Virginia Department of Transportation

Pedestrian Safety Action Plan

May 2018

Acknowledgments

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The following VDOT staff and local stakeholders also dedicated many hours to consideration of the inputs and development of the plan:

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- **Robert Gey,** City of Virginia Beach
- **Robert Hofrichter,** VDOT Office of Land Use
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- **Karen King,** FHWA Virginia Division Office
- **Mena Lockwood,** VDOT Traffic Engineering Division
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- **Shane Sawyer,** VDOT Transportation and Mobility Planning
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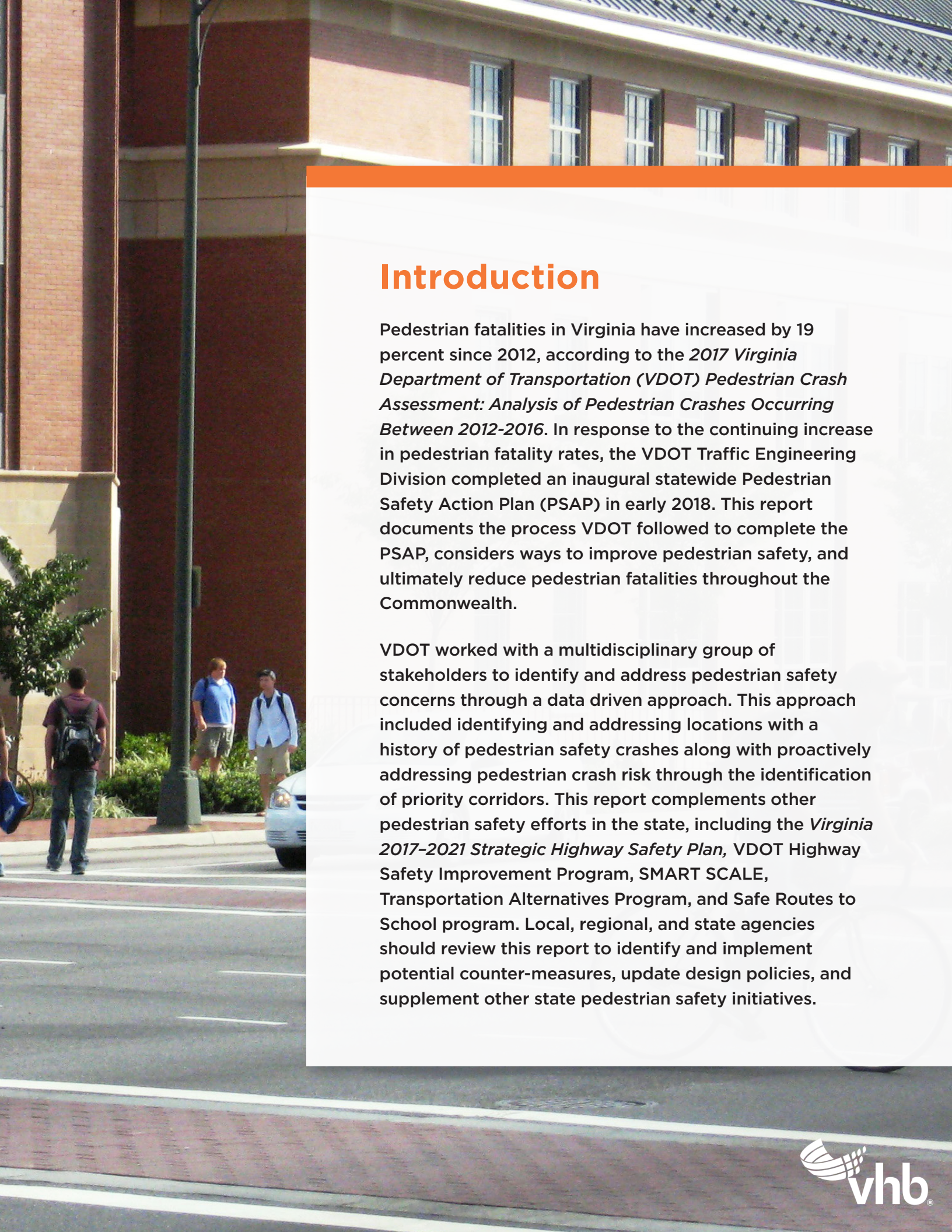
The project team would like to thank those outside the steering group who also contributed to this plan.

Photos by VHB unless otherwise noted.



Introduction

Pedestrian fatalities in Virginia have increased by 19 percent since 2012, according to the *2017 Virginia Department of Transportation (VDOT) Pedestrian Crash Assessment: Analysis of Pedestrian Crashes Occurring Between 2012-2016*. In response to the continuing increase in pedestrian fatality rates, the VDOT Traffic Engineering Division completed an inaugural statewide Pedestrian Safety Action Plan (PSAP) in early 2018. This report documents the process VDOT followed to complete the PSAP, considers ways to improve pedestrian safety, and ultimately reduce pedestrian fatalities throughout the Commonwealth.

VDOT worked with a multidisciplinary group of stakeholders to identify and address pedestrian safety concerns through a data driven approach. This approach included identifying and addressing locations with a history of pedestrian safety crashes along with proactively addressing pedestrian crash risk through the identification of priority corridors. This report complements other pedestrian safety efforts in the state, including the *Virginia 2017–2021 Strategic Highway Safety Plan,* VDOT Highway Safety Improvement Program, SMART SCALE, Transportation Alternatives Program, and Safe Routes to School program. Local, regional, and state agencies should review this report to identify and implement potential counter-measures, update design policies, and supplement other state pedestrian safety initiatives.

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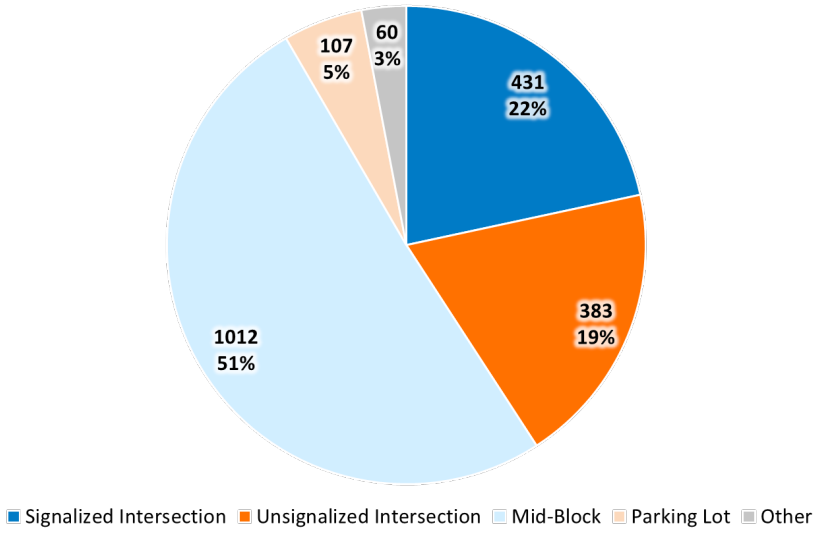
Executive Summary

According to the analysis of pedestrian crashes from 2012 to 2016 in the *2017 Virginia Department of Transportation (VDOT) Pedestrian Crash Assessment*, 51 percent of Virginia's pedestrian injury crashes were located at mid-block locations. Most of Virginia's pedestrian fatal crashes also occurred at unmarked or uncontrolled crossing locations, pointing to the need for improved crossing accommodations.

Pedestrian Injury Crashes by Crossing Type



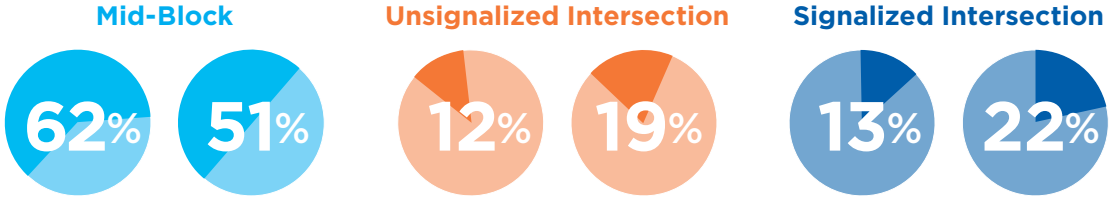
Source: *2017 VDOT Pedestrian Crash Assessment: Analysis of Pedestrian Crashes Occurring Between 2012-2016*

51%
of pedestrian injury crashes occurred at mid-block crossing locations

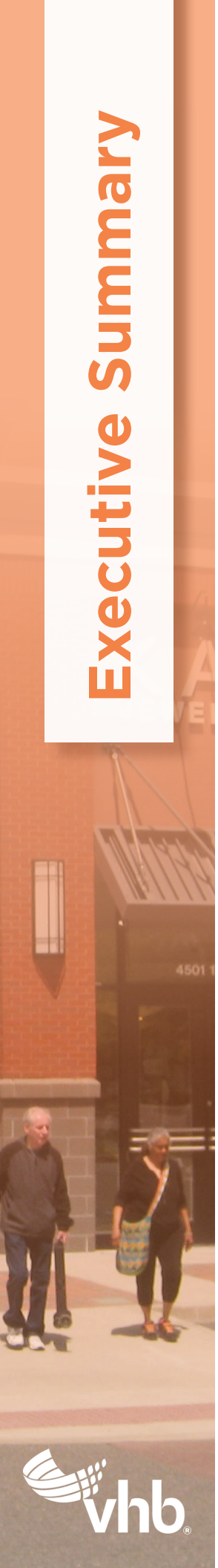
74%
of pedestrian injury crashes occurred at locations without a marked crosswalk

86%
of pedestrian fatal crashes occurred at locations without a marked crosswalk

Location of Fatal versus Injury Crashes



Executive Summary



VDOT Pedestrian Safety Action Plan (PSAP) Process

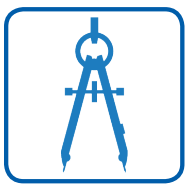
The PSAP process began with an inventory of VDOT policies and pedestrian crash conditions. The team then developed a method for evaluating exposure or risk to pedestrian safety. The analysis identified top-priority crash clusters using crash data and high-risk corridors through predictive analysis. The team identified countermeasures that may improve safety at priority sites, based on crash types, development context, and roadway characteristics.

The plan also considered how pedestrian safety and countermeasures could be better integrated into project funding programs such as the Highway Safety Improvement Program (HSIP), routine maintenance activities, and public education initiatives.

1 Evaluate VDOT Policies

2 Analyze Crash History and Identify Priority Crash Clusters

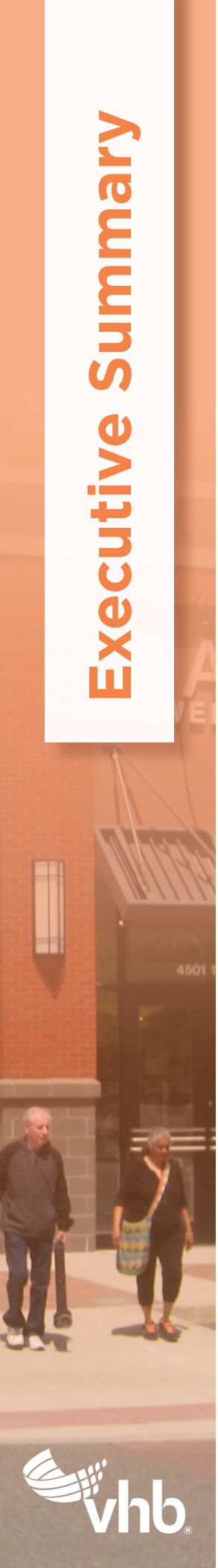
3 Conduct Systemic Analysis and Identify Priority Corridors



4 Create “Cut Sheets” and Assign Preliminary Countermeasures for Priority Clusters and Corridors

5 Share Results with VDOT Districts, Local and Regional Agencies and Entities, and Other Pedestrian Safety Partners

Executive Summary



Policy Recommendations

Following interviews with VDOT staff, review of existing VDOT policy, and review of national best practices, the PSAP provides a set of recommended policy updates and additional guidance that may provide for more consistent application of pedestrian safety treatments. The policy recommendations are organized by the business units that lead the implementation of the policies.

VDOT (Overall)

- ✓ Create performance metrics for achieving pedestrian safety goals in the SHSP and priorities identified in the PSAP.
- ✓ Recommend that the Office of Intermodal Planning and Investment (OIPI) incorporates the findings of the PSAP into Virginia's SMART SCALE prioritization process.

Transportation & Mobility Planning

- ✓ Form a VDOT working group or committee focusing on pedestrian safety and/or Complete Streets implementation.
- ✓ Develop training and distribute technical resources for selecting countermeasures.

Traffic Engineering

- ✓ Create a flowchart or instructions for developing HSIP projects from PSAP-selected priority corridors or crash cluster sites.
- ✓ Update VDOT-specific guidance on countermeasure selection and treatments at uncontrolled crossings and signalized intersection crossings.
- ✓ Develop Road Diet or lane width reduction guidelines.
- ✓ Develop Pedestrian Priority Zones (PPZs) criteria and support speed-setting and design policies for high-risk corridors. Traffic Engineering should coordinate design criteria with Location and Design.
- ✓ Implement Work Zone Pedestrian and Bicycle Guidance as standards.

Land Use

- ✓ Develop a checklist or model guidance for reviewing subdivisions or site plans for pedestrian safety.
- ✓ Update VDOT and local Traffic Impact Analysis (TIA) guidelines for pedestrian Levels of Service (LOS) to include mitigation options at uncontrolled crossings.

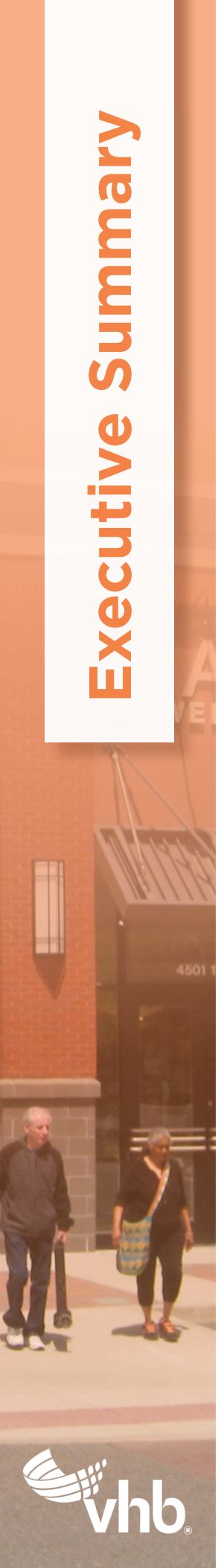
Location & Design

- ✓ Implement and improve existing multimodal design guidelines, with focus on pedestrian crossing improvements.

Maintenance

- ✓ Evaluate VDOT sidewalk maintenance policies for potential snow removal.
- ✓ Incorporate pedestrian safety treatments into routine maintenance activities, such as resurfacing and overlay projects.

Executive Summary



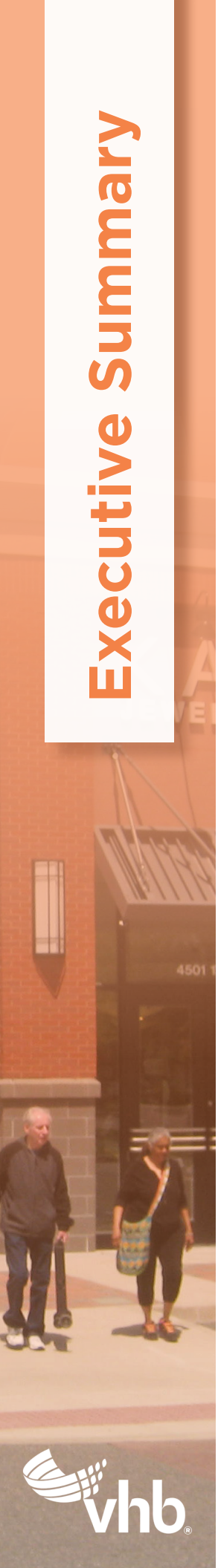
Crash Cluster Analysis

The PSAP analyzed spatial trends of geocoded pedestrian crashes (both fatal and injury) to identify clusters or "hot spots" of pedestrian crashes. Nineteen clusters that contained higher numbers of crashes in close proximity to one another were identified as high priority crash clusters that spanned intersections or short roadway segments. Most of the 19 priority clusters are located in urbanized areas with high volumes of traffic and pedestrian activity, most notably along arterials in or near downtown centers.

19 Priority Crash Clusters by Community and VDOT District

VDOT District	Location
2: Salem	• Main Street (US 460) - Blacksburg • Prices Fork Road (SR 412) - Blacksburg • Tyler Avenue (SR 177) – Radford • Campbell Avenue (US 11) - Roanoke
4: Richmond	• Broad Street (US 33/250) - Richmond • Belvidere Street (US 1) - Richmond • 10th Street - Richmond
5: Hampton Roads	• Pacific Avenue (US 60) - Virginia Beach
6: Fredericksburg	• William Street (US 1-Bus.) - Fredericksburg
7: Culpeper	• Water Street - Charlottesville • Ridge Street - Charlottesville • Emmet Street (US 29) - Charlottesville • Main Street (US 250-Bus.) - Charlottesville • Main Street (US 15) - Culpeper
8: Staunton	• Pleasant Valley Road - Winchester • Piccadilly Street (SR 7) - Winchester
9: NOVA	• Glebe Road (SR 120) - Arlington • Clarendon Boulevard - Arlington • Richmond Highway (US 1) - Fairfax

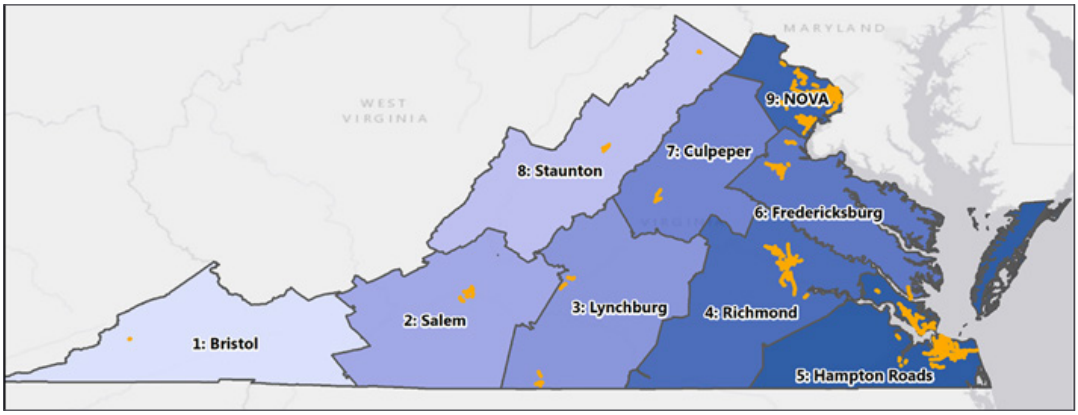
Executive Summary



Systemic Analysis and Priority Corridors

While conditions associated with pedestrian crashes may be present along a corridor, there may not be a recorded history of reported crashes. Therefore, the PSAP also conducted a predictive systemic analysis to consider corridors that do not have a strong crash history but should be prioritized for proactive pedestrian crash countermeasure improvements based on pedestrian safety factors. VDOT compiled GIS data to complete this analysis, considering the roadway conditions and other measures of pedestrian exposure to crash injury or fatality. Most priority corridors were in developed areas, along multi-lane roadways near destinations where pedestrians may frequent. The following map shows the locations for the statewide priority corridors (highlighted in yellow) that were identified by the analysis.

Geographic Distribution of Priority PSAP Corridors



Countermeasure Selection

VDOT considered current conditions and crash types when selecting countermeasures for each of the priority crash clusters and corridors. Priority site cut sheets show the location, describe key roadway conditions, summarize local crash types, and list countermeasure options. The conditions considered when selecting countermeasures included the following:

- Number of travel lanes
- Speed limit
- Average daily traffic (ADT)
- Presence of median or signalized crossing
- Land use context and nearby pedestrian destinations
- Presence of existing crosswalk markings
- Crash types and driver yield compliance reported
- Time of day for recorded crashes
- Location of crashes relative to crossing types (i.e. marked crosswalks)

Executive Summary

Current research provided guidance to VDOT when selecting countermeasures according to documented conditions. The most common countermeasures recommended for priority sites included the following:

- High Visibility Crosswalk
- Curb Extensions
- Pedestrian Countdown Signal Head
- Leading Pedestrian Interval
- Advance Warning Signage
- In-Street Yield Sign
- Pedestrian Hybrid Beacon (PHB)
- Rectangular Rapid-Flashing Beacons (RRFBs) and/or other Flashing Beacons
- Pedestrian Refuge Island (Raised Median)
- Road Diet
- Sidewalk Connections
- Transit Stop Access Improvements

Next Steps and Performance Measures

The PSAP also described non-engineering strategies to support physical countermeasure improvements, such as working with the Virginia Department of Motor Vehicles (DMV) to improve training for law enforcement officers. VDOT will monitor progress and implementation of the PSAP according to select performance metrics. These metrics are informed by the results of the PSAP and goals from related plans such as the *2017–2021 Strategic Highway Safety Plan* (SHSP).

Proposed PSAP Performance Measures

Pedestrian Safety Goal	Performance Metric
Reduce severe injury and fatal pedestrian crashes.	Achieve a 4 percent reduction in the five-year average for severe injury and fatal crashes statewide.
	Achieve a 4 percent reduction in the five-year average for severe injury and fatal crashes by VDOT District.
Accelerate consideration of pedestrian improvements at high-exposure pedestrian priority clusters and corridors.	Annually, track percentage of the PSAP priority clusters/corridors where projects are funded by SMART SCALE, TAP, Revenue Sharing, Safe Routes to School, HSIP, or other programs.
	Annually, review opportunities to incorporate pedestrian safety improvement projects into roadway resurfacing projects.
Create policies that promote pedestrian safety.	Annually, assess pedestrian safety policy gaps and updates and track PSAP listed policies that are improved.
	Annually, increase stakeholder participation in the development of pedestrian safety policies or plans (as determined by number of meeting attendees, survey respondents, and or public comment responses).

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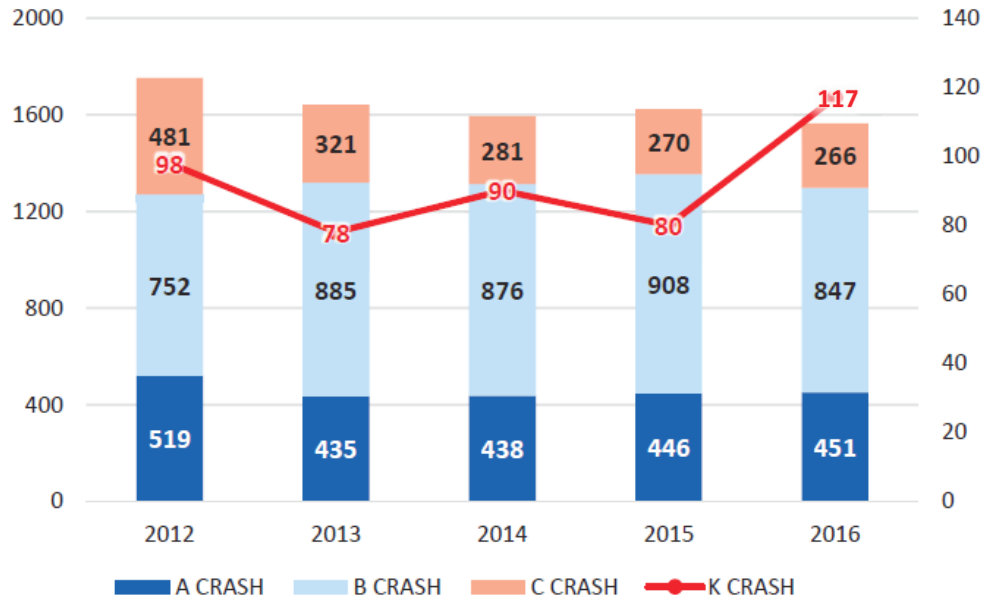
1 Pedestrian Safety Trends

Pedestrian Fatal Crash Rates are Increasing Statewide

Pedestrian fatal crashes in Virginia have increased by 19 percent since 2012, according to the *2017 Virginia Department of Transportation (VDOT) Pedestrian Crash Assessment: Analysis of Pedestrian Crashes Occurring Between 2012-2016*. This is in line with national trends, which showed a 24 percent increase in pedestrian fatal crashes over the same period. Most striking was the 46 percent increase in pedestrian fatal crashes on Virginia roadways between 2015 and 2016. In 2016, 117 crashes resulted in pedestrian fatalities out of 1,681 total pedestrian crashes on Virginia roadways. Total pedestrian crashes have declined from a five-year peak in 2012 of 1,910 crashes. The chart below, "Virginia Pedestrian Crash Database Summary: 2012-2016," shows these changes over time for pedestrian crashes on Virginia roadways.

Virginia Pedestrian Crash Database Summary: 2012-2016



Note: Crashes were rated using the KABCO scale. On the KABCO scale, K is fatal injury, A is incapacitating injury, B is non-incapacitating injury, C is possible injury, and O is property damage only (PDO). PDO crashes were not included in this summary.

Source: *2017 VDOT Pedestrian Crash Assessment: Analysis of Pedestrian Crashes Occurring Between 2012-2016*

Pedestrian Fatal Crashes are an Increasing Share of all Fatal Crashes

Pedestrians represented 12.5 percent of all traffic fatalities in Virginia between 2012 and 2016. Approximately 1.4 percent of all traffic crashes were pedestrian crashes. However, in 2016, pedestrians represented about 16 percent of all traffic fatalities in both Virginia and nationwide. The table below shows that almost half of all pedestrian crashes between 2012 and 2016 were Type B Injuries (non-incapacitating injuries).

Virginia Pedestrian Database Summary: 2012-2016

K (FATAL) CRASHES	TYPE A INJURY CRASHES	TYPE B INJURY CRASHES	TYPE C INJURY CRASHES	TOTAL INJURY CRASHES	PDO CRASHES	TOTAL CRASHES
465	2,289	4,268	1,619	8,176	10	8,651
5.4%	26.5%	49.3%	18.7%	94.5%	0.1%	100%

Note: Crashes were rated using the KABCO scale. On the KABCO scale, K is fatal injury, A is incapacitating injury, B is non-incapacitating injury, C is possible injury, and O is property damage only (PDO).

Source: *2017 VDOT Pedestrian Crash Assessment: Analysis of Pedestrian Crashes Occurring Between 2012-2016*

Pedestrian Crashes are Most Prevalent in Urban Areas with High Traffic Volumes

The highest share of fatal crashes occurred in the Northern Virginia and Hampton Roads Districts, with 23.2 percent and 26.5 percent of fatal crashes statewide, respectively, over the five-year period. The lowest share of crashes occurred in Bristol District (3.9 percent). Hampton Roads had the highest pedestrian fatal crash rate, with approximately 7.0 fatal crashes per 100,000 people compared to the statewide rate of 5.6 fatal crashes per 100,000 people. The table below shows these summary statistics by VDOT District.

Pedestrian Crashes and Fatalities by District

VDOT District	2014 Population		Pedestrian Fatal Crashes (2012-2016)		Pedestrian Injury Crashes (2012-2016)		Pedestrian Injury Sample Used in this Study (2012-2016)	
	District Total	Percent of Virginia	District Total	Percent of Virginia	District Total	Percent of Virginia	Existing District Sample Size	Percent of Statewide Sample
Bristol	355,497	4.3%	18	3.9%	169	2.1%	119	6.0%
Culpeper	402,511	4.8%	23	4.9%	338	4.1%	181	9.1%
Fredericksburg	493,490	5.9%	30	6.5%	279	3.4%	164	8.2%
Hampton Roads	1,741,531	20.9%	123	26.5%	2,103	25.7%	325	16.3%
Lynchburg	398,168	4.8%	20	4.3%	273	3.3%	160	8.0%
Northern Virginia	2,419,504	29.1%	108	23.2%	2,706	33.1%	337	16.9%
Richmond	1,278,033	15.3%	82	17.6%	1,446	17.7%	304	15.3%
Salem	692,267	8.3%	33	7.1%	499	6.1%	220	11.0%
Staunton	545,288	6.5%	28	6.0%	363	4.4%	183	9.2%
TOTAL	**8,326,289**	**100.0%**	**465**	**100.0%**	**8,176**	**100.0%**	**1,993**	**100.0%**

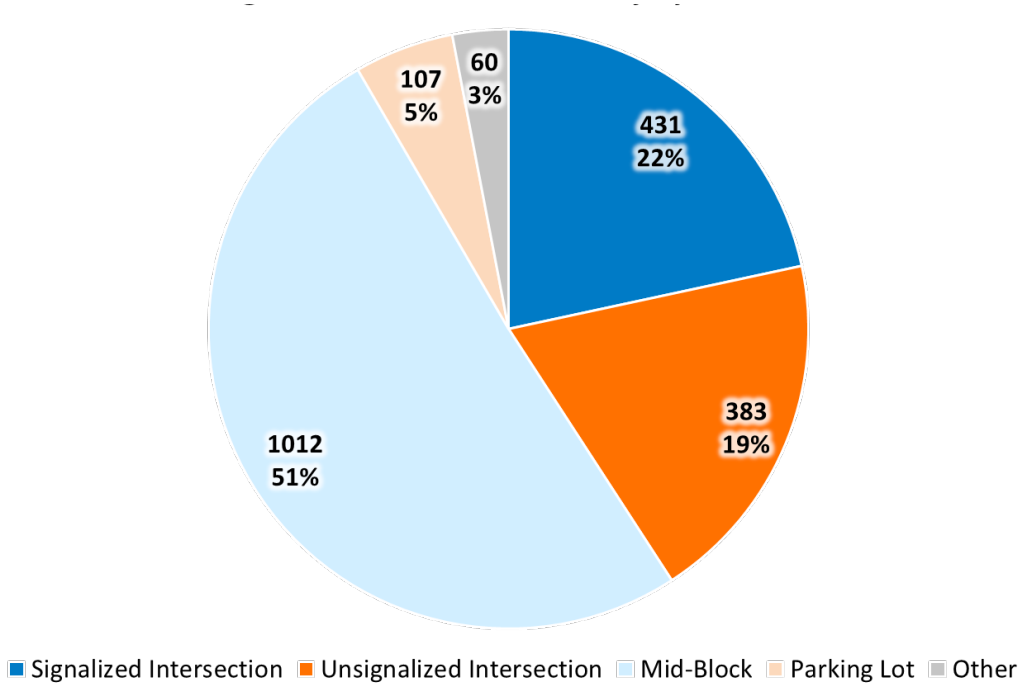
Source: *2017 VDOT Pedestrian Crash Assessment: Analysis of Pedestrian Crashes Occurring Between 2012-2016*

During the 2012 to 2016 period, 84 percent of all pedestrian crashes occurred in urban or suburban areas and 16 percent in rural areas. Furthermore, 43 percent of pedestrian injury crashes and 44 percent of pedestrian fatal crashes occurred along roadways in commercial areas (such as retail or restaurants). 36 percent of pedestrian injury crashes and 34 percent of pedestrian fatal crashes occurred along roadways in residential areas. These statistics describe how higher population densities, more pedestrian destinations, and higher traffic volumes increase pedestrian activity and exposure for pedestrians crossing urban and suburban roadways.

Pedestrians are Most Often Hit at Uncontrolled Crossing Locations

Uncontrolled pedestrian crossings occur where sidewalks or designated walkways intersect a roadway at a location where no traffic control (i.e., traffic signal or STOP sign) is present. These common crossing types occur at intersections (where they may be marked or unmarked) and at non-intersection or midblock locations (where they must be marked as crossings). The *2017 VDOT Pedestrian Crash Assessment* categorizes crash locations into three categories: mid-block, signalized intersection, and unsignalized intersection. 66 percent of pedestrian fatal crashes occurred at mid-block locations, followed by 14 percent at signalized, and 13 percent at unsignalized intersections. Similarly, 51 percent of pedestrian injury crashes occurred at mid-block locations, 22 percent at signalized intersections, and 19 percent at unsignalized intersections (see "Pedestrian Injury Crashes by Crossing Type" graph below). Overall, most pedestrian crashes occurred at uncontrolled crossing locations, pointing to the need for improved crossing accommodations.

Pedestrian Injury Crashes by Crossing Type



Source: *2017 VDOT Pedestrian Crash Assessment: Analysis of Pedestrian Crashes Occurring Between 2012-2016*

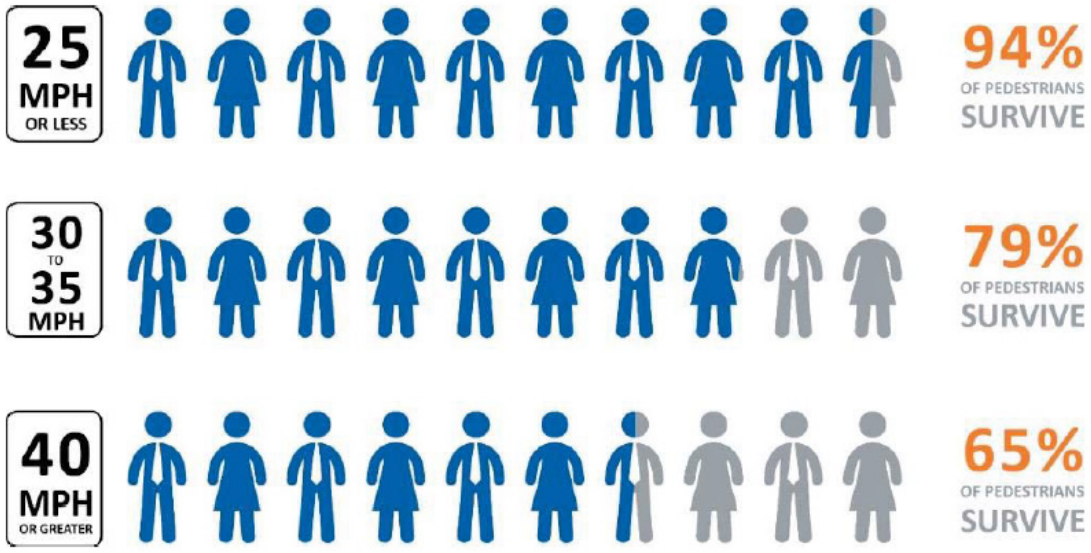
The *2017 VDOT Pedestrian Crash Assessment* found that pedestrian crossing infrastructure is often missing on streets where pedestrian travel is expected. For example, 77 percent of pedestrian fatal crashes occurred in urban areas, but only 14 percent of those locations had a marked crosswalk. Approximately 71 percent of pedestrian fatal crashes occurred in dark or unlit conditions, and only 43 percent occurred in locations with a sidewalk. Crossing improvements, such as marked crosswalks, are a vital, but often absent, part of a safe pedestrian network.

Pedestrian fatal crashes occurred most frequently (86 percent) at locations without a marked crosswalk. Likewise, 74 percent of pedestrian injury crashes occurred where no marked crosswalk was present. Higher crash rates in locations without marked crosswalks may reinforce the need for clearly marked crossing locations.

Increased Speed Reduces Pedestrian Survival Rates

Posted roadway speed limits are related to severity of pedestrian crashes. During the 2012 to 2016 period, 33 percent of pedestrian fatal crashes occurred in speed zones of 40-45 MPH, followed by 29 percent in 30-35 MPH speed zones. The *2017 VDOT Pedestrian Crash Assessment* found that survival rates for pedestrians in crashes dropped approximately 15 percentage points for each increase in posted speed limits. The assessment used posted speed because it was the most reliable data available. See the figure below, "Survival Rates for Different Posted Speed Limits."

Survival Rates for Different Posted Speed Limits



Source: *2017 VDOT Pedestrian Crash Assessment: Analysis of Pedestrian Crashes Occurring Between 2012-2016*

2 Planning Process

Objectives for the Pedestrian Safety Action Plan

According to the 2017 resource guide, *How to Develop a Pedestrian and Bicycle Safety Action Plan* (FHWA-SA-17-050), an action plan helps focus attention on improving safety conditions for bicycling and walking. The guide also says that action plans should follow a "data-driven approach to match safety programs and improvements with demonstrated problems." As such, VDOT developed a statewide Pedestrian Safety Action Plan (PSAP) to better understand the pedestrian safety concerns throughout the state and identify countermeasures to address those concerns. The VDOT PSAP includes the following elements:

- Inventory of key pedestrian safety issues, policies, and risk factors.
- Assessment and recommendations for addressing pedestrian safety through VDOT land development, roadway design, traffic engineering, and complete street policies.
- Consideration for integrating pedestrian safety needs into VDOT project funding programs such as SMART SCALE and Highway Safety Improvement Program (HSIP).
- Countermeasure project recommendations for priority sites with a measured history and risk for pedestrian crashes.
- Identification of maintenance issues that impact pedestrian access and safety.

The VDOT PSAP has the following specific objectives:

- Better understand pedestrian safety and crash trends throughout the state.
- Identify the locations with the highest numbers of pedestrian crashes.
- Consider the relationship between land use and pedestrian safety
- Identify countermeasures that address key pedestrian safety issues.
- Develop potential HSIP pedestrian safety projects.
- Improve pedestrian safety and accommodations in work zones and roadway maintenance activities.
- Integrate pedestrian crash and exposure data considerations and safety elements into SMART SCALE projects.
- Consider VDOT policy, procedure, and practice changes to better promote safe pedestrian travel.

- Support implementation of the *Virginia 2017-2021 Strategic Highway Safety Plan (SHSP)*.
- Coordinate with the Virginia Highway Safety Plan and efforts led by the Virginia Department of Motor Vehicles (DMV) to improve public education and law enforcement for pedestrian safety.

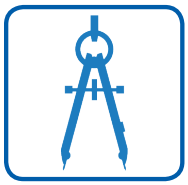
Development and Outreach Process

To support these objectives, the PSAP was developed in several stages, shown in the figure below.

1 Evaluate VDOT Policies

2 Analyze Crash History and Identify Priority Crash Clusters

3 Conduct Systemic Analysis and Identify Priority Corridors



4 Create "Cut Sheets" and Assign Preliminary Countermeasures for Priority Clusters and Corridors

5 Share Results with VDOT Districts, Local and Regional Agencies and Entities, and Other Pedestrian Safety Partners

The first stage was to evaluate VDOT policy. These policies included VDOT-specific countermeasure selection guidance, design standards, and practices to incorporate pedestrian accommodations into projects and funding programs. VDOT staff who manage policies and practices were interviewed, and best practices for pedestrian safety policy were considered.

The second stage was to analyze pedestrian crash history and trends. Spatial data was assembled, and VDOT determined a methodology for identifying the "hot spots" or clusters where pedestrian crashes had been most concentrated and severe. These

clusters were mapped and ranked according to relative density of pedestrian crash locations.

The third stage was to identify the criteria that may elevate exposure to pedestrian conflicts, where crash history may not be evident, and collect related data. VDOT included roadway and traffic characteristics that are commonly linked to increased pedestrian crashes, and they considered land use and context to describe pedestrian travel and exposure in time and space for crashes with motor vehicles. VDOT collected datasets covering the entire state that had been digitized into a geographic information systems (GIS) platform. This data was compiled and analyzed according to the weights that the stakeholder team assigned the related criteria. The results of the systemic analysis identified corridor segments of interest, and VDOT further evaluated the results to identify priority corridor segments for countermeasure recommendations.

The fourth stage was to create "cut sheets" for each of the priority sites and corridor segments identified in both the crash cluster and systemic analysis. These cut sheets included valuable information about the priority sites, such as posted speed limits, number of travel lanes, existing pedestrian crossing controls or treatments, and estimated traffic volumes. This data, in combination with available crash report and land use information, summarized the conditions relevant to countermeasure selection. VDOT referenced national guidance and research, in context of statewide countermeasure policy, to assign appropriate countermeasures. The countermeasure options are listed for each unique priority site on each cut sheet and in look-up tables.

Finally, VDOT engaged local agencies and divisions within the Department through several outreach methods to share the results of the PSAP and how partners can develop projects from the initial results. VDOT posted maps of the priority sites and corridors to a publicly accessible online viewer where a practitioner clicks on a priority site feature for more project information. Each site was given a unique identifier name—the corridor identification number and the name of the corridor on the cut sheet. VDOT also conducted a statewide webinar in September 2017 to explain the PSAP process and preliminary results, provide information to agencies, and develop the results into HSIP project submittals.

Stakeholder Team

VDOT began the process by forming a stakeholder team including representatives from local governments, various VDOT districts and divisions, and the DMV. The role of the stakeholder team was to review preliminary findings and represent their respective organizations as the plan was developed. The stakeholder team met four times in 2017 to consider the following topics or findings:

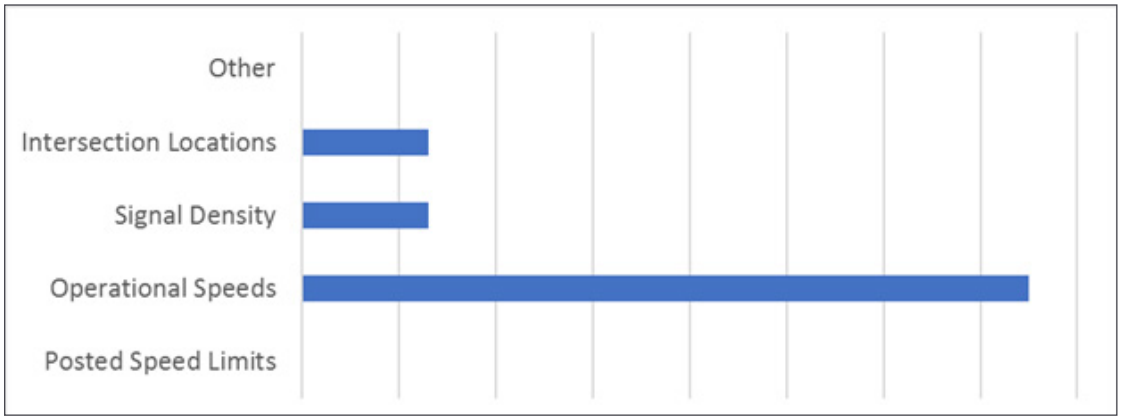
- Pedestrian safety issues and trends in Virginia.
- Tools for improving bike/ped safety at the state level.
- Explanation of the PSAP process.
- Initial findings from VDOT interviews and national policy case studies.

- Pedestrian "crash cluster" data analysis methods and priority site results.
- Criteria for considering potential conflicts and exposure to pedestrians along roadways.
- Analysis methods for ranking priority corridors for pedestrian safety risk (systemic analysis).
- Countermeasures selected for priority sites and corridors.
- Ongoing outreach and training for implementation of the PSAP.

The stakeholder team was key to identifying data sets and refining the methodology for the predictive systemic analysis. They explained what additional data sources may become available, such as GIS-based public transit information. During a stakeholder team meeting, they were asked to rank potential criteria per their importance to evaluating pedestrian safety factors. The chart below, "Stakeholder Team Preferences: Corridor Analysis Criteria," shows that the team found operational speeds to be very important criteria to understanding the potential for pedestrian crashes, compared with posted speed limits or the placement of intersections.

The stakeholder team also provided valuable input to the policy evaluation, including examples of best practices by local governments. The stakeholder team helped identify the most effective ways that VDOT could share the findings of the PSAP with local agencies and law enforcement officials. For instance, the stakeholders shared how the priority site "cut sheets" could be used to help local police target law enforcement activities and how the analysis could be presented on a public-facing map viewer.

Stakeholder Team Preferences: Corridor Analysis Criteria



3 Policy Evaluation

VDOT policies come in multiple forms, serving different purposes, and they are integral to how VDOT makes decisions to improve pedestrian safety. For the purposes of the PSAP, "policy" includes decision-making criteria and design guidelines for installing and maintaining countermeasures. This section describes a set of recommendations for areas of policy that can be addressed to improve decision-making for pedestrian safety. This section also includes a summary assessment of existing VDOT policies applicable to pedestrian crossings and accommodations.

Pedestrian Hybrid Beacon crossing. Source: VHB

Policy Gap Analysis

The following "Policy Gap Analysis" matrix compares current VDOT and other policies to types of national best practices for policy in support of pedestrian safety. VDOT policies are further described later in this section. The matrix shows where policy should be developed or improved.

Policy Gap Analysis

Policy Type	Tier	Strengths	Weaknesses
Complete Streets	♦	VDOT accepts responsibility for maintenance of eligible sidewalks; Includes list of accepted exceptions for providing sidewalks and pedestrian accommodations.	VDOT does not track implementation; exceptions listed in policy are subject to widely varied interpretation.
Crosswalk Marking	★	VDOT updated guidance as part of TE-384. Considers speed, AADT, and land use context.	Complexity of guidance may lead to less-than-optimal implementation.
Signalized Intersection Countermeasures	♦	Northern Virginia Region guidance considers signal phasing, crossing distance, and turning conflicts for installing pedestrian signals.	No existing guidance statewide.
Uncontrolled Crossing Countermeasures	★	TE-384 includes multiple countermeasures, such as PHBs and RRFBs.	Does not specifically address refuge islands and does not offer VDOT-specific criteria for PHBs.
Speed Setting	●	Engineering judgment provides opportunity to consider pedestrian safety.	No guidance or process available for pedestrian activity besides school zone speed setting.
Design Standards	♦	Includes references to refuge islands (medians), crosswalk markings, and signals.	Unclear guidance for assembly of beacons and signs for PHBs and RRFBs
Road Diets	●	Northern Virginia Region reviews resurfacing for road diet opportunities.	No existing statewide guidance.

Key:

● No Specific Policy Applicable

♦ Incomplete Guidance or Irregular Application

★ Clear Policy and Consistent Application

Policy Recommendations

Suggested improvements are summarized in the list below, organized by the group or division within VDOT that "owns" or manages the policy type. Each recommendation is explained in more detail following this summary list.

VDOT (Overall)

- ✓ Create performance metrics for achieving pedestrian safety goals in the SHSP and priorities identified in the PSAP.
- ✓ Recommend that the Office of Intermodal Planning and Investment (OIPI) incorporates the findings of the PSAP into Virginia's SMART SCALE prioritization process.

Transportation & Mobility Planning

- ✓ Form a VDOT working group or committee focusing on pedestrian safety and/or Complete Streets implementation.
- ✓ Develop training and distribute technical resources for selecting countermeasures.

Traffic Engineering

- ✓ Create a flowchart or instructions for developing HSIP projects from PSAP-selected priority corridors or crash cluster sites.
- ✓ Update VDOT-specific guidance on countermeasure selection and treatments at uncontrolled crossings and signalized intersection crossings.
- ✓ Develop Road Diet or lane width reduction guidelines.
- ✓ Develop Pedestrian Priority Zones (PPZs) criteria and support speed-setting and design policies for high-risk corridors. Traffic Engineering should coordinate design criteria with Location and Design.
- ✓ Implement Work Zone Pedestrian and Bicycle Guidance as standards.

Land Use

- ✓ Develop a checklist or model guidance for reviewing subdivisions or site plans for pedestrian safety.
- ✓ Update VDOT and local Traffic Impact Analysis (TIA) guidelines for pedestrian Levels of Service (LOS) to include mitigation options at uncontrolled crossings.

Location & Design

- ✓ Implement and improve existing multimodal design guidelines, with focus on pedestrian crossing improvements.

Maintenance

- ✓ Evaluate VDOT sidewalk maintenance policies for potential snow removal.
- ✓ Incorporate pedestrian safety treatments into routine maintenance activities, such as resurfacing and overlay projects.

VDOT Policy Improvements

✓ Create performance metrics for achieving pedestrian safety goals in the SHSP and priorities identified in the PSAP.

Performance metrics should be designed to track the progress of the PSAP's goals at key milestones. VDOT's 2014 *State Pedestrian Policy Plan* stressed both the importance of selecting performance measures and the difficulty of data collection. Similarly, the *Virginia 2017–2021 SHSP* includes recommended targets for reduced pedestrian fatalities and serious injuries. VDOT should establish comprehensive metrics based on the existing policy, the SHSP, and the PSAP to describe 5-year targets over a 20-year horizon.

Related Policy or Guidance: *Virginia Department of Transportation State Pedestrian Policy Plan*

http://www.virginiadot.org/programs/resources/bike/SPPP_FINAL_OnLine.pdf

This document was published in 2014 and summarized current VDOT policies about pedestrian accommodations and safety. The primary focus of the report was the 2004 Commonwealth Transportation Board (CTB) Policy for Integrating Bicycle and Pedestrian Accommodations. The policy plan included a series of recommendations, including the following:

- Develop design standards that address retrofitting pedestrian accommodations or adding accommodations to existing infrastructure.
- Revisit the CTB Policy decision-tree (the 2008 VDOT Bicycle and Pedestrian Accommodation Decision Process for Construction Projects) to ensure it clearly describes the process that should be undertaken to determine if an exemption to the Policy is warranted.
- Establish benchmarks needed for future tracking of pedestrian/bicycle-related implementation efforts and changes in ridership numbers over time.

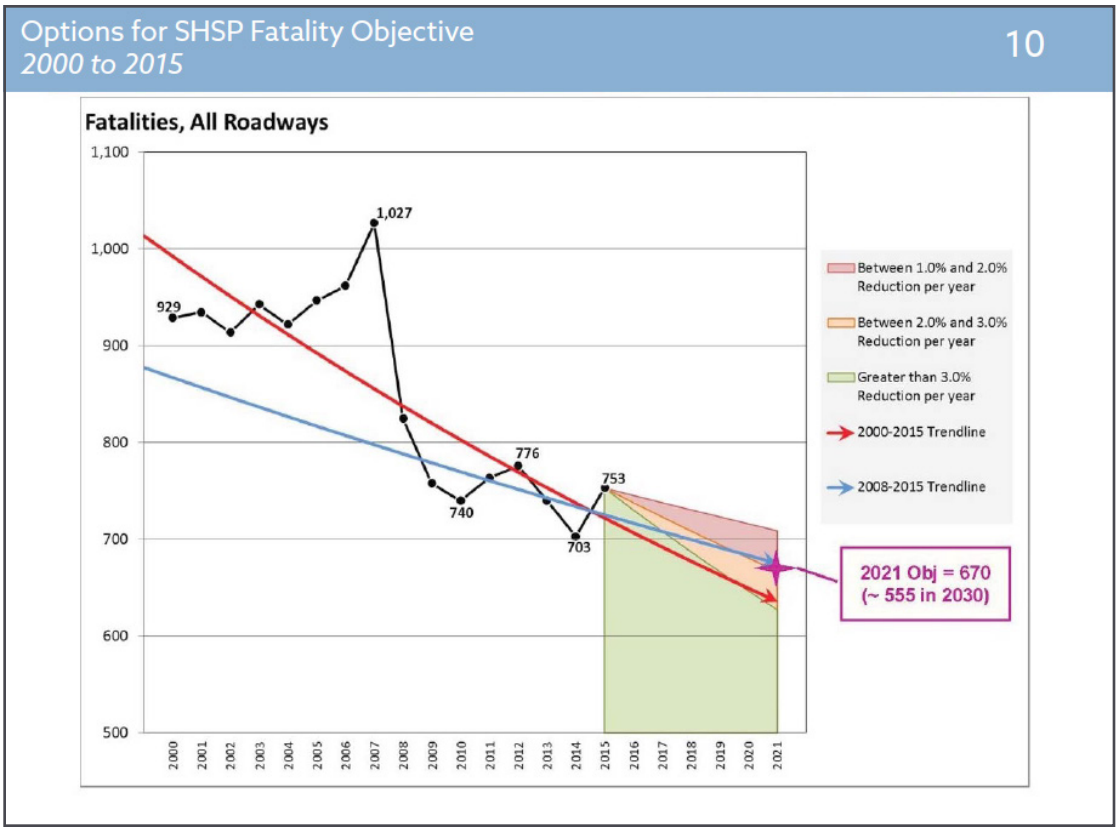
Related Policy or Guidance: *Virginia 2017-2021 Strategic Highway Safety Plan*

http://www.virginiadot.org/info/resources/SHSP/VA_2017_SHSP_Final_complete.pdf

The SHSP is a five-year plan adopted in 2017 that serves as Virginia's guiding document for its Toward Zero Deaths vision. Pedestrian safety is addressed directly under the Human Factors category, as well as throughout various other sections. The Intersection emphasis area also specifically addresses pedestrian safety, since 10 percent of fatalities and 7 percent of serious injuries at intersections involve pedestrians. Strategies to improve pedestrian safety at intersections include

assessing signalized intersections in accordance with VDOT and federal guidance and pedestrian change and clearance intervals and ensuring intersections are designed for all users by providing pedestrian and bicycle accommodations (e.g. crosswalks, refuge islands, and pedestrian countdown signals).

The SHSP summarized other recent achievements such as the development of guidelines for pedestrian crossing accommodations at uncontrolled locations and the creation of a Highway Safety Improvement Program web portal to streamline the process for localities submitting applications to VDOT for funding of pedestrian, bicycle, and highway safety improvements. The goal for the short-term is to reduce pedestrian fatalities by 2 percent each year and serious injuries by 5 percent each year between 2017 and 2021. Strategies in the plan include conducting analysis of crashes to identify countermeasures—much of the focus of the PSAP.



Source: *Virginia 2017–2021 SHSP*

✓ Recommend that the OIPI incorporates the findings of the PSAP into Virginia's SMART SCALE prioritization process.

The PSAP identified countermeasures that are not included in the Crash Modification Factor (CMF) list for calculating benefits within the Safety scoring module for SMART SCALE. Additional CMFs, reflecting additional pedestrian crossing countermeasures, should be considered for SMART SCALE. Also, VDOT Districts and local agencies should also have easy access to GIS information about the sites identified as priorities per the PSAP. The countermeasures suggested for PSAP priority sites and corridors should be reviewed within highway and pedestrian SMART SCALE candidate projects.

Related Policy or Guidance: SMART SCALE

http://vasmartscale.org/

SMART SCALE is Virginia's process by which transportation projects are prioritized for funding, as required by state statute. The process follows a data-driven process to evaluate eligible projects for state and federal funding programs, including independent bicycle and pedestrian projects and multimodal accommodations as part of highway projects. SMART SCALE considers projects at three tiers: statewide, regional, and local levels. The process also has a fourth category for considering projects according to safety need. All SMART SCALE projects are scored for safety according to established countermeasure CMFs. Pedestrian CMFs currently included in SMART SCALE focus on sidewalks and other accommodations adjacent to the roadway. Other SMART SCALE factors, such as accessibility and land use, also give consideration for non-motorized accommodations.

Factor Areas	Measure ID	Measure Name	Measure Weight
Safety	S.1	Equivalent property damage only (EPDO) of Fatal and Injury Crashes*	50%
	S.2	EPDO Rate of Fatal and Injury Crashes	50%
Congestion Mitigation	C.1	Person Throughput	50%
	C.2	Person Hours of Delay	50%
Accessibility	A.1	Access to Jobs	60%
	A.2	Access to Jobs for Disadvantaged Persons	20%
	A.3	Access to Multimodal Choices	20%
Environmental Quality	E.1	Air Quality and Environmental Effect	50%
	E.2	Impact to Natural and Cultural Resources	50%
Economic Development	ED.1	Project Support for Economic Development	60%
	ED.2	Intermodal Access and Efficiency	20%
	ED.3	Travel Time Reliability	20%
Land Use	L.1	Transportation-Efficient Land Use	70%
	L.2	Increase in Transportation Efficient Land Use	30%
100% for Transit and Transportation Demand Management projects			

Source: Virginia SMART SCALE (Office of Intermodal Planning and Investment)

Transportation & Mobility Planning Policy Improvements

✓ Form a VDOT working group or committee focusing on pedestrian safety and/or Complete Streets implementation.

This working group would help improve consistency in how pedestrian accommodations are included in VDOT projects, including both crossing treatments and sidewalk accommodations. This working group would serve several important roles:

- Identify gaps in VDOT pedestrian crossing safety policies and design guidelines.
- Serve as "appeals panel" for exceptions to including pedestrian improvements.
- Review current VDOT plans for needed updates or additional analysis.
- Represent local agency perspectives on urban and suburban issues.

The VDOT Bicycle and Pedestrian Advisory Committee (BPAC) meets to discuss general improvements for bicycling and walking in Virginia. This committee may provide core members or otherwise assist in identifying membership for a work group focusing on Complete Streets implementation. To better ensure implementation, the working group should include senior leadership from divisions responsible for design and installation of transportation infrastructure.

Case Study: State Level Implementation of Complete Streets

CalTrans Complete Streets Technical Advisory Committee

http://www.dot.ca.gov/transplanning/ocp/complete-streets.html

VDOT may consider creating an organization similar to one created by the California Department of Transportation ("CalTrans"). Caltrans created a Complete Streets Technical Advisory Committee (TAC) to complement the development of the state's Complete Streets Policy. The TAC is composed of representatives from each Caltrans district, functional unit, and division. It meets every other month to share information, review draft products, report on the Complete Streets Policy's progress, and recommend solutions for implementation.

FDOT Complete Streets Implementation Plan

http://www.flcompletestreets.com/files/Final-CSI-Implementation-Plan.pdf

The Florida Department of Transportation (FDOT) developed a Complete Streets Implementation Plan in 2015. This plan was created in partnership with Smart Growth America, and it reviewed current FDOT policy and process for opportunities to improve the execution of Complete Streets. The plan included recommendations for all stages of Complete Streets implementation, beginning

with the decision-making process, project development, design guidelines, performance measures, and ongoing training. The plan provided broad recommendations, such as those listed below:

- Incorporate more flexibility and/or provide a framework for applying different LOS standards based on context.
- Incorporate context-sensitive design standards for SIS (Strategic Intermodal System) roadways for cases when facilities run through downtowns, particularly regarding design speed.
- Develop and maintain Complete Streets network plans and GIS layers that compile information from existing land use and transportation plans to identify gaps in network connectivity and aid coordination across programs and with other agencies.
- Create Complete Streets performance measures, such as presence of pedestrian facilities in proximity to transit stops.
- Establish a Leadership Structure for Complete Streets Implementation.
- Continue Complete Streets training, through opportunities such as a speakers' bureau and topic-focused workshops.

Related Policy or Guidance: VDOT *Policy for Integrating Bicycle and Pedestrian Accomodations*

http://www.virginiadot.org/programs/resources/bike_ped_policy.pdf

The *Policy for Integrating Bicycle and Pedestrian Accomodations* was established in March 2004 to provide a framework for VDOT to integrate pedestrian and bicyclist accommodations into the planning, funding, design, construction, operation, and maintenance of the Commonwealth's transportation network.

The policy applies to projects that reach the scoping phase after March 2004. The policy creates opportunities to address pedestrian and bicycling accommodations during the development phase of various projects. The policy seeks to create opportunities in projects that do the following:

- Accommodate existing and future bicycle and pedestrian use.
- Improve or maintain safety for all users.
- Provide a connection to public transportation services and facilities.
- Serve areas or population groups with limited transportation options.
- Provide a connection to bicycling and walking trip generators such as employment, education, retail, recreation, and residential centers and public facilities.

- Are identified in a Safe Routes to School program or provides a connection to a school.
- Provide a regional connection or is of regional or state significance.
- Provide a link to other bicycle and pedestrian accommodations.
- Provide a connection to traverse natural or man-made barriers.
- Provide a tourism or economic development opportunity.
- Are independent of highway construction.
- Relate to access-controlled corridors.
- Focus on operation and maintenance activities.
- Pertain to long distance bicycle routes.

In these circumstances, the policy sets forth the procedures for integrating bicycle and pedestrian facilities in the decision-making process, and the stakeholders involved in the process.

Related Policy or Guidance: VDOT Report on Compliance Review of *Policy for Integrating Bicycle and Pedestrian Accommodations in Virginia*

In May 2016, VDOT conducted an audit of projects that were scoped between December 1, 2010 and April 19, 2015 to determine if the *Policy for Integrating Bicycle and Pedestrian Accommodations* (hereinafter, policy) was sufficiently comprehensive, adequately communicated, and had been consistently applied.

The review generally found that the policy had been adequately communicated, and localities were applying its guidelines in a uniform manner. The review also identified areas where the policy could be improved. These areas included:

- Creating metrics to measure process in implementing the policy as it relates to maintenance and construction activities.
- Update guidelines, procedures, and best practices developed to assist with the implementation of the policy.
- Include a requirement to remove snow from sidewalks that have been accepted by VDOT for maintenance.

This review resulted in the creation of a list of VDOT Designated Bicycle and Pedestrian Accommodations in 2017. This list includes, among other facility types, the following pedestrian crossing accommodation types:

- Pedestrian refuge islands (6 feet wide minimum) at intersections and roundabouts.

- Median island cut-throughs.
- Appropriately striped crosswalks.
- Pedestrian signals—walk/don't walk, countdown, and/or push buttons.
- "Bulb-outs" at intersections and other traffic calming methods.
- Warning flashers at crosswalks or Rectangular Rapid Flash Beacons (RRFBs).
- Pedestrian Hybrid Beacons (PHBs).

