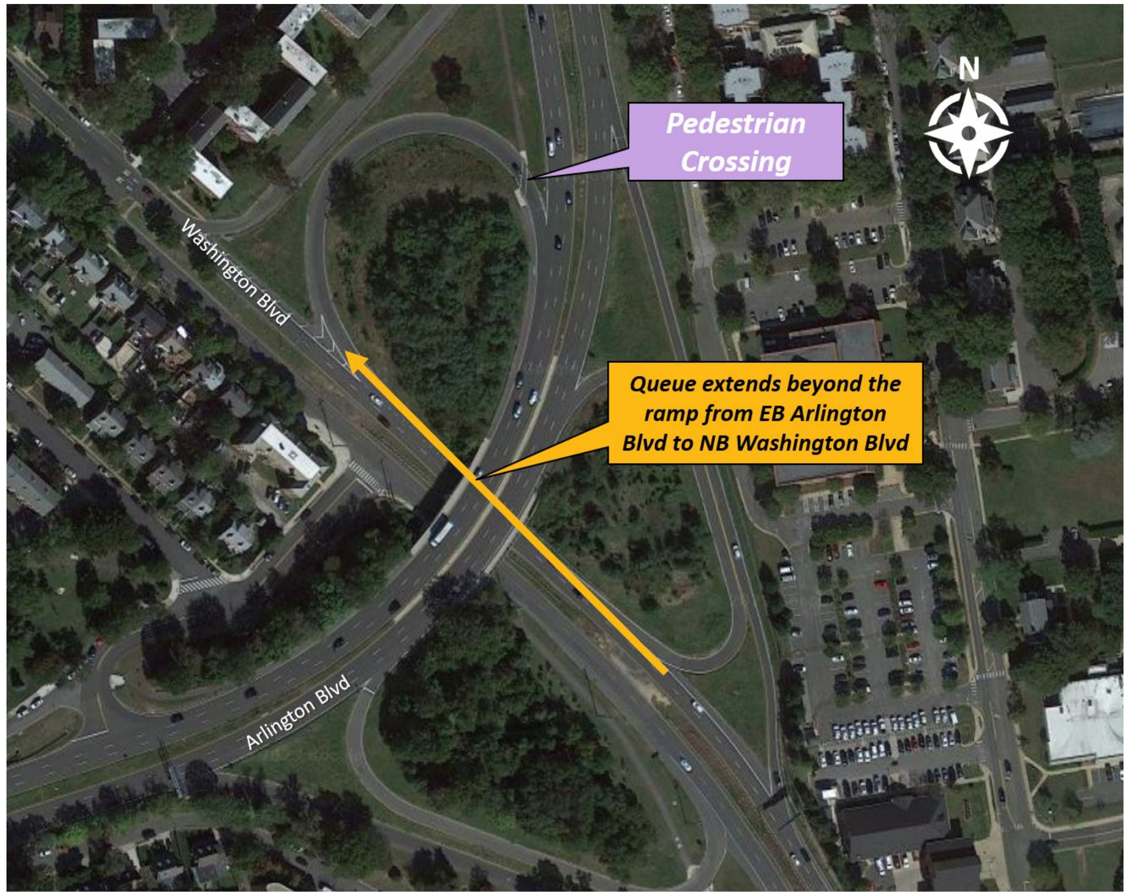


Figure 18. Traffic Operations and Mobility Issues along the ramp from NB Washington Blvd to WB Arlington Blvd

The ramp from westbound Arlington Boulevard to southbound Washington Boulevard

This is a challenging right turn due to the high conflicting traffic volumes along southbound Washington Boulevard and the limited sight distance. There is a pedestrian crossing at this intersection which presents safety issues for pedestrians and additional delays for the queues. Additionally, the queue extends onto westbound Arlington Boulevard which also impacts the mobility along westbound Arlington Boulevard and from the on ramp upstream from northbound Washington Boulevard onto Arlington Boulevard, as shown in **Figure 19**.

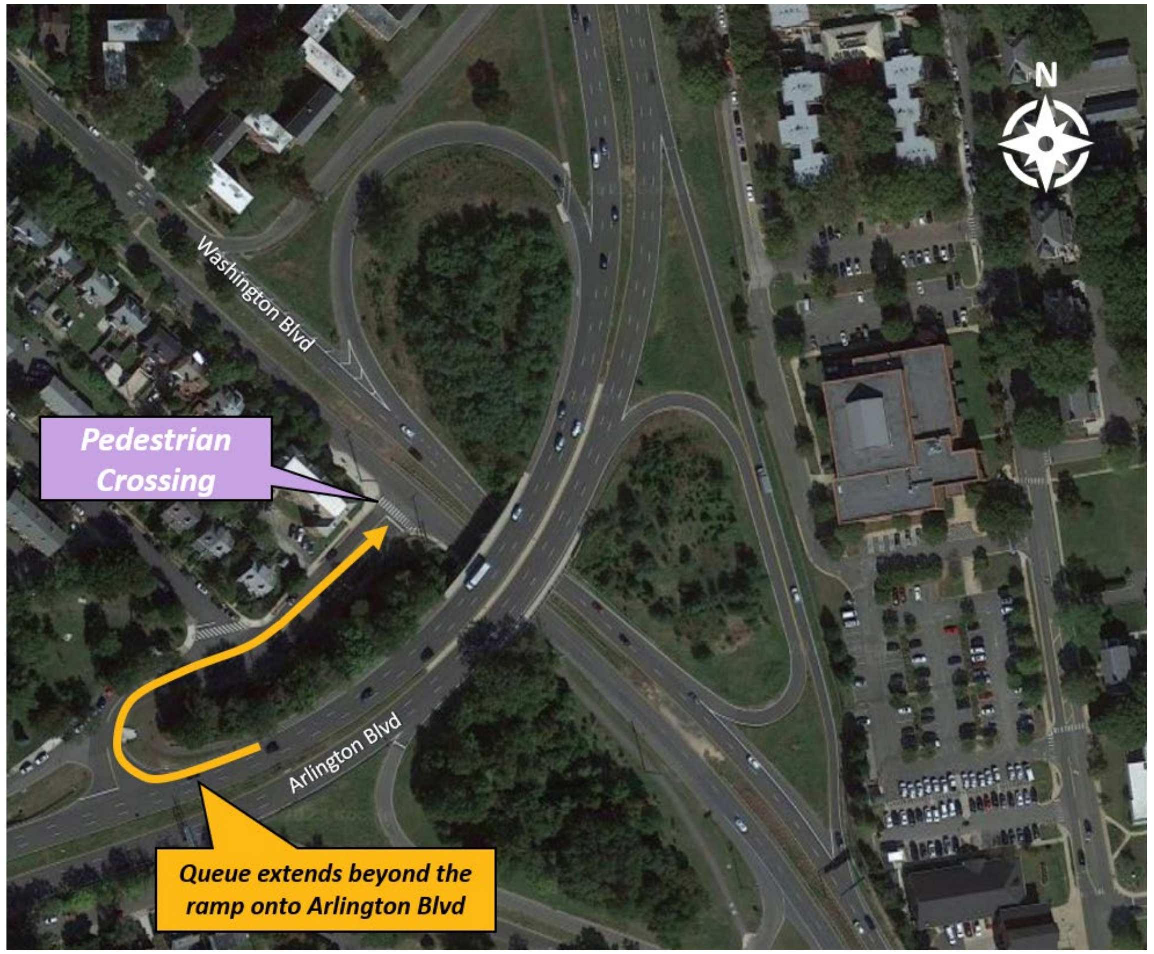


Figure 19. Traffic Operations and Mobility Issues along the ramp from WB Arlington Blvd to SB Washington Blvd

The ramp from eastbound Arlington Boulevard to southbound Washington Boulevard

This is a challenging merge due to the weave area with the Arlington County site downstream. There is a pedestrian crossing along this ramp which presents safety issues for pedestrians and additional delays for the queues, as shown in **Figure 20**.

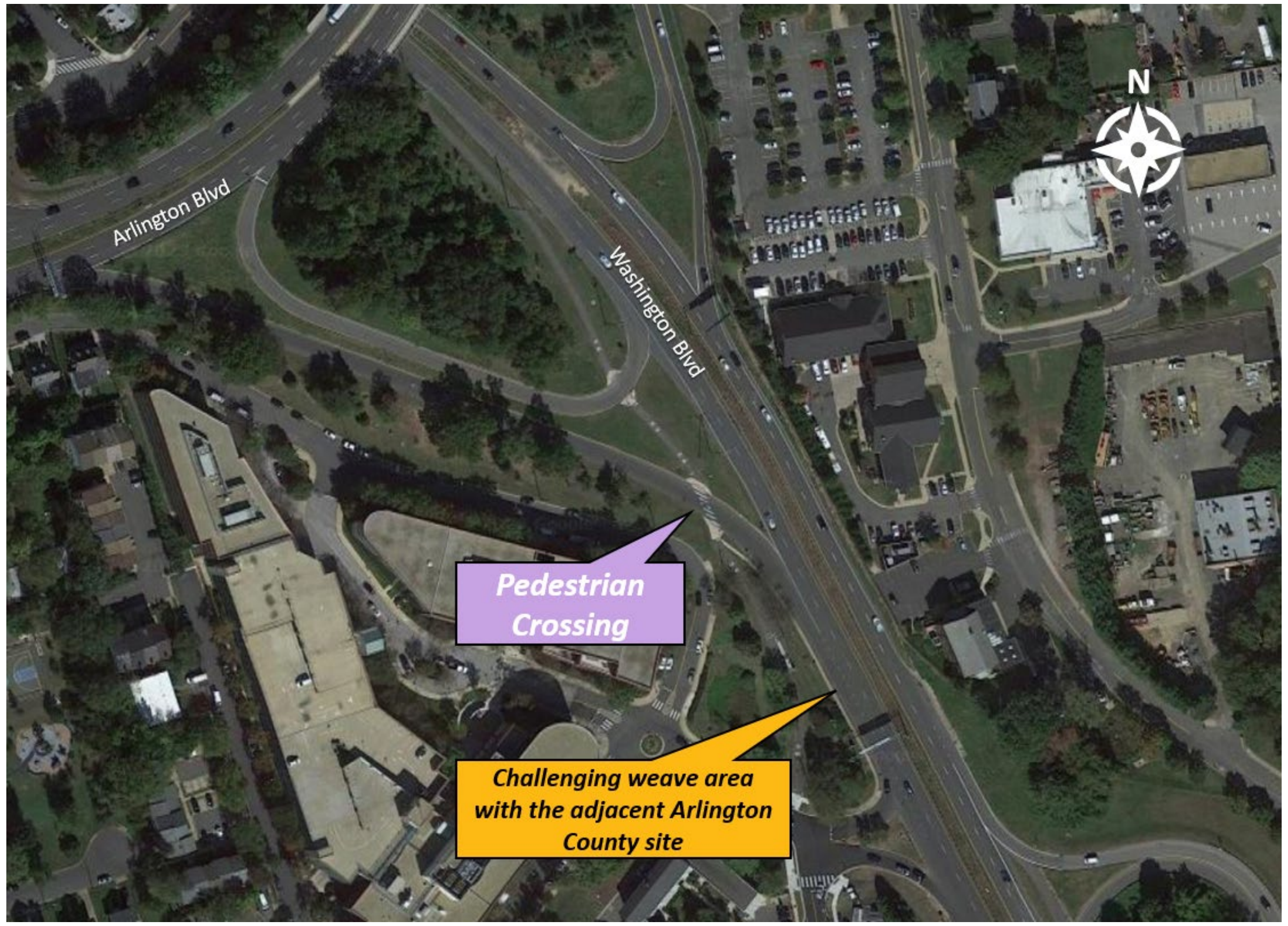


Figure 20. Traffic Operations and Mobility Issues along the ramp from EB Arlington Blvd to SB Washington Blvd

Travel Time Analysis

Travel time run (TTR) data on US Route 50 and VA Route 27 was collected on Wednesday, May 24, 2023, and Thursday, May 25, 2023. The data collection locations are shown in **Figure 22**. The collected values are shown in **Tables 10-17**.

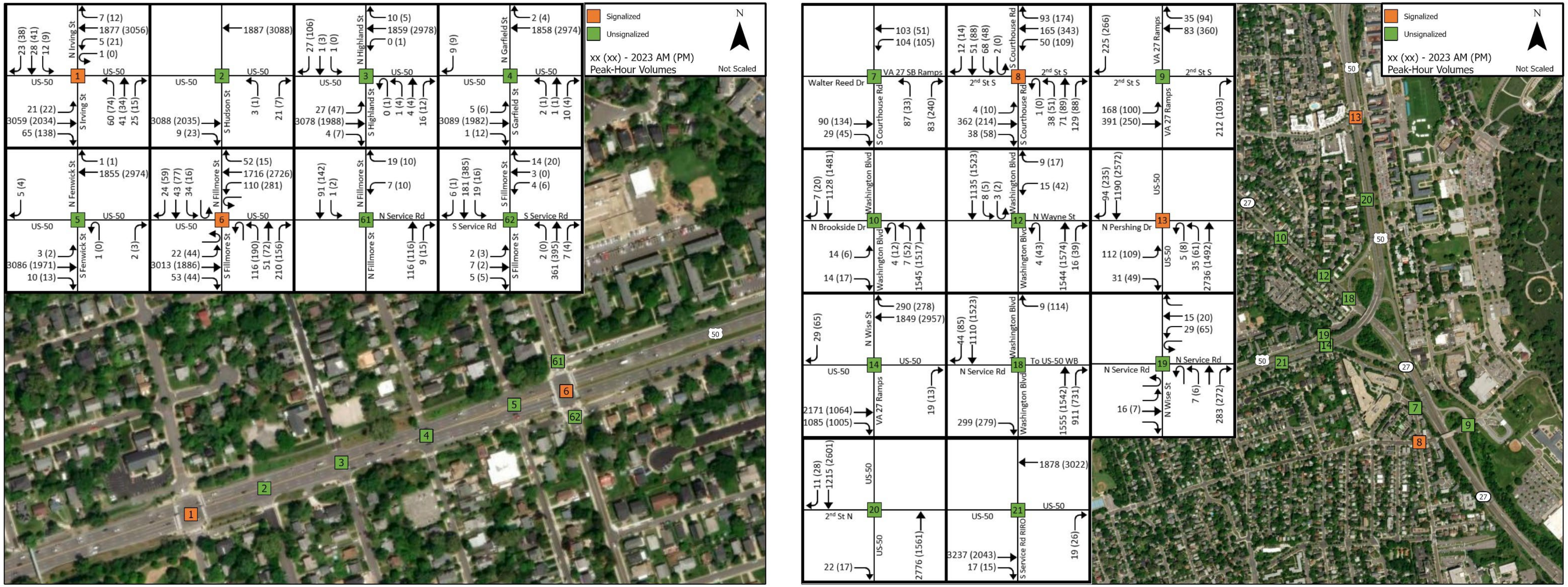


Figure 21. Turning Movement Counts

Table 4: 2023 Vissim Analysis Results Summary (Intersections 1 to 3)

ID	Intersection	Movement		Existing AM					Existing PM				
				Volume (veh)	Delay (sec/veh)	LOS	Avg Q (ft)	Max Q (ft)	Volume (veh)	Delay (sec/veh)	LOS	Avg Q (ft)	Max Q (ft)
1	US 50 at Irving St	EB	L	21	27.3	C	146	957	23	47.8	D	50	430
			T	3044	15.7	B	146	957	2034	10.7	B	50	430
			R	62	10.0	B	0	45	134	4.6	A	1	60
		EB Overall		**3127**	**15.7**	**B**	-	-	**2191**	**10.7**	**B**	-	-
		WB	L	3	38.2	D	12	241	18	19.8	B	27	284
			T	1864	2.4	A	12	241	3027	2.9	A	27	284
			R	7	0.6	A	11	246	13	1.8	A	26	286
		WB Overall		**1874**	**2.4**	**A**	-	-	**3058**	**3.0**	**A**	-	-
		NB	L	60	92.5	F	68	317	75	73.1	E	52	265
			T	43	90.8	F	68	317	35	68.7	E	52	265
			R	21	76.4	E	73	323	12	59.9	E	57	271
		NB Overall		**124**	**89.2**	**F**	-	-	**122**	**70.5**	**E**	-	-
		SB	L	8	75.1	E	23	127	6	57.5	E	25	148
			T	31	84.2	F	23	127	44	65.5	E	25	148
			R	21	39.3	D	40	159	37	35.4	D	41	179
		SB Overall		**60**	**67.3**	**E**	-	-	**87**	**52.1**	**D**	-	-
		Int Overall		**5185**	**174.5**	**F**	-	-	**5458**	**136.4**	**F**	-	-
2	US 50 at Hudson St	EB	T	3051	2.6	A	16	256	2025	2.4	A	5	179
			R	9	1.6	A	27	358	23	0.2	A	10	267
		EB Overall		**3060**	**2.6**	**A**	-	-	**2048**	**2.4**	**A**	-	-
		WB	T	1874	0.4	A	0	47	3057	0.9	A	3	255
		WB Overall		**1874**	**0.4**	**A**	-	-	**3057**	**0.9**	**A**	-	-
		NB	L	4	25.7	D	1	36	2	30.8	D	0	9
			R	18	25.2	D	1	36	4	5.7	A	0	9
		NB Overall		**22**	**25.3**	**D**	-	-	**6**	**14.1**	**B**	-	-
		Int Overall		**4956**	**28.3**	**D**	-	-	**5111**	**17.4**	**C**	-	-
3	US 50 at Highland St	EB	L	26	12.0	B	54	374	43	39.0	F	60	371
			T	3028	6.4	A	40	370	1962	10.6	B	36	367
			R	4	0.7	A	0	0	7	0.8	A	0	0
		EB Overall		**3058**	**6.4**	**A**	-	-	**2012**	**11.2**	**B**	-	-
		WB	L	0	0.0	A	1	93	1	22.9	C	2	236
			T	1851	0.4	A	0	39	2952	0.8	A	1	143
			R	9	0.1	A	1	90	4	0.0	A	2	164
		WB Overall		**1860**	**0.4**	**A**	-	-	**2957**	**0.8**	**A**	-	-
		NB	L	1	58.0	F	1	46	4	33.1	D	2	70
			T	4	49.8	E	1	46	4	50.3	F	2	70
			R	16	33.3	D	1	46	12	29.5	D	2	70
		NB Overall		**21**	**37.6**	**E**	-	-	**20**	**34.3**	**D**	-	-
		SB	L	1	50.8	F	1	61	0	0.0	A	10	147
			T	1	52.7	F	1	61	3	58.1	F	10	147
			R	26	13.8	B	1	61	104	28.9	D	10	147
		SB Overall		**28**	**16.5**	**C**	-	-	**107**	**29.7**	**D**	-	-
		Int Overall		**4967**	**61.0**	**F**	-	-	**5096**	**76.0**	**F**	-	-

Table 5: 2023 Vissim Analysis Results Summary Continued (Intersections 4 to 6)

ID	Intersection	Movement		Existing AM					Existing PM				
				Volume (veh)	Delay (sec/veh)	LOS	Avg Q (ft)	Max Q (ft)	Volume (veh)	Delay (sec/veh)	LOS	Avg Q (ft)	Max Q (ft)
4	US 50 at Garfield St	EB	L	5	12.8	B	48	346	6	31.4	D	72	348
			T	3035	6.8	A	21	205	1952	14.0	B	31	207
			R	1	2.3	A	50	345	12	12.5	B	81	346
		EB Overall		**3041**	**6.8**	**A**	-	-	**1970**	**14.0**	**B**	-	-
		WB	T	1853	0.2	A	0	32	2949	0.3	A	0	53
			R	2	2.7	A	1	55	3	0.3	A	1	86
		WB Overall		**1855**	**0.2**	**A**	-	-	**2952**	**0.3**	**A**	-	-
		NB	L	2	77.6	F	2	69	1	58.5	F	0	41
			T	1	96.4	F	2	69	0	24.9	C	0	41
			R	9	36.7	E	2	69	2	38.1	E	0	41
		NB Overall		**12**	**48.5**	E	-	-	**3**	**44.9**	E	-	-
		SB	R	8	8.3	A	0	0	8	17.5	C	0	4
		SB Overall		**8**	**8.3**	**A**	-	-	**8**	**17.5**	**C**	-	-
		Int Overall		**4916**	**63.8**	**F**	-	-	**4933**	**76.7**	**F**	-	-
5	US 50 at Fenwick St	EB	L	3	9.9	A	11	335	2	67.0	F	31	491
			T	3013	15.0	B	58	304	1899	29.6	D	101	301
			R	10	13.6	B	125	494	10	14.9	B	192	491
		EB Overall		**3026**	**14.9**	**B**	-	-	**1911**	**29.5**	D	-	-
		WB	T	1854	0.4	A	0	38	2950	0.3	A	0	0
			R	0	0.0	A	0	28	1	-0.7	A	0	7
		WB Overall		**1854**	**0.4**	**A**	-	-	**2951**	**0.3**	**A**	-	-
		NB	R	0	0.0	A	0	0	0	0.0	A	0	0
		NB Overall		**0**	**0.0**	**A**	-	-	**0**	**0.0**	**A**	-	-
		SB	R	4	5.1	A	0	0	2	7.0	A	0	0
		SB Overall		**4**	**5.1**	**A**	-	-	**2**	**7.0**	**A**	-	-
		Int Overall		**4884**	**20.4**	**C**	-	-	**4864**	**36.9**	E	-	-
6	US 50 at Fillmore St	EB	L	23	101.3	F	15	97	38	71.2	E	22	202
			T	2958	5.7	A	128	360	1857	10.8	B	184	356
			R	50	2.2	A	128	360	39	9.2	A	184	356
		EB Overall		**3031**	**6.3**	**A**	-	-	**1934**	**12.0**	**B**	-	-
		WB	L	105	179.2	F	202	687	286	99.7	F	400	1272
			T	1715	24.9	C	202	687	2716	23.6	C	400	1272
			R	50	22.6	C	202	687	13	22.3	C	400	1272
		WB Overall		**1870**	**33.5**	**C**	-	-	**3015**	**30.8**	**C**	-	-
		NB	L	116	1.4	A	64	137	176	1.7	A	79	128
			T	51	0.4	A	1	56	66	0.4	A	6	80
			R	208	-0.1	A	55	124	144	0.0	A	67	116
		NB Overall		**375**	**0.4**	**A**	-	-	**386**	**0.9**	**A**	-	-
		SB	L	30	28.1	C	31	122	12	20.3	C	26	118
			T	45	20.9	C	30	122	81	17.4	B	26	117
			R	26	14.6	B	29	121	59	9.4	A	25	117
		SB Overall		**101**	**21.4**	**C**	-	-	**152**	**14.5**	**B**	-	-
		Int Overall		**5377**	**61.7**	E	-	-	**5487**	**58.1**	E	-	-

Table 6: 2023 Vissim Analysis Results Summary Continued (Intersections 7 to 10)

ID	Intersection	Movement		Existing AM					Existing PM				
				Volume (veh)	Delay (sec/veh)	LOS	Avg Q (ft)	Max Q (ft)	Volume (veh)	Delay (sec/veh)	LOS	Avg Q (ft)	Max Q (ft)
7	Walter Reed Dr at Courhouse Rd	EB	T	90	9.7	A	4	103	132	11.8	B	7	127
			R	27	9.1	A	4	103	45	9.9	A	7	127
		EB Overall		**117**	**9.6**	**A**	-	-	**177**	**11.3**	**B**	-	-
		WB	L	104	2.2	A	0	69	104	2.1	A	0	0
			T	110	2.0	A	9	194	60	2.2	A	8	238
		WB Overall		**214**	**2.1**	**A**	-	-	**164**	**2.1**	**A**	-	-
		NB	L	91	12.2	B	8	122	40	14.1	B	20	207
			R	77	8.8	A	8	122	233	13.0	B	20	207
		NB Overall		**168**	**10.6**	**B**	-	-	273	13.2	B	-	-
		Int Overall		**499**	**22.3**	**C**	-	-	614	26.6	D	-	-
8	2nd St S at Courthouse Rd	EB	L	4	14.5	B	20	264	**10**	**15.2**	**B**	**14**	**210**
			T	361	10.4	B	20	264	210	10.6	B	14	210
			R	48	11.0	B	23	271	69	10.1	B	17	217
		EB Overall		**413**	**10.5**	**B**	-	-	**289**	**10.6**	**B**	-	-
		WB	L	48	14.8	B	18	251	106	17.9	B	70	511
			T	161	12.0	B	18	251	339	17.1	B	70	511
			R	96	8.2	A	21	256	179	15.3	B	73	516
		WB Overall		**305**	**11.2**	**B**	-	-	624	16.7	B	-	-
		NB	L	41	20.1	C	35	291	**51**	**28.2**	**C**	**44**	**294**
			T	69	21.9	C	35	291	86	25.8	C	44	294
			R	139	21.2	C	35	291	102	28.4	C	44	294
		NB Overall		**249**	**21.2**	**C**	-	-	**239**	**27.4**	**C**	-	-
		SB	L	67	17.6	B	12	150	43	20.5	C	16	163
			T	55	16.5	B	12	150	92	19.4	B	16	163
			R	9	9.1	A	14	156	11	12.5	B	19	169
		SB Overall		**131**	**16.6**	**B**	-	-	146	19.2	B	-	-
		Int Overall		**1098**	**59.5**	E	-	-	**1298**	**74.0**	E	-	-
9	2nd St S at VA 27 Ramps	EB	L	183	1.3	A	0	85	117	2.8	A	1	89
			T	384	1.9	A	0	5	237	1.0	A	0	5
		EB Overall		**567**	**1.7**	**A**	-	-	**354**	**1.6**	**A**	-	-
		WB	T	82	0.1	A	0	0	359	0.9	A	0	36
			R	33	1.9	A	0	38	92	1.8	A	1	112
		WB Overall		**115**	**0.7**	**A**	-	-	451	1.1	A	-	-
		NB	R	213	6.2	A	5	145	106	3.0	A	1	64
		NB Overall		**213**	**6.2**	**A**	-	-	**106**	**3.0**	**A**	-	-
		SB	R	222	0.3	A	1	80	265	4.4	A	8	175
		SB Overall		**222**	**0.3**	**A**	-	-	265	4.4	A	-	-
		Int Overall		**1117**	**8.8**	**A**	-	-	**1176**	**10.4**	**B**	-	-
10	VA 27 at Brookside Dr	EB	L	13	33.7	D	1	47	5	36.3	E	1	57
			R	14	16.8	C	1	47	15	16.6	C	1	57
		EB Overall		**27**	**24.9**	**C**	-	-	20	21.5	C	-	-
		NB	L	6	13.0	B	40	515	52	28.1	D	41	509
			T	1530	7.0	A	40	515	**1499**	**7.3**	**A**	**41**	**509**
		NB Overall		**1536**	**7.0**	**A**	-	-	1551	8.0	A	-	-
		SB	T	1132	6.4	A	29	461	1480	7.2	A	45	637
			R	8	3.4	A	17	322	**22**	**5.0**	**A**	**30**	**482**
		SB Overall		**1140**	**6.4**	**A**	-	-	1502	7.2	A	-	-
		Int Overall		**2703**	**38.4**	E	-	-	3073	36.7	E	-	-

