PROJECT PIPELINE

NV-23-07: CITY OF ALEXANDRIA

Eisenhower Avenue from Van Dorn Street (Route 401) to Holland Lane

DRPT Office of INTERMODAL Planning and Investment VDOT

Eisenhower Avenue from Van Dorn Street (Route 401) to Holland Lane

Final Report - DRAFT

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Virginia Department of Transportation

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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

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

Background

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**.

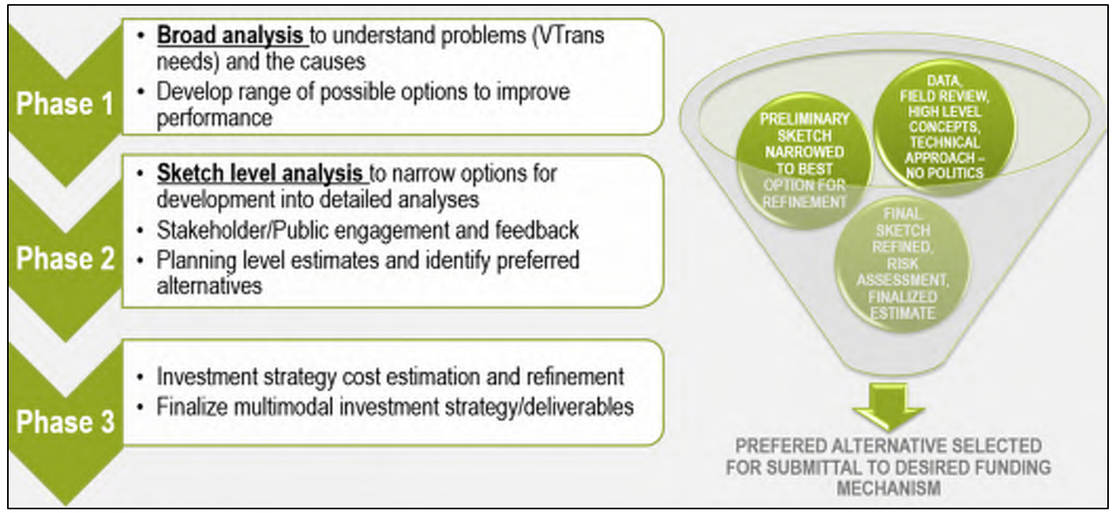


Figure 2. Study Phase Methods and Solutions

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 Eisenhower Avenue study corridor from Van Dorn Street (Route 401) to Holland Lane is located along the Cameron Run River at the City and County of Alexandria, Virginia border. The Eisenhower Ave corridor is classified as a Minor Arterial road within the study area and stretches 4.4 miles. The posted speed limit for Eisenhower Avenue is 35 MPH, west of E Mill Road, and 25 MPH, east of E Mill Road. A map detailing the locations of the study intersections along Fairfax Pike is shown below in **Figure 4.**

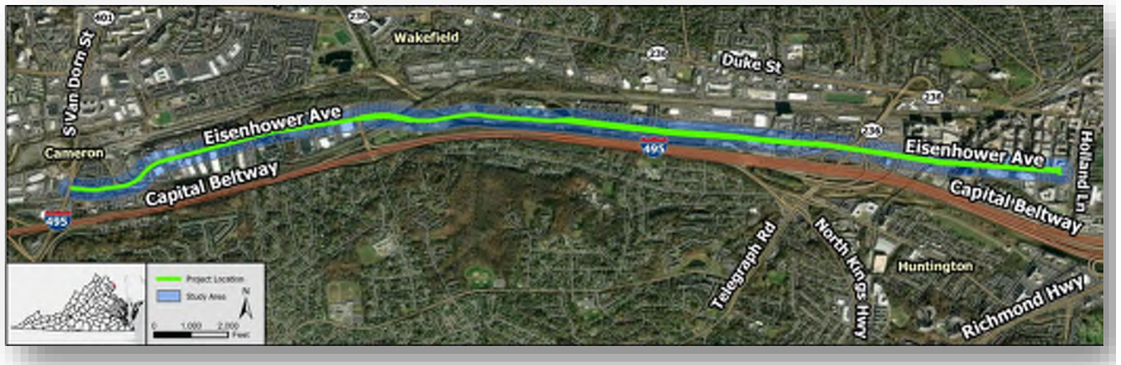


Figure 4. Eisenhower Ave Study Area Map

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 and Pedestrian Access, 'High' for Transit Demand Management, 'Medium' for Transit Access, and 'Low' for Congestion Mitigation and Safety Improvement, as presented in **Table 3.**

Table 3. VTrans Needs in Study Area

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

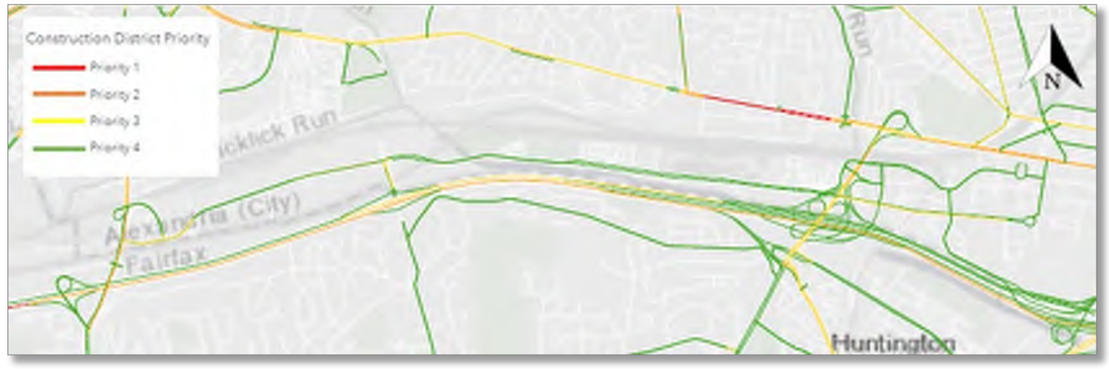


Figure 5. 2019 VTrans Prioritized Mid-term Needs in the Study Area

[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 Purpose, Goals, & Objectives

Analyze the operational and safety issues identified along Eisenhower Ave, 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.

Issues in the Study Area

TDM

- Existing Shared-Use Path on the south side of Eisenhower Ave, from the Holmes Run Trail to Stovall St. Bicycle connection at Eisenhower Ave Connector. Capital Bikeshare at Van Dorn Metro, Eisenhower Ave & Ike Dr, and Eisenhower Ave & Mill Race Ln.
- Sidewalks are inconsistent along Eisenhower Ave. There is demand for safe pedestrian crossings.
- Park & Ride lots at Van Dorn & Eisenhower Ave Metro.
- Existing bus stops along Eisenhower Ave serving DASH, Fairfax Connector, and WMATA routes. WMATA Metro Yellow & Blue Line stops located along the corridor.
- Van Dorn St & Eisenhower Ave intersection has major delays due to high volumes on Van Dorn St.
- 31 rear end incidents (2015-2022) at Van Dorn St & Eisenhower Ave. 1 fatal Fixed Object – Off Road (FOOR) incident along WB Eisenhower Ave near the Van Dorn Metro. Most of the pedestrian collisions near metro stations.

Project Fact Sheet	
VDOT District	Northern Virginia
Locality	City of Alexandria
# of Study Intersections	18 signalized; 11 unsignalized
Transit Routes	DASH Transit Bus Routes (30, 32, & 35); Fairfax Connector Routes (109, 231, 232, & 321); WMATA Bus Routes (7A, NH2, & REX); WMATA Metro Stops (Van Dorn St – Blue Line & Eisenhower Ave – Yellow Line)
Bikeways	Shared-Use-Path on the south side of Eisenhower Avenue that connects to Holmes Run Trail
Functional Classification	Minor Arterial
Speed Limit	35 mph (west of E Mill Rd); 25 mph (east of E Mill Rd)

Figure 6. Project Overview for Eisenhower Avenue from Van Dorn Street to Holland Lane

Previous Study Efforts

Three other studies were performed that may impact geometric and traffic conditions in the study area.

Alexandria Mobility Plan

The Alexandria Mobility Plan was published in 2021 with the vision of safe, seamless, and connected mobility options to foster a thriving Alexandria for all. The plan, shown in **Figure 7,** proposed a modified hub-and-spoke network design model with Old Town as the "hub," and the major east-west arterials, including Eisenhower Avenue, as the "spokes" to provide a better transit connection.

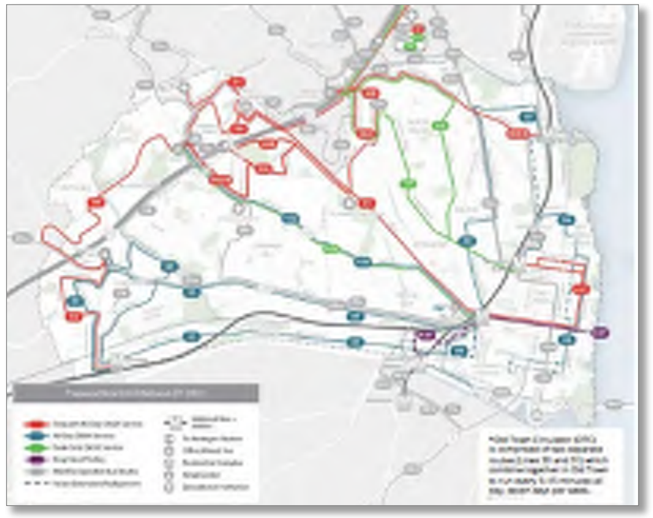


Figure 7. Alexandria Mobility Plan – Transit Hub and Spoke

Eisenhower East SAP

The Eisenhower East Small Area Plan focuses on density and land uses and how people experience the place, with recommendations to develop neighborhoods in the city that will be walkable, compact, equitable, and economically sustainable. The study area is shown in **Figure 8.**

Figure 8. Eisenhower East Small Area Plan Neighborhoods

Eisenhower West SAP

The Eisenhower West Small Area Plan is an integral part of the City's Eisenhower Valley economic development. The Eisenhower West plan proposes a mix of residential and employment uses, co-existing with industrial uses remaining in the area. The plan, shown in **Figure 9,** focuses on transit-oriented communities, and safe, connected pedestrian, bicycle, transit, and vehicular mobility. Pedestrian improvements extend to Van Dorn St, S Pickett St, and Eisenhower Ave.

Figure 9. Eisenhower West Small Business Plan

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 (73%) within the study area is between ages 18 and 64, 15% are children up to age 17, and 11% are over age 65, as shown in **Figure 10**.
- Approximately 50% of the households own only one vehicle, followed by 35% owning two vehicles, and 8% owning three or more vehicles, as shown in **Figure 11**. Additionally, 6% of households do not own a vehicle.
- 76% of the population in the study area consists of 1 or 2-person households, as shown in **Figure 12**.
- The population in poverty makes up 8% of the total population (2,400 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 13**.
- The linguistically isolated households, or limited English speaking, comprise 25% of the study area, as shown in **Figure 14**.
- The largest population in poverty based on their race are White, Black, or African American, which make up 6% of the population in poverty, as presented in **Figure 15**.
- The vulnerable population in the study area includes 11% veterans and 8% people with disabilities, as presented in **Figure 16**.
- The total households with no computers is 2% of the population and 3% have no access to the Internet, as presented in **Figure 17.** These are also below the average for the state, city, and county.

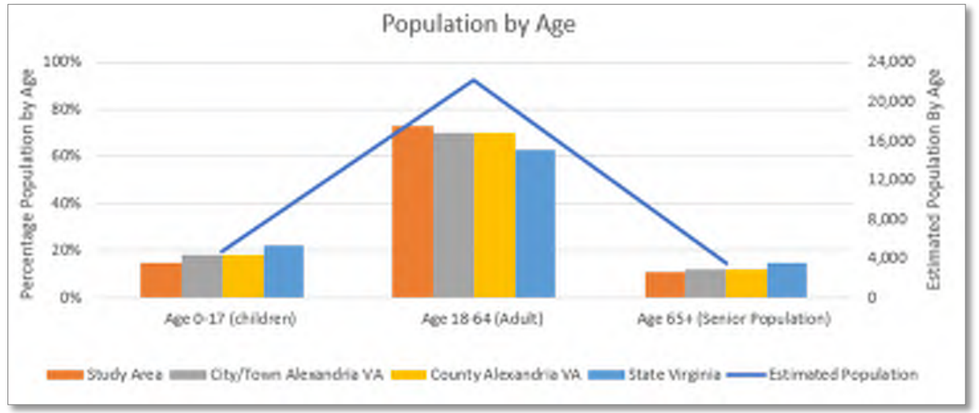


Figure 10. STEAP Tool Analysis Population by Age Group

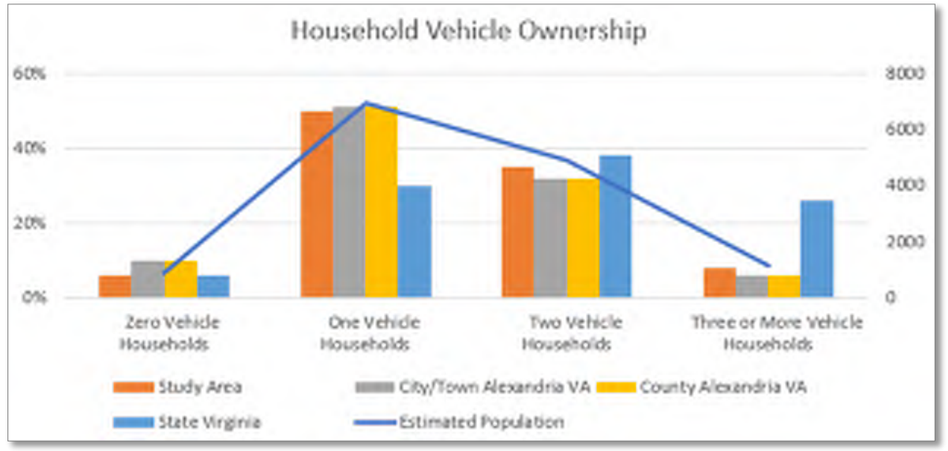


Figure 11. STEAP Tool Analysis Vehicle Ownership

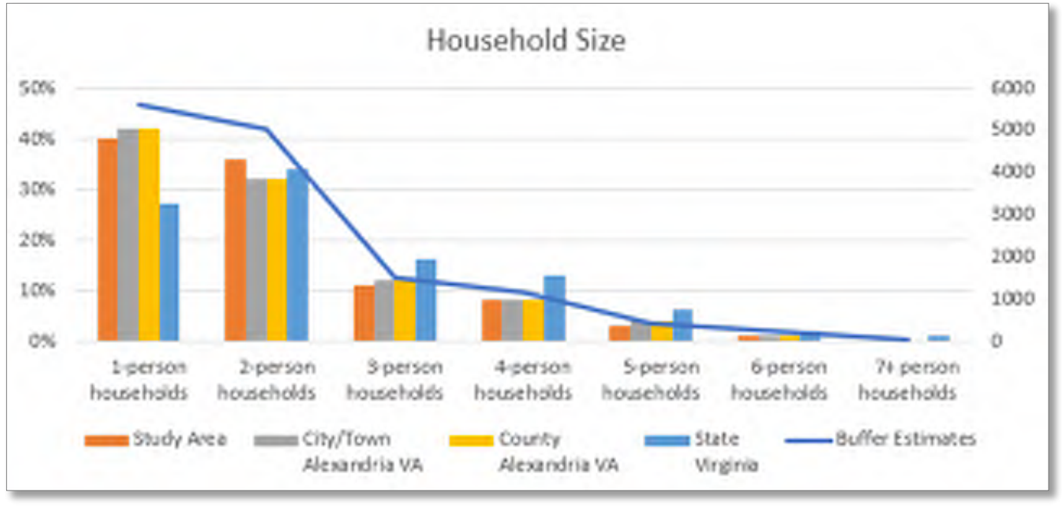


Figure 12. STEAP Tool Analysis Household Size

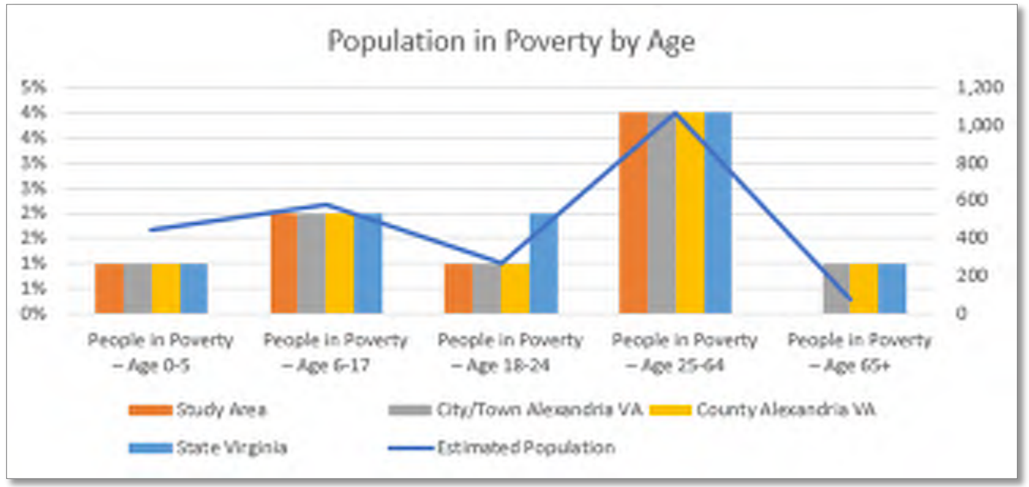


Figure 13. STEAP Tool Analysis Population in Poverty by Age

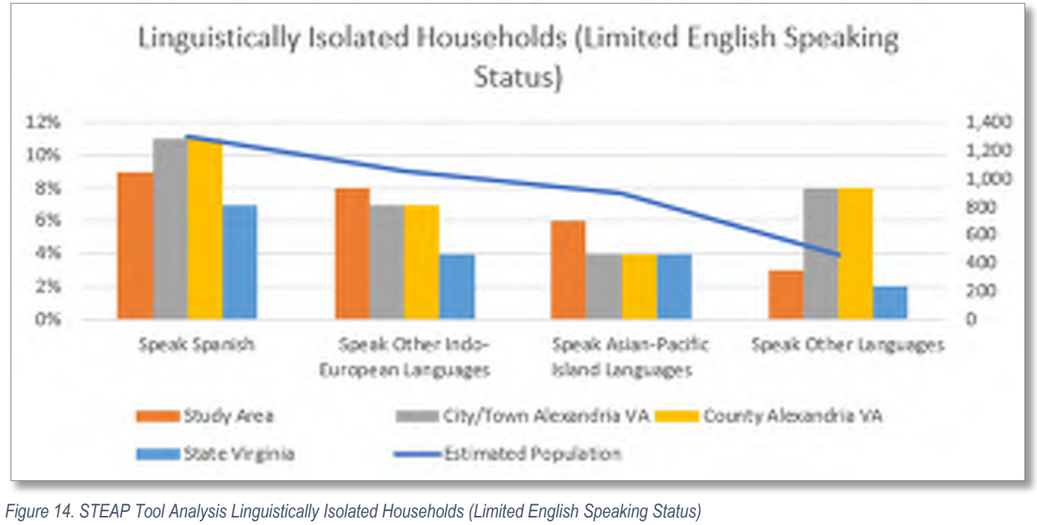


Figure 14. STEAP Tool Analysis Linguistically Isolated Households (Limited English Speaking Status)