Related Policy or Guidance: Scoping Worksheet—Bicycle & Pedestrian Accommodations

http://www.virginiadot.org/programs/resources/bike/BPAccommodationsDefined.pdf

Created by the VDOT Project Management Office in 2017, this worksheet asks questions about planned bicycle or pedestrian elements to improve coordination and successful accommodation. The worksheet should be completed prior to the scoping meeting by the appropriate project team member. The form requires signatures from multiple units of VDOT and lists accepted exceptions to accommodating bicycle and pedestrian improvements. Those exceptions include the following:

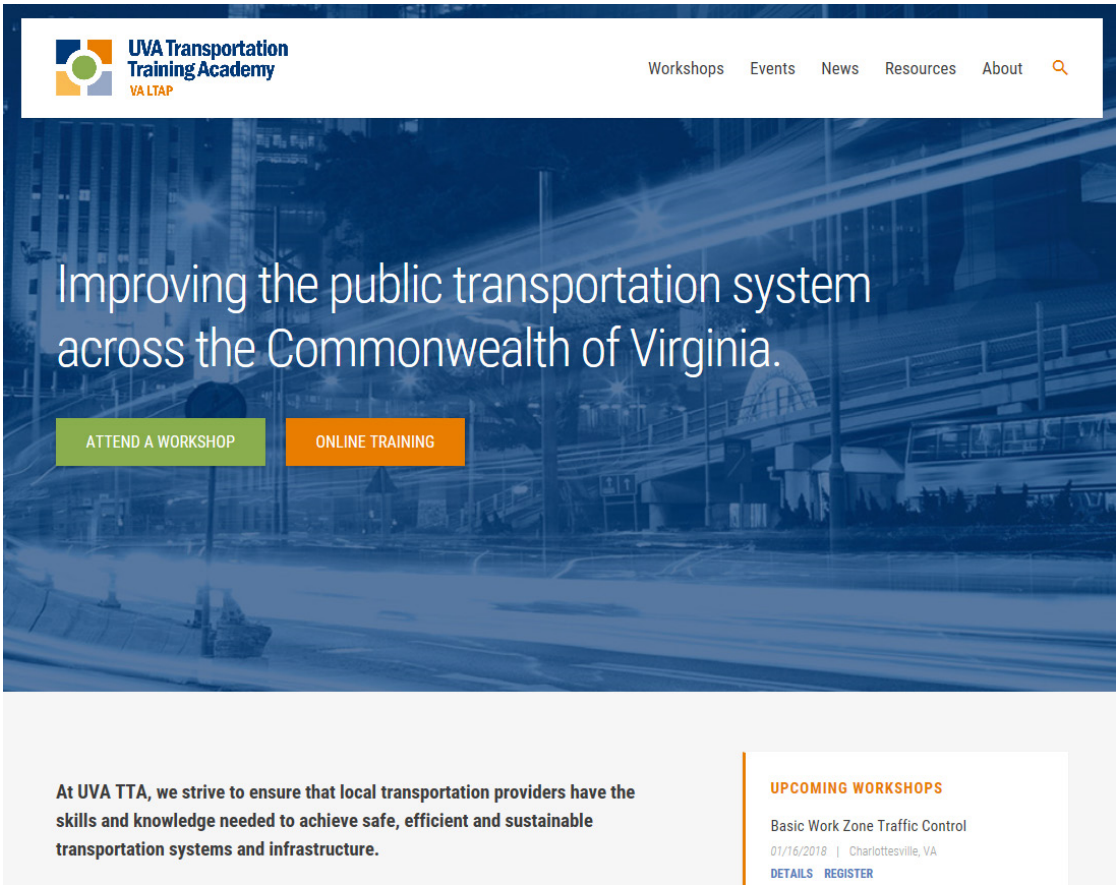
- Scarcity of population, travel, and attractors, both existing and future, indicate an absence of need.
- Environmental or social impacts outweigh the need.
- Safety would be compromised.
- Total cost to appropriate system (i.e., interstate, primary, etc.) is excessively disproportionate to need.
- Purpose and scope of project do not facilitate the need for provision (e.g., Rural Rustic Road Program).
- Bicycle and/or pedestrian travel is prohibited by state or federal laws.

✓ Develop training and distribute technical resources for selecting countermeasures.

VDOT should monitor and distribute national guidance for installing specific pedestrian crossing countermeasures, such as Transportation Research Board (TRB), National Cooperative Highway Research Program (NCHRP), and FHWA publications including updated CMFs for pedestrian countermeasures. These actions would keep the topic of pedestrian crossing safety at the forefront of the minds of decision makers.

To complement these national resources, VDOT should document case studies of exemplary countermeasure installations in Virginia. VDOT should post information from these case studies to its central website for other districts and local agencies to review. The case studies should include information about installation costs, design considerations, and public involvement in the decision-making process.

VDOT should review training modules to determine whether they currently address pedestrian safety or if new training events should be designed. For example, new modules may be required to describe when VDOT officials should incorporate countermeasures into projects or maintenance activities. The Virginia Local Technical Assistance Program (LTAP), administered by the University of Virginia's Transportation Training Academy (TTA), offers in-person and online training programs and may be a conduit for new or improved training modules and training materials.



Source: University of Virginia Transportation Training Academy

Traffic Engineering Policy Improvements

✓ Create a flowchart or instructions for developing HSIP projects from PSAP-selected priority corridors or crash cluster sites.

The PSAP process identified a list of sites where countermeasures should be further considered based on preliminary data analysis. VDOT district or local agency staff should consider additional sites and more information to make final countermeasure selections, including the following:

- Local pedestrian or transportation plans.
- Scheduled local or VDOT roadway or transit projects.
- Pending maintenance or operation activities or projects.
- Proposed land development projects.
- Recent crash reports or police observations.

PSAP priority sites have been geocoded and mapped in a GIS-based platform. These maps should be shared and promoted widely as a starting point for identifying needed pedestrian safety improvements. These corridors and sites have either a significant pedestrian crash history or are otherwise noted as high-risk for pedestrian crashes.

Case Study: Developing Pedestrian HSIP Projects

http://www.oregon.gov/ODOT/Engineering/Pages/ARTS.aspx

The Oregon Department of Transportation (ODOT) developed the All Roads Transportation Safety (ARTS) program to direct HSIP funds towards selected projects through a data-driven approach. ARTS utilizes crash data, risk factors, and other data to identify "hot spots" (i.e. locations with one or more fatalities in the past five years) and systemic problem areas. Once these areas are identified, ODOT and local jurisdictional representatives discuss potential projects from a list of countermeasures to generate an overall count. This draft list of countermeasures is reviewed by ODOT and a multi-disciplinary team, and the projects are then prioritized and programmed for funding. The VDOT PSAP analysis process is similar to that used in the ARTS program.

Related Policy or Guidance: *Framework for Selection and Evaluation of Bicycle and Pedestrian Safety Projects in Virginia*

http://www.virginiadot.org/vtrc/main/online_reports/pdf/08-r8.pdf

This 2008 report from the Virginia Transportation Research Council evaluated the state's Bicycle and Pedestrian Safety (BPS) Program project selection methodology and offered programmatic improvements. The report synthetized a new four-step systematic identification process for selecting safety projects based upon a literature review and consultation with leading safety engineers, transportation planners, and users:

1. Identify hazardous locations.
2. Determine causal factors.
3. Establish measures of effectiveness.
4. Generate potential countermeasures.

Five recommendations were offered to improve the BPS's project selection process and outcomes. BPS staff was encouraged to adopt a systematic approach to identifying hazardous locations and appropriate countermeasures, as well as share state-of-the-art methodologies and evaluation tools with VDOT offices and local jurisdictions. The report called for VDOT staff to require program participants to conduct post-implementation studies of countermeasure effectiveness.

In line with this four-step process and recommendations, this PSAP summarizes crash factors and risks, locations for improvement, and potential countermeasures. The summary in the report and cut sheets will provide VDOT Districts and localities with a good starting point for addressing pedestrian safety.

Source: VHB

✓ Update VDOT-specific guidance on countermeasure selection and treatments at uncontrolled crossings and signalized intersection crossings.

VDOT should review existing policy documents, such as TE-384 (*Pedestrian Crossing Accommodations at Unsignalized Locations*), to develop clear decision-making tools for a broad array of countermeasures. Existing installation guidance includes tools such as the "heat map" matrix in TE-384 identifying best conditions for adding a marked crosswalk. Additional countermeasures, such as the PHB, should be included in selection tools like the TE-384 heat map.

VDOT does not have statewide guidance in place for installation of countermeasures at signalized intersections. Forthcoming guidance should describe best practices for installing pedestrian signals, Leading Pedestrian Intervals (LPI), and signal timing or split-phasing improvements for pedestrian crossings.

Related Policy or Guidance: *Pedestrian Crossing Accommodations at Unsignalized Locations* (IIM-TE-384)

http://www.virginiadot.org/business/resources/IIM/TE-384_Ped_Xing_Accommodations_Unsignalized_Locs.pdf

The most recent version of this policy was published by VDOT in July 2016. The policy provides guidance on when and how pedestrian needs should be accommodated at unsignalized crossings. The policy applies to all projects advertised on or after December 1, 2016, and or projects under construction if approved by the Project Engineer; the resurfacing or reconstruction of an existing marked crosswalk, or unmarked crosswalks that are due for a safety review.

The policy recommends when to install crosswalks at unsignalized intersections, when to install marked crosswalks across stop-controlled or yield-controlled approaches, and when to install mid-block crosswalks across uncontrolled approaches. The decision to install is dependent on the roadway environment, and the policy considers three factors: roadway configuration, the roadway volume, and the speed limit. The memorandum also provides design guidance, including the width of crosswalks, crosswalk marking patterns, aesthetic treatments, and other safety treatments.

Related Policy or Guidance: *Pedestrian Accommodations at Traffic Signals* (Northern Region Traffic Engineering Practice)

This regional policy was developed in August 2014, and applies to newly constructed, rebuilt, or significantly modified traffic signals. The memorandum calls for pedestrian signal heads to be installed on all legs of signalized intersections, except in specific situations. The memorandum describes the exceptions as:

- Where pedestrian crossing would conflict with a multiple-lane turn movement.
- Where a traffic study finds that a pedestrian signal head would impede the operation of traffic through the intersection or corridor.
- Where there are no pedestrian facilities (i.e., sidewalks or curb ramps) or evidence of pedestrian activity on either end of the crossing.
- Where pedestrians are prohibited from or unable to access one end of the crossing (e.g., a guardrail fully surrounds one corner of an intersection).
- Where the length of the crosswalk is relatively short, and the vehicular signal indications are visible to pedestrians and can guide pedestrians across the intersection.

The memorandum requires marked crosswalks at crossings controlled by a pedestrian signal head. It also calls for pedestrian pushbuttons to be provided at all signalized pedestrian crossing except in specific circumstance. It also addresses the phasing of the pedestrian walk signal, specifying circumstances where a walk extension, rest in walk, and leading pedestrian interval would be appropriate.

Source: VHB

✓ Develop Road Diet or lane width reduction guidelines.

VDOT does not currently have statewide guidance for considering lane reconfiguration or lane-width reduction. Roadway reconfigurations, often referred to as Road Diets, most commonly convert a four-lane roadway to a three-lane roadway, including a center two-way turn lane and bike lanes. Road Diets have been studied for safety benefits to all traffic, including pedestrians. Road Diet guidance should consider traffic volumes, land use context, and preferred speeds.

Related Policy or Guidance: NoVA District Road Diet Practice

The Northern Virginia District of VDOT has made it a practice to identify candidate Road Diets that are scheduled for repaving and to engage local partners during the decision-making process. After a Road Diet is completed, the district conducts an evaluation of collisions for the multiyear periods pre- and post-project implementation. Successful projects in Reston and Dunn Loring, Virginia have supported this approach to Road Diets. For more information, consider FHWA's *Road Diet Informational Guide* (FHWA-SA-14-028). The FHWA guide describes what types of roadways may be candidates for Road Diets: https://safety.fhwa.dot.gov/road_diets/guidance/info_guide/

Road Diet implementation on Lawyers Road, Reston, VA. Source: Federal Highway Administration

✓ Develop Pedestrian Priority Zones (PPZs) criteria and supporting speed-setting and design policies for high-risk corridors. Traffic Engineering should coordinate design criteria with Location and Design.

Corridors identified as high-risk for severe pedestrian crashes may be candidates for speed management strategies, including the design flexibility to use lower-speed design options, in addition to pedestrian countermeasure installation. VDOT should review the priority corridors, as identified by the PSAP, to identify candidates for "Pedestrian Priority Zones." Pedestrian Priority Zones (PPZs) are unique sections of corridors where pedestrians are more prevalent and at greater risk for severe or fatal crashes. Additional criteria, such as high-density land uses or a significant differential between posted speed limits and actual speeds, may help identify corridors that could be designated as PPZs.

Speed management strategies to consider for PPZs may include the following:

- Traffic calming.
- Reduced or variable speed limits.
- Reduced design speeds for planned improvement projects that consider land use context.
- Coordinated signal timing and spacing designed to "platoon" traffic and moderate speeds.
- Pedestrian-focused signals and traffic controls, such as LPI, No Turn on Red restrictions, pedestrian countdown signals, and PHBs.
- PHBs or flashers with high-visibility crosswalks.
- Geometric improvements such as raised crosswalks, curb extensions, and chicanes.

Case Studies in Speed Setting Policy

Massachusetts *Procedures for Speed Zoning on State Highways and Municipal Roads*

http://www.massdot.State.ma.us/Portals/8/docs/traffic/SpeedLimits/Procedures_for_Speed_Zoning_02-2017.pdf

State legislation passed in 2016 provided municipalities the authority to reduce speed limits to 25 MPH on any non-state highway roadway within a thickly settled or business district. Two regulatory references combine to permit this speed setting outside of engineering-based speed setting policies. MGL c. 90 § 1 defines thickly settled areas as "built up with structures devoted to business, or the territory contiguous to any way where the dwelling houses are situated at such distances as will average less than two hundred feet between them for a quarter of a mile or over." The default speed limit for a thickly settled area and business district is 30 MPH, unless the municipality adopts MGL c. 90 § 17C that allows a further reduction to 25 MPH.

The Massachusetts Department of Transportation (MassDOT) speed zoning policy encourages municipalities to implement the speed reduction town-wide instead of on a street-by-street basis to avoid driver confusion. After adopting the speed reduction policy for thickly settled and business districts, the municipality is required to notify MassDOT, amend their respective Municipal Traffic Code, and post warning signs of the speed limit and extent.

Florida Department of Transportation (FDOT) *Speed Zoning: Highways, Roads & Streets in Florida*

http://fdot.gov/roadway/fdm/

This updated 2017 policy incorporates the state's new *Complete Streets Design Manual* and associated Context Classification system to inform speed limit setting on state, municipal, and county roads. FDOT intends for the policy to support safe access to users of all modes and abilities. While traditional speed setting procedures include pedestrian activity considerations, the speed limit is determined by an engineering study. The updated FDOT speed zoning policy calls for the consideration of a design speed range in speed zoning, where the design speed is based on the land use context and associated pedestrian and bicycle activity.

The design speed ranges detailed in the FDOT *Complete Streets Design Manual* are based on roadway design and adjacent land. In this concept, target speed ranges decrease as land use shifts from a natural and rural setting to a dense urban core. For example, allowable speed ranges on non-Strategic Intermodal System (SIS) roadways in C1-Natural areas is 55-70 MPH and 35-55 MPH in C3-Suburban areas. While the target speed range does not dictate speed zoning, it incorporates pedestrian and land use activities into the setting process.

Table 201.4.1 Design Speed

Limited Access Facilities (Interstates, Freeways, and Expressways)		
Area	**Allowable Range (mph)**	**SIS Minimum (mph)**
Rural and Urban	70	70
Urbanized	50-70	60
Arterials and Collectors		
Context Classification	**Allowable Range (mph)**	**SIS Minimum (mph)**
C1 Natural	55-70	65
C2 Rural	55-70	65
C2T Rural Town	25-45	40
C3 Suburban	35-55	50
C4 Urban General	30-45	45
C5 Urban Center	25-35	35
C6 Urban Core	25-30	30

Source: Florida Department of Transportation

Related Policy or Guidance: Speed Limit Change Process

http://www.virginiadot.org/business/resources/traffic_engineering/memos3/TE-365_Speed_Limit_Change_Procedures.pdf

The most recent version of the Speed Limit Change Process was adopted in February 2011. The policy assigns responsibility to the Regional Traffic Engineers, Regional Operations Directors, and State Traffic Engineers for reviewing and approving speed limit change request and ensuring that the speed limit change is implemented correctly and timely.

The policy considers road user safety as the impetus for changing the speed limit. Generally, the speed limit remains unchanged unless there has been an increase in crash frequency or severity, traffic volume, or roadside development. The posted speed limit remains the same if there has been no significant increase in the frequency or severity of crashes, traffic volumes, or roadside development since a speed limit was last established or posted or speed study was conducted.

A detailed review of low volume roads is conducted if there has been an average of three or more crashes per year over a three-year period, or there are more than 10 entrances on a single side per mile of roadway. The posted speed is also recommended to remain the same on interstates if there has been no significant increase in the frequency or severity of crashes, traffic volumes, or roadside development since a speed limit was last established or posted or speed study was conducted.

Source: VHB

Related Policy or Guidance: *Requirements for the Establishment, Operation, and Maintenance of School Zone Speed Limits (SZSLs)* (IIM-TE-183.1)

http://www.virginiadot.org/business/resources/IIM/TE-183_School_Zone_Speed_Limits.pdf

VDOT's Traffic Engineering Division adopted the *Requirements for the Establishment, Operation, and Maintenance of School Zone Speed Limits (SZSLs)* in March 2016. The policy provides guidance for the uniform establishment of school zone speed limits across the Commonwealth, required signage for school zones with speed limits, as well as the installation, operation, and maintenance of signage.

The level of pedestrian activity in the vicinity of a school, as well as the risk of pedestrian-related crashes, are among several factors in establishing school zone speed. The policy generally provides for a maximum speed limit of 25 MPH in school zones, except where an engineering study supports a deviation from 25 MPH and the speed change is approved by the Commissioner of Highways designee.

Related Policy or Guidance: *Traffic Calming Guide for Neighborhood Streets*

http://www.virginiadot.org/programs/resources/Traffic-Calming-Guide-For-Neighborhood-Streets.pdf

This guide was adopted in December 2015. The guide outlines the purpose and benefits of traffic calming, strategies available for achieving traffic calming, as well as the process that localities should follow to establish traffic calming in their communities.

The guide applies to residential and mixed-use streets on the state system of highways where the speed limit is 35 MPH and there is a documented speeding problem. The guide outlines various recommended physical measures to reduce the speed of vehicles traveling through neighborhoods to benefit pedestrian safety. These measures include: speed humps, chokers, raised crosswalk, mini-roundabout, crosswalk refuge, raised median island, and chicanes. The guide recommends siting the infrastructure to improve pedestrian access (where pedestrian volume is high) and to reduce pedestrian exposure to vehicles at intersections (shortening pedestrian crossing time and distance).

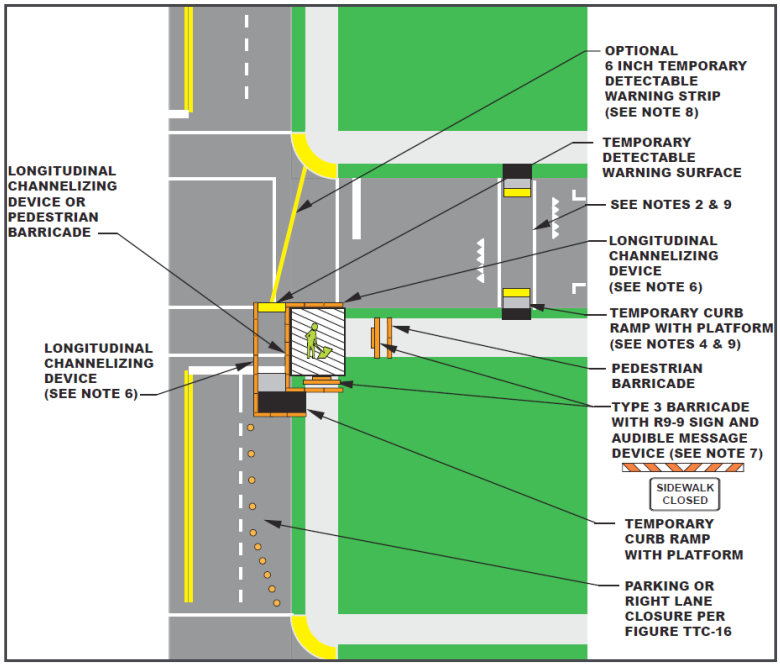
✓ Implement *Work Zone Pedestrian and Bicycle Guidance* as standards.

VDOT should consider formalizing the guidance into standards to improve consistent and regular accommodations for pedestrians of all abilities in project work zones. VDOT should produce virtual or routine training resources for staff who oversee construction and maintenance projects. VDOT should provide a quick reference guide to contractors responsible for compliance with providing accommodations to pedestrians and cyclists through work zones.

Related Policy or Guidance: VDOT *Work Zone Pedestrian and Bicycle Guidance*

http://www.virginiadot.org/business/resources/wztc/2016_WZ_Ped_BikeGuide.pdf

Per the Americans with Disabilities Act of 1990, the needs and control of all road users, including pedestrians, through a temporary traffic control zone shall be included within any roadway construction, maintenance and operations activity. This supplement to the *Virginia Work Area Protection Manual* provides recommendations for temporary traffic control for pedestrians and cyclists. The *Work Zone Pedestrian and Bicycle Guidance* is not a standard, and the *Virginia Work Area Protection Manual* contains the standards for temporary traffic control zones for roadways in Virginia. This guidance includes decision-making tools such as flow charts, example graphics, and checklists to assist the project planner in providing necessary accommodations for pedestrians of all abilities.



Source: VDOT *Work Zone Pedestrian and Bicycle Guidance*

Land Use Policy Improvements

✓ Develop a checklist or model guidance for reviewing subdivisions or site plans for pedestrian safety.

VDOT staff who review subdivision or land development permit requests have minimal guidance for considering pedestrian circulation and safety interior to the site and on adjoining roadways. Further, local VDOT and jurisdiction staff may not be aware of the pedestrian safety issues, so the PPZ should be promulgated to this community of practice. The checklist should include the following:

- Sidewalk (and shared-use path) width and placement along public roads.
- Sidewalk and crosswalk placement internal to development site.
- Pedestrian crossing spacing and distance at intersections and mid-block locations.
- Local agency subdivision ordinances or TIA guidelines best practices.
- Tips for how to determine pedestrian destinations both internal and adjacent to development site so appropriate pedestrian infrastructure can be requested.
- Explanation of roles and responsibilities for obtaining crossing improvements adjacent to, but separate from the private development. Tips on how to get adjacent crossing improvements made as a part of/or separate from individual land development activity.
- Guidance as to how landscaping design can be used to direct pedestrians to safe crossing locations and should permit clear sight lines at intersections and driveways.

VDOT should refer to the *2014 Pedestrian Policy Plan* when developing policy for development review. This plan provided an extensive checklist to assist project developers in the provision of adequate pedestrian and bicycle accommodations during site or project planning and design process. The checklist addresses plan coordination, design, budgeting, safety, access, and much more. (Source: http://www.virginiadot.org/programs/resources/bike/SPPP_FINAL_OnLine_LowRes.pdf)

Related Policy or Guidance: *Land Use Permit Guidance Manual*

http://www.virginiadot.org/business/resources/Land_Use_Permit_Regulations_2011/Land_Use_Permit_Regulations_Guidance_Manual_.pdf

The Land Use Permit Regulations were adopted in March 2010, and the manual was later amended in 2013. The guidance sets forth the rules that must be followed to perform work on property under VDOT's ownership or jurisdiction. Work includes installation of utilities, construction of private and commercial entrances, landscaping, and other activities. The rules outline the criteria that must be met for VDOT to issue a permit and authorize work.

The document references how and when pedestrian facilities should be built on and around a VDOT controlled right-of-way as part of development activity. The

installation of sidewalks, steps, curb ramps, shared use paths, pedestrian underpasses and overpasses within the VDOT controlled right-of-way are authorized under a single-use permit. Installation of pedestrian or bicycle facilities within limited access right-of-way involves additional scrutiny by the CTB prior to the issue of a permit. Pedestrian facilities that are parallel to and within the right-of-way of a nonlimited access highway require the approval of the CTB prior to the issue of a permit.

Related Policy or Guidance: Secondary Street Acceptance Requirements

http://www.virginiadot.org/info/secondary_street_acceptance_requirements.asp

The Commonwealth Transportation Board adopted the Secondary Street Acceptance Requirements in 2011. The regulations outline the criteria that must be met by newly constructed streets to be accepted for maintenance by VDOT.

The regulations include an extensive discussion of criteria for VDOT maintenance of pedestrian accommodations. For VDOT to maintain these facilities, they must be located within VDOT's right-of-way. Accommodations must be provided in the following scenarios:

- Streets with an average daily traffic (ADT) count over 400 vehicles.
- Developments within one-half mile of a public school, regardless of ADT.
- Collector and arterial roads with three or more lanes.
- Stub out connections in subdivisions.
- Developments adjacent to parcels with existing pedestrian facilities. The developer must construct accommodations that connect to these facilities and allow for connection to future facilities.
- Multi-use trails and shared paths located within the right-of-way.
- Alternative accommodations providing equivalent pedestrian mobility as the standard requirement as approved by the District Administrator's Designee.

✓ Update VDOT and local TIA guidelines for pedestrian LOS to include mitigation options at uncontrolled crossings.

VDOT should consider adding mitigation options and guidance for improved pedestrian crossing at uncontrolled intersections adjacent to the development site. VDOT may consider adding pedestrian crossing distance as a measure of pedestrian LOS. Mitigation measures may include the countermeasures that shorten or improve visibility of pedestrian crossings, such as Leading Pedestrian Intervals (LPIs) or signal phasing options, or other traffic calming improvements.

Related Policy or Guidance: *Administrative Guidelines for the Traffic Impact Analysis Regulations*

http://www.virginiadot.org/projects/resources/TIA_Administrative_Guidelines.pdf

The *Administrative Guidelines for the Traffic Impact Analysis Regulations* was adopted in July 2016. VDOT's Administrative Guidelines for Traffic Impact Assessments allows for the reduction of peak hour vehicle trips if bicycle and pedestrian facilities with an LOS of "A" through "C" are within 2,000 feet of the proposed development. Additionally, VDOT guidance allows for pedestrian crossing distances to be considered in the LOS determination. Traffic impact mitigation options are limited to on-site pedestrian accommodations such as sidewalks and on-site intersection treatments.

The guidelines provide details on the methodologies and procedures for assessing transportation impacts caused by new development. The guidelines cover all aspects of traffic impact analyses, including:

- When to include pedestrian and bicycle LOS analysis and how LOS should be calculated.
- Reductions in the number of vehicle trips for pedestrian and bicycle accommodations. The number of vehicle trips for portions of the development within a 2,000-foot radius of the connection can be reduced by 1.5 percent to 4.0 percent depending on the pedestrian LOS of the facility.

Location and Design Policy Improvements

✓ Implement and improve existing multimodal design guidelines, with focus on pedestrian crossing improvements.

VDOT should seek consistent application of existing specifications, such as the Department of Rail and Public Transportation's (DRPT) *Multimodal System Design Guidelines* for mixed-use urban centers, and describe guidelines in the VDOT *Road Design Manual*. These guidelines provide multimodal designs for implementation of Complete Streets. Special attention should be paid to improved design specifications for the following:

- Overhead lighting at crosswalks.
- Equipment options or components for flashing beacons.
- High-visibility markings at mid-block crossings and in combination with decorative crosswalk treatments.
- Pedestrian refuge islands (medians) in combination with other multimodal design features and landscape design.
- Landscaping design guidance to direct pedestrians to safe crossing locations.

Case Study for Roadway Design Standards

http://www.fdot.gov/planning/systems/programs/sm/accman/pdfs/fdotmedianhandbook.pdf

The Florida Department of Transportation (FDOT) has issued design guidance for medians that specifies the appropriate width of medians to accommodate a median refuge island. According to the FDOT guidance, refuge islands must be a minimum of 6 feet wide, though preferably 8.5 feet wide. The guidance also details how pedestrian and bicyclist amenities can be incorporated into a variety of median designs and the overall design principles that should guide median design to accommodate all travel modes.

Related Policy or Guidance: VDOT *Road Design Manual*, "Appendix A—Design Guidelines"

http://www.virginiadot.org/business/locdes/rdmanual-index.asp

The latest version of the *Road Design Manual*'s Appendix A was adopted in July 2017. The design manual provides design standards for the development of various roadway types in the Commonwealth. The manual sets standards for the following roadway elements: design speed, minimum radius, minimum stopping sight distance, width of lane, curb and gutter widths, buffer strip widths, sidewalk widths, and slope. The document also contains a section (Section A-5) that

provides guidelines for bicycle and pedestrian facilities.

Section A-5 considers pedestrian needs in its design guidance for active transportation facilities, including:

- The width and horizontal clearance of shared use paths, trails and trail heads, curb ramp locations and design guidelines.
- Pedestrian Access routes (sidewalks) height restriction, width, grade, slope, surface treatment.
- Temporary traffic control plans must provide accommodations to maintain pedestrian traffic, especially in urban areas.

Related Policy or Guidance: VDOT *Road Design Manual*, "Appendix B—Design Guidelines"

http://www.virginiadot.org/business/locdes/rdmanual-index.asp

Appendix B of the *Road Design Manual* was revised in July 2015. It provides street design standards for the development of new subdivision streets that will be classified as "local" streets. Like Appendix A of the *Road Design Manual*, Appendix B provides standards for various elements of roadway design, such as design speed, minimum radius, minimum stopping sight distance, width of lane, curb and gutter widths, buffer strip widths, sidewalk widths, and slope.

The manual requires curb ramps for all streets that include pedestrian access routes. It also sets forth sidewalk standards to ensure compliance with ADA requirements, and requires adequate separation between shared use paths adjacent to a roadway. Pedestrian tunnels are also encouraged to provide safe pedestrian crossings from roadway traffic.

Appendix B also advises that pedestrian needs be considered when designing planting strips or roadway lighting. These elements should be positioned so as not to impede pedestrian access or block drivers' views of pedestrians.

Related Policy or Guidance: DRPT *Multimodal System Design Guidelines*

http://www.drpt.virginia.gov/planning/multimodal-guidelines/

The *Multimodal System Design Guidelines* were published in October 2013 by the Virginia DRPT to assist localities to plan and design multimodal corridors. The guidelines provide educational resources for understanding the foundations and

principles of multimodal planning, while also providing information on current industry practices and standards for developing multimodal facilities. Pedestrian-oriented design and accommodation are discussed throughout the document. The guidelines encourage use of the Modal Emphasis principle, where one or more travel modes are emphasized in the design of a corridor. This approach creates a framework for establishing pedestrian-oriented design. The guidelines provide optimal and minimum cross section standards for multimodal facilities in each corridor type, including pedestrian paths. The guidelines also present best intersection design practices, including ones for pedestrians. The document helps localities identify opportunities for implementing transportation demand management, as well as funding options for multimodal projects. Chapter 5 of the document includes guidelines for retrofitting corridors to fulfill multimodal functions. These guidelines are referenced in Appendix B(2) of the *Road Design Manual*.

Related Policy or Guidance: *Traffic Engineering Design Manual*

http://www.virginiadot.org/business/locdes/traffic-engineering-manual.asp

The *Traffic Engineering Design Manual* was adopted in 2014 and dictates the processes and standards for installing traffic signals, lighting, signing, and pavement markings. Chapters 1 and 3 specify the design and implementation of pedestrian safety accommodations at intersections and crosswalks.

VDOT has established a 19-step process in Chapter 1 for designing traffic signals for new, replacement, and modified installations. Steps 6 through 9 of the process detail the iterative process for locating crosswalks, curb ramps, stop lines, and pedestrian signal heads. Decisions are to be made in consideration of the other elements and their respective guidelines and standards. The manual recommends longitudinal markings for urban and high pedestrian activity locations and transverse markings for low volume rural and residential areas. All crosswalks must have a minimum width of six feet. Coordination is required for curb ramp, stop line, and pedestrian signal head location decisions and must follow the applicable VDOT, VDOT District, ADA, and MUTCD guidelines.

Chapter 3 addresses pavement marking design and procedures, and it recommends the consideration of crosswalks and signalized and unsignalized intersections during the marking plan. As in Chapter 1 of the manual, marked crosswalks are to follow VDOT's Guidelines for the Installation of Marked Crosswalks. Proposed marked crosswalks at uncontrolled locations require an engineering study.

Maintenance Policy Improvements

✓ Review VDOT sidewalk maintenance policies, including snow removal practices.

VDOT works with local governments to perform long-term maintenance of sidewalks, and VDOT maintains the sidewalks in more rural areas. Underlying or adjacent property owners are also responsible for routine sidewalk maintenance, such as debris removal. However, VDOT does not remove snow or ice from sidewalks, and pedestrians travel carefully while ice and snow recede from sidewalks and curb ramps.

Related Policy or Guidance: *Asset Management's Best Practices Manual*

http://www.vdot.virginia.gov/programs/resources/Asset_Mgmt_Best_Practices_Manual_BP_12.9.pdf

The VDOT *Asset Management's Best Practices Manual* details the department's expectations and responsibilities for the maintenance of pedestrian facilities. Sidewalk facility surfaces should be smooth and free of defects, and VDOT will promptly repair problems if the facility is under VDOT's jurisdiction. VDOT is also responsible for pedestrian facilities built to VDOT design standards on state maintained routes. These responsibilities include:

- For towns of less than 3,500 population, VDOT will maintain sidewalks in which it has participated in the sidewalk construction cost.
- Outside of incorporated towns and cities, VDOT is responsible for the maintenance of all public sidewalks located on the right-of-way.
- Pedestrian accommodations located outside incorporated towns will be eligible for maintenance if built in accordance with the Subdivision Street Requirements.
- Pedestrian facilities not covered by the Subdivision Street Requirements may be approved for maintenance after review.

Snow and ice removal from pedestrian facilities is not a VDOT responsibility. However, VDOT will remove snow and ice from bicycle facilities if the accommodation is contiguous with the roadway (i.e. road shoulder, on-street bicycle lane).

✓ Incorporate pedestrian safety treatments into routine maintenance activities, such as resurfacing and overlay projects.

VDOT performs a safety assessment for all projects, including a field inspection of existing traffic control devices, curb ramp conditions, roadway markings, and crash history. The field inspection should carefully note the type and placement of crosswalk markings relative to curb ramps, pedestrian activity, and controlled crossings. As part of the safety analysis process for maintenance and operations projects, VDOT should direct Districts to review online maps showing PSAP priority sites and corridors to identify focus areas for field review and to identify pavement marking and signing adjustments and additions that could be made during maintenance activities to improve pedestrian safety.

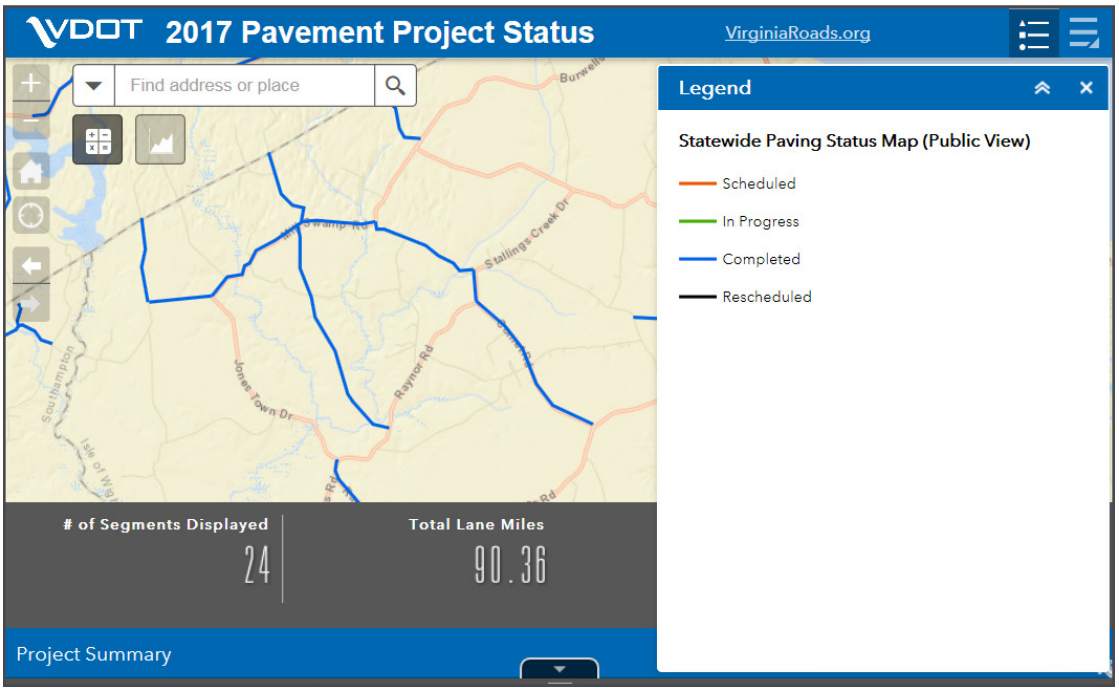
VDOT staff should strongly consider improving or adding low-cost treatments (i.e. marked crosswalks, refuge islands) as part of resurfacing projects, especially where the corridor overlaps with PSAP priority sites and corridors. To facilitate this coordination, VDOT should provide instruction and guidance to staff to know how to identify mapped PSAP priority sites. The instruction should also include example best practices from across Virginia where Districts have successfully implemented pedestrian crossing improvements.

Related Policy or Guidance: VDOT Safety Analysis Guidelines for Preservation and 3R (Resurfacing, Restoration and Rehabilitation) Maintenance Projects

http://www.virginiadot.org/business/resources/FHWA_VDOT_PM-3R_Agreement-_March_13_2015.pdf

An agreement between VDOT and the Federal Highway Administration (FHWA) includes a requirement to conduct safety analysis for federally funded maintenance projects. This document outlines the process by which VDOT will conduct the safety analysis. The process requires VDOT to follow a checklist and do the following for most eligible projects:

- Identify roadway segments planned for preservation.
- Produce a summary-level crash analysis.
- Document crash types.
- Conduct a field review.
- Document findings.
- Identify potential HSIP projects beyond the scope of the preservation or 3R project.


VDOT 2017 Pavement Project Status
VirginiaRoads.org
Find address or place
Legend
Statewide Paving Status Map (Public View)
Scheduled
In Progress
Completed
Rescheduled
# of Segments Displayed
24
Total Lane Miles
90.36
Project Summary

Source: VDOT

4 Data Analysis and Countermeasure Selection

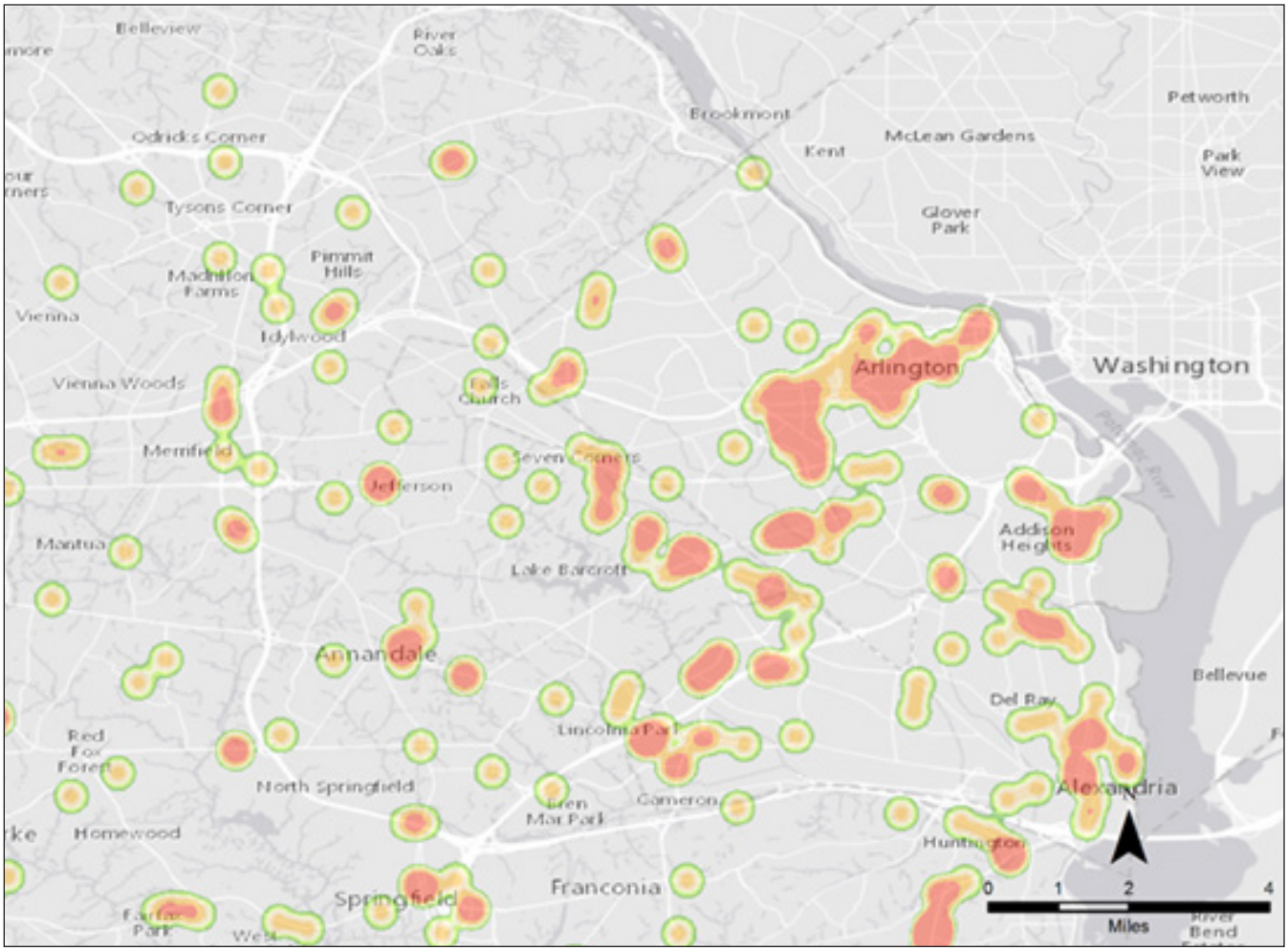
The PSAP's core task was to analyze pedestrian crash history, identify high-potential corridors for future crashes, and develop countermeasure improvement options. The first element was the crash cluster analysis, focusing on intersections or crossing areas with dense crash history. The second element was the systemic (corridor) analysis, starting with a list of criteria that measure exposure to pedestrians crossing roadways. The criteria or measures were weighted per their relative importance to pedestrian mobility and crash potential to identify priority corridors. Each priority crash cluster or corridor location identified was further developed into "cut sheets" including additional details about roadway conditions and crash types, yielding recommendations for countermeasures. All sites are subject to further scrutiny by local agencies and VDOT Districts to explore overlap with future projects and to conduct field reviews to refine countermeasure recommendations.

Crash Cluster Analysis

The project team defined a crash cluster as a relatively compact, neighborhood-size area that has a high-frequency of pedestrian crashes. These clusters are generally the size of a few city blocks. The relative intensity of the crash cluster, crash types, and additional roadway characteristics informed the countermeasures recommended.

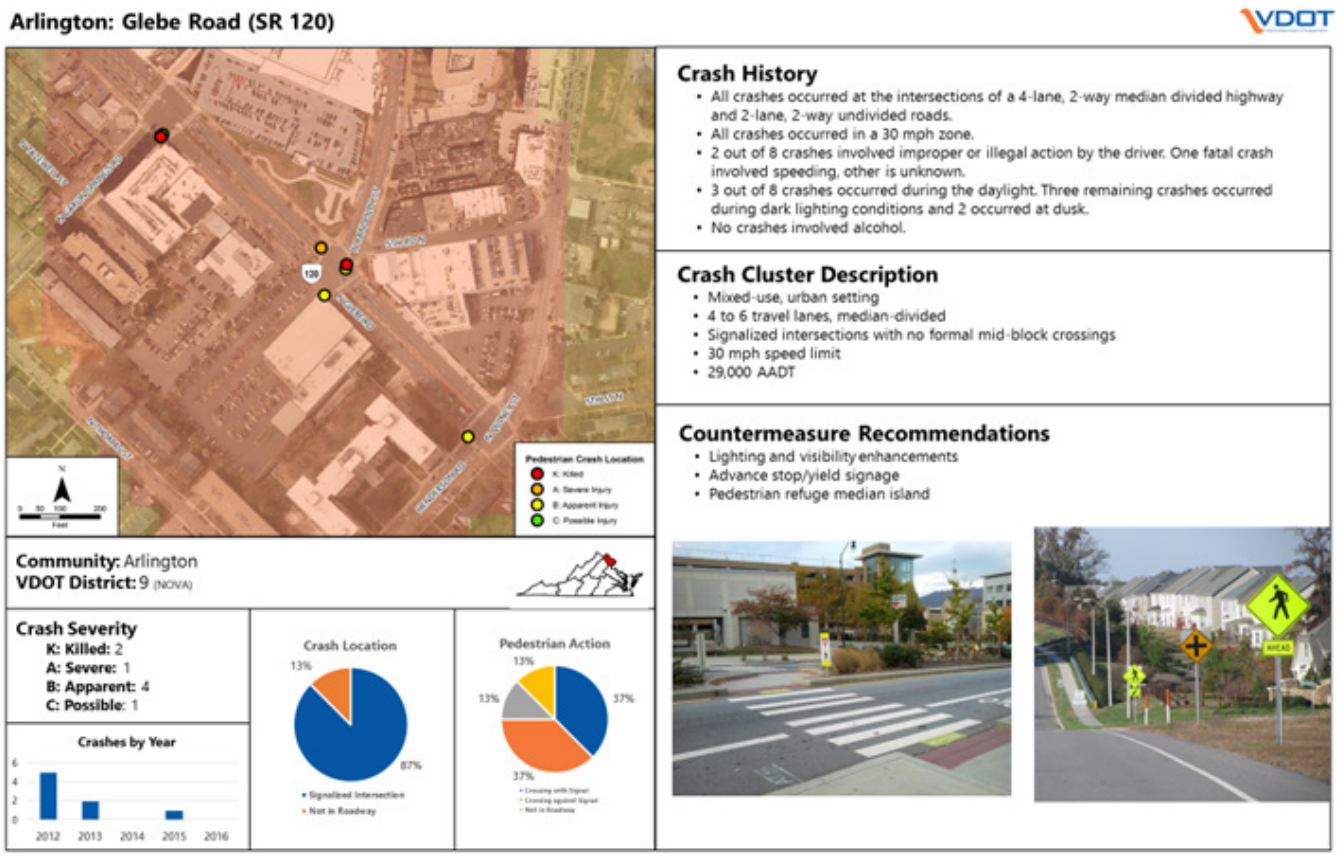
The project team analyzed five years (2012-2016) of fatal and injury pedestrian crashes for the entire state. The analysis excluded all crashes that did not result in a reported injury. The team processed the crashes using GIS software. This analysis considered the geographic density of crashes only, and evenly weighted the distance between crashes. No additional weight was assigned to fatal or more severe injury crashes over less severe injury crashes. The results of this analysis produced a map of dense clusters of fatal and injury pedestrian crashes. The map, "Statewide Crash Cluster Analysis Output Example," illustrates these results for one part of the state. The project team identified a total of 328 individual crash clusters statewide for further analysis.

Statewide Crash Cluster Analysis Output Example



Each cluster received a score through the density analysis in GIS. Higher-scored clusters contain several fatal and injury crashes located near one another. VDOT sorted the 328 clusters into three tiers based on these scores. The team analyzed the priority tier of crash clusters to determine locations suitable for more detailed analysis. VDOT selected 19 locations and generated formal "cut sheets" for each of the priority crash clusters. These sheets include the location and VDOT District, crash types, posted speeds, number of travel lanes, and proposed countermeasures. The graphic "Example Crash Cluster Map: Arlington Area, District 9" shows an example cut sheet for a crash cluster in Arlington, District 9.

Example Crash Cluster Map: Arlington Area, District 9



The table "Crash Cluster by Community and VDOT District" outlines the location of the 19 priority clusters within the state by name of the local jurisdiction and VDOT district. All priority site crash cluster cut sheets are in the Appendix. These locations represent areas with the strongest history of pedestrian crashes over the study period with similar characteristics. Other locations identified in the crash cluster analysis may have a similarly strong history of pedestrian safety issues, but present challenges such as difficult roadway geometry, unknown conditions, or unclear pedestrian behaviors. Although the crashes occurred within close proximity, their causes may be too unrelated to address in a single spot project. State and local planners must exercise professional judgment when considering projects at specific, narrowly defined locations.

Priority Crash Clusters by Community and VDOT District

VDOT District	Location
2: Salem	• Main Street (US 460) - Blacksburg • Prices Fork Road (SR 412) - Blacksburg • Tyler Avenue (SR 177) – Radford • Campbell Avenue (US 11) - Roanoke
4: Richmond	• Broad Street (US 33/250) - Richmond • Belvidere Street (US 1) - Richmond • 10th Street - Richmond
5: Hampton Roads	• Pacific Avenue (US 60) - Virginia Beach
6: Fredericksburg	• William Street (US 1-Bus.) - Fredericksburg
7: Culpeper	• Water Street - Charlottesville • Ridge Street - Charlottesville • Emmet Street (US 29) - Charlottesville • Main Street (US 250-Bus.) - Charlottesville • Main Street (US 15) - Culpeper
8: Staunton	• Pleasant Valley Road - Winchester • Piccadilly Street (SR 7) - Winchester
9: NOVA	• Glebe Road (SR 120) - Arlington • Clarendon Boulevard - Arlington • Richmond Highway (US 1) - Fairfax

Systemic/Predictive Analysis—Corridor Evaluation

VDOT analyzed the state road network for corridors with characteristics which may lead to pedestrian crashes. These roads may or may not have any history of pedestrian fatalities or injuries. This systemic/predictive approach to pedestrian safety allows for proactive consideration for traffic safety. Rather than retrofitting locations after crashes have occurred, planners and policy makers can identify circumstances along an entire network that may be potentially unsafe. Like the crash cluster analysis, the project team used the characteristics and context of each corridor to develop relevant safety countermeasure recommendations.

VDOT, with support from the stakeholder team, identified twelve key criteria or measures that may indicate elevated crash potential or exposure for pedestrians:

- Annual average daily traffic (AADT).
- Posted speed limit.
- Number of lanes and presence of a median.
- Zero vehicle households (Census block group-level).
- Population below the poverty line (Census block group-level).
- Population density (Census block group-level).
- Density of employed persons (Census block group-level).

- Existing pedestrian crash history.
- Urban/Rural context (as defined by Census-defined urbanized boundaries).
- Proportion of alcohol-related crashes by VDOT district.
- Proximity to a park (within ¼ mile).
- Proximity to a school (within ¼ mile).

While these criteria do not represent all factors of interest to pedestrian exposure and safety, these were the criteria for which reliable statewide data were available. Other criteria or measures of interest included transit stop location, signal density, and availability of sidewalks. Each of selected criteria were weighted according to importance as an indicator of pedestrian traffic and crash potential. The table below, "Pedestrian Risk Criteria and Scoring," outlines the method used by the project team.

Pedestrian Crash Potential Criteria and Scoring

Pedestrian Criteria (Unit of Measure)	Weight (percent of Total Score)	Categories & Corresponding Score
Annual average daily traffic (AADT)	High (14 percent)	• < 500 = 2 • < 1,500 = 4 • < 7,000 = 6 • < 20,000 = 8 • ≤ 40,000 = 10 • > 40,000 = 8
Posted speed limit	High (14 percent)	• ≤ 25 = 1 • 30-35 = 5 • 40-55 =10 • 60+ = 5
Number of lanes and presence of a median	Medium (7 percent)	• 1 lane = 2 • 2 lanes, divided = 4 • 2 lanes, undivided = 6 • 3 or 4 lanes = 8 • > 4 lanes =10
Zero vehicle households (Census block group-level)	High (14 percent)	• 1st-10th percentile = 1 • 11th-20th percentile = 2 • 21st-30th percentile = 3 • 31st-40th percentile = 4 • 41st-50th percentile = 5 • 51st-60th percentile = 6 • 61st-70th percentile = 7 • 71st-80th percentile = 8 • 81st-90th percentile = 9 • 91st-100th percentile = 10

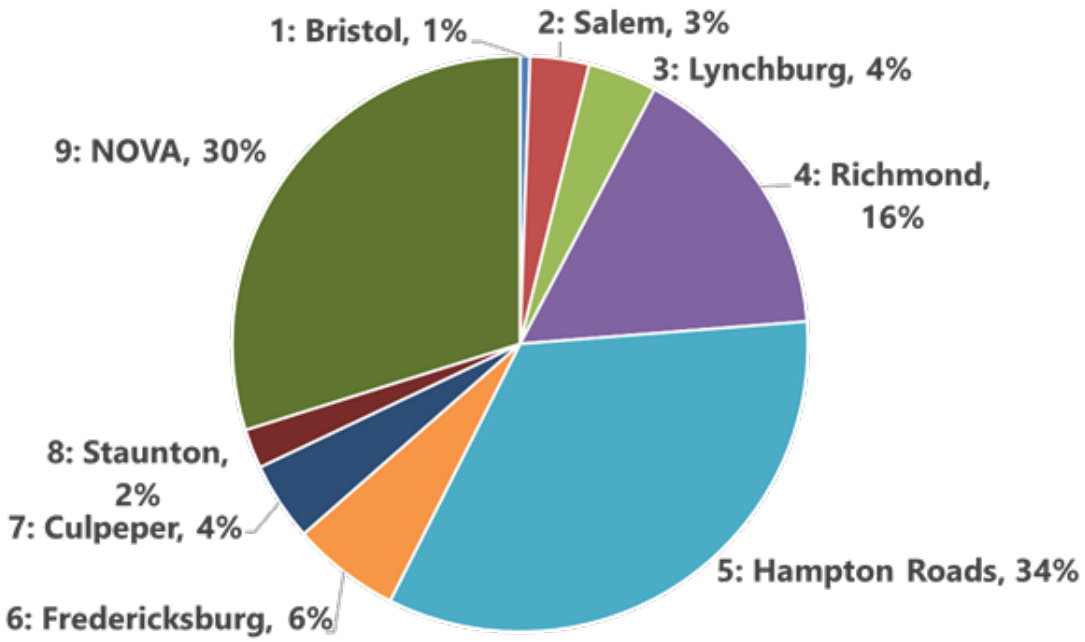
Population below the poverty line (Census block group-level)	Low (4 percent)	• 1st-10th percentile = 1 • 11th-20th percentile = 2 • 21st-30th percentile = 3 • 31st-40th percentile = 4 • 41st-50th percentile = 5 • 51st-60th percentile = 6 • 61st-70th percentile = 7 • 71st-80th percentile = 8 • 81st-90th percentile = 9 • 91st-100th percentile = 10
Population density (Census block group-level)	High (14 percent)	• 1st-10th percentile = 1 • 11th-20th percentile = 2 • 21st-30th percentile = 3 • 31st-40th percentile = 4 • 41st-50th percentile = 5 • 51st-60th percentile = 6 • 61st-70th percentile = 7 • 71st-80th percentile = 8 • 81st-90th percentile = 9 • 91st-100th percentile = 10
Employment density (Census block group-level)	Medium (7 percent)	• 1st-10th percentile = 1 • 11th-20th percentile = 2 • 21st-30th percentile = 3 • 31st-40th percentile = 4 • 41st-50th percentile = 5 • 51st-60th percentile = 6 • 61st-70th percentile = 7 • 71st-80th percentile = 8 • 81st-90th percentile = 9 • 91st-100th percentile = 10
Pedestrian crash history	Low (4 percent)	• ≤ 250 feet from a crash = 10 • > 250 feet from a crash = 1
Urban/Rural context	Medium (7 percent)	• Urban =10 • Rural = 1
Proportion of alcohol-related crashes by VDOT district	Low (4 percent)	• Top 3 districts (highest proportion of alcohol-related pedestrian crashes) = 10 • Middle 3 districts = 5 • Bottom 3 districts = 1
Proximity to a park (quarter mile)	Low (4 percent)	• ≤ ¼ mile = 10 • > ¼ mile = 1
Proximity to a school (quarter mile)	Medium (7 percent)	• ≤ ¼ mile = 10 • > ¼ mile = 1

VDOT screened the entire road system in the state by using VDOT's GIS linear referencing system (LRS) network and by applying these twelve criteria. The LRS network represents every public road in the state in a digital format. The team removed all access-controlled roads prior to analysis since pedestrians are not

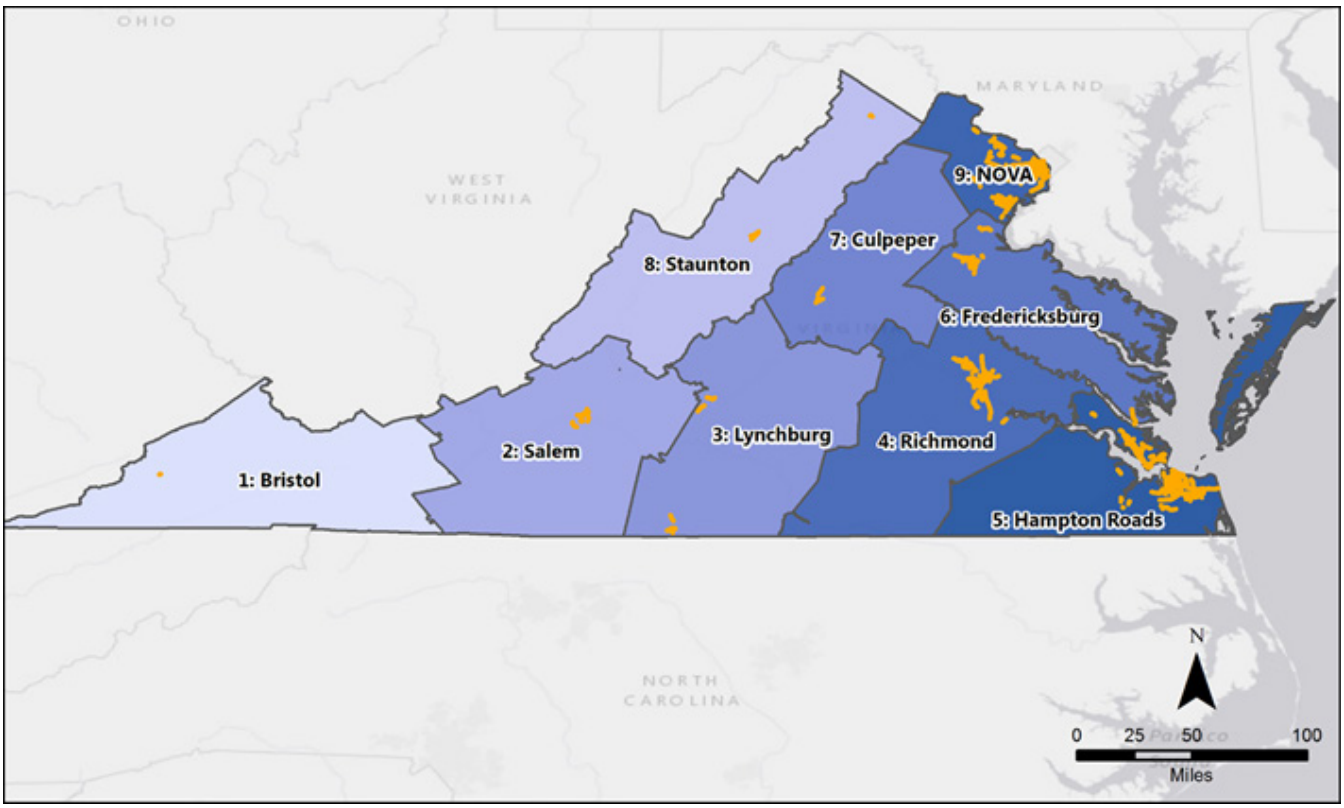
typically present along these roads and their inclusion may influence the distribution of scores. The team scored each roadway segment in the state, with 100 representing the highest possible composite score. Only the top 0.1 percent of scores were selected for inclusion in the final set of priority corridors. High-scoring corridor segments were also filtered for those that were a minimum of 1,000 feet in length—roughly equivalent to a large city block.

The systemic analysis generated a pool of 181 candidate priority corridors, 43 of which were further detailed in cut sheets in the PSAP Appendix. VDOT selected the 43 as a representative sample of corridors from across all VDOT districts containing at least one priority corridor. See the chart "Distribution of Priority Corridors by VDOT District" for a clearer understanding of where most priority corridors were located by VDOT District. The map "Geographic Distribution of Priority PSAP Corridors" shows the geographic distribution of priority corridors throughout the state.

Distribution of Priority Corridors by VDOT District



Geographic Distribution of Priority PSAP Corridors



Cut sheets were generated for these final 43 priority corridors. These cut sheets can be found in the Appendix. Each cut sheet includes a map of the corridor; a description of the location; roadway characteristics such as traffic volumes, posted speeds, and number of travel lanes; and aerial imagery to describe the surrounding land use context. Where an individual corridor was too long to include on one cut sheet at a readable scale or where the character of the corridor changed significantly, the corridor was divided into segments. A separate cut sheet was produced for each segment. Each cut sheet also provides a description of the segment and general countermeasure recommendations.

The 181 corridors represent 610 miles of Virginia roads, 61 percent of which are locally maintained. These corridors are generally located in densely populated, urbanized areas. They are roads with high volumes of motor vehicle traffic and typically have between four and six travel lanes. Despite being difficult for pedestrians to navigate and having high exposure to vehicles, they are locations where people are likely to walk. Since these corridors were selected according to common criteria, they represent locations that may benefit from similar countermeasures. However, as with the crash cluster analysis, the priority corridors identified during the PSAP process are intended to serve as a guide for planning decisions and should be further discussed and refined per field review and coordination with the local agency and VDOT District.