Table 7: 2023 Vissim Analysis Results Summary Continued (Intersections 12 to 19)

ID	Intersection	Movement		Existing AM					Existing PM				
				Volume (veh)	Delay (sec/veh)	LOS	Avg Q (ft)	Max Q (ft)	Volume (veh)	Delay (sec/veh)	LOS	Avg Q (ft)	Max Q (ft)
12	VA 27 at Wayne St	WB	L	14	30.6	D	2	65	41	51.5	F	12	106
			R	9	12.6	B	2	65	15	20.3	C	12	106
		WB Overall		**23**	**23.5**	**C**	-	-	**56**	**43.1**	E	-	-
		NB	U	5	3.9	A	8	284	42	25.3	D	18	326
			T	1541	1.8	A	2	191	1578	2.6	A	8	234
			R	15	2.1	A	8	274	43	3.2	A	16	316
		NB Overall		**1561**	**1.7**	**A**	-	-	1663	3.2	A	-	-
		SB	L	10	11.2	B	0	38	**6**	**14.7**	**B**	**0**	**28**
			T	1135	0.6	A	0	0	1516	1.1	A	0	10
		SB Overall		**1145**	**0.7**	**A**	-	-	1522	1.2	A	-	-
		Int Overall		**2729**	**25.9**	D	-	-	3241	47.5	E	-	-
13	US 50 at Pershing Dr	EB	L	36	131.4	F	31	134	61	120.4	F	52	195
			T	2714	5.7	A	34	513	**1484**	**2.2**	**A**	**5**	**134**
		EB Overall		**2750**	**7.4**	**A**	-	-	1545	6.8	A	-	-
		WB	T	1170	13.6	B	38	300	2588	13.1	B	103	803
			R	98	4.4	A	39	306	234	5.4	A	104	809
		NB Overall		**1268**	**12.9**	**B**	-	-	2822	12.4	B	-	-
		SB	L	113	76.3	E	51	243	**109**	**77.0**	E	**52**	**240**
			R	30	8.1	A	52	249	46	14.4	B	52	246
		SB Overall		**143**	**62.0**	E	-	-	155	58.4	E	-	-
		Int Overall		**4161**	**82.3**	F	-	-	4522	77.7	E	-	-
14	US 50 WB at N Wise St RIRO	WB	T	1821	1.4	A	3	250	2942	2.6	A	13	483
			R	300	3.5	A	3	250	**273**	**2.9**	**A**	**13**	**483**
		WB Overall		**2121**	**1.7**	**A**	-	-	3215	2.6	A	-	-
		SB	R	37	3.2	A	1	51	80	9.8	A	6	133
		SB Overall		**37**	**3.2**	**A**	-	-	80	9.8	A	-	-
		Int Overall		**2158**	**4.9**	**A**	-	-	3295	12.4	B	-	-
18	VA 27 SB at N Service Rd RIRO	EB	R	309	10.7	B	20	293	**270**	**58.1**	F	**118**	**438**
		EB Overall		**309**	**10.7**	**B**	-	-	270	58.1	F	-	-
		SB	T	1112	1.2	A	4	161	1519	1.4	A	5	323
			R	42	2.1	A	6	200	83	2.3	A	7	271
		SB Overall		**1154**	**1.2**	**A**	-	-	1602	1.4	A	-	-
		Int Overall		**1463**	**11.9**	**B**	-	-	**1872**	**59.5**	F	-	-
19	N Service Rd at N Wise St	EB	L	15	11.3	B	1	71	4	19.4	C	0	48
			R	0	0.0	A	1	72	0	0.0	A	0	49
		EB Overall		**15**	**11.3**	**B**	-	-	4	19.4	C	-	-
		NB	L	7	0.5	A	0	19	6	0.6	A	2	52
			T	293	0.3	A	4	122	**267**	**1.8**	**A**	**5**	**126**
		NB Overall		**300**	**0.3**	**A**	-	-	273	1.8	A	-	-
		SB	T	37	1.0	A	0	8	81	3.1	A	0	17
			R	5	0.7	A	0	8	**3**	**0.7**	**A**	**0**	**17**
		SB Overall		**42**	**0.9**	**A**	-	-	84	3.0	A	-	-
		Int Overall		**357**	**12.6**	**B**	-	-	361	24.2	C	-	-

Table 8: 2023 Vissim Analysis Results Summary Continued (Intersections 20, 21, 61, and 62)

ID	Intersection	Movement		Existing AM Volume (veh)	Existing AM Delay (sec/veh)	Existing AM LOS	Existing AM Avg Q (ft)	Existing AM Max Q (ft)	Existing PM Volume (veh)	Existing PM Delay (sec/veh)	Existing PM LOS	Existing PM Avg Q (ft)	Existing PM Max Q (ft)
12	VA 27 at Wayne St	WB	L	14	30.6	D	2	65	41	51.5	F	12	106
			R	9	12.6	B	2	65	15	20.3	C	12	106
20	US 50 WB at 2nd St N	WB	T	1197	0.5	A	0	0	2620	1.0	A	0	24
			R	10	1.0	A	0	3	27	1.3	A	0	51
		SB Overall		**1207**	**0.5**	A	-	-	**2647**	**1.0**	A	-	-
		SB	R	20	1.4	A	0	7	16	7.9	A	0	40
		EB Overall		**20**	**1.4**	A	-	-	**16**	**7.9**	A	-	-
		Int Overall		**1227**	**2.0**	A	-	-	**2663**	**8.9**	A	-	-
21	US 50 EB at S Service Rd RIRO	EB	T	3175	1.0	A	3	307	1999	1.5	A	2	216
			R	14	3.4	A	3	307	13	4.1	A	2	216
		EB Overall		**3189**	**1.0**	A	-	-	**2012**	**1.5**	A	-	-
		NB	R	16	-0.5	A	0	11	24	0.4	A	0	22
		NB Overall		**16**	**-0.5**	A	-	-	**24**	**0.4**	A	-	-
		Int Overall		**3205**	**0.6**	A	-	-	**2036**	**1.9**	A	-	-
61	N Fillmore St at N Service Rd	WB	L	8	51.9	F	2	50	9	38.9	E	1	38
			R	16	11.9	B	2	50	9	11.8	B	1	38
		WB Overall		**24**	**25.3**	D	-	-	**18**	**25.3**	D	-	-
		NB	T	116	0.1	A	0	102	103	0.1	A	0	106
			R	8	0.1	A	0	81	14	0.0	A	0	71
		NB Overall		**124**	**0.1**	A	-	-	**117**	**0.1**	A	-	-
		SB	L	1	46.4	E	33	240	2	51.5	F	31	240
			T	91	59.3	F	33	240	142	36.0	E	31	240
		SB Overall		**92**	**59.2**	F	-	-	**144**	**36.2**	E	-	-
		Int Overall		**240**	**84.5**	F	-	-	**279**	**61.6**	F	-	-
62	S Fillmore St at S Service Rd	EB	L	2	96.4	F	1	45	2	77.4	F	1	32
			T	6	16.3	C	1	45	2	29.8	D	1	32
			R	5	9.6	A	1	45	4	10.7	B	1	32
		EB Overall		**13**	**26.0**	D	-	-	**8**	**32.1**	D	-	-
		WB	L	3	89.7	F	11	71	4	1058.3	F	142	282
			T	3	70.3	F	11	71	0	0.0	A	142	282
			R	15	213.5	F	11	71	14	1108.0	F	142	282
		WB Overall		**21**	**175.4**	F	-	-	**18**	**1097.0**	F	-	-
		NB	L	2	92.8	F	407	1058	0	0.0	A	905	1616
			T	355	103.9	F	407	1058	369	108.2	F	905	1616
			R	6	81.7	F	426	1085	3	95.6	F	926	1621
		NB Overall		**363**	**103.4**	F	-	-	**372**	**108.1**	F	-	-
		SB	L	18	0.0	A	355	1098	17	0.0	A	914	1628
			T	178	0.1	A	0	105	388	0.1	A	0	110
			R	5	-0.2	A	0	118	1	-0.3	A	0	118
		SB Overall		**201**	**0.1**	A	-	-	**406**	**0.1**	A	-	-
		Int Overall		**598**	**305.0**	F	-	-	**804**	**1237.3**	F	-	-

[1] Level of Service (LOS) is obtained from Synchro per HCM 2000 criteria

[2] Delay is expressed as Seconds per Vehicle

[3] Queues obtained from Synchro queueing output

[4] Worst approach delay and LOS reported as the overall unsignalized intersection operation

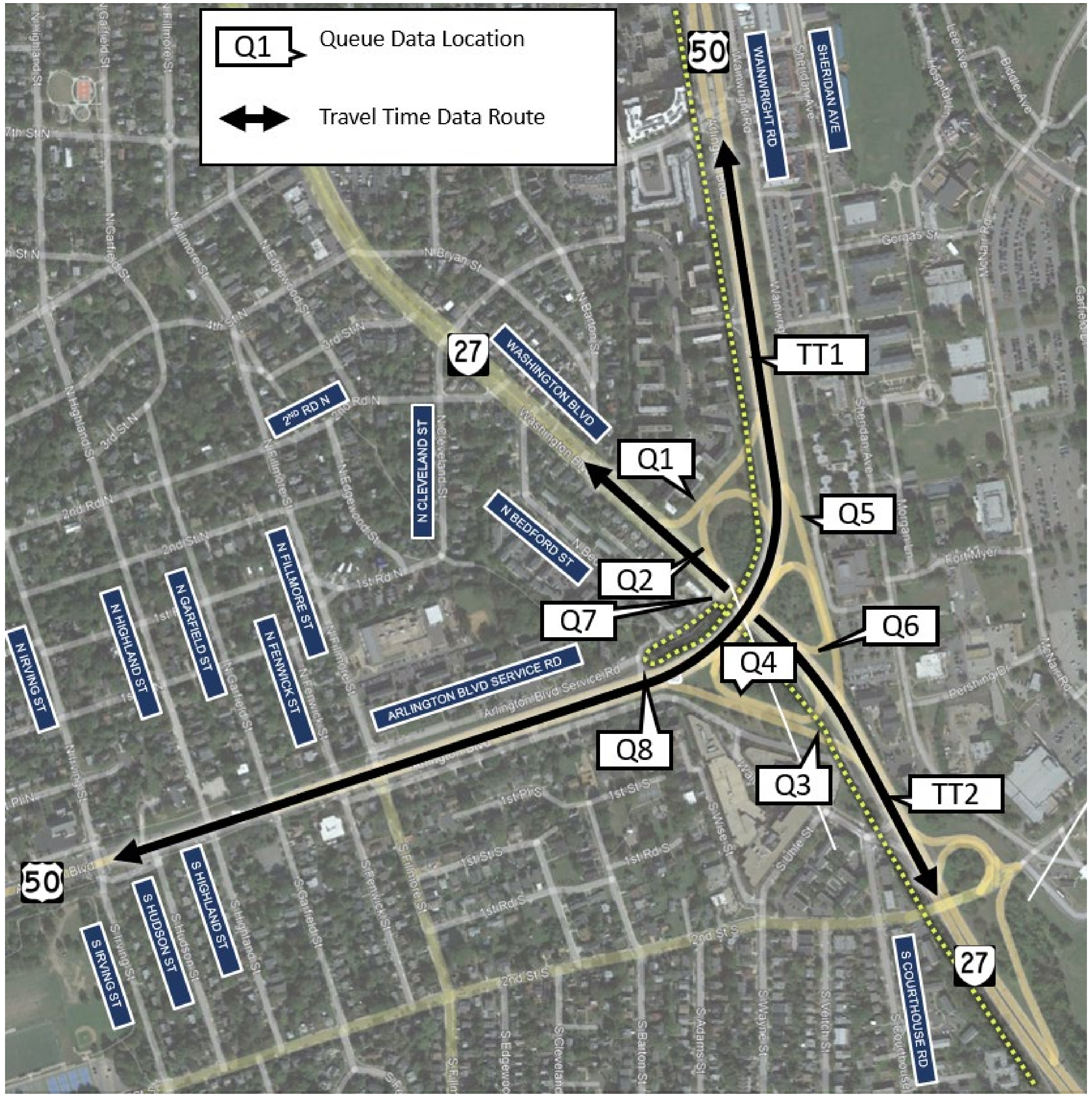


Figure 22. Existing Queue and Travel Time Locations

Table 9: 2023 Maximum Queue from Vissim Analysis vs. Collected in Field

Existing (2023) AM

Queue Counter	Max Queue (feet)		
	Field	Vissim	Difference
1	50	25	-25
2	650	629	-21
3	350	266	-84
4	25	5	-20
5	300	314	14
6	75	0	-75
7	275	305	30
8	50	41	-9

Existing (2023) PM

Queue Counter	Max Queue (feet)		
	Field	Vissim	Difference
1	125	122	-3
2	1350	1262	-88
3	450	394	-56
4	0	3	3
5	125	99	-26
6	50	0	-50
7	500	545	45
8	100	129	29

Table 10: Existing (2023) AM Peak-Hour Travel Time Run Results – US 50 Westbound

US 50 Eastbound					
From	To	Travel Time (Seconds)		Difference	
		Field	Vissim	Seconds	%
S Irving St	S Fillmore St	54.6	54.0	-0.6	-1%
S Fillmore St	Washington Blvd	29.1	32.03	2.9	10%
Washington Blvd	N Pershing Dr	41.7	39.86	-1.8	-4%
Total		125.4	125.9	0.4	0%

Table 11: Existing (2023) AM Peak-Hour Travel Time Run Results – US 50 Westbound

US 50 Westbound					
From	To	Travel Time (Seconds)		Difference	
		Field	Vissim	Seconds	%
N Pershing Dr	Washington Blvd	34.5	38.54	4.0	12%
Washington Blvd	N Fillmore St	56.9	61.57	4.7	8%
N Fillmore St	N Irving St	21.9	22.2	0.3	1%
Total		113.3	122.3	9.0	8%

Table 12: Existing (2023) AM Peak-Hour Travel Time Run Results – VA 27 Southbound

VA 27 Southbound					
From	To	Travel Time (Seconds)		Difference	
		Field	Vissim	Seconds	%
N Barton St	Arlington Blvd	17.3	21.33	4.0	23%
Arlington Blvd	2nd Street S	26.2	26.76	0.6	2%
Total		43.5	48.1	4.6	11%

Table 13: Existing (2023) AM Peak-Hour Travel Time Run Results – VA 27 Northbound

VA 27 Northbound					
From	To	Travel Time (Seconds)		Difference	
		Field	Vissim	Seconds	%
2nd Street S	Arlington Blvd	27.2	31.40	4.2	15%
Arlington Blvd	N Barton St	20.5	20.15	-0.4	-2%
Total		47.7	51.6	3.8	8%

Table 14: Existing (2023) PM Peak-Hour Travel Time Run Results – US 50 Eastbound

US 50 Eastbound					
From	To	Travel Time (Seconds)		Difference	
		Field	Vissim	Seconds	%
S Irving St	S Fillmore St	95.5	89.5	-6.0	-6%
S Fillmore St	Washington Blvd	32.6	30.69	-1.9	-6%
Washington Blvd	N Pershing Dr	37.9	36.90	-1.0	-3%
Total		166.0	157.1	-8.9	-5%

Table 15: Existing (2023) PM Peak-Hour Travel Time Run Results – US 50 Westbound

US 50 Westbound					
From	To	Travel Time (Seconds)		Difference	
		Field	Vissim	Seconds	%
N Pershing Dr	Washington Blvd	38.2	45.69	7.5	20%
Washington Blvd	N Fillmore St	88.3	67.82	-20.5	-23%
N Fillmore St	N Irving St	25.8	23.0	-2.8	-11%
Total		152.3	136.5	-15.8	-10%

Table 16: Existing (2023) PM Peak-Hour Travel Time Run Results – VA 27 Southbound

VA 27 Southbound					
From	To	Travel Time (Seconds)		Difference	
		Field	Vissim	Seconds	%
N Barton St	Arlington Blvd	20.6	21.71	1.1	5%
Arlington Blvd	2nd Street S	26.9	28.30	1.4	5%
Total		47.5	50.0	2.5	5%

Table 17: Existing (2023) PM Peak-Hour Travel Time Run Results – VA 27 Northbound

VA 27 Northbound					
From	To	Travel Time (Seconds)		Difference	
		Field	Vissim	Seconds	%
2nd Street S	Arlington Blvd	29.9	31.79	1.9	6%
Arlington Blvd	N Barton St	25.1	21.22	-3.9	-15%
Total		55.0	53.0	-2.0	-4%

Pedestrian and Bicycle Access

To identify the needs concerning accessibility, the study team reviewed existing conditions of the pedestrian and bicycle infrastructure. The 2019 VTrans Prioritized Midterm Needs for Pedestrian and Bicycle Access shows Very High needs along Arlington Blvd and Washington Blvd, as shown in **Figure 23**.

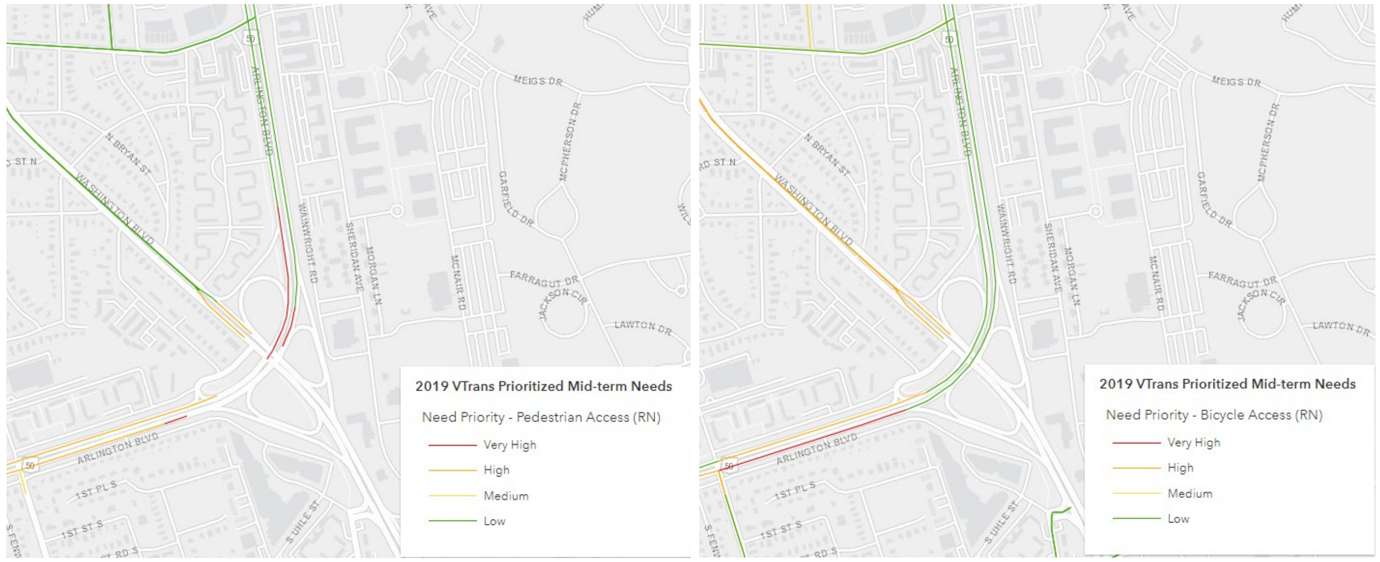


Figure 23. VTrans 2019 Prioritized Mid-Term Needs, Pedestrian Access on the Left and Bicycle Access on the Right.

A summary of the pedestrian and bicycle infrastructure and needs is shown in **Figure 24**.

The Fillmore Park Trail/Shared-Use-Path runs parallel to Arlington Boulevard from Pershing Drive to Washington Boulevard, and south to Columbia Pike. The Shared-Use-Path along the Arlington Boulevard bridge over Washington Boulevard is narrow on the north side and has gaps at both ends on the south side. The Shared-Use-Path under the bridge, along Washington Boulevard, is narrow on the west side and there is no path on the east side.

There is an unprotected bike lane marking along each side of the road on Pershing Drive from Arlington Boulevard to Barton Street. Then, it becomes a protected bike lane between the curb and on-street parking spaces from Barton Drive to Washington Boulevard.

While pedestrians and cyclists can use these trails and paths, there are gaps along both corridors. There is no sidewalk along Arlington Boulevard from Pershing Road to the west, and then Washington Boulevard to Filmore Street has no sidewalk. The latter segment has Service Road on both sides. The existing sidewalk map is shown in **Figure 25**.

There were 2 pedestrian and 4 bicycle crashes that occurred during the study period of 2015 – 2022 in the vicinity of the interchange, as shown in **Figure 24**.

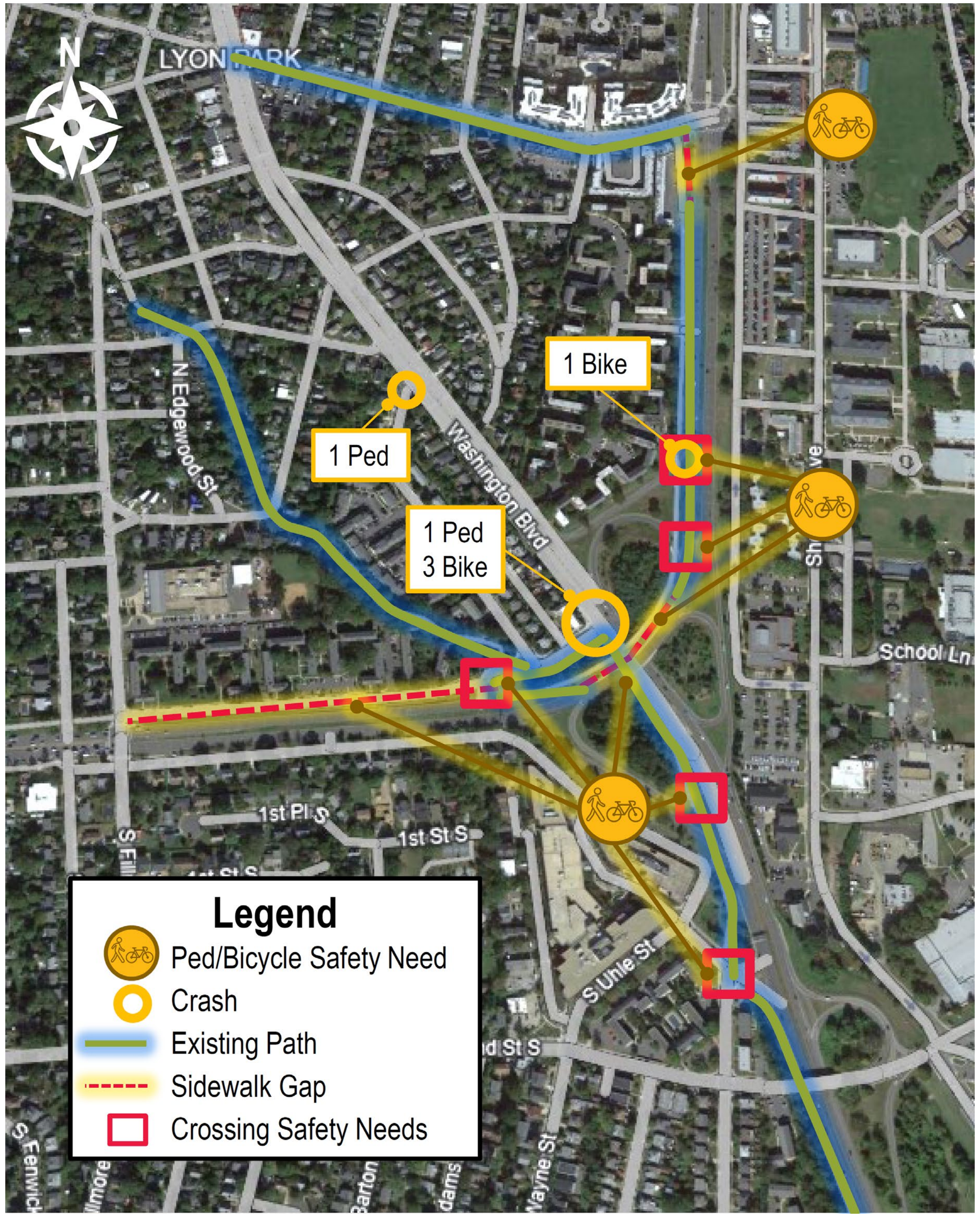


Figure 24. Pedestrian and Bicycle Needs Summary

Figure 25. Existing Sidewalk Map (Obtained from Arlington County Website)

Safety and Reliability:

For the analysis of existing safety conditions, the VDOT Crash Analysis PowerBI Tool was utilized to determine the crash history in the study corridor. Crash data was collected and analyzed for an eight-year period spanning from January 2015 to February 2023. The study team reviewed the FR-300 reports provided by VDOT to determine specific trends and "hot spot" areas for consideration in developing alternative improvement concepts. For the purposes of this analysis, "injury crashes" is defined as the sum of type A (severe injury), B (visible injury), and C (non-visible injury) crashes. Raw crash data is provided in **Appendix C**.