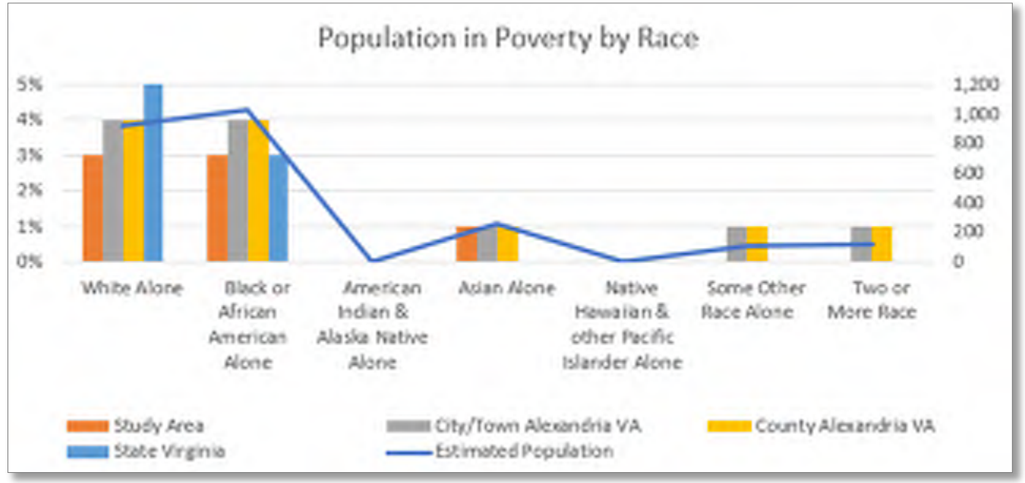


Figure 15. STEAP Tool Analysis Population in Poverty by Race

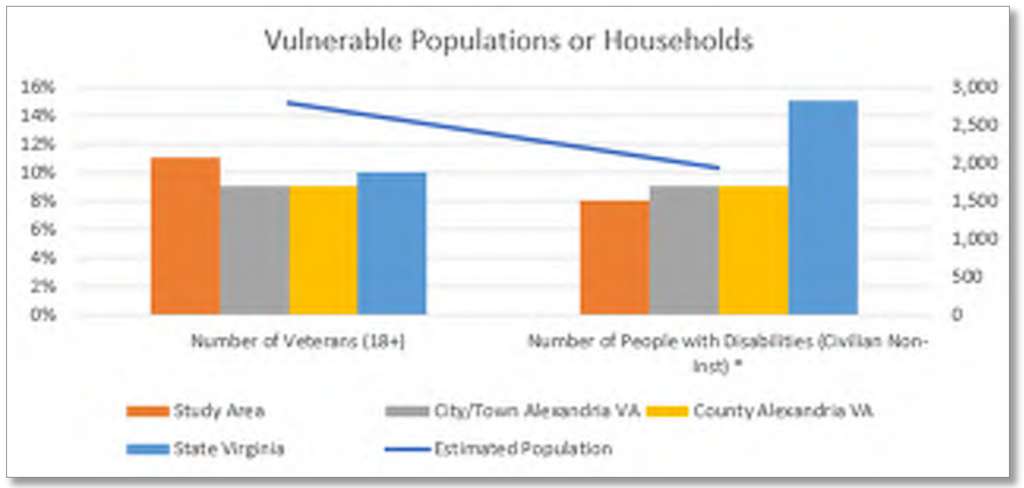


Figure 16. STEAP Tool Analysis Vulnerable Populations or Households - Disability

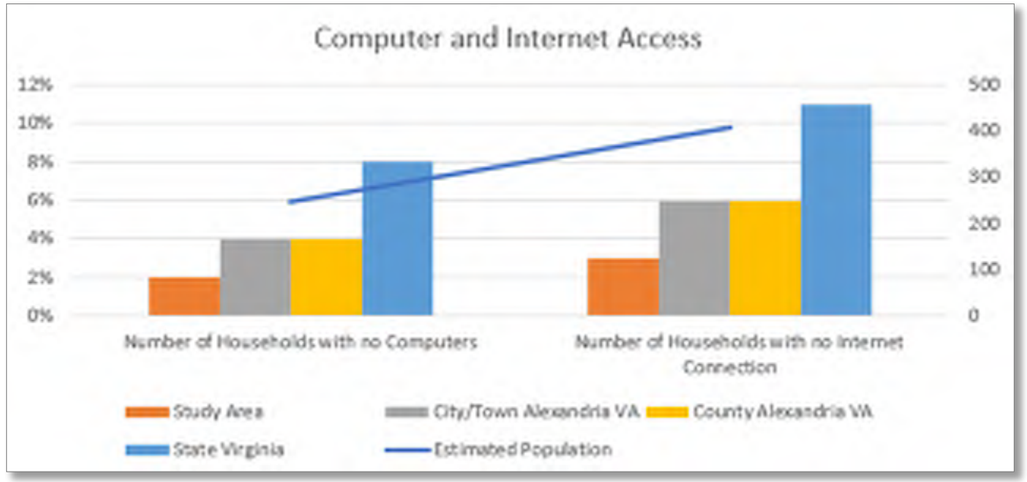


Figure 17. STEAP Tool Analysis Vulnerable Populations or Households - Computer and Internet Access

Traffic Operations and Accessibility:

Initial traffic operational analysis was performed using Synchro 11 software for all study intersections along the Eisenhower Ave corridor. 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.

Traffic Data

The traffic data for the study area was obtained from turning movement counts collected on Wednesday, June 7, 2023. The morning counts were collected from 6:00 AM to 9:00 AM and the evening counts were collected from 3:30 PM to 6:30 PM. The intersection volumes are shown in **Figure 18**, **Figure 19**, and **Figure 20**.

Measures of Effectiveness

There are many measures of effectiveness (MOE) in traffic operations analysis to quantify operational and safety objectives and provide a basis for evaluating the performance of a transportation network. Several MOEs for intersection analyses can be reported from Synchro/SimTraffic, VDOT Junction Screening Tool (VJuST), and SIDRA. For the purposes of 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:

- Control Delay (measured in seconds per vehicle – sec/veh)
- 95th Percentile Queue Length for Synchro and SIDRA (measured in feet – ft)
- Maximum Queue Length for SimTraffic (measured in feet – ft)
- Volume-to-Capacity (v/c) Ratio

Traffic Operations Analysis Results

To identify operational and accessibility needs along the study corridor, initial Synchro analysis results were reviewed for the existing year 2023.

The Synchro operational analysis shows that all study intersections operate at a Level Of Service (LOS) D or better during both AM and PM peak hours in 2023, except for Van Dorn Street, Stovall Street/I-95 Ramp, and East Mill Road. Additionally, some of the movements operate at LOS E or worse as summarized below:

Eisenhower Avenue at Van Dorn Street

- The EB approach operates at LOS F during the AM peak and LOS E during the PM peak.
- The WB approach operates at LOS F during the AM and PM peaks.
- The NB left turn movement operates at LOS E during the AM and PM peaks.
- The SB left turn movement operates at LOS F during the AM and PM peaks.
- The SB through movement operates at LOS E during the PM peaks.

Eisenhower Avenue at Eisenhower Avenue Connector/Clermont Avenue

- The SB left turn movement operates at LOS E during the AM peak.

Eisenhower Avenue at Stovall Street/I-95 Ramp

- The NB right turn movement operates at LOS F during the AM and PM peaks.

Eisenhower Avenue at East Mill Road

- The EB through/right turn movement operates at LOS F during the AM peak.
- The NB through/right turn movement operates at LOS F during the AM peak.
- The SB left turn/through movement operates at LOS F during the AM peak.

Eisenhower Avenue at Hooffs Run Drive

- The NB approach operates at LOS E during the PM peak.

Table 4 through **Table 9** presents the AM and PM peak hour Synchro analysis results summary for the existing conditions in 2023. The Synchro reports for the existing year are included in **Appendix B**.

Travel Time Analysis

To evaluate the reliability of traffic operations, the travel time indexes and average speeds were obtained from the VDOT Pipeline Round 2 Dashboards, for an average weekday in April. The source for reliability data is the Regional Integrated Transportation Information System (RITIS). The results, presented in **Figure 21**, indicate significant travel time increases during the AM and PM peak hours compared to other times of day, resulting in average speeds of lower than 30 MPH.