Cut Sheet Example

Warwick Boulevard (US 60) – Sheet 7 of 7

Community: Newport News
VDOT District: 5 (Hampton Roads)

Corridor Description

- **Segment 1:** 2-lane undivided roadway with adjacent industrial and residential land uses. **AADT: ~10,000 to 15,000; Speed Limit: 45**
- **Segment 2:** 6-and-4-lane median divided roadway with moderate commercial and residential density land use. **AADT: ~25,000 to 40,000; Speed Limit: 35**

Recommended Countermeasures

- **Segment 1:** Advance warning signage, RRFBs (if applicable), and high visibility crosswalks at pedestrian activity centers.
- **Segment 2:** Pedestrian signal heads at signalized intersections, modification of existing medians to median islands, PHBs at key mid-block locations, review of signal phasing for extended pedestrian phase or LPI, and high visibility crosswalks.

Notes

- **Segment 1:** Potential for crosswalks at key pedestrian activity centers.
- **Segment 2:** Width of road and activity generators support the deployment of crosswalk facilities and pedestrian amenities.

Countermeasure Selection

The crash cluster and corridor countermeasure selection methodology was a two-part process of an existing conditions review and application of countermeasure guidance. Corridors and cluster sites were reviewed for existing pedestrian facilities and existing roadway conditions. Crash type summaries were also evaluated for the crash cluster sites. The primary site conditions considered when selecting countermeasures included the following:

- Number of travel lanes.
- Speed limit.
- AADT.
- Presence of median or signalized crossing.
- Land use context and nearby pedestrian destinations.
- Presence of existing crosswalk markings.
- Crash types and driver yield compliance reported.
- Time of day for recorded crashes.
- Location of crashes relative to crossing types (i.e. marked crosswalks).

Countermeasures recommendations were derived from current pedestrian safety research and best practices. Research referenced included the following resources:

- *NCHRP Synthesis 498: Application of Pedestrian Crossing Treatments for Streets and Highways*.
- *NCHRP Report 841: Development of Crash Modification Factors for Uncontrolled Pedestrian Crossing Treatments*.
- FHWA *Road Diet Informational Guide*.
- PEDSAFE, Pedestrian Safety Guide and Countermeasure Selection System.
- The MUTCD (and Interim Approvals list as of July 31, 2017).

VDOT has developed a library of potential countermeasure options in 2017. This list of countermeasures was referenced, in addition to other proven countermeasures discussed in national research, when assigning recommended improvements to priority sites. The Appendix includes a full glossary of the countermeasures included in the PSAP. The most common countermeasures recommended for priority sites (both crash clusters and corridors) included the following:

- High-visibility crosswalk.
- Curb extensions.
- Pedestrian countdown signal head.
- LPI.
- Advance warning signage.
- In-street Yield sign.
- PHB.
- RRFB and/or other flashing beacon.
- Pedestrian refuge island (raised median).
- Road Diet.
- Sidewalk connections.
- Transit stop access improvements.

5 Overall Action Plan Strategies

Engineering Implementation Strategies

Crash clusters and high-potential corridors have been prioritized for countermeasure recommendations, but priority sites may need to be further ranked for implementation given funding constraints. VDOT may rank improvements based on factors such as cost to install the countermeasure(s), right-of-way (ROW) availability and utility conflicts, and opportunity to incorporate the countermeasure into other VDOT projects. For example, VDOT may review resurfacing schedules for opportunities to reallocate lane width to accommodate a Road Diet or refuge island. Other opportunities for accommodating the countermeasures into other VDOT projects are described later in this section.

Each priority site has been itemized in a look-up table, available in the Appendix, including site identifier data (i.e. corridor name or segment number), relevant roadway characteristics, countermeasure options, and relative costs. Actual cost estimates should be developed for each site upon field review. Site countermeasure costs are presented as three generalized cost categories—Low, Medium, and High—each representing simplified cost estimate categories such as $0 to $10,000, $10,000 to $50,000, and greater than $50,000, respectively. These cost estimates were based on the average per unit countermeasures costs from the 2013 report, *Costs for Pedestrian and Bicyclist Infrastructure Improvements: A Resource for Researchers, Engineers, Planners, and the General Public*. Engineering judgment, detailed field review, and design guidelines should be applied to all potential countermeasure options to determine the appropriate type and cost of improvements at each site.

Non-Engineering Strategies

Non-engineering strategies, such as public education campaigns, law enforcement operations, and improved safety evaluation support the engineering strategies (countermeasures) recommended by the PSAP. VDOT partners, such as the DMV, the National Highway Traffic Safety Administration (NHTSA), and local governments are key to developing and sustaining public awareness of and compliance with traffic safety laws designed to prevent pedestrian crashes and fatalities.

In 2017, Virginia DMV, DOT, and the Virginia State Police (VSP) agreed to a goal to eliminate roadway fatalities. This Towards Zero Deaths vision is called Arrive Alive Virginia and is supported by the *Virginia 2017-2021 SHSP*. Implementation for behavioral strategies is accomplished through the DMV HSP and partners' efforts. The following strategies support the pedestrian safety goals in these plans.

Continue to meet with local agencies and other pedestrian safety stakeholders.

The Virginia DMV organized a Pedestrian Fatality Task Force in 2017 in response to increasing pedestrian fatalities in the state in 2016. The task force is looking at pedestrian crash and fatality data trends, with special focus on what local agencies can do to improve pedestrian safety. The Task Force includes representatives from six local agencies with especially high pedestrian fatality rates: Richmond, Henrico County, Norfolk, Newport News, Roanoke, and Fairfax County. The Task Force also includes stakeholders from law enforcement, transportation departments, and pedestrian safety advocacy organizations. Dwight Jenkins, the DMV program manager for pedestrian and bicycle safety, helps plan these meetings once per quarter, and the meetings will continue until pedestrian fatality trends decline.

Develop a toolkit of multi-media marketing materials for educating the public about pedestrian safety.

Public education messages should convey specific messages about expected behaviors that can address pedestrian safety. For instance, pedestrian crash trends suggest that messages should remind drivers that pedestrians have the right of way when in the crosswalk.

During these meetings, task force members present or share information about current activities, such as the Alexandria Vision Zero program and the Northern Virginia/DC area program called Street Smart. DMV has worked with non-governmental organizations such as AARP to create educational materials, such as the "See and Be Seen" brochure for older pedestrians in the Northern Virginia region. These materials should be adapted for a statewide pedestrian safety campaign, including multilingual materials and partnerships with public health officials.

Work with partner organizations to continue and expand training opportunities for local agency law enforcement officers and transportation safety staff.

The Virginia DMV worked with NHTSA and offered a Transportation Safety Institute (TSI) course to six agencies focusing on pedestrian safety. The DMV also worked with NHTSA to pilot the Coastal Pedestrian Safety Awareness Project in Virginia Beach, in addition to several other coastal locations in other states.

Continue to review the DMV police report form for opportunities to improve data recorded for pedestrian crashes.

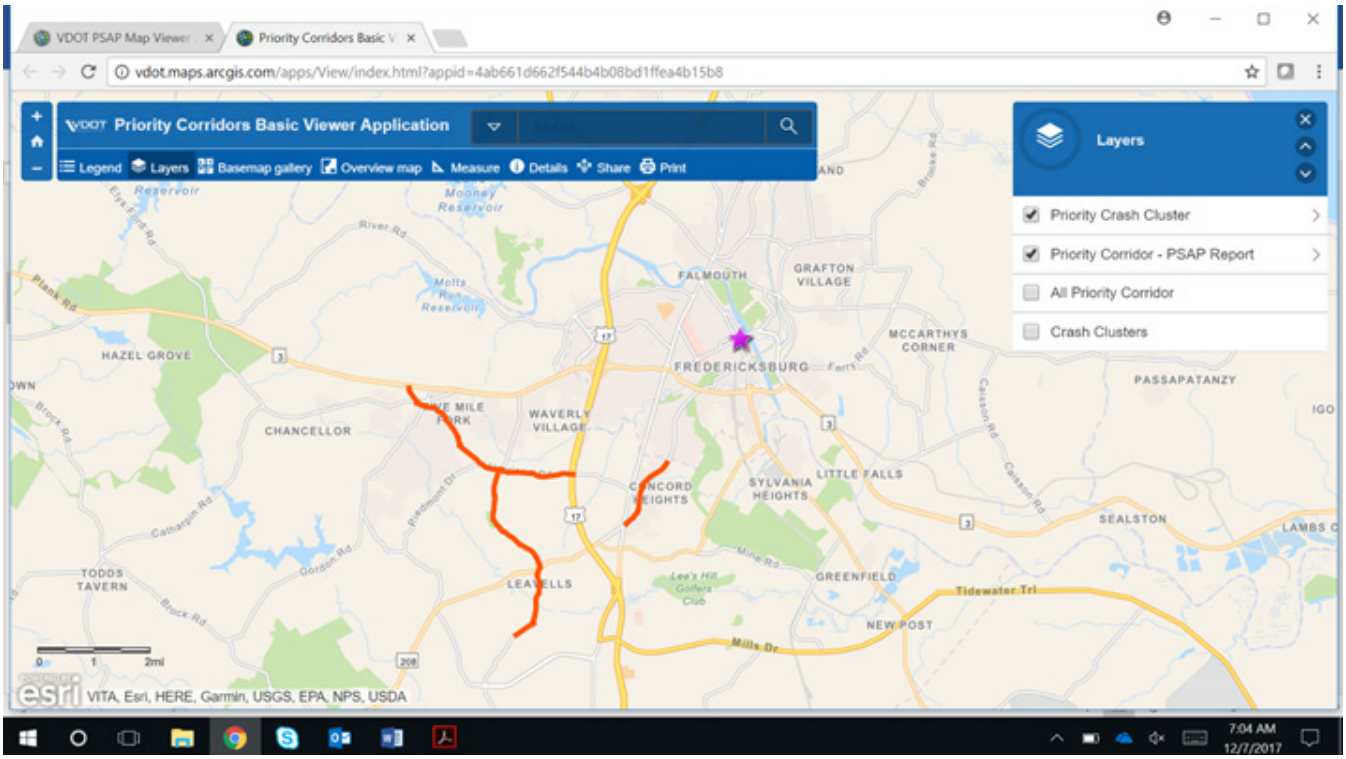
The DMV has been reviewing the standard Police Crash Report (FR300P) for possible updates to collect more detailed information about pedestrian crashes. This information is received by TREDS (Traffic Records Electronic Data System) – the state's crash reporting system – and it is a key resource for evaluating pedestrian crash and fatality trends. The FR300P form and TREDS reporting system should be further evaluated for opportunities to include more details from pedestrian crashes. This data will improve future data analysis and pedestrian safety recommendations.

Outreach and Next Steps

Review the results of the PSAP.

High priority corridors and crash clusters identified during the PSAP process were digitized and mapped for local government agencies and VDOT Districts to view. These priority sites were mapped and made available online, and officials were instructed to contact the VDOT Traffic Engineering Division to request a copy of the respective cut sheets for priority sites. The online map is shown in the image below.

VDOT ArcGIS Online PSAP Viewer: Priority Corridors and Priority Crash Clusters in the Fredericksburg Area



Conduct a local review of the priority sites.

The local agency or VDOT District should review the priority sites and consider whether there are planned projects into which the pedestrian safety improvements may be incorporated. For instance, the priority site may fall on a roadway where resurfacing is scheduled to occur over the next few years, or a SMART SCALE highway project has been or is about to be proposed. The local agency and VDOT should discuss opportunities to incorporate the countermeasures into planned projects and activities. Safety assessments, required for all VDOT project, should include a review of the PSAP recommendations.

The local agency or VDOT District should also consider other corridors in their area that have similar characteristics to the priority sites. For example, priority sites are frequently located along multi-lane highways passing through suburban or commercial areas. Similar corridors or intersections may also be important locations

at which to consider countermeasure improvements. The agency or District should consider evaluating the site according to many of the same criteria and references as used in the PSAP.

The local agency and/or VDOT staff should visit the site and collect additional information that can help inform countermeasure selection and placement. Additionally, the local agency or District may consider conducting a **Road Safety Audit** along priority corridors to better understand the conditions and refine countermeasure options. Local staff should collect information such as the following during site visits and more detailed investigation:

- Distance between pedestrian crossings, both at controlled intersections and uncontrolled crossings.
- Right-of-way availability.
- Driveway and roadway intersections.
- Condition of sidewalks, marked crosswalks, and warning signage.
- Crossing distance.
- Pedestrian volumes.
- Conflicts between turning vehicles and pedestrian movements.
- 50th and 85th percentile speed (as collected in a speed study) and the difference between posted and actual speeds.
- Proximity to important pedestrian destinations, such as parks, schools, or bus stops.
- Visual obstructions and sightline distances between drivers and pedestrians.

Submit pedestrian safety improvements for HSIP, SMART SCALE, Transportation Alternatives Program (TAP), or as part of resurfacing projects.

An overall objective of the PSAP was to identify sites and improvements that can benefit pedestrian safety across the state, following a data-driven process and stakeholder input. The results of the PSAP are preliminary and should be further vetted according to local input and field review. Once vetted, the PSAP recommendations should be considered for programming and funding by VDOT. The **VDOT HSIP** is a prime opportunity, given that the PSAP followed a data-driven process to identify pedestrian improvements. The HSIP program reserves funding for bicycle and pedestrian safety improvements. The window for submitting HSIP projects is generally in the Fall of each year, closing November 1st. VDOT Districts should coordinate HSIP submittals with local agencies.

Virginia's SMART SCALE is the state's primary prioritization process for scoring and ranking projects across all modes for programming and funding over a six-year period. SMART SCALE is described in more detail in Chapter 3 of the PSAP. Pedestrian safety improvements can be submitted as either stand-alone pedestrian projects or as accommodations within highway projects submitted to SMART SCALE. SMART SCALE considers new project submittals every 2 years, and the window for submittals is generally open in the spring and early summer months. Pedestrian safety

improvements can boost a highway project's multimodal score while not negatively impacting the cost-benefit score. VDOT and local agencies can realize cost efficiencies, in addition to the safety improvements, by incorporating pedestrian countermeasures into highway SMART SCALE projects. VDOT Districts and local agencies should coordinate when considering pedestrian safety accommodations as part of SMART SCALE submittals.

TAP (set-aside that also includes Safe Routes to School) is another opportunity to fund pedestrian accommodations. The **Revenue Sharing program** between the Commonwealth and the locality could also be used to split the cost for pedestrian elements of improvements or standalone projects. Proposed projects for funding from all of these programs are now submitted by accessing CTB's **Smart Portal**. Additional information on the requirements for electronic submittals is provided on the portal website.

Update the PSAP analysis results.

As future year pedestrian crash data is coded, digitized and analyzed, the analysis results and countermeasure recommendations of the PSAP should be refreshed at least every 3 years. Future trends may indicate that priorities should shift to new areas of the state or to other types of corridors. Also, as Districts and local agencies work to implement the PSAP, their feedback should be collected and considered for future PSAP process improvements.

VDOT should also track the implementation of the PSAP over the 3-year period, following the submittal of countermeasures into HSIP, SMART SCALE, and the other above mentioned funding sources and as part of resurfacing projects.

Additionally, the entire PSAP process, including policy review, review of systemic analysis criteria, and consideration for non-engineering strategies should be updated every 5 years. VDOT may update design policies that will inform countermeasure selection. VDOT may also identify new data sources, such as transit bus stop locations statewide, that may inform how priority corridors should be identified.

Source: VHB

Create performance metrics to track and demonstrate progress towards the goals identified in the PSAP.

VDOT should create performance metrics for tracking and demonstrating progress towards the PSAP's goals and key milestones. The tracking of pedestrian crash data and VDOT District and local agency PSAP implementation feedback will provide the necessary information for the plan's ongoing performance evaluation. For pedestrian safety-related injury and fatality targets, metrics should align with those identified in the SHSP. Other goals that consist of policy modifications and project development should draw upon VDOT's SMART SCALE, TAP, and HSIP.

Proposed PSAP Performance Measures

The implementation of the state's PSAP recommendations can be tracked and evaluated in numerous ways. The evaluation framework should include metrics for which VDOT has or can acquire data. VDOT can track crash rates, infrastructure improvements, plan-making progress, and policy adoption. The following chart presents a set of proposed performance measures for tracking the state's progress and implementation of the PSAP.

Proposed PSAP Performance Measures

Pedestrian Safety Goal	Performance Metric
Reduce severe injury and fatal pedestrian crashes.	Achieve a 4 percent reduction in the five-year average for severe injury and fatal crashes statewide.
	Achieve a 4 percent reduction in the five-year average for severe injury and fatal crashes by VDOT District.
Accelerate consideration of pedestrian improvements at high-exposure pedestrian priority clusters and corridors.	Annually, track percentage of the PSAP priority clusters/corridors where projects are funded by SMART SCALE, TAP, Revenue Sharing, Safe Routes to School, HSIP, or other programs.
	Annually, review opportunities to incorporate pedestrian safety improvement projects into roadway resurfacing projects.
Create policies that promote pedestrian safety.	Annually, assess pedestrian safety policy gaps and updates and track PSAP listed policies that are improved.
	Annually, increase stakeholder participation in the development of pedestrian safety policies or plans (as determined by number of meeting attendees, survey respondents, and or public comment responses).

VDOT
Virginia Department of Transportation

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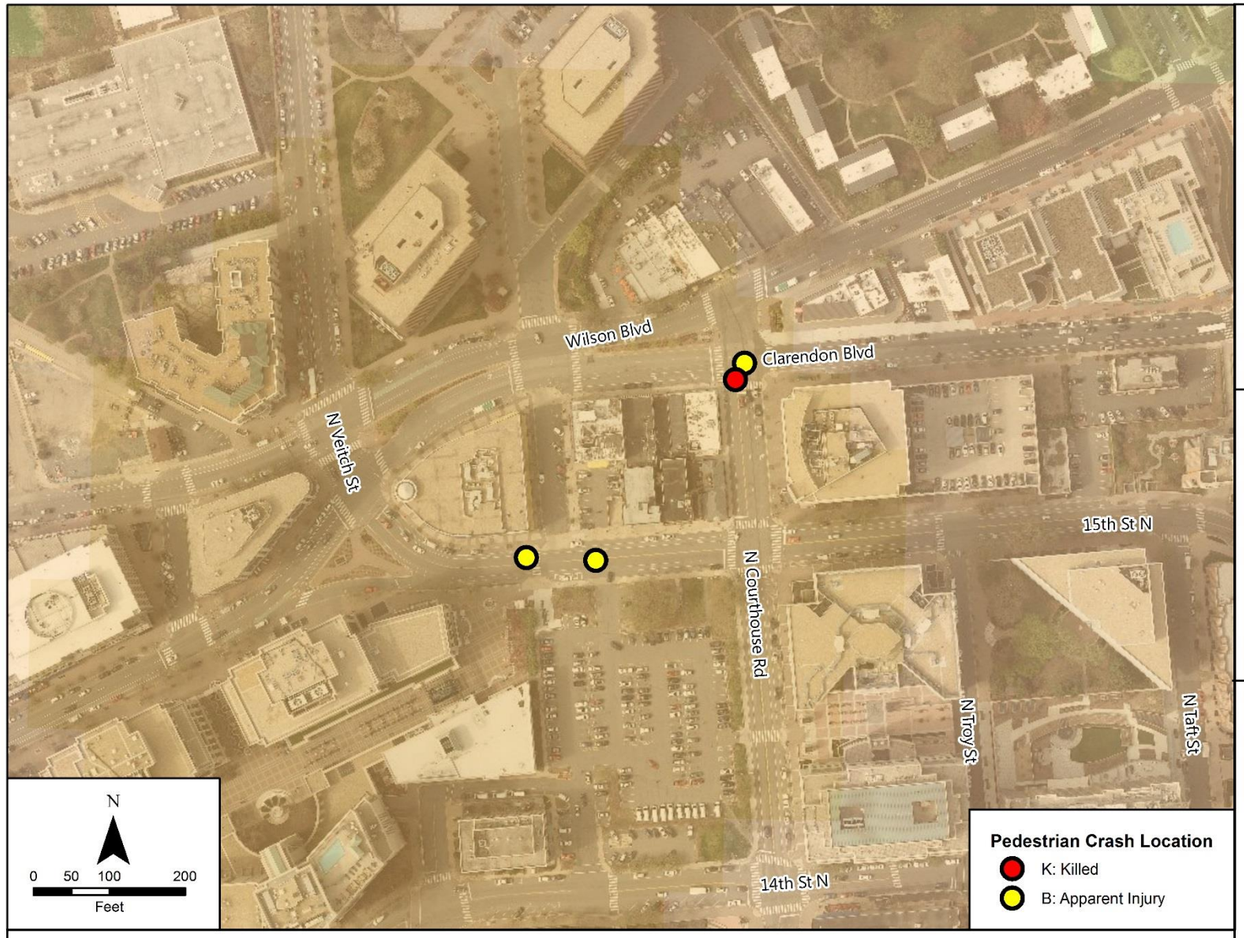
A Appendix A: Crash Cluster Cut Sheets

Site Location	Community	CM Recommendation	Justification	Estimated Cost
Clarendon Blvd	Arlington	Visibility enhancements (high visibility markings, in-street stop/yield sign and markings) and raised median island for 4 lane segments	Mid block crossings already marked but need increased signage, and partially marked signalized intersection.	Medium
Glebe Road	Arlington	Visibility enhancements (lighting), advanced stop/yield signs, refuge median island	In some instances, 4 travel lanes, although median is present, it is not wide enough to accommodate pedestrians, crashes occurring in evening.	Medium
Main Street	Blacksburg	Visibility enhancements (curb extension, in-street yield/stop signs)	2 travel lanes with unsignalized intersections with painted parking restrictions near intersections	Low
Prices Fork Road	Blacksburg	Visibility enhancements (curb extension, advance stop line, high visibility crosswalk)	2 travel lanes with poor visibility of crosswalk area	Low
Emmet Street	Charlottesville	Visibility enhancements (High visibility crosswalk, advanced stop/yield sign markings)	Unsignalized mid-block crossing without markings	Low
Main Street	Charlottesville	Visibility enhancements (curb extension, in-street yield/stop signs)	Collisions occurring at marked intersections, though parking is allowed near intersection	Low
Ridge Street	Charlottesville	Visibility enhancements (high visibility crosswalks, in-street yield/stop sign), raised median island	Combination of intersection types with aging markings	Medium
Water Street	Charlottesville	Visibility enhancements (high visibility crosswalks, in-street yield/stop sign)	2 travel lanes with unsignalized intersections without room for on-street parking restrictions or curb extensions	Low
Main Street	Culpeper	Pedestrian hybrid beacon, visibility enhancements (high visibility crosswalks), and advanced stop/yield sign and markings	Aging crosswalk markings, unsignalized intersections	Low
Richmond Highway	Fairfax	Visibility enhancements (lighting), advanced stop/yield signs, refuge median island	7 travel lanes, although median is present, it is not wide enough to accommodate pedestrians, crashes occurring in evening	Medium
William Street	Fredericksburg	Visibility enhancements (curb extension, high visibility crosswalks, in-street yield/stop sign)		Low
Tyler Avenue	Radford	Visibility enhancements (in-street stop/yield sign, advanced stop/yield sign markings adequate nighttime lighting levels)	2 travel lane, slow speed, with minimal pedestrian crossing markings	Medium

Site Location	Community	CM Recommendation	Justification	Estimated Cost
10th Street	Richmond	Visibility enhancements (curb extension, in street sign stop/yield sign)	Mid block crossings are already marked	Low
Belvidere Street	Richmond	High visibility crosswalks, Advanced stop and yield signs, Pedestrian Signal Heads	6 travel lanes, most actions committed by illegal driver action. Most collisions at signalized intersections	Medium
Broad Street	Richmond	High visibility crosswalks, Advanced stop and yield signs, Raised Median Island	6 travel lanes, most actions committed by illegal driver action	Medium
Campbell Avenue	Roanoke	Visibility enhancements (parking restriction on crosswalk approach, curb extension, in-street yield/stop signs)	2 travel lanes with frequent crossings and on street parking	Low
Pacific Avenue	Virginia Beach	Visibility enhancements (lighting), raised median island, advanced stop/yield signs	4 travel lanes that are undivided, crashes occurring in dark conditions	Medium
Piccadilly Street	Winchester	Visibility enhancements (high visibility crosswalks, advanced stop/yield sign and markings), split signal phasing	Collisions occurring at marked intersections with heavy turning movements	Low
Pleasant Valley Road	Winchester	Visibility enhancements (high visibility crosswalks, advanced stop/yield sign and markings), raised median island	Unmarked crossings and 4 travel lanes without medians	Medium

Arlington: Clarendon Boulevard

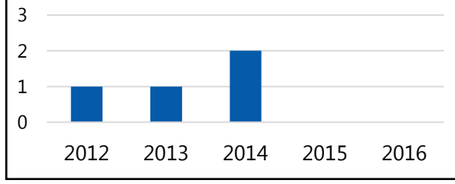


Community: Arlington
VDOT District: 9 (NOVA)

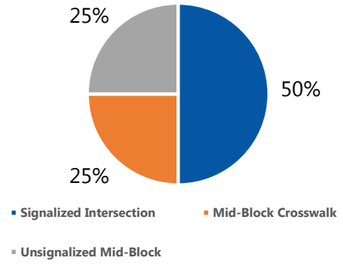
Crash Severity

K: Killed: 1
A: Severe: 0
B: Apparent: 3
C: Possible: 0

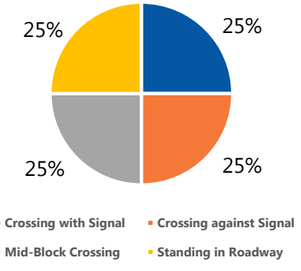
Crashes by Year



Crash Location



Pedestrian Action



Crash History

- 2 out of 4 crashes, including the fatal crash, occurred on a 4-lane, two-way median divided highway. The remaining occurred on a 2-lane, two-way undivided highway.
- All crashes occurred in a 25 mph zone.
- 1 out of 4 crashes involved improper or illegal action by the driver. The driver was not at fault for the fatal crash.
- 3 out of 4 crashes occurred during the daylight. The remaining crash occurred during dark/lighted conditions.
- No crashes involved alcohol.

Crash Cluster Description

- Mixed-use, urban setting
- 4 travel lanes, median-divided
- Signalized intersections with occasional formal mid-block crossings
- 25 mph speed limit
- 12,000 AADT

Countermeasure Recommendations

- Lighting and visibility enhancements
- Pedestrian refuge median island

Pedestrian Refuge

Asheville, NC. Lyuba Zuyeva

Intersection Visibility Signage

Marcos Island, FL. VHB

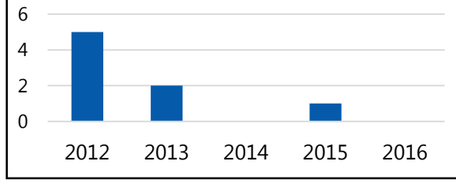
Arlington: Glebe Road (SR 120)

Community: Arlington
VDOT District: 9 (NOVA)

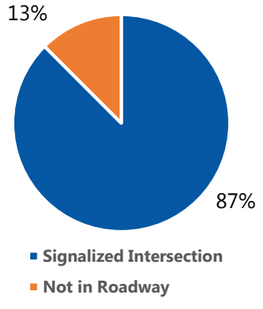
Crash Severity

K: Killed: 2
A: Severe: 1
B: Apparent: 4
C: Possible: 1

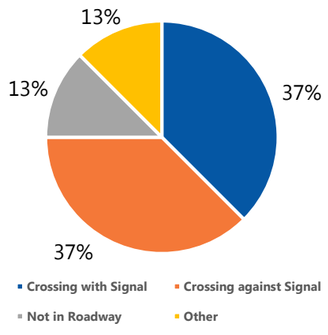
Crashes by Year



Crash Location



Pedestrian Action



Crash History

- All crashes occurred at the intersections of a 4-lane, two-way median divided highway and 2-lane, two-way undivided roads.
- All crashes occurred in a 30 mph zone.
- 2 out of 8 crashes involved improper or illegal action by the driver. One fatal crash involved speeding, other is unknown.
- 3 out of 8 crashes occurred during the daylight. Three remaining crashes occurred during dark/lighted conditions and 2 occurred at dusk.
- No crashes involved alcohol.

Crash Cluster Description

- Mixed-use, urban setting
- 4 to 6 travel lanes, median-divided
- Signalized intersections with occasional formal mid-block crossings
- 30 mph speed limit
- 29,000 AADT

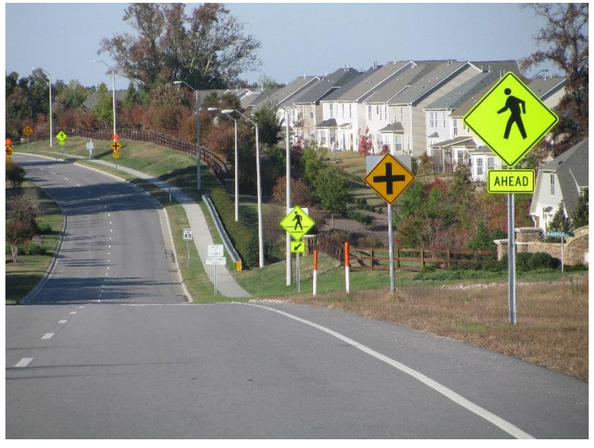
Countermeasure Recommendations

- Lighting and visibility enhancements
- Advance stop/yield signage
- Pedestrian refuge median island

Pedestrian Refuge

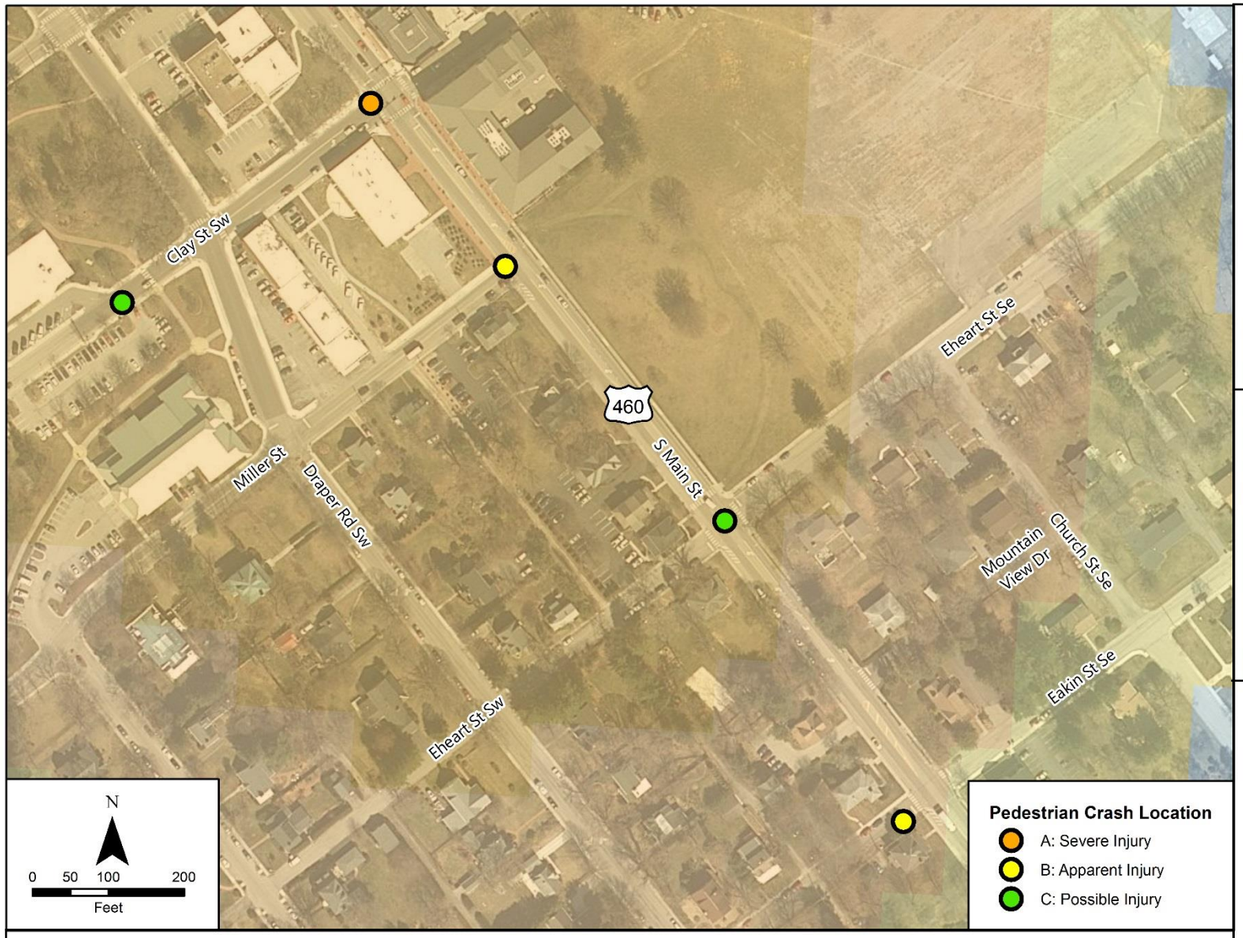
Asheville, NC. Lyuba Zuyeva

Advance Pedestrian Warning Signage

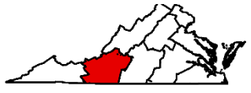


Cary, NC. VHB

Blacksburg: Main Street (US 460)



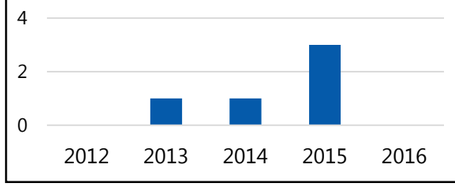
Community: Blacksburg
VDOT District: 2 (Salem)



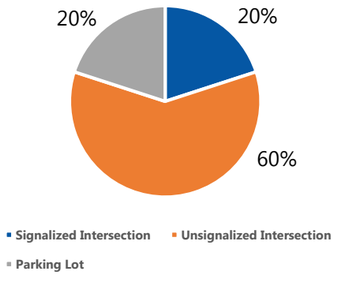
Crash Severity

K: Killed: 0
A: Severe: 1
B: Apparent: 2
C: Possible: 2

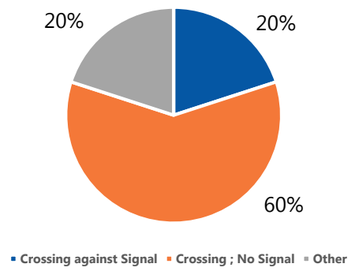
Crashes by Year



Crash Location



Pedestrian Action



Crash History

- 4 out of 5 crashes occurred on a two-way, left turn lane separated roadway. The remaining crash occurred on a two-way undivided road.
- All crashes occurred in a 25 mph zone.
- 4 out of 5 crashes involved improper or illegal action by the driver.
- 4 out of 5 crashes occurred during the daylight. The remaining crash occurred during dark/lighted conditions.
- No crashes involved alcohol.

Crash Cluster Description

- Commercial and single family, urban setting
- 2 travel lanes, undivided
- Unsignalized intersections with no formal mid-block crossings
- 25 mph speed limit
- 19,000 AADT

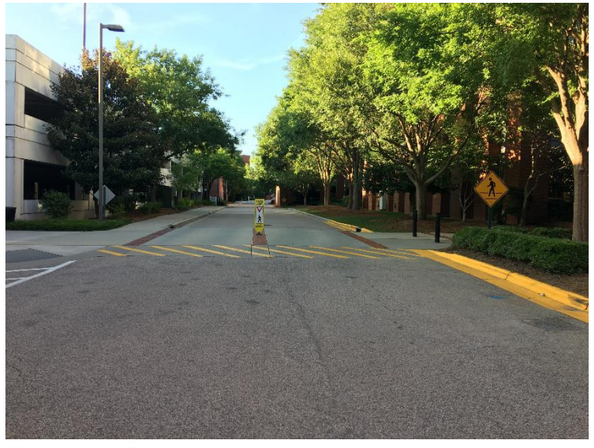
Countermeasure Recommendations

- Curb extensions
- Advance stop/yield signage

Curb Extensions

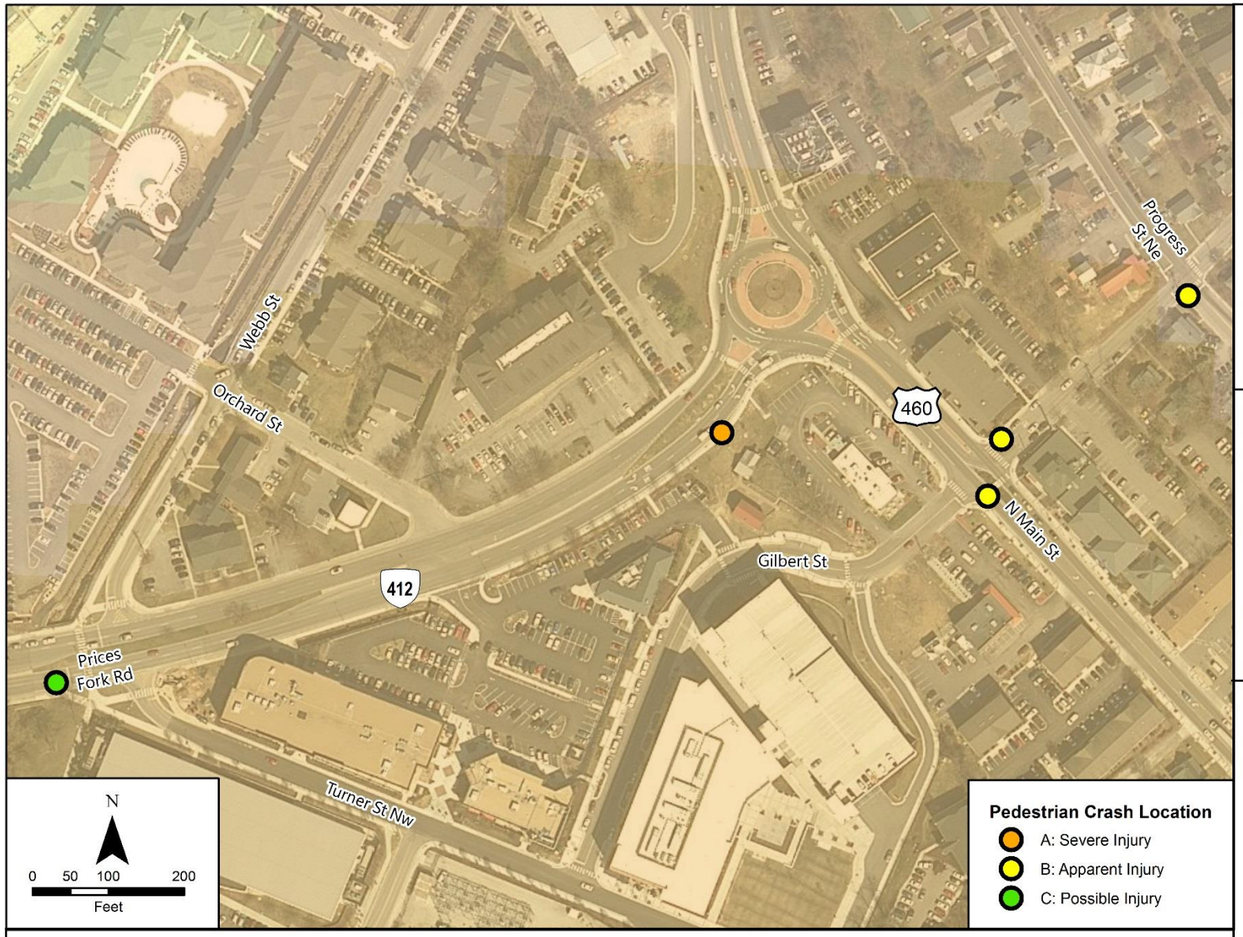
Vancouver, BC, Canada. Richard Drdul

Stop/Yield Signage



Raleigh, NC. VHB

Blacksburg: Prices Fork Road (SR 412)

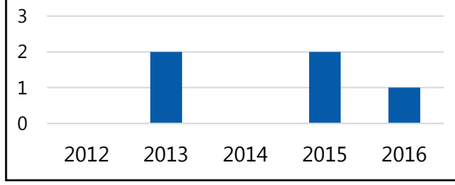


Community: Blacksburg
VDOT District: 2 (Salem)

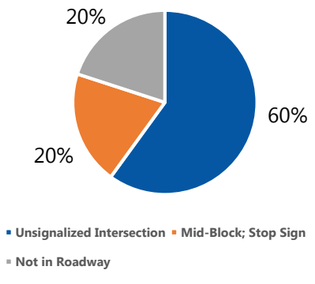
Crash Severity

K: Killed: 0
A: Severe: 1
B: Apparent: 3
C: Possible: 1

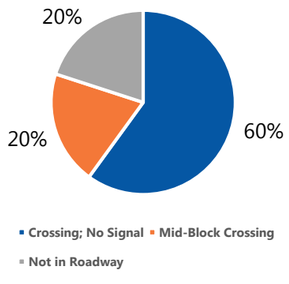
Crashes by Year



Crash Location



Pedestrian Action



Crash History

- Two crashes occurred on a 2-lane divided highway, two more occurred on a 2-lane undivided highway, and the remaining crash occurred on a 4-lane divided highway.
- 3 out of 5 crashes occurred in 35 mph zones. The others occurred in a 25 mph zone.
- 4 out of 5 crashes involved improper or illegal action by the driver.
- 3 out of 5 crashes occurred during the daylight. The remaining crashes occurred during dark/lighted conditions.
- 2 out of 5 crashes involved alcohol (1 pedestrian and 1 driver).

Crash Cluster Description

- Mixed-use, urban setting
- 2 travel lanes, undivided and median-divided
- Mix of signalized and unsignalized intersections with no formal mid-block crossings
- 25 and 35 mph speed limit
- 17,000 to 19,000 AADT

Countermeasure Recommendations

- Curb extensions
- Advance stop line
- High visibility crosswalks

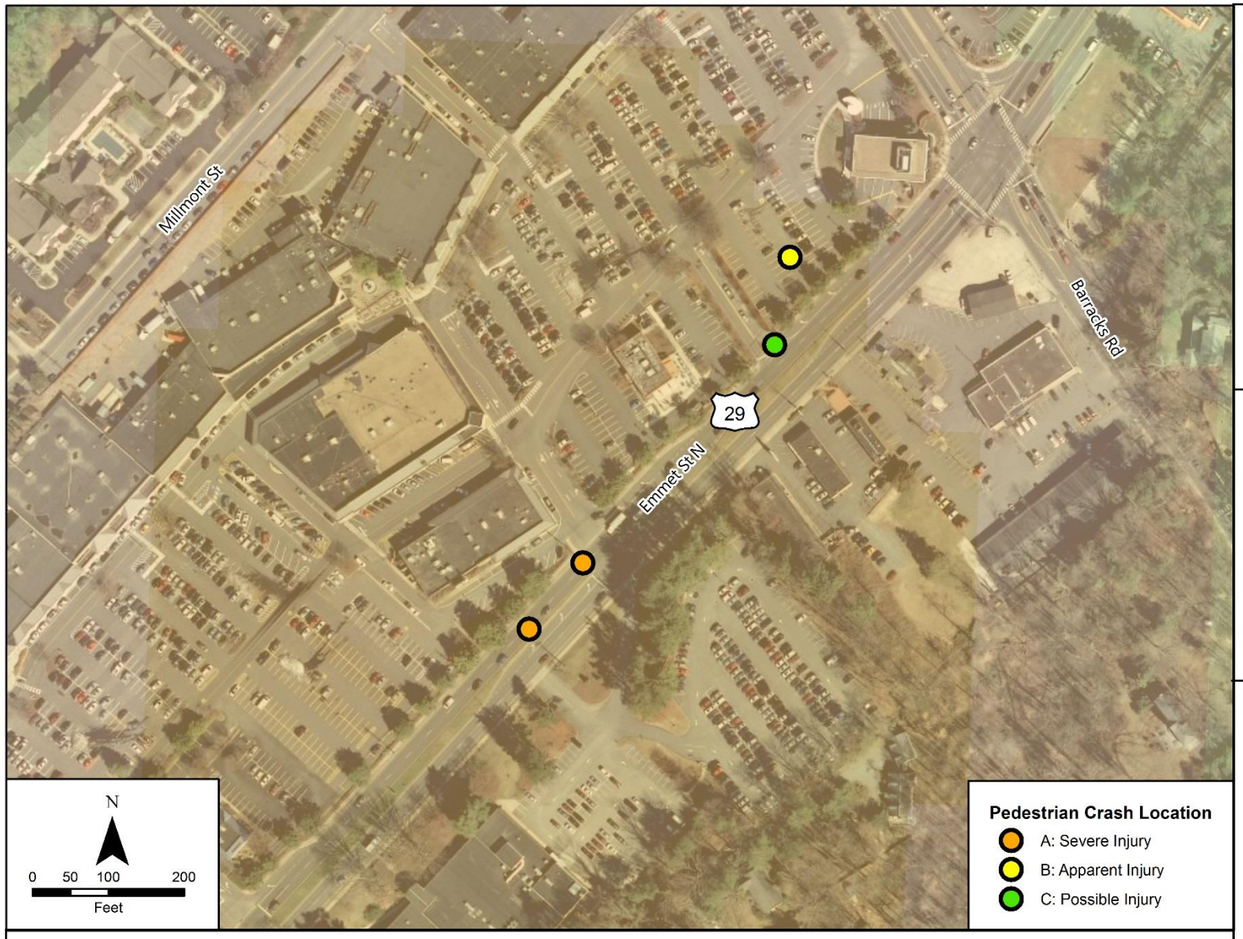
Curb Extensions

Vancouver, BC, Canada. Richard Drdul

High Visibility Crosswalks

Memphis, TN. VHB

Charlottesville: Emmet Street (US 29)

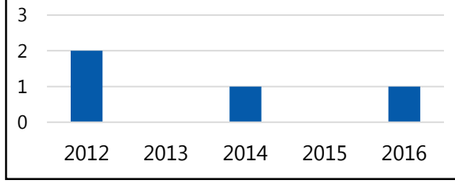


Community: Charlottesville
VDOT District: 7 (Culpeper)

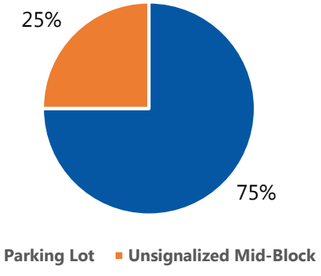
Crash Severity

K: Killed: 0
A: Severe: 2
B: Apparent: 1
C: Possible: 1

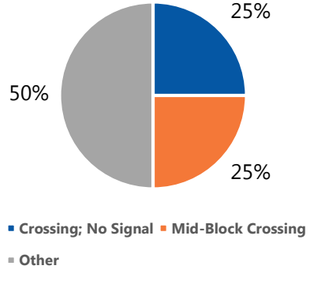
Crashes by Year



Crash Location



Pedestrian Action



Crash History

- The only non-parking lot crash occurred on 4-lane, two-way median divided highway.
- This crash occurred in a 40 mph zone.
- 1 out of 4 crashes involved improper or illegal action by the driver.
- 3 out of 4 crashes occurred during the daylight. The remaining crash occurred during dark/lighted conditions.
- No crashes involved alcohol.

Crash Cluster Description

- Commercial, suburban setting
- 4 travel lanes, median-divided
- Signalized intersections with no formal mid-block crossings
- 40 mph speed limit
- 24,000 AADT

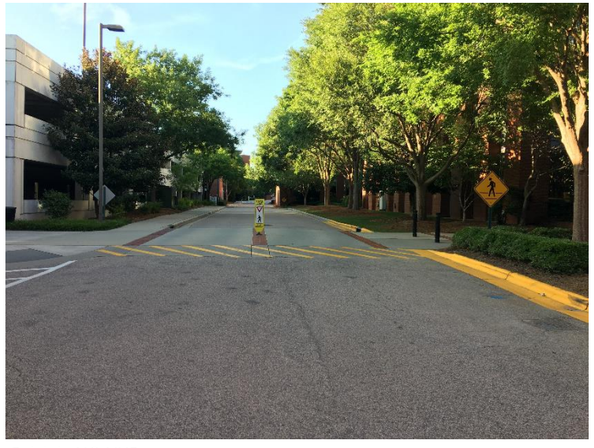
Countermeasure Recommendations

- High visibility crosswalks
- Stop/yield signage

High Visibility Crosswalks

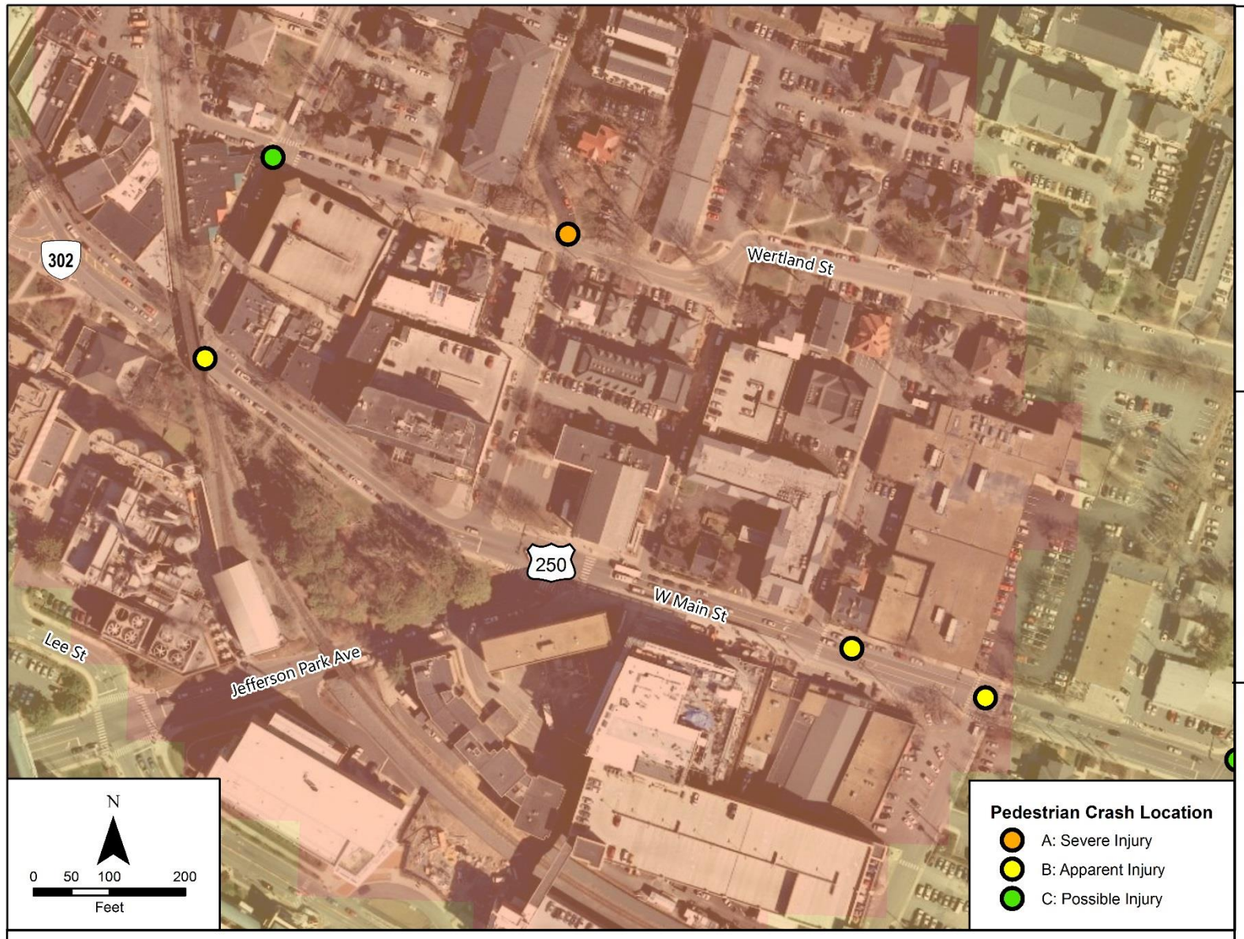
Memphis, TN. VHB

Stop/Yield Signage



Raleigh, NC. VHB

Charlottesville: Main Street (US 250-Bus.)

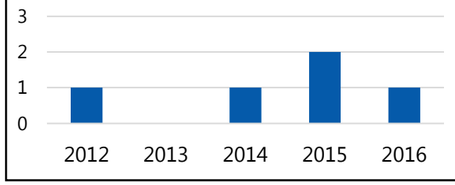


Community: Charlottesville
VDOT District: 7 (Culpeper)

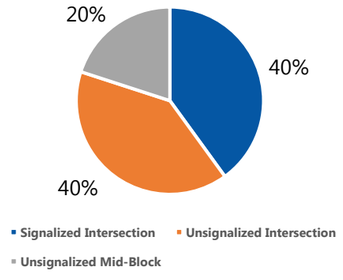
Crash Severity

K: Killed: 0
A: Severe: 1
B: Apparent: 3
C: Possible: 1

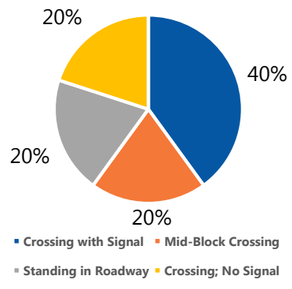
Crashes by Year



Crash Location



Pedestrian Action



Crash History

- 3 out of 5 crashes occurred on 2-lane, two-way, left turn separated roads. the remaining occur on 2-lane, two-way undivided roads.
- 4 out of 5 crashes occurred on 25 mph zones. One occurred in a 35 mph zone.
- 4 out of 5 crashes involved improper or illegal action by the driver.
- 3 out of 5 crashes occurred during the daylight. One remaining crash occurred in dark/lighted conditions and 1 occurred at dawn.
- 1 out of 5 crashes involved alcohol (pedestrian).

Crash Cluster Description

- Mixed-use, urban setting
- 2 travel lanes, undivided
- Mix of signalized and unsignalized intersections with no formal mid-block crossings
- 35 mph speed limit
- 13,000 AADT

Countermeasure Recommendations

- Curb extensions
- Stop/yield signage

Curb Extensions

Vancouver, BC, Canada. Richard Drdul

Stop/Yield Signage

Raleigh, NC. VHB

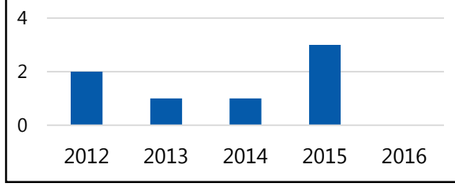
Charlottesville: Ridge Street

Community: Charlottesville
VDOT District: 7 (Culpeper)

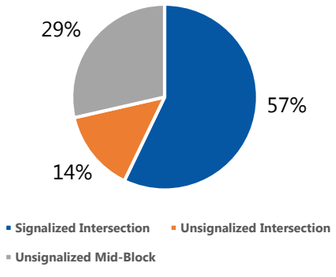
Crash Severity

K: Killed: 0
A: Severe: 1
B: Apparent: 6
C: Possible: 0

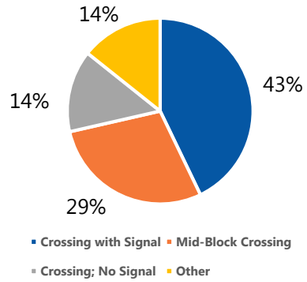
Crashes by Year



Crash Location



Pedestrian Action



Crash History

- 5 out of 7 crashes occurred on 2-lane, two-way, left turn lane separated roads.
- All crashes occurred in a 25 mph zone.
- 4 out of 7 crashes involved improper or illegal action by the driver.
- 4 out of 7 crashes occurred during the daylight. The remaining crashes occurred during dark/lighted conditions.
- 2 out of 7 crashes involved alcohol (both pedestrians).

Crash Cluster Description

- Mixed-use, urban setting
- 2 travel lanes, undivided
- Mix of signalized and unsignalized intersections with no formal mid-block crossings
- 25 mph speed limit
- 21,000 AADT

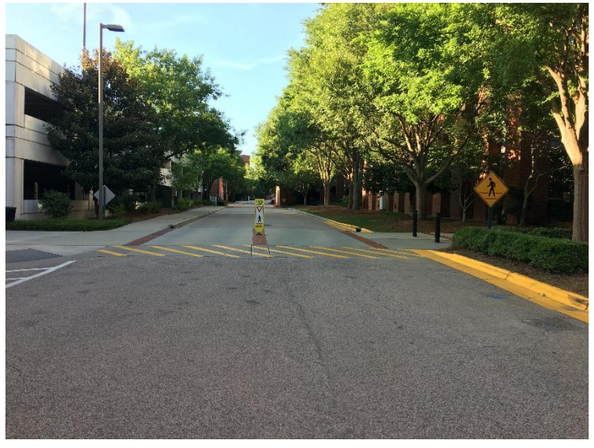
Countermeasure Recommendations

- High visibility crosswalks
- Pedestrian refuge median island
- Stop/yield signage

Pedestrian Refuge & High Visibility Crosswalks

Asheville, NC. Lyuba Zuyeva

Stop/Yield Signage



Raleigh, NC. VHB

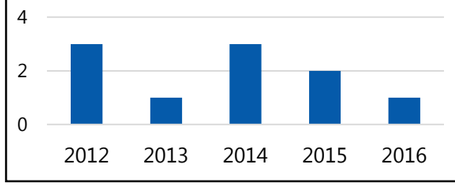
Charlottesville: Water Street

Community: Charlottesville
VDOT District: 7 (Culpeper)

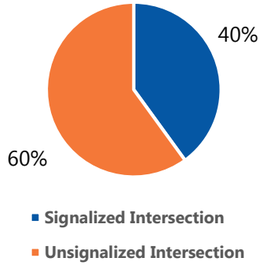
Crash Severity

K: Killed: 0
A: Severe: 1
B: Apparent: 7
C: Possible: 2

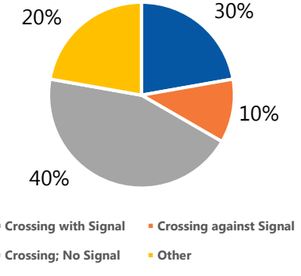
Crashes by Year



Crash Location



Pedestrian Action



Crash History

- 8 out of 10 crashes occurred on 2-lane, two-way undivided roads. The remaining two occurred at an intersection with a one-way road.
- All crashes occurred in a 25 mph zone.
- 7 out of 10 crashes involved improper or illegal action by the driver.
- 8 out of 10 crashes occurred during the daylight. The remaining crashes occurred during dark/lighted conditions.
- 1 out of 10 crashes involved alcohol (both parties).