Safety Analysis Results

The crash severity within the study area is summarized by year and type in **Table 18** and **Table 19**, respectively.

Table 18: Study Area Crash Severity by Year

Crash Year and Severity	K. Fatal Injury	A. Severe Injury	B. Visible Injury	C. Nonvisible Injury	PDO. Property Damage Only	Total
2015	0	0	24	3	97	**124**
2016	0	3	36	7	108	**154**
2017	0	1	22	4	79	**106**
2018	0	2	33	3	83	**121**
2019	0	2	30	1	95	**128**
2020	0	1	10	2	36	**49**
2021	1	4	20	3	58	**86**
2022	0	2	18	3	74	**97**
2023	0	0	1	0	2	**3**
Total	**1**	**15**	**194**	**26**	**632**	**868**

Table 19: Study Area Crash Severity by Type

Crash Year and Severity	K. Fatal Injury	A. Severe Injury	B. Visible Injury	C. Nonvisible Injury	PDO. Property Damage Only	Total
Rear End	1	5	137	23	419	**585**
Angle	0	1	31	1	98	**131**
Sideswipe – Same Direction	0	0	7	1	57	**65**
Fixed Object – Off Road	0	1	3	0	31	**35**
Other	0	2	6	0	14	**22**
Head On	0	1	2	0	7	**10**
Pedestrian	0	4	4	1	0	**9**
Sideswipe – Opposite Direction	0	0	1	0	3	**4**
Non-Collision	0	1	2	0	1	**4**
Fixed Object – In Road	0	0	1	0	2	**3**
Total	**1**	**15**	**194**	**26**	**632**	**868**

868 crashes were reported within the study area during the eight-year study period. Key takeaways from the crash data are as follows:

1. Year-over-year crash occurrence varies. The number of crashes were high until 2020. In 2020, the number of crashes dropped significantly but rose again in the following years. As shown in **Table 18.**
2. The approximate average number of reported crash incidents per year is 109.
3. The majority of reported crash incidents are rear-ended and angle crashes. These constitute approximately 83% of the total crashes, as shown in **Table 19.**
4. 236 crash incidents lead to injuries, accounting for 27% of the reported crashes. There was one rear end crash which led to a fatality.
5. Nine pedestrian-related crash incidents occurred, with four severe injuries, four visible injuries and 1 nonvisible injury. Most of the crashes occurred at intersections along Arlington Blvd.
6. 361 incidents were associated with the interchange of Arlington Boulevard and Washington Boulevard.
7. There are 127 rear end incidents along the ramp from northbound Washington Boulevard to westbound Arlington Boulevard, as shown in **Figure 26**.
8. There are 29 rear end incidents along the ramp from northbound Washington Boulevard to eastbound Arlington Boulevard, as shown in **Figure 26**.
9. There are 33 rear end incidents along the ramp from eastbound Arlington Boulevard to southbound Washington Boulevard, as shown in **Figure 27**.
10. There are 24 rear end incidents along eastbound Arlington Boulevard approaching the ramp to southbound Washington Boulevard, and 54% of these occurred at night, as shown in **Figure 28**.
11. There are 15 rear end incidents along eastbound Arlington Boulevard approaching the ramp from southbound Washington Boulevard, as shown in **Figure 28**.

The detailed collision diagrams are shown in **Appendix A.**

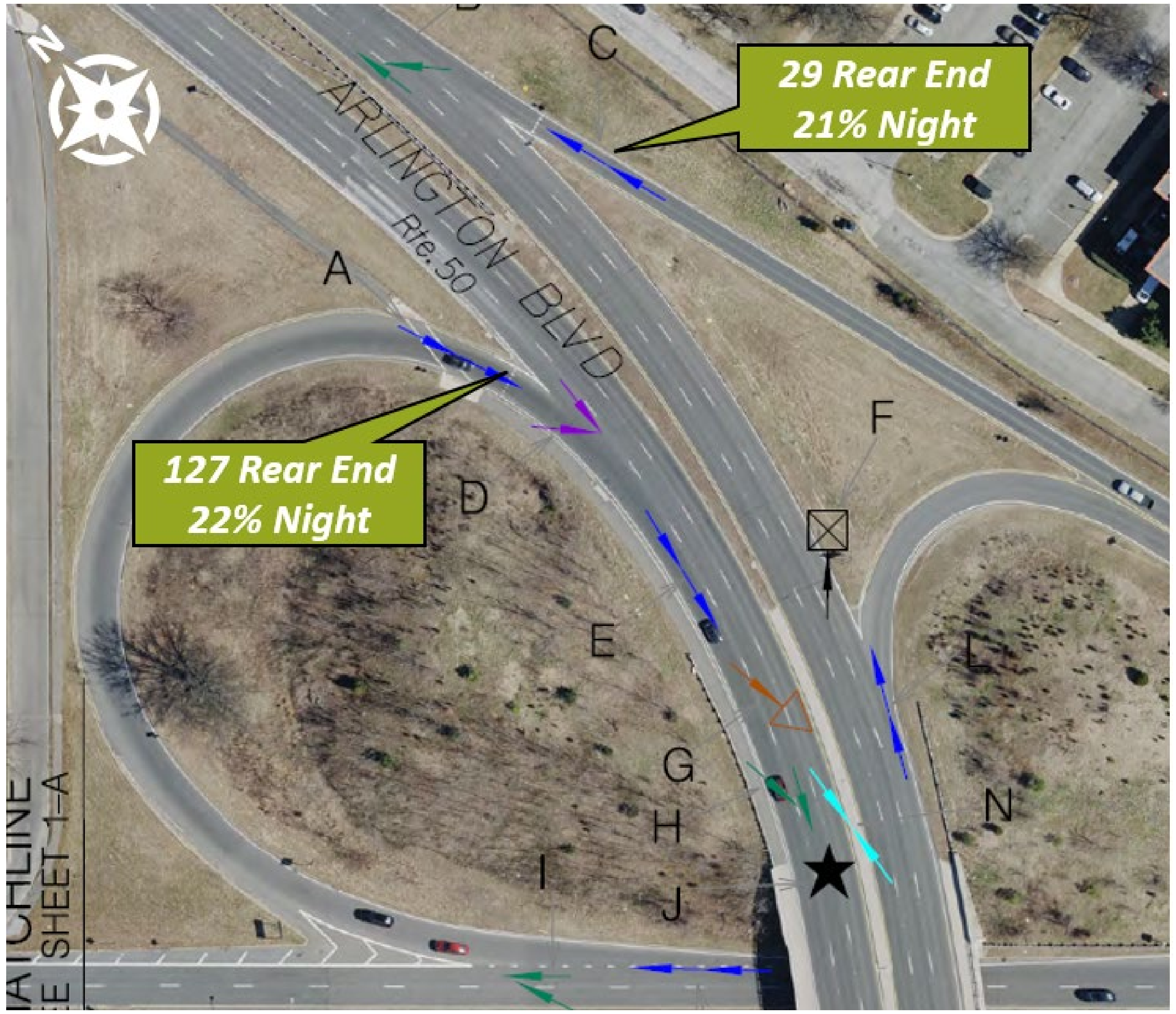


Figure 26. Crashes along the Ramps from northbound Washington Boulevard to Arlington Boulevard

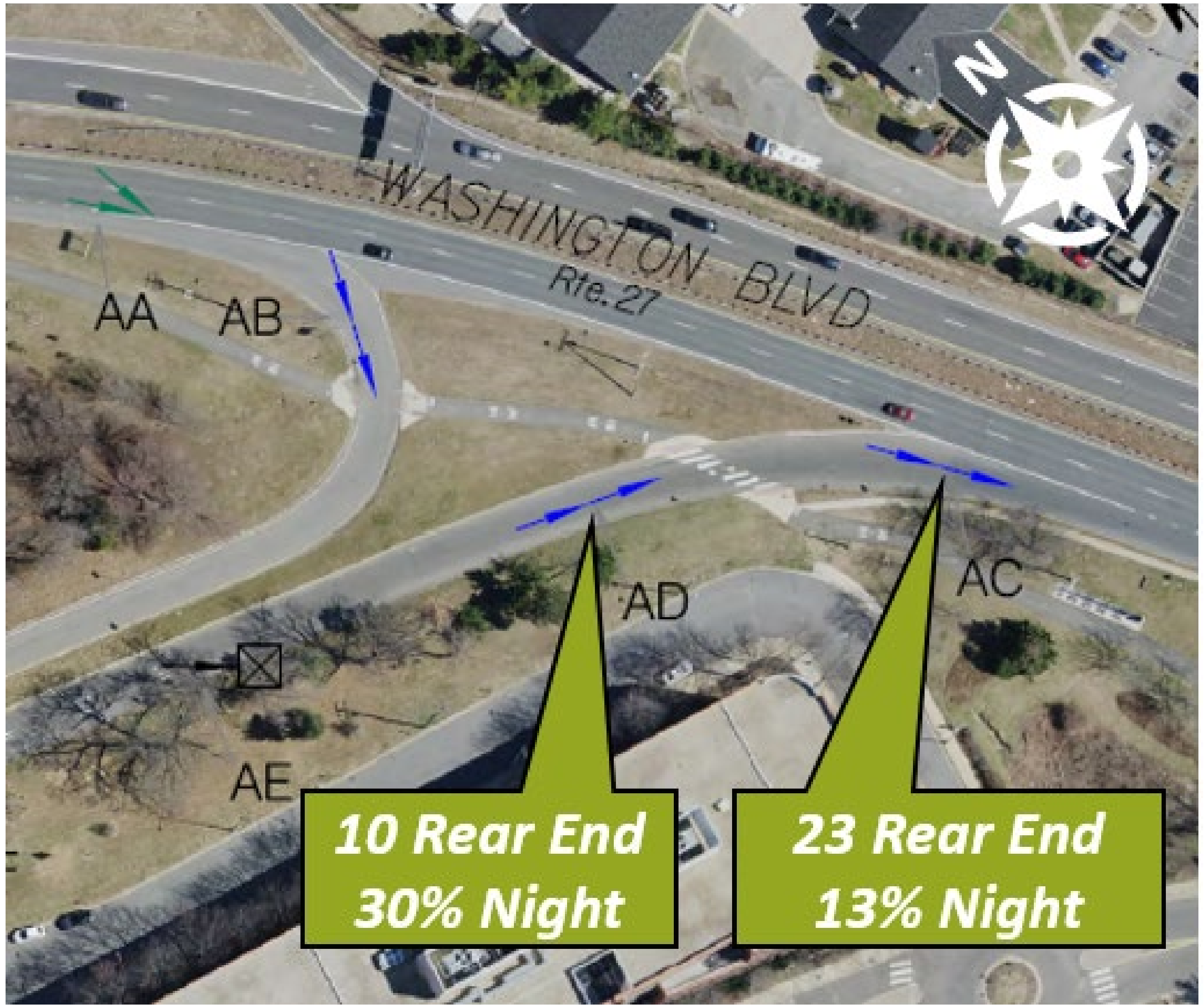


Figure 27. Crashes along the Ramp from eastbound Arlington Boulevard to southbound Washington Boulevard

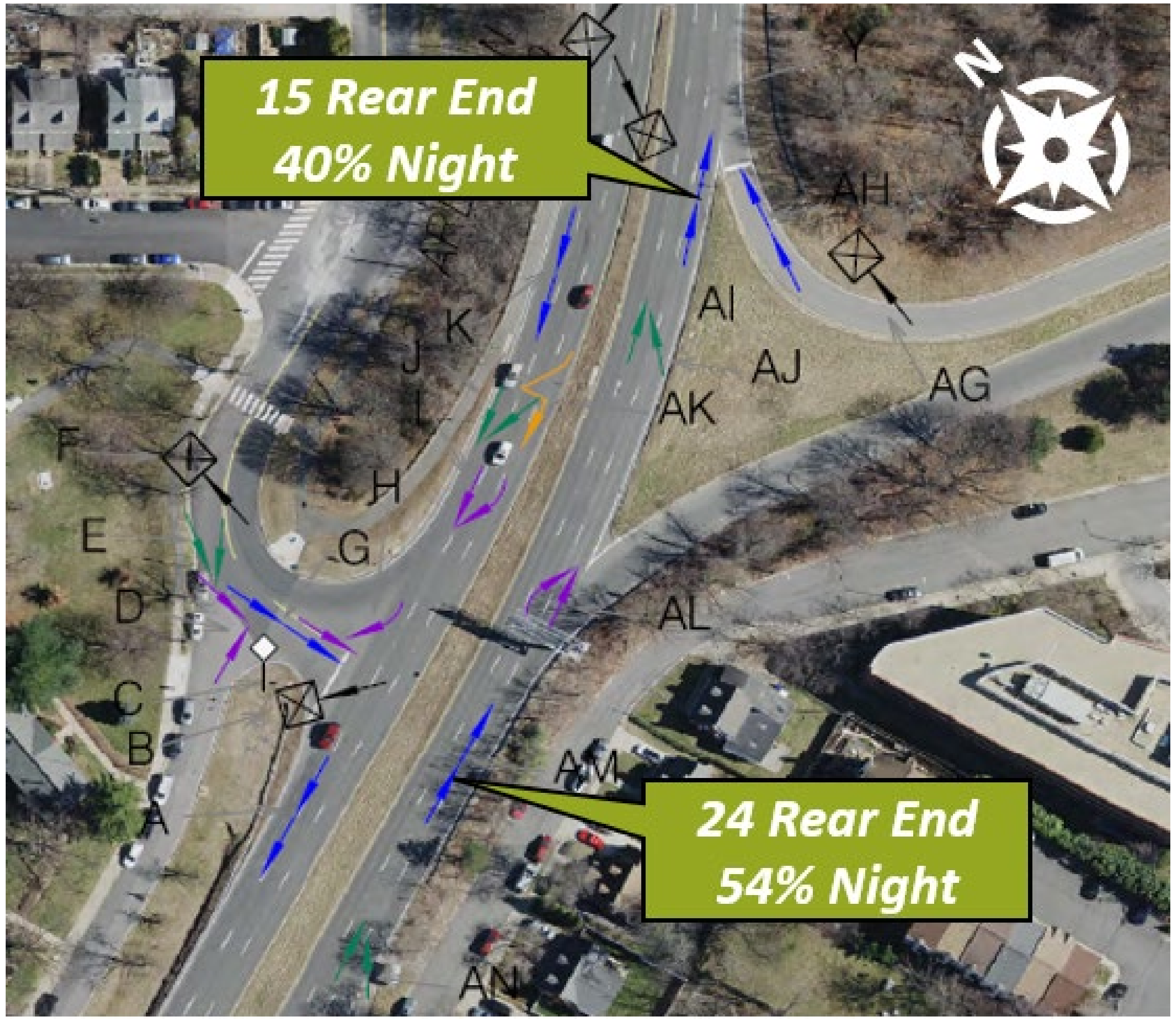


Figure 28. Crashes along eastbound Arlington Boulevard approaching the ramps to Washington Boulevard

Safety and Reliability Needs and Diagnosis Summary:

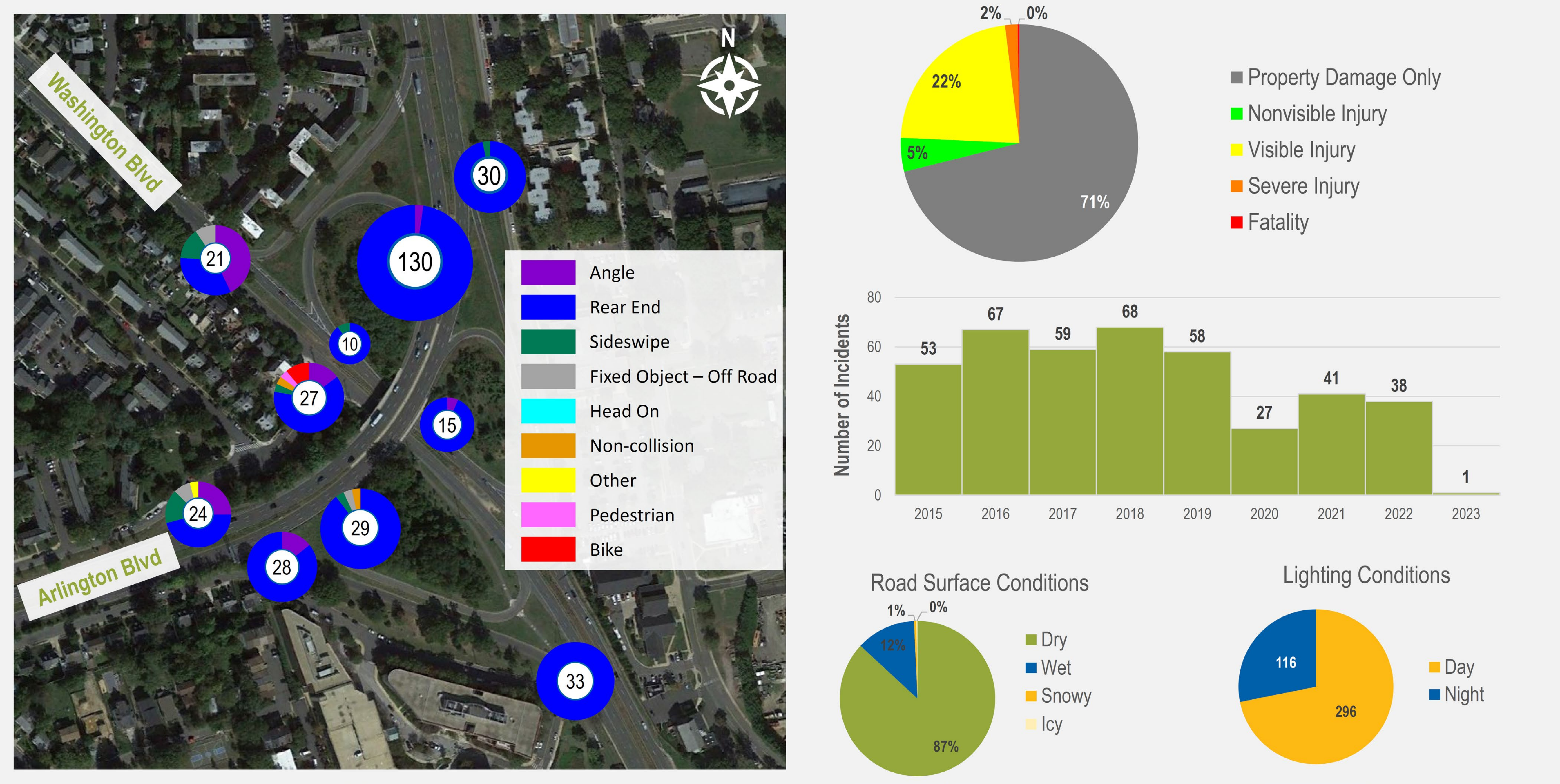


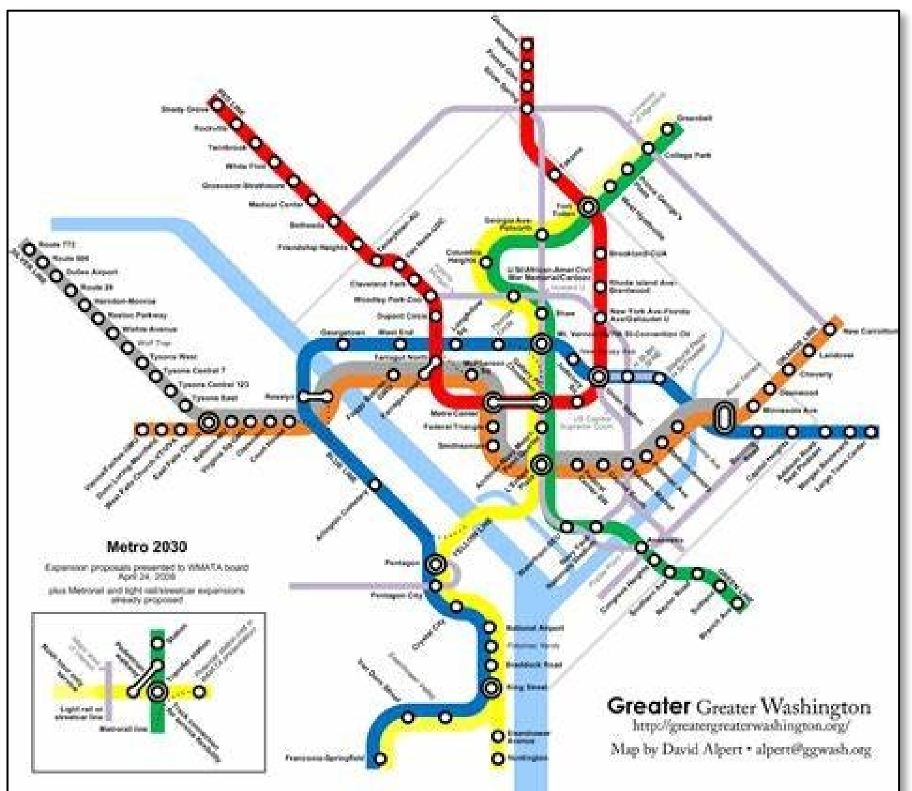
Figure 29. Safety and Reliability Needs and Diagnosis

Rail, Transit, and TDM:

Arlington County is truly multimodal and is served by many different modes both motorized and non-motorized. Arlington has a mix of different bus services including local bus, commuter bus and Bus Rapid Transit (BRT). The Orange, Blue, Silver, and Yellow Metrorail lines serve the County as well as VRE commuter rail. The County has an extensive bike share program with Capital Bikeshare and there are other micro-mobility modes including various types and vendors of e-scooters. The County has created the Mobility Lab, which is an initiative from Arlington County Commuter Services to further the effectiveness of Transportation Demand Management (TDM) through research, collaboration, and innovation. Mobility Lab's work focuses on TDM by conducting research studies, providing data analysis, and statistical information sharing.

Arlington County has the highest non-SOV mode share in Northern Virginia. MWCOG's Regional Household Travel Survey (HTS) shows that only 41 percent of adults drive alone, while 12 percent of trips by adults are in transit modes. For commuting trips, 29 percent of Arlington residents use transit. The majority of those trips are on Metrorail. The are 28,300 average entries and exits from Metro Stations in the County based on ridership data from WMATA.

In the specific study area for this project there are four bus routes that either pass through the study area and/or stop in the study area. These routes include ART routes 42, 45, and 77. For WMATA service route 16Y services the study area.



Phase 1 Corridor/Existing Conditions Public Outreach & Involvement

The Phase 1 Corridor/Existing Conditions Public Survey was active from August 1st through August 15th, 2023. The results from the survey are summarized below and the detailed results are in **Appendix B**.

- The most prevalent needs for the study were identified to be safety (85%), congestion mitigation (65%), and bike/pedestrian access and mobility (63%), as shown in **Figure 30**.
  - Some of the comments to address these needs include, removing the non-protected left turns, adding variable speed limits throughout the day, removing parking along the street, and adding traffic calming efforts.
- The major safety issues identified by the survey respondents include, difficulty weaving/merging (67%), speeding/aggressive driving (61%), sudden stopping/rear-end crashes (59%), lack of sidewalks/missing sidewalks (43%), and inadequate bicycle facilities (36%), as shown in **Figure 31**.
  - Many of the comments were regarding concern for bike and pedestrian safety, concern related to safety issues in merge areas, and visibility/sight distance.
- The majority of respondents experience mobility issues along the corridor during the weekday afternoon rush (77%), from 4:00 PM to 7:00 PM, and the weekday morning rush (61%), from 6:00 AM to 9:00 AM, as shown in **Figure 32**.
- The mobility issues experienced by the survey respondents were lack of turn lanes (45%), difficulty when riding a bicycle (40%), difficulty making left turns (37%), difficulty when walking (36%), and issues with signal coordination and timing (30%), as shown in **Figure 33**.
- This corridor is used by respondents for shopping/errands (69%), work (54%), passing through (52%), home (52%), and dining and entertainment (46%), as shown in **Figure 34**.
- The main modes of travel along the study area include personal vehicle (93%), walking (37%), and cycling (36%), as shown in **Figure 35**.
- The identified multimodal facilities needed in the study corridor include marked crosswalks (60%), pedestrian signals (58%), sidewalks (51%), shared-use path (49%) and bicycle lanes (45%), as shown in **Figure 36**.