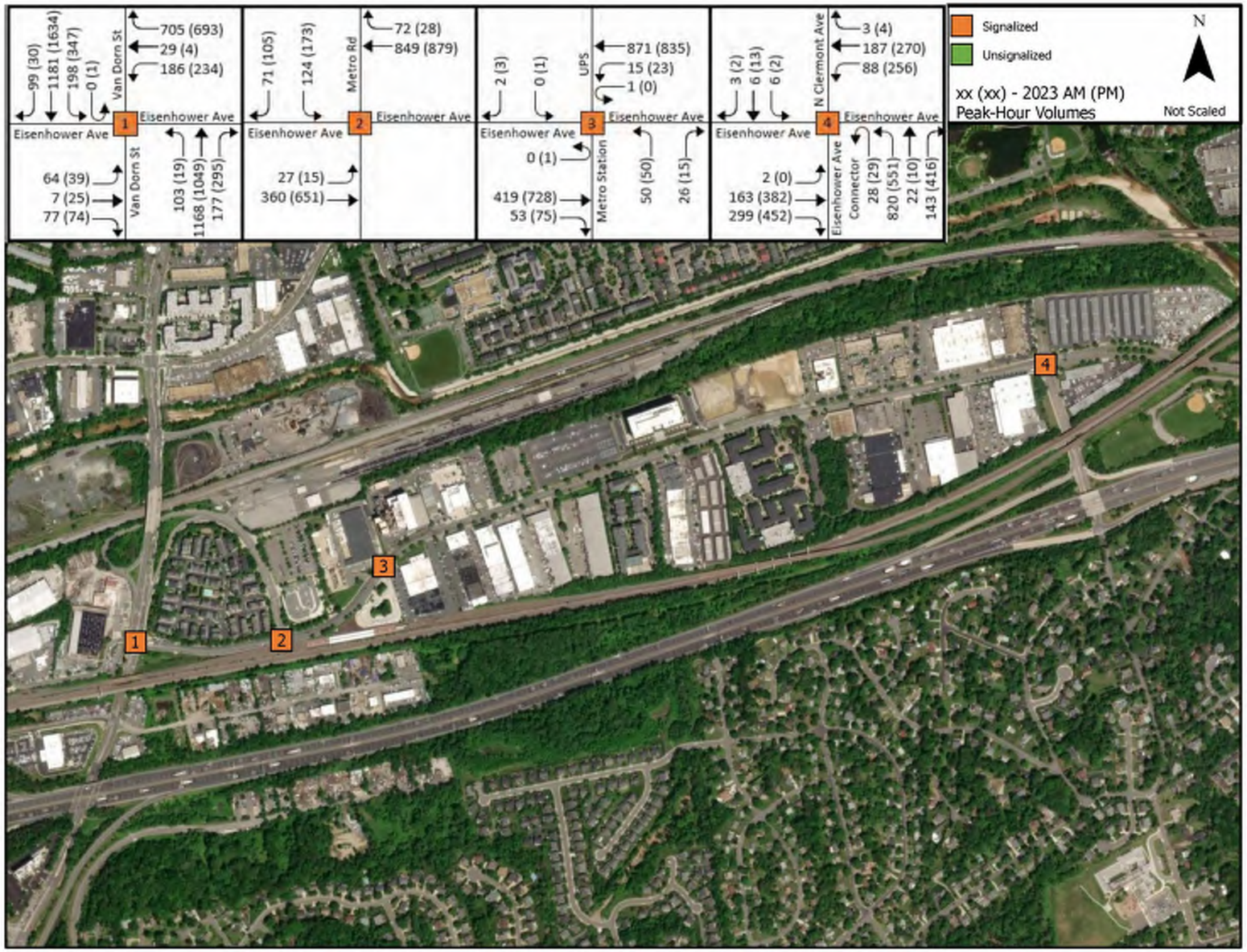


Figure 18. Turning Movement Counts

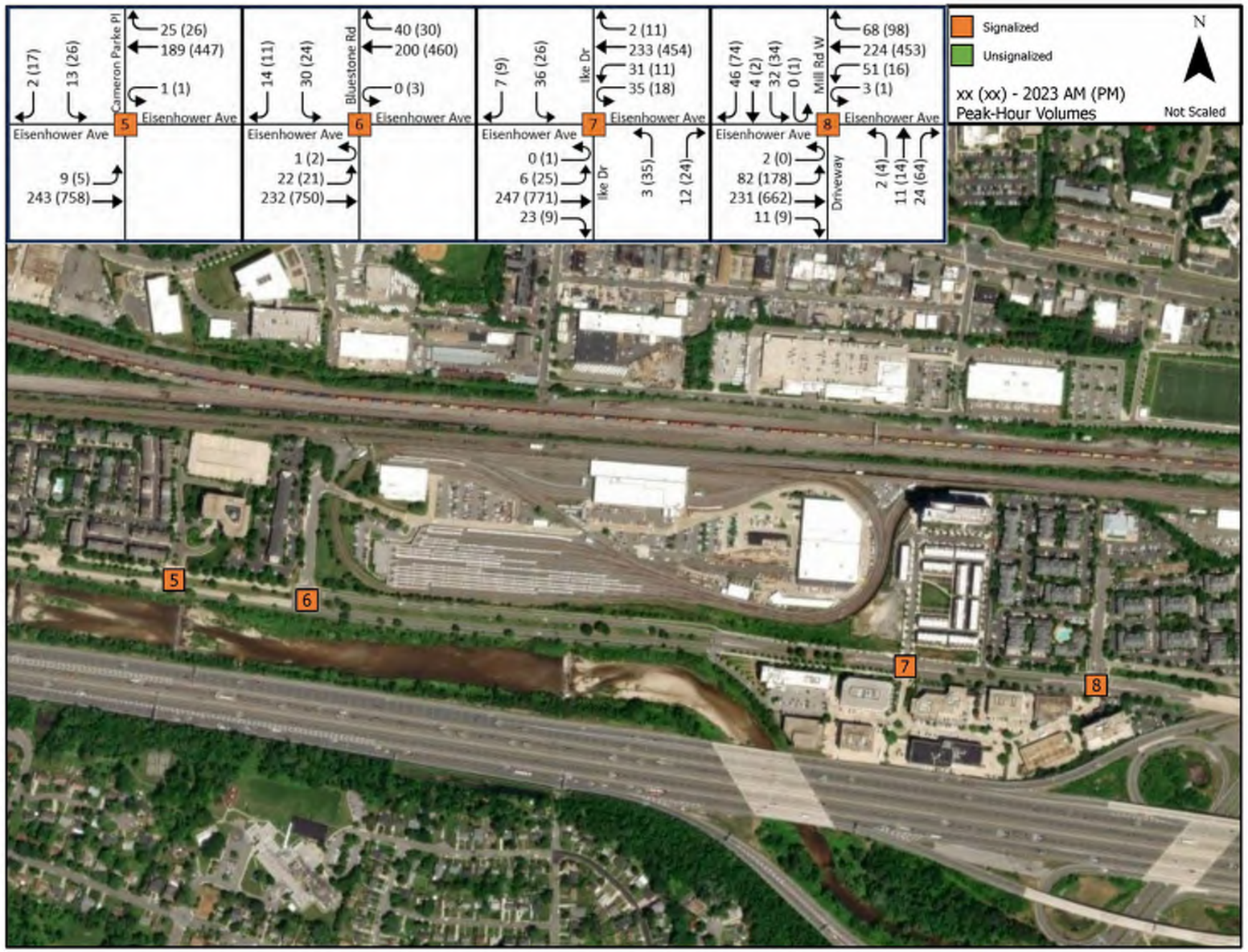


Figure 19. Turning Movement Counts

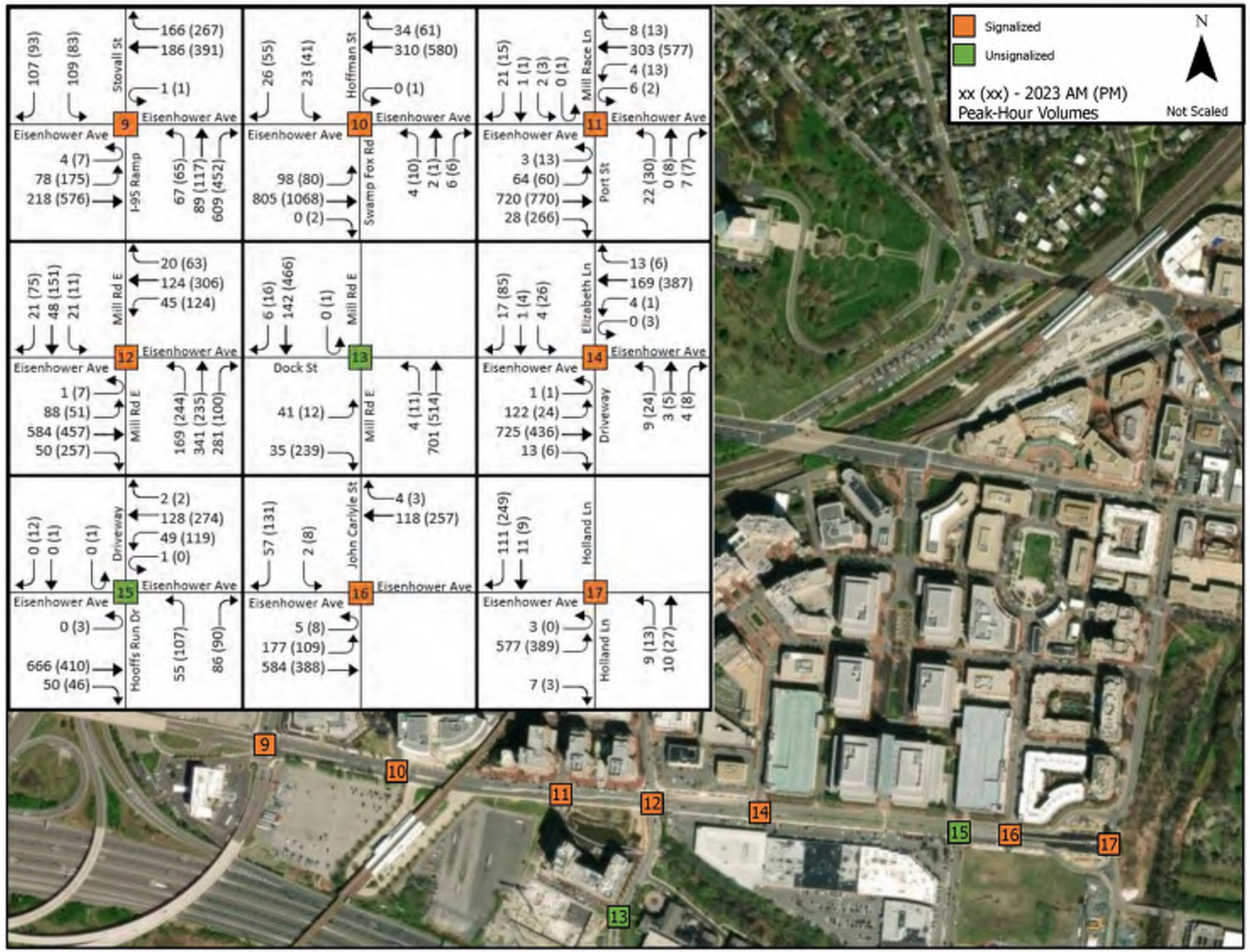


Figure 20. Turning Movement Counts

Table 4: 2023 Synchro Analysis Results Summary

	Intersection	Movement		Storage(ft)	AM			PM		
					Synchro 95th Queue (ft)	Delay (sec/veh)	LOS	Synchro 95th Queue (ft)	Delay (sec/veh)	LOS
1	Eisenhower Ave at Van Dorn St	EB	LTR	-	18	85.5	F	27	70.6	E
		EB Overall		-	-	**85.5**	F	-	**70.6**	E
		WB	L	150	269	160.8	F	238	108.9	F
			LT	-	341	172.1	F	132	121.7	F
			R	175	390	112.9	F	235	73.2	E
		WB Overall		-	-	**126.1**	F	-	**85.3**	F
		NB	L	145	196	73.1	E	38	56.9	E
			T	-	767	51.5	D	412	22.5	C
			R	115	68	30.6	C	134	18.3	B
		NB Overall		-	-	**49.8**	D	-	**22.3**	C
		SB	L	395	431	104.8	F	848	796.6	F
			T	-	813	43.9	D	1195	62.8	E
			R	240	3	26.3	C	0	19.7	B
		SB Overall		-	-	**51.1**	D	-	**190.1**	F
		Int Overall		-	-	**69.2**	E	-	**112.6**	F
2	Eisenhower Ave at Metro Rd	EB	L	325	12	11.3	B	3	9.1	A
			T	-	80	8.9	A	185	6.6	A
		EB Overall		-	-	**9.1**	A	-	**6.6**	A
		WB	T	-	102	8.3	A	116	8.9	A
			R	400	3	3.8	A	4	5.0	A
		WB Overall		-	-	**7.9**	A	-	**8.7**	A
		SB	LR	-	77	30.7	C	105	28.4	C
		SB Overall		-	-	**30.7**	C	-	**28.4**	C
		Int Overall		-	-	**10.9**	B	-	**11.1**	B
3	Eisenhower Ave at Metro Station	NB	LTR	-	66	36.4	D	50	33.6	C
		NB Overall		-	-	**36.4**	D	-	**33.6**	C
		SB	LTR	-	0	31.7	C	0	30.6	C
		SB Overall		-	-	**31.7**	C	-	**30.6**	C
		EB	LTR	-	11	1.8	A	95	2.6	A
		EB Overall		-	-	**1.8**	A	-	**2.6**	A
		WB	L	75	10	3.2	A	11	3.2	A
			TR	-	141	5.1	A	116	4.1	A
		WB Overall		-	-	**5.0**	A	-	**4.1**	A
		Int Overall		-	-	**5.9**	A	-	**4.8**	A

[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

Table 5: 2023 Synchro Analysis Results Summary Continued

	Intersection	Movement		Storage(ft)	AM			PM		
					Synchro 95th Queue (ft)	Delay (sec/veh)	LOS	Synchro 95th Queue (ft)	Delay (sec/veh)	LOS
4	Eisenhower Ave at Eisenhower Ave Connector/ Clermont Ave	EB	L	150	7	47.7	D	0	0.0	A
			T	-	77	30.0	C	168	25.8	C
			R	60	73	29.7	C	361	33.7	C
		EB Overall		-	-	**29.9**	C	-	**30.2**	C
		WB	L	310	50	36.7	D	128	36.2	D
			TR	-	83	26.2	C	85	12.3	B
		WB Overall		-	-	**29.2**	C	-	**24.1**	C
		NB	L	-	297	19.9	B	247	34.4	C
			T	-	22	11.9	B	15	21.9	C
			R	-	26	12.4	B	60	24.1	C
		NB Overall		-	-	**18.7**	B	-	**29.8**	C
		SB	L	145	13	72.2	E	8	47.0	D
			TR	-	5	37.9	D	10	39.1	D
		SB Overall		-	-	**50.8**	D	-	**39.8**	D
		Int Overall		-	-	**23.4**	C	-	**28.9**	C
5	Eisenhower Ave at Cameron Parker Pl	EB	L	100	3	1.6	A	2	1.9	A
			T	-	21	1.7	A	72	2.7	A
		EB Overall		-	-	**1.7**	A	-	**2.7**	A
		WB	LTR	-	18	1.7	A	43	2.4	A
		WB Overall		-	-	**1.7**	A	-	**2.4**	A
		SB	L	-	17	35.7	D	30	33.3	C
			R	-	4	33.9	C	11	31.8	C
		SB Overall		-	-	**35.4**	D	-	**32.7**	C
		Int Overall		-	-	**3.4**	A	-	**3.9**	A
6	Eisenhower Ave at Bluestone Rd	EB	L	125	8	4.6	A	8	4.1	A
			T	-	46	5.9	A	150	6.9	A
		EB Overall		-	-	**5.8**	A	-	**6.8**	A
		WB	LTR	-	43	6.0	A	94	6.2	A
		WB Overall		-	-	**6.0**	A	-	**6.2**	A
		SB	L	-	27	25.4	C	23	27.7	C
			R	-	8	23.7	C	9	24.4	C
		SB Overall		-	-	**24.8**	C	-	**26.6**	C
		Int Overall		-	-	**7.7**	A	-	**7.2**	A

[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

Table 6. 2023 Synchro Analysis Results Summary Continued

	Intersection	Movement		Storage(ft)	AM			PM		
					Synchro 95th Queue (ft)	Delay (sec/veh)	LOS	Synchro 95th Queue (ft)	Delay (sec/veh)	LOS
7	Eisenhower Ave at Ike Dr	EB	L	155	4	3.4	A	9	3.9	A
			TR	-	54	5.7	A	156	6.9	A
		EB Overall		-	-	**5.6**	A	-	**6.8**	A
		WB	L	175	17	3.6	A	11	4.0	A
			TR	-	50	4.1	A	91	6.3	A
		WB Overall		-	-	**4.0**	A	-	**6.2**	A
		NB	LTR	-	0	36.2	D	38	33.5	C
		NB Overall		-	-	**36.2**	D	-	**33.5**	C
		SB	LT	-	58	44.6	D	44	35.3	D
			R	55	0	36.1	D	0	33.1	C
		SB Overall		-	-	**43.0**	D	-	**34.7**	C
		Int Overall		-	-	**9.1**	A	-	**9.1**	A
8	Eisenhower Ave at West Mill Rd	EB	L	150	27	3.6	A	62	4.0	A
			T	-	56	5.8	A	171	7.2	A
		EB Overall		-	-	**5.1**	A	-	**6.5**	A
		WB	L	140	19	4.5	A	9	5.9	A
			T	-	62	6.5	A	153	8.8	A
		WB Overall		-	-	**6.1**	A	-	**8.6**	A
		NB	LT	-	25	49.7	D	35	48.2	D
			R	-	0	48.9	D	0	47.5	D
		NB Overall		-	-	**49.2**	D	-	**47.7**	D
		SB	LTR	-	11	54.1	D	55	54.4	D
		SB Overall		-	-	**54.1**	D	-	**54.4**	D
		Int Overall		-	-	**14.1**	B	-	**14.0**	B
9	Eisenhower Ave at Stovall St/ I-95 Ramp	EB	L	150	50	11.5	B	105	14.0	B
			T	-	76	14.7	B	200	18.7	B
		EB Overall		-	-	**13.8**	B	-	**17.4**	B
		WB	L	360	8	26.5	C	1	16.8	B
			T	-	57	25.4	C	107	16.6	B
			R	-	0	0.0	A	0	0.0	A
		WB Overall		-	-	**25.5**	C	-	**16.6**	B
		NB	LT	-	84	33.9	C	83	32.8	C
			R	280	323	87.7	F	253	111.2	F
		NB Overall		-	-	**75.4**	E	-	**89.1**	F
		SB	L	215	67	45.0	D	50	44.4	D
			R	-	0	0.0	A	0	0.0	A
		SB Overall		-	-	**45.0**	D	-	**44.4**	D
		NE	LTR	-	0	0.0	A	0	0.0	A
		NE Overall		-	-	**0.0**	A	-	**0.0**	A
		Int Overall		-	-	**53.0**	D	-	**45.8**	D

[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

Table 7. 2023 Synchro Analysis Results Summary Continued

	Intersection	Movement		Storage(ft)	AM			PM		
					Synchro 95th Queue (ft)	Delay (sec/veh)	LOS	Synchro 95th Queue (ft)	Delay (sec/veh)	LOS
10	Eisenhower Ave at Hoffman St/ Swamp Fox Rd	EB	L	65	34	5.3	A	19	4.2	A
			T	-	172	5.2	A	231	9.1	A
		EB Overall		-	-	**5.2**	A	-	**8.7**	A
		WB	TR	-	47	4.8	A	26	2.2	A
		WB Overall		-	-	**4.8**	A	-	**2.2**	A
		NB	LTR	-	15	50.1	D	6	48.6	D
		NB Overall		-	-	**50.1**	D	-	**48.6**	D
		SB	L	-	40	48.2	D	57	46.4	D
			R	-	0	45.4	D	0	43.2	D
		SB Overall		-	-	**46.7**	D	-	**44.6**	D
		Int Overall		-	-	**7.5**	A	-	**9.1**	A
11	Eisenhower Ave at Mill Race Ln Port St	EB	L	115	1	0.5	A	40	5.7	A
			TR	-	15	1.3	A	263	10.6	B
		EB Overall		-	-	**1.2**	A	-	**10.2**	B
		WB	L	85	7	9.9	A	8	5.3	A
			TR	-	90	10.9	B	133	8.1	A
		WB Overall		-	-	**10.9**	B	-	**8.0**	A
		NB	LTR	-	10	44.5	D	58	48.1	D
		NB Overall		-	-	**44.5**	D	-	**48.1**	D
		SB	LTR	-	0	45.0	D	0	42.5	D
		SB Overall		-	-	**45.0**	D	-	**42.5**	D
		Int Overall		-	-	**6.4**	A	-	**11.3**	B
12	Eisenhower Ave at East Mill Rd	EB	L	100	21	8.2	A	34	17.0	B
			TR	-	356	107.2	F	321	53.6	D
		EB Overall		-	-	**94.5**	F	-	**50.6**	D
		WB	L	200	12	18.5	B	16	15.7	B
			T	-	42	22.0	C	156	25.8	C
		WB Overall		-	-	**21.2**	C	-	**23.1**	C
		NB	L	-	135	25.2	C	241	74.9	E
			TR	-	653	113.6	F	263	41.7	D
		NB Overall		-	-	**94.1**	F	-	**54.6**	D
		SB	LT	-	128	166.1	F	204	66.1	E
			R	-	0	29.1	C	0	37.8	D
		SB Overall		-	-	**129.8**	F	-	**56.6**	E
		Int Overall		-	-	**88.1**	F	-	**46.2**	D

[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

Table 8. 2023 Synchro Analysis Results Summary Continued

	Intersection	Movement		Storage(ft)	AM			PM		
					Synchro 95th Queue (ft)	Delay (sec/veh)	LOS	Synchro 95th Queue (ft)	Delay (sec/veh)	LOS
13	East Mill Rd at Dock St	EB	LR	-	14	11.9	B	61	14.8	B
		EB Overall		-	-	**11.9**	B	-	**14.8**	B
		NB	LT	-	0	0.3	A	1	0.8	A
			T	-	0	0.0	A	1	0.0	A
		NB Overall		-	-	**0.1**	A	-	**0.3**	A
		SB	T	-	0	0.0	A	0	0.0	A
			TR	-	0	0.0	A	0	0.0	A
		SB Overall		-	-	**0.0**	A	-	**0.0**	A
		Int Overall		-	-	**1.1**	A	-	**3.5**	A
14	Eisenhower Ave at Elizabeth Ln	EB	L	150	14	1.8	A	1	0.3	A
			TR	-	223	5.3	A	10	0.5	A
		EB Overall		-	-	**4.8**	A	-	**0.5**	A
		WB	L	120	1	3.6	A	1	4.0	A
			T	-	40	5.5	A	64	5.0	A
			R	-	0	4.4	A	0	4.7	A
		WB Overall		-	-	**5.3**	A	-	**5.0**	A
		NB	LTR	-	15	48.6	D	28	46.5	D
		NB Overall		-	-	**48.6**	D	-	**46.5**	D
		SB	L	-	11	46.1	D	42	42.7	D
			TR	-	0	45.7	D	0	41.9	D
		SB Overall		-	-	**45.8**	D	-	**42.1**	D
		Int Overall		-	-	**7.4**	A	-	**10.3**	B
15	Eisenhower Ave at Hooffs Run Dr	EB	L	50	0	0.0	A	0	0.0	A
			T	-	0	0.0	A	0	0.0	A
			TR	-	0	0.0	A	0	0.0	A
		EB Overall		-	-	**0.0**	A	-	**0.0**	A
		WB	LT	-	8	6.7	A	12	6.3	A
			T	-	8	0.0	A	12	0.0	A
			TR	-	0	0.0	A	0	0.0	A
		WB Overall		-	-	**3.3**	A	-	**3.0**	A
		NB	R	-	78	28.4	D	144	45.7	E
		NB Overall		-	-	**28.4**	D	-	**45.7**	E
		SB	R	-	0	0.0	A	4	12.1	B
		SB Overall		-	-	**0.0**	A	-	**12.1**	B
		Int Overall		-	-	**4.8**	A	-	**9.9**	A