Crash Cluster Description

- Mixed-use, urban setting
- 2 travel lanes, undivided
- Mix of signalized and unsignalized intersections with no formal mid-block crossings
- 25 mph speed limit
- 8,000 AADT

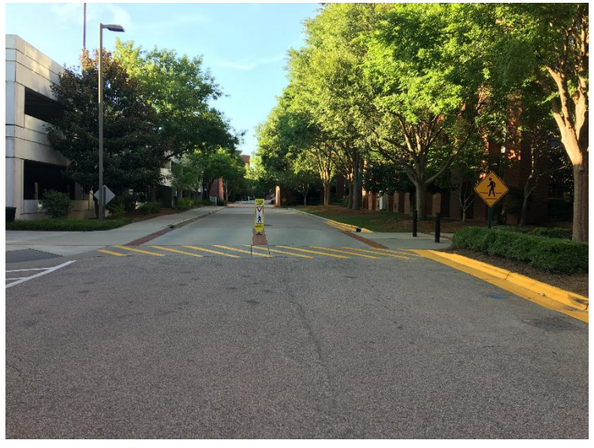
Countermeasure Recommendations

- High visibility crosswalks
- Stop/yield signage

High Visibility Crosswalks

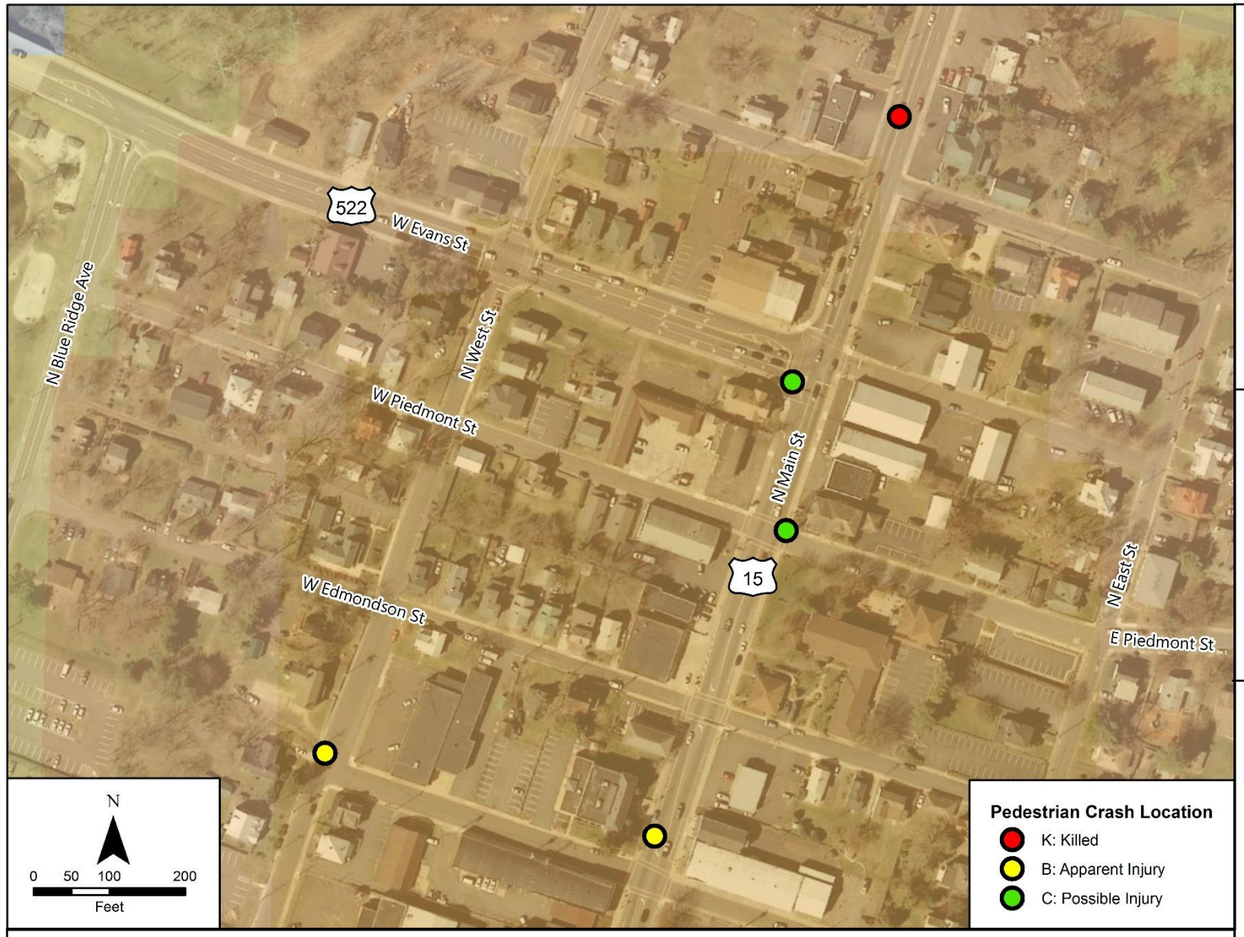
Memphis, TN. VHB

Stop/Yield Signage



Raleigh, NC. VHB

Culpeper: Main Street (US 15)

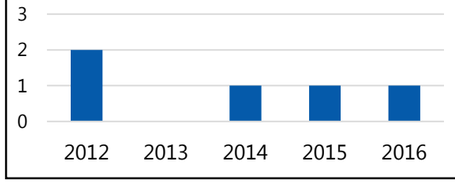


Community: Culpeper
VDOT District: 7 (Culpeper)

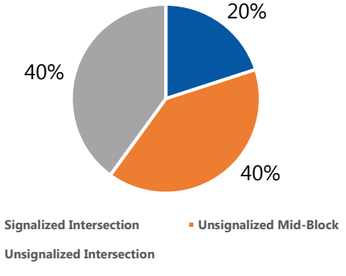
Crash Severity

K: Killed: 1
A: Severe: 0
B: Apparent: 2
C: Possible: 2

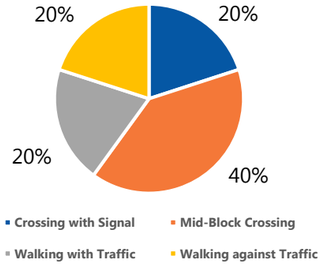
Crashes by Year



Crash Location



Pedestrian Action



Crash History

- 4 out of 5 crashes occurred on 2-lane, two-way undivided roads. The fatality occurred on a 4-lane undivided highway.
- All crashes occurred in a 25 mph zone.
- 2 out of 5 crashes involved improper or illegal action by the driver. The driver was not at fault for the fatal crash.
- 3 out of 5 crashes occurred during the daylight. The remaining crashes occurred during dark/lighted conditions.
- No crashes involved alcohol.

Crash Cluster Description

- Commercial and single family residential, urban setting
- 2 travel lanes, undivided
- Mix of signalized and unsignalized intersections with no formal mid-block crossings
- 25 mph speed limit
- 18,000 AADT

Countermeasure Recommendations

- Pedestrian hybrid beacon (PHB)
- High visibility crosswalks
- Advance stop/yield signage

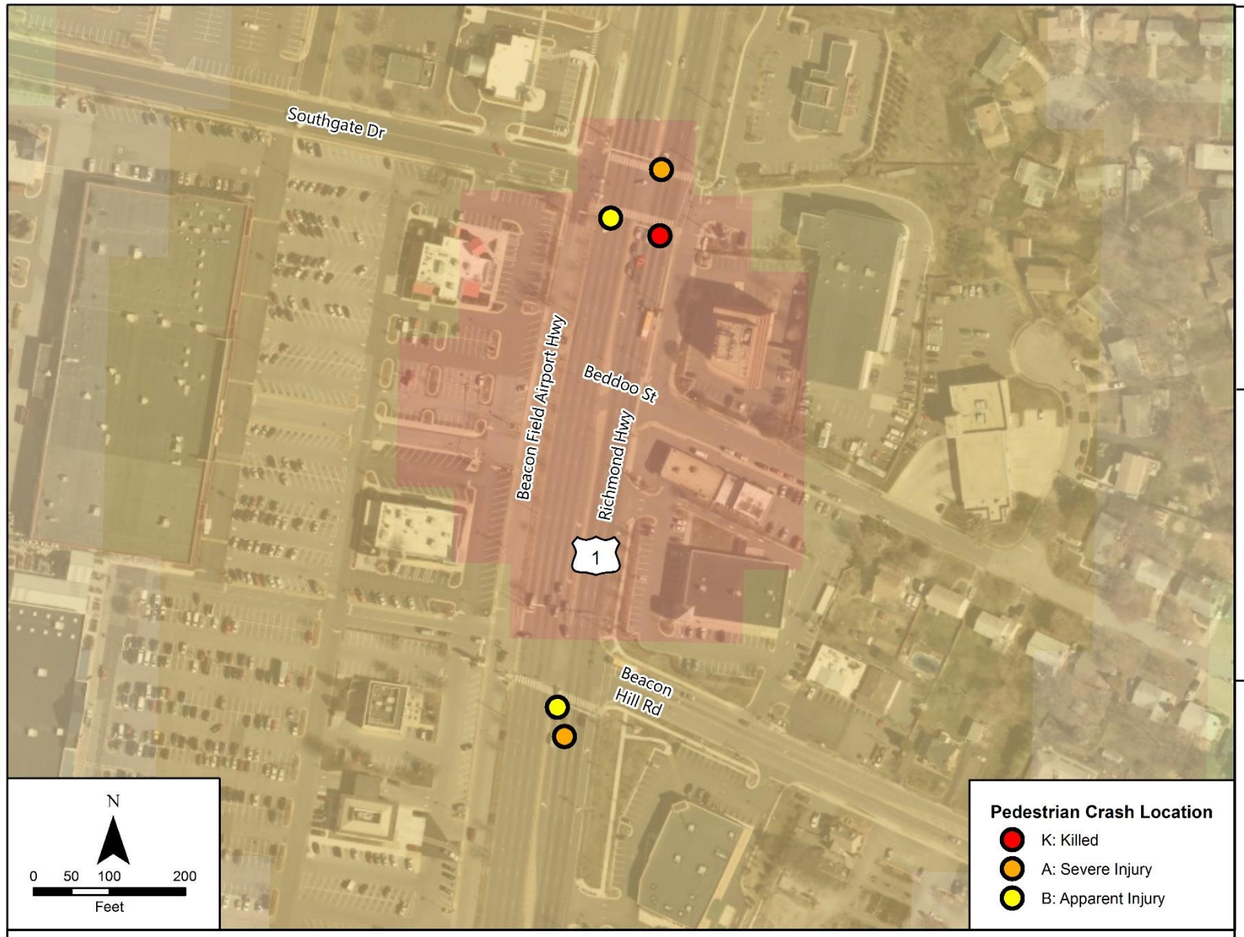
Pedestrian Hybrid Beacon

Charlotte, NC. City of Charlotte

Advance Pedestrian Warning Signage

Cary, NC. VHB

Fairfax: Richmond Highway (US 1)

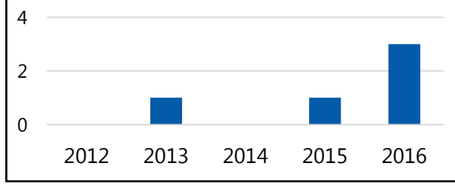


Community: Fairfax
VDOT District: 9 (NOVA)

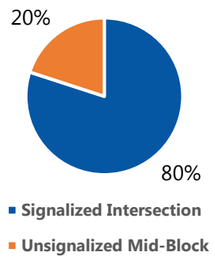
Crash Severity

K: Killed: 1
A: Severe: 2
B: Apparent: 2
C: Possible: 0

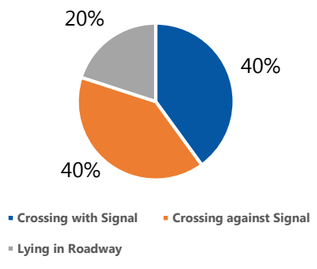
Crashes by Year



Crash Location



Pedestrian Action



Crash History

- All crashes occurred on a 7-lane, two-way median divided highway.
- All crashes occurred in a 45 mph zone.
- 2 out of 5 crashes involved improper or illegal action by the driver. The driver was not at fault for the fatal crash.
- 2 out of 5 crashes occurred during the daylight. The remaining crashes occurred during dark/lighted conditions.
- Only the fatal crash involved alcohol (pedestrian).

Crash Cluster Description

- Commercial and single family residential, suburban setting
- 7 travel lanes, median-divided
- Signalized intersections with no formal mid-block crossings
- 45 mph speed limit
- 51,000 AADT

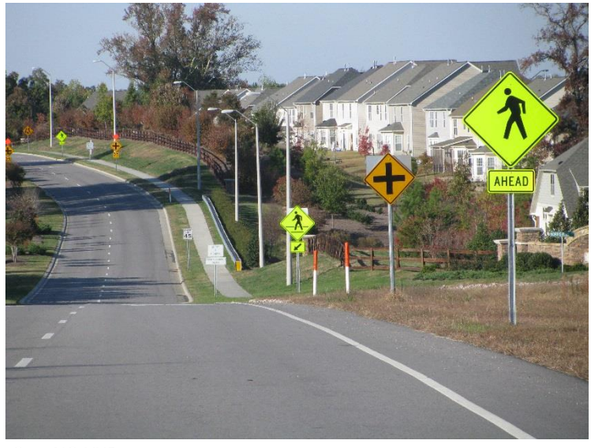
Countermeasure Recommendations

- Lighting and visibility enhancements
- Advance stop/yield signage
- Pedestrian refuges

Pedestrian Refuge

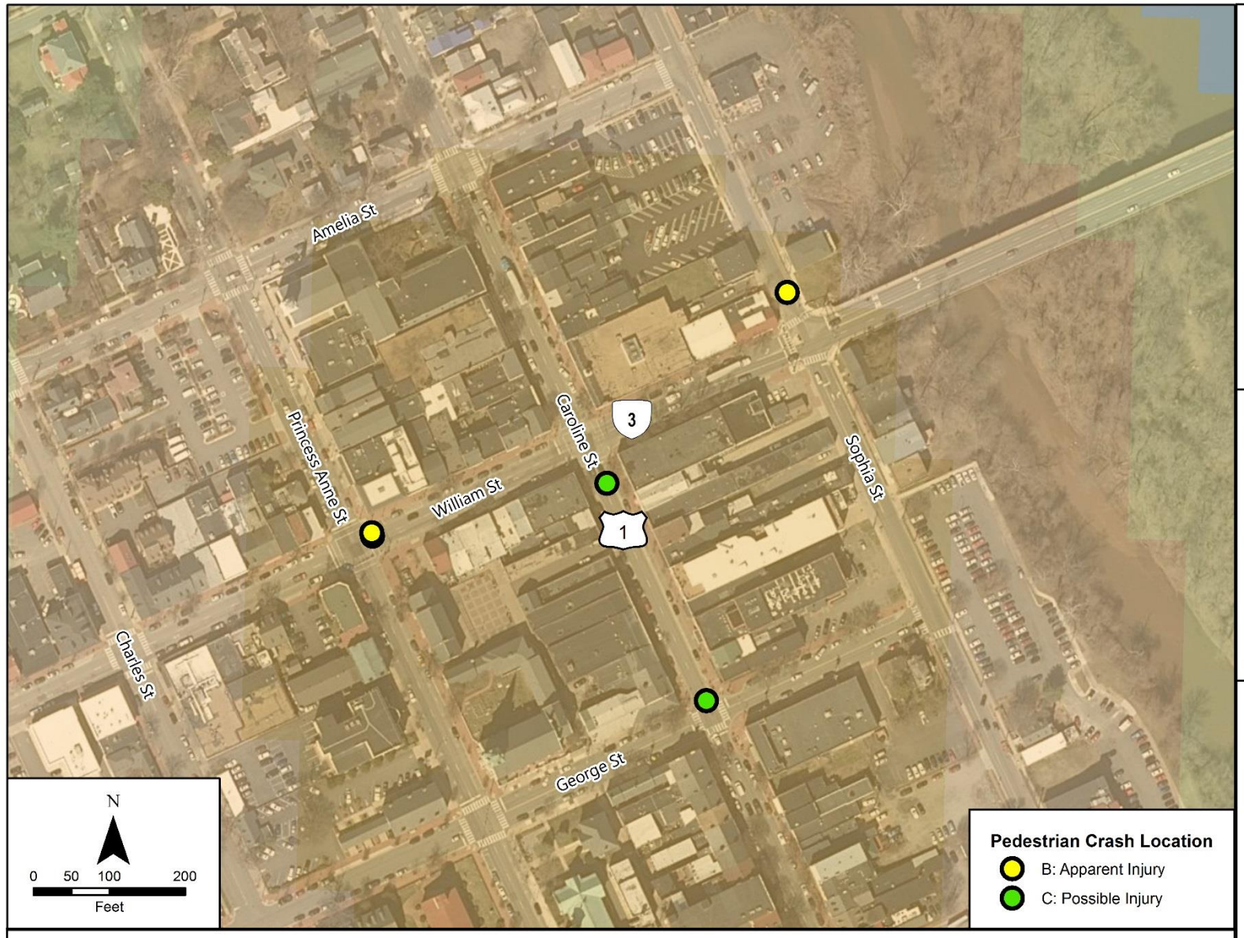
Asheville, NC. Lyuba Zuyeva

Advance Pedestrian Warning Signage



Cary, NC. VHB

Fredericksburg: William Street (US 1-Bus.)

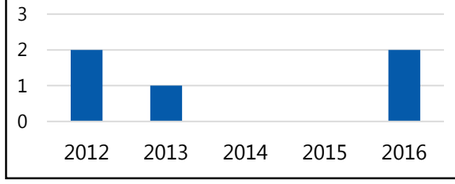


Community: Fredericksburg
VDOT District: 6 (Fredericksburg)

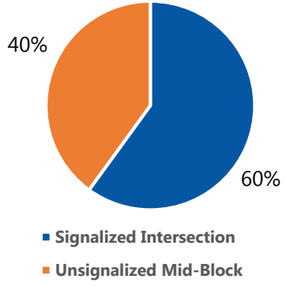
Crash Severity

K: Killed: 0
A: Severe: 0
B: Apparent: 2
C: Possible: 3

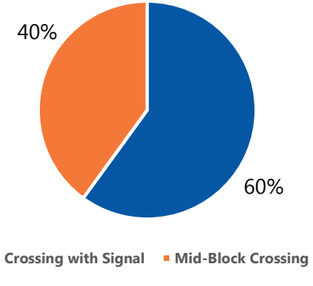
Crashes by Year



Crash Location



Pedestrian Action



Crash History

- 4 out of 5 crashes occurred on one-way streets.
- All crashes occurred in a 25 mph zone.
- 4 out of 5 crashes involved improper or illegal action by the driver. The driver's action for the remaining crash is unknown.
- 4 out of 5 crashes occurred during the daylight. The remaining crash occurred during dark/lighted conditions.
- No crashes involved alcohol.

Crash Cluster Description

- Mixed-use, urban setting
- 2 travel lanes, one-way
- Signalized intersections with no formal mid-block crossings
- 25 mph speed limit
- 6,000 to 7,500 AADT

Countermeasure Recommendations

- High visibility crosswalks
- Curb extensions
- Stop/yield signage

Curb Extensions

Vancouver, BC, Canada. Richard Drdul

High Visibility Crosswalks

Memphis, TN. VHB

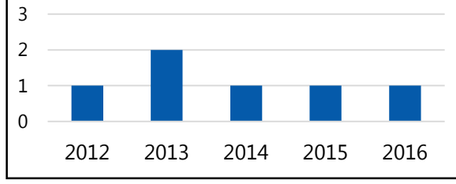
Radford: Tyler Avenue (SR 177)

Community: Radford
VDOT District: 2 (Salem)

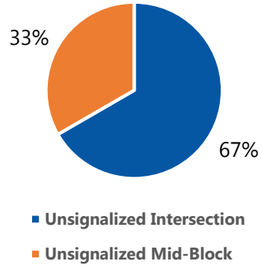
Crash Severity

K: Killed: 0
A: Severe: 0
B: Apparent: 6
C: Possible: 0

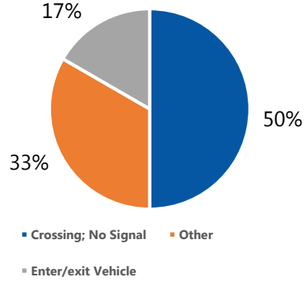
Crashes by Year



Crash Location



Pedestrian Action



Crash History

- 5 out of 6 crashes occurred on a 2-lane, two-way, median divided roadway. The other occurred on a one-way street.
- All crashes occurred in a 25 mph zone.
- 4 out of 6 crashes involved improper or illegal action by the driver.
- 3 out of 6 crashes occurred during the daylight. Two occurred during dark/lighted conditions and 1 at dawn.
- No crashes involved alcohol.

Crash Cluster Description

- Residential, urban setting
- College campus adjacent
- 2 travel lanes, median-divided
- Unsignalized intersections with no formal mid-block crossings
- 25 mph speed limit
- 9,000 AADT

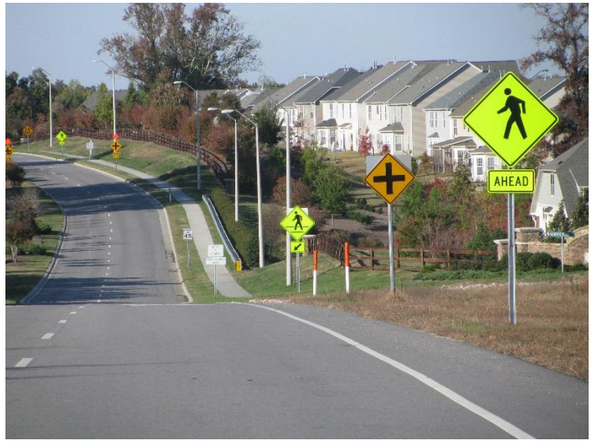
Countermeasure Recommendations

- Advance stop/yield signage
- Lighting and visibility enhancements

Intersection Visibility Signage

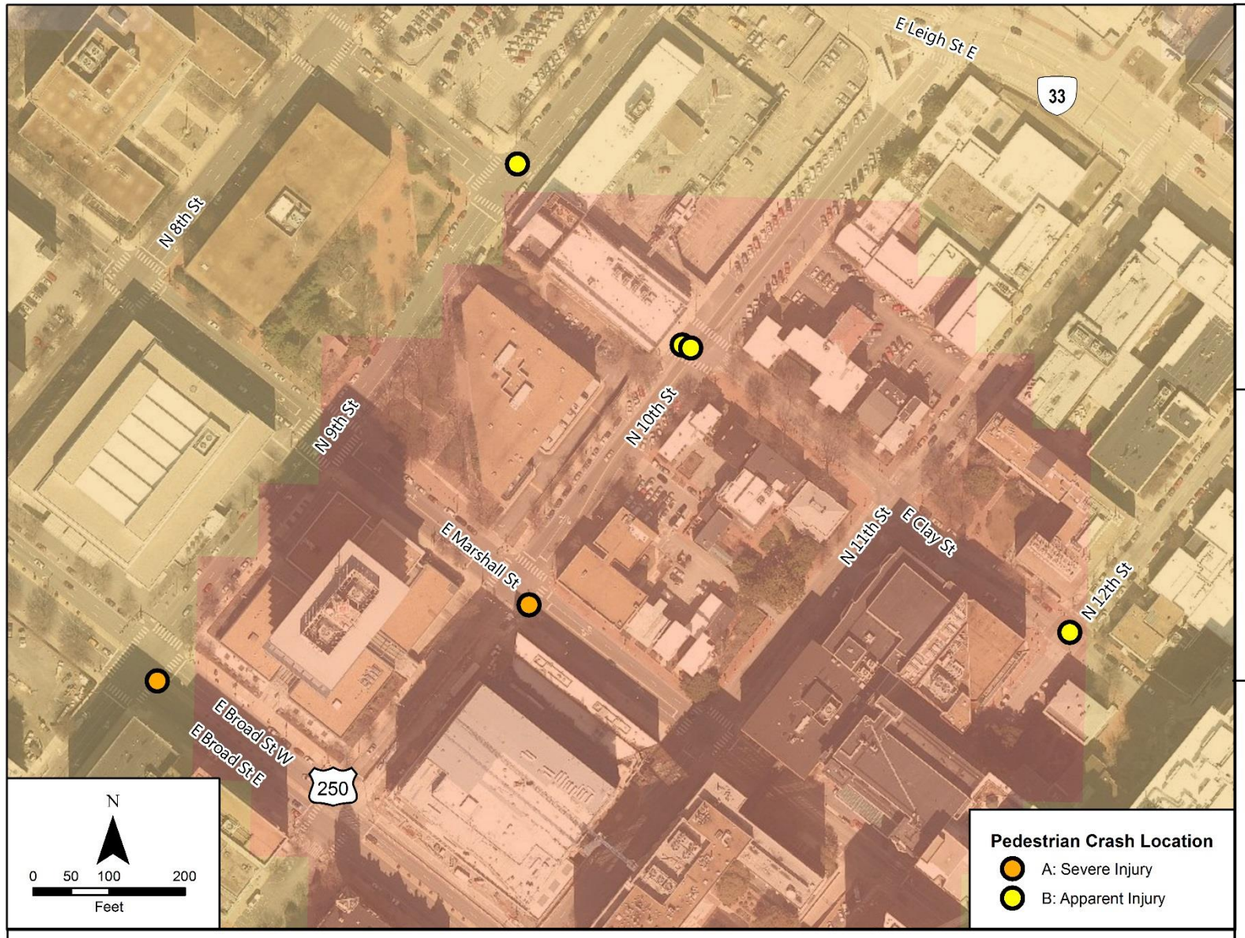
Marcos Island, FL. VHB

Advance Pedestrian Warning Signage



Cary, NC. VHB

Richmond: 10th Street

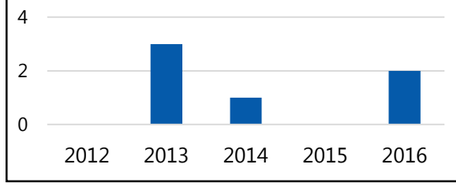


Community: Richmond
VDOT District: 4 (Richmond)

Crash Severity

K: Killed: 0
A: Severe: 2
B: Apparent: 4
C: Possible: 0

Crashes by Year



Crash Location

Pedestrian Action

Crash History

- 3 out of 6 crashes occurred on 2-lane, two-way undivided roads. Two occurred on one-way streets and 1 occurred on a 4-lane divided highway.
- All crashes occurred in a 25 mph zone.
- 5 out of 6 crashes involved improper or illegal action by the driver. The driver's action for the remaining crash is unknown.
- All crashes occurred during the daylight.
- No crashes involved alcohol.

Crash Cluster Description

- Mixed-use, urban setting
- 2 travel lanes, undivided
- Mix of signalized and unsignalized intersections with no formal mid-block crossings
- 25 mph speed limit
- ~7,000 AADT

Countermeasure Recommendations

- Visibility enhancements
- Curb extensions
- Stop/yield signage

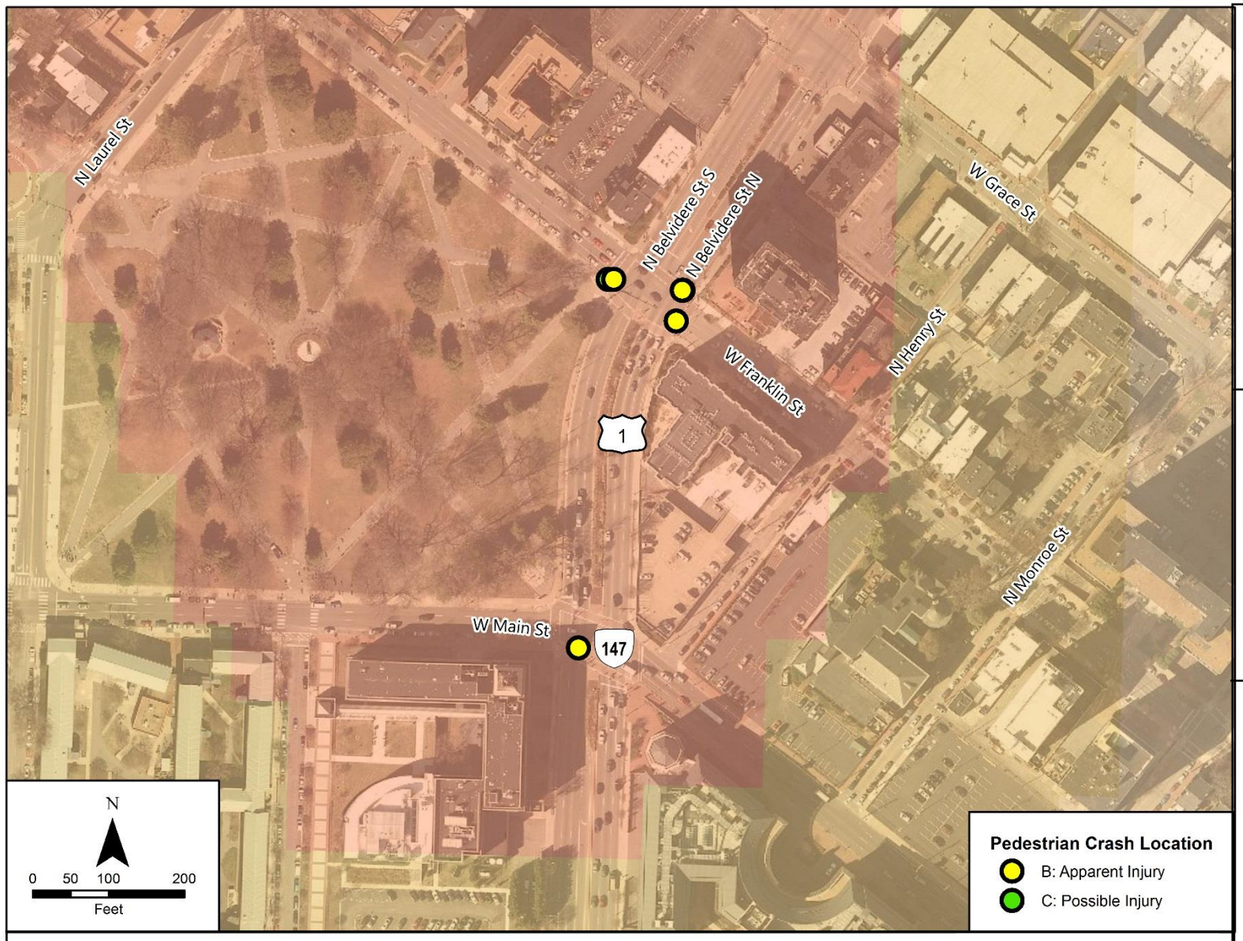
Curb Extensions

Vancouver, BC, Canada. Richard Drdul

Stop/Yield Signage

Raleigh, NC. VHB

Richmond: Belvidere Street (US 1)

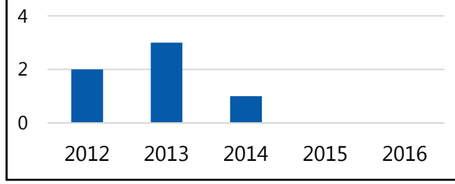


Community: Richmond
VDOT District: 4 (Richmond)

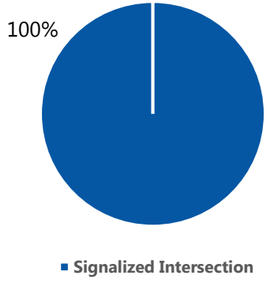
Crash Severity

K: Killed: 0
A: Severe: 0
B: Apparent: 5
C: Possible: 1

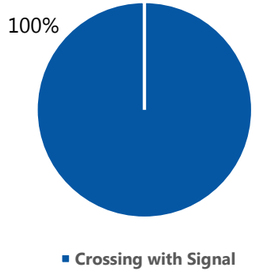
Crashes by Year



Crash Location



Pedestrian Action



Crash History

- All crashes occurred at the intersection of a 6-lane, two-way median divided highway and one-way streets.
- All crashes occurred in a 35 mph zone.
- 5 out of 6 crashes involved improper or illegal action by the driver. The driver's action for the remaining crash is unknown.
- 4 out of 6 crashes occurred during the daylight. One remaining crash occurred during dark/lighted conditions and the other occurred at dusk.
- 1 out of 6 crashes involved alcohol (pedestrian).

Crash Cluster Description

- Mixed-use, urban setting
- 6 travel lanes, median-divided
- Signalized intersections with no formal mid-block crossings
- 35 mph speed limit
- 25,000 to 35,000 AADT

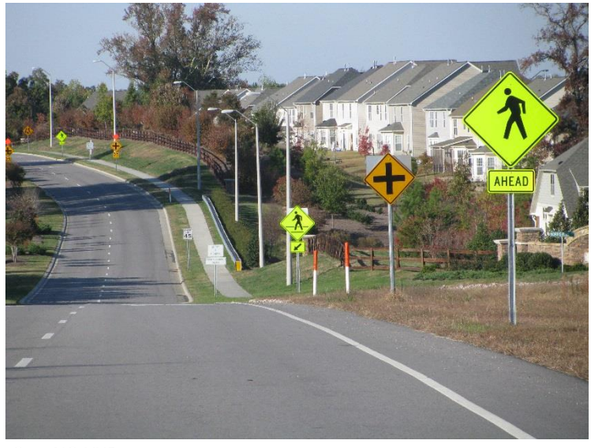
Countermeasure Recommendations

- High visibility crosswalks
- Advance stop/yield signage
- Pedestrian signal heads

High Visibility Crosswalks

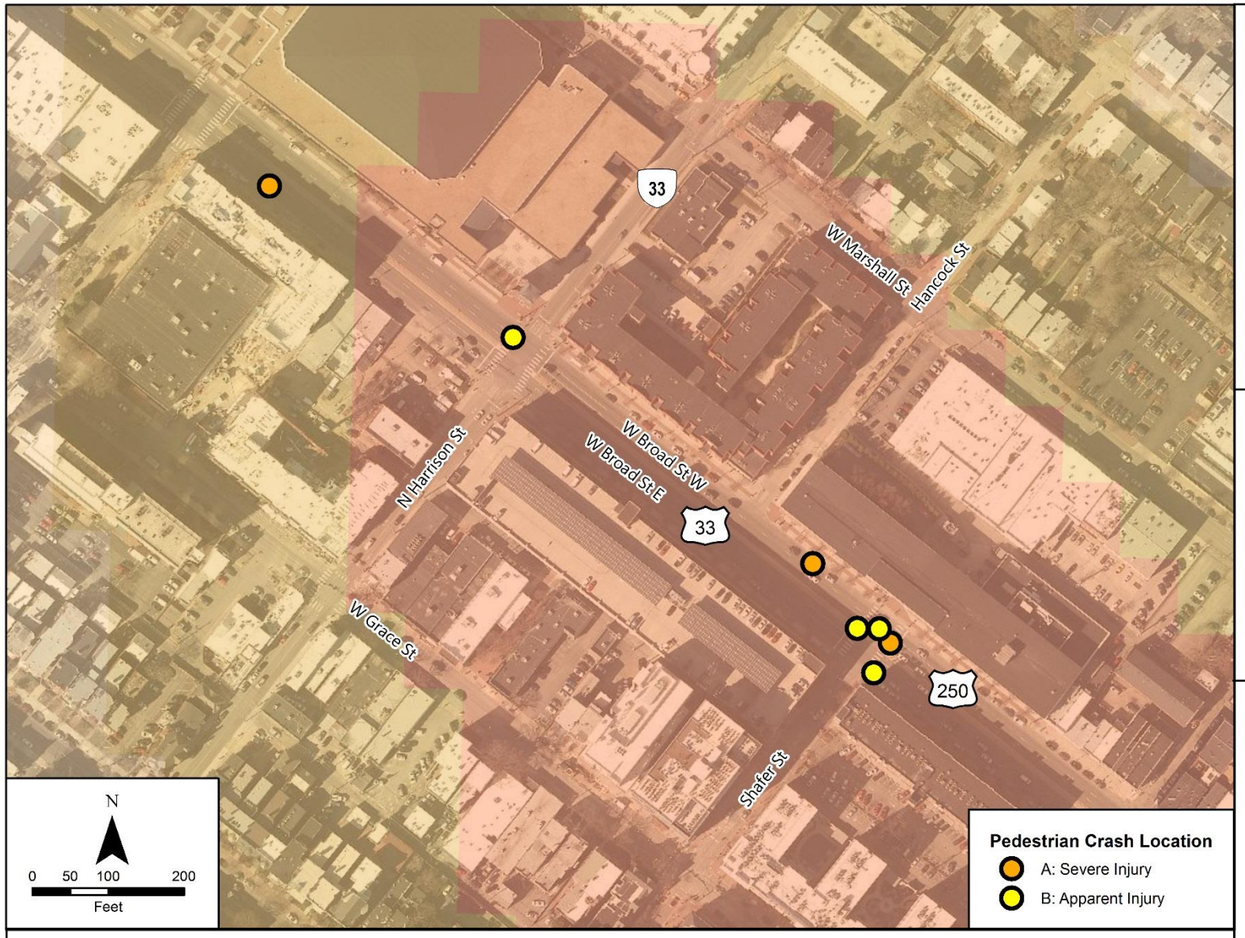
Memphis, TN. VHB

Advance Pedestrian Warning Signage

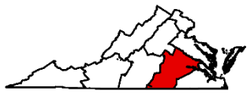


Cary, NC. VHB

Richmond: Broad Street (US 33/250)



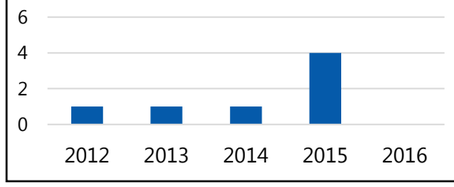
Community: Richmond
VDOT District: 4 (Richmond)



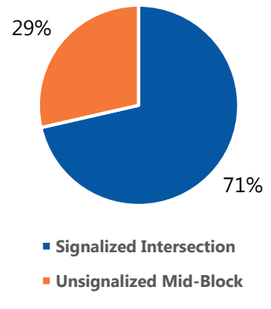
Crash Severity

K: Killed: 0
A: Severe: 3
B: Apparent: 4
C: Possible: 0

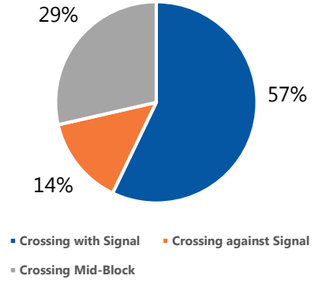
Crashes by Year



Crash Location



Pedestrian Action



Crash History

- All crashes occurred on a 6-lane, two-way undivided highway.
- All crashes occurred in a 25 mph zone.
- 3 out of 7 crashes involved improper or illegal action by the driver.
- 6 out of 7 crashes occurred during the daylight. The remaining crash occurred during dark/lighted conditions.
- No crashes involved alcohol.

Crash Cluster Description

- Mixed-use, urban setting
- College campus adjacent
- 6 travel lanes, median-divided
- Signalized intersections with no formal mid-block crossings
- 25 mph speed limit
- 16,000 to 26,000 AADT

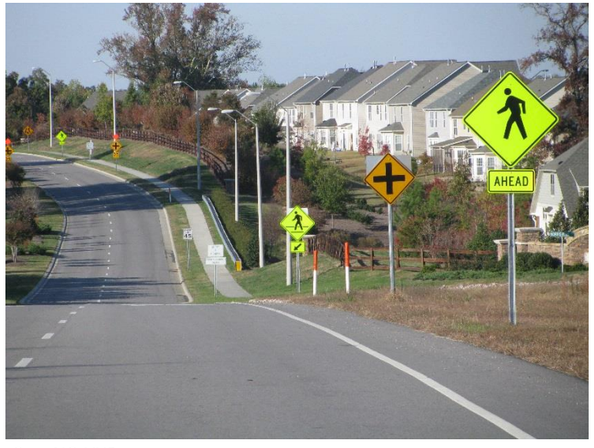
Countermeasure Recommendations

- High visibility crosswalks
- Advance stop/yield signage
- Pedestrian refuge

Pedestrian Refuge & High Visibility Crosswalks

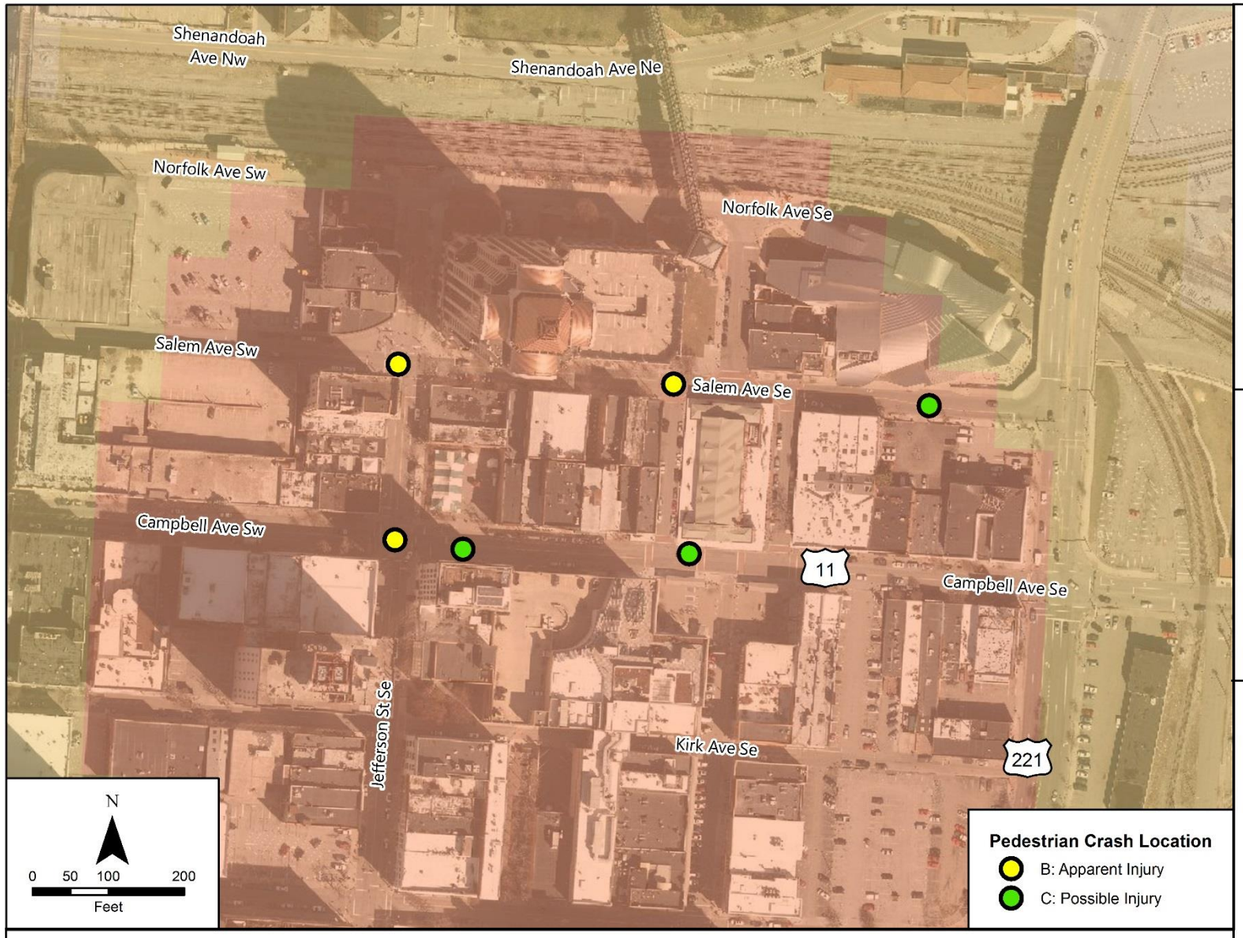
Asheville, NC. Lyuba Zuyeva

Advance Pedestrian Warning Signage



Cary, NC. VHB

Roanoke: Campbell Avenue (US 11)

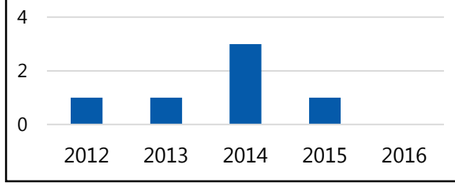


Community: Roanoke
VDOT District: 2 (Salem)

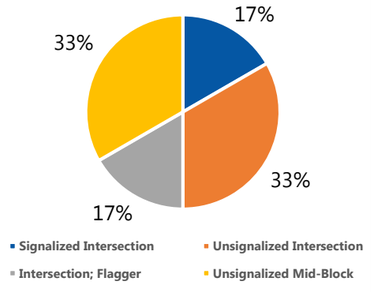
Crash Severity

K: Killed: 0
A: Severe: 0
B: Apparent: 3
C: Possible: 3

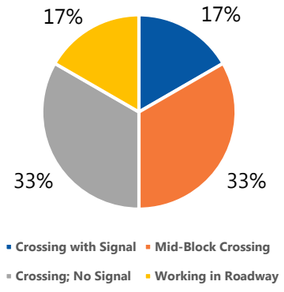
Crashes by Year



Crash Location



Pedestrian Action



Crash History

- All crashes occurred on 2-lane, two-way undivided roads.
- All crashes occurred in a 25 mph zone.
- 3 out of 6 crashes involved improper or illegal action by the driver.
- 3 out of 6 crashes occurred during in dark/lighted conditions. Two occurred during the daylight and 1 at dawn.
- 2 out of 6 crashes involved alcohol (both pedestrians).

Crash Cluster Description

- Mixed-use, urban setting
- 2 travel lanes, undivided
- Mix of signalized and unsignalized intersections with no formal mid-block crossings
- 25 mph speed limit
- 7,500 AADT

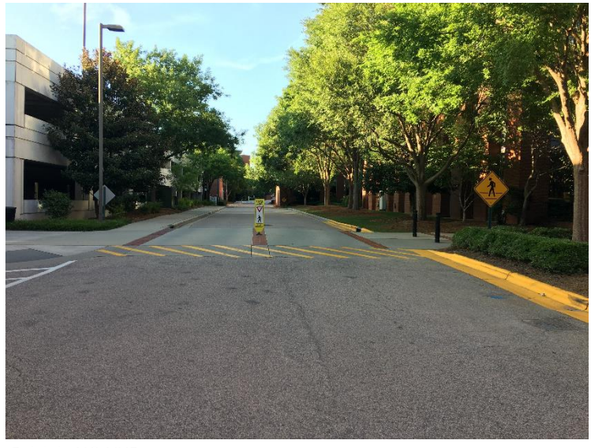
Countermeasure Recommendations

- Parking restrictions on crosswalk approach
- Curb extensions
- Stop/yield signage

Curb Extensions

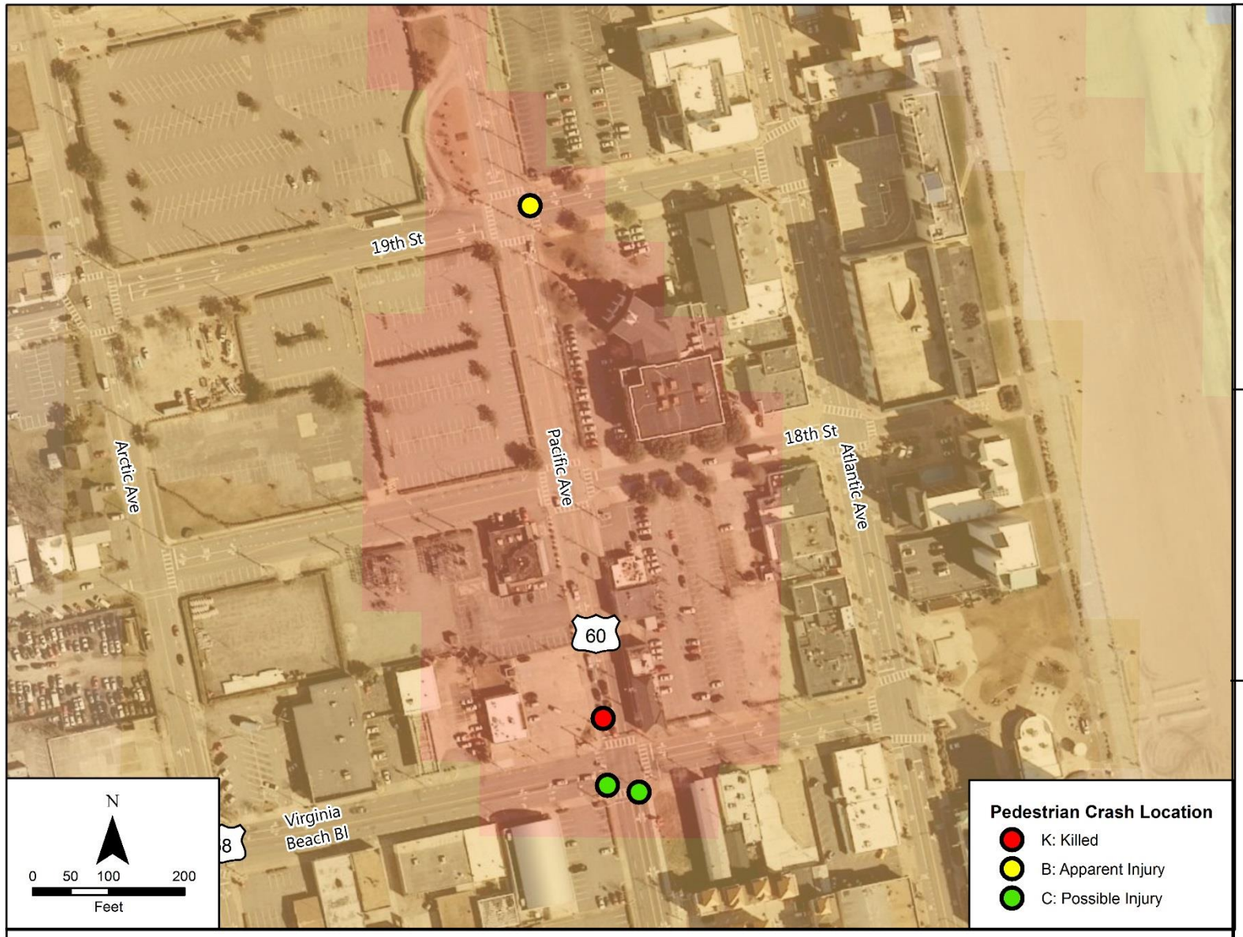
Vancouver, BC, Canada. Richard Drdul

Stop/Yield Signage



Raleigh, NC. VHB

Virginia Beach: Pacific Avenue (US 60)

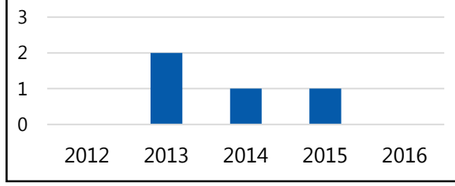


Community: Virginia Beach
VDOT District: 5 (Hampton Roads)

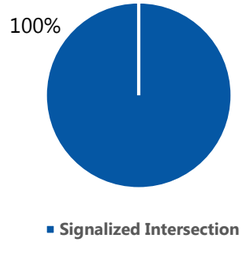
Crash Severity

K: Killed: 1
A: Severe: 0
B: Apparent: 1
C: Possible: 2

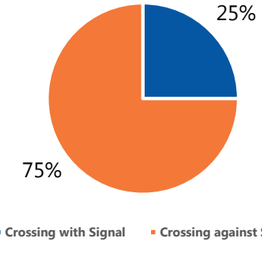
Crashes by Year



Crash Location



Pedestrian Action



Crash History

- All crashes occurred on a 4-lane, two-way undivided highway.
- All crashes occurred in a 35 mph zone.
- 1 out of 4 crashes involved improper or illegal action by the driver. The fatality involved the pedestrian crossing against the signal and the driver action is unknown.
- 3 out of 4 crashes occurred during dark/lighted conditions. The remaining crash occurred during the daylight.
- Only the fatal crash involved alcohol (both parties).

Crash Cluster Description

- Commercial, urban setting
- 4 travel lanes, undivided
- Mix of signalized and unsignalized intersections with no formal mid-block crossings
- 35 mph speed limit
- 15,000 AADT

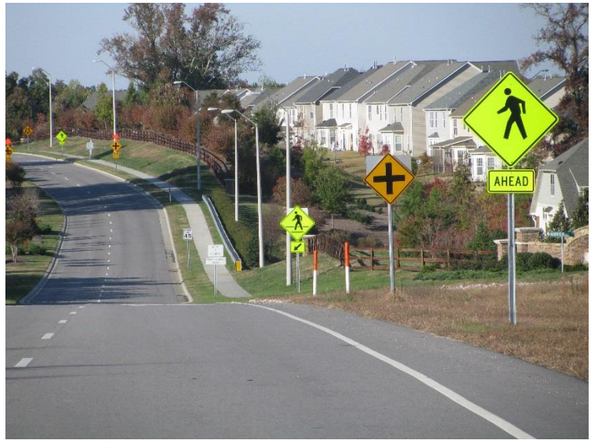
Countermeasure Recommendations

- Lighting and visibility enhancements
- Advance stop/yield signage
- Pedestrian refuge median island

Pedestrian Refuge Island

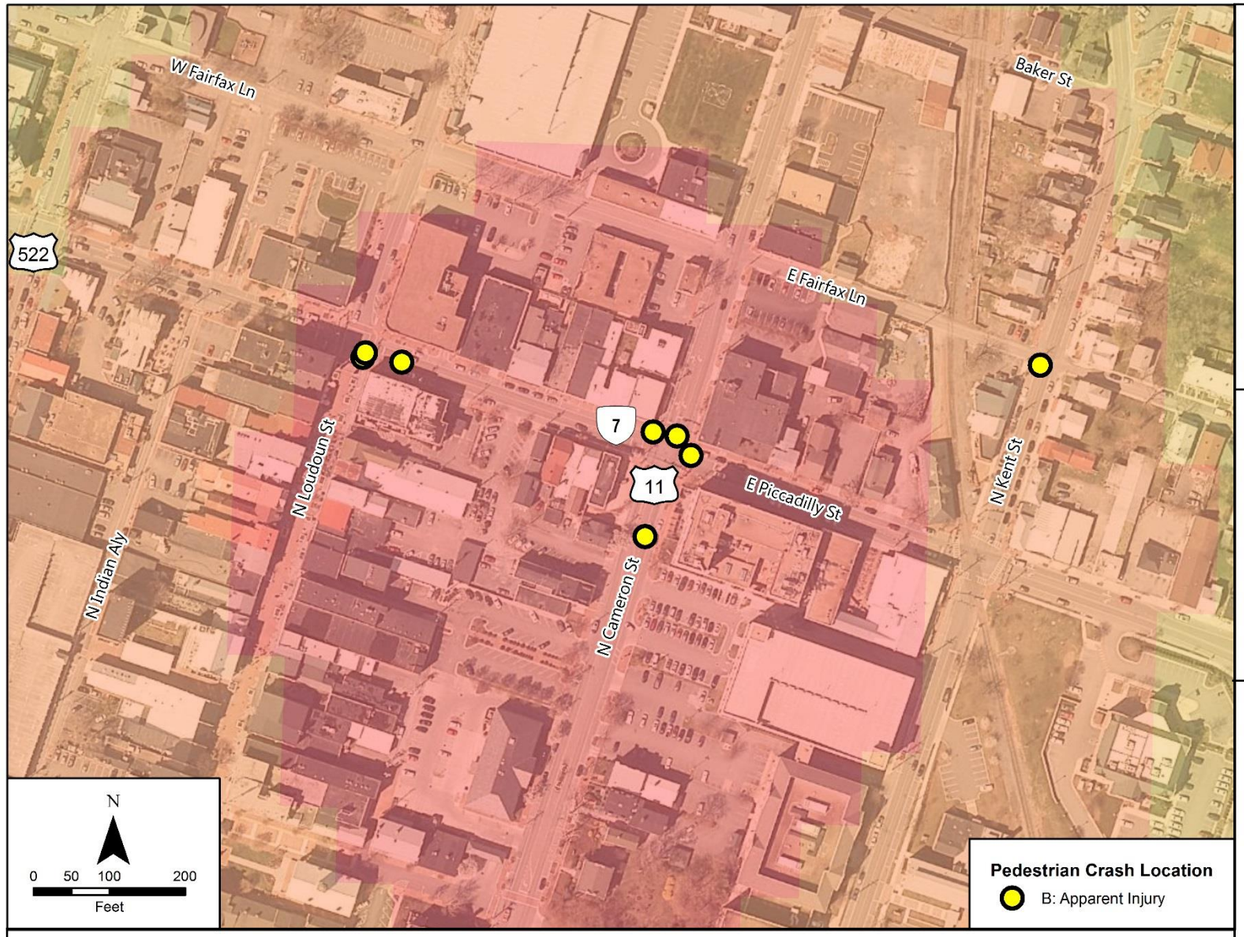
Port Townsend, WA. Richard Drdul

Advance Pedestrian Warning Signage



Cary, NC. VHB

Winchester: Piccadilly Street (SR 7)

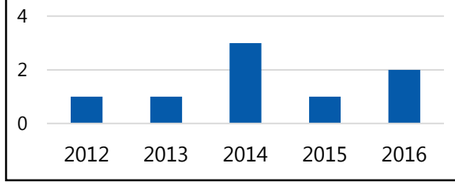


Community: Winchester
VDOT District: 8 (Staunton)

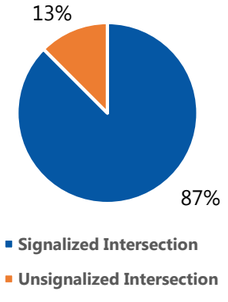
Crash Severity

K: Killed: 0
A: Severe: 0
B: Apparent: 8
C: Possible: 0

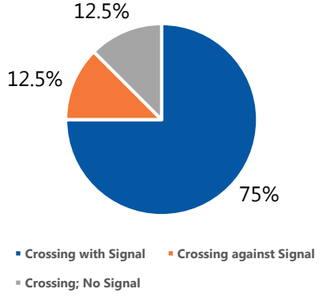
Crashes by Year



Crash Location



Pedestrian Action



Crash History

- 7 out of 8 crashes occurred on 2-lane, two-way undivided roads.
- All crashes occurred in a 25 mph zone.
- 5 out of 8 crashes involved improper or illegal action by the driver.
- 6 out of 8 crashes occurred during the daylight. One occurred in dark/lighted conditions and 1 occurred at dawn.
- 1 out of 8 crashes involved alcohol (pedestrian).

Crash Cluster Description

- Mixed-use, urban setting
- 2 travel lanes, undivided
- Signalized intersections with no formal mid-block crossings
- 25 mph speed limit
- 10,000 AADT

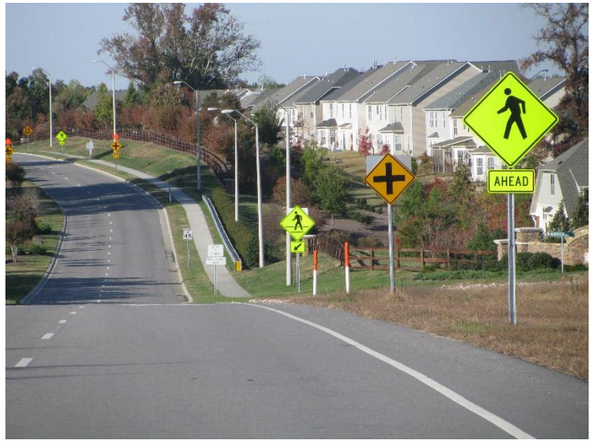
Countermeasure Recommendations

- High visibility crosswalks
- Advance stop/yield signage
- Split signal phasing

High Visibility Crosswalks

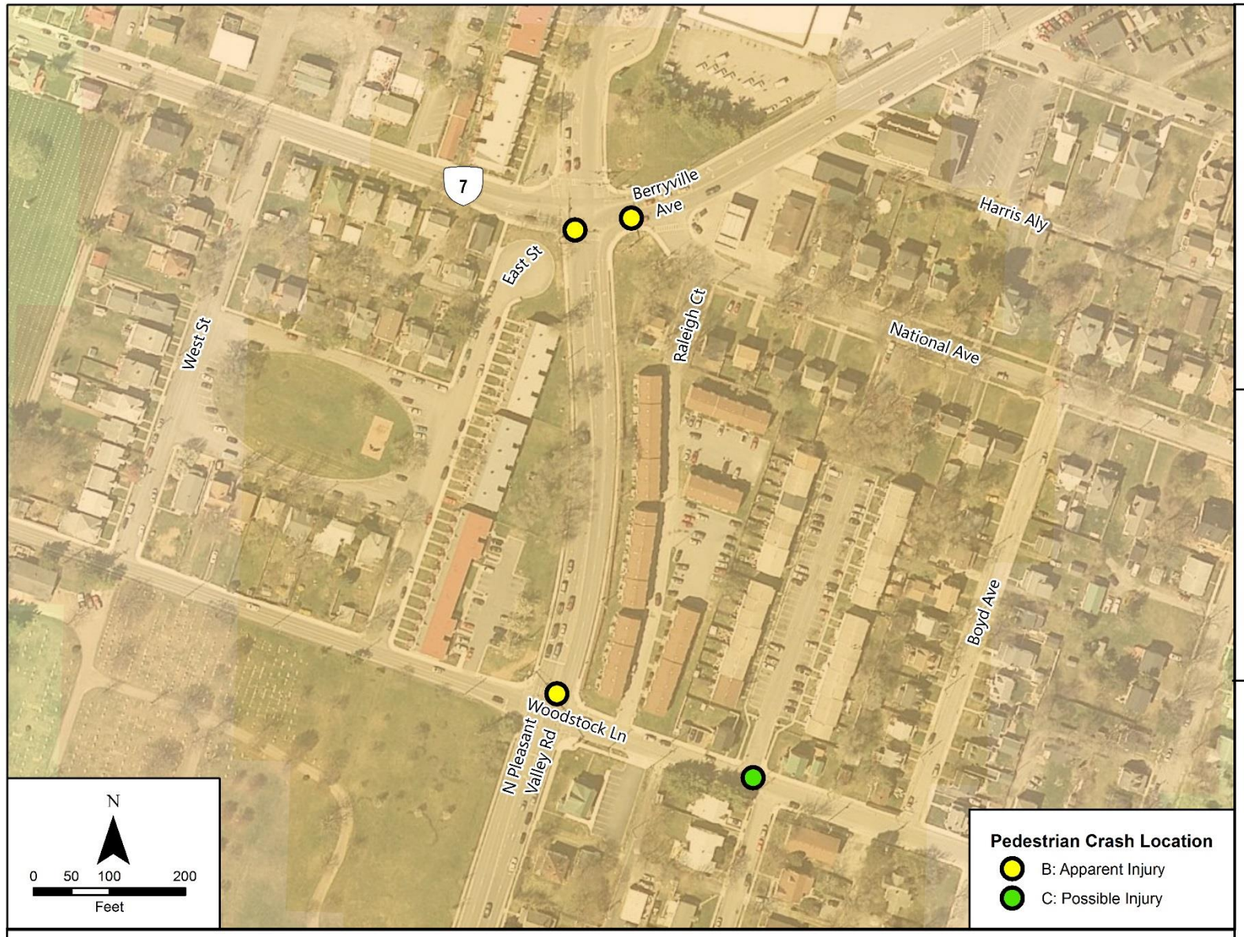
Memphis, TN. VHB

Advance Pedestrian Warning Signage



Cary, NC. VHB

Winchester: Pleasant Valley Road

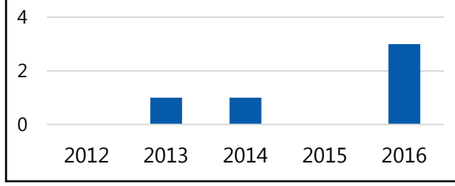


Community: Winchester
VDOT District: 8 (Staunton)

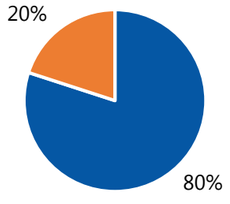
Crash Severity

K: Killed: 0
A: Severe: 0
B: Apparent: 4
C: Possible: 1

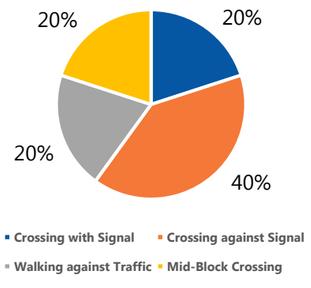
Crashes by Year



Crash Location



Pedestrian Action



Crash History

- 4 out of 5 crashes occurred on 4-lane, two-way undivided highways. the remaining occurred on a 2-lane, two-way undivided road.
- 3 out of 5 crashes occurred in 25 mph zones. One occurred in a 35 mph zone and the other in a 40 mph zone.
- 2 out of 5 crashes involved improper or illegal action by the driver.
- 3 out of 5 crashes occurred during the daylight. The remaining crashes occurred during dark/lighted conditions.
- No crashes involved alcohol.