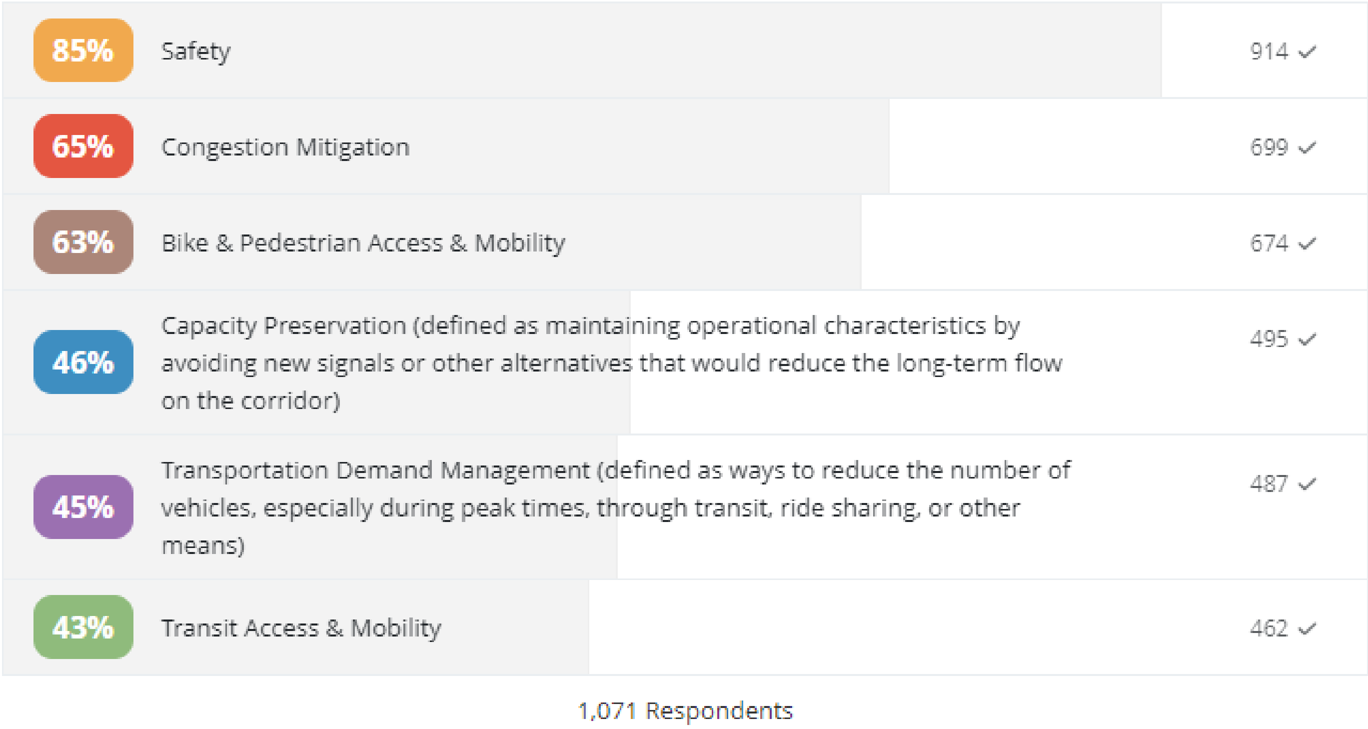


Figure 30. Public Survey Results for the Study Needs

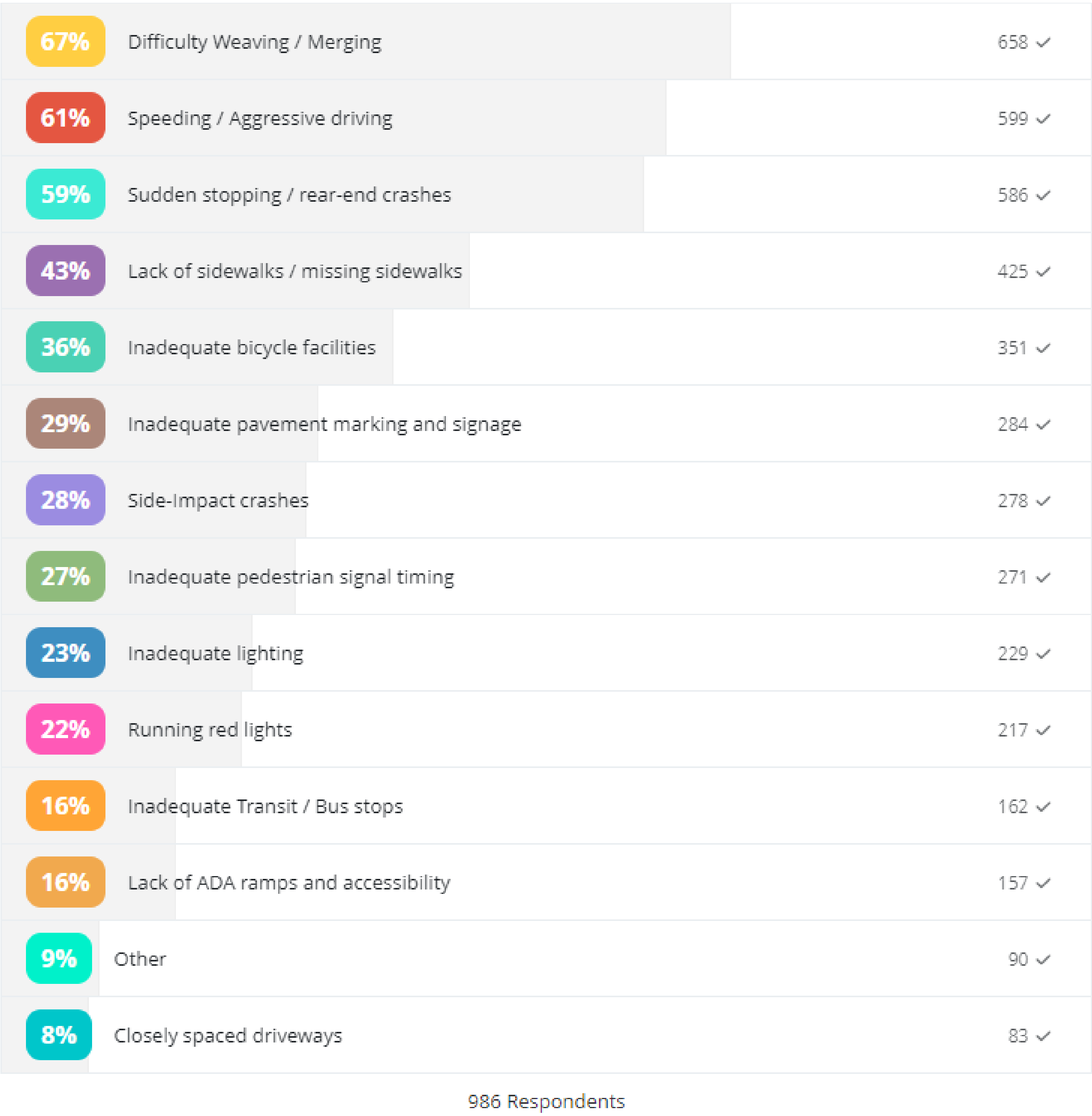


Figure 31. Public Survey Results for the Safety Issues

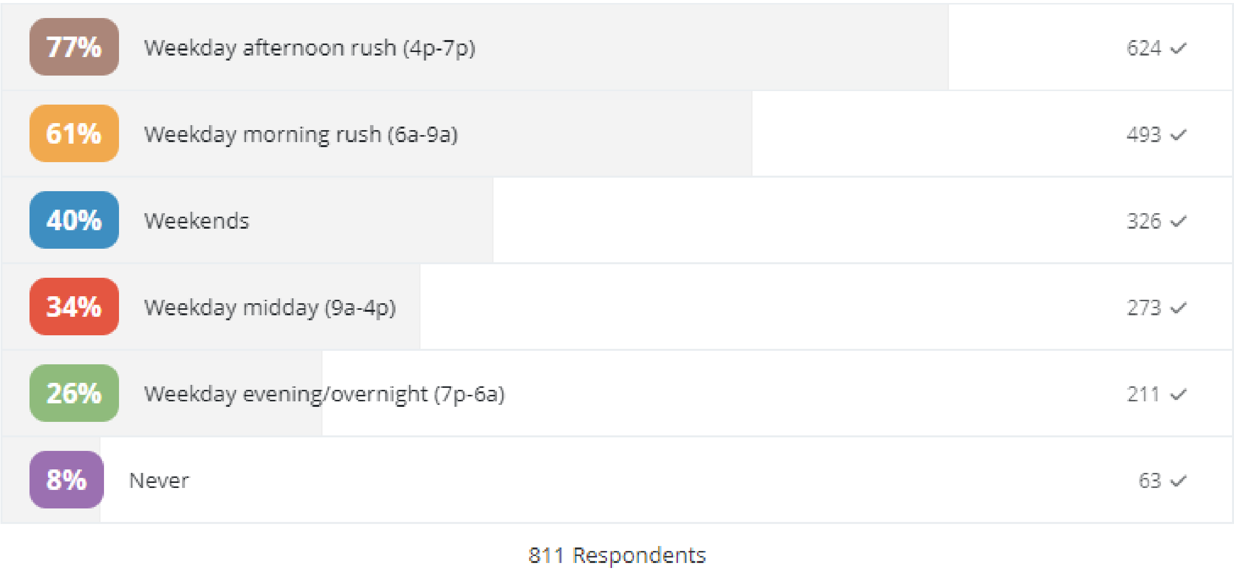


Figure 32. Public Survey Results for the Mobility Issues in the Study Area by Time of Day

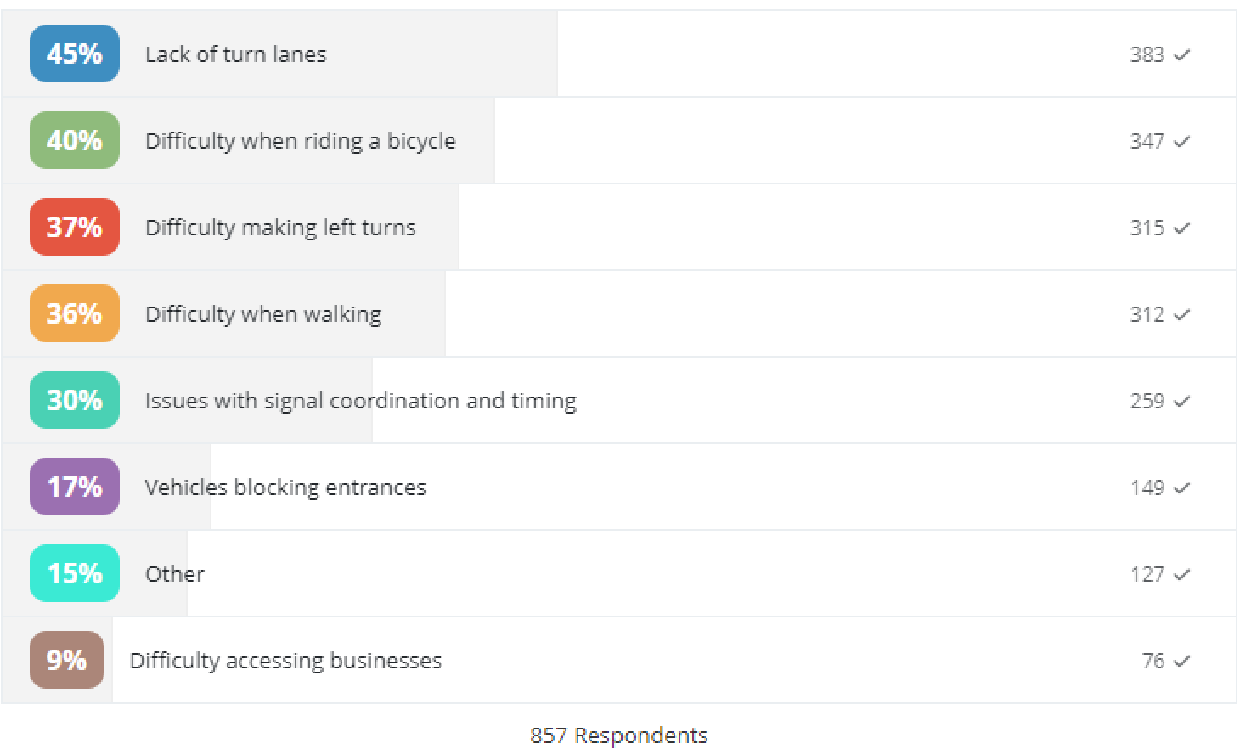


Figure 33. Public Survey Results for Mobility Issues in the Study Area

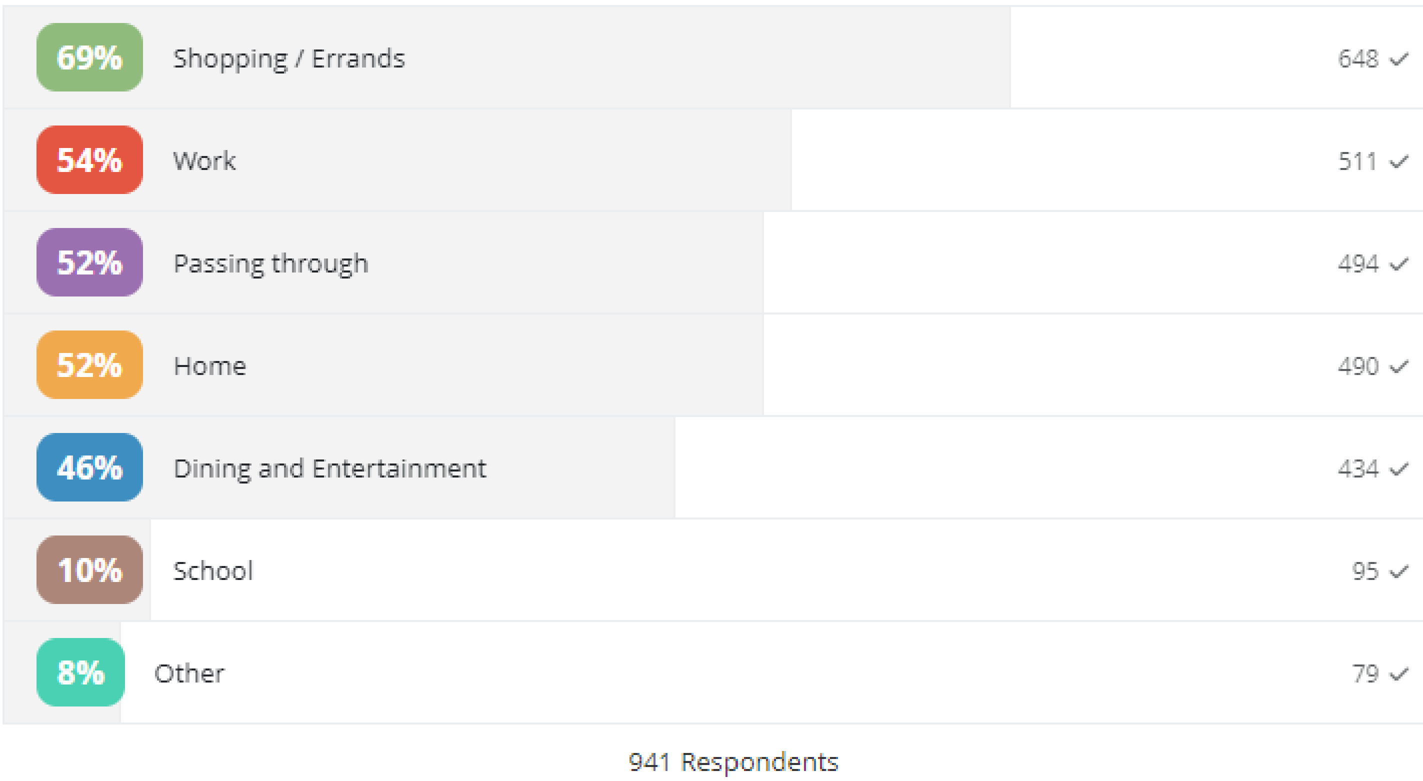


Figure 34. Public Survey Results for the Travel Use in the Study Area

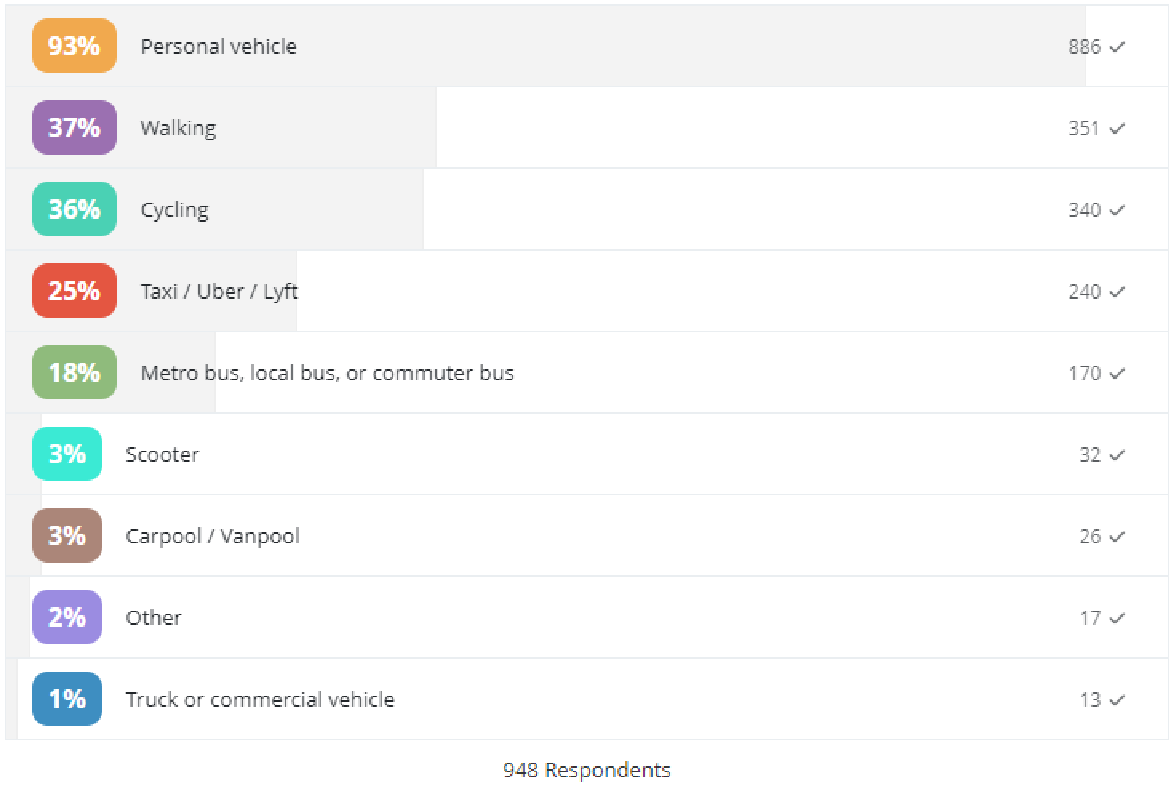


Figure 35. Public Survey Results for the Modes of Travel in the Study Area

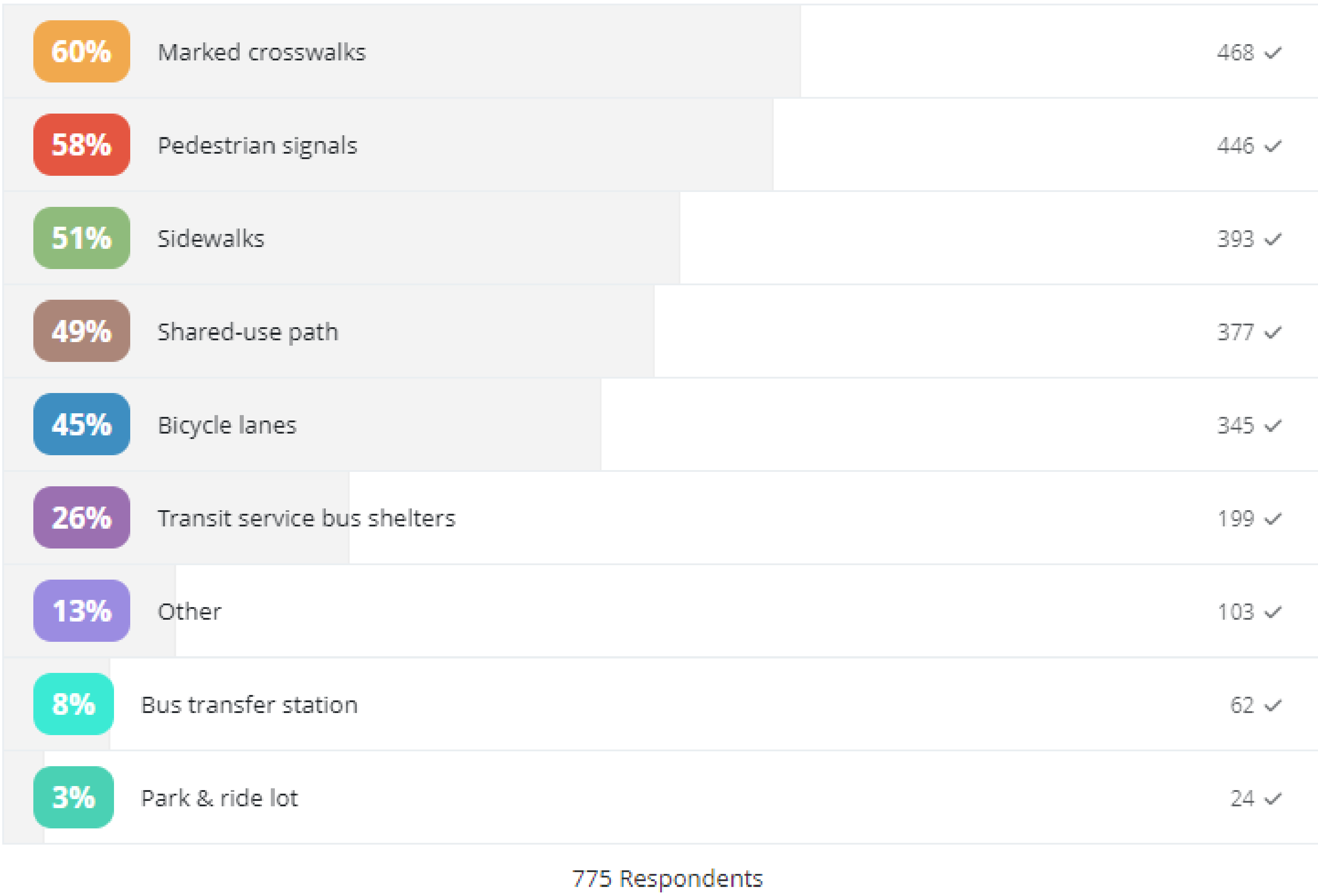


Figure 36. Public Survey Results for the Multimodal Facilities Needed in the Study Area

Chapter 2:

Alternative Development and Refinement

Alternative Development and Screening:

In order to develop alternative concepts to address the needs and incorporate diagnosis identified in Chapter 1, a thorough review of the existing conditions data was conducted. A screening-level analysis was performed in Vissim Microsimulation on potential alternative options at the study intersections. The input and analysis methodologies are consistent with the VDOT TOSAM guidelines. For the purposes of alternative testing and screening, the AM and PM peak hour Vissim analyses were performed for future years 2035 and 2050. The analyses conducted are discussed in greater detail in the following section.

A VJuST analysis was completed prior to the Vissim analyses to consider alternative interchanges and compare their potential operational and safety benefits to the conventional interchange. VJuST is a screening tool that helps in the decision-making process of identifying innovative intersections and interchange configurations that are most appropriate in reducing congestion and improving safety to advance to further study, analysis, and design. The input and analysis methodology are consistent with the VDOT TOSAM guidelines.

Based on the findings from the existing and future No-Build conditions analyses performed for the study area, potential alternative options were developed, and a screening-level Vissim analysis was performed for the study area for the 2035 and 2050 AM and PM peak hours.

Traffic Forecasts

In order to address operational and capacity needs and analyze future traffic conditions, it is necessary to estimate future traffic volumes that reflect the impact of both the planned land use and future transportation system improvements. The two traffic forecasts prepared for the scenarios include both morning and evening weekday peak hour volumes for the 2035 near-term year and 2050 design year.

Traffic Forecasting Methodology

Travel demand and the corresponding traffic levels are a function of land use, sociodemographic data, and the transportation network. A Travel Demand Forecast Model (TDFM) is a series of mathematical relationships linked in a sequential process that calculates travel demand based on existing travel choice and trip characteristics. The travel impacts related to changes in land use and the transportation system are reflected in the travel patterns forecasted by the TDFM. The model calculates activity levels based on the interaction of the land use and socioeconomic factors given the future highway and transit networks. Given a future land use scenario and transportation network, the model produces the anticipated traffic related to those changes.

The assignment sub-model of a TDFM involves determining what path trips will take to go from an origin to a destination. Highway networks are represented in a TDFM as nodes and links. The links are coded with a set of attributes that represent specific highway segments. These attributes include but are not limited to speed, capacity, and distance. The purpose of the TDFM network is to serve as an input for developing travel demand. The assignment algorithm in the TDFM process is macroscopic. The highway network that is used in a TDFM is coarse and does not represent all the roads nor all the intersections or access points (e.g., curve cuts, driveways, etc.). Therefore, the results that are produced from the assignment need to be adjusted to compensate for the model's limitations. The post-processing refinement should not be viewed as a separate step in the TDFM process, but rather as an extension of the highway assignment. The national accepted guidance and methods for adjust highway forecast can be found in NCHRP-255 Highway Traffic Data for Urbanized Area Project Planning and Design as well as the update NCHRP-765 Analytical Travel Forecasting Approaches for Project-Level Planning and Design. It is noted that some of the methodologies and details presented in NCHRP-255 are not completely covered in NCHRP-765. The procedures, methodologies, and guidance in presented NCHRP-255 were followed in developing traffic forecast for this project.

Validation

Validation is an important factor in the use of TDFM outputs and post-processing. Validation involves checking the model results against observed data, sometimes at the aggregate level, and adjusting the calibration until the model results fall within an acceptable range of error. Validation is performed at different levels corresponding to the different focus levels of transportation studies. It is noted here that VDOT has established a set of validation metrics as well as some guidelines on post-processing and refinement of model outputs in *VDOT IIM TMPD 7.0 Traffic Forecasting* and *VDOT Traffic Forecasting Guidebook*. Those guidelines and methods were applied for the development of this traffic forecast.