[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

Table 9. 2023 Synchro Analysis Results Summary Continued

	Intersection	Movement		Storage(ft)	AM			PM		
					Synchro 95th Queue (ft)	Delay (sec/veh)	LOS	Synchro 95th Queue (ft)	Delay (sec/veh)	LOS
16	Eisenhower Ave at John Carlyle St	EB	L	-	58	5.9	A	61	6.1	A
			T	-	53	5.3	A	64	5.8	A
		EB Overall		-	-	**5.5**	A	-	**5.8**	A
		WB	TR	-	29	4.8	A	53	6.1	A
		WB Overall		-	-	**4.8**	A	-	**6.1**	A
		SB	LR	-	0	44.7	D	25	43.1	D
		SB Overall		-	-	**44.7**	D	-	**43.1**	D
		Int Overall		-	-	**8.1**	A	-	**11.5**	B
17	Eisenhower Ave at Holland Ln	EB	L	-	219	6.1	A	97	2.8	A
			R	-	4	2.4	A	0	1.8	A
		EB Overall		-	-	**6.1**	A	-	**2.7**	A
		NB	L	-	15	38.2	D	21	38.1	D
			T	-	19	37.8	D	38	37.5	D
		NB Overall		-	-	**38.0**	D	-	**37.8**	D
		SB	T	-	23	44.6	D	19	44.1	D
			R	-	6	0.9	A	7	1.0	A
		SB Overall		-	-	**6.0**	A	-	**3.2**	A
		Int Overall		-	-	**7.4**	A	-	**5.5**	A

[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

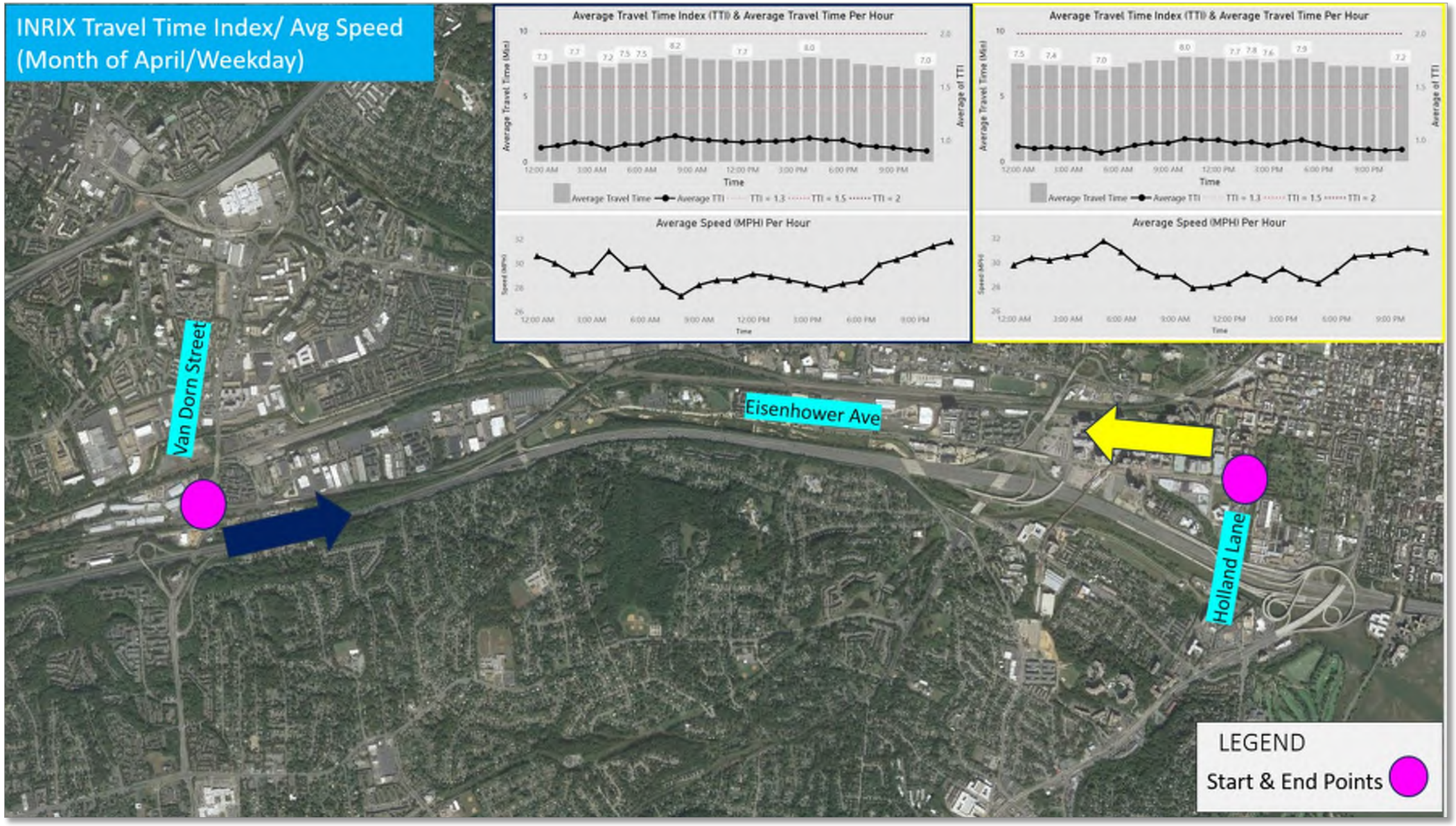


Figure 21. INRIX Travel Time Index and Average Speed

Pedestrian and Bicycle Access

To identify the needs concerning accessibility, the study team reviewed existing conditions of pedestrian and bicycle infrastructure. The 2019 VTrans Prioritized Midterm Needs for Pedestrian and Bicycle Access shows Very High needs along Eisenhower Avenue, as shown in **Figure 22** and **Figure 23**.

Figure 22. VTrans 2019 Prioritized Midterm Needs - Pedestrian Access

Figure 23. VTrans 2019 Prioritized Midterm Needs - Bicycle Access

As shown in **Figure 24**, sidewalks are inconsistent along Eisenhower Avenue, and there is demand for safe pedestrian crossings. There is a sidewalk gap without closure rerouting or signs from Pepperell Street to Warburton Street due to the land development. Additionally, the sidewalk is very narrow along Eisenhower Avenue from Ike Drive to Bluestone Road.

The existing bicycle facilities along the corridor include an existing Shared-Use-Path on the south side of Eisenhower Avenue, from the Holmes Run Trail to Stovall Street, a bicycle connection at the Eisenhower Avenue Connector, and Capital Bikeshares at Van Dorn Metro, Eisenhower Avenue and Ike Drive, and Eisenhower Avenue and Mill Race Lane.

There were 13 pedestrian crashes and 10 bicycle crashes that occurred along this corridor, with the majority located near the metro stations.

Bicycle and Pedestrian Safety and Accessibility Needs Summary:

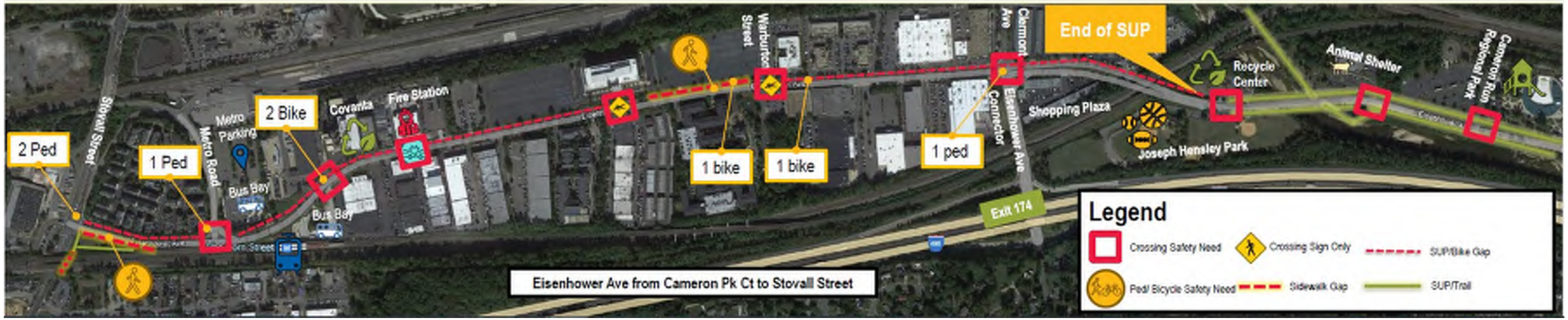


Figure 24. Bicycle and Pedestrian Safety and Accessibility Needs

Safety and Reliability:

For the analysis of existing safety conditions, the VDOT Crash Analysis PowerBI Tool was utilized to determine the crash history at the study intersections and along the study corridor on US Route 50. Crash data was collected and analyzed for an eight-year period spanning from January 2015 to December 2022. 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 10 and Table 11, respectively.

Table 10: 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	10	1	25	36
2016	0	0	13	0	21	34
2017	0	2	14	0	23	39
2018	0	4	14	1	25	44
2019	1	2	9	0	24	36
2020	0	2	5	1	15	23
2021	0	0	10	1	17	28
2022	0	0	8	1	26	35
Total	1	10	83	5	176	275

Table 11: 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
Angle	0	3	21	3	64	91
Rear End	0	1	26	2	47	76
Sideswipe – Same Direction	0	2	7	0	33	42
Fixed Object – Off Road	1	1	7	0	21	30
Pedestrian	0	2	12	0	0	14
Bicycle	0	1	7	0	1	9
Sideswipe – Opposite Direction	0	0	1	0	4	5
Head On	0	0	1	0	4	5
Non-Collision	0	0	1	0	1	2
Backed Into	0	0	0	0	1	1
Total	1	10	83	5	176	275

A total of 275 crashes were reported within the Eisenhower Avenue study area during the eight-year study period.

Key takeaways from the crash data are as follows:

1. Year-over-year crash occurrence varies with the highest number of crashes (44) occurring in 2018, followed by 39 in 2017, as shown in **Table 10.**
2. The approximate average number of reported crash incidents per year is 34.
3. The majority of reported crash incidents within the corridor are rear-end and angle crashes. Combined, these constitute approximately 61% of the total crashes, as shown in **Table 11.**
4. A total of 99 crash incidents were associated with injuries, which account for approximately 36% of the total reported crashes within the corridor. There was one crash which led to a fatality.
5. The fatal crash was a westbound single-vehicle fixed object – off road crash that occurred at night and involved high speeds along Eisenhower Avenue, approximately 1200 feet east of Metro Road, as shown in **Figure 25**.
6. The pedestrian crashes occurred in the vicinity of the Van Dorn and Eisenhower Avenue metro.
7. 11 angle crashes occurred at the intersection of Stovall Street and Eisenhower Avenue, as shown in **Figure 26**.

8. Additionally, 8 pedestrian crashes occurred along Eisenhower Avenue between Stovall Street and Mill Road in the vicinity of the Eisenhower Avenue Metro, as shown in **Figure 27**.
9. There were 57 crashes that occurred at the intersection of S Van Dorn Street and Eisenhower Avenue. 31 crashes were rear end crashes, which consists of 54% of the total crashes. There were 7 northbound rear end crashes and 14 southbound rear end crashes along S Van Dorn Street, as shown in **Figure 28**.