Crash Cluster Description

- Residential, suburban setting
- 4 travel lanes, undivided
- Signalized intersections with no formal mid-block crossings
- 35 mph speed limit
- 19,000 AADT

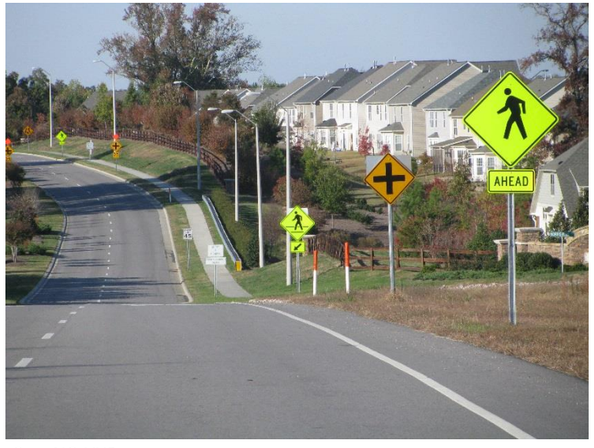
Countermeasure Recommendations

- High visibility crosswalks
- Advance stop/yield signage
- Pedestrian refuge median island

Pedestrian Refuge & High Visibility Crosswalks

Asheville, NC. Lyuba Zuyeva

Advance Pedestrian Warning Signage



Cary, NC. VHB

B Appendix B: Priority Corridor Index and Cut Sheets

Priority ID	Segment ID	Priority Segment ID	Street	From	To	Community	Character	Countermeasures	Support	Estimated Cost
41	1	411	Arlington Boulevard	Pershing Drive	Granada Street	Arlington County	6-lane median divided arterials with adjacent institutional, recreational, and residential land uses	Evaluate area for grade separated pedestrian crossing at activity centers, modify medians to median islands, PHBs at midblock crossings, and pedestrian countdown signals	Roadway acts a barrier to adjacent land uses and is largely restricted access.	High
23	1	231	Columbia Pike	Joyce Street	Jefferson Street	Arlington County	4-lane undivided collector roadway with moderate commercial and residential density of land uses	Review signal timing for adequate pedestrian crossing time and LPI, median islands at wide crossings, advanced warning signage, and installation of PHBs at key mid-block locations with high pedestrian activity (RRFBs are already present)	Existing pedestrian facilities appear supportive	High
56	1	561	Lee Highway	Lynn Street	Powhatan Street	Arlington County	6-and-4-lane median divided roadway arterial roadway with higher density commercial and residential land uses	Advanced warning signage, PHBs at mid-block crossings with high levels of pedestrian activity, consistent application of median islands and high visibility crosswalks, review of signal timing for LPI	Existing facilities have possess median islands, crosswalks, and signal heads. Some countermeasures applied inconsistently	Low
37	1	371	N George Mason Drive	Lee Highway	Arlington Boulevard	Arlington County	4-lane median divided collector roadway with residential, commercial, and recreational land uses	Curb extensions and parking restrictions near crossings and intersections, advanced warning signage, PHBs at key activity center mid block crossing	Traffic calming already underway and high visibility crosswalks in place, but numerous mid-block and unsignalized crossings present challenges to crossing	High
137	1	1371	S George Mason Drive	4th Street	Dinwiddie Street	Arlington County	4-lane median divided collector roadway with moderate commercial and residential land uses	Consistent application of high visibility crosswalks, RRFB or PHB at key mid-block crossings, and review signal timing for LPI or pedestrian phasing	Traffic calming and countermeasures already in place, although inconsistently in places	High
146	1	1461	Jefferson Davis Highway	Falling Creek Avenue	Arrowfield Road	Chesterfield County	6-and-4-lane median divided highway with wide range of adjacent commercial and residential land uses	Pedestrian signal heads at signalized intersections, high visibility crosswalks, and raised median islands at pedestrian activity centers. Potential of PHB in locations where high pedestrian demand is demonstrated, or consideration of grade separated crossing facility	Wide crossing widths, lack of pedestrian infrastructure, high ADT, and high operating speeds	High
111	1	1111	High Street	Long Street	Lexington Avenue	City of Charlottesville	2-lane undivided collector with moderate density of residential and commercial land uses	Advanced warning signage, and review existing signal timing for pedestrian phase or LPI	Existing crosswalks are high visibility and continental, and most of signalized intersections have pedestrian signal heads	Medium
111	2	1112	High Street	Lexington Avenue	Preston Avenue	City of Charlottesville	2-lane undivided local street with moderate residential density	Curb extensions and parking restrictions, high visibility crosswalks, in-street yield signage	On-street parking allows for curb extensions, small blocks and frequent intersections with pedestrian demand and existing infrastructure	High
140	1	1401	Preston Avenue	Rosser Avenue E	4th Street NW	City of Charlottesville	4-lane raised median divided collector with moderate density commercial and recreational development land uses	Formalize existing raised median islands, review signalized intersections for LPI, RTOR at signalized intersections	Marked crosswalks and signalized intersections present, though improvements can be made to existing infrastructure	High
125	1	1251	Riverside Drive	Fairview Avenue	Main Street	City of Danville	6-and-4-lane median divided collector with minimal pedestrian crossings, frequent access points, and commercial and recreational land uses	Pedestrian signal heads and countdown signals, high visibility crosswalk materials and patterns, modification of medians to median islands, and Pedestrian Hybrid Beacon at midblock crossings	Wide crossing distance of over 100 feet in most locations with minimal pedestrian crossing infrastructure across corridor	Low

Priority ID	Segment ID	Priority Segment ID	Street	From	To	Community	Character	Countermeasures	Support	Estimated Cost
150	1	1501	Main Street	Johnson Street	Grattan Street	City of Harrisonburg	2-lane one way local roadway with moderate commercial and residential density	Pedestrian signal heads, high visibility crosswalks, curb extensions and parking restrictions, and RRFB (if applicable)	Existing traffic calming and pedestrian sidewalk infrastructure, but lack of pedestrian signals at signalized intersections	Medium
150	2	1502	Main Street	Grattan Street	Pleasant Valley Road	City of Harrisonburg	4-lane road turning lane median divided with moderate institutional and commercial density	Implement pedestrian countdown signals and median raised island at signalized intersections. Due to block length, consider PHB at mid-block crossings in locations with pedestrian activity centers	Long block lengths and wide crossing widths with signalized intersections and pedestrian signals	Low
132	1	1321	12th Street	Campbell Avenue	Commerce Street	City of Lynchburg	2-lane undivided collector with moderate density of institutional and commercial land uses	LPI or extended signal phase at signalized intersections, updated high visibility crosswalks, curb extensions and parking restrictions where on-street parking exists, in-street yield signs, and RRFB near vulnerable population centers (e.g. school)	Existing crosswalk markings and designs are outdated, traffic calming activities already underway, and few signalized intersections.	Low
48	1	481	Jefferson Avenue	Fort Eustis Boulevard	18th Street	City of Newport News	6-lane median divided arterial with broad mix of moderate density residential, commercial, and industrial land uses	Upgrade crosswalks to high visibility materials and patterns, consider pedestrian signal phasing or LPI, adaptation of existing medians to median islands, and location of PHBs in residential areas	Few signalized crossing locations in southern portion of corridor. Wide crossing distances necessitate area median islands and longer crossing periods	Medium
72	1	721	Warwick Boulevard	Falls Reach Parkway	Dozier Road	City of Newport News	2-lane undivided local roadway with adjacent industrial and residential land uses	Advance warning signage, RRFB, high visibility crosswalks at pedestrian activity centers	Potential for crosswalks in marked locations at key pedestrian activity centers	Medium
72	2	722	Warwick Boulevard	Dozier Road	71st Street	City of Newport News	6-and-4-lane median divided collector roadway with moderate commercial and residential density land use	Pedestrian signal heads at signalized intersections, modification of existing medians to median islands, PHBs at mid-block locations, review of signal phasing for extended pedestrian phase or LPI, and high visibility crosswalks	Width of road and activity generators support the deployment of crosswalk facilities	Medium
164	1	1641	Ballentine Boulevard	Princess Anne Road	Kimball Terrace	City of Norfolk	4-lane median divided and 2-lane undivided local roadways with commercial, recreational, an residential land uses	Pedestrian countdown signals at already signalized intersections, upgrade crosswalks to high visibility materials and patterns, advance warning signs, and in-street yield signs at midblock location	Variety of land uses with existing pedestrian crossing infrastructure, though improvements can be made to enhance CMs	Medium
149	1	1491	Campostella Road	Wilson Road	Berkley Avenue	City of Norfolk	6-and-4-lane median divided collector roadway with residential, commercial, and institutional land uses	Pedestrian countdown signals, expand medians to median islands, PHBs at key midblock locations, consider LPI or pedestrian signal timing at wider intersections	Numerous mid-block crossing locations with high pedestrian activity centers and wide roads	High
177	1	1771	Chesapeake Boulevard	Ocean View Avenue	Ballentine Boulevard	City of Norfolk	6-and-4-lane median divided collector roadway with institutional, recreational, residential, and commercial land uses	Pedestrian countdown signals at already signalized intersections, upgrade crosswalks to high visibility materials and patterns, expand medians to median islands, PHBs at key midblock locations, consider LPI or pedestrian signal timing at wider intersections	Surrounding land use and existing sidewalk infrastructure are supportive of enhanced pedestrian crossing facilities given roadway configuration	Low
177	2	1772	Chesapeake Boulevard	Ballentine Boulevard	Tait Terrace	City of Norfolk	2-lane undivided local roadway with moderate density of residential land uses	High visibility crosswalks and traffic calming measures such as raised crosswalks and speed tables and share use markings	Local roadway with high pedestrian activity and few crossing facilities	Low

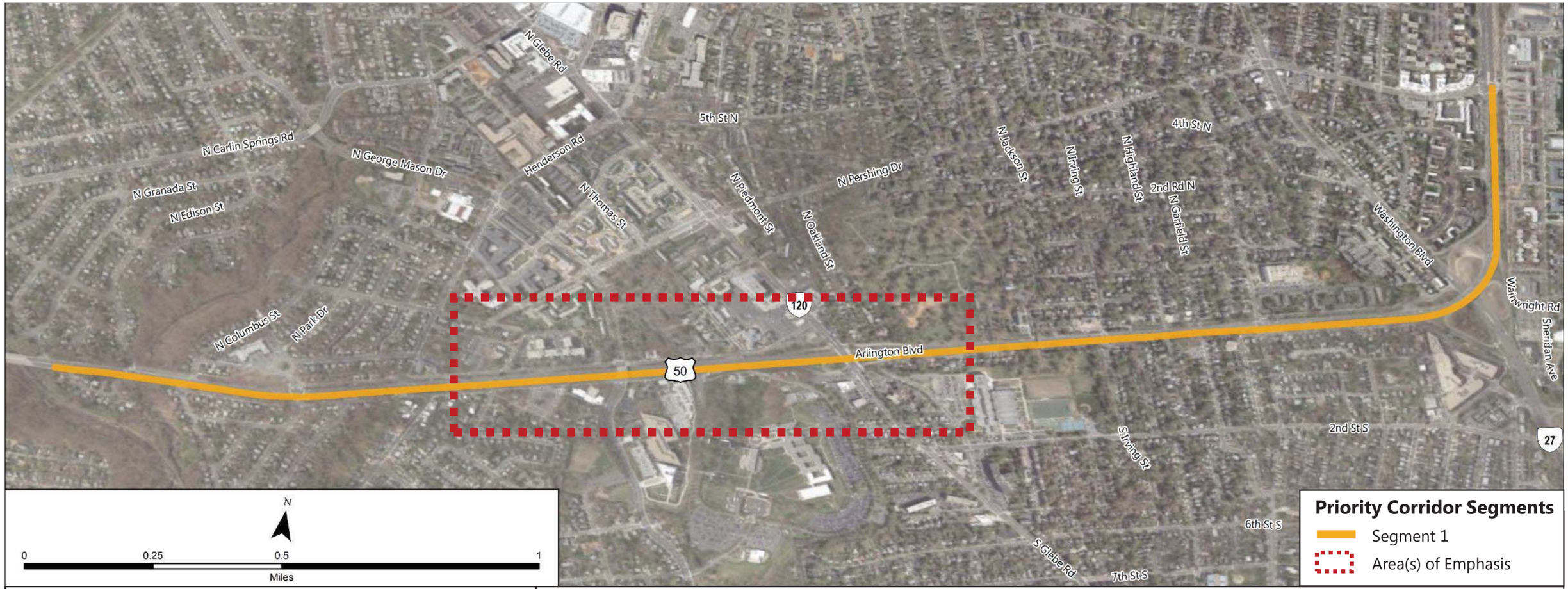
Priority ID	Segment ID	Priority Segment ID	Street	From	To	Community	Character	Countermeasures	Support	Estimated Cost
104	1	1041	Granby Street	Dupre Avenue	Church Street	City of Norfolk	4-lane median divided collector roadway with residential, commercial, and institutional land uses	High visibility crosswalks, conversion of existing medians to median islands, advance warning signage, PHB at key crossing locations. Consider speed reduction through residential portion	Land use patterns indicate demand for crossing median, though few opportunities existing .	High
104	2	1042	Granby Street	Church Street	Main Street	City of Norfolk	2-lane undivided local roadway with low density residential and commercial land uses	In-street yield signs, high visibility crosswalks, curb extensions, review of pedestrian signal timing for phases or LPI, traffic calming in such as bicycle lanes	Area of high pedestrian activity with on-street parking and short blocks marked by existing crosswalks.	Medium
67	1	671	Lafayette Boulevard	Chesapeake Boulevard	Tidewater Drive	City of Norfolk	4-lane undivided collector with moderate residential and commercial density	Consideration road diet for portion of corridor, advance warning signage, and PHB at crossing locations (or RRFB is road diet is adopted), traffic calming measures such as bike lanes	ADT count may indicate opportunity for road diet, and remain pavement would be supportive to pedestrian crossing facilities	Medium
67	2	672	Lafayette Boulevard	Tidewater Drive	Dupont Circle	City of Norfolk	4-lane median divided local road with moderate residential density	Advance warning signage, PHB at mid-block locations, curb extensions	Traffic calming already underway, but numerous mid-block crossings present challenges to crossing	Medium
16	1	161	Little Creek Road	Shore Drive	Virginian Drive	City of Norfolk	6-and-4-lane median divided arterial with wide range of adjacent commercial and residential land uses	Expand median to accommodate median islands, pedestrian signal heads at signalized intersections, and high visibility crosswalk materials and patterns.	Wide crossing widths, high ADT, lack of pedestrian crossing infrastructure	High
16	2	162	Little Creek Road	Virginian Drive	Hampton Boulevard	City of Norfolk	4-lane undivided collector with moderate residential density and institutional land uses	Consider road diet for portion of corridor, review signalized intersections for pedestrian phasing or LPI, advance warning signage, and PHB near crossing locations of sensitive uses	Corridor could be reduced to two travel lanes with central turning lane if ADT permits. Also, numerous signalized intersections and mid-block crossings would benefit from pedestrian crossing enhancements given land use	Medium
108	1	1081	Sewells Point Road	Little Creek Road	Widgeon Road	City of Norfolk	4-lane undivided collector roadway with moderate commercial and residential density of land uses	Consideration road diet for portion of corridor, high visibility crosswalks, PHB at crossing locations , traffic calming measures such as bike lanes and on	Recommendations dependent on ADT for conversion to road diet. Additional pavement surfaces could support access to commercial	Medium
108	2	1082	Sewells Point Road	Widgeon Road	Chesapeake Boulevard	City of Norfolk	2-lane undivided local road with residential and institutional land uses	High visibility crosswalks, advance warning signs, and in-street yield signs at midblock crossings	Sensitive populations near crossing locations that warrant additional countermeasures	Medium
108	3	1083	Sewells Point Road	Chesapeake Boulevard	Princess Anne Road	City of Norfolk	4-lane median divided collector roadway with residential, commercial, and institutional land uses	Pedestrian signal heads, high visibility crosswalks, PHB at key midblock crossing locations	Wide crossing distances with pedestrian supporting land uses and lack of pedestrian crossing facilities	High
52	1	521	Tidewater Drive	Ocean View Avenue	I-264	City of Norfolk	6-and-4-lane median divided arterial with wide range of adjacent commercial and residential land uses	Advance warning signage, PHB at mid-block locations, evaluation of pedestrian signal phases or LPI, and high visibility crosswalks	Wide road widths with short blocks and mid-blocks, need for access to transit across corridor	High
144	1	1441	Wilson Road	Campostella Road	Berkley Avenue	City of Norfolk	2-lane undivided local roadway with moderate density of residential land uses	Curb extensions, high visibility crosswalks, in-street yield signage	Low speed road with frequent unsignalized intersections	High
183	1	1831	Park Avenue	Coeburn Avenue	11th Street	City of Norton	4-lane median undivided roadway with moderate density of commercial and low density residential and institutional land uses	Pedestrian countdown signal, evaluate signalized intersections for LPI or pedestrian phasing, curb extensions paired with parking restrictions, possibly reduce speed limits, and consideration of road diet.	Downtown commercial area has well marked crosswalks and is supportive of pedestrian activity, though improvements can be made to increase pedestrian crossing visibility and add amenities for non-motorists if the AADT is supportive of a road diet.	High

Priority ID	Segment ID	Priority Segment ID	Street	From	To	Community	Character	Countermeasures	Support	Estimated Cost
127	1	1271	Belvidere Street	Main Street	Tredegar Street	City of Richmond	6-lane median divided arterial with moderate density commercial and institutional land uses	Raised median islands at signalized intersections, pedestrian signal heads, high visibility crosswalks	Long block lengths and wide crossing widths with signalized intersections and pedestrian signals present challenges to pedestrians	Medium
167	1	1671	Broad Street	2nd Street	I-95	City of Richmond	4-lane median divided collector with dense commercial land uses	Review signal timing for adequate pedestrian crossing time and LPI, advanced warning signage, consider turning restrictions, and curb extensions in locations of on-street parking	High visibility crosswalks and signal heads already in place, and blocks are short enough to not necessarily require a PHB	High
167	2	1672	Broad Street	I-95	34th Street	City of Richmond	4-and-2-lane with moderate residential density and recreational land uses	Raised median island, curb extensions, and high visibility crosswalks. Consider evaluating signal timing.	Crossing facilities appear outdated, and on-street parking is available	High
68	1	681	Franklin Street	Stuart Circle N	Madison Street	City of Richmond	2-lane one way local roadway with moderate commercial and residential density and institutional	Curb extensions and parking restrictions, high visibility crosswalks, and evaluation of pedestrian	Area of high pedestrian activity with on-street parking and short blocks marked by existing	Medium
26	1	261	Williamson Road	Malvern Road NW	Angell Avenue NW	City of Roanoke	4-lane median divided collector with minimal pedestrian crossings and commercial land uses	Pedestrian signal heads and countdown signals, high visibility crosswalk materials and patterns, Pedestrian Hybrid Beacon at midblock crossings	Little to no existing pedestrian crossing infrastructure	High
26	2	262	Williamson Road	Angell Avenue NW	Pocahontas Avenue NE	City of Roanoke	4-lane undivided arterial collector with adjacent land uses	Pedestrian signal heads and countdown signals, high visibility crosswalk materials and patterns, Pedestrian Hybrid Beacon at midblock crossings	Little to no existing pedestrian crossing infrastructure	High
26	3	263	Williamson Road	Pocahontas Avenue NE	Church Avenue SE	City of Roanoke	4-6-lane divided collector with access to arterials and adjacent to commercial land uses	Advance warning signage and markings, RTOR restrictions at signalized intersections, review for LPI or extended pedestrian signal phasing	Existing crosswalks with pedestrians signals but opportunity for turning motion conflicts, especially given ROW near 100 feet	Medium
26	4	264	Williamson Road	Church Avenue SE	Albemarle Avenue SE	City of Roanoke	2-4 lane undivided collector and local roadway that transitions with institutional and commercial adjacent land use	Advance warning signage and markings, RTOR restrictions at signalized intersections, review for LPI or extended pedestrian signal phasing, PHB at prominent mid-block crossings, consistent application of high visibility crosswalks	Existing crosswalks are marked but not of high visibility patterns, and angled intersections present longer crossing distances	High
155	1	1551	Holland Road	Plaza Trail	Dam Neck Road	City of Virginia Beach	4-lane median divided collector with mix of residential, commercial, and industrial land uses	Pedestrian countdown signals at already signalized intersections, upgrade crosswalks to high visibility materials and patterns, expand medians to median	Existing crosswalks are marked with high visibility patterns, though review of signal phases and mid-block crossings would support improved	Low
55	1	551	Virginia Beach Boulevard	Pacific Avenue	Great Neck Road	City of Virginia Beach	4-lane median divided collector with moderate residential and commercial density	PHB at mid-block crossing locations, high visibility crosswalks, raised median islands at crossing locations where missing	Roadway cross-section and land use is conducive to PHB and median islands where pedestrian demand is anticipated	High
55	2	552	Virginia Beach Boulevard	Great Neck Road	Mayo Road	City of Virginia Beach	8-lane median divided arterial with access to highway network and adjacent to moderate	Slip-lane refuge island, expanded median island for two stage crossing, consideration of grade separated	Wide crossing distance with increased exposure to automobile collisions	Low
112	1	1121	National Avenue	East Lane	Pleasant Valley Road	City of Winchester	2-lane undivided local roadway with moderate density of residential land uses	Curb extensions and parking restrictions, high visibility crosswalks, in-street yield signage	Low speed road with frequent unsignalized intersections	High
160	1	1601	Braddock Road	Lincolnia Road	Witch Hazel Road	Fairfax County	2-lane undivided local roadway with low density residential and commercial land uses	Lighting near marked midblock intersections, advanced warning signage	Occasional marked crossings in low density area	High
160	2	1602	Braddock Road	Witch Hazel Road	Old Centreville Road	Fairfax County	4-lane median divided collector roadway with moderate commercial and residential land uses	Consistent application of high visibility crosswalks, RRFB or PHB at key mid-block crossings, modification of medians to refuge islands, and review signal timing for countdown signal and LPI or pedestrian phasing	Long corridor with shared use paths and existing pedestrian infrastructure, though is lacking consistent application of countermeasures	Low

Priority ID	Segment ID	Priority Segment ID	Street	From	To	Community	Character	Countermeasures	Support	Estimated Cost
168	1	1681	Columbia Pike	Jefferson Street	Little River Turnpike	Fairfax County	4-lane median divided collector roadway and adjacent parallel access roadways with commercial, institutional, and moderate density land uses	PHBs at mid-block locations with sensitive land uses, advance warning signage, high visibility crosswalks both on main roadway and adjacent access local road, pedestrian countdown signals, and modification of medians to median islands	Blocks are interrupted by access roads to neighborhoods and sensitive land uses such as schools. Crossings are frequent and inconsistently marked	High
29	1	291	Lee Highway	Poplar Drive	Blake Lane	Fairfax County	6-and-4-lane median divided collector roadway with moderate density commercial and residential land uses	Modify medians to median islands, high visibility crosswalks, pedestrian countdown signals, and PHB at key midblock crossing locations	Busy roadway with long blocks and signalized intersections	Medium
29	2	292	Lee Highway	Stevenson Street	Pleasant Valley Road	Fairfax County	4-lane median divided collector roadway with residential, commercial, and industrial land uses	Slip lane refuge median islands, pedestrian countdown signals, review of signal timing for pedestrian phasing or LPI at heavy pedestrian areas, high visibility crosswalks, PHBs at key midblock crossing locations (or RRFBs), advance warning signs	Wide road widths with long blocks and mid-blocks need access to transit across the median	High
79	1	791	Lee Jackson Memorial Highway	Centreville Road	Jermantown Road	Fairfax County	6-lane median divided arterial with low density commercial and residential land uses	Conversion of existing medians to median islands, high visibility crosswalks, pedestrian countdown signals and review of signal timing for LPI or special pedestrian phasing.	Shared use path on either side of corridor necessitates frequent roadway crossings of wide roadway	High
87	1	871	Little River Turnpike	I-395	Pickett Road	Fairfax County	6-and-4-lane median divided roadway arterial roadway flanked by 2-lane undivided roadways with moderate density commercial and residential land uses	High visibility crosswalks (especially on 2-lane undivided side boulevard roads with access to transit stops and intersections), PHBs at mid-block crossings, modification of existing medians and boulevard barriers to refuge islands, review of signal timing for LPI or pedestrian phasing, and parking restrictions near side roadway intersections and crossings. Consider shared use markings on parallel local roadways	System of the boulevard's roadways and crossing should be coordinated to allow crossing	High
182	1	1821	Ox Road	School Street	Burke Centre Parkway	Fairfax County	4-lane median divided collector roadway with medium residential and low density commercial land uses	Modify medians to median islands, high visibility crosswalks, pedestrian countdown signals, review signal timing for LPI, and review corridor for potential mid-block crossings with PHBs to provided pedestrian access to neighborhoods	Few signalized crossing locations, and wide crossing distances necessitate area median islands and longer crossing periods	High
89	1	891	Richmond Highway	Huntington Avenue	Gunston Road	Fairfax County	6-and-4-lane median divided roadway arterial roadway flanked by 2-lane undivided roadways with moderate density commercial and residential land uses	High visibility crosswalks (especially on 2-lane undivided side boulevard roads with access to transit stops and intersections), consideration of PHBs at new mid-block crossings, modification of existing medians and boulevard barriers to refuge islands, review of signal timing for LPI or pedestrian phasing. Consider shared use markings on parallel local roadways.	Diverse land uses along corridor with long block lengths support the installation of new mid-block crossings and enhancement of existing crossings	High

Priority ID	Segment ID	Priority Segment ID	Street	From	To	Community	Character	Countermeasures	Support	Estimated Cost
133	1	1331	Nine Mile Road	I-64	Pleasant Street	Henrico County	4-lane median divided arterial roadway with low density commercial and sparse residential land uses	Pedestrian signal heads at signalized intersections, high visibility crosswalks, and raised median islands where at pedestrian activity centers.	Wide crossing distances and lack pedestrian crossing facilities corridor wide	High
18	1	181	Pemberton Road	Broad Street	Three Chopt Road	Henrico County	2-lane turning lane median divided collector with low density residential and commercial development	Pedestrian signal heads at signalized intersections, high visibility crosswalks,	Existing intersection widths and signalization dictate expanding pedestrian facilities	Medium
18	2	182	Pemberton Road	Three Chopt Road	Quioccasin Road	Henrico County	2-lane turning undivided roadway with low density residential and commercial development	High visibility crosswalks, advance warning signage at unsignalized intersections and unmarked crossing locations	Low density land use with limited pedestrian infrastructure	High
49	1	491	W Broad Street	Cold Hill Lane	Bishop Road	Henrico County	6-lane median divided arterial with low density commercial land uses	Pedestrian signal heads at signalized intersections, high visibility crosswalks, and raised median islands where at pedestrian activity centers. Certain locations may be suitable for PHBs	Area does not contain significant pedestrian infrastructure, and roadway width presents crossing challenges.	High
99	1	991	Electric Road	Keagy Road	Brambleton Avenue	Roanoke County	4-lane median divided collector with minimal pedestrian crossings and mixed low density residential and commercial land uses	Review land uses and pedestrian activity for provision of sidewalk or shared use path in the area. Implement pedestrian countdown signals and median raised island at signalized intersections. Consider PHB at mid-block crossings	Little to no existing pedestrian crossing infrastructure and wide crossing distances	High
82	1	821	Harrison Road	Plank Road	Leavells Road	Spotsylvania County	4-lane undivided collector with moderate density commercial and residential plus institutional land uses	Raised median islands at signalized intersections, pedestrian signal heads, high visibility crosswalks, and advanced stop lines at signalized intersections	Wide crossing distances with pedestrian supporting land uses and lack of pedestrian crossing facilities	Medium
82	2	822	Harrison Road	Leavells Road	I-95	Spotsylvania County	2-lane undivided collector with low density residential, commercial, and agricultural land uses	High visibility crosswalks, advance warning signage at pedestrian activity centers	Minimal pedestrian crosswalk facilities present	High
9	1	91	Lafayette Boulevard	Jefferson Davis Highway	Rodes Street	Spotsylvania County	2-lane turning lane median divided collector with low density residential and commercial development	Pedestrian signal heads and countdown signals at signalized intersections, high visibility crosswalk materials and patterns at unsignalized intersections, Pedestrian Hybrid Beacon at midblock crossings	Limited pedestrian infrastructure (i.e. sidewalks) along corridor, minimal markings for crosswalks at currently marked locations, and few signalized intersections with pedestrian heads	High
81	1	811	Leavells Road	Harrison Road	Rising Ridge Road	Spotsylvania County	4-lane median divided collector with low density residential, commercial, and institutional land uses	Advanced stop/yield signage paired with high visibility crosswalk markings, pedestrian hybrid beacon near sensitive land uses, pedestrian signal heads at currently signalized intersections	Lack of pedestrian crossing infrastructure despite existing sidewalks and sensitive land uses	High
81	2	812	Leavells Road	Rising Ridge Road	Oak Tree Drive	Spotsylvania County	2 lane undivided local roadway with low density residential and agricultural land uses	Advanced stop/yield signage paired with high visibility crosswalk markings	Land use patterns indicate low demand for pedestrian activity, though lack of existing marked crosswalks	Medium

Arlington Boulevard (US 50) – Sheet 1 of 1



Community: Arlington
VDOT District: 9 (NOVA)

Corridor Description

- **Segment 1:** 6-lane median divided roadway with adjacent moderate density of institutional, recreational, and residential land uses. **AADT: ~57,000; Speed Limit: 45**

Recommended Countermeasures

- **Segment 1:** Evaluate area for grade separated pedestrian crossing at activity centers, modify medians to median islands, PHBs at key midblock crossings, and pedestrian countdown signals.

Notes

- **Segment 1:** Roadway acts as a barrier to adjacent land uses and is largely restricted access.

Columbia Pike (SR 244) – Sheet 1 of 2

Community: Arlington
VDOT District: 9 (NOVA)

Corridor Description

- **Segment 1:** 4-lane undivided roadway with moderate commercial and residential density of land uses. **AADT: ~24,000; Speed Limit: 35**

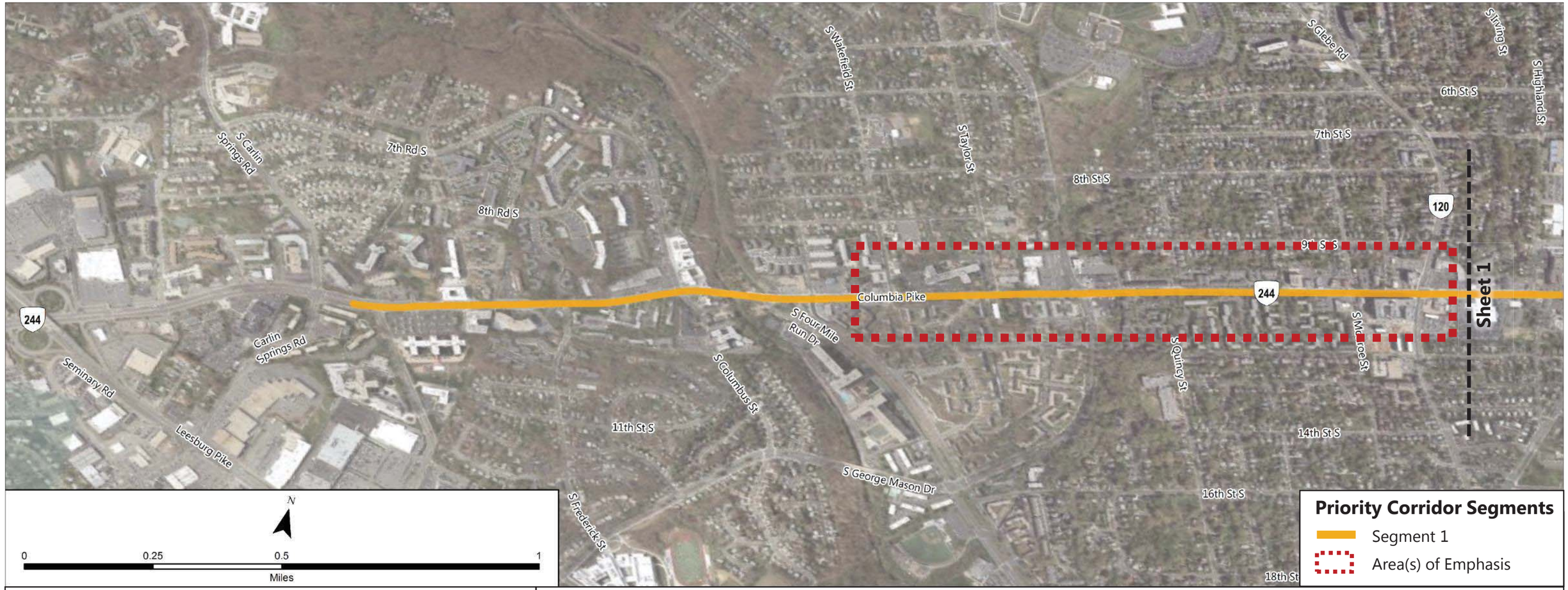
Recommended Countermeasures

- **Segment 1:** Review signal timing for adequate pedestrian crossing time and LPI, median islands at wide crossings, advanced warning signage, and installation of PHBs at key mid-block locations with high pedestrian activity (RRFBs are already present at shorter crossing distances).

Notes

- **Segment 1:** Existing pedestrian facilities appear supportive of land uses, and proposed improvements are incremental

Columbia Pike (SR 244) – Sheet 2 of 2



Community: Arlington
VDOT District: 9 (NOVA)

Corridor Description

- **Segment 1:** 4-lane undivided roadway with moderate commercial and residential density of land uses. **AADT: ~24,000; Speed Limit: 35**

Recommended Countermeasures

- **Segment 1:** Review signal timing for adequate pedestrian crossing time and LPI, median islands at wide crossings, advanced warning signage, and installation of PHBs at key mid-block locations with high pedestrian activity (RRFBs are already present at shorter crossing distances).

Notes

- **Segment 1:** Existing pedestrian facilities appear supportive of land uses, and proposed improvements are incremental

Lee Highway (US 29) – Sheet 1 of 2

Community: Arlington
VDOT District: 9 (NOVA)

Corridor Description

- **Segment 1:** 6-and-4-lane median divided roadway with higher density commercial and residential land uses. **AADT: ~16,000 to 24,000; Speed Limit: 30 to 40**

Recommended Countermeasures

- **Segment 1:** Advanced warning signage, PHBs at key mid-block crossings with high levels of pedestrian activity, consistent application of median islands and high visibility crosswalks, and review of signal timing for LPI.

Notes

- **Segment 1:** Existing facilities possess median islands, crosswalks, and signal heads, however countermeasures applied inconsistently.

Lee Highway (US 29) – Sheet 2 of 2

Community: Arlington
VDOT District: 9 (NOVA)

Corridor Description

- **Segment 1:** 6-and-4-lane median divided roadway with higher density commercial and residential land uses. **AADT: ~16,000 to 24,000; Speed Limit: 30 to 40**

Recommended Countermeasures

- **Segment 1:** Advanced warning signage, PHBs at key mid-block crossings with high levels of pedestrian activity, consistent application of median islands and high visibility crosswalks, and review of signal timing for LPI.

Notes

- **Segment 1:** Existing facilities possess median islands, crosswalks, and signal heads, however countermeasures applied inconsistently.

North George Mason Drive (SC 6710) – Sheet 1 of 1

Community: Arlington
VDOT District: 9 (NOVA)

Corridor Description

- **Segment 1:** 4-lane median divided roadway with residential, commercial, and recreational land uses. **AADT: ~16,000 to 23,000; Speed Limit: 35**

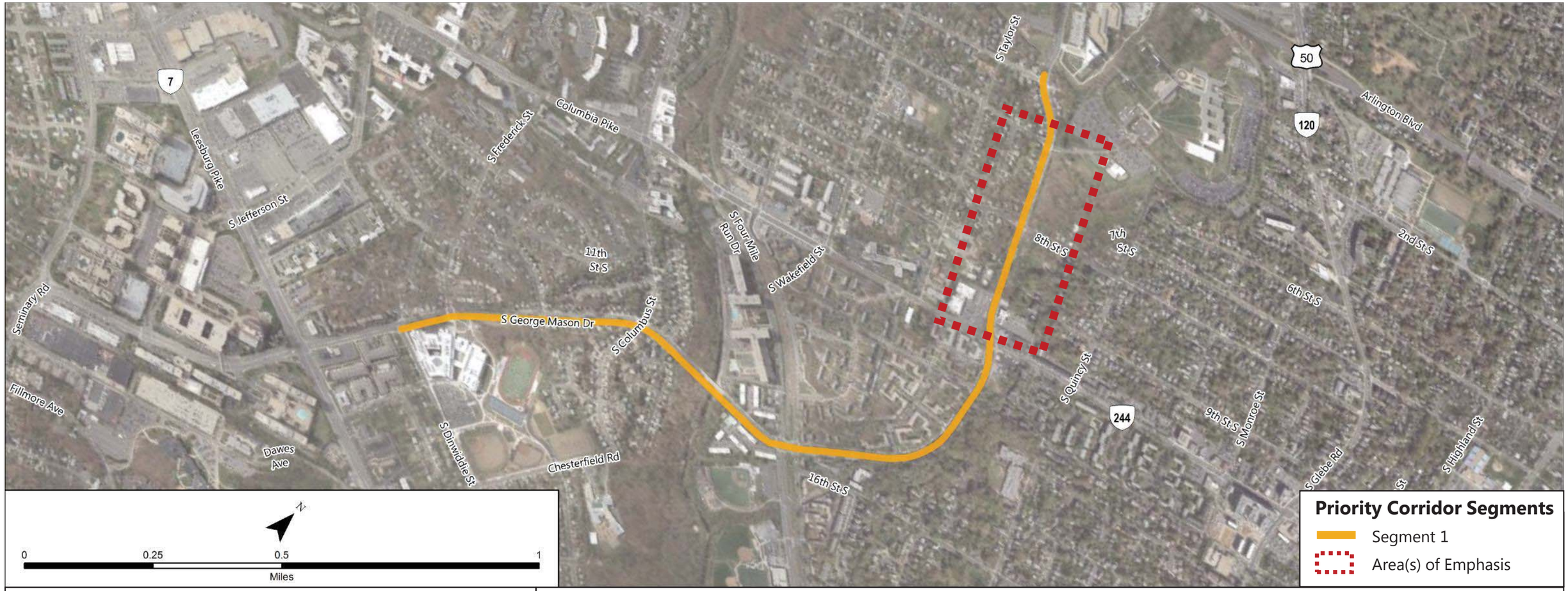
Recommended Countermeasures

- **Segment 1:** Curb extensions and parking restrictions near crossings and intersections, advanced warning signage, and PHBs at key activity center mid-block crossings.

Notes

- **Segment 1:** Traffic calming already underway and high visibility crosswalks in place, but numerous mid-block and unsignalized crossings present challenges to crossing.

South George Mason Drive (SC 6710) – Sheet 1 of 1



Community: Arlington
VDOT District: 9 (NOVA)

Corridor Description

- **Segment 1:** 4-lane median divided roadway with moderate commercial and residential land uses. **AADT: ~15,000 to 25,000; Speed Limit: 35**

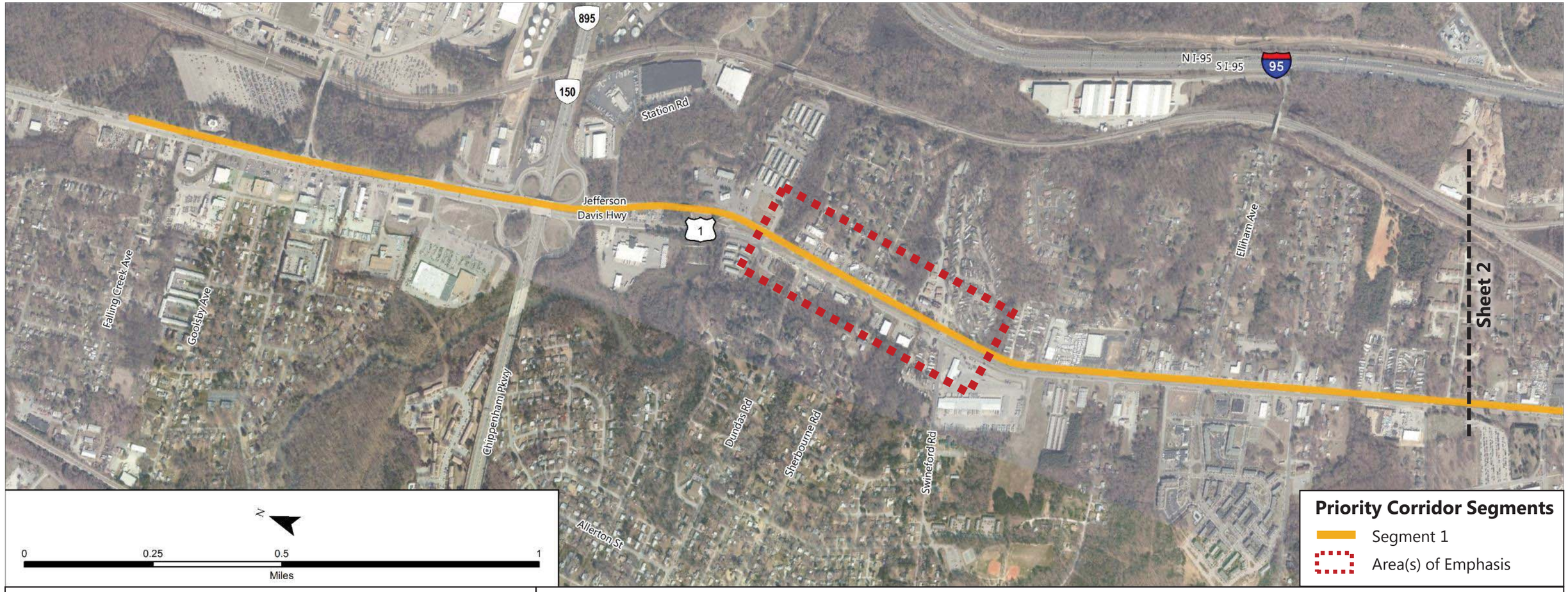
Recommended Countermeasures

- **Segment 1:** Consistent application of high visibility crosswalks, RRFBs or PHBs at key mid-block crossings, and review signal timing for LPI or pedestrian phasing.

Notes

- **Segment 1:** Traffic calming and countermeasures already in place, although inconsistently.

Jefferson Davis Highway (US 1) – Sheet 1 of 5



Community: Chesterfield County
VDOT District: 4 (Richmond)

Corridor Description

- **Segment 1:** 6-and-4-lane median divided roadway with wide range of adjacent commercial and residential land uses. **AADT: ~17,000 to 28,000; Speed Limit: 45**

Recommended Countermeasures

- **Segment 1:** Pedestrian signal heads at signalized intersections, high visibility crosswalks, and raised median islands at pedestrian activity centers; potential of PHB in locations where high pedestrian demand is demonstrated, or consideration of grade separated crossing facility.

Notes

- **Segment 1:** Wide crossing widths, lack of pedestrian infrastructure, and high operating speeds support robust pedestrian amenities.

Jefferson Davis Highway (US 1) – Sheet 2 of 5

Community: Chesterfield County
VDOT District: 4 (Richmond)

Corridor Description

- **Segment 1:** 6-and-4-lane median divided roadway with wide range of adjacent commercial and residential land uses. **AADT: ~17,000 to 28,000; Speed Limit: 45**

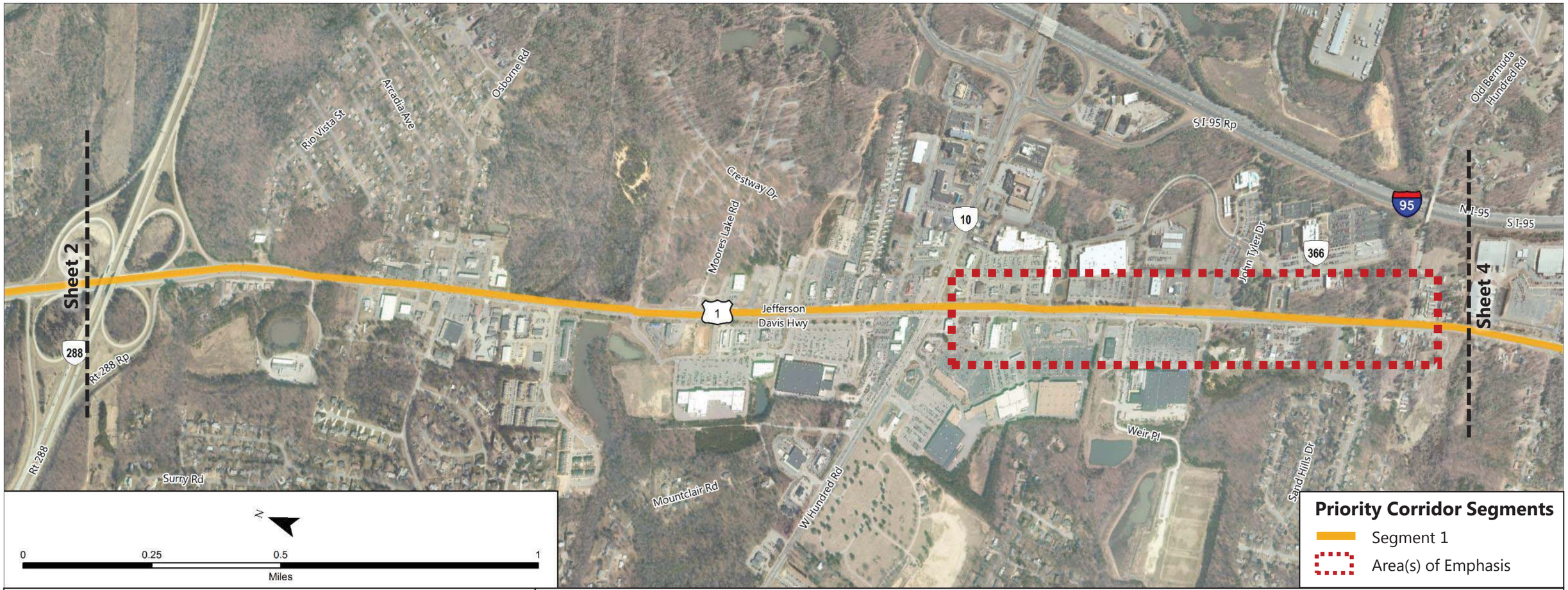
Recommended Countermeasures

- **Segment 1:** Pedestrian signal heads at signalized intersections, high visibility crosswalks, and raised median islands at pedestrian activity centers; potential of PHB in locations where high pedestrian demand is demonstrated, or consideration of grade separated crossing facility.

Notes

- **Segment 1:** Wide crossing widths, lack of pedestrian infrastructure, and high operating speeds support robust pedestrian amenities.

Jefferson Davis Highway (US 1) – Sheet 3 of 5



Community: Chesterfield County
VDOT District: 4 (Richmond)

Corridor Description

- **Segment 1:** 6-and-4-lane median divided roadway with wide range of adjacent commercial and residential land uses. **AADT: ~17,000 to 28,000; Speed Limit: 45**

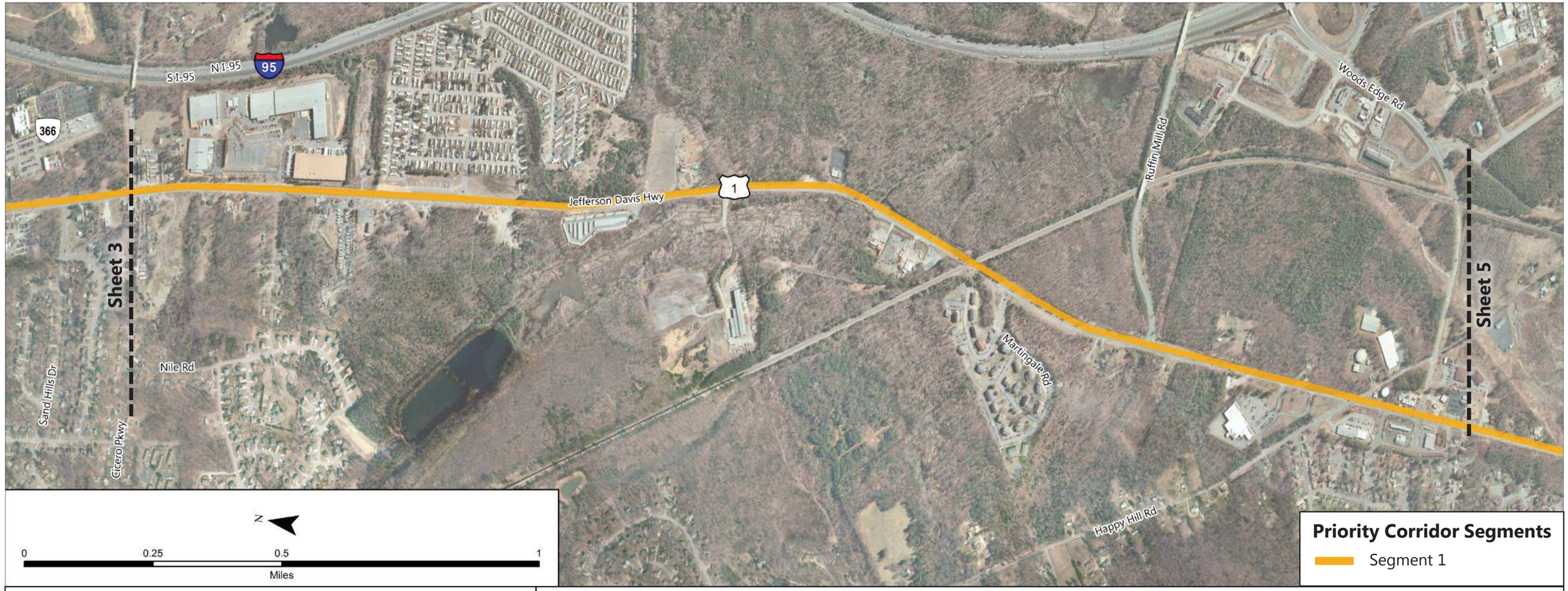
Recommended Countermeasures

- **Segment 1:** Pedestrian signal heads at signalized intersections, high visibility crosswalks, and raised median islands at pedestrian activity centers; potential of PHB in locations where high pedestrian demand is demonstrated, or consideration of grade separated crossing facility.

Notes

- **Segment 1:** Wide crossing widths, lack of pedestrian infrastructure, and high operating speeds support robust pedestrian amenities.

Jefferson Davis Highway (US 1) – Sheet 4 of 5



Community: Chesterfield County
VDOT District: 4 (Richmond)

Corridor Description

- **Segment 1:** 6-and-4-lane median divided roadway with wide range of adjacent commercial and residential land uses. **AADT: ~17,000 to 28,000; Speed Limit: 45**

Recommended Countermeasures

- **Segment 1:** Pedestrian signal heads at signalized intersections, high visibility crosswalks, and raised median islands at pedestrian activity centers; potential of PHB in locations where high pedestrian demand is demonstrated, or consideration of grade separated crossing facility.

Notes

- **Segment 1:** Wide crossing widths, lack of pedestrian infrastructure, and high operating speeds support robust pedestrian amenities.

Jefferson Davis Highway (US 1) – Sheet 5 of 5

Community: Chesterfield County
VDOT District: 4 (Richmond)

Corridor Description

- **Segment 1:** 6-and-4-lane median divided roadway with wide range of adjacent commercial and residential land uses. **AADT: ~17,000 to 28,000; Speed Limit: 45**

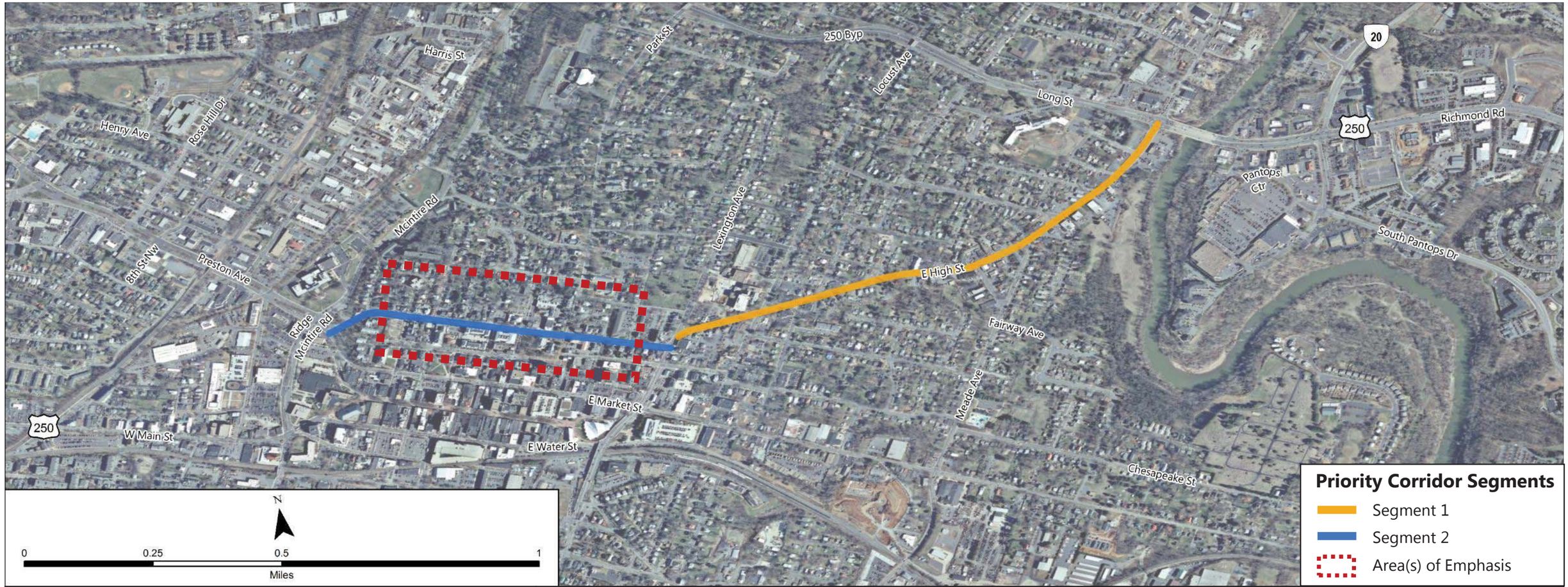
Recommended Countermeasures

- **Segment 1:** Pedestrian signal heads at signalized intersections, high visibility crosswalks, and raised median islands at pedestrian activity centers; potential of PHB in locations where high pedestrian demand is demonstrated, or consideration of grade separated crossing facility.

Notes

- **Segment 1:** Wide crossing widths, lack of pedestrian infrastructure, and high operating speeds support robust pedestrian amenities.

High Street (BUS 1 US 250) – Sheet 1 of 1



Community: Charlottesville
VDOT District: 7 (Culpeper)

Corridor Description

- **Segment 1:** 2-lane undivided roadway with moderate density of residential and commercial land uses. **AADT: ~15,000; Speed Limit: 35**
- **Segment 2:** 2-lane undivided roadway with moderate residential density. **AADT: ~7,000; Speed Limit: 35**

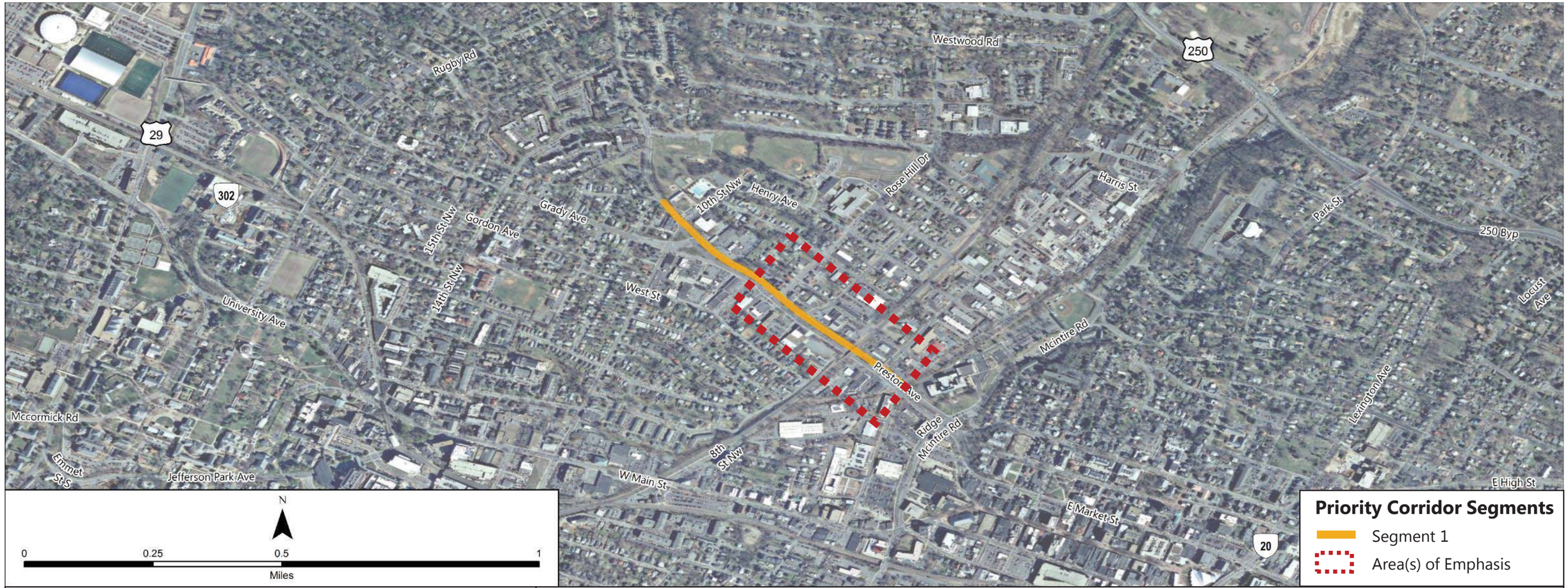
Recommended Countermeasures

- **Segment 1:** Advanced warning signage, and review of existing signal timing for pedestrian phase or LPI.
- **Segment 2:** Curb extensions and parking restrictions, high visibility crosswalks, in-street yield signage.

Notes

- **Segment 1:** Existing crosswalks are high visibility and continental, and most of signalized intersections have pedestrian signal heads.
- **Segment 2:** On-street parking allows for curb extensions, small blocks and frequent intersections with pedestrian demand and existing infrastructure.

Preston Avenue – Sheet 1 of 1



Community: Charlottesville
VDOT District: 7 (Culpeper)

Corridor Description

- **Segment 1:** 4-lane median divided roadway with moderate density commercial and recreational development land uses. **AADT: ~17,000; Speed Limit: 35**

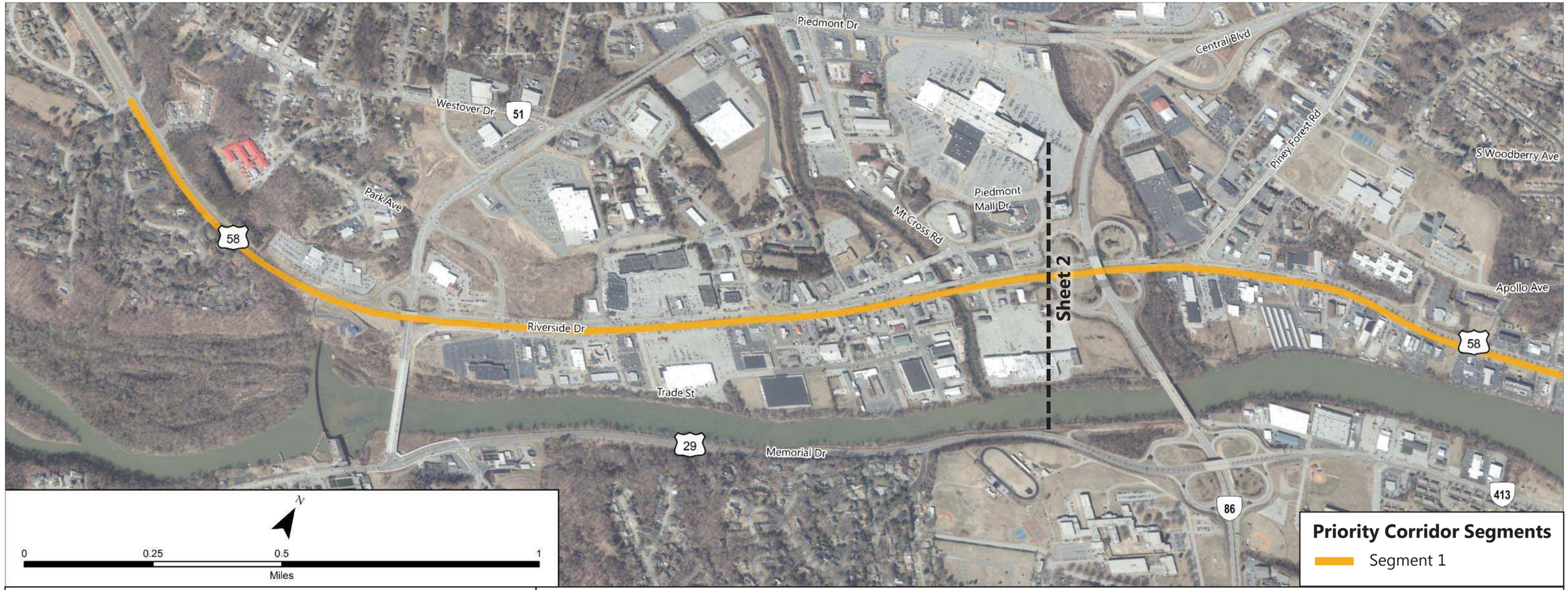
Recommended Countermeasures

- **Segment 1:** Formalize existing raised median islands, review signalized intersections for LPI, evaluate turning restrictions at signalized intersections.