Forecasts for the study corridor were developed for the years 2035, and 2050. The forecasts for 2035 and 2050 were pivoted from the year 2045. The growth in this area is very low, so the difference between 2045 and 2050 was very small. It is noted that having land use for year 2050 would have been the preferred method, but VDOT required a year 2050 forecast regardless that the MWCOG Cooperative Land Use Forecast Round 9.2 only included out to year 2045. The final forecasted numbers were rounded to the nearest 25, so as to address the margin of error in the traffic forecast. Given the low growth between the year 2045 and year 2050 and the rounding by 25 – the difference in the forecast years was margin. This is also reflected in the year 2045 as compared to year 2035.

The model set used for this forecasting effort was the MWCOG/TPB Version 2.4 Travel Model, obtained in August of 2023 from MWCOG/TPB. The corresponding land use was Round 9.2. The model was run as provided, no changes were made to the input data or model parameters. The following highway assignment results were obtained from the model and are shown in Table 1 and Table 4.

Table 20 shows the percent difference from the observed count data (2017 Traffic Data Publications[2]) compared to the model output for the base year 2017 for specific links in the study area where count data for the base year was available. The percent difference or percent deviation is defined as the

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[2] https://www.vdot.virginia.gov/doing-business/technical-guidance-and-support/traffic-operations/traffic-counts/

absolute value of the Forecast minus the count divided by the count. This formula can be found in NCHRP-255 on page 49. Year 2017 is the base year and therefore is the year that the model set has been validated to. It serves as the base year for the forecasting effort. Although land use is available for other years, such as year 2021 or year 2022 – these are forecasts years and the results are not validated, furthermore the land use input is a forecast and is not validated. It is not acceptable to use forecast years as the base year in the link refinement process.

The MWCOG/TPB travel demand forecast model is more complex than other model sets used in Virginia. The highway and transit networks are more complex covering HOV, managed lanes, and other TDM aspects. The transit network in Northern Virginia alone far exceeds all of the transit services combined from the other parts of the state in terms of hours and miles of operation. (The National Transit Database (NTD) | FTA (dot.gov)) The geographic area covered by the model set goes from the Maryland border with Pennsylvania in the north to Fredericksburg in the south. MWCOG/TPB does an extensive model calibration and validation effort. Given the scope of this study and the model performance for Northern Virginia inside the Beltway cordon, no changes were made to the model and the results were post processed using the methods in NCHRP-255. These same procedures, for the Inter-County Connector Study which has been cited in FHWA NEPA guidance on developing traffic forecast for environmental studies. (Intercounty Connector, Maryland Case Study (dot.gov))

Overall, the model is performing within the guidelines recommended by FHWA on model validation. This guidance is taken from the *FHWA's Travel Model Improvement Program Calibration and Validation Guidance*. For daily weekday VMT in Arlington County the model simulation 4,109,213 miles and the observed value was 4,115,600. The ratio between the estimated to observed values was 1.00. For the Potomac River Crossings that directly impact the study interchange, this would include the Memorial Bridge, Roosevelt Bridge, and Key Bridge; the observed daily volume was 218,730 vpd and the estimated was 219,141 vpd. This resulted in a ration of estimated to observed of 1.00. For all the links in Table 1, the percent Root Mean Square Error (RMSE) was calculated. The percent RMSE is a measure of the difference between the observed link volume and the model-simulated link volume. The percent RMSE for the links in aggregate is 6.9 percent. This is below the guidance threshold provided by FHWA. Overall given the VMT for County, the bridge cutline volumes and the data in Table 13, the data shows that the model is performing adequately for purposes of this study based on national accepted practice and is within the VDOT standards for link percent deviation.

Table 20: Percent Deviation for Links in the Study Area

Facility	Count	Model	% Deviation
Arlington Blvd. East OF Washington Blvd.	53,000	49,925	5.8%
Washington Blvd. North OF Arlington Blvd.	19,000	17,004	10.5%
Pershing Drive East OF Washington Blvd.	8,500	8,126	4.4%
Columbia Pike West OF Washington Blvd.	25,000	24,988	0.0%
George Mason Drive South OF Arlington Blvd	25,000	26,589	6.4%

**%RMSE = 6.9% for all data*

As part of the validation effort and reasonableness checking, as well as developing growth factors for the traffic forecast in the study area, four post-processing traffic refinement cutlines were developed across the study area. The cutlines were constructed as outlined in NCHRP-255 and are presented in **Appendix M**. Each cutline lists the a-node and b-node of the specific links that compose that specific cutline. **Table 21** presents the percent deviation for each cutline. The cutlines were focused on the interchange at Arlington Boulevard and Washington Boulevard and captured travel along competing routes. In the model, Arlington Boulevard was under simulation therefore the use of the cutlines for refining the traffic was important and required in order to develop a reasonable forecast.

The definition of acceptable deviation as outlined in NCHRP-255 is based on the maximum permissible deviation of a cutline traffic estimate being such that a highway design would not vary by more than one roadway lane. The VDOT allowable maximum is less than the maximum recommended in NCHRP-255. There is no rationale for why the VDOT maximum is less than the NCHRP maximum in the current guidebook. Using the VDOT maximum acceptable deviation Cutline 4.0 marginally exceeds acceptable deviation all other cutlines are within both the excepted NCHRP-255 criteria and VDOT criteria.

Table 21: Cutline Percent Deviation

Cutline	Percent Deviation	NCHRP255 Acceptable Deviation	VDOT Acceptable Deviation
1.0 West of Washington Blvd.	0%	18%	6%
2.0 East of Washington Blvd	5%	29%	9%
3.0 North of Arlington Blvd.	3%	26%	8%
4.0 South of Arlington Blvd.	11%	22%	7%

The travel demand forecast model provided a forecast for the year 2045 with the year 2017 as the base year. The count data was from the year 2023, so an adjustment factor was applied based on the rate of growth around the interchange to account for the difference between year 2017 and year 2023. To adjust the forecast for the year 2023 to year 2035, a factor of 0.95 was applied based on the annualized growth rate. **Table 22** summarizes the growth factor for each approach link from the base year of 2023 to the year 2050 for the signalized intersections in the study area as well as the interchange at Arlington Boulevard and Washington Boulevard.

Table 22: Growth Factor from 2023 to 2050 by Intersection Approach Leg

Percent Increase from 2023 to 2050	Approach*			
Intersection	West	East	North	South
Arlington Blvd. & Irving St.	1.17	1.18	1.33	1.22
Arlington Blvd. & Filmore St.	1.19	1.19	1.03	1.05
Arlington Blvd. & Washington Blvd.	1.19	1.09	1.07	1.09
Arlington Blvd. & Pershing Drive North	1.10	1.05	1.08	

Table 23 shows the difference and ratio adjustments, and the corresponding rate of growth, for links where count data was available. A linear annual growth percent was calculated for comparison to the annual growth rate from year 2017 to year 2045. A ten-year historical growth annual growth rate was provided for the set of links in the table, as requested by VDOT Northern Virginia District. The count data is from the VDOT count books.

Table 23: Annual Growth along the Links in the Study Area

Exits	Count 2007	Count 2017	Model 2017	Model 2045	Adjustment Difference	Adjustment Ratio	Adjustment Average	Annual Growth Rate	Historical Growth Rate	Annual Linear Growth Percent
Arlington Blvd. East of Washington Blvd.	55,000	53,000	49,925	55,572	58,647	58,995	58,800	0.37%	0.7%	0.39%
Washington Blvd. North of Arlington Blvd.	17,000	19,000	17,004	19,696	21,692	22,008	21,800	0.49%	2.5%	0.53%
Pershing Drive East of Washington Blvd.	5,900	8,500	8,126	8,380	8,754	8,766	8,800	0.12%	4.1%	0.13%
Columbia Pike West of Washington Blvd.	27,000	25,000	24,988	25,158	25,170	25,170	25,200	0.03%	-0.7%	0.03%
George Mason Drive South of Arlington Blvd.	20,000	25,000	26,589	30,381	28,792	28,565	28,700	0.49%	3.7%	0.53%

Traffic Forecast

The forecasts were developed by applying a growth factor to each link approach based on the model output. The corridor volumes were then slightly adjusted to make sure that the volumes were balanced. These adjustments were minor, and a result of the future volumes being rounded to the nearest 25. Growth along Arlington Boulevard and Washington Boulevard was very moderate. The rounding of very low volume turning movements by 25 resulted in some higher growth rates on smaller non-signalized cross streets. The morning and evening weekday turning movement traffic volumes are provided for the base year 2023, mid-term year 2035, and year 2050 in **Appendix M**.

VJuST Analysis

In order to address operational and capacity needs, a VJuST analysis was completed for the three subject interchanges to consider alternative interchange and intersection designs and evaluate their potential benefits. VJuST analysis does not consider the influence of adjacent intersections/interchanges on traffic patterns. Therefore, it was conducted for screening purposes only with detailed analyses performed using Vissim. VJuST analysis was performed for the following interchanges:

- Washington Blvd. to WB Arlington Blvd. Ramps
- Partial Signal WB Arlington Blvd to Washington Blvd.
- Partial Signal EB Arlington Blvd. to SB Washington Blvd.

The VJuST analysis was completed for the No-Build scenario using 2035 forecasted turning movement volumes in addition to the Build scenario using the 2035 forecasted turning movement volumes for both the AM and PM peak hour. Some alternative design options were not feasible for the roadway type at the subject interchanges; hence, only the ones deemed most feasible were considered. The VJuST analysis summaries are attached in **Appendix I**.

Preferred Alternative

The Preferred Alternative was developed for the study area based on the VTrans Mid-Term Needs mentioned in Chapter 1. Alternative 1B includes the following:

- Double Left Turn Lane from SB Washington Boulevard
- Signalized Intersection for Traffic Heading WB on Arlington Boulevard with Lane Drop on EB Washington Boulevard
- One lane would be dropped on EB Arlington Boulevard at the first exit ramp.
- One lane would be added back in for the entrance ramp serving NB Washington Boulevard to EB Arlington Boulevard.

These improvements are expected to provide the following benefits:

- Improved efficiency for the exit lanes from EB Arlington Boulevard to SB Washington Boulevard. The two-lane exit would address the queues and back-ups at Fillmore Street.
- Improved access to and from EB Arlington Boulevard with the merge and diverge area between the two loop ramps.
- Elimination of the merge issues with the additional lane at the on-ramp from NB Washington Boulevard to EB Arlington Boulevard.

Overall, the improvements address the VTrans priority need for capacity preservation and congestion mitigation by improving peak period throughput, reducing vehicle delays, and improving safety.

Other Considered Alternatives

The other alternatives considered for the study area include:

- Alternative 1A
    - Double Left Turn Lane from SB Washington Boulevard
    - Signalized Intersection for WB Arlington Boulevard
    - Proposed Improvements Include:
        - Relocation of the shared-use path (SUP) to reduce the number of conflict points and improve non-motorized access for bicyclists and pedestrians throughout the interchange area.
        - Addition of a new traffic signal for access between the Washington Boulevard on- and off- ramps and WB Arlington Boulevard.
        - Closure of the service road ramp from WB Arlington Boulevard, which would resolve the sight distance issue with Washington Boulevard. ON-street parking would be added along the service road.
        - Addition of a new partial traffic signal for NB and SB traffic on Washington Boulevard to access WB Arlington Boulevard, which would improve safety for merging vehicles.
        - Addition of a new partial traffic signal for EB traffic on Arlington Boulevard exiting to SB Washington Boulevard, which would help provide a safer route for vehicles heading SB and allow for a controlled non-motorized crossing for bicycles and pedestrians where the current path crosses the ramps.

Figure 37 shows the concept level sketch for Alternative 1A. **Figure 38** illustrates a concept level sketch of Alternative 1B.

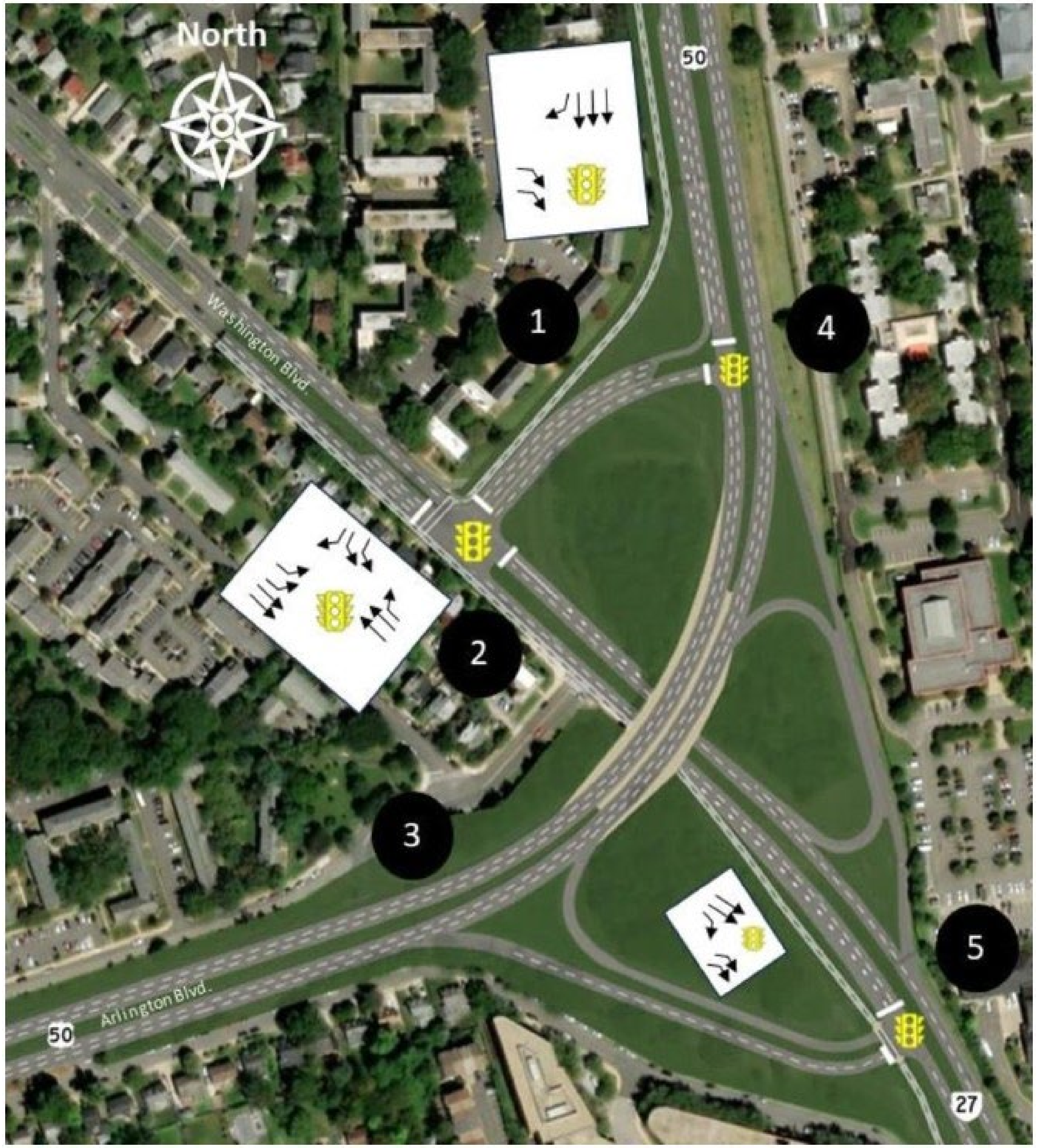


Figure 37: Concept Level Sketch (Alternative 1A)

Figure 38: Concept Level Sketch (Alternative 1B)

- Alternative 2
    - Single Left Turn Lane from SB Washington Boulevard
    - Entrance Ramp (No Yield) for Traffic Heading WB on Arlington Boulevard
    - Proposed Improvements Include:
        - One lane would be dropped on EB Arlington Boulevard at the first exit ramp (similar to Alternative 1B).
        - For WB traffic on Arlington Boulevard, the outermost lane would become an exit lane and be dropped at the off-ramp to Washington Boulevard.

Figure 39 illustrates a concept level sketch of Alternative 2.

Figure 39: Concept Level Sketch (Alternative 2)

- Alternative 3
  - Full Stop-Controlled Intersections for Traffic Entering EB Arlington Boulevard
  - Proposed Improvements Include:
    - The on-ramp for traffic traveling SB on Washington boulevard would have a stop sign at the intersection with EB Arlington Boulevard
    - The on-ramp for traffic traveling NB on Washington Boulevard to EB Arlington Boulevard would also have a stop sign.

Figure 40 illustrates a concept level sketch of Alternative 3.

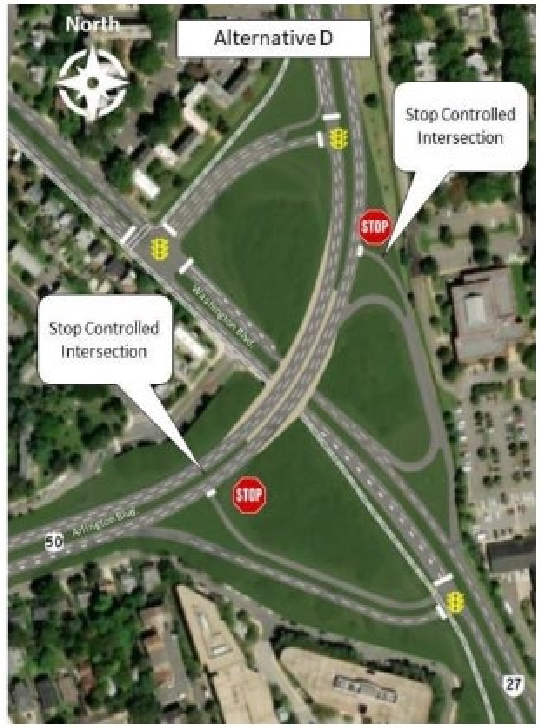


Figure 40: Concept Level Sketch (Alternative 3)

- Alternative 4B
  - Green-T Signalized Intersections
  - Full Stop Controlled Intersection
  - Proposed Improvements Include:
    - The off-loop ramp from EB Arlington Boulevard to NB Washington Boulevard would be removed and traffic would be relocated to share the EB off-ramp for SB Washington Boulevard. This would combine all the EB traffic exiting from Arlington Boulevard to Washington Boulevard to use the current off ramp.
    - For traffic heading to NB Washington Boulevard a new traffic signal would provide for a left turn at a Green-T intersection, allowing for uninterrupted flow on the NB lanes with a merge for traffic coming off the ramp.
    - There would still be a stop-controlled intersection on the on-ramp for SB traffic on Washington Boulevard to access EB Arlington Boulevard (similar to Alternative 2)
    - The traffic going NB on Washington Boulevard to EB Arlington Boulevard would use the current ramp and an acceleration lane would be added to improve the merge.

Figure 41 illustrates a concept level sketch of Alternative 4.

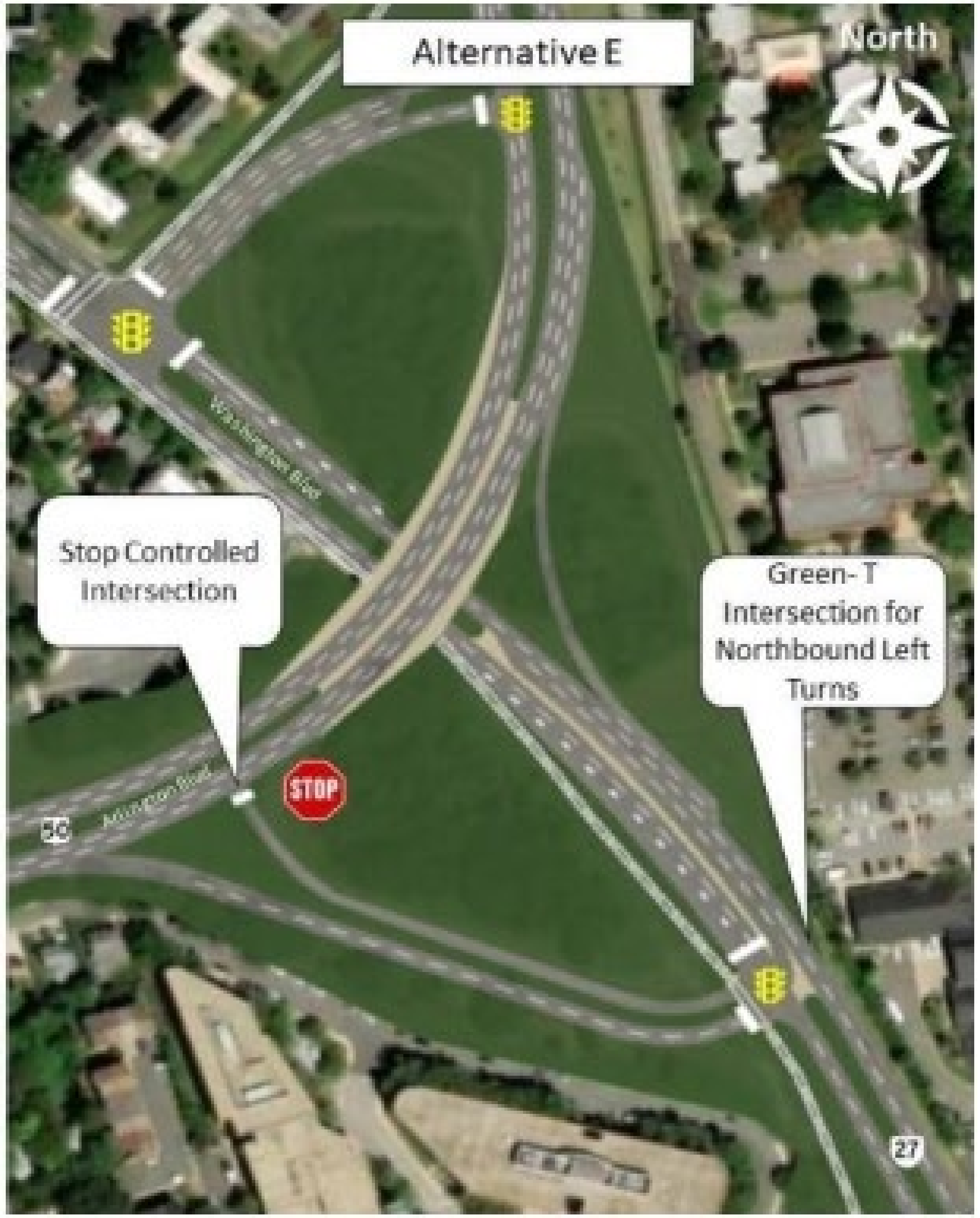


Figure 41: Concept Level Sketch (Alternative 4)

Assessment of Alternatives

The assessment of the alternatives consists of reviewing the advantages and disadvantages of each alternative.

- Alternative 1A/1B
  - Advantages (Compared to Existing)
    - Reduces weaving on VA-27 SB east of US 50.
    - Reduces conflicts on US 50 WB south of VA-27.
    - Enhances pedestrian and bicycle safety.
    - Enhances safety and improves mobility for VA-27 to US 50 WB traffic.
  - Disadvantages (Compared to Existing)
    - Introduces signal control on US 50 WB with an expected increase in delay.
    - Lane drop introduced on US 50 EB at exit for ramp to VA-27

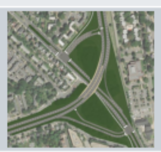
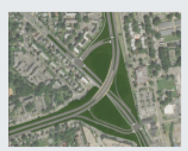
- Alternative 2
  - Advantages (Compared to Alternative 1A/1B)
    - No half signal for US 50 WB.
  - Disadvantages (Compared to Alternative 1A/1B)
    - Lane drop introduced on US 50 WB at exit for ramp to VA-27.

- Alternative 3
  - Advantages (Compared to Alternative 1A/1B)
    - Maintains 6 lanes on US 50.
  - Disadvantages (Compared to Alternative 1A/1B)
    - Forces traffic on ramps from VA-27 NB and VA-27 SB to stop before turning onto US 50 EB.

- Alternative 4B
  - Advantages (Compared to Alternative 1A/1B)
    - Maintains 3 lanes on US 50 EB.
    - Improves ramp and merge of ramp from VA-27 NB to US 50 EB.
    - Continuous Green-T Intersection.
  - Disadvantages (Compared to Alternative 1A/1B)
    - Removes a ramp for a low volume movement.

A summary of the alternative assessment is shown in **Table 17** below.

Table 24: Summary of Alternative Assessment

Alternative Name	Configuration	Key Elements
Alternatives 1A ("Base" Alternative – Expanded Arlington County Proposal) and 1B (Base with 2-lane exit from US 50 EB to VA 27 SB		- Modified VA 27 to US 50 WB Ramp in NW Quadrant - New Full Signal at VA 27 / New Ramp junction - New Half Signal at US 50 WB / New Ramp junction - Lane Drops on US 50 EB at Exits to VA 27 SB & VA 27 NB - Lane Adds on US 50 EB at ramps from VA 27 SB & NB - New Half Signal at VA 27 SB / Ramp from US 50 EB
Alternative 2. Modified Alternative with Lane Drops and Adds on US 50 WB and US 50 EB		- Modified VA 27 to US 50 WB Ramp in NW Quadrant - New Full Signal at VA 27/New Ramp junction - Lane Drop and Lane Add on US 50 WB for VA 27 ramps - Lane Drops on US 50 EB at Exits to VA 27 SB & VA 27 NB - Lane Adds on US 50 EB at ramps from VA 27 SB & NB - New Half Signal at VA 27 SB / Ramp from US 50 EB
Alternative 3. Modified Alternative with No lane drops on US 50 and a Reconfigured Ramp Terminals for on-ramps from VA 27 onto a 3-lane US 50 EB		- Modified VA 27 to US 50 WB Ramp in NW Quadrant - New Full Signal at VA 27/New Ramp junction - New Half Signal at US 50 WB / New Ramp junction - Reconfigured Ramp Terminals on US 50 EB for ramps from VA 27 SB & NB - New Half Signal at VA 27 SB / Ramp from US 50 EB
Alternatives 4A & 4B. Modified Alternative with No Lane Drops on US 50 and Modified Signalized Junction at VA 27 and ramp from US 50 EB		- Modified VA 27 to US 50 WB Ramp in NW Quadrant - New Signal at VA 27/New Ramp junction - New Half Signal at US 50 WB / New Ramp junction - Removed US 50 EB to VA 27 NB Ramp in NE Quadrant - Conventional (or Continuous Green-T) Signal at VA 27 - Reconfigured VA 27 NB to US 50 EB ramp in NE Quad

The full planning level assessment is attached in **Appendix L**.