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

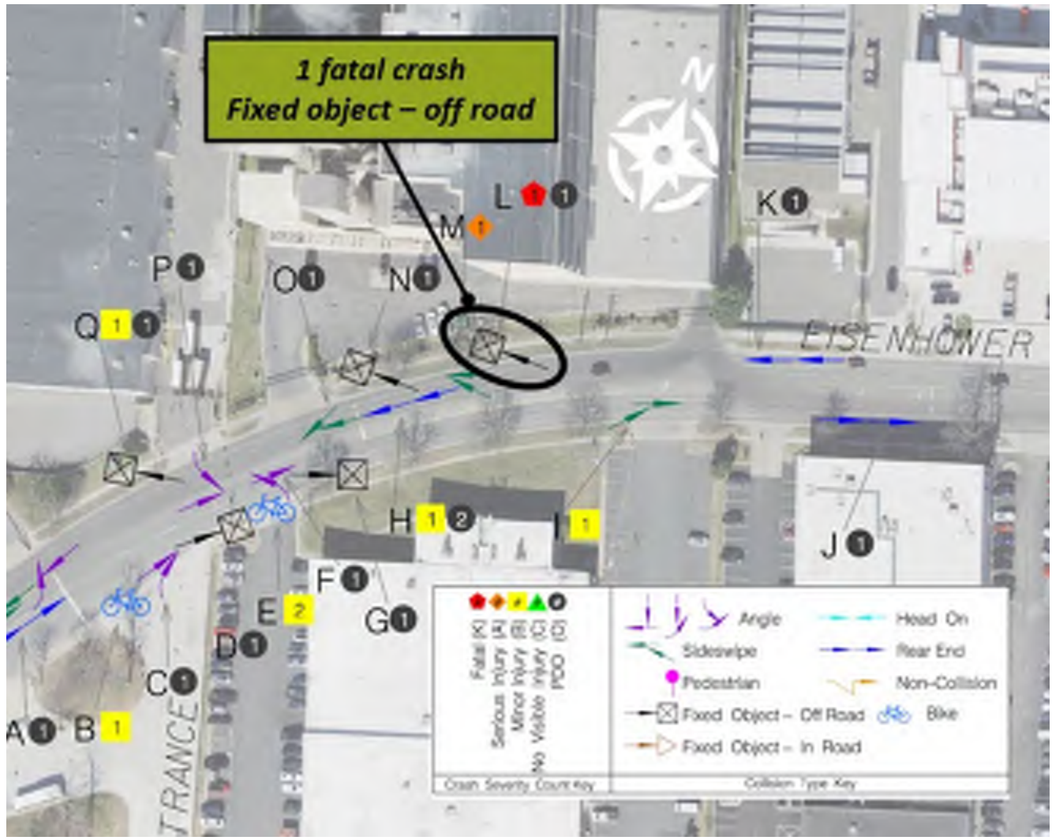


Figure 25. Crash Summary for the Fatal Crash east of Metro Road

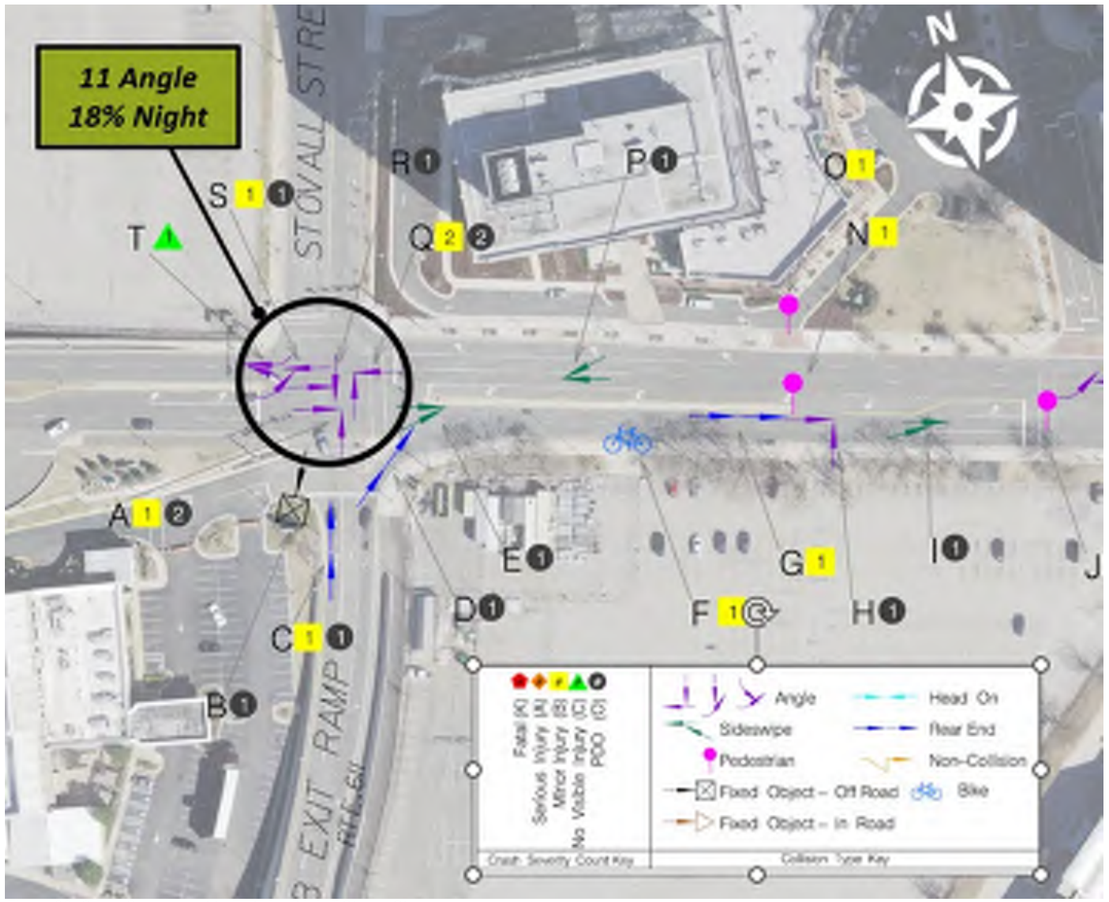


Figure 26. Crash Summary at the Intersection of Stovall St and Eisenhower Ave

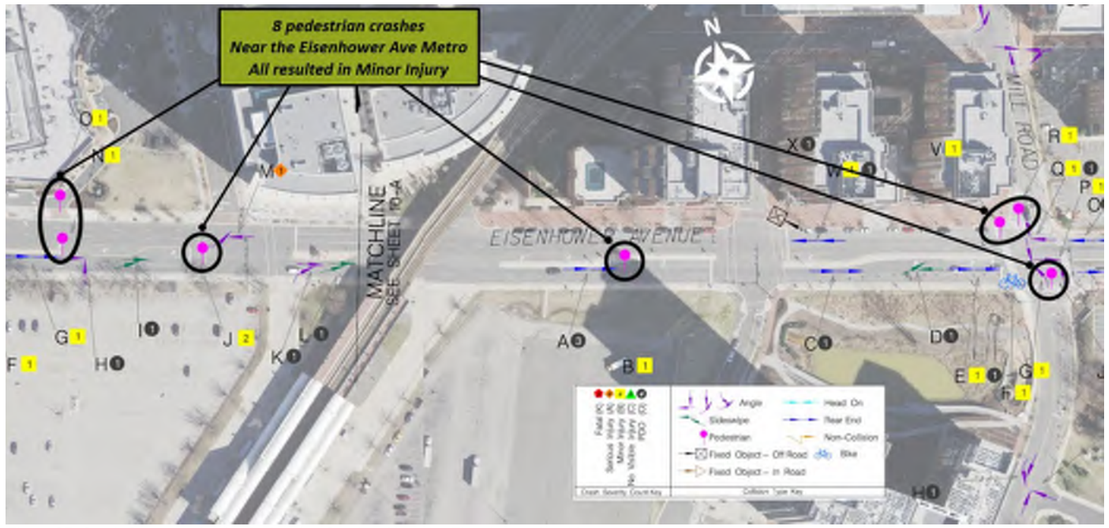


Figure 27. Crash Summary for the Pedestrian Crashes Near the Eisenhower Ave Metro

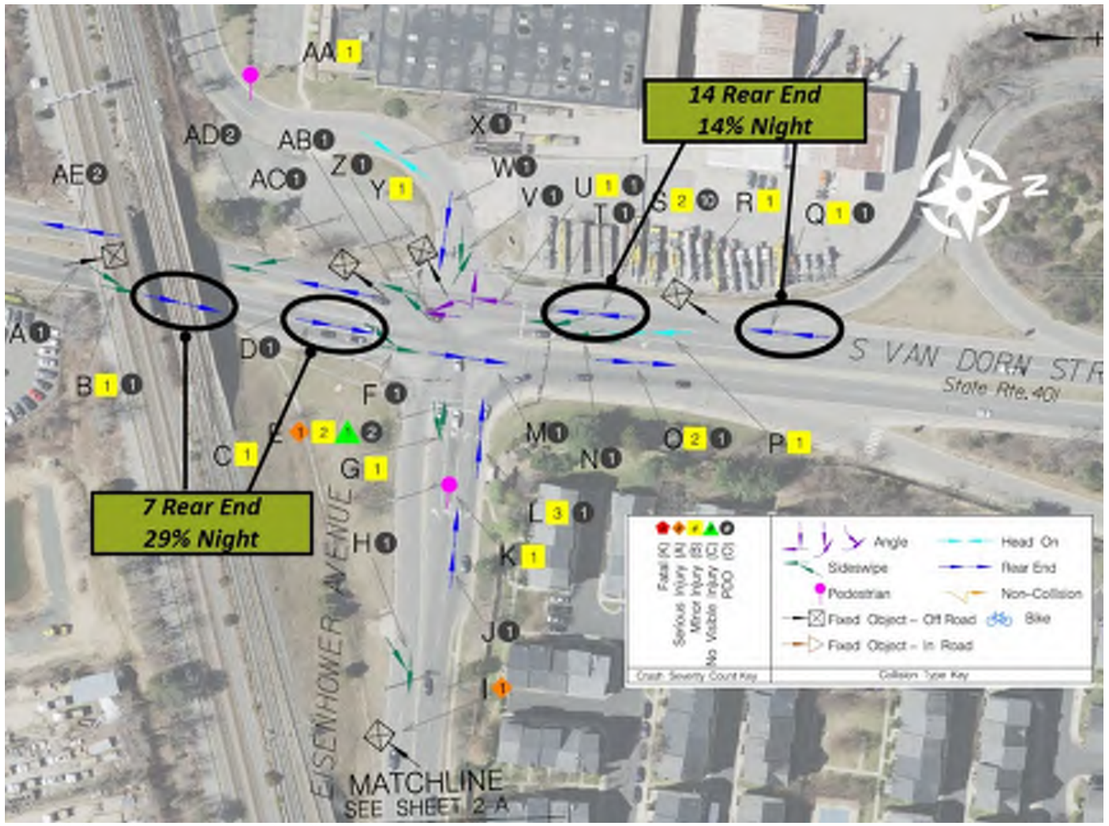


Figure 28. Crash Summary for S Van Dorn St and Eisenhower Ave

Safety and Reliability Needs and Diagnosis Summary:

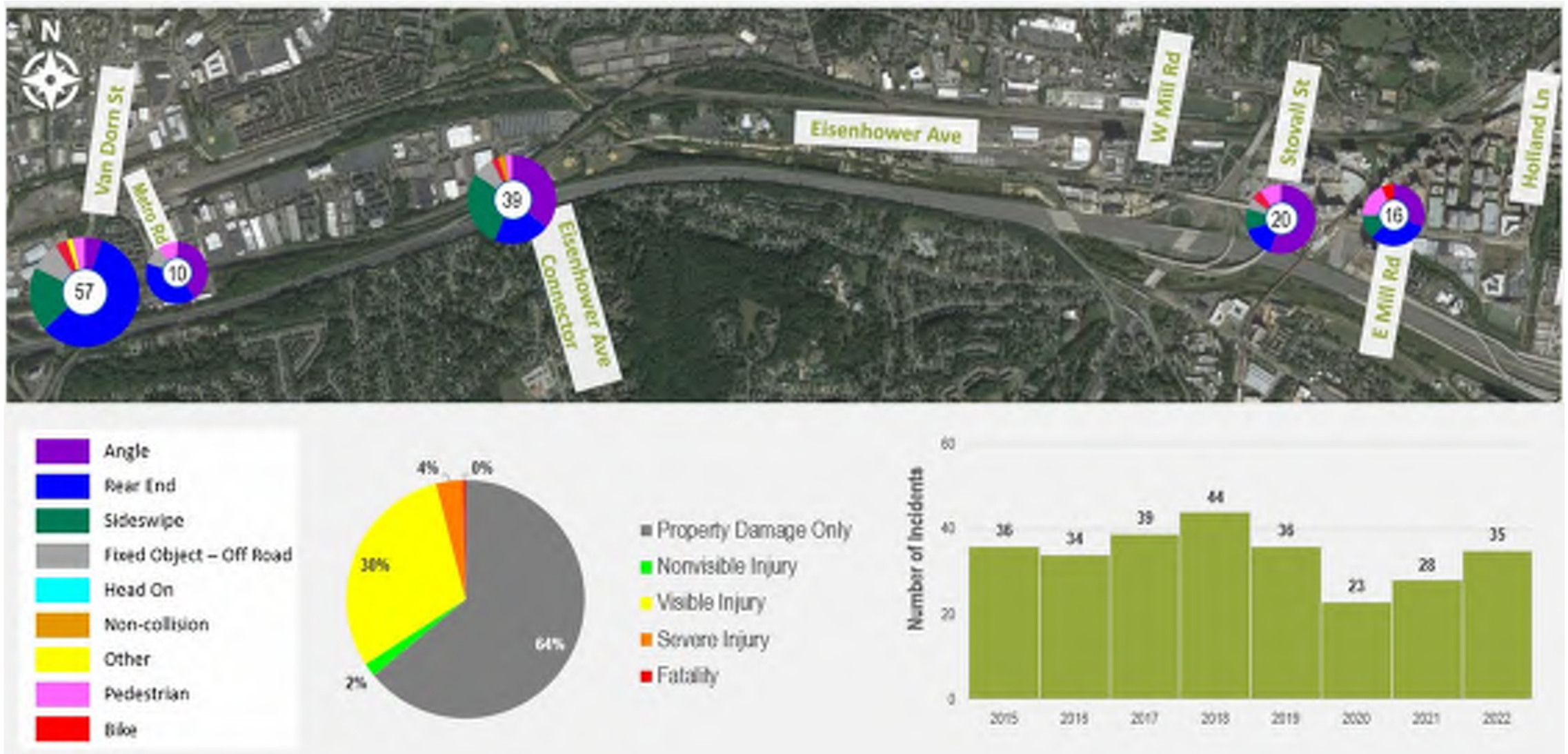


Figure 29. Safety and Reliability Needs and Diagnosis

Rail, Transit, and TDM:

The existing transit service involves a mix of modes including DASH bus, Metrobus, and Metrorail. The following are ridership numbers for March of this year:

- Van Dorn Metro Station 1,236 Average Weekday Entries
- Eisenhower Metro Station 881 Average Weekday Entries
- Metrobus Route 7A 1456 Average Weekday Entries
- DASH 30 72,600 Monthly Boardings
- DASH 32 11,600 Monthly Boardings
- DASH 35 135,700 Monthly Boardings

Phase 1 Corridor/Existing Conditions Public Outreach and Involvement

The Phase 1 Corridor/Existing Conditions Public Survey was active from August 29th through September 17th, 2023. The results from the survey are summarized below and the detailed results are in **Appendix B**.

Eisenhower Avenue from South Van Dorn Street to Holmes Run Trail

- The most prevalent travel uses for the study area were identified to be living/working in the area (49%), to access parks/trails (45%), and to access shops or restaurants (37%), as shown in **Figure 30**.
- The modes of travel identified by the survey respondents include, driving (81%), walking (43%), biking/scootering (36%), and metro rail (26%), as shown in **Figure 31**.
- The majority of respondents agree that people drive too fast (63%), there are no dedicated bicycle facilities (46%), and it is difficult to cross the street at unsignalized intersections (45%), as shown in **Figure 32**.

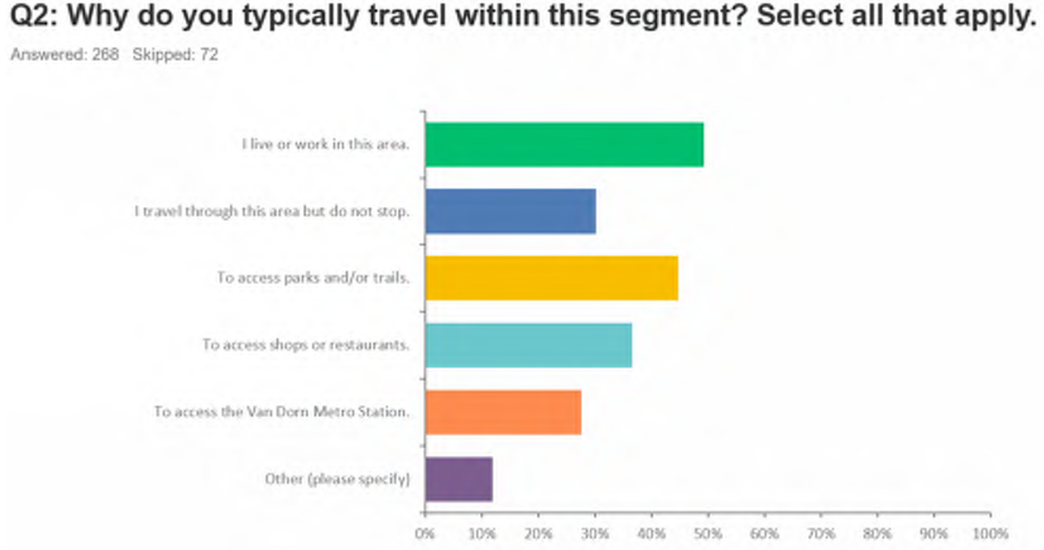


Figure 30. Public Survey Results for the Travel Uses of Eisenhower Avenue

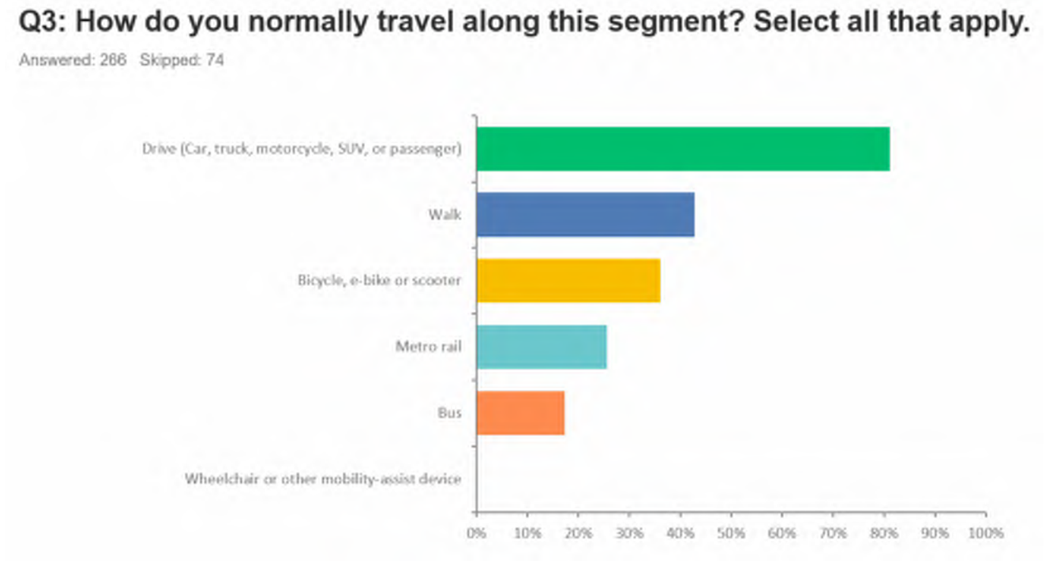


Figure 31. Public Survey Results for the Modes of Travel on Eisenhower Avenue

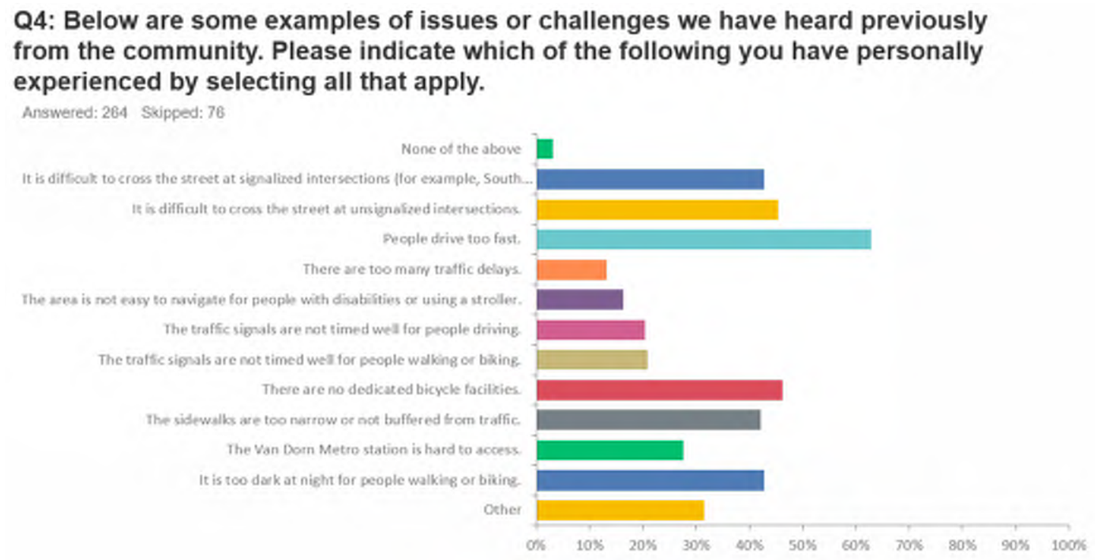


Figure 32. Public Survey Results for the Issues along Eisenhower Avenue

Eisenhower Avenue from Holmes Run Trail to Telegraph Road

- The most prevalent travel uses for the study area were identified to be to access parks/trails (68%), to travel through the area (45%), to access shops or restaurants (43%), and to living/working in the area (40%), as shown in **Figure 33**.
- The modes of travel identified by the survey respondents include, driving (53%), biking/scootering (30%), and walking (11%), as shown in **Figure 34**.
- The majority of respondents agree that people drive too fast (55%), there are no dedicated on-street bicycle facilities (38%), and it is difficult to cross the street at signalized intersections (35%), as shown in **Figure 35**.