Notes

- **Segment 1:** Marked crosswalks and signalized intersections present, though improvements can be made to existing infrastructure.

Riverside Drive (BUS US 58) – Sheet 1 of 2



Community: Danville
VDOT District: 3 (Lynchburg)

Corridor Description

- **Segment 1:** 6-and-4-lane median divided roadway with minimal pedestrian crossings, frequent access points, and commercial and recreational land uses. **AADT: ~21,000; Speed Limit: 35**

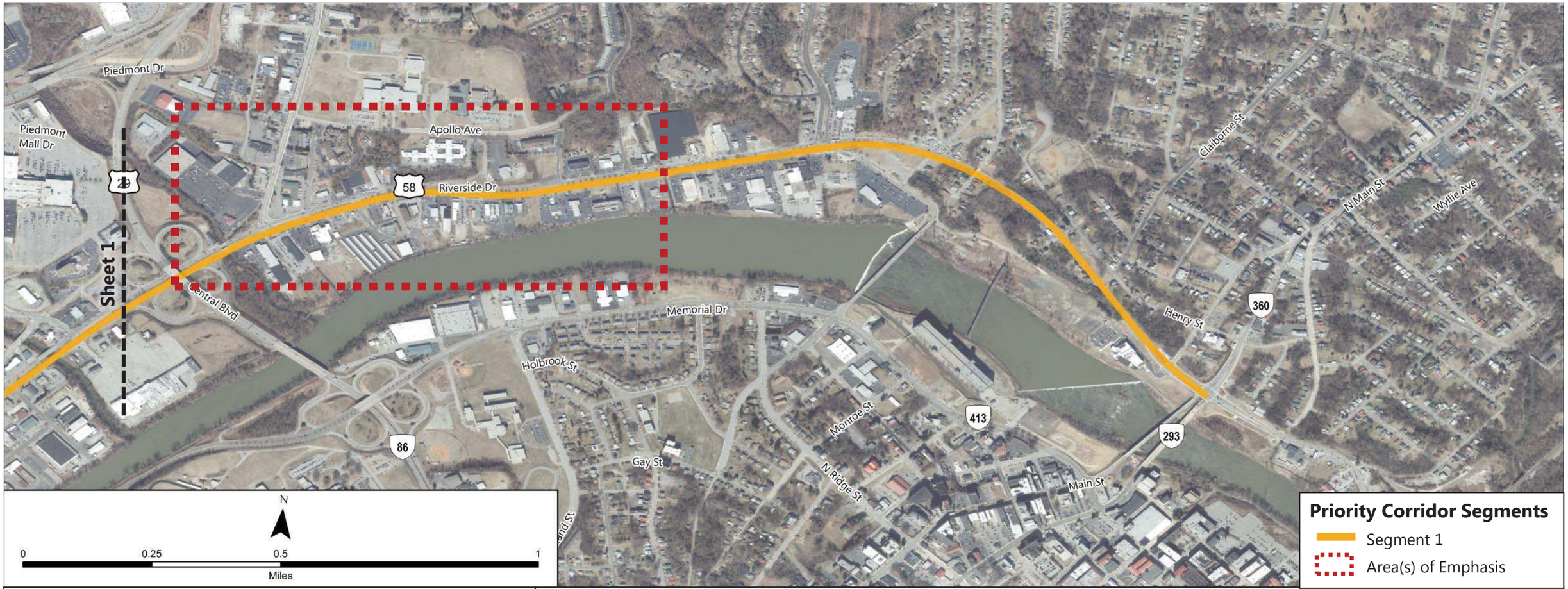
Recommended Countermeasures

- **Segment 1:** Pedestrian signal heads and countdown signals, high visibility crosswalks, modification of medians to median islands, and PHB at key midblock crossings.

Notes

- **Segment 1:** Wide crossing distance of over 100 feet in most locations with minimal pedestrian crossing infrastructure across corridor.

Riverside Drive (BUS US 58) – Sheet 2 of 2



Community: Danville
VDOT District: 3 (Lynchburg)

Corridor Description

- **Segment 1:** 6-and-4-lane median divided roadway with minimal pedestrian crossings, frequent access points, and commercial and recreational land uses. **AADT: ~21,000; Speed Limit: 35**

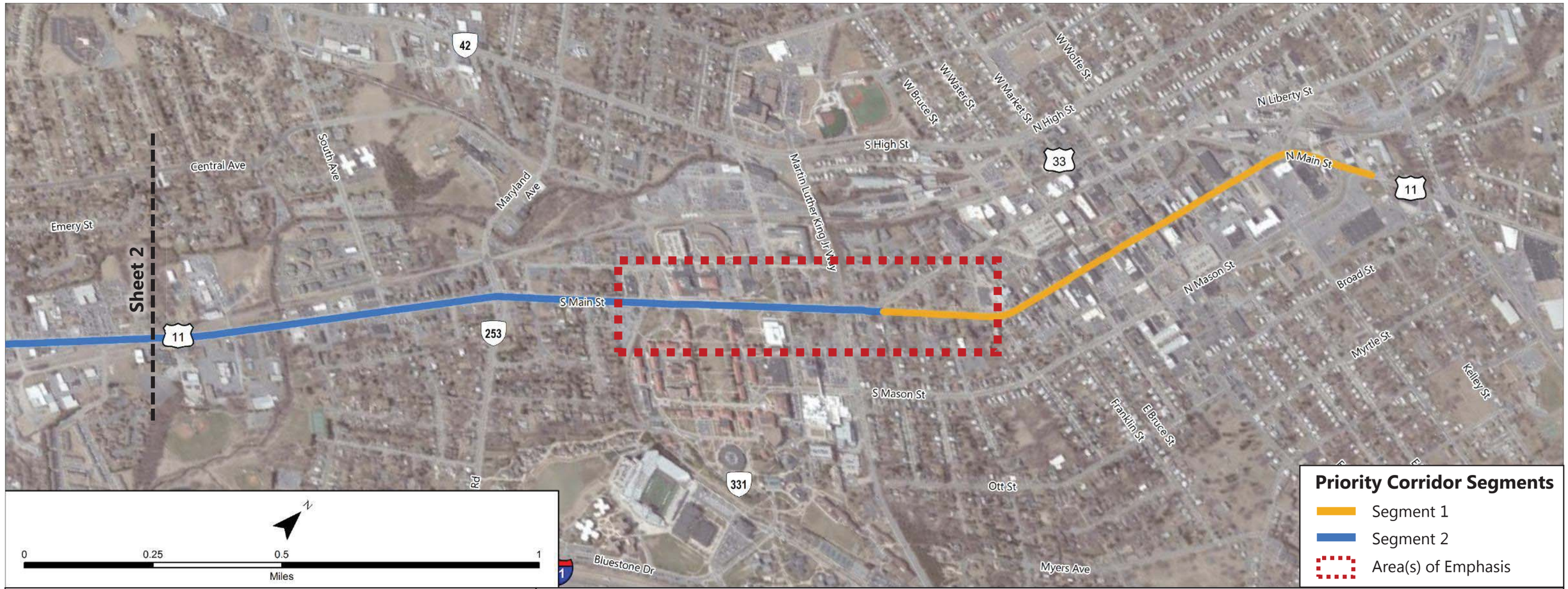
Recommended Countermeasures

- **Segment 1:** Pedestrian signal heads and countdown signals, high visibility crosswalks, modification of medians to median islands, and PHB at key midblock crossings.

Notes

- **Segment 1:** Wide crossing distance of over 100 feet in most locations with minimal pedestrian crossing infrastructure across corridor.

Main Street (US 11) – Sheet 1 of 2



Community: Harrisonburg
VDOT District: 8 (Staunton)

Corridor Description

- **Segment 1:** 2-lane one way roadway with moderate commercial and residential density. **AADT: ~6,000 to 8,000; Speed Limit: 35**
- **Segment 2:** 4-lane road turning lane median divided roadway with moderate institutional and commercial density. **AADT: ~12,000 to 22,000; Speed Limit: 35**

Recommended Countermeasures

- **Segment 1:** Pedestrian signal heads, high visibility crosswalks, curb extensions and parking restrictions, and RRFBs (if applicable).
- **Segment 2:** Implement pedestrian countdown signals and median raised island at signalized intersections. Due to block length, consider PHB at mid-block crossings in locations with pedestrian activity centers.

Notes

- **Segment 1:** Existing traffic calming and pedestrian sidewalk infrastructure, but lack of pedestrian signals at signalized intersections.
- **Segment 2:** Long block lengths and wide roadway widths with signalized intersections and pedestrian signals.

Main Street (US 11) – Sheet 2 of 2

Community: Harrisonburg
VDOT District: 8 (Staunton)

Corridor Description

- **Segment 1:** 2-lane one way roadway with moderate commercial and residential density. **AADT: ~6,000 to 8,000; Speed Limit: 35**

- **Segment 2:** 4-lane road turning lane median divided roadway with moderate institutional and commercial density. **AADT: ~12,000 to 22,000; Speed Limit: 35**

Recommended Countermeasures

- **Segment 1:** Pedestrian signal heads, high visibility crosswalks, curb extensions and parking restrictions, and RRFBs (if applicable).
- **Segment 2:** Implement pedestrian countdown signals and median raised island at signalized intersections. Due to block length, consider PHB at mid-block crossings in locations with pedestrian activity centers.

Notes

- **Segment 1:** Existing traffic calming and pedestrian sidewalk infrastructure, but lack of pedestrian signals at signalized intersections.

- **Segment 2:** Long block lengths and wide roadway widths with signalized intersections and pedestrian signals.

Twelfth Street (US 221) – Sheet 1 of 1

Community: Lynchburg
VDOT District: 3 (Lynchburg)

Corridor Description

- **Segment 1:** 2-lane undivided roadway with moderate density of institutional and commercial land uses. **AADT: ~9,000; Speed Limit: 35**

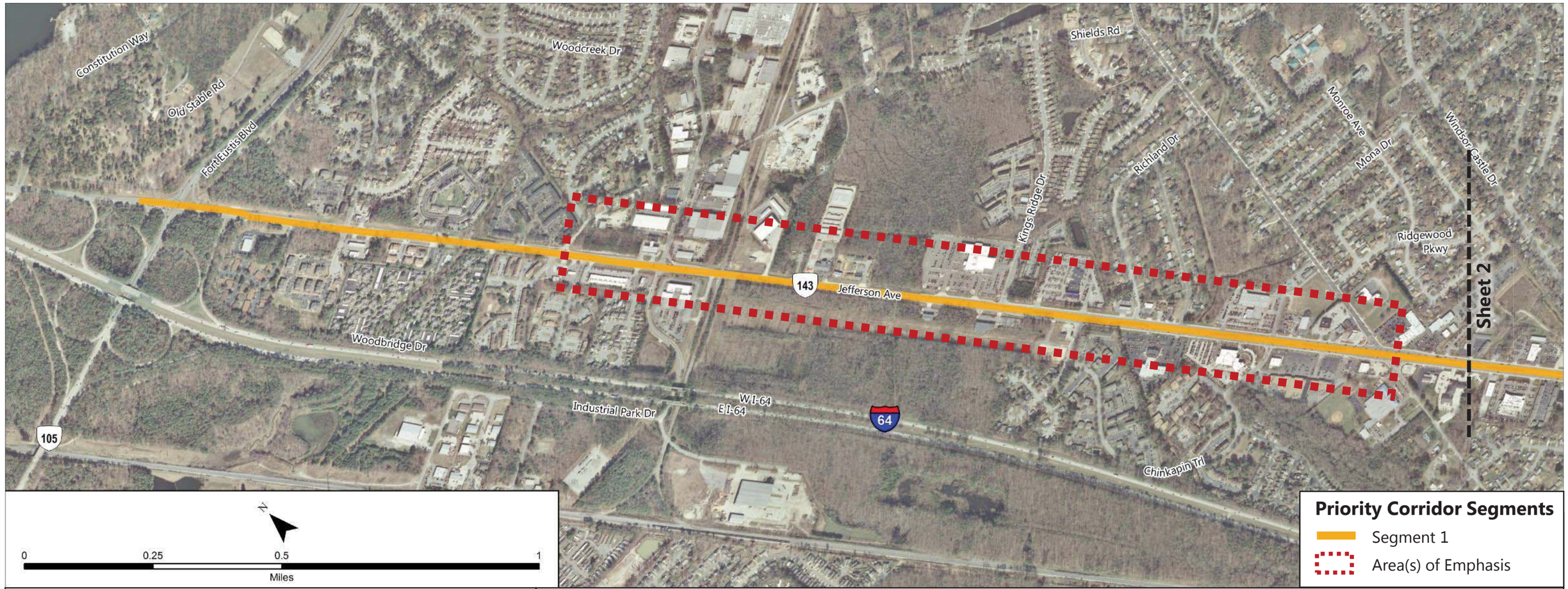
Recommended Countermeasures

- **Segment 1:** Evaluate for LPI or extended signal phase at signalized intersections, update high visibility crosswalks, curb extensions and parking restrictions where on-street parking exists, in-street yield signs, and RRFB or PHB near vulnerable population centers (e.g. school).

Notes

- **Segment 1:** Existing crosswalk markings and designs are outdated, traffic calming activities already underway, and few intersections are signalized.

Jefferson Avenue (SR 143/US 17) – Sheet 1 of 7



Community: Newport News
VDOT District: 5 (Hampton Roads)

Corridor Description

- **Segment 1:** 6-lane median divided roadway with broad mix of moderate density residential, commercial, and industrial land uses. **AADT: ~25,000 to 40,000; Speed Limit: 35**

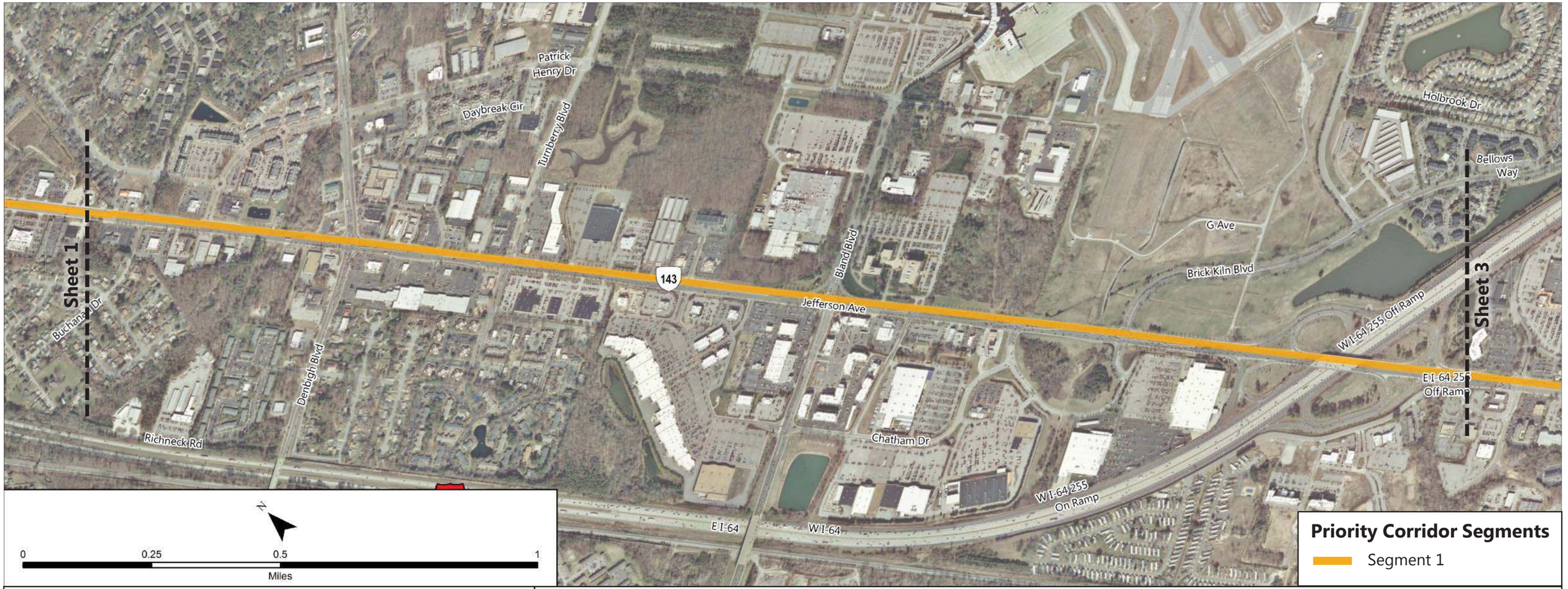
Recommended Countermeasures

- **Segment 1:** Upgrade crosswalks to high visibility materials and patterns, consider pedestrian signal phasing or LPI, adaptation of existing medians to median islands, and location of PHBs in residential areas with high crossing demand.

Notes

- **Segment 1:** Few signalized crossing locations in southern portion of corridor, and wide crossing distances necessitate median islands and longer crossing periods.

Jefferson Avenue (SR 143/US 17) – Sheet 2 of 7



Community: Newport News
VDOT District: 5 (Hampton Roads)

Corridor Description

- **Segment 1:** 6-lane median divided roadway with broad mix of moderate density residential, commercial, and industrial land uses. **AADT: ~25,000 to 40,000; Speed Limit: 35**

Recommended Countermeasures

- **Segment 1:** Upgrade crosswalks to high visibility materials and patterns, consider pedestrian signal phasing or LPI, adaptation of existing medians to median islands, and location of PHBs in residential areas with high crossing demand.

Notes

- **Segment 1:** Few signalized crossing locations in southern portion of corridor, and wide crossing distances necessitate median islands and longer crossing periods.

Jefferson Avenue (SR 143/US 17) – Sheet 3 of 7

Community: Newport News
VDOT District: 5 (Hampton Roads)

Corridor Description

- **Segment 1:** 6-lane median divided roadway with broad mix of moderate density residential, commercial, and industrial land uses. **AADT: ~25,000 to 40,000; Speed Limit: 35**

Recommended Countermeasures

- **Segment 1:** Upgrade crosswalks to high visibility materials and patterns, consider pedestrian signal phasing or LPI, adaptation of existing medians to median islands, and location of PHBs in residential areas with high crossing demand.

Notes

- **Segment 1:** Few signalized crossing locations in southern portion of corridor, and wide crossing distances necessitate median islands and longer crossing periods.

Jefferson Avenue (SR 143/US 17) – Sheet 4 of 7

Community: Newport News
VDOT District: 5 (Hampton Roads)

Corridor Description

- **Segment 1:** 6-lane median divided roadway with broad mix of moderate density residential, commercial, and industrial land uses. **AADT: ~25,000 to 40,000; Speed Limit: 35**

Recommended Countermeasures

- **Segment 1:** Upgrade crosswalks to high visibility materials and patterns, consider pedestrian signal phasing or LPI, adaptation of existing medians to median islands, and location of PHBs in residential areas with high crossing demand.

Notes

- **Segment 1:** Few signalized crossing locations in southern portion of corridor, and wide crossing distances necessitate median islands and longer crossing periods.

Jefferson Avenue (SR 143/US 17) – Sheet 5 of 7

Community: Newport News
VDOT District: 5 (Hampton Roads)

Corridor Description

- **Segment 1:** 6-lane median divided roadway with broad mix of moderate density residential, commercial, and industrial land uses. **AADT: ~25,000 to 40,000; Speed Limit: 35**

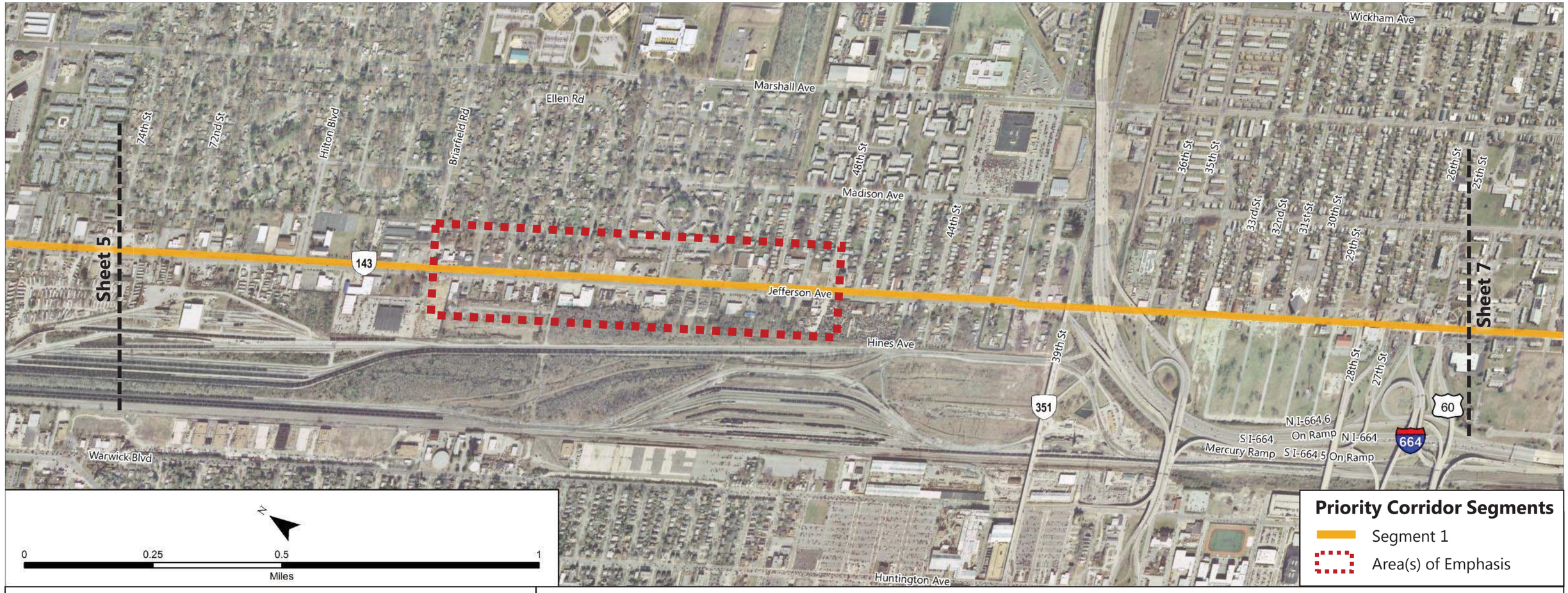
Recommended Countermeasures

- **Segment 1:** Upgrade crosswalks to high visibility materials and patterns, consider pedestrian signal phasing or LPI, adaptation of existing medians to median islands, and location of PHBs in residential areas with high crossing demand.

Notes

- **Segment 1:** Few signalized crossing locations in southern portion of corridor, and wide crossing distances necessitate median islands and longer crossing periods.

Jefferson Avenue (SR 143/US 17) – Sheet 6 of 7



Community: Newport News
VDOT District: 5 (Hampton Roads)

Corridor Description

- **Segment 1:** 6-lane median divided roadway with broad mix of moderate density residential, commercial, and industrial land uses. **AADT: ~25,000 to 40,000; Speed Limit: 35**

Recommended Countermeasures

- **Segment 1:** Upgrade crosswalks to high visibility materials and patterns, consider pedestrian signal phasing or LPI, adaptation of existing medians to median islands, and location of PHBs in residential areas with high crossing demand.

Notes

- **Segment 1:** Few signalized crossing locations in southern portion of corridor, and wide crossing distances necessitate median islands and longer crossing periods.

Jefferson Avenue (SR 143/US 17) – Sheet 7 of 7

Community: Newport News
VDOT District: 5 (Hampton Roads)

Corridor Description

- **Segment 1:** 6-lane median divided roadway with broad mix of moderate density residential, commercial, and industrial land uses. **AADT: ~25,000 to 40,000; Speed Limit: 35**

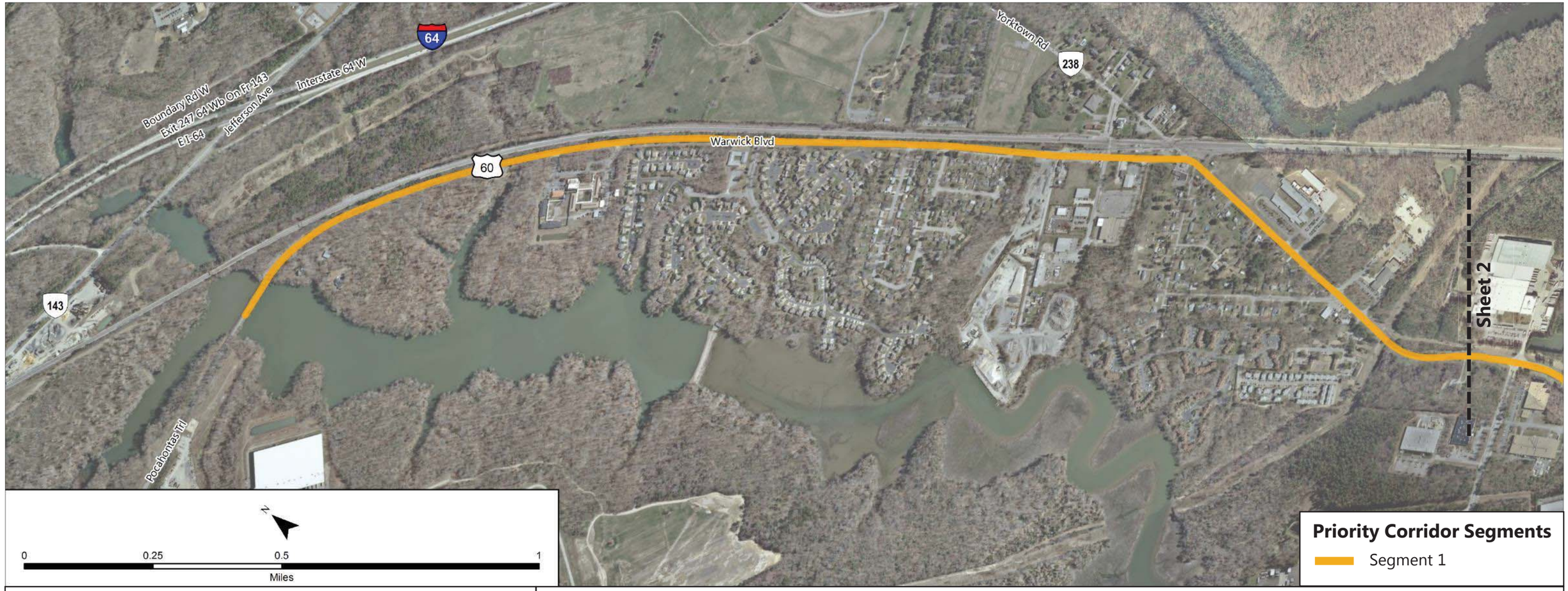
Recommended Countermeasures

- **Segment 1:** Upgrade crosswalks to high visibility materials and patterns, consider pedestrian signal phasing or LPI, adaptation of existing medians to median islands, and location of PHBs in residential areas with high crossing demand.

Notes

- **Segment 1:** Few signalized crossing locations in southern portion of corridor, and wide crossing distances necessitate median islands and longer crossing periods.

Warwick Boulevard (US 60) – Sheet 1 of 7



Community: Newport News
VDOT District: 5 (Hampton Roads)

Corridor Description

- **Segment 1:** 2-lane undivided roadway with adjacent industrial and residential land uses. **AADT: ~10,000 to 15,000; Speed Limit: 45**
- **Segment 2:** 6-and-4-lane median divided roadway with moderate commercial and residential density land use. **AADT: ~25,000 to 40,000; Speed Limit: 35**

Recommended Countermeasures

- **Segment 1:** Advance warning signage, RRFBs (if applicable), and high visibility crosswalks at pedestrian activity centers.
- **Segment 2:** Pedestrian signal heads at signalized intersections, modification of existing medians to median islands, PHBs at key mid-block locations, review of signal phasing for extended pedestrian phase or LPI, and high visibility crosswalks.

Notes

- **Segment 1:** Potential for crosswalks at key pedestrian activity centers.
- **Segment 2:** Width of road and activity generators support the deployment of crosswalk facilities and pedestrian amenities.

Warwick Boulevard (US 60) – Sheet 2 of 7

Community: Newport News
VDOT District: 5 (Hampton Roads)

Corridor Description

- **Segment 1:** 2-lane undivided roadway with adjacent industrial and residential land uses. **AADT: ~10,000 to 15,000; Speed Limit: 45**
- **Segment 2:** 6-and-4-lane median divided roadway with moderate commercial and residential density land use. **AADT: ~25,000 to 40,000; Speed Limit: 35**

Recommended Countermeasures

- **Segment 1:** Advance warning signage, RRFBs (if applicable), and high visibility crosswalks at pedestrian activity centers.
- **Segment 2:** Pedestrian signal heads at signalized intersections, modification of existing medians to median islands, PHBs at key mid-block locations, review of signal phasing for extended pedestrian phase or LPI, and high visibility crosswalks.

Notes

- **Segment 1:** Potential for crosswalks at key pedestrian activity centers.
- **Segment 2:** Width of road and activity generators support the deployment of crosswalk facilities and pedestrian amenities.

Warwick Boulevard (US 60) – Sheet 3 of 7

Community: Newport News
VDOT District: 5 (Hampton Roads)

Corridor Description

- **Segment 1:** 2-lane undivided roadway with adjacent industrial and residential land uses. **AADT: ~10,000 to 15,000; Speed Limit: 45**
- **Segment 2:** 6-and-4-lane median divided roadway with moderate commercial and residential density land use. **AADT: ~25,000 to 40,000; Speed Limit: 35**

Recommended Countermeasures

- **Segment 1:** Advance warning signage, RRFBs (if applicable), and high visibility crosswalks at pedestrian activity centers.
- **Segment 2:** Pedestrian signal heads at signalized intersections, modification of existing medians to median islands, PHBs at key mid-block locations, review of signal phasing for extended pedestrian phase or LPI, and high visibility crosswalks.

Notes

- **Segment 1:** Potential for crosswalks at key pedestrian activity centers.
- **Segment 2:** Width of road and activity generators support the deployment of crosswalk facilities and pedestrian amenities.

Warwick Boulevard (US 60) – Sheet 4 of 7

Community: Newport News
VDOT District: 5 (Hampton Roads)

Corridor Description

- **Segment 1:** 2-lane undivided roadway with adjacent industrial and residential land uses. **AADT: ~10,000 to 15,000; Speed Limit: 45**
- **Segment 2:** 6-and-4-lane median divided roadway with moderate commercial and residential density land use. **AADT: ~25,000 to 40,000; Speed Limit: 35**

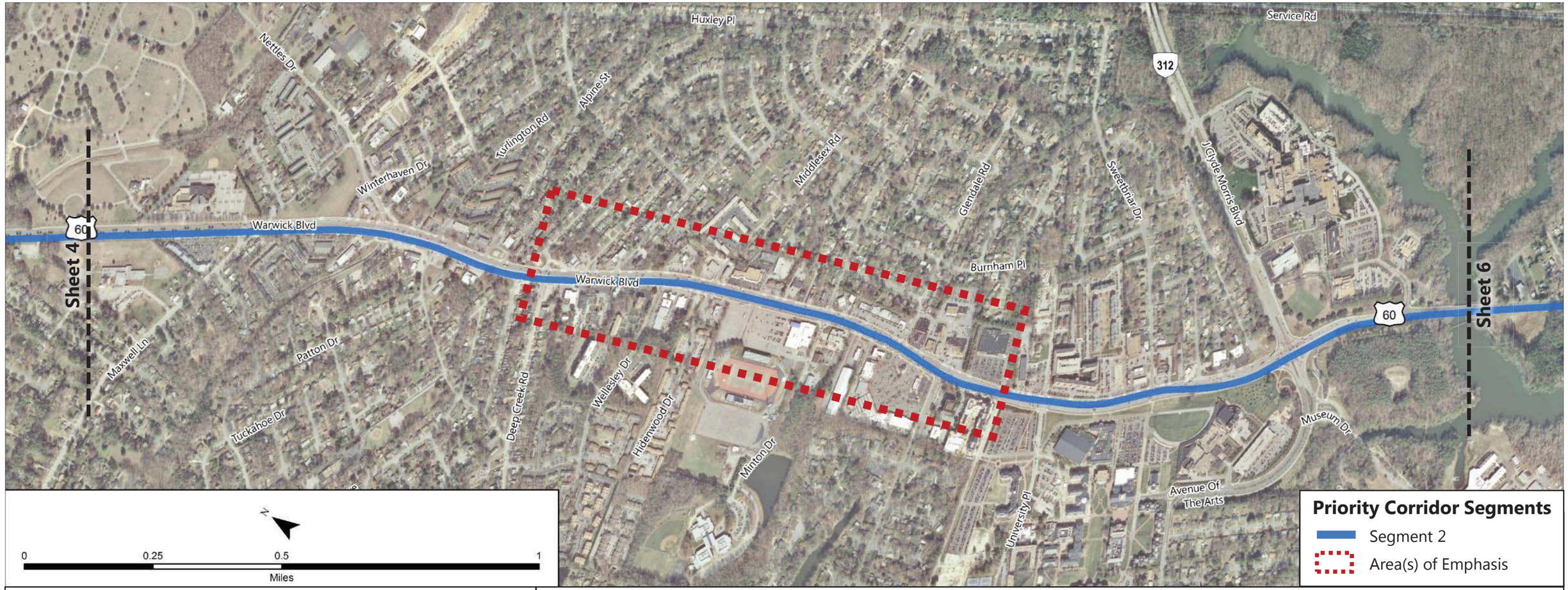
Recommended Countermeasures

- **Segment 1:** Advance warning signage, RRFBs (if applicable), and high visibility crosswalks at pedestrian activity centers.
- **Segment 2:** Pedestrian signal heads at signalized intersections, modification of existing medians to median islands, PHBs at key mid-block locations, review of signal phasing for extended pedestrian phase or LPI, and high visibility crosswalks.

Notes

- **Segment 1:** Potential for crosswalks at key pedestrian activity centers.
- **Segment 2:** Width of road and activity generators support the deployment of crosswalk facilities and pedestrian amenities.

Warwick Boulevard (US 60) – Sheet 5 of 7



Community: Newport News
VDOT District: 5 (Hampton Roads)

Corridor Description

- **Segment 1:** 2-lane undivided roadway with adjacent industrial and residential land uses. **AADT: ~10,000 to 15,000; Speed Limit: 45**
- **Segment 2:** 6-and-4-lane median divided roadway with moderate commercial and residential density land use. **AADT: ~25,000 to 40,000; Speed Limit: 35**

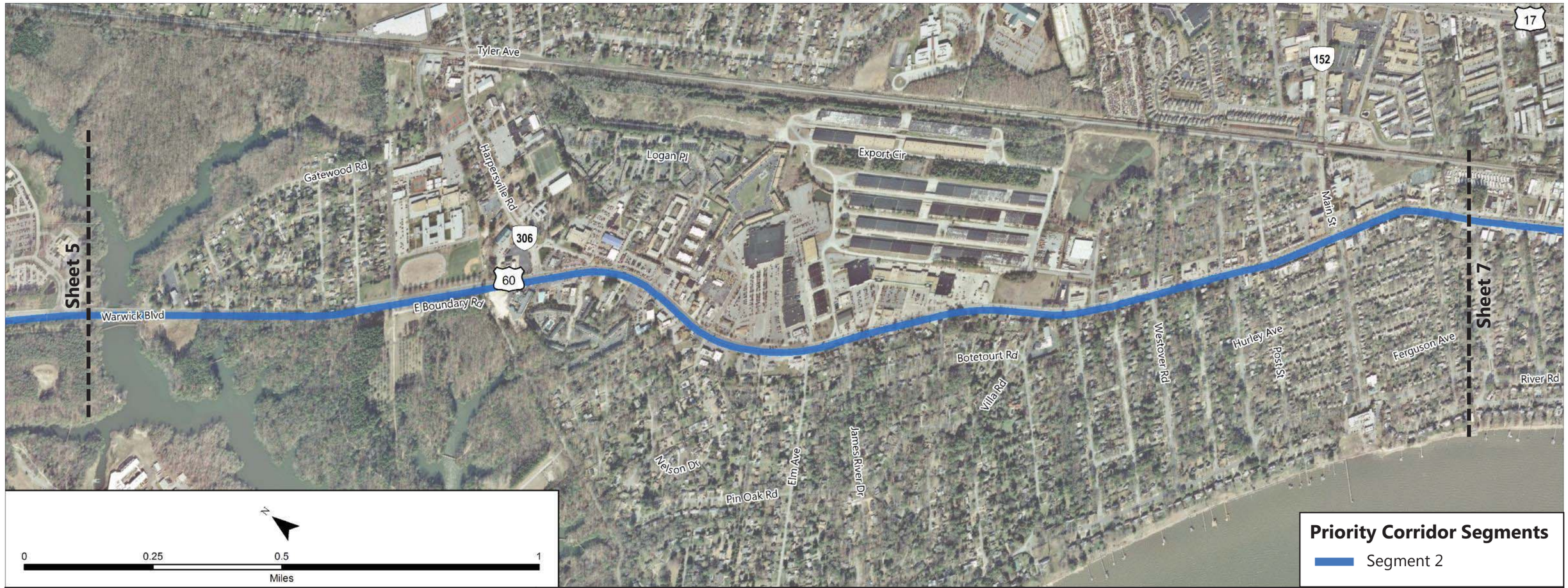
Recommended Countermeasures

- **Segment 1:** Advance warning signage, RRFBs (if applicable), and high visibility crosswalks at pedestrian activity centers.
- **Segment 2:** Pedestrian signal heads at signalized intersections, modification of existing medians to median islands, PHBs at key mid-block locations, review of signal phasing for extended pedestrian phase or LPI, and high visibility crosswalks.

Notes

- **Segment 1:** Potential for crosswalks at key pedestrian activity centers.
- **Segment 2:** Width of road and activity generators support the deployment of crosswalk facilities and pedestrian amenities.

Warwick Boulevard (US 60) – Sheet 6 of 7



Community: Newport News
VDOT District: 5 (Hampton Roads)

Corridor Description

- **Segment 1:** 2-lane undivided roadway with adjacent industrial and residential land uses. **AADT: ~10,000 to 15,000; Speed Limit: 45**
- **Segment 2:** 6-and-4-lane median divided roadway with moderate commercial and residential density land use. **AADT: ~25,000 to 40,000; Speed Limit: 35**

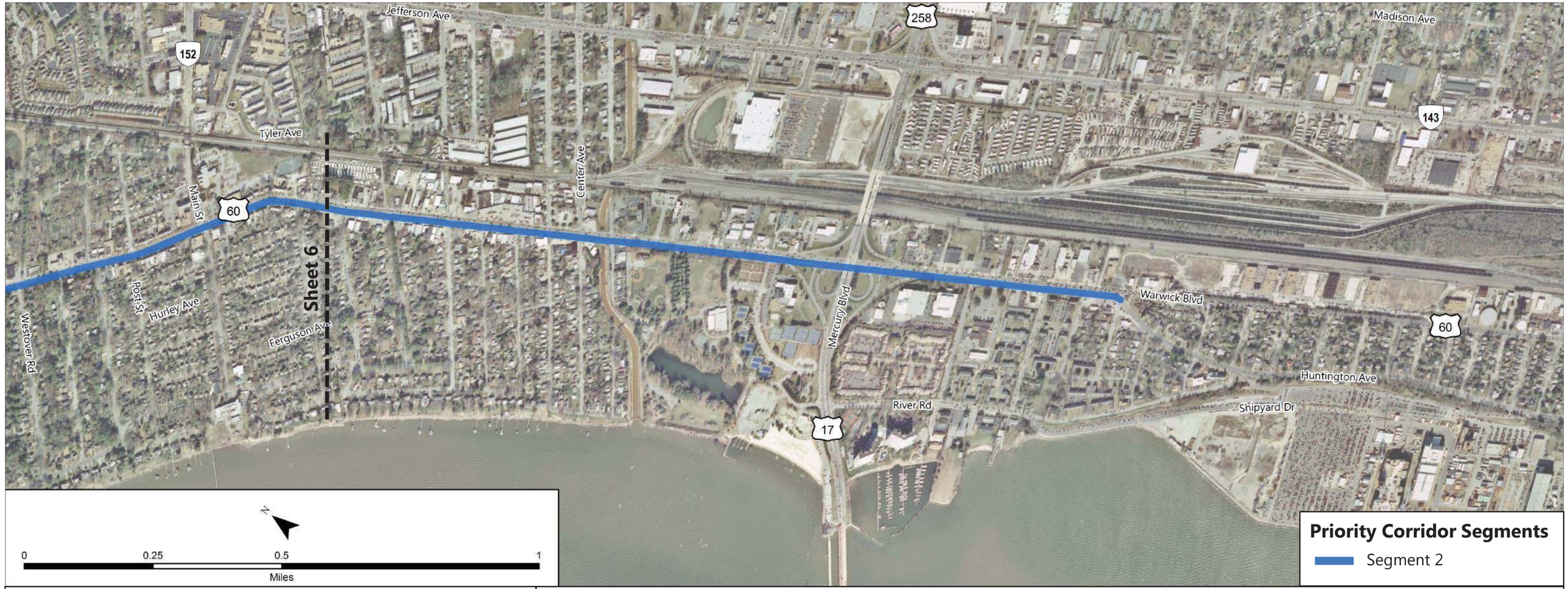
Recommended Countermeasures

- **Segment 1:** Advance warning signage, RRFBs (if applicable), and high visibility crosswalks at pedestrian activity centers.
- **Segment 2:** Pedestrian signal heads at signalized intersections, modification of existing medians to median islands, PHBs at key mid-block locations, review of signal phasing for extended pedestrian phase or LPI, and high visibility crosswalks.

Notes

- **Segment 1:** Potential for crosswalks at key pedestrian activity centers.
- **Segment 2:** Width of road and activity generators support the deployment of crosswalk facilities and pedestrian amenities.

Warwick Boulevard (US 60) – Sheet 7 of 7



Community: Newport News
VDOT District: 5 (Hampton Roads)

Corridor Description

- **Segment 1:** 2-lane undivided roadway with adjacent industrial and residential land uses. **AADT: ~10,000 to 15,000; Speed Limit: 45**
- **Segment 2:** 6-and-4-lane median divided roadway with moderate commercial and residential density land use. **AADT: ~25,000 to 40,000; Speed Limit: 35**

Recommended Countermeasures

- **Segment 1:** Advance warning signage, RRFBs (if applicable), and high visibility crosswalks at pedestrian activity centers.
- **Segment 2:** Pedestrian signal heads at signalized intersections, modification of existing medians to median islands, PHBs at key mid-block locations, review of signal phasing for extended pedestrian phase or LPI, and high visibility crosswalks.

Notes

- **Segment 1:** Potential for crosswalks at key pedestrian activity centers.
- **Segment 2:** Width of road and activity generators support the deployment of crosswalk facilities and pedestrian amenities.

Ballentine Boulevard (SR 405) – Sheet 1 of 1

Community: Norfolk
VDOT District: 5 (Hampton Roads)

Corridor Description

- **Segment 1:** 4-lane median divided and 2-lane undivided roadways with commercial, recreational, and residential land uses.
  AADT: ~4,000 to 22,000; Speed Limit: 35

Recommended Countermeasures

- **Segment 1:** Pedestrian countdown signals at already signalized intersections, upgrade crosswalks to high visibility materials and patterns, advance warning signage, and in-street yield signs at midblock locations.

Notes

- **Segment 1:** Variety of land uses are present with existing pedestrian crossing infrastructure, though improvements can be made to enhance countermeasures.

Campostella Road (SR 168) – Sheet 1 of 1

Community: Norfolk
VDOT District: 5 (Hampton Roads)

Corridor Description

- **Segment 1:** 6-and-4-lane median divided roadway roadway with residential, commercial, and institutional land uses. **AADT: ~25,000; Speed Limit: 35**

Recommended Countermeasures

- **Segment 1:** Pedestrian countdown signals, expand medians to median islands, PHBs at key midblock locations, and consider LPI or pedestrian signal timing at wider intersections.

Notes

- **Segment 1:** Numerous mid-block crossing locations with high pedestrian activity centers and wide roads.

Chesapeake Boulevard (SR 194/SR 247) – Sheet 1 of 3

Community: Norfolk
VDOT District: 5 (Hampton Roads)

Corridor Description

- **Segment 1:** 6-and-4-lane median divided roadway with institutional, recreational, residential, and commercial land uses. **AADT: ~11,000 to 23,000; Speed Limit: 35**
- **Segment 2:** 2-lane undivided roadway with moderate density of residential land uses. **AADT: ~1,000; Speed Limit: 35**

Recommended Countermeasures

- **Segment 1:** Pedestrian countdown signals, high visibility crosswalks, expand medians to median islands, PHBs at key midblock locations, and consider LPI or pedestrian signal timing at wider intersections.
- **Segment 2:** High visibility crosswalks and traffic calming measures such as raised crosswalks and speed tables and shared use markings.

Notes

- **Segment 1:** Surrounding land use and existing sidewalk infrastructure are supportive of enhanced pedestrian crossing facilities given roadway configuration.
- **Segment 2:** Local roadway with high pedestrian activity and few crossing facilities.

Chesapeake Boulevard (SR 194/SR 247) – Sheet 2 of 3

Community: Norfolk
VDOT District: 5 (Hampton Roads)

Corridor Description

- **Segment 1:** 6-and-4-lane median divided roadway with institutional, recreational, residential, and commercial land uses. **AADT: ~11,000 to 23,000; Speed Limit: 35**
- **Segment 2:** 2-lane undivided roadway with moderate density of residential land uses. **AADT: ~1,000; Speed Limit: 35**

Recommended Countermeasures

- **Segment 1:** Pedestrian countdown signals, high visibility crosswalks, expand medians to median islands, PHBs at key midblock locations, and consider LPI or pedestrian signal timing at wider intersections.
- **Segment 2:** High visibility crosswalks and traffic calming measures such as raised crosswalks and speed tables and shared use markings.

Notes

- **Segment 1:** Surrounding land use and existing sidewalk infrastructure are supportive of enhanced pedestrian crossing facilities given roadway configuration.
- **Segment 2:** Local roadway with high pedestrian activity and few crossing facilities.

Chesapeake Boulevard (SR 194/SR 247) – Sheet 3 of 3

Community: Norfolk
VDOT District: 5 (Hampton Roads)

Corridor Description

- **Segment 1:** 6-and-4-lane median divided roadway with institutional, recreational, residential, and commercial land uses. **AADT: ~11,000 to 23,000; Speed Limit: 35**
- **Segment 2:** 2-lane undivided roadway with moderate density of residential land uses. **AADT: ~1,000; Speed Limit: 35**

Recommended Countermeasures

- **Segment 1:** Pedestrian countdown signals, high visibility crosswalks, expand medians to median islands, PHBs at key midblock locations, and consider LPI or pedestrian signal timing at wider intersections.
- **Segment 2:** High visibility crosswalks and traffic calming measures such as raised crosswalks and speed tables and shared use markings.

Notes

- **Segment 1:** Surrounding land use and existing sidewalk infrastructure are supportive of enhanced pedestrian crossing facilities given roadway configuration.
- **Segment 2:** Local roadway with high pedestrian activity and few crossing facilities.

Granby Street (US 460) - Sheet 1 of 3

Community: Norfolk
VDOT District: 5 (Hampton Roads)

Corridor Description

- **Segment 1:** 4-lane median divided roadway with residential, commercial, and institutional land uses. **AADT: ~10,000 to 25,000; Speed Limit: 35**
- **Segment 2:** 2-lane undivided roadway with low density residential and commercial land uses. **AADT: ~5,000 to 10,000; Speed Limit: 35**

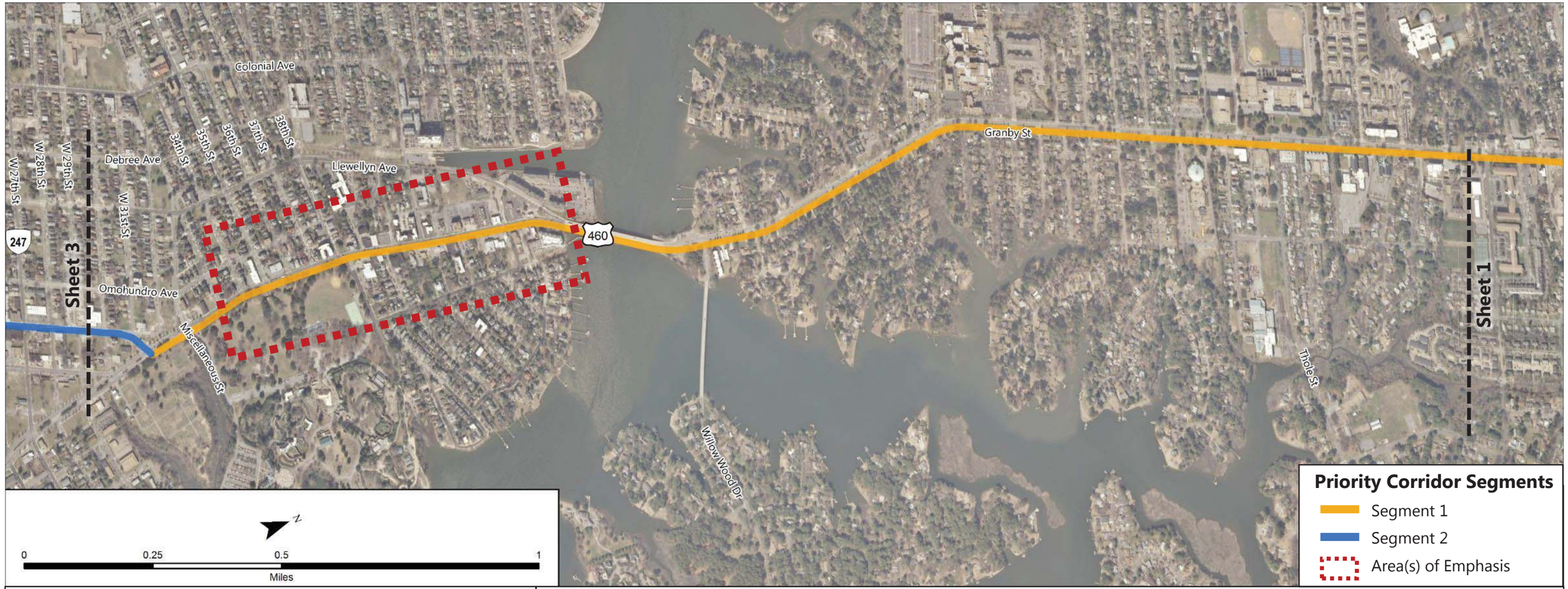
Recommended Countermeasures

- **Segment 1:** High visibility crosswalks, conversion of existing medians to median islands, advance warning signage, PHBs at key crossing locations, and consider speed reduction through residential area.
- **Segment 2:** In-street yield signs, high visibility crosswalks, curb extensions, review of pedestrian signal timing for phases or LPI, traffic calming such as bicycle lanes.

Notes

- **Segment 1:** Land use patterns indicate demand for crossing median, though few opportunities in place.
- **Segment 2:** Area of high pedestrian activity with on-street parking and short blocks marked by existing crosswalks.

Granby Street (US 460) - Sheet 2 of 3



Community: Norfolk
VDOT District: 5 (Hampton Roads)

Corridor Description

- **Segment 1:** 4-lane median divided roadway with residential, commercial, and institutional land uses. **AADT: ~10,000 to 25,000; Speed Limit: 35**
- **Segment 2:** 2-lane undivided roadway with low density residential and commercial land uses. **AADT: ~5,000 to 10,000; Speed Limit: 35**

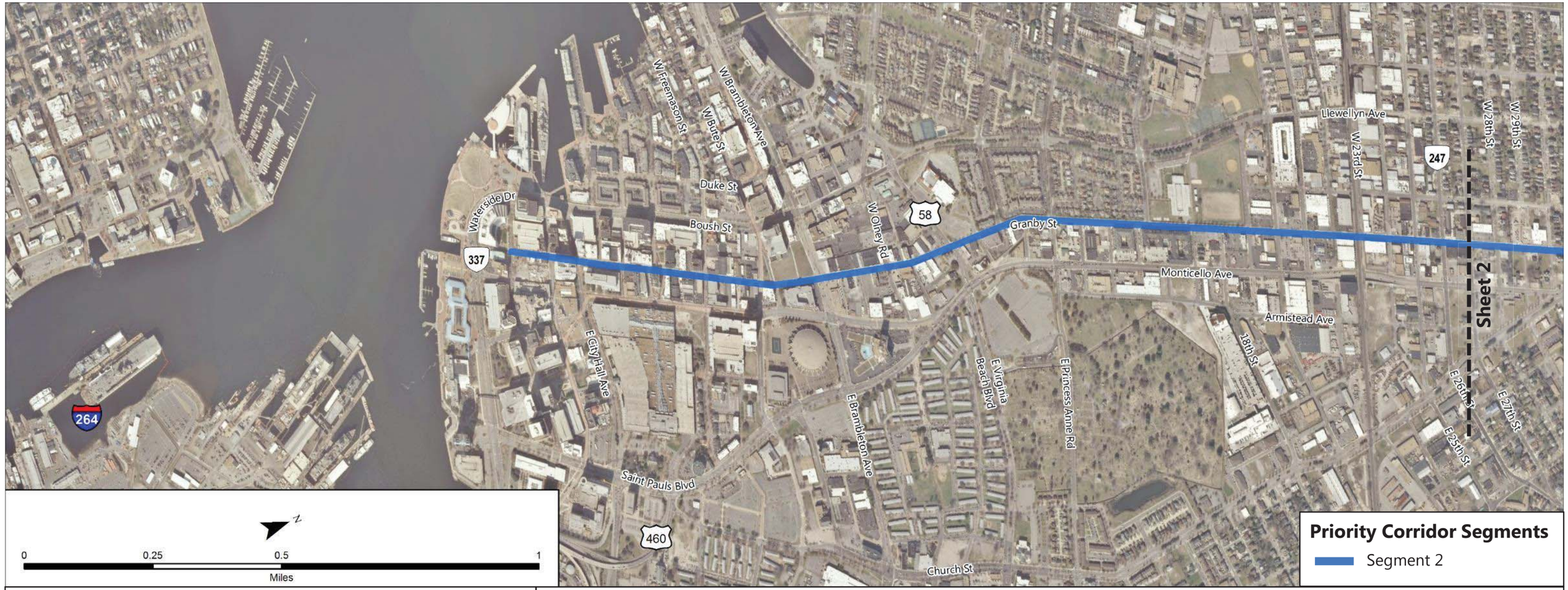
Recommended Countermeasures

- **Segment 1:** High visibility crosswalks, conversion of existing medians to median islands, advance warning signage, PHBs at key crossing locations, and consider speed reduction through residential area.
- **Segment 2:** In-street yield signs, high visibility crosswalks, curb extensions, review of pedestrian signal timing for phases or LPI, traffic calming such as bicycle lanes.

Notes

- **Segment 1:** Land use patterns indicate demand for crossing median, though few opportunities in place.
- **Segment 2:** Area of high pedestrian activity with on-street parking and short blocks marked by existing crosswalks.

Granby Street (US 460) - Sheet 3 of 3



Community: Norfolk
VDOT District: 5 (Hampton Roads)

Corridor Description

- **Segment 1:** 4-lane median divided roadway with residential, commercial, and institutional land uses. **AADT: ~10,000 to 25,000; Speed Limit: 35**
- **Segment 2:** 2-lane undivided roadway with low density residential and commercial land uses. **AADT: ~5,000 to 10,000; Speed Limit: 35**

Recommended Countermeasures

- **Segment 1:** High visibility crosswalks, conversion of existing medians to median islands, advance warning signage, PHBs at key crossing locations, and consider speed reduction through residential area.
- **Segment 2:** In-street yield signs, high visibility crosswalks, curb extensions, review of pedestrian signal timing for phases or LPI, traffic calming such as bicycle lanes.

Notes

- **Segment 1:** Land use patterns indicate demand for crossing median, though few opportunities in place.
- **Segment 2:** Area of high pedestrian activity with on-street parking and short blocks marked by existing crosswalks.

Lafayette Boulevard (SR 247) – Sheet 1 of 1

Community: Norfolk
VDOT District: 5 (Hampton Roads)

Corridor Description

- **Segment 1:** 4-lane undivided roadway with moderate residential and commercial density. **AADT: ~17,000; Speed Limit: 35**
- **Segment 2:** 4-lane median divided roadway with moderate residential density. **AADT: ~15,000; Speed Limit: 35**

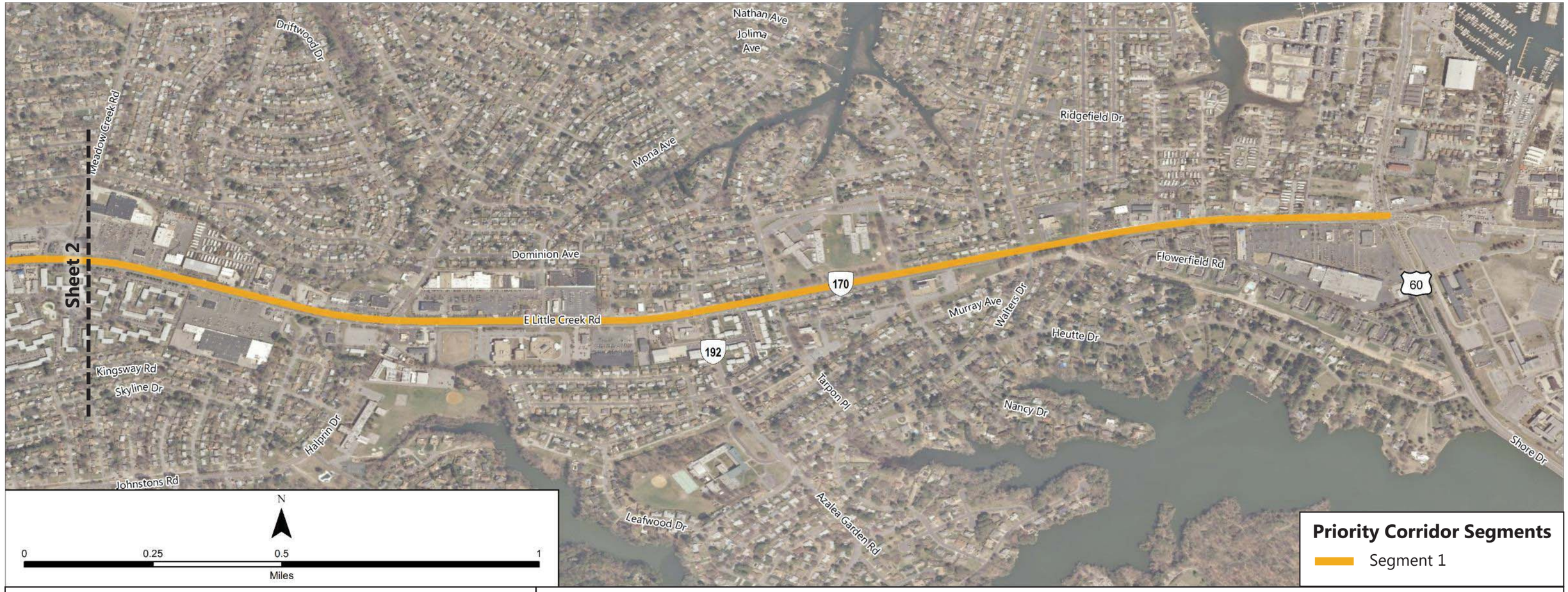
Recommended Countermeasures

- **Segment 1:** Consideration of road diet for portion of corridor, advance warning signage, and PHB at crossing locations (or RRFB if road diet is adopted), and traffic calming measures such as bike lanes.
- **Segment 2:** Advance warning signage, PHB at key mid-block locations, and curb extensions.

Notes

- **Segment 1:** AADT may indicate opportunity for road diet, and remaining pavement would be supportive of new pedestrian crossing facilities and bicycle amenities.
- **Segment 2:** Traffic calming already underway, but numerous mid-block crossings present challenges to crossing.

Little Creek Road (SR 165/170) – Sheet 1 of 3



Community: Norfolk
VDOT District: 5 (Hampton Roads)

Corridor Description

- **Segment 1:** 6-and-4-lane median divided roadway with wide range of adjacent commercial and residential land uses. **AADT: ~22,000; Speed Limit: 35**
- **Segment 2:** 4-lane undivided roadway with moderate residential density and institutional land uses. **AADT: ~12,000; Speed Limit: 35**

Recommended Countermeasures

- **Segment 1:** Expand medians to accommodate median islands, pedestrian signal heads at signalized intersections, and high visibility crosswalks.
- **Segment 2:** Consider road diet for portion of corridor, review signalized intersections for pedestrian phasing or LPI, advance warning signage, and PHBs near crossing locations of sensitive populations.

Notes

- **Segment 1:** Wide crossing widths, higher AADT, and lack of pedestrian crossing infrastructure.
- **Segment 2:** Corridor could be reduced to two travel lanes with central turning lane if AADT permits; also, numerous signalized intersections and mid-block crossings would benefit from pedestrian crossing enhancements given land use.

Little Creek Road (SR 165/170) – Sheet 2 of 3

Community: Norfolk
VDOT District: 5 (Hampton Roads)

Corridor Description

- **Segment 1:** 6-and-4-lane median divided roadway with wide range of adjacent commercial and residential land uses. **AADT: ~22,000; Speed Limit: 35**
- **Segment 2:** 4-lane undivided roadway with moderate residential density and institutional land uses. **AADT: ~12,000; Speed Limit: 35**

Recommended Countermeasures

- **Segment 1:** Expand medians to accommodate median islands, pedestrian signal heads at signalized intersections, and high visibility crosswalks.
- **Segment 2:** Consider road diet for portion of corridor, review signalized intersections for pedestrian phasing or LPI, advance warning signage, and PHBs near crossing locations of sensitive populations.