Measures of Effectiveness (MOEs)

For this study, guidance for reporting MOEs for signalized and unsignalized intersections was obtained from Chapter 4 of the VDOT TOSAM 2.0. A summary of the MOEs evaluated for the study intersections is presented below:

- Delay (seconds per vehicle – sec/veh) & Level of Service
- Travel Time Run (sec)
- Maximum Queue Length (feet)

Traffic Operational Analysis Results (No-Build & Build)

To identify operational and accessibility needs along the study corridor, initial Synchro and Vissim analysis results were reviewed for the future years 2035 and 2050 for the No-Build and Build condition.

Delay & Level of Service

Table 25 below shows the delay and LOS Synchro output for the following intersections:

- Washington Blvd. to WB Arlington Blvd. Ramps
- Partial Signal WB Arlington Blvd to Washington Blvd.
- Partial Signal EB Arlington Blvd. to SB Washington Blvd.

The Synchro outputs with individual movement delays and LOS table is attached in **Appendix K**.

Table 25: Synchro Analysis Results Summary

Intersection		Movement	AM - Existing		PM - Existing		AM 2035 Build		PM 2035 Build		AM 2050 Build		PM - 2050 Build	
			Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
2	Washington Blvd. to WB Arlington Blvd. Ramps Partial Signal WB Arlington Blvd to Washington Blvd.	Int Overall	11.3	B	12.3	B	10.8	B	9.8	A	10.9	B	9.9	A
4	Partial Signal WB Arlington Blvd to Washington Blvd.	Int Overall	8.7	A	15.5	B	7.3	A	13.7	B	7.1	A	14.6	B
7	Partial Signal EB Arlington Blvd. to SB Washington Blvd.	Int Overall	48.8	D	41.9	D	66.3	E	60.1	E	7.1	A	79.2	E

Travel Time Run

Table 26 shows the Vissim results for travel time run between N. Pershing Dr. to S. Fillmore St. for US 50 EB and US 50 WB.

Table 26: TTR Data for US 50 EB & US 50 WB

TTR		No-Build (Sec)	Alternative 1A (Sec)	Alternative 1B (Sec)	Alternative 2 (Sec)	Alternative 3 (Sec)	Alternative 4 (Sec)
US 50 EB	2035 AM	85.4	74.0	71.6	71.7	75.3	74.3
	2035 PM	70.3	72.0	70.5	70.2	71.8	71.6
	2050 AM	86.9	93.0	71.9	71.7	74.5	74.4
	2050 PM	70.3	73.8	71.7	70.6	73.6	72.6
US 50 WB	2035 AM	82.5	118.7	119.8	97.6	116.9	117.0
	2035 PM	146.0	223.6	212.9	185.4	218.5	195.5
	2050 AM	83.8	103.0	121.3	98.0	119.7	119.6
	2050 PM	155.7	297.3	296.1	266.5	294.6	283.3

Table 27 below shows the combined travel time run for both US 50 EB and US 50 WB.

Table 27: Combined TTR Data for US 50 EB & US 50 WB

Combined TTR		No-Build (Sec)	Alternative 1A (Sec)	Alternative 1B (Sec)	Alternative 2 (Sec)	Alternative 3 (Sec)	Alternative 4 (Sec)
US 50 (EB & WB)	2035 AM	167.9	192.7	191.4	169.3	192.2	191.3
	2035 PM	216.3	295.6	283.4	255.6	290.3	267.1
	2050 AM	170.7	196.0	193.2	169.7	194.2	194.0
	2050 PM	226.0	371.1	367.8	337.1	368.2	355.9

Maximum Queue

Table 28 shows the Vissim results for the maximum queue length at each specific location.

Table 28: Maximum Queue Length

Scenario	Queue Counter		Max Queue (feet)					
			No Build	Alt. 1A	Alt. 1B	Alt. 2	Alt. 3	Alt. 4B
2035 AM	**1**	Ramp from US 50 WB to VA 27 NB	51	233	233	231	231	222
	2	Ramp from VA 27 NB to US 50 WB	668	801	871	0	854	1147
	3	Ramp from US 50 EB to VA 27 SB	241	837	909	871	790	830
	4	Ramp from VA 27 SB to US 50 EB	3	13	25	30	55	43
	5	Ramp from VA 27 NB to US 50 EB	184	197	0	0	1189	0
	6	Ramp from US 50 EB to VA 27 NB	0	5	0	0	0	0
	23	Ramp from US 50 WB to VA 27 SB	210	230	230	228	228	217
2035 PM	**1**	Ramp from US 50 WB to VA 27 NB	109	211	220	223	221	250
	2	Ramp from VA 27 NB to US 50 WB	1685	1412	1395	1517	1325	840
	3	Ramp from US 50 EB to VA 27 SB	411	799	722	680	682	850
	4	Ramp from VA 27 SB to US 50 EB	0	7	12	0	41	46
	5	Ramp from VA 27 NB to US 50 EB	54	46	0	0	527	0
	6	Ramp from US 50 EB to VA 27 NB	0	0	0	0	0	0
	23	Ramp from US 50 WB to VA 27 SB	309	206	215	217	216	247
2050 AM	**1**	Ramp from US 50 WB to VA 27 NB	42	245	247	248	245	232
	2	Ramp from VA 27 NB to US 50 WB	458	221	1181	0	1322	978
	3	Ramp from US 50 EB to VA 27 SB	257	958	869	1018	765	943
	4	Ramp from VA 27 SB to US 50 EB	0	7	30	19	48	55
	5	Ramp from VA 27 NB to US 50 EB	211	98	0	0	1237	0
	6	Ramp from US 50 EB to VA 27 NB	0	3	0	0	3	0
	23	Ramp from US 50 WB to VA 27 SB	225	242	244	245	242	229
2050 PM	**1**	Ramp from US 50 WB to VA 27 NB	88	226	255	241	256	392
	2	Ramp from VA 27 NB to US 50 WB	1696	1623	1554	1696	1588	1433
	3	Ramp from US 50 EB to VA 27 SB	403	987	750	755	771	1003
	4	Ramp from VA 27 SB to US 50 EB	2	4	9	5	52	46
	5	Ramp from VA 27 NB to US 50 EB	42	63	0	0	461	0
	6	Ramp from US 50 EB to VA 27 NB	0	0	0	0	0	0
	23	Ramp from US 50 WB to VA 27 SB	343	221	250	236	251	387

Alternative Summary

Project Pipeline was designed to develop a steady stream of high-priority projects to help feed projects into Virginia's statewide prioritization processes. The objective of the program is to conduct studies across the Commonwealth with a focus on the priority locations and corridors that were adopted during the VTrans process. The Project Pipeline program focuses on the multimodal priorities; streamlines project planning and improves project readiness to ensure that needs are understood before solutions are developed; develops and refines methodologies that make use of powerful data and improve collaboration; identifies investment strategies that solve more problems with limited state transportation funds and resources; and standardizes a performance-oriented and multidisciplinary approach. The goal of the Project Pipeline program is to prepare projects for a successful Smart Scale application. Smart Scale is a discretionary funding program, where projects benefits are scored, and cost effectiveness measured. For a project to be successful in the scoring process it must deliver benefits commensurate with the project's cost. In evaluating the alternatives for this study, cost effectiveness was considered.

The interchange at Arlington Boulevard (US Route 50) and Washington Boulevard (VA Route 27) was originally built in the 1960's, many of the merge and diverge points are substandard compared to today's design guidelines. A primary need for this study was the improvement to safety for both motorized and non-motorized modes throughout the interchange area. This was determined by a high priority need in VTrans and favored by the County and community. The relocation of the shared-use path as well as the installation of dedicated signal phases aims to reduce the number of conflict points between motorized and non-motorized modes. The installation of signalized intersections as opposed to ramps aims to improve the merge and diverge areas for traffic entering and exiting Arlington Boulevard and Washington Boulevard. As previously discussed in Chapter 1, the majority of crashes occur in daylight conditions and are rear end collisions. This is a function of the lack of adequate and safe merging areas. As a result, the alternatives were developed to address this issue by allowing for merge and diverge lanes and improved intersection control.

All the alternatives close the westbound to southbound exit ramp from Arlington Boulevard onto the service road and to the intersection with Washington Boulevard. This movement is to be combined with the westbound to northbound exit ramp. A new signal is proposed for Washington Boulevard and the westbound ramps, this will serve traffic going and coming northbound and southbound Washington Boulevard to westbound Arlington Boulevard. A partial signal is proposed to improve the merging of vehicles from the on-ramp to westbound Arlington Boulevard. Alternative 2 had a free flow lane here and a temporary lane drop, but the County was not in favor of this alternative, because of upstream signals and possible left turns.

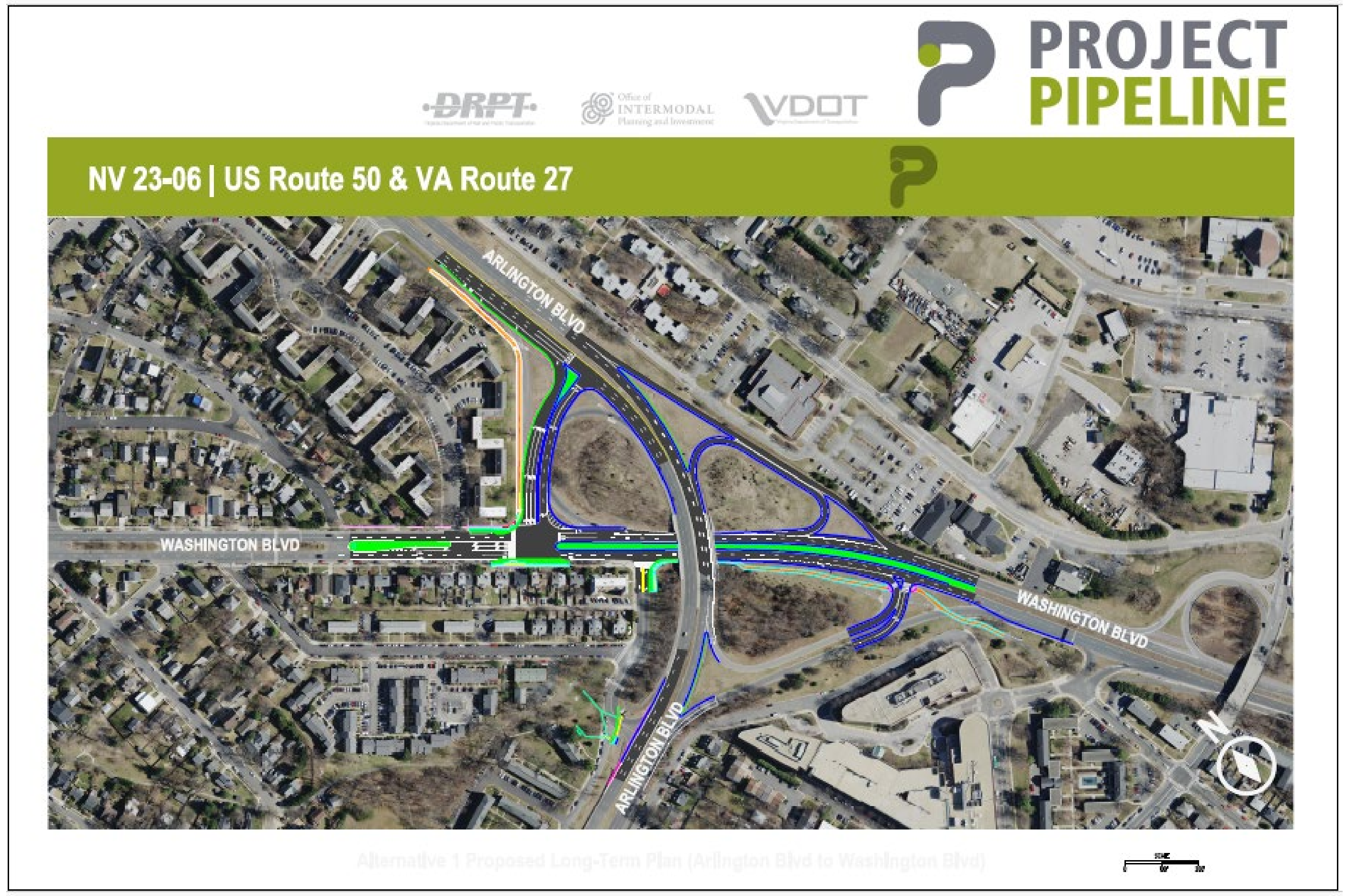


Figure 42: Alternative 1B

lanes. The lane drop allows for the addition of a limited merge and diverge area for the northbound exit and northbound entrance loop ramps to and from eastbound Arlington Boulevard. In addition, it allows for the adding of a lane for the northbound to eastbound ramp, addressing a high rear end crash area.

For traffic in the eastbound direction, the County favored dropping one lane through the interchange area. Given the high volumes exiting from eastbound Arlington Boulevard to southbound Washington Boulevard, the curb lane already is a default exit lane. The volume exiting is forecast to be 1,350 vph in the year 2050. The through volume is 2,525 vph which can easily be accommodated in the two remaining A partial signal is proposed for the junction of the eastbound to southbound off ramp and Washington boulevard to address the weave area for vehicles entering Washington Boulevard and vehicles maneuvering to turn right to access Arlington County's social services site. There are approximately 200 vehicles forecasted to turn right to access the site. The partial signal will allow for more efficient and safer movement of vehicles from the exit ramp to Washington Boulevard. Overall, the selected Alternative 1B addresses the VTrans needs in a cost effective and efficient manner.

Transportation Demand Management and Transit Accessibility Potential Solutions

Arlington County is served by three major transit providers:

- ART (Arlington Transit): Provides local bus service within Arlington County
- WMATA: Provides services within Arlington County
    - Includes: Metrobus, Metroway, and Metrorail
- VRE: Provides commuter rail services from the Virginia suburbs to Alexandria Union Station, Crystal City, L'Enfant Plaza, and Washington D.C.'s Union Station.

ART Routes 42, 45, 77. 4B, and 16Y serve segments of Arlington Blvd. and Washington Blvd. as shown in **Figure 43** below.

Figure 43: Arlington Transit Routes

Metrobus Route 4B (Pershing Dr. – Arlington Blvd.) serves segments of Arlington Blvd. Route 25B (Carlin Spring Rd.) serves areas of Arlington County along Carlin Spring Rd. Route 38B (Ballston-Farragut Square) serves segments of Washington Blvd. **Figure 44** shows Route 4B stops, **Figure 45** shows Route 25B stops, and **Figure 46** shows Route 38B stops.

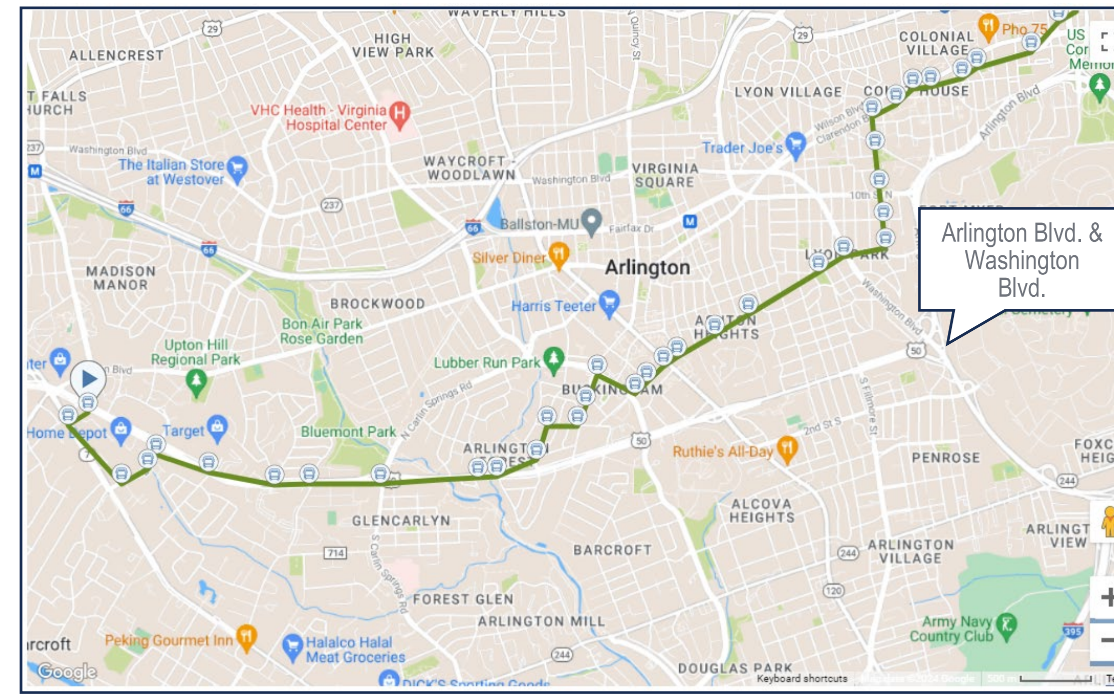


Figure 44: Metrobus Route 4B

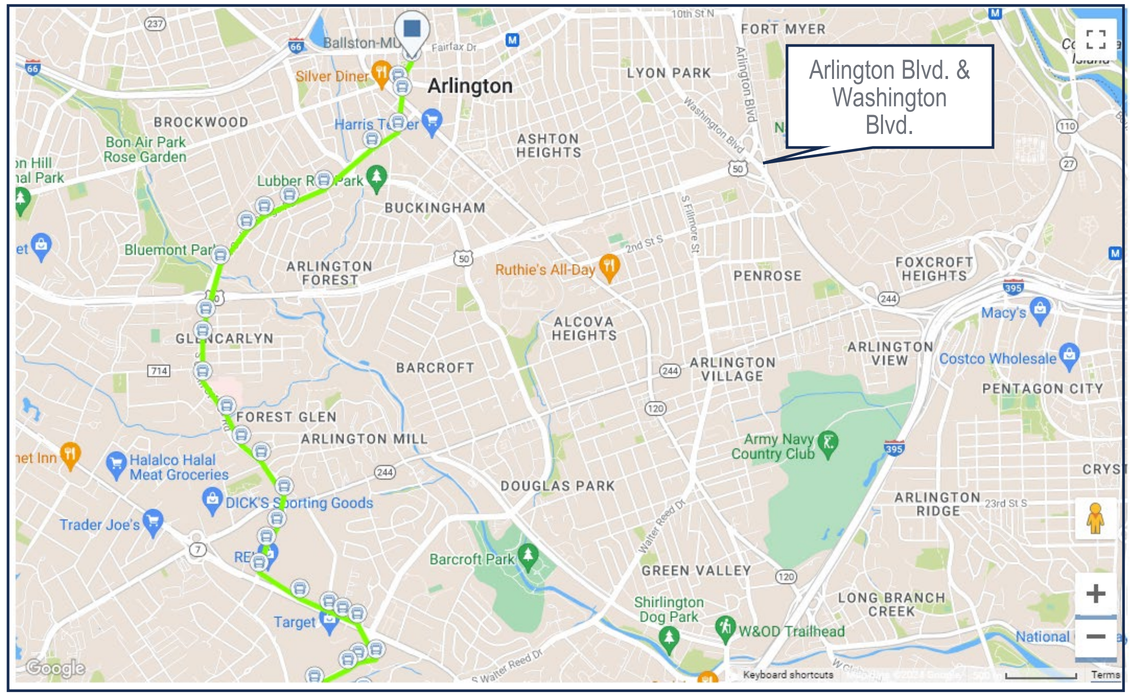


Figure 45: Metrobus Route 25B

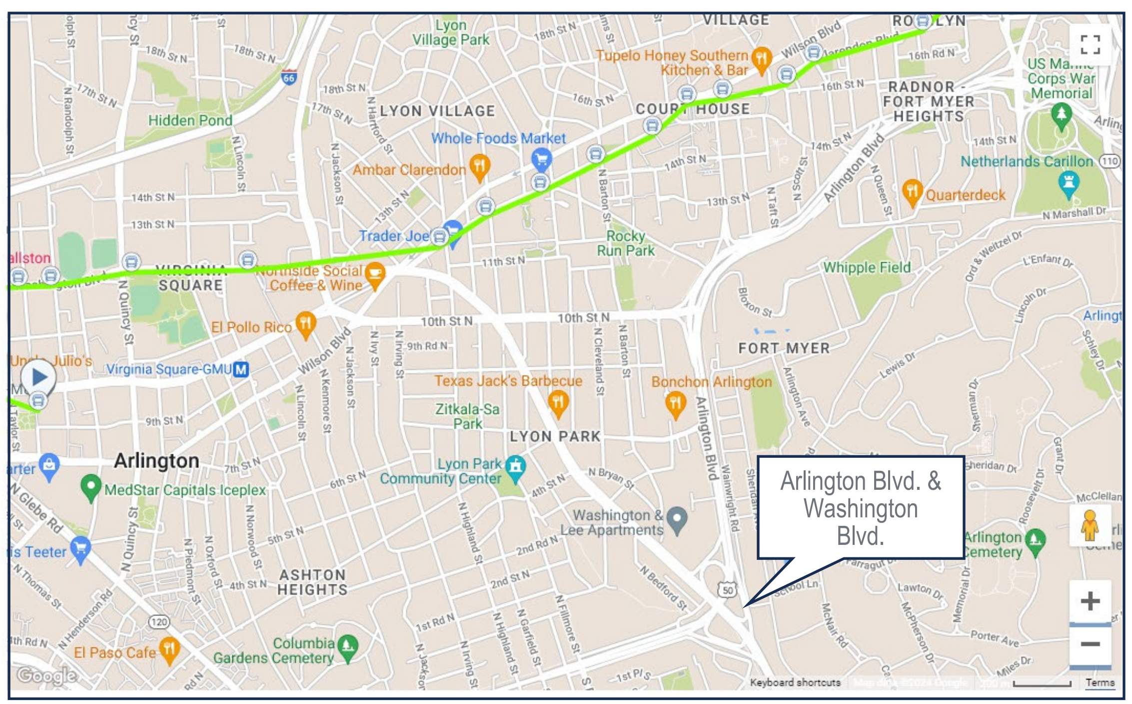


Figure 46: Metrobus Route 38B

Additionally, Ballston-MU Station, Virginia Square-GMU Station, Clarendon Station, Court House, and Rosslyn Station are within 1.5 miles of the Arlington Blvd. and Washington Blvd. intersection. They are part of the Orange and Silver Line. **Figure 47** below shows the location of each station.

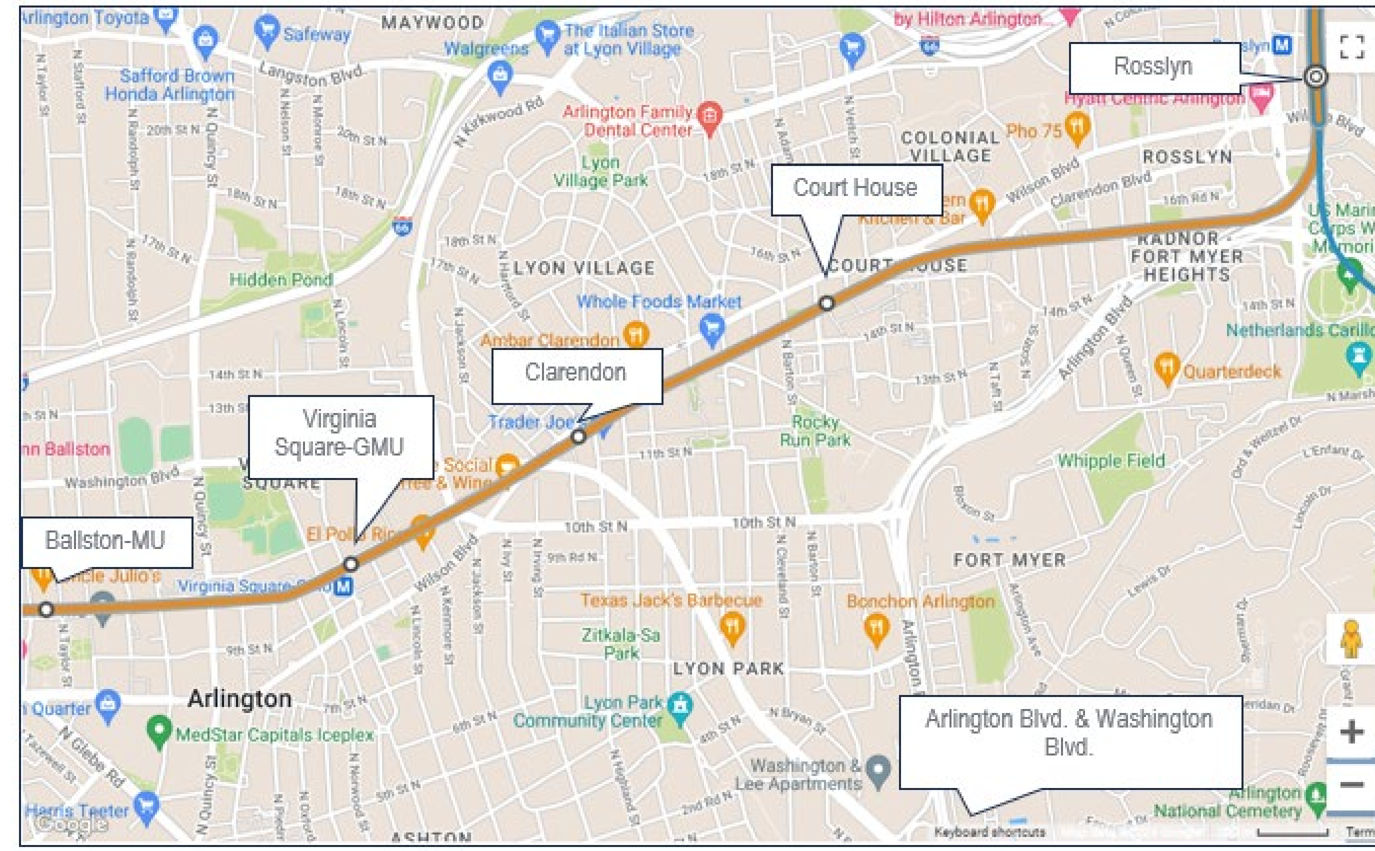


Figure 47: Metrorail Orange/Silver Line

Build Conditions Safety Analysis

The proposed partial signal control for the westbound access ramp to Arlington Boulevard will improve the current 130 crashes where the current northbound to westbound ramp merge. This is the highest crash location in the study area. It will also help mitigate the 51 crashes on the westbound to southbound exit ramp and service road. The added signal at Washington Boulevard and westbound access and exit ramps will address the issues where the service road intersects with Washington Boulevard and the sight distance is an issue. It will eliminate this safety issue.