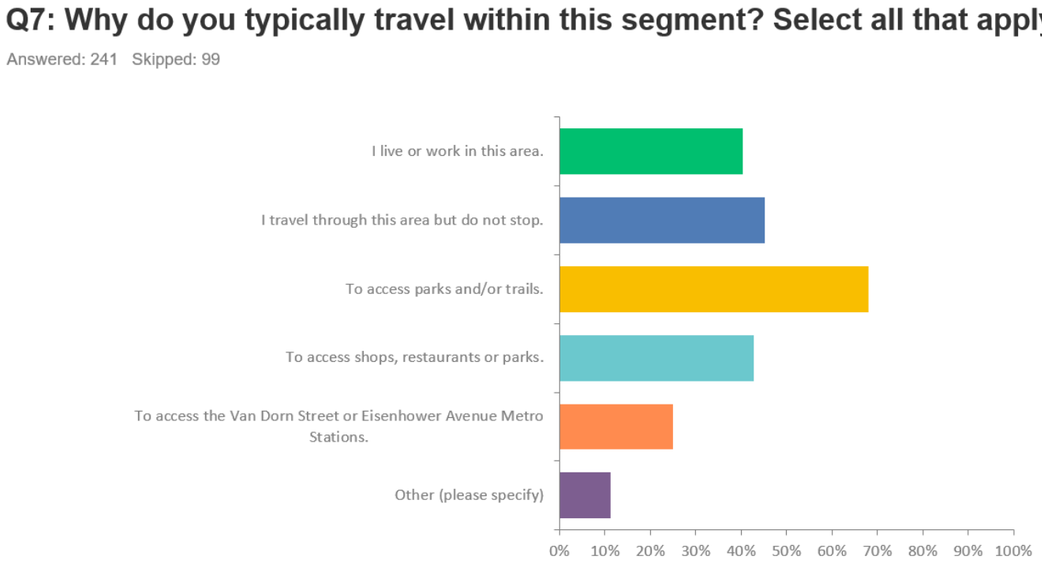


Figure 33. Public Survey Results for Travel Uses for Eisenhower Avenue

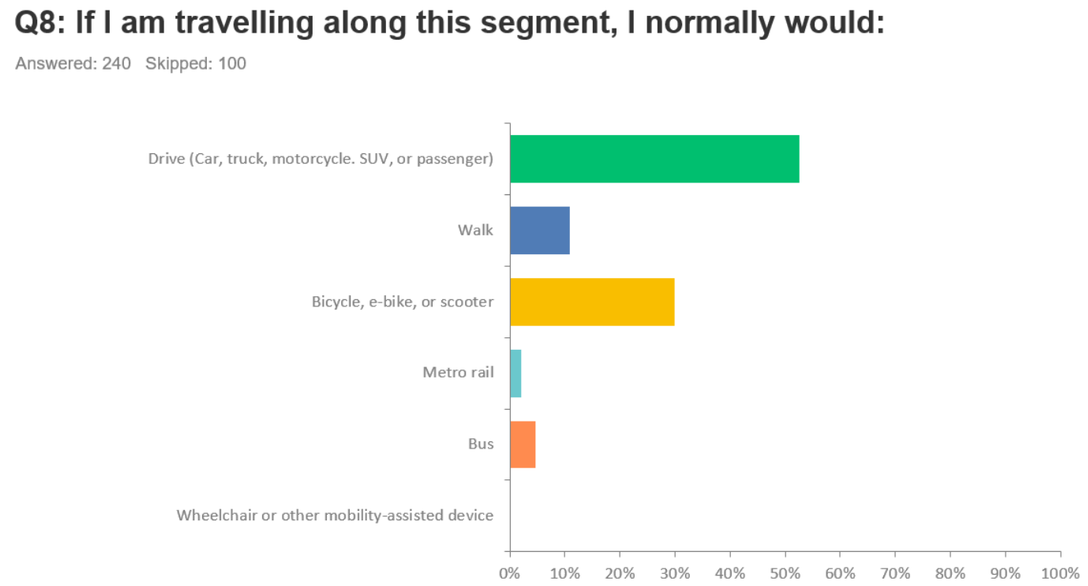


Figure 34. Public Survey Results for the Modes of Travel on Eisenhower Avenue

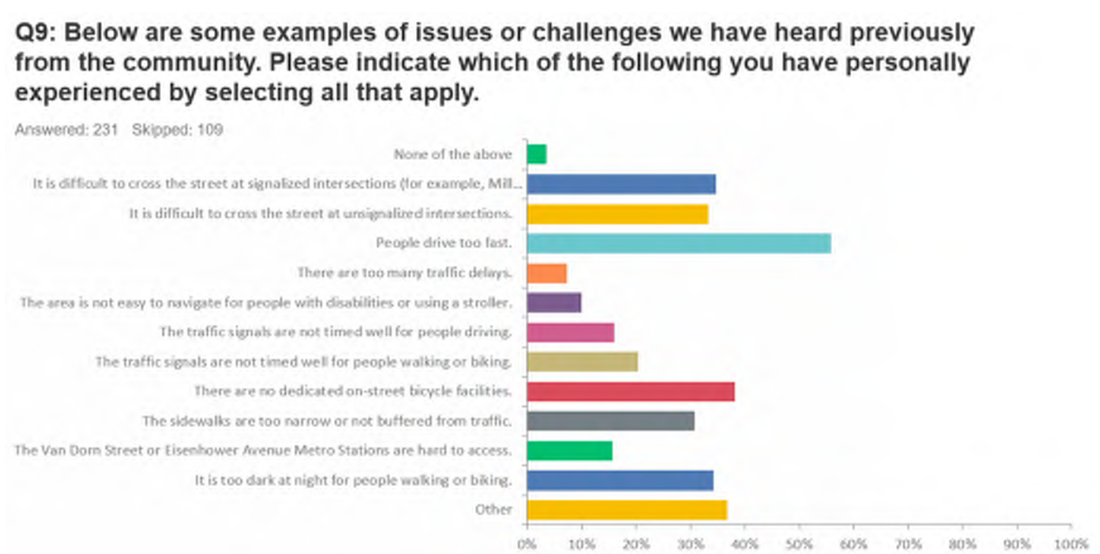


Figure 35. Public Survey Results for the Issues along Eisenhower Avenue

Eisenhower Avenue from Holmes Run Trail to Telegraph Road

- The most prevalent travel uses for the study area were identified to be to access shops or restaurants (72%), to access parks/trails (44%), living/working in the area (41%), to travel through the area (37%), and to access the Eisenhower Metro Station (36%), as shown in **Figure 36**.
- The modes of travel identified by the survey respondents include, driving (74%), walking (46%), biking/scootering (40%), and metro rail (22%), as shown in **Figure 37**.
- The majority of respondents agree that people drive too fast (49%), there are no bicycle facilities (44%), and it is difficult to cross the street at signalized intersections (40%), as shown in **Figure 38**.

Q12: Why do you typically travel within this segment? Select all that apply.

Answered: 270 Skipped: 70

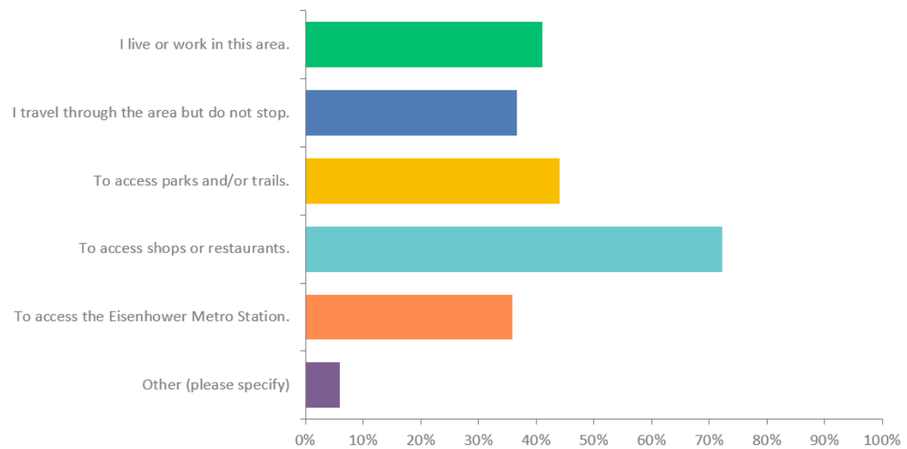


Figure 36. Public Survey Results for Travel Uses for Eisenhower Avenue

Q13: How do you normally travel along this segment? Select all that apply.

Answered: 270 Skipped: 70

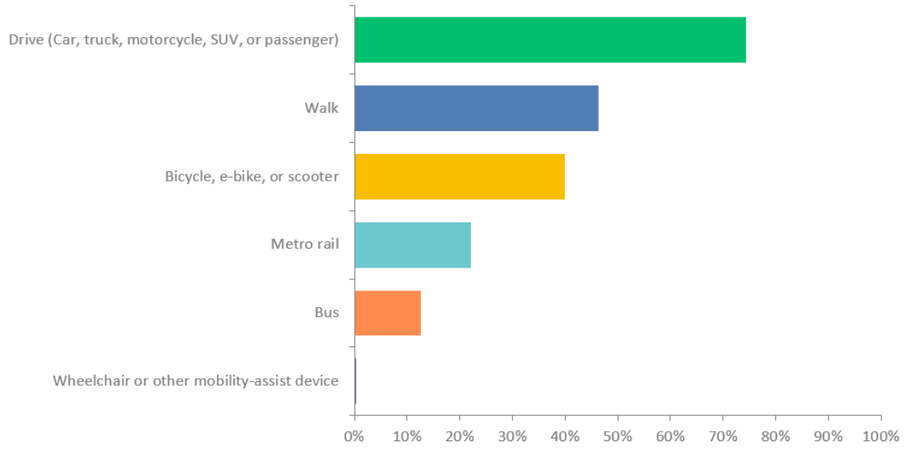


Figure 37. Public Survey Results for the Modes of Travel on Eisenhower Avenue

Q14: Below are some examples of issues or challenges we have heard previously from the community. Please indicate which of the following you have personally experienced by selecting all that apply.

Answered: 263 Skipped: 77

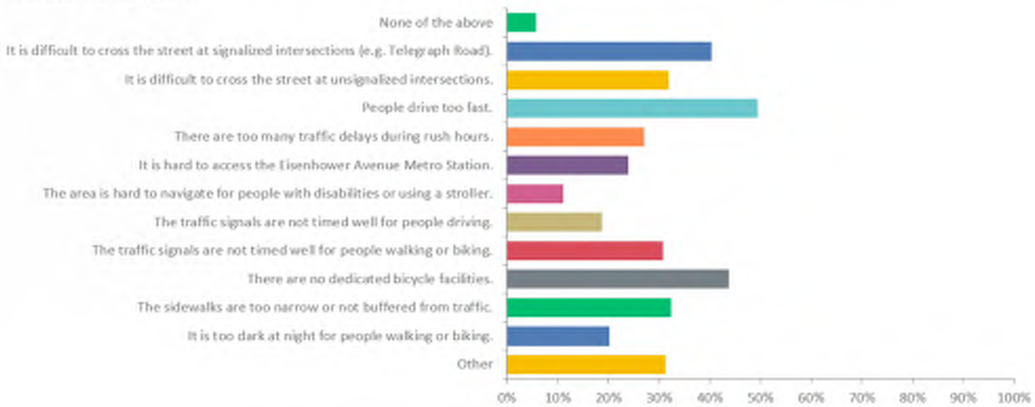


Figure 38. Public Survey Results for the Issues along Eisenhower Avenue

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 using the traffic analysis software Synchro 11 on potential alternative options at the study intersections along the corridor. The inputs and analysis methodologies are consistent with the VDOT TOSAM guidelines. For the purposes of alternative testing and screening, the AM and PM peak hour Synchro analyses were performed for future years 2035 and 2045. The analyses conducted are discussed in greater detail in the following section.

For the intersection of Eisenhower Avenue and Van Dorn Street and the intersection of Eisenhower and Metro Road, a VJuST analysis was completed prior to the Synchro analyses to consider alternative intersections and compare their potential operational and safety benefits to the conventional intersection. 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 Synchro analysis was performed at the Eisenhower Avenue and Van Dorn Street intersection and Eisenhower Avenue and Metro Road intersection for the 2035 and 2045 AM and PM peak hours.

Future Traffic Forecasting

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 2045 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 expected travel patterns. 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 travel demand forecast is a function of planned land use.

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 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. Although some of the methodologies and details presented in NCHRP-255 are not completely covered in NCHRP-765. In developing traffic forecast for this project, link refinement and development of turning movements the procedures and methodologies in NCHRP-255 were followed.

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 2045. The forecasts for 2035 were pivoted from the year 2045. There were no land use nor network inputs available for year 2035. Although a forecast for the year 2035 is provided, it was simply factored from the year 2045.

The model set used for this forecasting effort was the MWCOG/TPB Version 2.4.6 Travel Model with the Cooperative Land Use Round 9.2 the current CLRP as of August of 2023. The model set and input files were received directly from MWCOG/TPB. The model was run as provided, no changes were made to the input data or model parameters. Table 12 and Table 14 present the validation results for the highway assignment validation.

Table 12 and Table 14 show the results of the model run for the base year. The model set is calibrated and validated to the base year of 2017. The validation and calibration datasets were developed from the Regional Travel Survey (RTS) conducted in 2017/2018. Year 2023 was not used as the base year since this is a forecast year. In order to use year 2023 as the base year, it would require a validation of the whole model set and then the study area. That was not part of this study.

Table 12 shows the percent difference from the observed count data (2017 Traffic Data Publications1) 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. For these links in the study area, based on the percent deviation 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. The percent deviation is defined in NCHRP-255 as the absolute value of the difference between the base year count and the model simulation divided by the base year count. For all the links in the table, 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 8.6 percent.

Table 12. Percent Deviation for Links in the Study Area

Facility	Count	Model	% Deviation
Van Dorn Street north of I-95	41,000	45,089	10.0%
Connector/Clermont Ave.	16,000	14,410	9.9%
Telegraph Rd. south of I-95	34,000	32,768	3.6%
Eisenhower Ave. east of Telegraph Rd.	17,000	16,944	0.3%
Eisenhower Ave. west of Telegraph Rd.	11,000	11,211	1.9%

**%RMSE = 8.6% for all data*

As part of the validation effort and reasonableness checking, as well as developing growth factors for the traffic forecast along Eisenhower Avenue, three post-processing traffic refinement cutlines were developed across the entire study corridor. The cutlines were constructed as outlined in NCHRP-255 and are presented in **Appendix D**. Table 13 shows the percent deviation for each cutline. The cutlines were focused on Eisenhower Avenue and captured east-west travel along competing routes. The cutlines included all facilities between Duke Street to the north and Franconia Road/Huntington Avenue to the south. In developing guidance

Table 13. Cutline Percent Deviation

Cutline	Percent Deviation	Acceptable Deviation
1.0 East of Van Dorn St. (E-W)	2%	16%
2.0 East of Connector (E-W)	0%	17%
3.0 East of Telegraph Rd. (E-W)	13%	18%

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 approximately half of 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 3.0 exceeds acceptable deviation all other cutlines are within both the excepted NCHRP-255 criteria and VDOT criteria.

VDOT policy was to develop a growth factor based on the refined model output and apply that factor to the project collected count data. 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 on Eisenhower Avenue 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 0.89 was applied based on the same rate of growth for Eisenhower Avenue. Table 14 summarizes the percent growth for each approach link from the base year of 2023 to the year 2045 for the four intersections in the refined study area.

Table 14. Growth Factor from 2023 to 2045 by Intersection Approach Leg

Percent Increase from 2023 to 2045	Approach*			
Intersection	West	East	North	South
Eisenhower Ave. & Van Dorn St.	1.39	1.28	1.01	1.03
Eisenhower Ave. & Metro Rd.	1.28	1.27	1.20	
Eisenhower Ave. & Metro Station	1.27	1.31		1.25
Eisenhower Ave. & Connector	1.3	1.32	1.37	1.38

**Eisenhower Avenue runs east-west*

Table 15 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 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. The linear annual growth percent was calculated, it should be noted that this growth represents a constant number of vehicles being added each year. This differs from a growth rate where the percent is constant, and the number of additional vehicles increases each year. The linear annual growth percent is not a rate since depending on the year the percentage changes while the number of additional vehicles is constant.