Notes

- **Segment 1:** Wide crossing widths, higher AADT, and lack of pedestrian crossing infrastructure.
- **Segment 2:** Corridor could be reduced to two travel lanes with central turning lane if AADT permits; also, numerous signalized intersections and mid-block crossings would benefit from pedestrian crossing enhancements given land use.

Little Creek Road (SR 165/170) – Sheet 3 of 3

Community: Norfolk
VDOT District: 5 (Hampton Roads)

Corridor Description

- **Segment 1:** 6-and-4-lane median divided roadway with wide range of adjacent commercial and residential land uses. **AADT: ~22,000; Speed Limit: 35**
- **Segment 2:** 4-lane undivided roadway with moderate residential density and institutional land uses. **AADT: ~12,000; Speed Limit: 35**

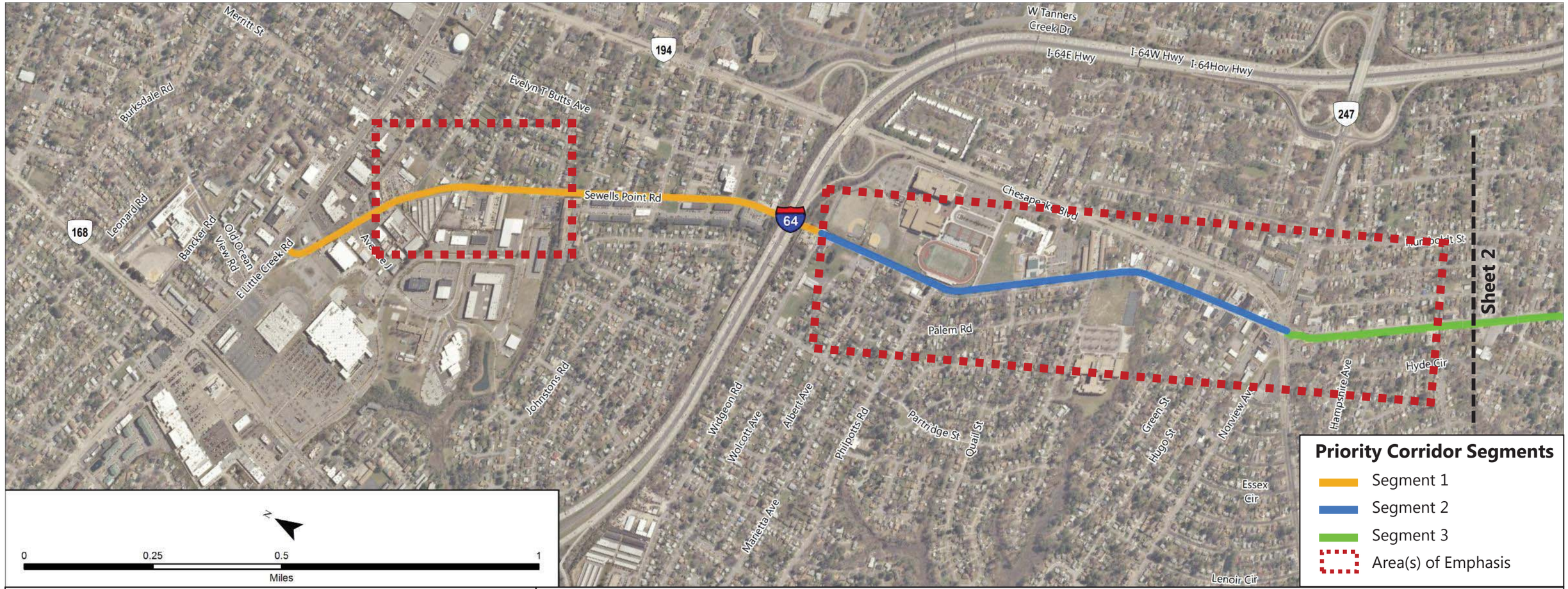
Recommended Countermeasures

- **Segment 1:** Expand medians to accommodate median islands, pedestrian signal heads at signalized intersections, and high visibility crosswalks.
- **Segment 2:** Consider road diet for portion of corridor, review signalized intersections for pedestrian phasing or LPI, advance warning signage, and PHBs near crossing locations of sensitive populations.

Notes

- **Segment 1:** Wide crossing widths, higher AADT, and lack of pedestrian crossing infrastructure.
- **Segment 2:** Corridor could be reduced to two travel lanes with central turning lane if AADT permits; also, numerous signalized intersections and mid-block crossings would benefit from pedestrian crossing enhancements given land use.

Sewells Point Road (SR 194) – Sheet 1 of 2



Community: Norfolk
VDOT District: 5 (Hampton Roads)

Corridor Description

- **Segment 1:** 4-lane undivided roadway with moderate commercial and residential land use density. **AADT: ~7,000; Speed Limit: 35**
- **Segment 2:** 2-lane undivided roadway with residential and institutional land uses. **AADT: ~7,000; Speed Limit: 35**
- **Segment 3:** 4-lane median divided roadway with moderate density of residential, commercial, and institutional land uses. **AADT: ~12,000; Speed Limit: 35**

Recommended Countermeasures

- **Segment 1:** Consideration of road diet for portion of corridor, high visibility crosswalks, PHBs at key mid-block crossing locations , traffic calming measures such as bicycle lanes and on-street parking as deemed appropriate.
- **Segment 2:** High visibility crosswalks, advance warning signs, and in-street yield signs at midblock crossings.
- **Segment 3:** Pedestrian signal heads, high visibility crosswalks, and PHBs at key midblock crossing locations.

Notes

- **Segment 1:** Recommendations dependent on AADT for conversion, and additional pavement surfaces could support parking access to commercial entities.
- **Segment 2:** Sensitive populations near crossing locations warrant additional countermeasures.
- **Segment 3:** Wide crossing distances with pedestrian supporting land uses and lack of pedestrian crossing facilities.

Sewells Point Road (SR 194) – Sheet 2 of 2

Community: Norfolk
VDOT District: 5 (Hampton Roads)

Corridor Description

- **Segment 1:** 4-lane undivided roadway with moderate commercial and residential land use density. **AADT: ~7,000; Speed Limit: 35**
- **Segment 2:** 2-lane undivided roadway with residential and institutional land uses. **AADT: ~7,000; Speed Limit: 35**
- **Segment 3:** 4-lane median divided roadway with moderate density of residential, commercial, and institutional land uses. **AADT: ~12,000; Speed Limit: 35**

Recommended Countermeasures

- **Segment 1:** Consideration of road diet for portion of corridor, high visibility crosswalks, PHBs at key mid-block crossing locations , traffic calming measures such as bicycle lanes and on-street parking as deemed appropriate.
- **Segment 2:** High visibility crosswalks, advance warning signs, and in-street yield signs at midblock crossings.
- **Segment 3:** Pedestrian signal heads, high visibility crosswalks, and PHBs at key midblock crossing locations.

Notes

- **Segment 1:** Recommendations dependent on AADT for conversion, and additional pavement surfaces could support parking access to commercial entities.
- **Segment 2:** Sensitive populations near crossing locations warrant additional countermeasures.
- **Segment 3:** Wide crossing distances with pedestrian supporting land uses and lack of pedestrian crossing facilities.

Tidewater Drive (SR 168/SR 337) – Sheet 1 of 3

Community: Norfolk
VDOT District: 5 (Hampton Roads)

Corridor Description

- **Segment 1:** 6-and-4-lane median divided roadway with wide range of adjacent commercial and residential land uses. **AADT: ~20,000 to 40,000; Speed Limit: 35**

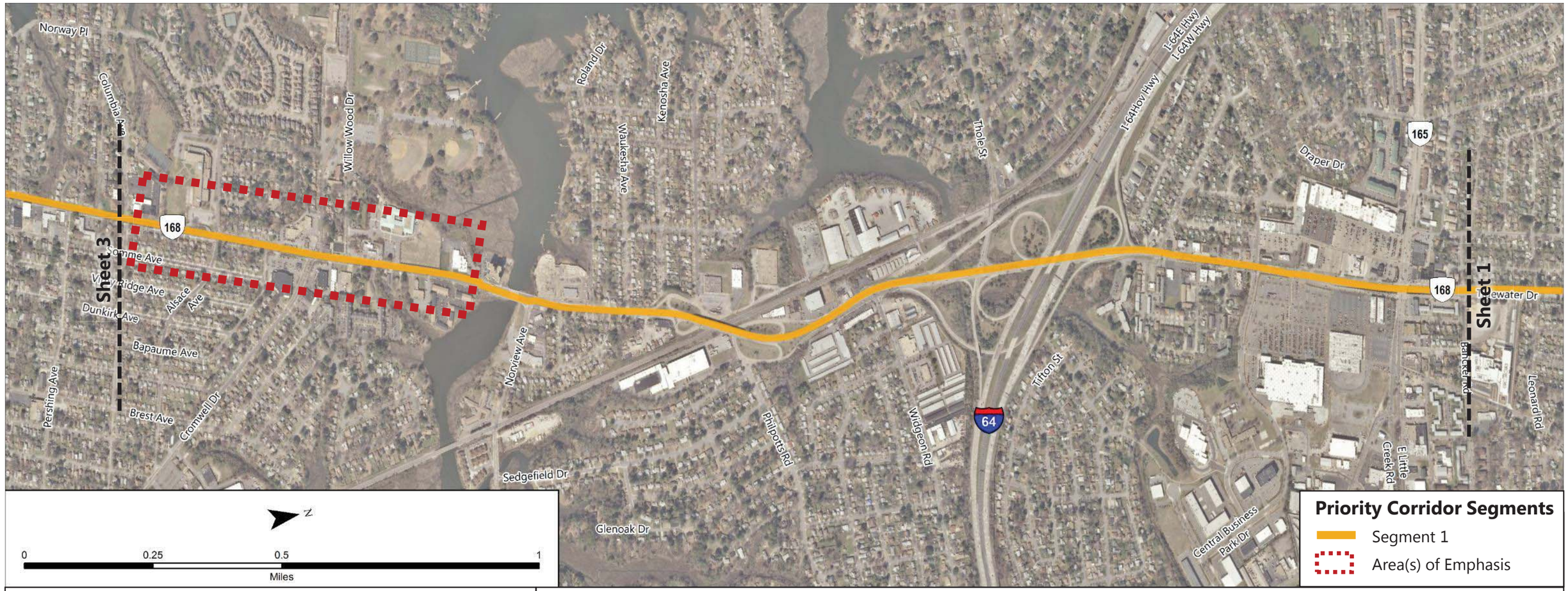
Recommended Countermeasures

- **Segment 1:** Advance warning signage, PHB at key mid-block locations, evaluation of pedestrian signal phases or LPI, and high visibility crosswalks.

Notes

- **Segment 1:** Wide road widths with short blocks and mid-blocks with need for access to transit across corridor.

Tidewater Drive (SR 168/SR 337) – Sheet 2 of 3



Community: Norfolk
VDOT District: 5 (Hampton Roads)

Corridor Description

- **Segment 1:** 6-and-4-lane median divided roadway with wide range of adjacent commercial and residential land uses. **AADT: ~20,000 to 40,000; Speed Limit: 35**

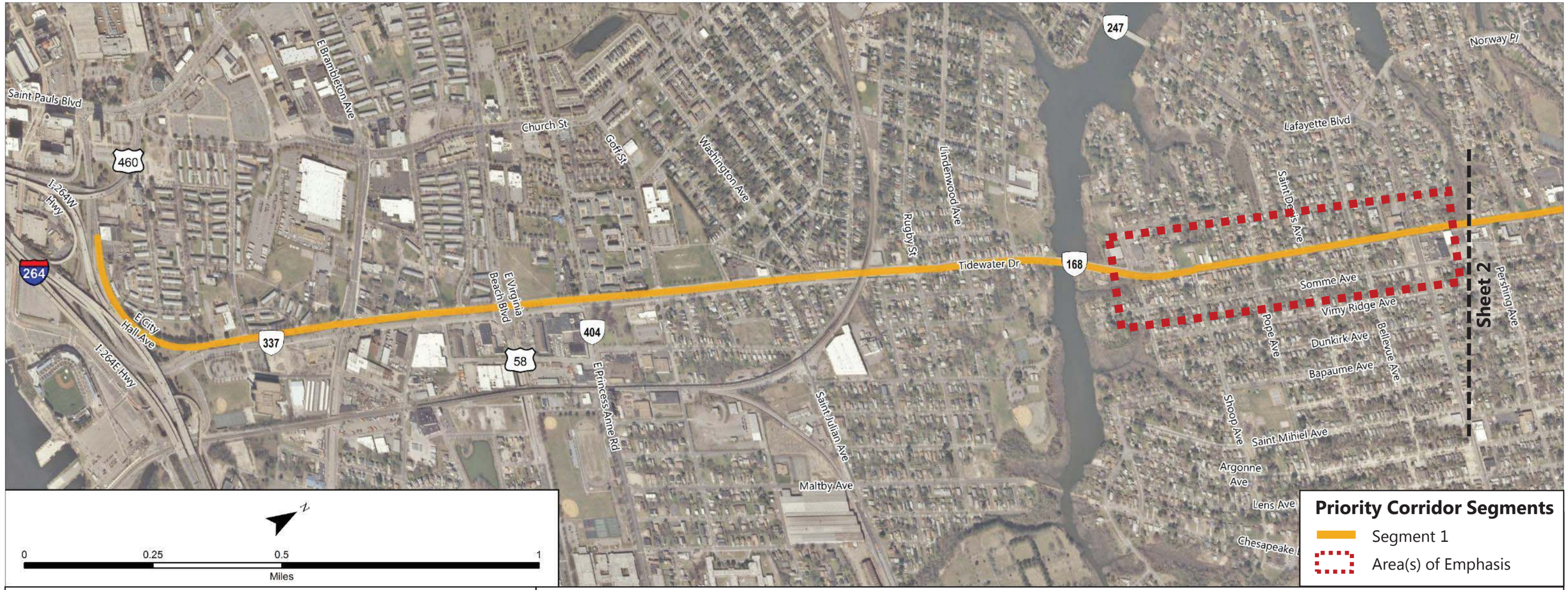
Recommended Countermeasures

- **Segment 1:** Advance warning signage, PHB at key mid-block locations, evaluation of pedestrian signal phases or LPI, and high visibility crosswalks.

Notes

- **Segment 1:** Wide road widths with short blocks and mid-blocks with need for access to transit across corridor.

Tidewater Drive (SR 168/SR 337) – Sheet 3 of 3



Community: Norfolk
VDOT District: 5 (Hampton Roads)

Corridor Description

- **Segment 1:** 6-and-4-lane median divided roadway with wide range of adjacent commercial and residential land uses. **AADT: ~20,000 to 40,000; Speed Limit: 35**

Recommended Countermeasures

- **Segment 1:** Advance warning signage, PHB at key mid-block locations, evaluation of pedestrian signal phases or LPI, and high visibility crosswalks.

Notes

- **Segment 1:** Wide road widths with short blocks and mid-blocks with need for access to transit across corridor.

Wilson Road (US 460) – Sheet 1 of 1

Community: Norfolk
VDOT District: 5 (Hampton Roads)

Corridor Description

- **Segment 1:** 2-lane undivided roadway with moderate density of residential land uses. **AADT: ~9,000; Speed Limit: 35**

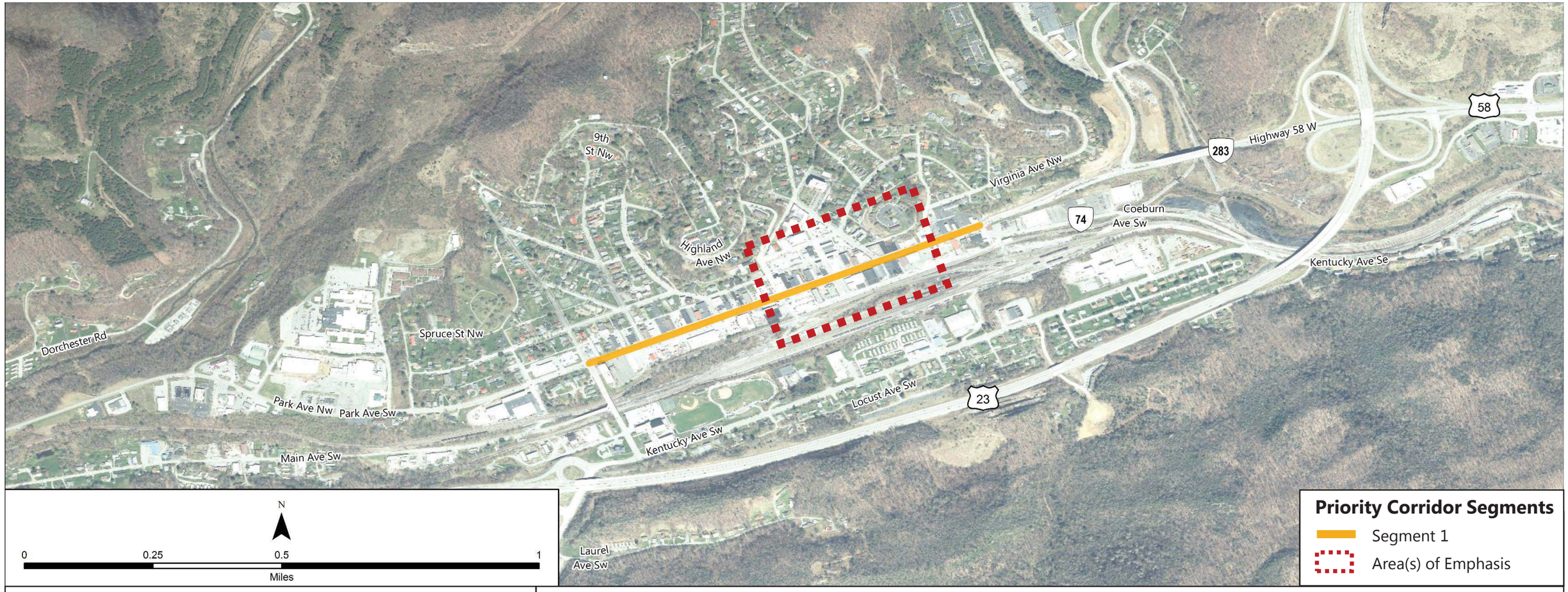
Recommended Countermeasures

- **Segment 1:** Curb extensions, high visibility crosswalks, and in-street yield signage.

Notes

- **Segment 1:** Low speed road with frequent unsignalized intersections.

Park Avenue (US 23-Bus.) – Sheet 1 of 1



Community: Norton
VDOT District: 1 (Bristol)

Corridor Description

- **Segment 1:** 4-lane median undivided roadway with moderate density of commercial and low density residential and institutional land uses. **AADT: ~7,000 to 10,000; Speed Limit: 45**

Recommended Countermeasures

- **Segment 1:** Pedestrian countdown signal, evaluate signalized intersections for LPI or pedestrian phasing, curb extensions paired with parking restrictions, possibly reduce speed limits, and consideration of road diet.

Notes

- **Segment 1:** Downtown commercial area has well marked crosswalks and is supportive of pedestrian activity, though improvements can be made to increase pedestrian crossing visibility and add amenities for non-motorists if the AADT is supportive of a road diet.

Belvidere Street South (US 1) – Sheet 1 of 1

Community: Richmond
VDOT District: 4 (Richmond)

Corridor Description

- **Segment 1:** 6-lane median divided roadway with moderate density commercial and institutional land uses. **AADT: ~27,000; Speed Limit: 35**

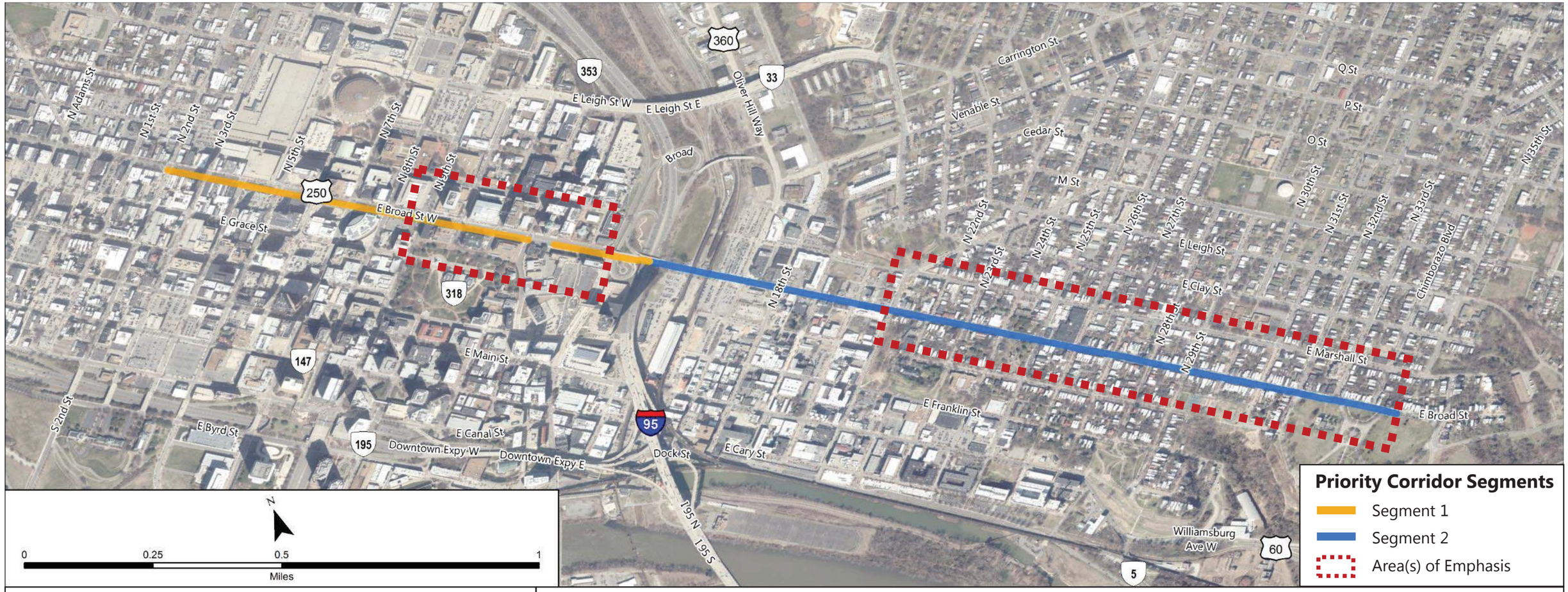
Recommended Countermeasures

- **Segment 1:** Raised median islands at signalized intersections, pedestrian signal heads, and high visibility crosswalks.

Notes

- **Segment 1:** Long block lengths and wide crossing widths with signalized intersections and pedestrian signals likely present challenges to pedestrians.

Broad Street East (US 250) – Sheet 1 of 1



Community: Richmond
VDOT District: 4 (Richmond)

Corridor Description

- **Segment 1:** 4-lane median divided roadway with dense commercial land uses. **AADT: ~17,000 to 26,000; Speed Limit: 35**
- **Segment 2:** 4-and-2-lane roadway with moderate residential density and recreational land uses. **AADT: ~6,000; Speed Limit: 35**

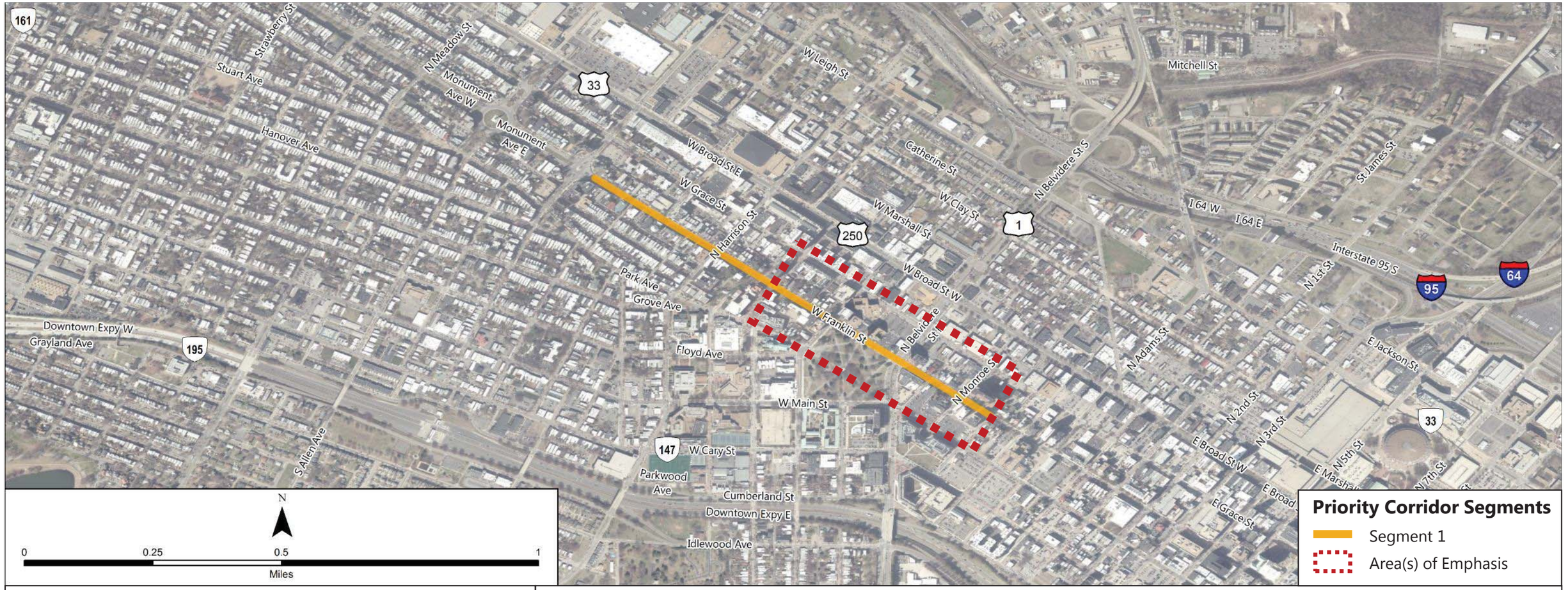
Recommended Countermeasures

- **Segment 1:** Pedestrian signal heads at signalized intersections, high visibility crosswalks, and raised median islands at pedestrian activity centers; certain mid-block locations may be suitable for PHBs.
- **Segment 2:** Raised median island, curb extensions, high visibility crosswalks, and consider evaluating signal timing.

Notes

- **Segment 1:** Area does not contain significant pedestrian infrastructure, and roadway width presents crossing challenges**.**
- **Segment 2:** Crossing facilities appear outdated, and on-street parking is available

Franklin Street – Sheet 1 of 1



Community: Richmond
VDOT District: 4 (Richmond)

Corridor Description

- **Segment 1:** 2-lane one way roadway with moderate commercial and residential density and institutional land uses. **AADT: ~7,000; Speed Limit: 35**

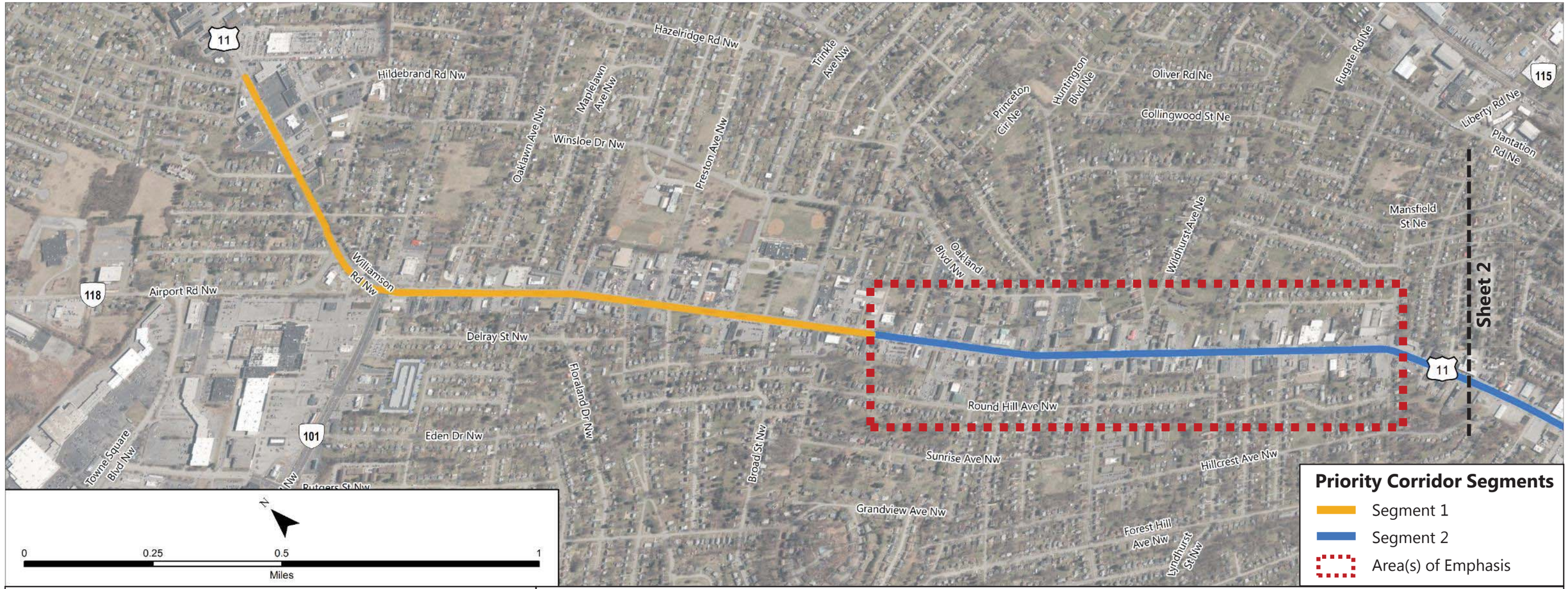
Recommended Countermeasures

- **Segment 1:** Curb extensions and parking restrictions, high visibility crosswalks, and evaluation of pedestrian signal phasing or LPI at signalized intersections.

Notes

- **Segment 1:** Area of high pedestrian activity with on-street parking and short blocks marked by existing crosswalks.

Williamson Road (US 11) – Sheet 1 of 2



Community: Roanoke
VDOT District: 2 (Salem)

Corridor Description

- **Segment 1:** 4-lane median divided roadway with minimal pedestrian crossings and adjacent commercial land uses. **AADT: ~15,000; Speed Limit: 35**
- **Segment 2:** 4-lane undivided roadway with adjacent residential and commercial land uses. **AADT: ~15,000; Speed Limit: 35**
- **Segment 3:** 4-6-lane divided roadway with access to arterials and adjacent to commercial land uses. **AADT: ~21,000; Speed Limit: 35**
- **Segment 4:** 2-4 lane undivided roadway that transitions with institutional and adjacent commercial land uses. **AADT: ~10,000; Speed Limit: 35**

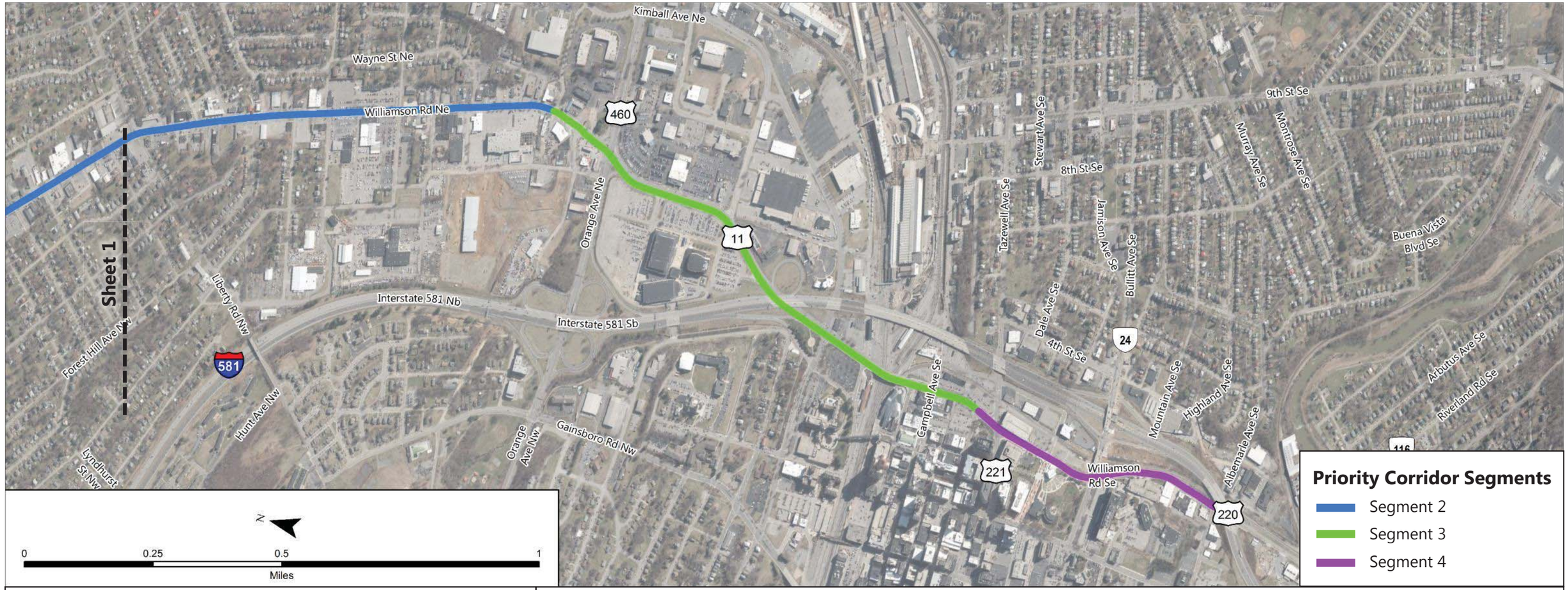
Recommended Countermeasures

- **Segment 1:** Pedestrian signal heads and countdown signals, high visibility crosswalks, PHBs at key midblock crossings.
- **Segment 2:** Pedestrian signal heads and countdown signals, high visibility crosswalks, PHBs at key midblock crossings.
- **Segment 3:** Advance warning signage and markings, turn restrictions at signalized intersections, review for LPI or pedestrian signal phasing.
- **Segment 4:** Advance warning signage and markings, turn restrictions at signalized intersections, review for LPI, PHB at prominent mid-block crossings, consistent high visibility crosswalk application.

Notes

- **Segment 1:** Little to no existing pedestrian crossing infrastructure in place.
- **Segment 2:** Little to no existing pedestrian crossing infrastructure in place.
- **Segment 3:** Existing crosswalks with pedestrians signals but opportunity for turning motion conflicts, especially given crossing distance is approximately 100 feet.
- **Segment 4:** Existing crosswalks are marked but not high visibility patterns, and angled intersections present longer crossing distances.

Williamson Road (US 11) – Sheet 2 of 2



Community: Roanoke
VDOT District: 2 (Salem)

Corridor Description

- **Segment 1:** 4-lane median divided roadway with minimal pedestrian crossings and adjacent commercial land uses. **AADT: ~15,000; Speed Limit: 35**
- **Segment 2:** 4-lane undivided roadway with adjacent residential and commercial land uses. **AADT: ~15,000; Speed Limit: 35**
- **Segment 3:** 4-6-lane divided roadway with access to arterials and adjacent to commercial land uses. **AADT: ~21,000; Speed Limit: 35**
- **Segment 4:** 2-4 lane undivided roadway that transitions with institutional and adjacent commercial land uses. **AADT: ~10,000; Speed Limit: 35**

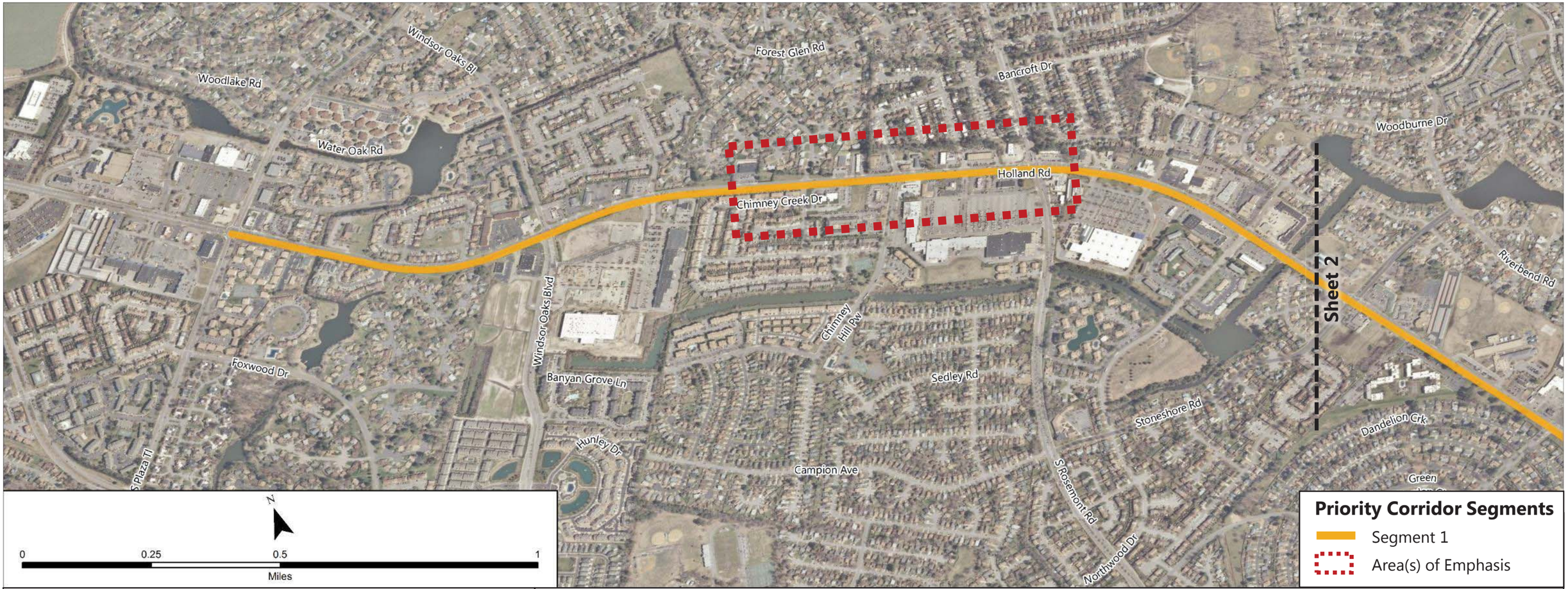
Recommended Countermeasures

- **Segment 1:** Pedestrian signal heads and countdown signals, high visibility crosswalks, PHBs at key midblock crossings.
- **Segment 2:** Pedestrian signal heads and countdown signals, high visibility crosswalks, PHBs at key midblock crossings.
- **Segment 3:** Advance warning signage and markings, turn restrictions at signalized intersections, review for LPI or pedestrian signal phasing.
- **Segment 4:** Advance warning signage and markings, turn restrictions at signalized intersections, review for LPI, PHB at prominent mid-block crossings, consistent high visibility crosswalk application.

Notes

- **Segment 1:** Little to no existing pedestrian crossing infrastructure in place.
- **Segment 2:** Little to no existing pedestrian crossing infrastructure in place.
- **Segment 3:** Existing crosswalks with pedestrians signals but opportunity for turning motion conflicts, especially given crossing distance is approximately 100 feet.
- **Segment 4:** Existing crosswalks are marked but not high visibility patterns, and angled intersections present longer crossing distances.

Holland Road – Sheet 1 of 2



Community: Virginia Beach
VDOT District: 5 (Hampton Roads)

Corridor Description

- **Segment 1:** 4-lane median divided roadway with mix of residential, commercial, and industrial land uses. **AADT: ~30,000; Speed Limit: 35**

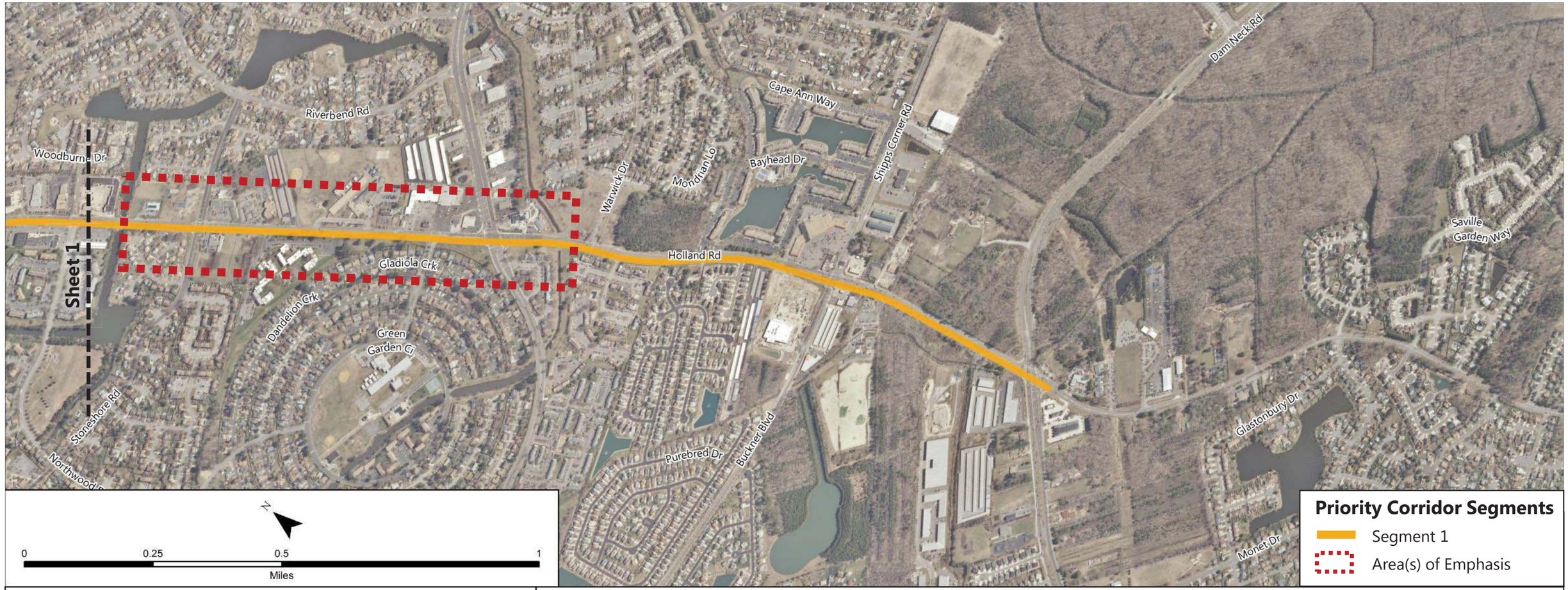
Recommended Countermeasures

- **Segment 1:** Pedestrian countdown signals at already signalized intersections, upgrade crosswalks to high visibility materials and patterns, expand medians to median islands, PHBs at key midblock locations, and consider LPI or pedestrian signal timing at wider intersections.

Notes

- **Segment 1:** Existing crosswalks are marked with high visibility patterns, though review of signal phases and mid-block crossings would support an improved pedestrian environment.

Holland Road – Sheet 2 of 2



Community: Virginia Beach
VDOT District: 5 (Hampton Roads)

Corridor Description

- **Segment 1:** 4-lane median divided roadway with mix of residential, commercial, and industrial land uses. **AADT: ~30,000; Speed Limit: 35**

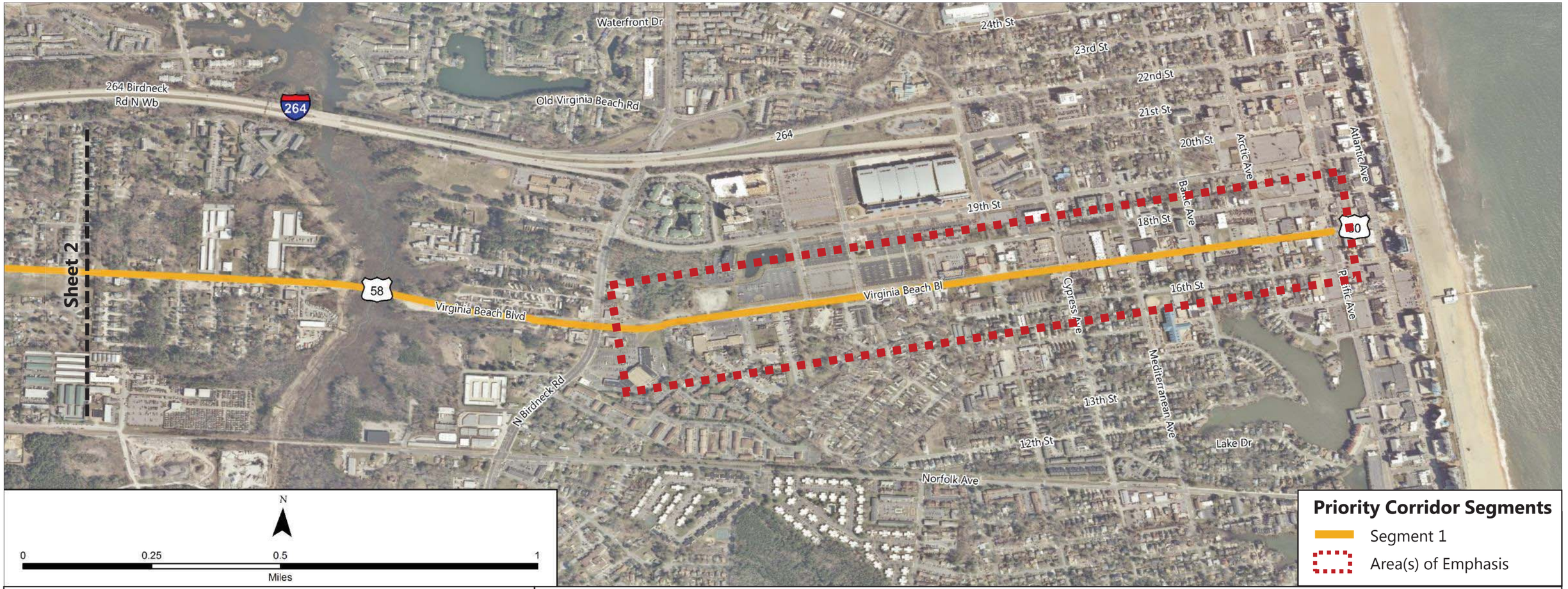
Recommended Countermeasures

- **Segment 1:** Pedestrian countdown signals at already signalized intersections, upgrade crosswalks to high visibility materials and patterns, expand medians to median islands, PHBs at key midblock locations, and consider LPI or pedestrian signal timing at wider intersections.

Notes

- **Segment 1:** Existing crosswalks are marked with high visibility patterns, though review of signal phases and mid-block crossings would support an improved pedestrian environment.

Virginia Beach Boulevard (US 58) – Sheet 1 of 6



Community: Virginia Beach
VDOT District: 5 (Hampton Roads)

Corridor Description

- **Segment 1:** 4-lane median divided roadway with moderate residential and commercial density. **AADT: ~10,000 to 30,000; Speed Limit: 35**
- **Segment 2:** 8-lane median divided roadway with access to highway network and adjacent to moderate density residential, commercial, and industrial land uses. **AADT: ~30,000 to 40,000; Speed Limit: 55**

Recommended Countermeasures

- **Segment 1:** PHB at key mid-block crossing locations, high visibility crosswalks, raised median islands at crossing locations where missing.
- **Segment 2:** Slip-lane refuge island, expanded median island for two stage crossing, consideration of grade separated pedestrian facility.

Notes

- **Segment 1:** Roadway cross-section and land use is conducive to PHBs and median islands where pedestrian demand is anticipated.
- **Segment 2:** Wide crossing distance with increased exposure to automobile conflicts.

Virginia Beach Boulevard (US 58) – Sheet 2 of 6

Community: Virginia Beach
VDOT District: 5 (Hampton Roads)

Corridor Description

- **Segment 1:** 4-lane median divided roadway with moderate residential and commercial density. **AADT: ~10,000 to 30,000; Speed Limit: 35**
- **Segment 2:** 8-lane median divided roadway with access to highway network and adjacent to moderate density residential, commercial, and industrial land uses. **AADT: ~30,000 to 40,000; Speed Limit: 55**

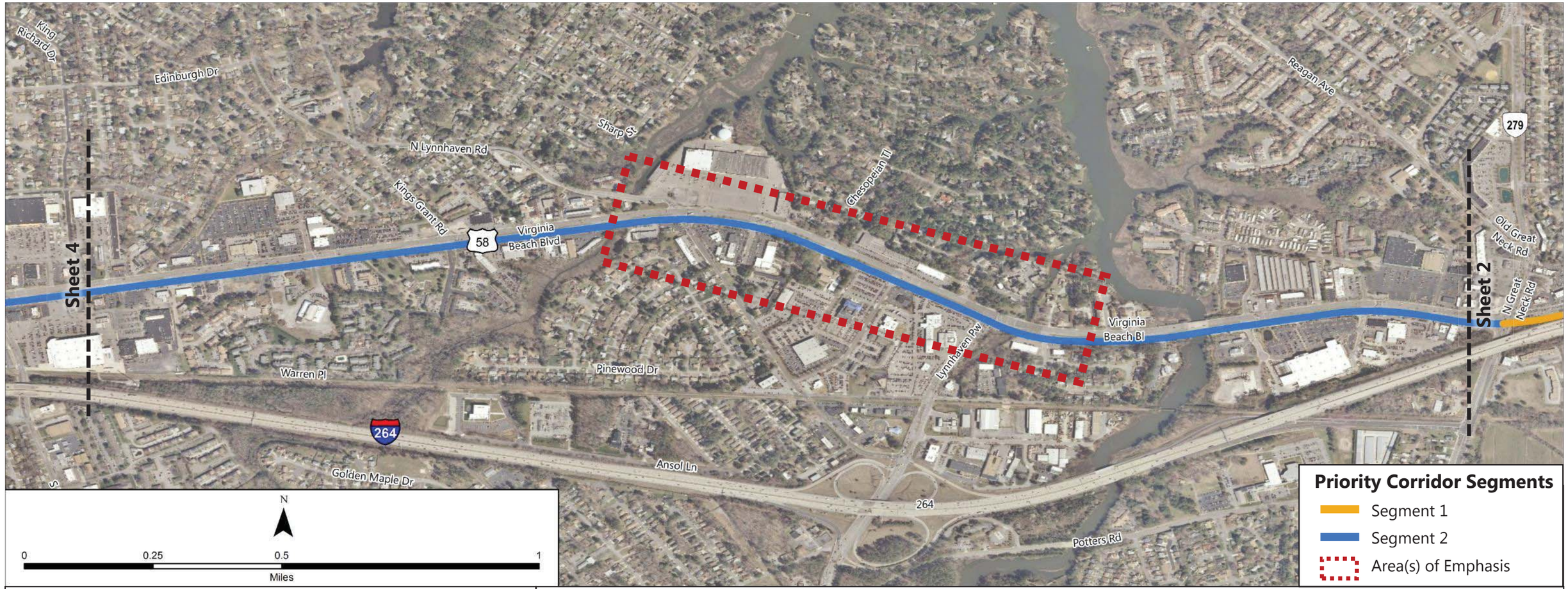
Recommended Countermeasures

- **Segment 1:** PHB at key mid-block crossing locations, high visibility crosswalks, raised median islands at crossing locations where missing.
- **Segment 2:** Slip-lane refuge island, expanded median island for two stage crossing, consideration of grade separated pedestrian facility.

Notes

- **Segment 1:** Roadway cross-section and land use is conducive to PHBs and median islands where pedestrian demand is anticipated.
- **Segment 2:** Wide crossing distance with increased exposure to automobile conflicts.

Virginia Beach Boulevard (US 58) – Sheet 3 of 6



Community: Virginia Beach
VDOT District: 5 (Hampton Roads)

Corridor Description

- **Segment 1:** 4-lane median divided roadway with moderate residential and commercial density. **AADT: ~10,000 to 30,000; Speed Limit: 35**
- **Segment 2:** 8-lane median divided roadway with access to highway network and adjacent to moderate density residential, commercial, and industrial land uses. **AADT: ~30,000 to 40,000; Speed Limit: 55**

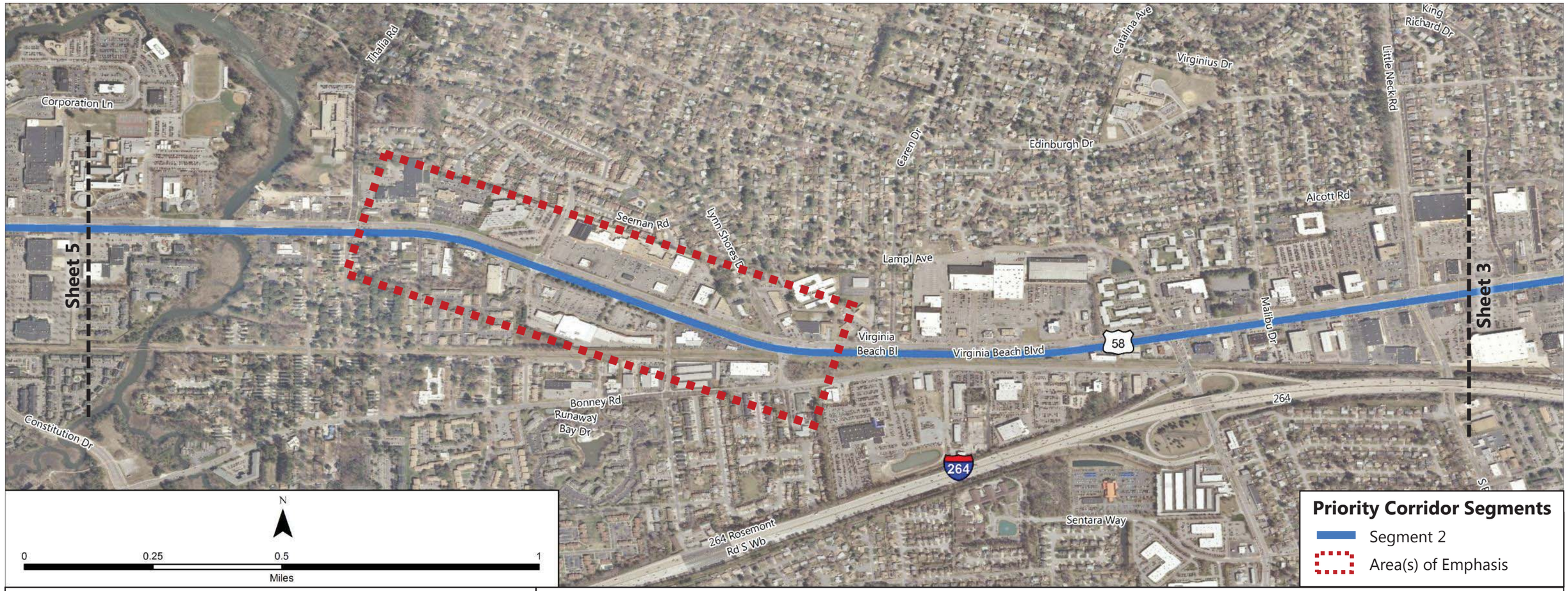
Recommended Countermeasures

- **Segment 1:** PHB at key mid-block crossing locations, high visibility crosswalks, raised median islands at crossing locations where missing.
- **Segment 2:** Slip-lane refuge island, expanded median island for two stage crossing, consideration of grade separated pedestrian facility.

Notes

- **Segment 1:** Roadway cross-section and land use is conducive to PHBs and median islands where pedestrian demand is anticipated.
- **Segment 2:** Wide crossing distance with increased exposure to automobile conflicts.

Virginia Beach Boulevard (US 58) – Sheet 4 of 6



Community: Virginia Beach
VDOT District: 5 (Hampton Roads)

Corridor Description

- **Segment 1:** 4-lane median divided roadway with moderate residential and commercial density. **AADT: ~10,000 to 30,000; Speed Limit: 35**
- **Segment 2:** 8-lane median divided roadway with access to highway network and adjacent to moderate density residential, commercial, and industrial land uses. **AADT: ~30,000 to 40,000; Speed Limit: 55**

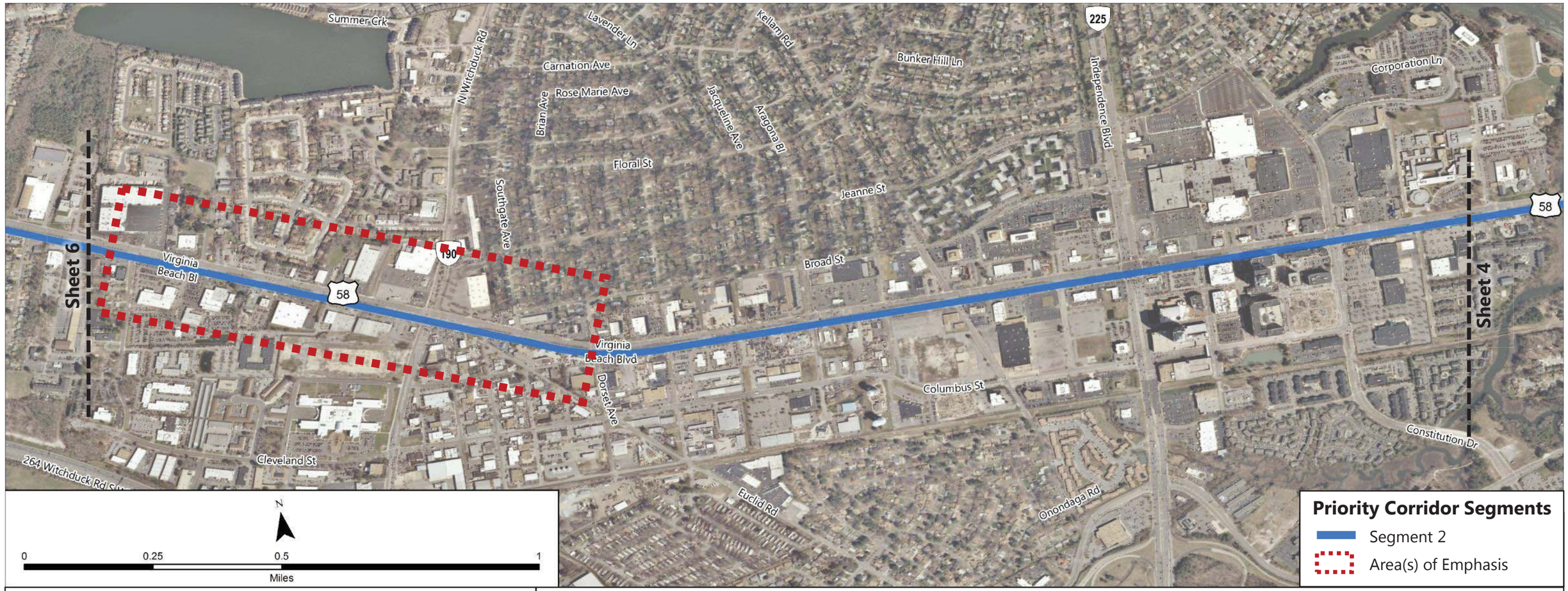
Recommended Countermeasures

- **Segment 1:** PHB at key mid-block crossing locations, high visibility crosswalks, raised median islands at crossing locations where missing.
- **Segment 2:** Slip-lane refuge island, expanded median island for two stage crossing, consideration of grade separated pedestrian facility.

Notes

- **Segment 1:** Roadway cross-section and land use is conducive to PHBs and median islands where pedestrian demand is anticipated.
- **Segment 2:** Wide crossing distance with increased exposure to automobile conflicts.

Virginia Beach Boulevard (US 58) – Sheet 5 of 6



Community: Virginia Beach
VDOT District: 5 (Hampton Roads)

Corridor Description

- **Segment 1:** 4-lane median divided roadway with moderate residential and commercial density. **AADT: ~10,000 to 30,000; Speed Limit: 35**

- **Segment 2:** 8-lane median divided roadway with access to highway network and adjacent to moderate density residential, commercial, and industrial land uses. **AADT: ~30,000 to 40,000; Speed Limit: 55**

Recommended Countermeasures

- **Segment 1:** PHB at key mid-block crossing locations, high visibility crosswalks, raised median islands at crossing locations where missing.