The lane drop improvement for eastbound vehicles exiting to southbound Washington Boulevard will address the crashes of vehicles maneuvering late to exit. The added partial signal will address safety issues with the merge and weave issues at the ramp terminus with southbound Washington boulevard.

The lane drop will also allow for a merge and diverge area between the eastbound on and exit loop ramps. The volume for these movements is low, but the improvement is a cost-effective way to provide a safer section. For vehicles entering eastbound Arlington Boulevard from northbound Washington Boulevard, there will be two mainline lines eastbound, and the on-ramp will add another continuous lane, therefore eliminating the stop control where the ramp merges with eastbound Arlington Boulevard. Currently there are 30 crashes at this location with the vast majority being rear end crashes.

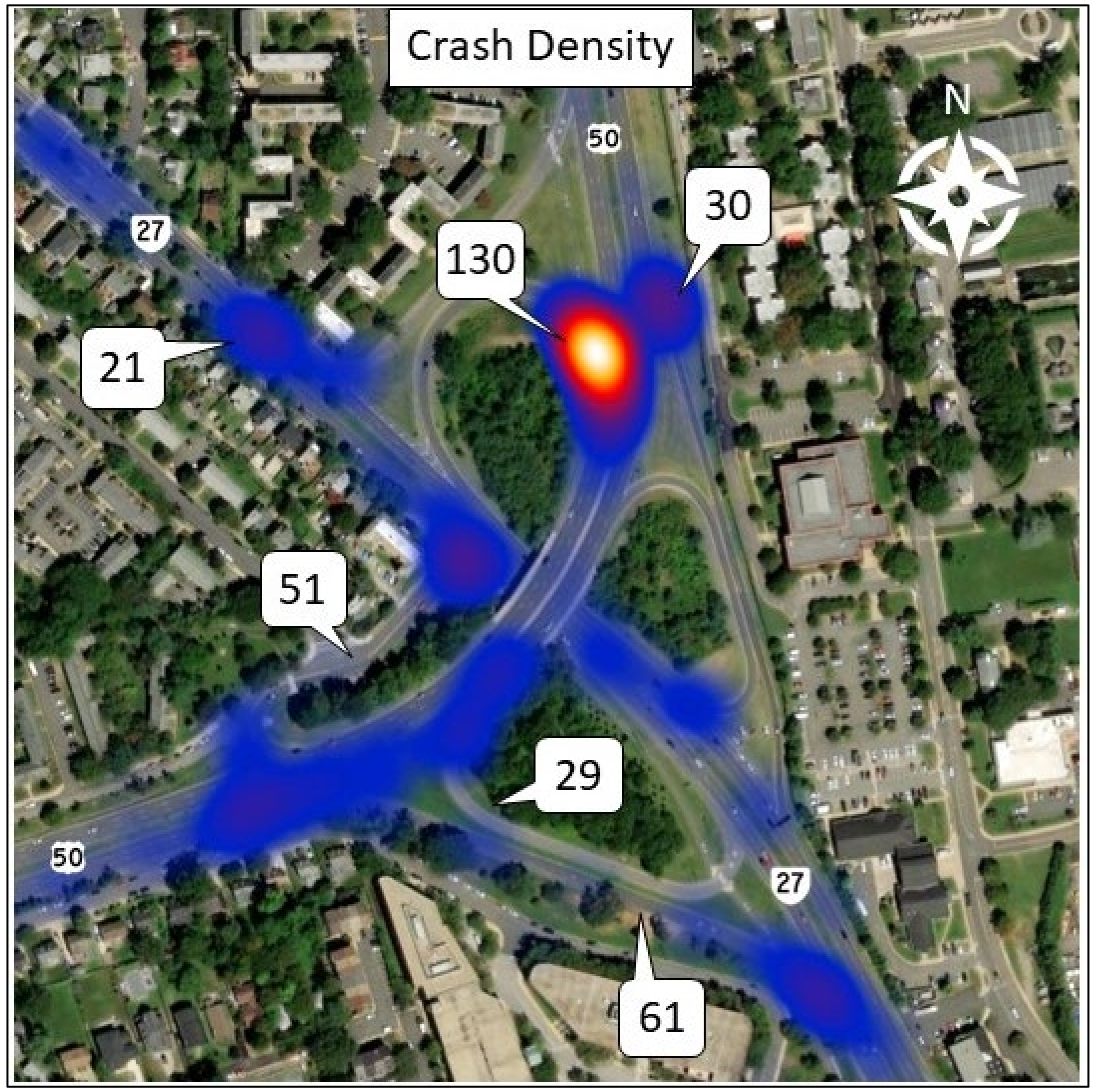


Figure 48: Crash Density Map

Chapter 3:

Public and Stakeholder Outreach and Feedback

Public Involvement

Following the development and analysis of the alternative designs for the study, a public involvement survey was developed to determine the public's responses to the recommended improvements and what they perceived as the relevant issues within the study area. This survey was available online for 16 days spanning from May 6, 2024, to May 22, 2024.

Survey Design

Public involvement for this study took place in the form of an online survey developed in MetroQuest which is an online engagement platform that is designed to educate the public while gathering informed output. The goals of this public outreach effort were to present relevant issues, educate the public on the recommended improvement concepts outlined in Chapter 2, and to receive the public's feedback on the proposed improvements.

Overall, the survey is divided into six sections, which include the following:

1. Project Background
2. Study Location
3. Existing Conditions
4. Bicycle and Pedestrian Improvements
5. Roadway Improvements
6. Demographic Information

The first section provides an overview of the study area and the project initiative. The second section details the study location as shown in **Figure 49.**

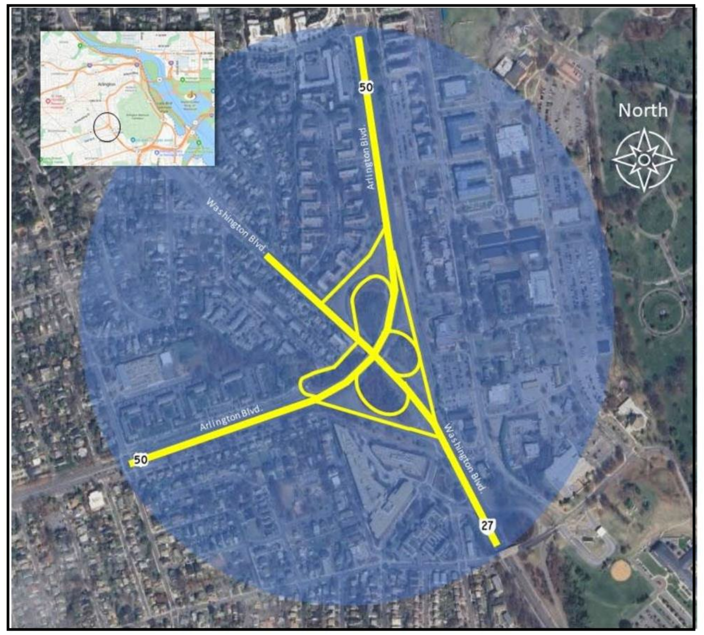


Figure 49: Study Location

The third section discusses the existing conditions at the project location including crash analysis. The fourth section discusses the proposed bicycle and pedestrian improvements as shown in **Figure 50.**

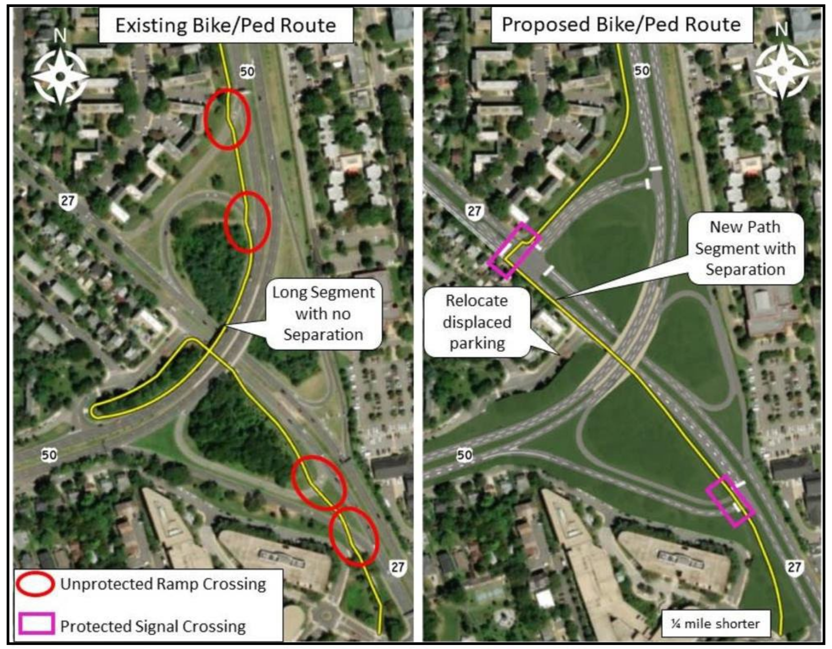


Figure 50: Proposed Bicycle and Pedestrian Improvement

The fifth section discusses the roadway alternatives. The final section asks optional questions regarding the demographics of the survey participants including their home and work zip code, gender, age, race and ethnicity, and household income.

Survey Questions and Results

The survey had a total of 1,454 unique participants. The survey asked the participants how strongly they support each proposed improvement and alternative. The results are shown below:

1. Do you believe that the safety improvements provided by the proposed new shared use path (SUP) location are worth relocating on-street parking from Washington Boulevard to the service road?

Yes	64%
No	36%

2. Please rate the proposed improvement that would construct a separated shared use path (SUP), which would reroute bicyclists and pedestrians through a new signalized crossing and relocate on-street parking to the service road.

	1. Strongly oppose	2. Somewhat oppose	3. Neutral	4. Somewhat support	5. Strongly support
Rate the concept on a scale of 1 to 5.	3%	10%	9%	21%	51%

3. Please rank the alternatives for improving the grade-separated interchange at US Route 50/Arlington Boulevard and VA Route 27/Washington Boulevard. The following shows the percentage of participants that ranked each alternative as their top priority.

Alternative 1A	Alternative 1B	Alternative 2	Alternative 3	Alternative 4B
24%	18%	43%	7%	8%

The full public survey results are attached in **Appendix N.**

Chapter 4:

Design

Major Design Features

Major design features associated with this project include:

- Reconfigure shared use path from south of the US 50 ramps and reconnect to the existing path approximately 200' south of overhead bridge along Washington Street.
- US 50 ramps south of the overhead bridge will be realigned and signals installed at the new intersection with Washington Street.
- Modify existing shared use path and widen Arlington Boulevard Service Road for additional parking spaces.
- Remove existing path along the Arlington Boulevard bridge from the crosswalk on Arlington Boulevard Service Road to the ramps north of the bridge.
- Introduce share use path from north of ramps on Arlington Boulevard to Washington Boulevard.
- Realign the ramp connections between Arlington Boulevard to Washington Boulevard and install signal at the new intersection on Arlington Boulevard.
- Convert the parking along Washington Boulevard to a bicycle path north of the overhead bridge.

Background

The following studies, efforts and analyses have been conducted to develop design alternatives, select a preferred alternative, refine concept designs and develop cost estimates:

- Field visits – Teams of traffic engineers, roadway engineers and hydraulic engineers conducted site visits to better ascertain existing conditions.
- Stakeholder coordination – Multiple stakeholder coordination meetings were held during the project development process to gain input/feedback, validate designs, and identify issues/risks.
- Public Survey – A public survey was conducted and asked respondents to identify items such as their preferred mode of travel, suggested safety and operational improvements, and feedback on proposed improvements.
- Traffic Operational Analysis – Initial traffic operational analysis was performed using Synchro 11 software. Inputs and analysis methodologies are consistent with the VDOT Traffic Operations and Safety Analysis Manual (TOSAM) guidelines. Both AM and PM peak hour analyses were performed for the existing year 2023.
- Safety Analysis – Phase I of a Pipeline Study, requires a comprehensive review and traffic safety study. The analysis focused on identifying issues, as well as developing and evaluating design alternatives.
- Concept development Pipeline Process – Pipeline Phase I-initially developed high-level options to improve performance; Pipeline Phase II- narrowed down options, more detailed concepts, detailed analysis, stakeholder/public engagement, planning level estimates and identify the preferred alternative; Pipeline Phase III-concept refinement, more detailed engineering, identify risks and contingencies, detailed cost estimation.

Design Information

Design Criteria

The following is the main design criteria and basic project information. Please see Appendix A for a more detailed list of design criteria:

Arlington Boulevard:

- Functional Classification – Principal Arterial (GS-5)
- Average Annual Daily Traffic (AADT) –
  - 64,000 West of VA 27
  - 69,000 East of VA 27
- Posted Speed Limit and Design Speed – 45 MPH
- Existing Shared Use Path – 10 feet
- Existing Sidewalk – 5-foot sidewalk

Washington Boulevard:

- Functional Classification –
  - VA 27 South of US 50 – Principal Arterial (GS-5)
  - VA 27 North of US 50 – Urban Minor Arterial (GS-6)
- Average Annual Daily Traffic (AADT) –
  - VA 27 South of US 50 – 84,000
  - VA 27 North of US 50 – 38,000
- Posted Speed Limit and Design Speed –
  - VA 27 South of US 50 – 45 MPH
  - VA 27 North of US 50 – 30 MPH
- Existing Shared Use Path – 10 feet
- Existing Sidewalk – 5-foot sidewalk

Data Sources

The following data sources were collected/reviewed and informed the project design and analysis work:

- Existing GIS data inclusive of right-of-way, parcel lines, some utility information, and aerial imagery
- Utility information was compiled from field visits and GIS information.
- Planning studies and development plans as available
- Wetland/Stream data – National Wetlands Inventory and aerial imagery
- Hazardous Materials – VA Department of Environmental Quality What's in my back yard mapper and aerial imagery
- Cultural Resources – VA Department of Historic Resources VCRIS and aerial imagery
- Threatened/Endangered Species – US Fish and Wildlife Service IPaC, and Department of Wildlife Resources fish and wildlife information services
- Floodplain data – FEMA
- Parks and recreational facilities – available online mapping
- Multiple field visits were conducted with the latest being May 30, 2024. Field visit staff included traffic engineers, roadway engineers and hydraulic engineers. Staff focused on key aspects of the proposed project and potential impacts and risks:
- The shared use path was evaluated to minimize permanent and temporary impacts to surrounding properties.
- Interchange ramps were evaluated to deconflict with shared use paths and maximize pedestrian and bicycle safety.
- Sidewalk and facility connections were evaluated for contiguous use and maintain availability during construction.
- Potential utility impacts were evaluated within the corridor.
- Hydraulics and stormwater management were evaluated with the new ramp configurations and utilizing the existing drainage system at the project connections. Bioretention areas were considered within right-of-way and within existing interchange areas.

The design concept was developed in accordance with the requirements of the following references:

- AASHTO "A Policy on Geometric Design of Highway and Streets", 2018, 7th Edition
- AASHTO "Roadside Design Guide", 2011, 4th Edition
- 2009 MUTCD with Revision Numbers 1 & 2 Incorporated
- VDOT Road and Design Manual, Rev. July 2021
- VDOT Instructional and Information Memorandum for all VDOT Divisions
- VDOT Road and Bridge Standards, 2016
- VDOT Cost Estimating Manual Version 2.0
- VDOT Right of Way Cost Estimate Guide
- SMART SCALE Technical Guide for Round 5

- Design Waiver/Exception Policy for SMART SCALE Applications
- IIM-LD-255 - Practical Design Flexibility in the Project Development Process

Assumptions

Following are key design assumptions that informed the concept development and cost estimate preparation:

- Roadway geometry – The ramp geometry will be revised at the interchange connections to Washington Boulevard and Arlington Boulevard. The ramps will be configured to align with the proposed traffic signals at each location. The deceleration lane along northbound Washington Boulevard will be designed for maximum storage length without impacting the Arlington Boulevard bridge abutments.
- Structures – Two retaining walls may be necessary along the new shared use path at the Washington/Arlington Boulevard connection. One of the walls is expected to be approximate 5' high and about 30' long in order to avoid additional right-of-way and utility impacts. Another wall is anticipated along the Washington Boulevard westbound deceleration lane to protect impacts to the overhead sign and is approximately 5' high and 250' long.
- Hydraulics and stormwater management (SWM) – A new closed storm drain system is proposed to accommodate new curb lines associated with the updated ramp configurations. The proposed storm drain system will tie-in to the existing storm drain system at each location. Five separate areas have been identified for SWM mitigation purposes, providing approximately 5,000 sq. ft each. The total disturbed area for the project is estimated to be about 4.5 acres, with approximately 2 acres of impervious land cover and 2.5 acres of managed turf. With an increase in impervious area estimated to be about 0.3 acres, and with conservatively assuming all D soils, VRRM version 4.1 yields 0.78 lb/yr total phosphorous (TP) load reduction required and a final post-development treatment volume (Tv) of 0.2122 acre-ft (9,242 cubic ft). Multiple extended detention ponds and/or bioretention facilities appear to be most appropriate for this scenario. Five potential SWM facility locations have been identified on the design **exhibits;** however, all five locations will most likely not be needed. Therefore, only three facilities have been included in the project cost estimate. The surface area for a bioretention can be conservatively estimated to be 10% of the contributing drainage area, yielding a total BMP footprint of approximately 0.45 acres (20,000 sq. ft.). Alternatively, nutrient credits may be purchased in lieu of the SWM facilities and may be a more cost-effective rate.
- Utility impacts – The shared path and revised ramp geometry will be designed to minimize impacts to aerial and underground utilities. The new connection between Washington Boulevard and Arlington Boulevard will impact several utility poles. There are various underground utilities that will need to be adjusted throughout the project.
- Lighting – The new connection between Washington Boulevard and Arlington Boulevard will require updated highway lighting design and relocations.
- Right of Way – Right-of-way impacts and/or temporary construction easements will be necessary along the new shared use path at the Washington/Arlington Boulevard connection, along the shared use path on Washington Boulevard adjacent to the residences.
- Schedule – Following is the anticipated project development schedule:
  - PE 8/2027 Start 1/2030 End
  - RW/Utility 1/2030 Start 1/2032 End
  - CN 1/2032 Start 7/2034 End

Environmental Considerations

A preliminary environmental review was conducted as part of this study including the following elements:

- Wetland/streams
- Hazardous Materials
- Cultural Resources
- Threatened/Endangered Species
- Floodplains
- Parks and recreational facilities

Based on the review, the potential environmental issues anticipated would be related to unknown hazardous materials or unknown archeological and architectural resources. The level of environmental document anticipated is a Categorical Exclusion, either a PCE or a CE depending on final project impacts/scope.

Constructability and Maintenance of Traffic Assessment

It is anticipated that construction will follow the following general phases:

- Phase 1 – Construct portions of proposed ramps and shared use paths. Maintain existing traffic and pedestrian/bicycle traffic. Temporary pavement as needed to maintain traffic. Widen Arlington Boulevard Service Road for additional parking. Install signal poles at both interchange locations and install/relocate highway lighting.
- Phase 2 – Stage traffic or use detours to complete ramp tie-ins. Complete share use path connections at interchange ramp areas. Shift traffic to new ramps.
- Phase 3 – Construct shared use path and median improvements on Washington Boulevard.
- Phase 4 – Remove shared use path pavement across Washington Boulevard bridge.

Risk Plan/Contingency

The project is considered Moderately Complex and at a Pre-Scoping Phase. The level of concept design development is relatively detailed (between Pre-Scoping and PFI level), therefore the Most Likely Estimate (MLE) contingency would be more accurately at the 40% to 45% range for all categories. Updated survey information and final design may identify additional roadway design risks but are not anticipated to be significant. Risks were identified and assessed based on data collected, field visits, stakeholder input and concept design development. In addition, other typical project risks were assessed as applicable. Risks were organized by both broad and project specific categories. Each individual risk was “scored” based on probability, cost impact and time impact (See attached Cost Estimate Contingency Worksheet). Scoring was used to assign contingencies per risk line item. These line-item risk contingencies were then aggregated to determine a **contingency amount per category:**

- Project Scope/PE = 25%
- Mobilization/Construction Survey = 40%
- Construction/MOT = 45%
- Roadway Design = 40%
- Structures/Bridge = 40%
- Right of Way = 20%
- Utilities = 70%
- Environmental/Geotechnical = 40%
- Hydraulics = 40%
- Traffic = 50%

A Risk Analysis Matrix was also developed to summarize and justify the risk assessment by category and identify mitigation strategies (See Attachments).

Cost Estimate

Methodology

The project cost estimate was developed using the following methodology:

- Understanding the goals of the project and scope of improvements to be implemented

- Gathering and reviewing as much information about the project as possible including site visits and stakeholder input
- Establishing design criteria and developing a detailed design concept
- Performing quantity take offs and identifying unit prices based on Bid Express to develop "defined costs"
- Developing "allowance costs" for some elements based on potential impacts and complexity. Allowances add costs for elements based on percentage of the base construction cost.
  - MOT 15% Allowance
  - E&S 7% Allowance
  - Traffic (Signs) 4% Allowance
  - Roadside and Landscaping 5% Allowance
- Identifying proposed property impacts, developing a Right of Way Data Sheet and coordinating with VDOT to develop Right-of-Way costs. Note that 12 parcels are anticipated to be impacted with temporary easements and one parcel will have a fee taking and temporary easement.
- Performing a risk assessment as outlined above and identifying appropriate contingency percentages by category.
- Developing Preliminary Engineering costs by category based on a percentage of the Construction cost (See the Cost Estimate for more details)
- Participating in VDOT SME meetings to gather input related to project quantities and costs.

Cost Estimate Breakdown

The total 2024 project cost is estimated to be $27,666,025 and broken down by Phase/Major area as follows:

- Preliminary Engineering Phase $3,779,100
- Right of Way and Utilities Phase $1,456,786
- Construction Phase $18,412,801
- CEI $4,017,338

See the attached Cost Estimate and Cost Estimate Workbook for documentation of calculations, assumptions, and justifications.