Table 15. 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
Van Dorn Street north of I-95	47,000	41,000	45,089	46,586	42,497	42,361	42,400	0.12%	-1.0%	0.12%
Connector/Clermont Ave.	16,000	16,000	14,410	19,944	21,534	22,145	21,800	1.11%	3.1%	1.29%
Telegraph Rd. south of I-95	30,000	34,000	32,768	41,349	42,581	42,904	42,700	0.82%	3.6%	0.91%
Eisenhower Ave. east of Telegraph Rd.	14,000	17,000	16,944	20,324	20,380	20,391	20,400	0.65%	3.8%	0.71%
Eisenhower Ave. west of Telegraph Rd.	9,100	11,000	11,211	15,072	14,861	14,788	14,800	1.07%	5.0%	1.23%

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 along Eisenhower Avenue. These adjustments were minor, and a result of the future volumes being rounded to the nearest 25. Growth along Eisenhower Avenue was highest at the western end. Although traffic turning movement forecast were not developed for the eastern end of the corridor, a cutline was developed for validation and reasonableness checking. The average growth factor over 28 years for the refined study area was 1.26, while the highest factor applied was 1.3 at the western end of the corridor. The morning and evening weekday turning movement traffic volumes are provided for the base year 2023, mid-term year 2035, and year 2045 in **Appendix E.**

VJuST Analysis

In order to address operational and capacity needs, a VJuST analysis was completed for the two subject intersections to consider alternative intersection designs and evaluate their potential benefits. VJuST analysis does not consider the influence of adjacent intersections on traffic patterns. Therefore, it was conducted for screening purposes only with detailed analyses performed using Synchro. VJuST analysis was performed for the intersection of Eisenhower Avenue and Van Dorn Street and the intersection of Eisenhower and Metro Road. 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. The VJuST analysis summaries are attached in **Appendix F.**

Traffic Operation Analysis Results (No-Build)

To identify operational and accessibility needs along the study corridor, initial Synchro analysis results were reviewed for the future years 2035 and 2045 for the No-Build condition. The full Synchro analysis results are attached in **Appendix H.**

2035 NO-BUILD

The following movements that operate at a LOS E or worse for 2035 are summarized below:
Eisenhower Avenue at Van Dorn Street

- The EB approach operates at LOS F during the AM and PM peaks.
- The WB approach operates at LOS F during the AM and PM peaks.
- The NB left turn movement operates at LOS F during the AM and PM peaks.
- The NB thru movement operates at LOS E during the AM and PM peaks.
- The SB left turn movement operates at LOS F during the AM and PM peaks.

Overall, the intersection operates at LOS F for the AM peak and E for the PM peak for 2035.
Eisenhower Avenue at Metro Road
Overall, the intersection operates at LOS B for the AM and PM peaks for 2035.

2045 NO-BUILD

The following movements that operate at a LOS E or worse for 2045 are summarized below:
Eisenhower Avenue at Van Dorn Street

- The EB approach operates at LOS F during the AM peak.
- The WB approach operates at LOS F during the AM peak.
- The WB left turn movement operates at LOS F during the PM peak.
- The WB thru movement operates at LOS E during the PM peak.
- The WB right turn movement operates at LOS E for the PM peak.

- The NB left turn movement operates at LOS F during the AM and PM peaks.
- The NB thru movement operates at LOS E during the AM and PM peaks.
- The SB left turn movement operates at LOS F during the AM and PM peaks.
- The WB approach operates at LOS F during the AM and PM peaks.

Overall, the intersection operates at LOS F for the AM peak and LOS E for the PM peak for 2045.
Eisenhower Avenue at Metro Road
Overall, the intersection operates at LOS B for the AM and PM peaks for 2045.

Preferred Alternative

The Preferred Alternative was developed for the study area based on the VTrans Mid-Term Needs mentioned in Chapter 1.
The proposed improvements on Eisenhower Avenue between Van Dorn Street and Metro Road include:

- A new sidewalk along the south side of Eisenhower Avenue
- Conversion of the sidewalk to a two-way separated bike path on the north side of Eisenhower Avenue
- Reduction of conflict by shifting left turns from Van Dorn Street and Eisenhower Avenue to the interchange ramps on Metro Road
- Addition of an improved bus shelter

The separated two-way bike path on the north side of Eisenhower Ave would provide a route for bikes without conflicting with pedestrians, and the sidewalk on the south side would provide connections to public transit by providing ADA compliant access along a desire path through grass The proposed two-way bike path and sidewalk are aimed to address the VTrans identified needs for bicycle/pedestrian access, transit access, and transportation demand management.

The relocation of the southbound and eastbound left turning movements at the intersection of Eisenhower Avenue and Van Dorn Street aims to reduce the number of crashes at the intersection by reducing the number of conflict points for turning vehicles. The proposal to add a two-way bicycle path and sidewalk along with the reduction of the eastbound lane from two lanes to one lane will reduce speeding on Eisenhower Avenue.

The proposed improvement for the preferred alternative is shown in **Figure 39**. The proposed cross sections for the WB Approach on Van Dorn Street and Metro Road are shown in **Figure 40.**

Figure 39: Preferred Alternative Concept Level Sketch

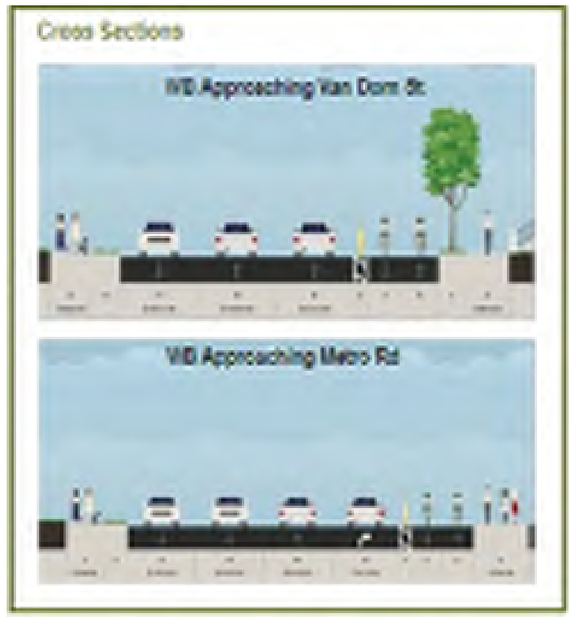


Figure 40: Preferred Alternative Cross-Section

Other Considered Alternatives

The second alternative considered for Eisenhower Avenue between Van Dorn Street and Metro Road proposes the same improvements on the south side of Eisenhower Avenue and the shifting of left turns from Van Dorn Street and Eisenhower Avenue. The second alternative proposed a shared-use path instead of a two-way bike path on the north side of Eisenhower Avenue.
The improvements proposed at this location include:

- New sidewalk on southside of Eisenhower Avenue
- Conversion of the sidewalk to a shared-use path on the north side of Eisenhower Avenue
- Reduction of conflict by shifting left turns from Van Dorn St and Eisenhower Ave to the interchange ramps on Metro Road
- Addition of an improved bus shelter

The proposed improvement for the other considered alternative is shown in **Figure 41**. The proposed cross sections for the WB Approach on Van Dorn Street and Metro Road for this alternative is shown in **Figure 42**.

Figure 41: Share-Use Path Alternative Concept Level Sketch

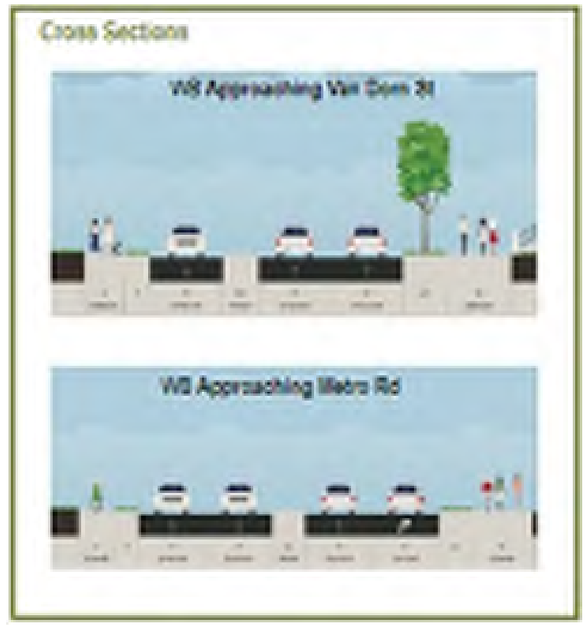


Figure 42: Share-Use Path Alternative Cross-Section

Traffic Operation Analysis Results (Build)
Synchro analysis results were reviewed for the future years 2035 and 2045 for the Build condition incorporating the proposed improvements as detailed in the preferred alternative.
Overall, the proposed improvements as the Build scenario reduces the vehicle delay when compared to the No-Build scenario. For the intersection of Eisenhower Avenue and Van Dorn Street the delay is decreased by the following seconds per vehicle:

- 2035 AM: 46.6 (LOS F to C)
- 2035 PM: 27.8 (LOS E to D)
- 2045 AM: 52.5 (LOS F to D)
- 2045 PM: 32.4 (LOS E to D)

2035 BUILD
The following movements that operate at a LOS E or worse for 2035 are summarized below:
Eisenhower Avenue at Van Dorn Street

- The WB thru movement operates at LOS E for the PM peak.
- The NB left turn movement operates at LOS F during the PM peak.

Overall, the intersection operates at LOS D for the A and PM peak for 2035.

Eisenhower Avenue at Metro Road

- The SB approach operates at LOS E for the PM peak.

2045 BUILD
The following movements that operate at a LOS E or worse for 2045 are summarized below:

Eisenhower Avenue at Van Dorn Street

- The EB approach operates at LOS E during the AM peak.
- The WB thru movement operates at LOS E during the PM peak.
- The NB left turn movement operates at LOS E during the AM peak and LOS F during the PM peak.

Overall, the intersection operates at LOS D for the AM and PM peaks for 2045.

Eisenhower Avenue at Metro Road

- The WB thru movement operates at LOS E for the AM and PM peaks.

Overall, the intersection operates at LOS C for the AM peak and LOS D and PM peak for 2045.

The following table presents the Synchro output results for 2035 and 2045 years for the AM Peak and PM Peak for the intersection of Eisenhower Avenue and Van Dorn Street and the intersection of Eisenhower Avenue and Metro Road. The full Synchro output results are attached in **Appendix H.**

Intersection		Movement		Storage	AM - Existing		PM - Existing		AM 2035 No-Build		PM 2035 No-Build		AM 2045 No-Build		PM - 2045 No-Build		AM - 2035 Build		PM - 2035 Build		AM - 2045 Build		PM - 2045 Build	
				(ft)	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
1	Eisenhower Ave at Van Dorn St	EB	LTR	-	85.5	F	70.6	E	135.6	F	118.7	F	151.9	F	126.6	F	49.8	D	50.2	D	56.3	E	52.8	D
			R	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		EB Overall		-	**85.5**	F	**70.6**	E	**135.6**	F	**118.7**	F	**151.9**	F	**126.6**	F	**49.8**	D	**50.2**	D	**56.3**	E	**52.8**	D
		WB	L	150	160.8	F	108.9	F	104.6	F	65.6	E	128.2	F	68.1	E	-	-	-	-	-	-	-	-
			LT	-	172.1	F	121.7	F	114.4	F	123.6	F	142.3	F	121.4	F	46.0	D	65.4	E	53.2	D	70.8	E
			R	175	112.9	F	73.2	E	124.9	F	47.5	D	164.1	F	51.2	D	42.7	D	39.8	D	53.7	D	46.3	D
		WB Overall		-	**126.1**	F	**85.3**	F	**120.4**	F	**66.3**	E	**155.2**	F	**67.6**	E	**42.9**	D	**42.7**	D	**53.7**	D	**48.8**	D
		NB	L	145	73.1	E	56.9	E	116.1	F	145.0	F	116.1	F	164.3	F	46.3	D	78.1	F	60.2	E	88.0	F
			T	-	51.5	D	22.5	C	73.6	E	59.5	E	72.5	E	70.7	E	33.9	C	33.9	C	45.7	D	36.6	D
			R	115	30.6	C	18.3	B	36.2	D	44.5	D	37.4	D	55.4	E	23.8	C	29.7	C	29.7	C	33.7	C
		NB Overall		-	**49.8**	D	**22.3**	C	**69.9**	E	**57.8**	E	**69.4**	E	**68.7**	E	**33.0**	C	**34.0**	C	**43.8**	D	**37.1**	D
		SB	L	395	104.8	F	796.6	F	121.8	F	89.4	F	133.0	F	103.9	F	-	-	-	-	-	-	-	-
			T	-	43.9	D	62.8	E	46.1	D	51.6	D	47.0	D	58.2	E	32.4	C	31.9	C	26.0	C	32.6	C
			R	240	26.3	C	19.7	B	25.7	C	17.5	B	26.0	C	19.3	B	15.0	B	9.3	A	13.2	B	9.0	A
		SB Overall		-	**51.1**	D	**190.1**	F	**56.4**	E	**58.1**	E	**58.9**	E	**66.5**	E	**31.0**	C	**31.5**	C	**24.9**	C	**32.2**	C
		Int Overall		-	**69.2**	E	**112.6**	F	**81.8**	F	**63.1**	E	**93.3**	F	**70.6**	E	**35.3**	D	**35.5**	D	**40.1**	D	**38.2**	D
2	Eisenhower Ave at Metro Rd	EB		-	11.3	B	9.1	A	19.1	B	16.9	B	20.9	C	18.9	B	-	-	-	-	-	-	-	-
			LT	-	8.9	A	6.6	A	10.9	B	13.2	B	10.9	B	12.5	B	18.9	B	21.2	C	22.9	C	40.2	D
		EB Overall		-	**9.1**	A	**6.6**	A	**11.9**	B	**13.5**	B	**12.1**	B	**13.1**	B	**18.9**	B	**21.2**	C	**22.9**	C	**40.2**	D
		WB	TR	-	8.3	A	8.9	A	17.1	B	16.7	B	20.2	C	16.5	B	14.7	B	15.3	B	16.2	B	20.0	C
				-	3.8	A	5.0	A	9.3	A	9.4	A	9.3	A	8.7	A	-	-	-	-	-	-	-	-
		WB Overall		-	**7.9**	A	**8.7**	A	**16.2**	B	**16.4**	B	**19.0**	B	**16.3**	B	**14.7**	B	**15.3**	B	**16.2**	B	**20.0**	C
		SB	LR	-	30.7	C	28.4	C	21.1	C	20.2	C	21.5	C	26.2	C	47.0	D	60.9	E	56.8	E	58.5	E
		SB Overall		-	**30.7**	C	**28.4**	C	**21.1**	C	**20.2**	C	**21.5**	C	**26.2**	C	**47.0**	D	**60.9**	E	**56.8**	E	**58.5**	E
		Int Overall		-	**10.9**	B	**11.1**	B	**16.5**	B	**16.1**	B	**17.5**	B	**17.0**	B	**22.6**	C	**31.4**	C	**28.4**	C	**36.6**	D

Table 16: Synchro Analysis Results Summary

Alternative Summary

EISENHOWER AVENUE FROM VAN DORN STREET TO METRO ROAD

Separated Bike Path Alternative

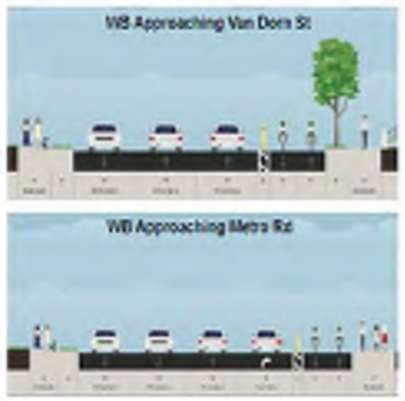
Improvements Description

The improvements proposed at this location include:

- New sidewalk on south side
- Two-way separated bike path on north side
- Reduction of conflict by shifting left turns from Van Dorn St and Eisenhower Ave to the interchange ramps on Metro Rd

These improvements are expected to provide increased safety for pedestrians, reduce conflicts between turning vehicles, and reduce speeding along the corridor. The separated two-way bike path on the north side of Eisenhower Ave would provide a route for bikes without conflicting with pedestrians, and the sidewalk on the south side would provide connections to public transit by providing ADA compliant access along a desire path through grass.

Cross Sections



Project Location

Traffic Operations Results

Eisenhower Ave at Van Dorn St
(Delay per Vehicle in Seconds)

	AM Peak	PM Peak
No-Build (2035)	81.8	85.1
Build (2035)	35.3	35.5
No-Build (2045)	80.3	70.6
Build (2045)	40.1	38.2

Project Schedule & Updated Preliminary Cost

Project schedules and cost estimates were developed based on information available at the time of study and should be reassessed prior to submitting funding applications.