Additional Study/Analysis Needs

Unresolved/Outstanding Items

Future work should include a detailed topographic survey, and utility designation (Level B) with test pits (Level A) at potential utility conflict locations. Future work would also include design development phases such as:

- Scoping Phase – Preliminary Field Inspection (PFI) Plans
- Preliminary Design Phase – Public Hearing (PH) Plans, design waiver requests,
- Detailed Design Phase – Field Inspection (FI) Plans, utility field inspection, final environmental documentation
- Final Design Phase – Right of Way (RW) Plans and acquisition, Pre-Advertisement Conference (PAC) Plans
- Advertisement Phase – Advertisement Plans, permitting

Design Criteria Summary

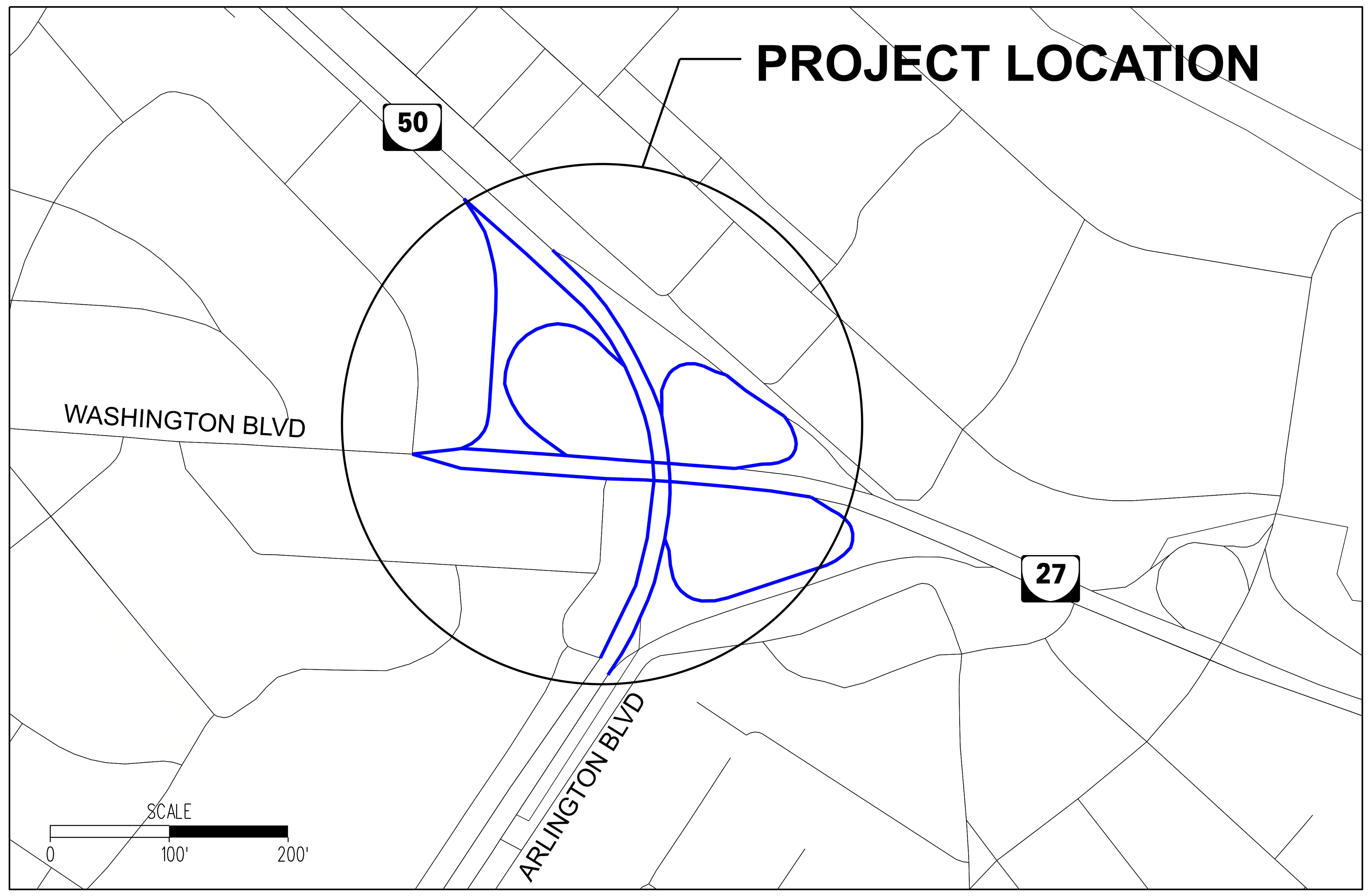
Following provides the basic design criteria for the subject project:

Design Criteria	
Functional Classification	See page 3 of the report
Posted & Design Speed	See page 3 of the report
Minimum Lane Width	12' and minimum ramp width criteria
Cross Slope	2%
Roadway Curb and Gutter	CG-2 / CG-6
Minimum Sidewalk Width	5'
Minimum Sidewalk Buffer	4'
Pedestrian Crossings	High visibility marking, detectable surface
Curb Ramp Standard	CG-12
Minimum Shared Use Path Width	10'
Minimum Shared Use Path Buffer Width	3'
Roadway Lighting	Intersection Locations
Median	Grass
Entrance Standard	CG-11

US ROUTE 50 & VA ROUTE 27 INTERCHANGE REALIGNMENT

JULY 2024

LOCATION MAP: ARLINGTON COUNTY



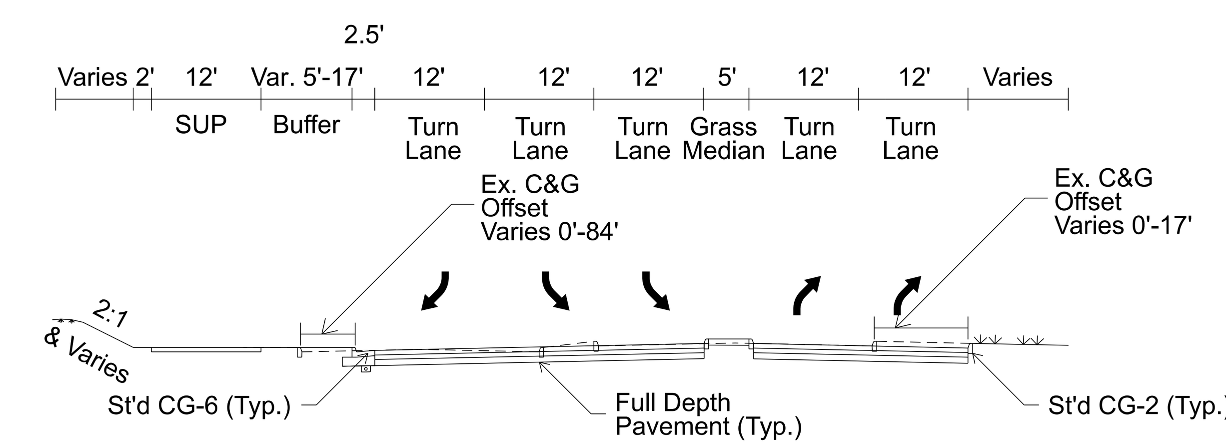
FUNCTIONAL CLASSIFICATION AND TRAFFIC DATA

	Arlington Blvd US 50 West of VA 27	Arlington Blvd US 50 East of VA 27	Washington Blvd VA 27 South of US 50	Washington Blvd VA 27 North of US 50
Functional Classification	Principal Arterial GS-5	Principal Arterial GS-5	Principal Arterial GS-5	Urban Minor Arterial GS-6
AWDT (2023)	64,000 vpd	69,000 vpd	84,000 vpd	38,000 vpd
DHV	3,600	3,300	3,700	1,900
D (%) (design hour)	65.3%	57.6%	51.2%	57.6%
T (%) (design hour)	0%	0%	1%	1%
Design/Posted Speed Limit (MPH)	45 MPH	45 MPH	45 MPH	30 MPH

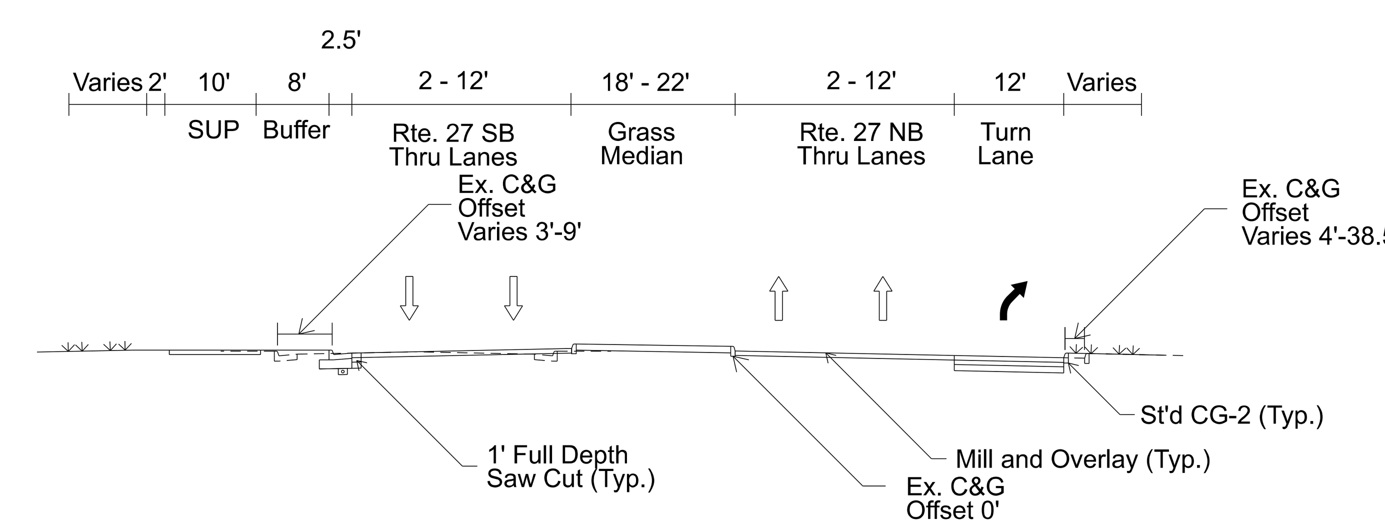
LAND DISTURBANCE

	AREA (SF)
TOTAL DISTURBED AREA	196,020
EXIST. IMPERVIOUS AREA	67,015
EXIST. PERVIOUS AREA	129,005
PROP. IMPERVIOUS AREA	87,120
PROP. PERVIOUS AREA	108,900
CHANGE IN IMPERVIOUS AREA	20,105

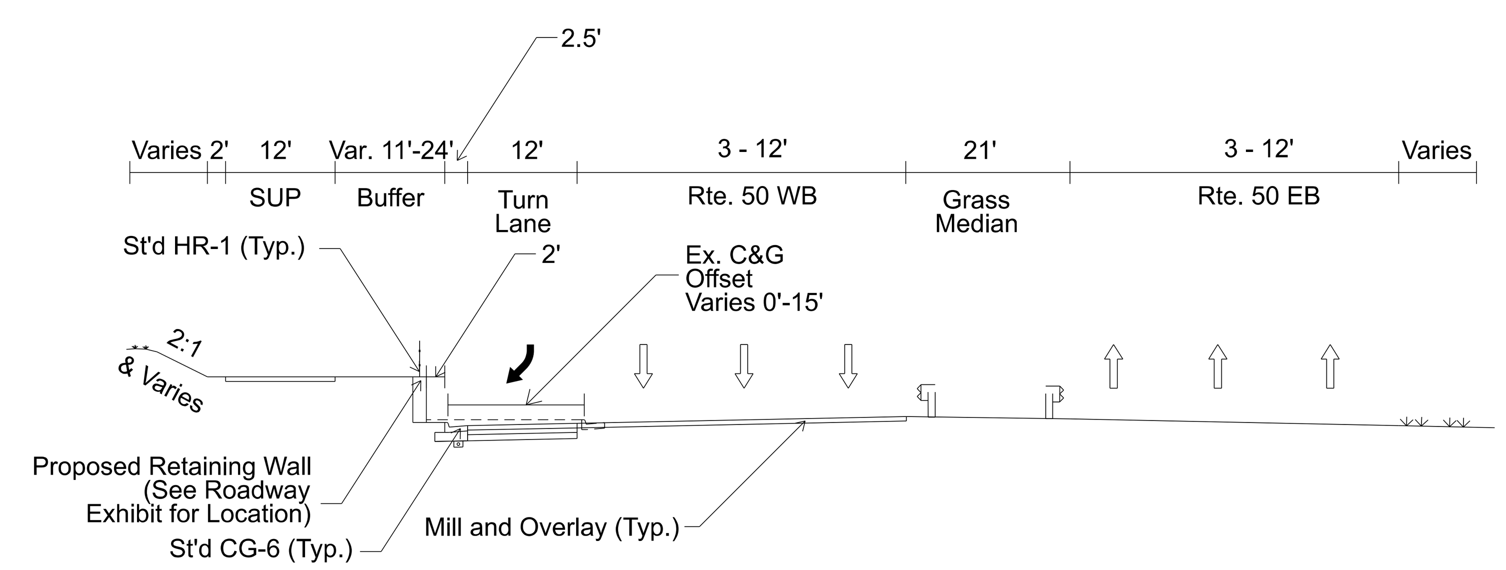
PROPOSED TYPICAL SECTIONS



Connection Road between Washington Boulevard and WB Arlington Boulevard



Washington Blvd: Arlington Blvd Service Rd to N Wayne St

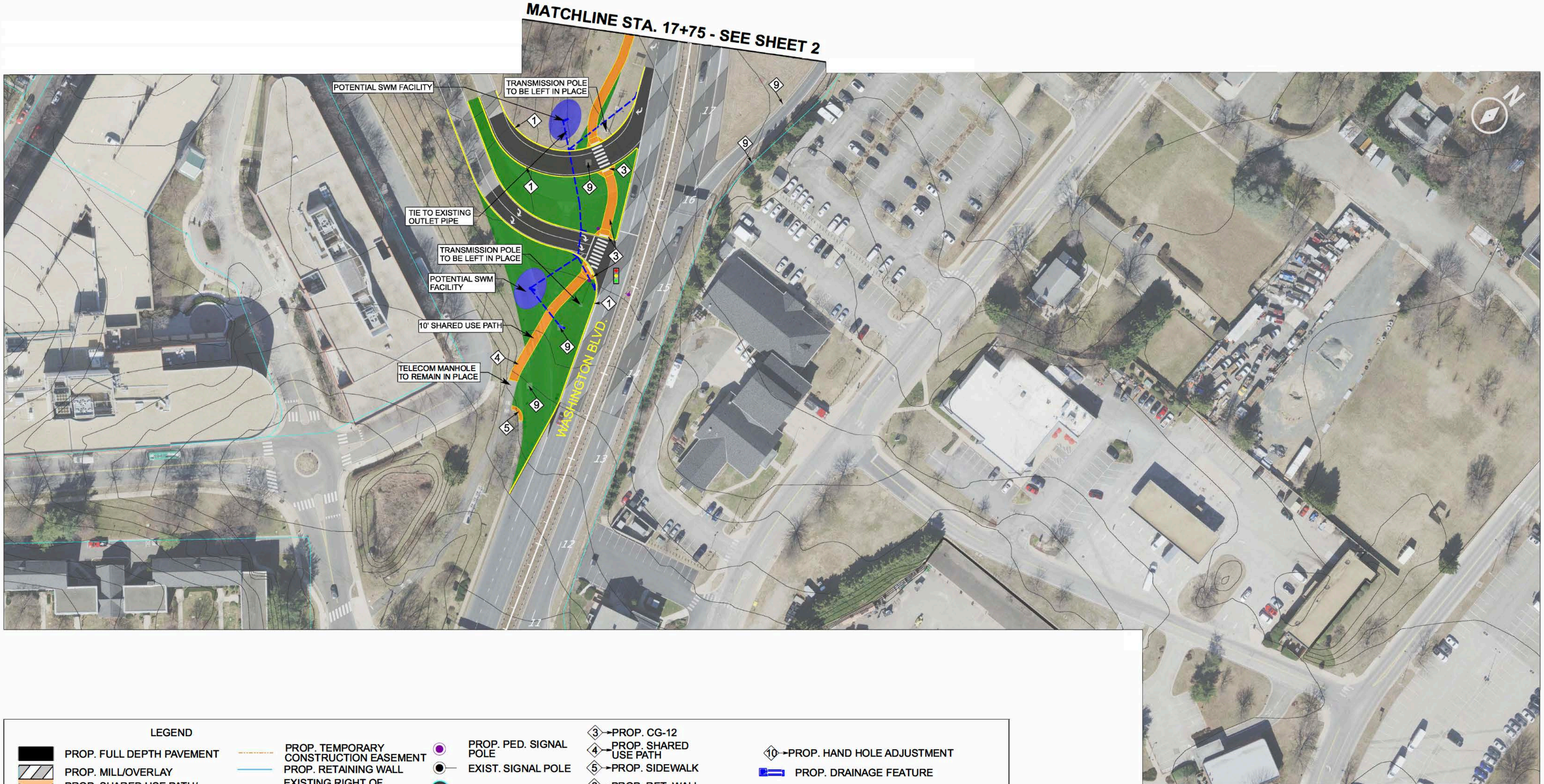


Arlington Blvd: 2nd St to off-Ramp Washington Blvd NB

TITLE SHEET

US ROUTE 50 & VA ROUTE 27 INTERCHANGE REALIGNMENT

JULY 2024



LEGEND

- PROP. FULL DEPTH PAVEMENT
- PROP. MILL/OVERLAY
- PROP. SHARED USE PATH/ SIDEWALK
- PROP. GRASS AREA
- PROP. DETECTABLE WARNING SURFACE
- PROP. RIGHT OF WAY
- PROP. TEMPORARY CONSTRUCTION EASEMENT
- PROP. RETAINING WALL
- EXISTING RIGHT OF WAY/PROPERTY LINE
- EXISTING CONTOURS AT 4' INTERVAL
- EXISTING GAS LINE
- PROP. SIGNAL POLE
- PROP. PED. SIGNAL POLE
- EXIST. SIGNAL POLE
- 01 IMPACTED PARCELS
- PROP. SIGNAL
- 1 PROP. CG-2
- 2 PROP. CG-6
- 3 PROP. CG-12
- 4 PROP. SHARED USE PATH
- 5 PROP. SIDEWALK
- 6 PROP. RET. WALL
- 7 PROP. ST'D UD-4
- 8 PROP. ST'D HR-1
- 9 EXISTING DRAINAGE STRUCTURE
- 10 PROP. HAND HOLE ADJUSTMENT
- PROP. DRAINAGE FEATURE

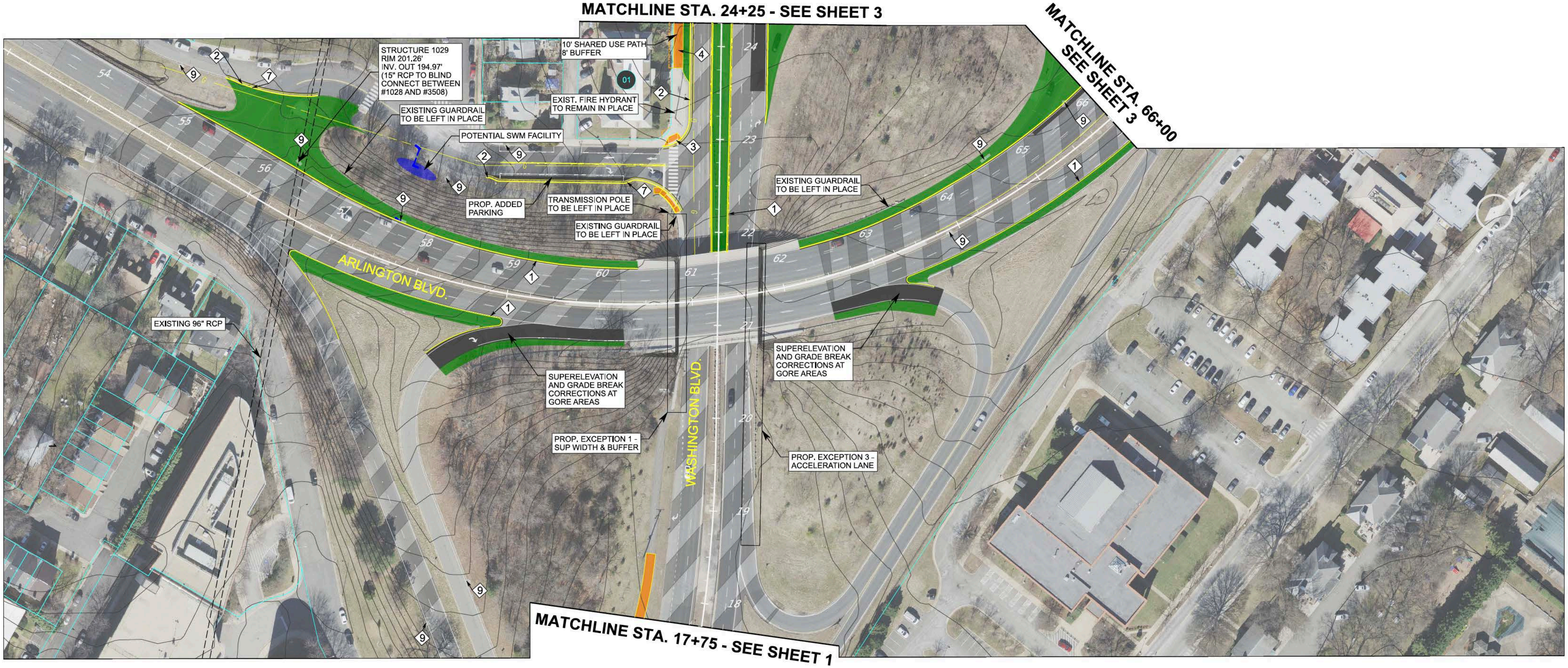
SCALE 0 50' 100'

IMPACTED PARCELS
NONE

SHEET NO. 1

US ROUTE 50 & VA ROUTE 27 INTERCHANGE REALIGNMENT

JULY 2024



LEGEND

- PROP. FULL DEPTH PAVEMENT
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- 8 PROP. ST'D HR-1
- 9 EXISTING DRAINAGE STRUCTURE
- 10 PROP. HAND HOLE ADJUSTMENT
- PROP. DRAINAGE FEATURE

SCALE 0 50' 100'

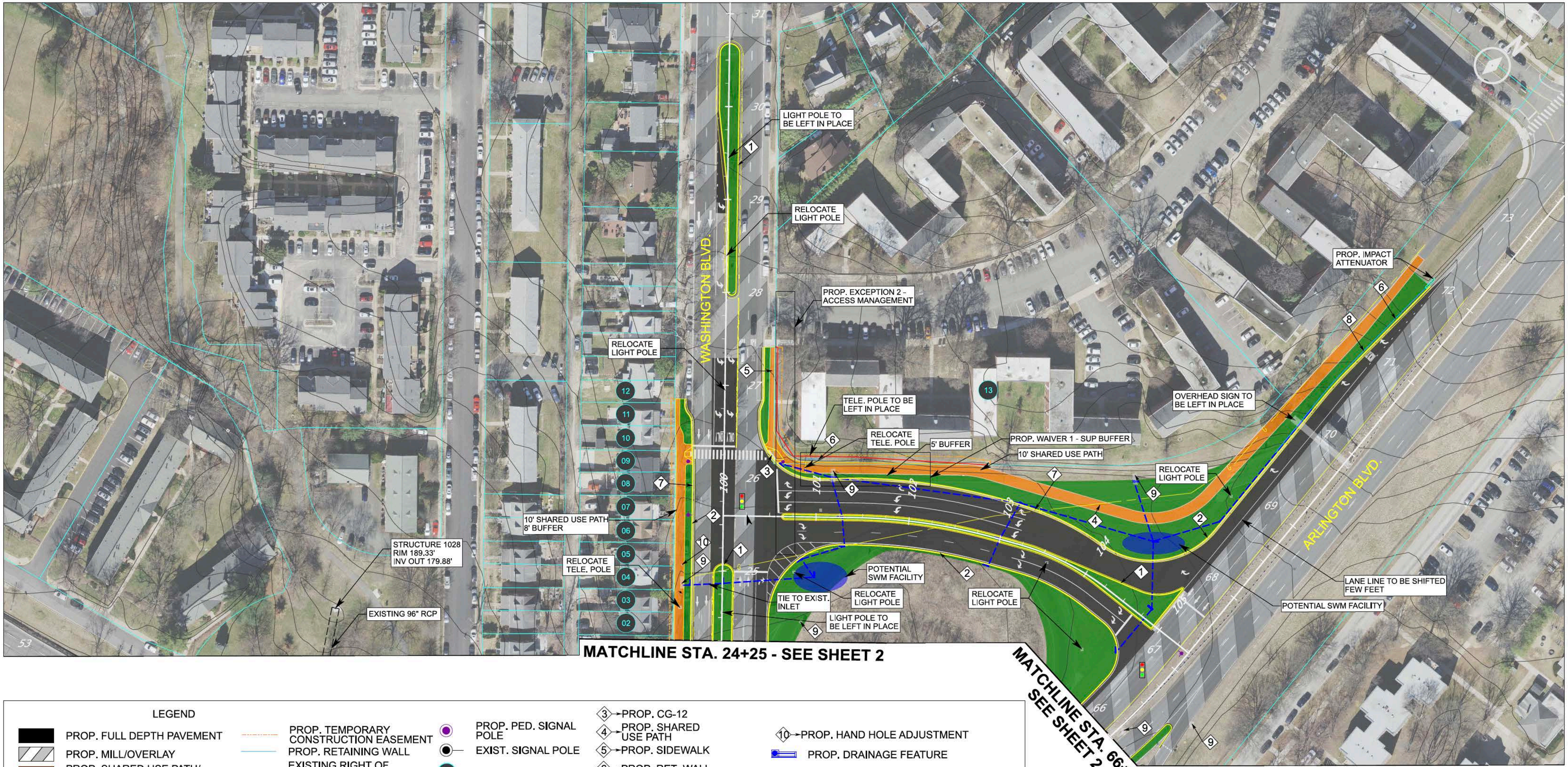
IMPACTED PARCELS

01 - BEVERLY LC A VA LLC & JOHNSON ASSOCIATES INC

SHEET NO. 2

US ROUTE 50 & VA ROUTE 27 INTERCHANGE REALIGNMENT

JULY 2024



LEGEND

PROP. FULL DEPTH PAVEMENT	PROP. TEMPORARY CONSTRUCTION EASEMENT
PROP. MILL/OVERLAY	PROP. RETAINING WALL
PROP. SHARED USE PATH/ SIDEWALK	EXISTING RIGHT OF WAY/PROPERTY LINE
PROP. GRASS AREA	EXISTING CONTOURS AT 4' INTERVAL
PROP. DETECTABLE WARNING SURFACE	EXISTING GAS LINE
PROP. RIGHT OF WAY	PROP. SIGNAL POLE

PROP. PED. SIGNAL POLE	3 PROP. CG-12
EXIST. SIGNAL POLE	4 PROP. SHARED USE PATH
01 IMPACTED PARCELS	5 PROP. SIDEWALK
PROP. SIGNAL	6 PROP. RET. WALL
1 PROP. CG-2	7 PROP. ST'D UD-4
2 PROP. CG-6	8 PROP. ST'D HR-1
	9 EXISTING DRAINAGE STRUCTURE
	10 PROP. HAND HOLE ADJUSTMENT
	PROP. DRAINAGE FEATURE

SCALE 0 50' 100'

IMPACTED PARCELS

02 - LINDSAY GEOFFREY G	08 - DE LEON EMMANUEL & REYNA
03 - CASTRO SANTOS	09 - VARGAS JONATHAN M FORTUN
04 - PUTZ CHRISTINE A	10 - PHILIPS JONATHAN M & LAUREN B
05 - MAIN ROBERT W TR	11 - KOO JUSTIN WILLIAM
06 - GINSBERG SCOTT M	12 - EVANS MARK O & MARIA LOURDES
07 - HOWENSTEIN KAREN S	13 - BOYD BERTHA ECKHARDT ET AL

SHEET NO. 3