Phase	Cost Estimate (2024 Dollars)
Preliminary Engineering	$2,300,000
Construction	$12,800,000
Total Cost	$14,500,000

PROJECT PIPELINE | NV-23-07 | EISENHOWER AVENUE CORRIDOR | DRPT VDOT

EISENHOWER AVENUE FROM VAN DORN STREET TO METRO ROAD

Share Use Path Alternative

Improvements Description

The improvements proposed at this location include:

- New sidewalk along south side
- Convert sidewalk on north side to shared use path
- Reduction of conflict by shifting left turns from Van Dorn St and Eisenhower Ave to the interchange ramps on Metro Rd

These improvements are expected to provide increased safety for pedestrians, reduce conflicts between turning vehicles, and reduce speeding along the corridor. The shared use path on the north side of Eisenhower Ave would provide a separated facility for bikes, and the sidewalk on the south side would provide connections to public transit by providing ADA compliant access along a desire path through grass.

Cross Sections

Project Location

Traffic Operations Results

Eisenhower Ave at Van Dorn St (Delay per Vehicle in Seconds)

	AM Peak	PM Peak
No-Build (2035)	61.6	63.1
Build (2035)	35.3	35.5
No-Build (2045)	69.3	70.6
Build (2045)	40.1	38.2

Anticipated Schedule & Preliminary Cost

Project schedules and cost estimates were developed based on information available at the time of study and should be reassessed prior to submitting funding applications.

Phase	Cost Estimate (2024 Dollars)
Preliminary Engineering	$2,000,000
Construction	$12,500,000
Total Cost	$14,500,000

PROJECT PIPELINE NV-23-07 | EISENHOWER AVENUE CORRIDOR DRPT VDOT

Transportation Demand Management and Transit Accessibility Potential Solutions

The proposal to improve the Eisenhower Avenue and Van Dorn Street bus shelter (located on the south side of Eisenhower Avenue) is intended to address the VTrans needs for transit access and transportation demand management. Currently, the bus stop does not provide shelter as shown in the Google Maps street-view image (below) and confirmed via site visits.

Figure 43: Eisenhower Ave and Van Dorn Street Bus Stop

The proposed bus shelter is intended to be built as shown below.

Figure 44: WH King St. & Bradlee Shopping Center Bus Shelter

The City of Alexandria is served by three major transit providers:

- DASH: Provides local bus service within the City of Alexandria.
- WMATA: Provide services within city boundaries.
    - 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.

Additionally, the Fairfax Connector system serves a number of communities through Fairfax County.

DASH Routes 30, 32, and 35 serve Eisenhower Avenue as shown in **Figure 45** below:

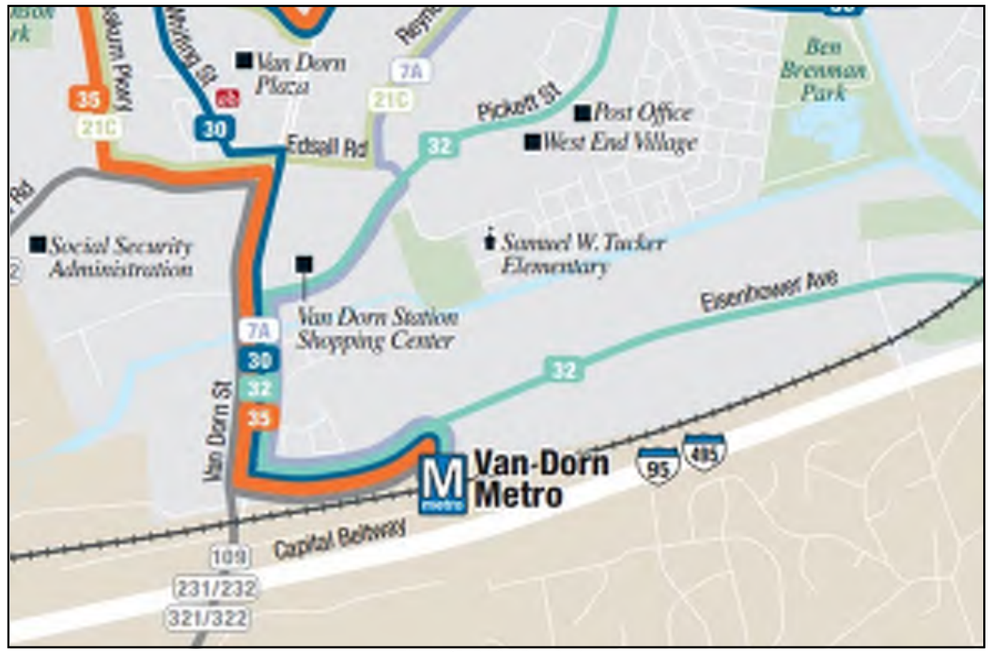


Figure 45: DASH Bus Routes

Metrobus Route 7A (Landmark-North Fairlington Line) serves segments of Eisenhower Avenue and includes stops at the Van Dorn St. Metrorail Station, South Reynolds & Duke Street, North Van Dorn St. & Rickenbacher Ave., and Kenmore Ave & Seminary Rd. **Figure 46** below shows the routes for 7A.

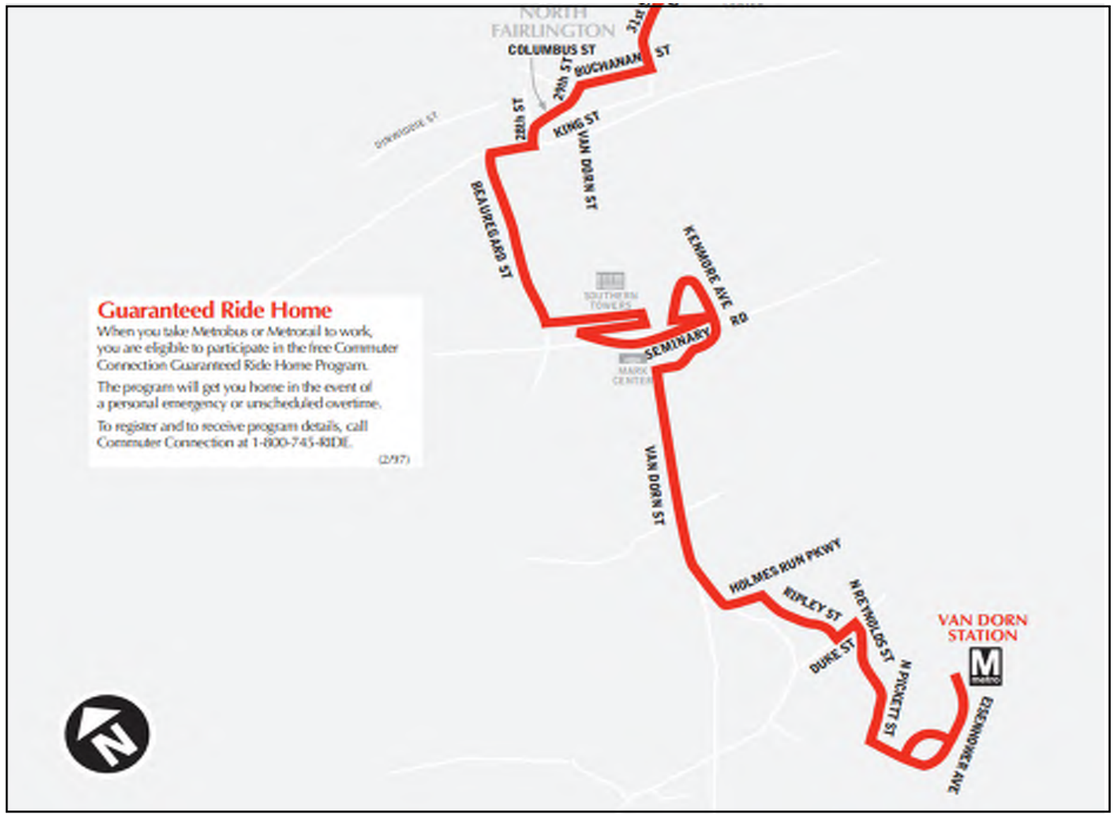


Figure 46: Metrobus Route 7A

Additionally, the Van Dorn St. Metrorail Station is located on Eisenhower Avenue and is part of the Blue Line.

The Fairfax Connector system Kingstowne Circulator Routes 231 and 232 services segments of Van Dorn Street, Kingstowne Village Parkway, and Franconia-Springfield Parkway. It includes stops at the Van Dorn St. Metro Station and the Franconia-Springfield Metro and VRE Station. **Figure 47** shows the routes.

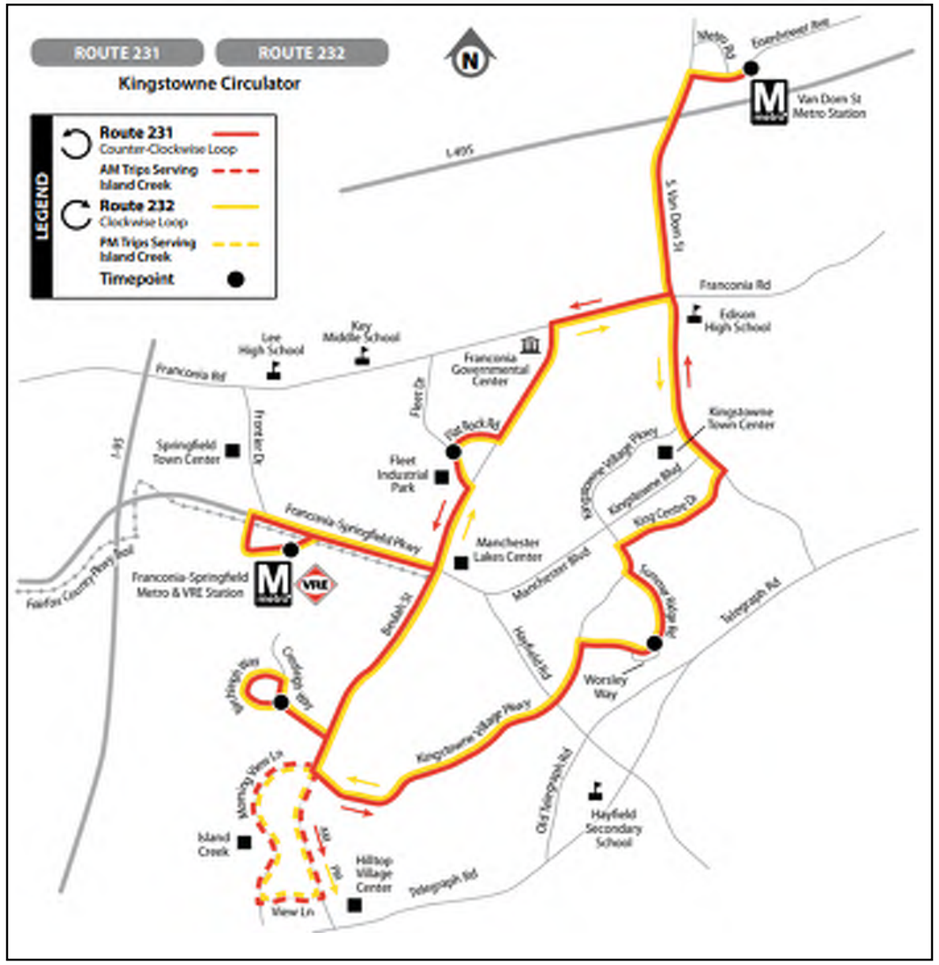


Figure 47: Fairfax Connector Route 231-232

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 18 days spanning from April 22, 2024, to May 10, 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 five sections, which include the following:

1. Project Background
2. Study Location
3. Existing Conditions
4. Proposed Alternatives
5. Proposed Improvements
6. Demographic Information

The first section provides an overview of the project initiative and the prioritized VTRANS needs. The second section details the study location as shown in **Figure 48**.

Figure 48: Study Location

The third section discusses the existing conditions at the project location. The fourth and fifth section discusses the proposed alternatives and improvements as shown in **Figure 49** and **Figure 50**. 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.

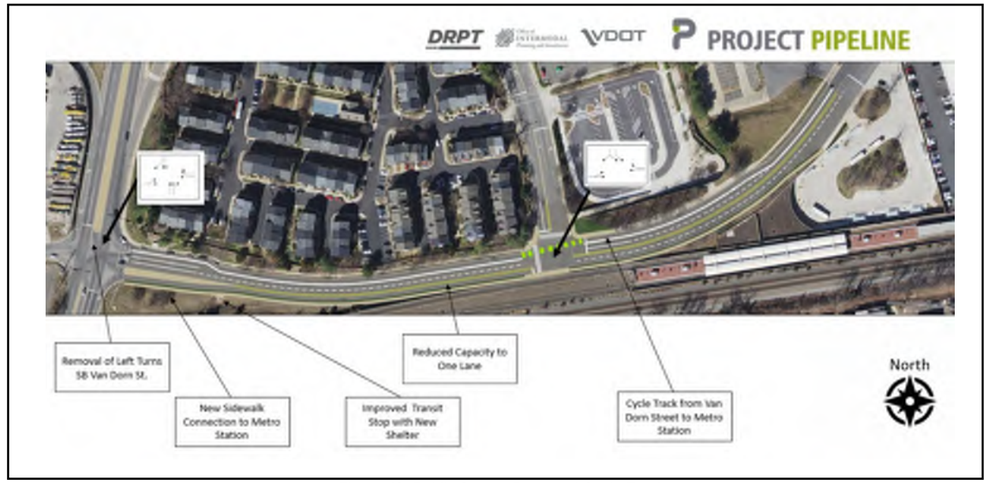


Figure 49: Public Survey Proposed Cycle Track

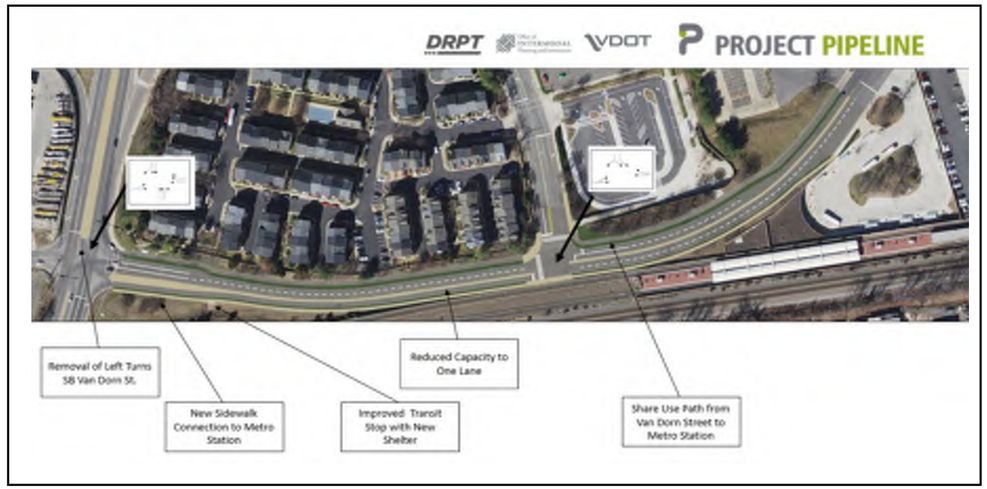


Figure 50: Public Survey Proposed Share-Use Path

Survey Questions and Results

The survey had a total of 439 unique participants. The survey asked the participants how strongly they support each proposed alternative on a scale of 1 to 5. The results are shown below:

1. Relocation of the left turns at the intersection of Van Dorn Street and Eisenhower Avenue for the southbound and westbound approaches

	1. Strongly oppose	2. Somewhat oppose	3. Neutral	4. Somewhat support	5. Strongly support
Rate the concept on a scale of 1 to 5.	14%	7%	13%	25%	41%

2. Construction of a sidewalk on the south side of Eisenhower Avenue

Provision of a direct pedestrian connection to the Metro station
Reduction of capacity and re-utilization of one lane on eastbound Eisenhower Avenue between Van Dorn Street and Metro 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.	14%	6%	7%	17%	55%

3. Improvements to the bus stop on the south side of Eisenhower Avenue between Metro Road and Van Dorn Street

	1. Strongly oppose	2. Somewhat oppose	3. Neutral	4. Somewhat support	5. Strongly support
Rate the concept on a scale of 1 to 5.	9%	3%	24%	19%	45%

4. Construction of a two-way cycle track along the north side of Eisenhower Avenue from Van Dorn Street to the Metro station

	1. Strongly oppose	2. Somewhat oppose	3. Neutral	4. Somewhat support	5. Strongly support
Rate the concept on a scale of 1 to 5.	18%	7%	12%	16%	46%

5. Potential future traffic improvement

Reduction in capacity (i.e., Road Diet) for Eisenhower Avenue from Clermont Avenue to the Van Dorn Metro Station

Option 1: Two travel lanes (one in each direction) with a center turn lane	69%
Option 2: Four travel lanes with no center turn lane	57%
Option 3: Two travel lanes westbound (peak direction), one eastbound travel lane, and a center turn lane	68%
Option 4: No Build	66%

6. Do you think the City of Alexandria should consider continuing the north side bicycle facility on Eisenhower Avenue from Holmes Run Trail to Mill Road (West)?

Yes	76%
No	24%

The full survey results are attached in **Appendix I.**