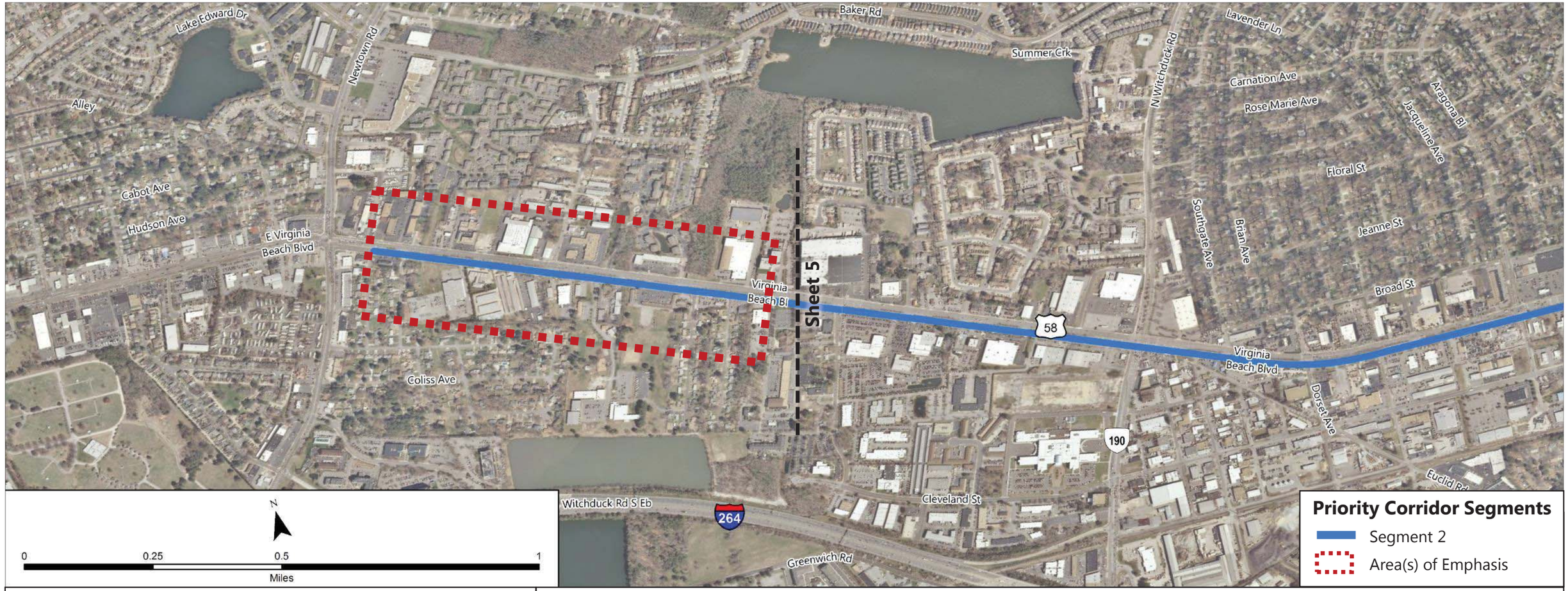
- **Segment 2:** Slip-lane refuge island, expanded median island for two stage crossing, consideration of grade separated pedestrian facility.

Notes

- **Segment 1:** Roadway cross-section and land use is conducive to PHBs and median islands where pedestrian demand is anticipated.

- **Segment 2:** Wide crossing distance with increased exposure to automobile conflicts.

Virginia Beach Boulevard (US 58) – Sheet 6 of 6



Community: Virginia Beach
VDOT District: 5 (Hampton Roads)

Corridor Description

- **Segment 1:** 4-lane median divided roadway with moderate residential and commercial density. **AADT: ~10,000 to 30,000; Speed Limit: 35**
- **Segment 2:** 8-lane median divided roadway with access to highway network and adjacent to moderate density residential, commercial, and industrial land uses. **AADT: ~30,000 to 40,000; Speed Limit: 55**

Recommended Countermeasures

- **Segment 1:** PHB at key mid-block crossing locations, high visibility crosswalks, raised median islands at crossing locations where missing.
- **Segment 2:** Slip-lane refuge island, expanded median island for two stage crossing, consideration of grade separated pedestrian facility.

Notes

- **Segment 1:** Roadway cross-section and land use is conducive to PHBs and median islands where pedestrian demand is anticipated.
- **Segment 2:** Wide crossing distance with increased exposure to automobile conflicts.

National Avenue (SR 7) – Sheet 1 of 1

Community: Winchester
VDOT District: 8 (Staunton)

Corridor Description

- **Segment 1:** 2-lane undivided roadway with moderate density of residential land uses. **AADT: ~11,000; Speed Limit: 35**

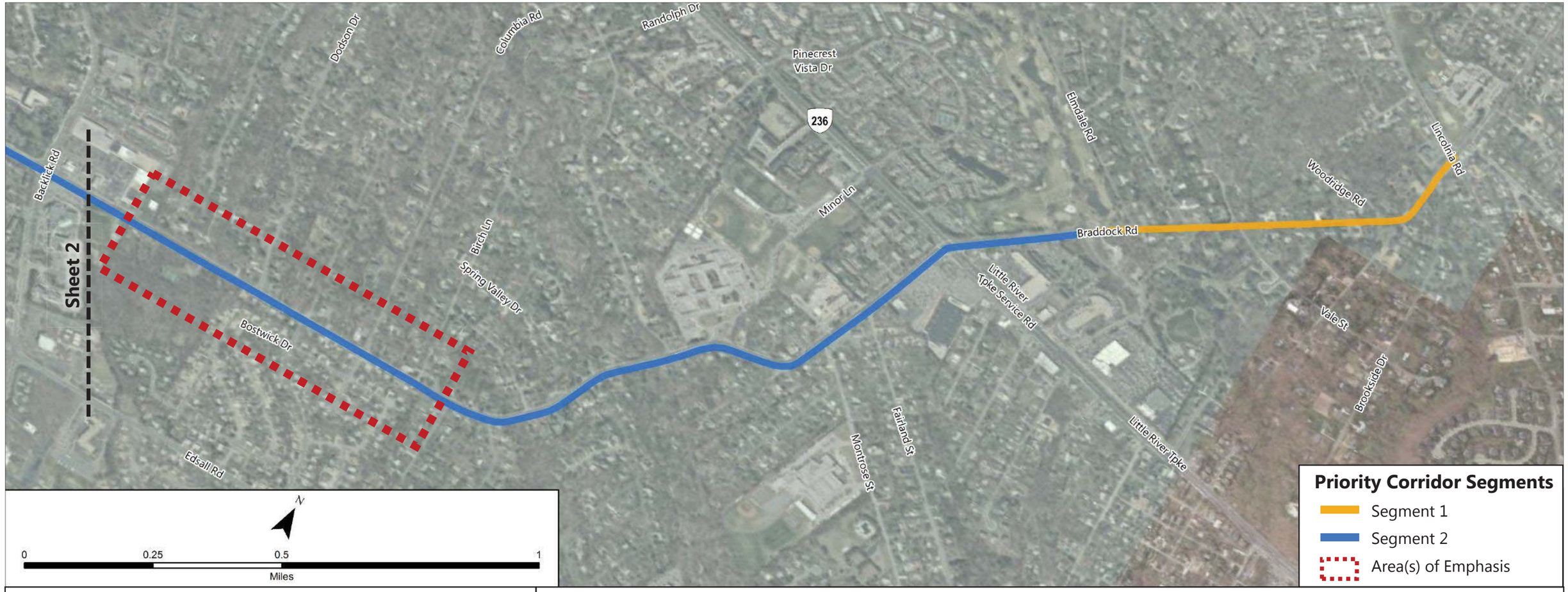
Recommended Countermeasures

- **Segment 1:** Curb extensions and parking restrictions, high visibility crosswalks, and in-street yield signage.

Notes

- **Segment 1:** Lower speed road with frequent unsignalized intersections.

Braddock Road (SC 620) – Sheet 1 of 8



Community: Fairfax
VDOT District: 9 (NOVA)

Corridor Description

- **Segment 1:** 2-lane undivided roadway with low density residential and commercial land uses. **AADT: ~11,000; Speed Limit: 35**
- **Segment 2:** 4-lane median divided roadway with moderate commercial and residential land uses. **AADT: ~20,000 to 40,000; Speed Limit: 35 to 45**

Recommended Countermeasures

- **Segment 1:** Lighting near marked midblock intersections and advanced warning signage.
- **Segment 2:** Consistent application of high visibility crosswalks, RRFBs or PHBs at key mid-block crossings, modification of medians to refuge islands, and review signal timing for countdown signal and LPI or pedestrian phasing.

Notes

- **Segment 1:** Low density area with few marked crosswalks.
- **Segment 2:** Long corridor with shared use paths and existing pedestrian infrastructure, though it is lacking consistent application of countermeasures.

Braddock Road (SC 620) – Sheet 2 of 8

Community: Fairfax
VDOT District: 9 (NOVA)

Corridor Description

- **Segment 1:** 2-lane undivided roadway with low density residential and commercial land uses. **AADT: ~11,000; Speed Limit: 35**
- **Segment 2:** 4-lane median divided roadway with moderate commercial and residential land uses. **AADT: ~20,000 to 40,000; Speed Limit: 35 to 45**

Recommended Countermeasures

- **Segment 1:** Lighting near marked midblock intersections and advanced warning signage.
- **Segment 2:** Consistent application of high visibility crosswalks, RRFBs or PHBs at key mid-block crossings, modification of medians to refuge islands, and review signal timing for countdown signal and LPI or pedestrian phasing.

Notes

- **Segment 1:** Low density area with few marked crosswalks.
- **Segment 2:** Long corridor with shared use paths and existing pedestrian infrastructure, though it is lacking consistent application of countermeasures.

Braddock Road (SC 620) – Sheet 3 of 8

Community: Fairfax
VDOT District: 9 (NOVA)

Corridor Description

- **Segment 1:** 2-lane undivided roadway with low density residential and commercial land uses. **AADT: ~11,000; Speed Limit: 35**
- **Segment 2:** 4-lane median divided roadway with moderate commercial and residential land uses. **AADT: ~20,000 to 40,000; Speed Limit: 35 to 45**

Recommended Countermeasures

- **Segment 1:** Lighting near marked midblock intersections and advanced warning signage.
- **Segment 2:** Consistent application of high visibility crosswalks, RRFBs or PHBs at key mid-block crossings, modification of medians to refuge islands, and review signal timing for countdown signal and LPI or pedestrian phasing.

Notes

- **Segment 1:** Low density area with few marked crosswalks.
- **Segment 2:** Long corridor with shared use paths and existing pedestrian infrastructure, though it is lacking consistent application of countermeasures.

Braddock Road (SC 620) – Sheet 4 of 8

Community: Fairfax
VDOT District: 9 (NOVA)

Corridor Description

- **Segment 1:** 2-lane undivided roadway with low density residential and commercial land uses. **AADT: ~11,000; Speed Limit: 35**
- **Segment 2:** 4-lane median divided roadway with moderate commercial and residential land uses. **AADT: ~20,000 to 40,000; Speed Limit: 35 to 45**

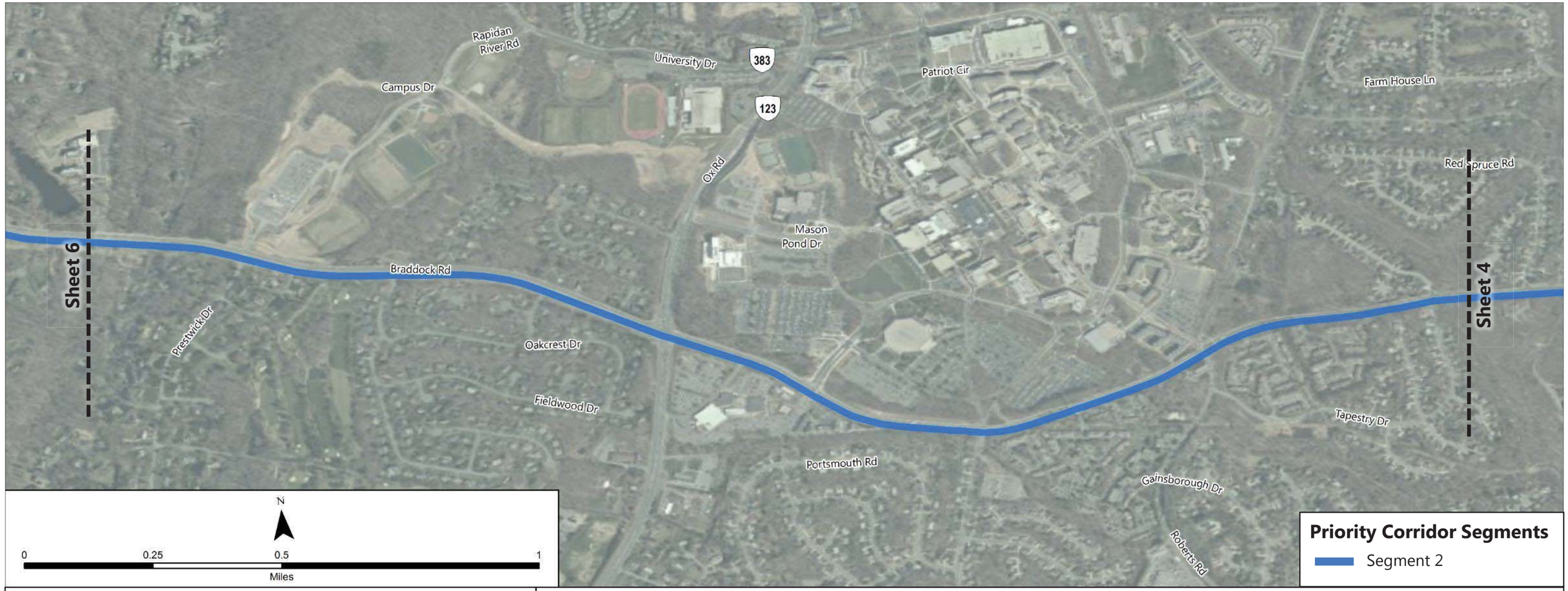
Recommended Countermeasures

- **Segment 1:** Lighting near marked midblock intersections and advanced warning signage.
- **Segment 2:** Consistent application of high visibility crosswalks, RRFBs or PHBs at key mid-block crossings, modification of medians to refuge islands, and review signal timing for countdown signal and LPI or pedestrian phasing.

Notes

- **Segment 1:** Low density area with few marked crosswalks.
- **Segment 2:** Long corridor with shared use paths and existing pedestrian infrastructure, though it is lacking consistent application of countermeasures.

Braddock Road (SC 620) – Sheet 5 of 8



Community: Fairfax
VDOT District: 9 (NOVA)

Corridor Description

- **Segment 1:** 2-lane undivided roadway with low density residential and commercial land uses. **AADT: ~11,000; Speed Limit: 35**
- **Segment 2:** 4-lane median divided roadway with moderate commercial and residential land uses. **AADT: ~20,000 to 40,000; Speed Limit: 35 to 45**

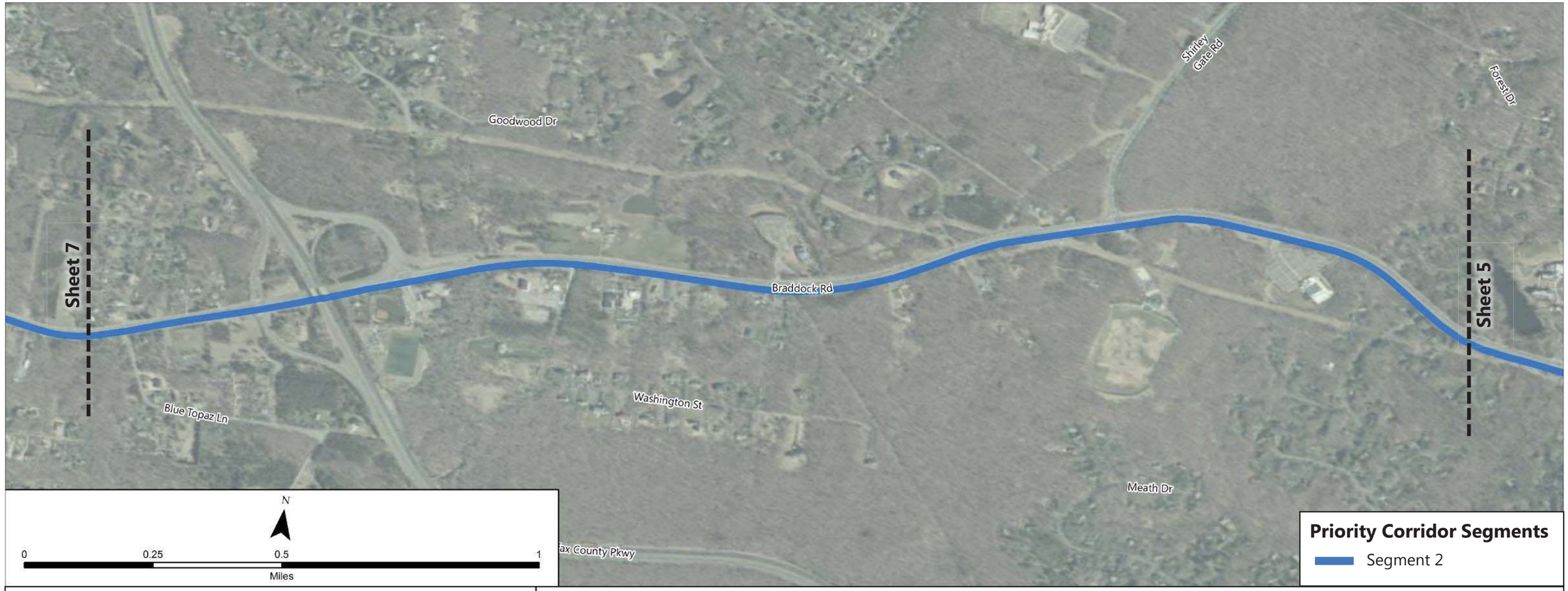
Recommended Countermeasures

- **Segment 1:** Lighting near marked midblock intersections and advanced warning signage.
- **Segment 2:** Consistent application of high visibility crosswalks, RRFBs or PHBs at key mid-block crossings, modification of medians to refuge islands, and review signal timing for countdown signal and LPI or pedestrian phasing.

Notes

- **Segment 1:** Low density area with few marked crosswalks.
- **Segment 2:** Long corridor with shared use paths and existing pedestrian infrastructure, though it is lacking consistent application of countermeasures.

Braddock Road (SC 620) – Sheet 6 of 8



Community: Fairfax
VDOT District: 9 (NOVA)

Corridor Description

- **Segment 1:** 2-lane undivided roadway with low density residential and commercial land uses. **AADT: ~11,000; Speed Limit: 35**
- **Segment 2:** 4-lane median divided roadway with moderate commercial and residential land uses. **AADT: ~20,000 to 40,000; Speed Limit: 35 to 45**

Recommended Countermeasures

- **Segment 1:** Lighting near marked midblock intersections and advanced warning signage.
- **Segment 2:** Consistent application of high visibility crosswalks, RRFBs or PHBs at key mid-block crossings, modification of medians to refuge islands, and review signal timing for countdown signal and LPI or pedestrian phasing.

Notes

- **Segment 1:** Low density area with few marked crosswalks.
- **Segment 2:** Long corridor with shared use paths and existing pedestrian infrastructure, though it is lacking consistent application of countermeasures.

Braddock Road (SC 620) – Sheet 7 of 8

Community: Fairfax
VDOT District: 9 (NOVA)

Corridor Description

- **Segment 1:** 2-lane undivided roadway with low density residential and commercial land uses. **AADT: ~11,000; Speed Limit: 35**
- **Segment 2:** 4-lane median divided roadway with moderate commercial and residential land uses. **AADT: ~20,000 to 40,000; Speed Limit: 35 to 45**

Recommended Countermeasures

- **Segment 1:** Lighting near marked midblock intersections and advanced warning signage.
- **Segment 2:** Consistent application of high visibility crosswalks, RRFBs or PHBs at key mid-block crossings, modification of medians to refuge islands, and review signal timing for countdown signal and LPI or pedestrian phasing.

Notes

- **Segment 1:** Low density area with few marked crosswalks.
- **Segment 2:** Long corridor with shared use paths and existing pedestrian infrastructure, though it is lacking consistent application of countermeasures.

Braddock Road (SC 620) – Sheet 8 of 8

Community: Fairfax
VDOT District: 9 (NOVA)

Corridor Description

- **Segment 1:** 2-lane undivided roadway with low density residential and commercial land uses. **AADT: ~11,000; Speed Limit: 35**
- **Segment 2:** 4-lane median divided roadway with moderate commercial and residential land uses. **AADT: ~20,000 to 40,000; Speed Limit: 35 to 45**

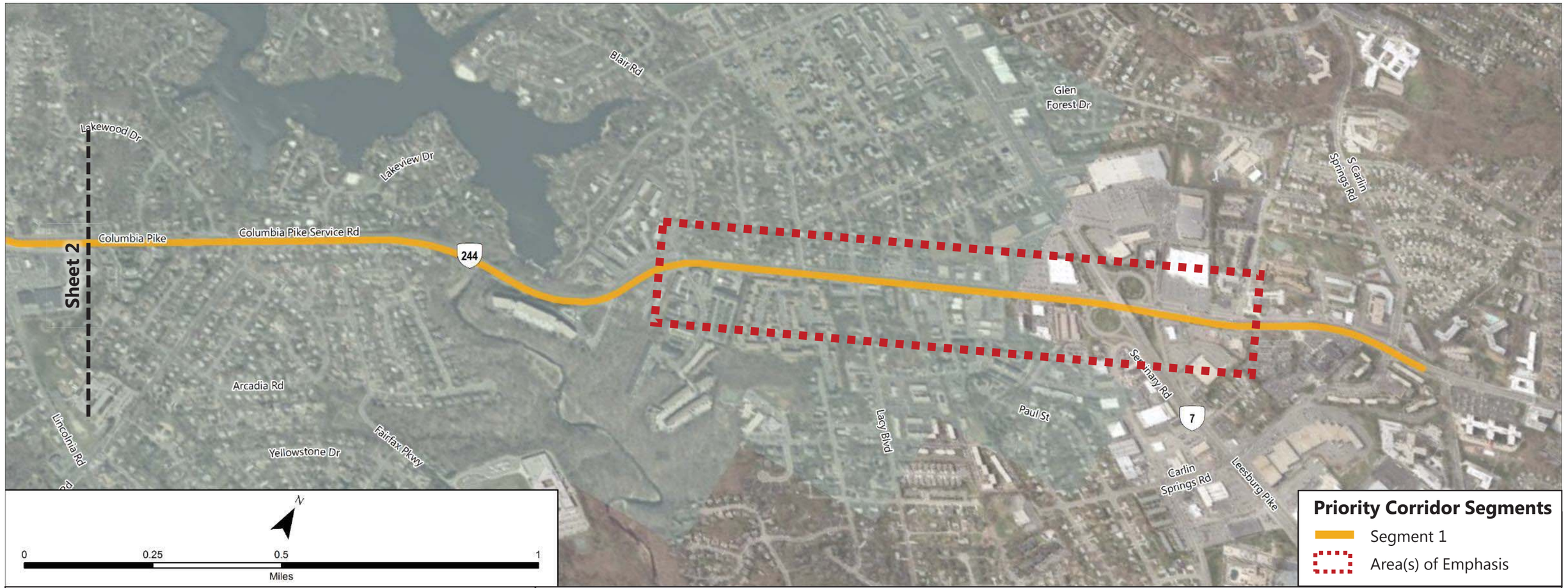
Recommended Countermeasures

- **Segment 1:** Lighting near marked midblock intersections and advanced warning signage.
- **Segment 2:** Consistent application of high visibility crosswalks, RRFBs or PHBs at key mid-block crossings, modification of medians to refuge islands, and review signal timing for countdown signal and LPI or pedestrian phasing.

Notes

- **Segment 1:** Low density area with few marked crosswalks.
- **Segment 2:** Long corridor with shared use paths and existing pedestrian infrastructure, though it is lacking consistent application of countermeasures.

Columbia Pike (SR 244) – Sheet 1 of 2



Community: Fairfax
VDOT District: 9 (NOVA)

Corridor Description

- **Segment 1:** 4-lane median divided roadway and adjacent parallel access roadways with commercial, institutional, and moderate density land uses. **AADT: ~30,000; Speed Limit: 35**

Recommended Countermeasures

- **Segment 1:** PHBs at key mid-block locations with sensitive land uses, advance warning signage, high visibility crosswalks both on main roadway and adjacent access roads, pedestrian countdown signals, and modification of medians to median islands.

Notes

- **Segment 1:** Blocks are interrupted by access roads to neighborhoods and sensitive land uses such as schools; crossings are frequent and inconsistently marked.

Columbia Pike (SR 244) – Sheet 2 of 2

Community: Fairfax
VDOT District: 9 (NOVA)

Corridor Description

- **Segment 1:** 4-lane median divided roadway and adjacent parallel access roadways with commercial, institutional, and moderate density land uses. **AADT: ~30,000; Speed Limit: 35**

Recommended Countermeasures

- **Segment 1:** PHBs at key mid-block locations with sensitive land uses, advance warning signage, high visibility crosswalks both on main roadway and adjacent access roads, pedestrian countdown signals, and modification of medians to median islands.

Notes

- **Segment 1:** Blocks are interrupted by access roads to neighborhoods and sensitive land uses such as schools; crossings are frequent and inconsistently marked.

Lee Highway (US 29) – Sheet 1 of 7

Community: Fairfax
VDOT District: 9 (NOVA)

Corridor Description

- **Segment 1:** 6-and-4-lane median divided roadway with moderate density commercial and residential land uses. **AADT: ~30,000; Speed Limit: 40**
- **Segment 2:** 4-lane median divided roadway with moderate density residential, commercial, and industrial land uses. **AADT: ~25,000 to 40,000; Speed Limit: 40 to 50**

Recommended Countermeasures

- **Segment 1:** Modify medians to median islands, high visibility crosswalks, pedestrian countdown signals, and PHBs at key midblock crossing locations.
- **Segment 2:** Slip lane refuge median islands, pedestrian countdown signals, review of signal timing for pedestrian phasing or LPI at heavy pedestrian areas, high visibility crosswalks, PHBs at key midblock crossing locations (or RRFBs), and advance warning signage.

Notes

- **Segment 1:** Busy roadway with long blocks and signalized intersections.
- **Segment 2:** Wide roadways with long blocks and mid-blocks, also need for pedestrian access to transit across the median.

Lee Highway (US 29) – Sheet 2 of 7

Community: Fairfax
VDOT District: 9 (NOVA)

Corridor Description

- **Segment 1:** 6-and-4-lane median divided roadway with moderate density commercial and residential land uses. **AADT: ~30,000; Speed Limit: 40**
- **Segment 2:** 4-lane median divided roadway with moderate density residential, commercial, and industrial land uses. **AADT: ~25,000 to 40,000; Speed Limit: 40 to 50**

Recommended Countermeasures

- **Segment 1:** Modify medians to median islands, high visibility crosswalks, pedestrian countdown signals, and PHBs at key midblock crossing locations.
- **Segment 2:** Slip lane refuge median islands, pedestrian countdown signals, review of signal timing for pedestrian phasing or LPI at heavy pedestrian areas, high visibility crosswalks, PHBs at key midblock crossing locations (or RRFBs), and advance warning signage.

Notes

- **Segment 1:** Busy roadway with long blocks and signalized intersections.
- **Segment 2:** Wide roadways with long blocks and mid-blocks, also need for pedestrian access to transit across the median.

Lee Highway (US 29) – Sheet 3 of 7

Community: Fairfax
VDOT District: 9 (NOVA)

Corridor Description

- **Segment 1:** 6-and-4-lane median divided roadway with moderate density commercial and residential land uses. **AADT: ~30,000; Speed Limit: 40**
- **Segment 2:** 4-lane median divided roadway with moderate density residential, commercial, and industrial land uses. **AADT: ~25,000 to 40,000; Speed Limit: 40 to 50**

Recommended Countermeasures

- **Segment 1:** Modify medians to median islands, high visibility crosswalks, pedestrian countdown signals, and PHBs at key midblock crossing locations.
- **Segment 2:** Slip lane refuge median islands, pedestrian countdown signals, review of signal timing for pedestrian phasing or LPI at heavy pedestrian areas, high visibility crosswalks, PHBs at key midblock crossing locations (or RRFBs), and advance warning signage.

Notes

- **Segment 1:** Busy roadway with long blocks and signalized intersections.
- **Segment 2:** Wide roadways with long blocks and mid-blocks, also need for pedestrian access to transit across the median.

Lee Highway (US 29) – Sheet 4 of 7

Community: Fairfax
VDOT District: 9 (NOVA)

Corridor Description

- **Segment 1:** 6-and-4-lane median divided roadway with moderate density commercial and residential land uses. **AADT: ~30,000; Speed Limit: 40**
- **Segment 2:** 4-lane median divided roadway with moderate density residential, commercial, and industrial land uses. **AADT: ~25,000 to 40,000; Speed Limit: 40 to 50**

Recommended Countermeasures

- **Segment 1:** Modify medians to median islands, high visibility crosswalks, pedestrian countdown signals, and PHBs at key midblock crossing locations.
- **Segment 2:** Slip lane refuge median islands, pedestrian countdown signals, review of signal timing for pedestrian phasing or LPI at heavy pedestrian areas, high visibility crosswalks, PHBs at key midblock crossing locations (or RRFBs), and advance warning signage.

Notes

- **Segment 1:** Busy roadway with long blocks and signalized intersections.
- **Segment 2:** Wide roadways with long blocks and mid-blocks, also need for pedestrian access to transit across the median.

Lee Highway (US 29) – Sheet 5 of 7

Community: Fairfax
VDOT District: 9 (NOVA)

Corridor Description

- **Segment 1:** 6-and-4-lane median divided roadway with moderate density commercial and residential land uses. **AADT: ~30,000; Speed Limit: 40**
- **Segment 2:** 4-lane median divided roadway with moderate density residential, commercial, and industrial land uses. **AADT: ~25,000 to 40,000; Speed Limit: 40 to 50**

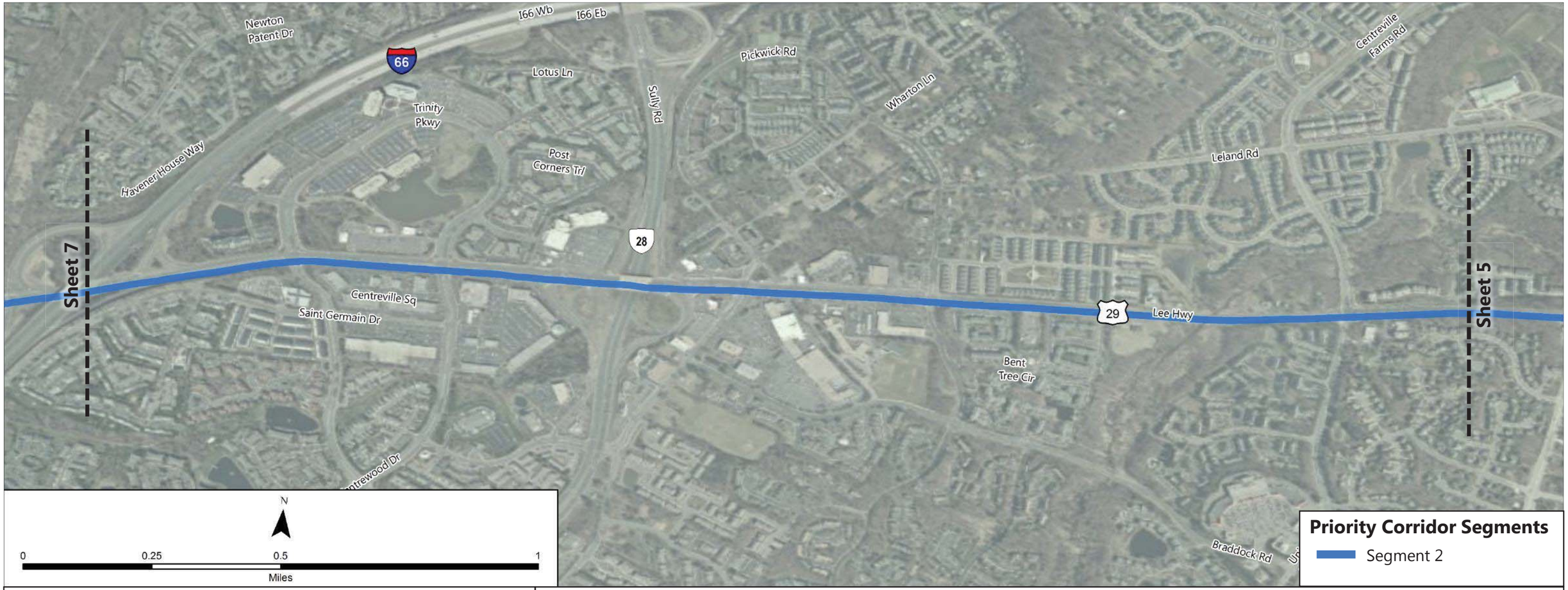
Recommended Countermeasures

- **Segment 1:** Modify medians to median islands, high visibility crosswalks, pedestrian countdown signals, and PHBs at key midblock crossing locations.
- **Segment 2:** Slip lane refuge median islands, pedestrian countdown signals, review of signal timing for pedestrian phasing or LPI at heavy pedestrian areas, high visibility crosswalks, PHBs at key midblock crossing locations (or RRFBs), and advance warning signage.

Notes

- **Segment 1:** Busy roadway with long blocks and signalized intersections.
- **Segment 2:** Wide roadways with long blocks and mid-blocks, also need for pedestrian access to transit across the median.

Lee Highway (US 29) – Sheet 6 of 7



Community: Fairfax
VDOT District: 9 (NOVA)

Corridor Description

- **Segment 1:** 6-and-4-lane median divided roadway with moderate density commercial and residential land uses. **AADT: ~30,000; Speed Limit: 40**
- **Segment 2:** 4-lane median divided roadway with moderate density residential, commercial, and industrial land uses. **AADT: ~25,000 to 40,000; Speed Limit: 40 to 50**

Recommended Countermeasures

- **Segment 1:** Modify medians to median islands, high visibility crosswalks, pedestrian countdown signals, and PHBs at key midblock crossing locations.
- **Segment 2:** Slip lane refuge median islands, pedestrian countdown signals, review of signal timing for pedestrian phasing or LPI at heavy pedestrian areas, high visibility crosswalks, PHBs at key midblock crossing locations (or RRFBs), and advance warning signage.

Notes

- **Segment 1:** Busy roadway with long blocks and signalized intersections.
- **Segment 2:** Wide roadways with long blocks and mid-blocks, also need for pedestrian access to transit across the median.

Lee Highway (US 29) – Sheet 7 of 7

Community: Fairfax
VDOT District: 9 (NOVA)

Corridor Description

- **Segment 1:** 6-and-4-lane median divided roadway with moderate density commercial and residential land uses. **AADT: ~30,000; Speed Limit: 40**
- **Segment 2:** 4-lane median divided roadway with moderate density residential, commercial, and industrial land uses. **AADT: ~25,000 to 40,000; Speed Limit: 40 to 50**

Recommended Countermeasures

- **Segment 1:** Modify medians to median islands, high visibility crosswalks, pedestrian countdown signals, and PHBs at key midblock crossing locations.
- **Segment 2:** Slip lane refuge median islands, pedestrian countdown signals, review of signal timing for pedestrian phasing or LPI at heavy pedestrian areas, high visibility crosswalks, PHBs at key midblock crossing locations (or RRFBs), and advance warning signage.

Notes

- **Segment 1:** Busy roadway with long blocks and signalized intersections.
- **Segment 2:** Wide roadways with long blocks and mid-blocks, also need for pedestrian access to transit across the median.

Lee Jackson Memorial Highway (US 50) – Sheet 1 of 3

Community: Fairfax
VDOT District: 9 (NOVA)

Corridor Description

- **Segment 1:** 6-lane median divided roadway with low density commercial and residential land uses. **AADT: ~60,000 to 70,000; Speed Limit: 45**

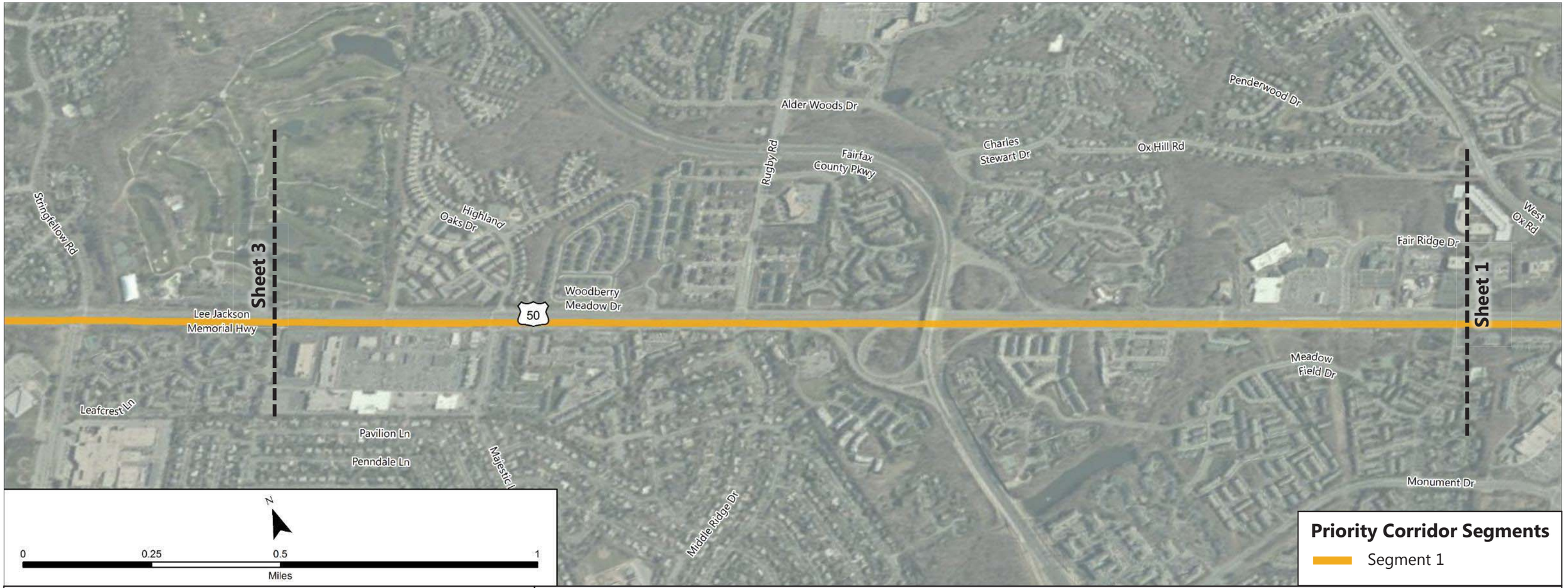
Recommended Countermeasures

- **Segment 1:** Conversion of existing medians to median islands, high visibility crosswalks, pedestrian countdown signals and review of signal timing for LPI or special pedestrian phasing.

Notes

- **Segment 1:** Shared use path on either side of corridor supports frequent crossings of wide roadway and corresponding amenities.

Lee Jackson Memorial Highway (US 50) – Sheet 2 of 3



Community: Fairfax
VDOT District: 9 (NOVA)

Corridor Description

- **Segment 1:** 6-lane median divided roadway with low density commercial and residential land uses. **AADT: ~60,000 to 70,000; Speed Limit: 45**

Recommended Countermeasures

- **Segment 1:** Conversion of existing medians to median islands, high visibility crosswalks, pedestrian countdown signals and review of signal timing for LPI or special pedestrian phasing.

Notes

- **Segment 1:** Shared use path on either side of corridor supports frequent crossings of wide roadway and corresponding amenities.

Lee Jackson Memorial Highway (US 50) – Sheet 3 of 3

Community: Fairfax
VDOT District: 9 (NOVA)

Corridor Description

- **Segment 1:** 6-lane median divided roadway with low density commercial and residential land uses. **AADT: ~60,000 to 70,000; Speed Limit: 45**

Recommended Countermeasures

- **Segment 1:** Conversion of existing medians to median islands, high visibility crosswalks, pedestrian countdown signals and review of signal timing for LPI or special pedestrian phasing.

Notes

- **Segment 1:** Shared use path on either side of corridor supports frequent crossings of wide roadway and corresponding amenities.

Little River Turnpike (SR 236) – Sheet 1 of 4

Community: Fairfax
VDOT District: 9 (NOVA)

Corridor Description

- **Segment 1:** 6-and-4-lane median divided roadway flanked by 2-lane undivided roadways with moderate density commercial and residential land uses. **AADT: ~30,000 to 55,000; Speed Limit: 40 to 45**

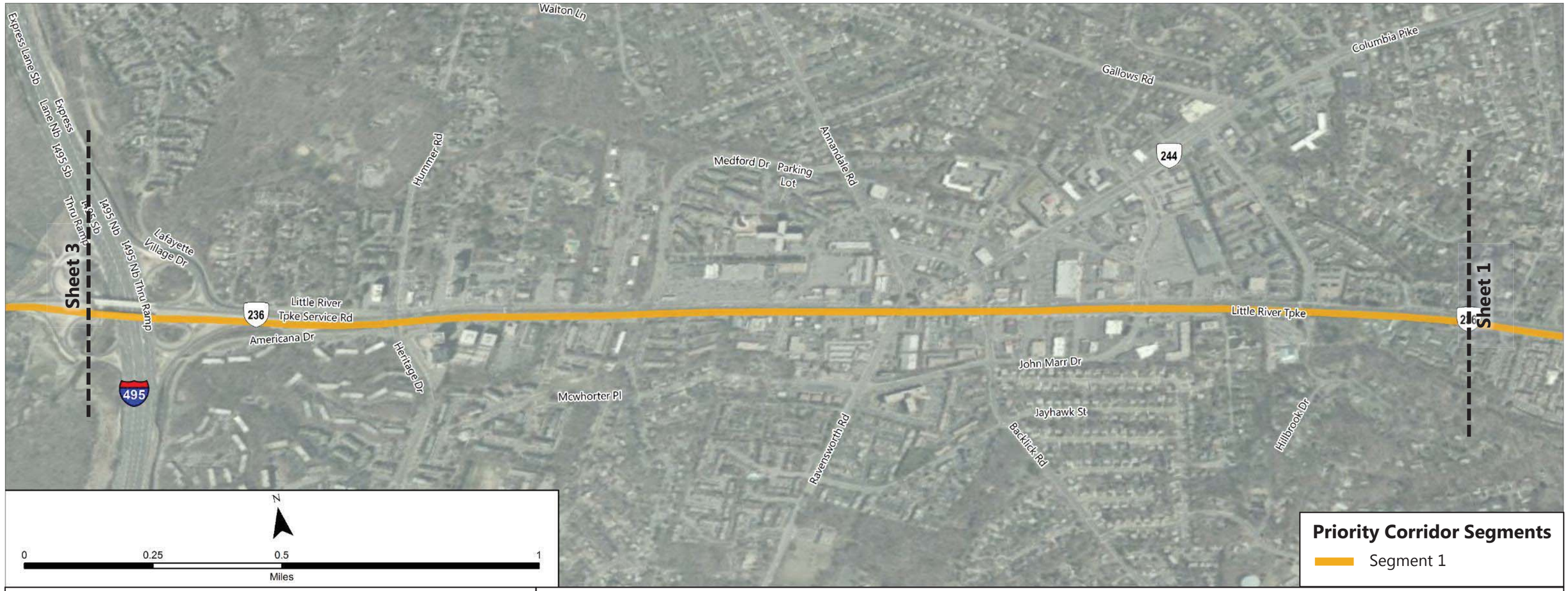
Recommended Countermeasures

- **Segment 1:** High visibility crosswalks (especially on 2-lane undivided side boulevard roads with access to transit stops and intersections), PHBs at key mid-block crossings, modification of existing medians and boulevard barriers to refuge islands, review of signal timing for LPI or pedestrian phasing, parking restrictions near side roadway intersections and crossings, and consider shared use markings on parallel local roadways.

Notes

- **Segment 1:** System of lower level parallel roadways and crossings should be coordinated to facilitate crossing of the corridor.

Little River Turnpike (SR 236) – Sheet 2 of 4



Community: Fairfax
VDOT District: 9 (NOVA)

Corridor Description

- **Segment 1:** 6-and-4-lane median divided roadway flanked by 2-lane undivided roadways with moderate density commercial and residential land uses. **AADT: ~30,000 to 55,000; Speed Limit: 40 to 45**

Recommended Countermeasures

- **Segment 1:** High visibility crosswalks (especially on 2-lane undivided side boulevard roads with access to transit stops and intersections), PHBs at key mid-block crossings, modification of existing medians and boulevard barriers to refuge islands, review of signal timing for LPI or pedestrian phasing, parking restrictions near side roadway intersections and crossings, and consider shared use markings on parallel local roadways.

Notes

- **Segment 1:** System of lower level parallel roadways and crossings should be coordinated to facilitate crossing of the corridor.

Little River Turnpike (SR 236) – Sheet 3 of 4

Community: Fairfax
VDOT District: 9 (NOVA)

Corridor Description

- **Segment 1:** 6-and-4-lane median divided roadway flanked by 2-lane undivided roadways with moderate density commercial and residential land uses. **AADT: ~30,000 to 55,000; Speed Limit: 40 to 45**

Recommended Countermeasures

- **Segment 1:** High visibility crosswalks (especially on 2-lane undivided side boulevard roads with access to transit stops and intersections), PHBs at key mid-block crossings, modification of existing medians and boulevard barriers to refuge islands, review of signal timing for LPI or pedestrian phasing, parking restrictions near side roadway intersections and crossings, and consider shared use markings on parallel local roadways.

Notes

- **Segment 1:** System of lower level parallel roadways and crossings should be coordinated to facilitate crossing of the corridor.

Little River Turnpike (SR 236) – Sheet 4 of 4

Community: Fairfax
VDOT District: 9 (NOVA)

Corridor Description

- **Segment 1:** 6-and-4-lane median divided roadway flanked by 2-lane undivided roadways with moderate density commercial and residential land uses. **AADT: ~30,000 to 55,000; Speed Limit: 40 to 45**

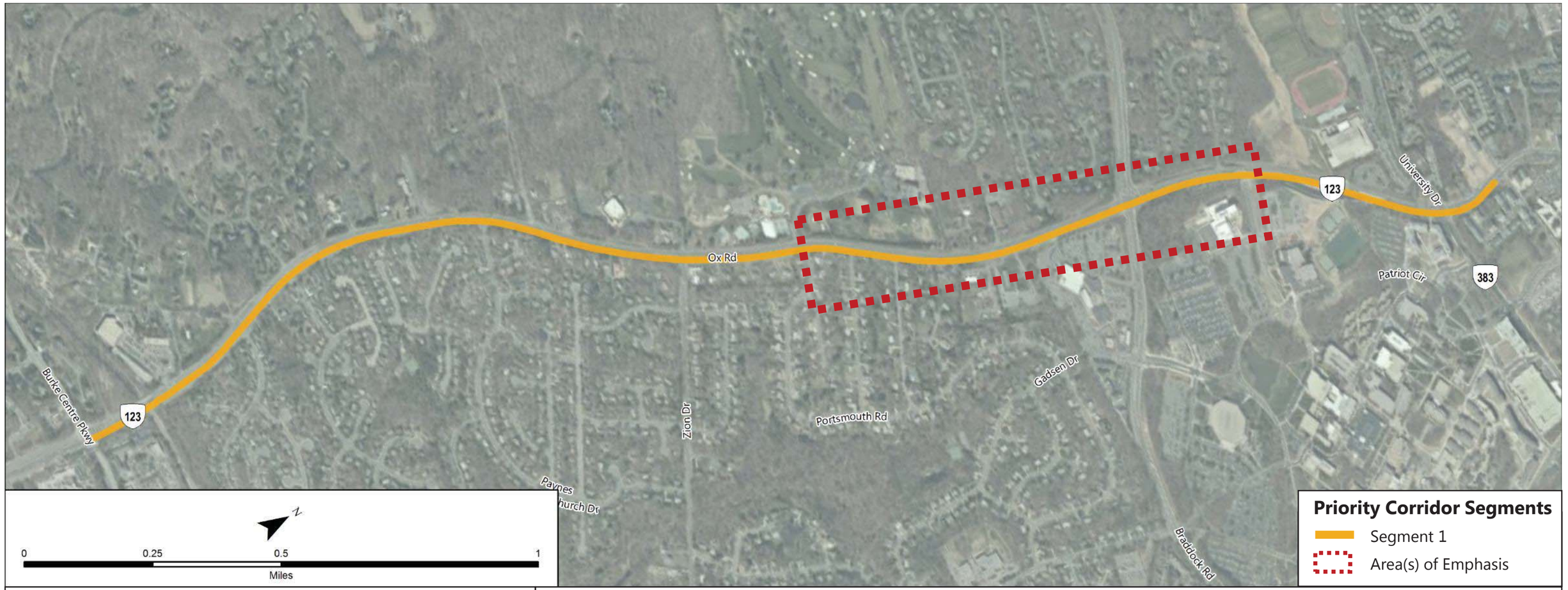
Recommended Countermeasures

- **Segment 1:** High visibility crosswalks (especially on 2-lane undivided side boulevard roads with access to transit stops and intersections), PHBs at key mid-block crossings, modification of existing medians and boulevard barriers to refuge islands, review of signal timing for LPI or pedestrian phasing, parking restrictions near side roadway intersections and crossings, and consider shared use markings on parallel local roadways.

Notes

- **Segment 1:** System of lower level parallel roadways and crossings should be coordinated to facilitate crossing of the corridor.

Ox Road (SR 123) – Sheet 1 of 1



Community: Fairfax
VDOT District: 9 (NOVA)

Corridor Description

- **Segment 1:** 4-lane median divided roadway roadway with medium residential and low density commercial land uses. **AADT: ~25,000 to 30,000; Speed Limit: 45**

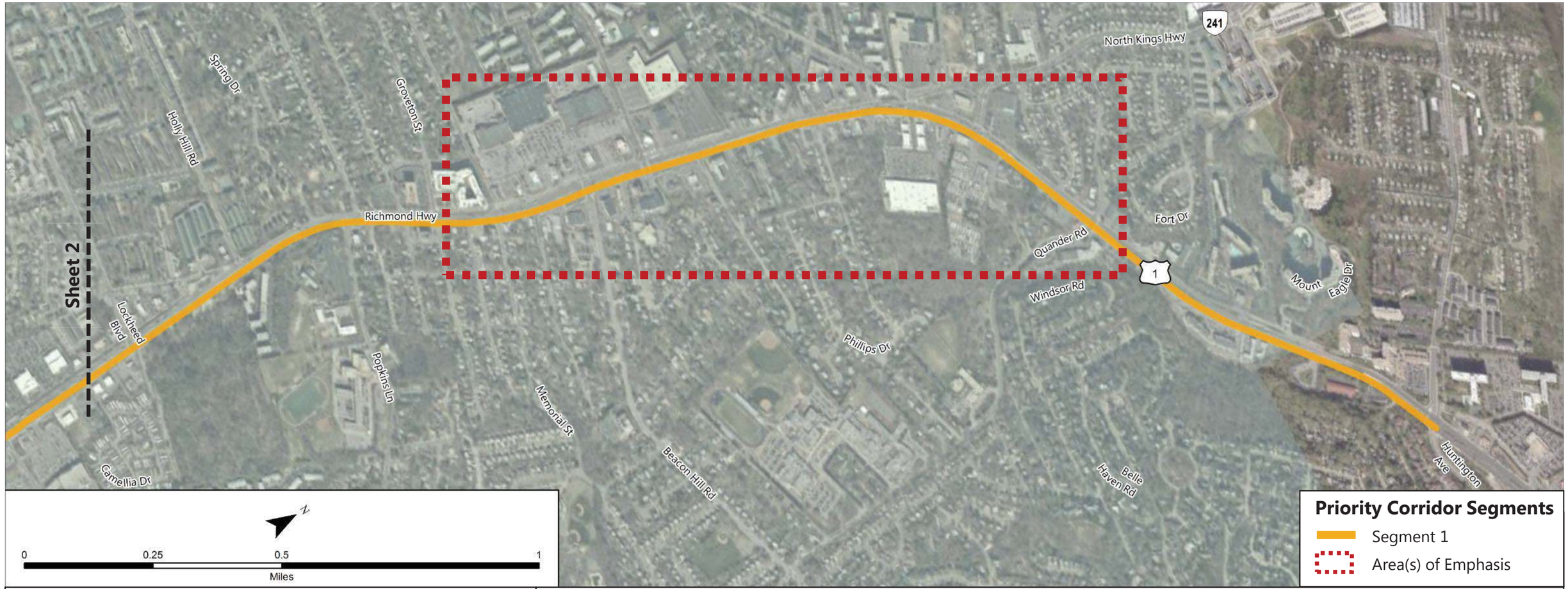
Recommended Countermeasures

- **Segment 1:** Modify medians to median islands, high visibility crosswalks, pedestrian countdown signals, review signal timing for LPI, and review corridor for potential mid-block crossings with PHBs to provide pedestrian access to neighborhoods.

Notes

- **Segment 1:** Few signalized crossing locations and wide crossing distances necessitate median islands and potentially longer crossing phases**.**

Richmond Highway (US 1) – Sheet 1 of 3



Community: Fairfax
VDOT District: 9 (NOVA)

Corridor Description

- **Segment 1:** 6-and-4-lane median divided roadway flanked by 2-lane undivided roadways with moderate density commercial and residential land uses. **AADT: ~32,000 to 50,000; Speed Limit: 45**

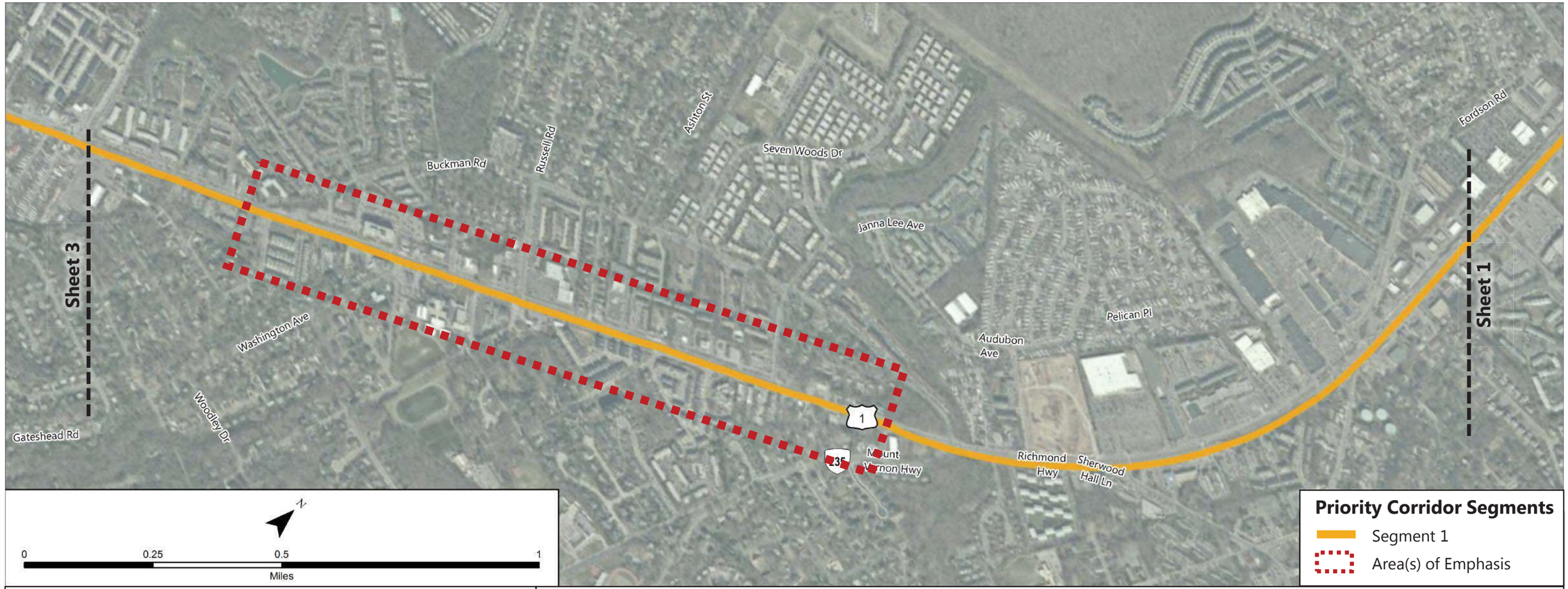
Recommended Countermeasures

- **Segment 1:** High visibility crosswalks (especially on 2-lane undivided side boulevard roads with access to transit stops and intersections), consideration of PHBs at key mid-block crossings, modification of existing medians and boulevard barriers to refuge islands, review of signal timing for LPI or pedestrian phasing. Consider shared use markings on parallel local roadways.

Notes

- **Segment 1:** Diverse land uses along corridor with long block lengths support the installation of new mid-block crossings and enhancement of existing crossings.

Richmond Highway (US 1) – Sheet 2 of 3



Community: Fairfax
VDOT District: 9 (NOVA)

Corridor Description

- **Segment 1:** 6-and-4-lane median divided roadway flanked by 2-lane undivided roadways with moderate density commercial and residential land uses. **AADT: ~32,000 to 50,000; Speed Limit: 45**

Recommended Countermeasures

- **Segment 1:** High visibility crosswalks (especially on 2-lane undivided side boulevard roads with access to transit stops and intersections), consideration of PHBs at key mid-block crossings, modification of existing medians and boulevard barriers to refuge islands, review of signal timing for LPI or pedestrian phasing. Consider shared use markings on parallel local roadways.

Notes

- **Segment 1:** Diverse land uses along corridor with long block lengths support the installation of new mid-block crossings and enhancement of existing crossings.

Richmond Highway (US 1) – Sheet 3 of 3

Community: Fairfax
VDOT District: 9 (NOVA)

Corridor Description

- **Segment 1:** 6-and-4-lane median divided roadway flanked by 2-lane undivided roadways with moderate density commercial and residential land uses. **AADT: ~32,000 to 50,000; Speed Limit: 45**

Recommended Countermeasures

- **Segment 1:** High visibility crosswalks (especially on 2-lane undivided side boulevard roads with access to transit stops and intersections), consideration of PHBs at key mid-block crossings, modification of existing medians and boulevard barriers to refuge islands, review of signal timing for LPI or pedestrian phasing. Consider shared use markings on parallel local roadways.

Notes

- **Segment 1:** Diverse land uses along corridor with long block lengths support the installation of new mid-block crossings and enhancement of existing crossings.

Nine Mile Road (SR 33) - Sheet 1 of 1

Community: Henrico County
VDOT District: 4 (Richmond)

Corridor Description

- **Segment 1:** 4-lane median divided roadway roadway with low density commercial and residential land uses. **AADT: ~17,000 to 27,000; Speed Limit: 40**

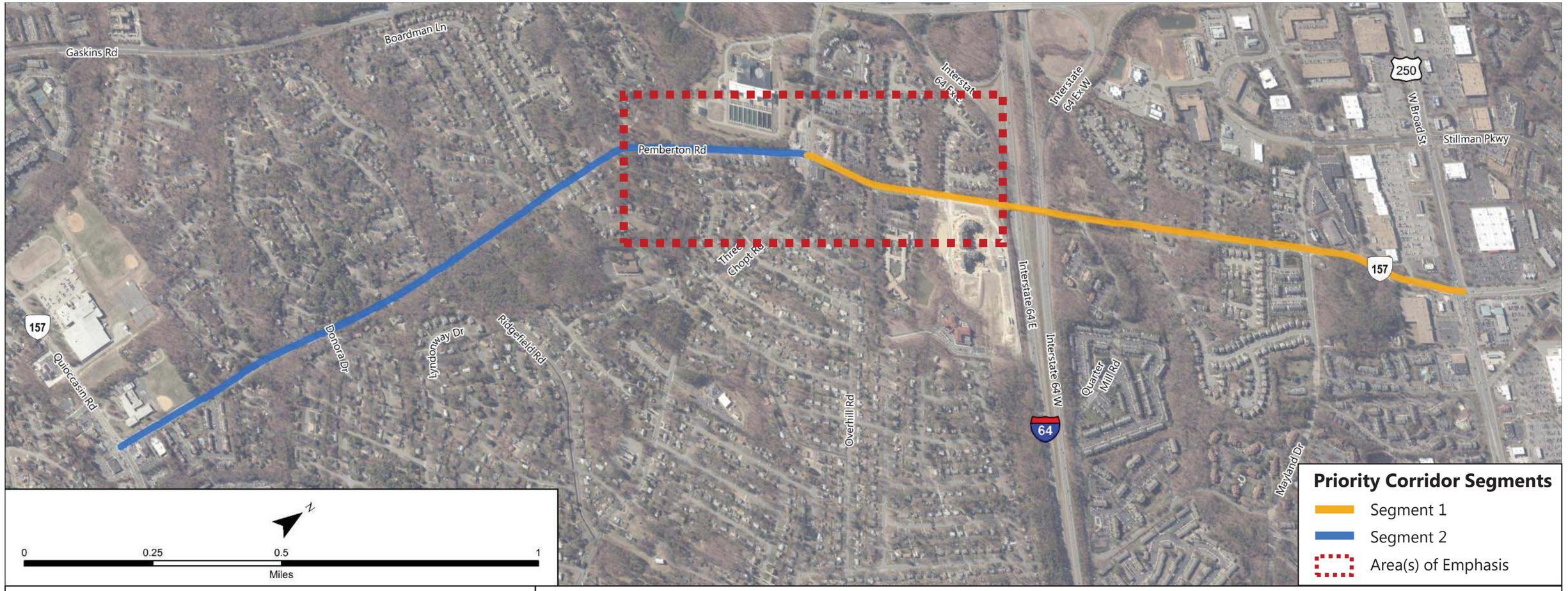
Recommended Countermeasures

- **Segment 1:** Pedestrian signal heads at signalized intersections, high visibility crosswalks, and raised median islands at pedestrian activity centers.

Notes

- **Segment 1:** Wide crossing distances and lack of pedestrian crossing facilities corridor wide.

Pemberton Road (SR 157) – Sheet 1 of 1



Community: Henrico County
VDOT District: 4 (Richmond)

Corridor Description

- **Segment 1:** 2-lane turning lane median divided roadway with low density residential and commercial development. **AADT: ~12,000; Speed Limit: 40**
- **Segment 2:** 2-lane turning undivided roadway with low density residential and commercial development. **AADT: ~9,000; Speed Limit: 40**

Recommended Countermeasures

- **Segment 1:** Pedestrian signal heads at signalized intersections and high visibility crosswalks.
- **Segment 2:** High visibility crosswalks, advance warning signage at unsignalized intersections and unmarked crossing locations.

Notes

- **Segment 1:** Existing intersection widths and signalization support the expansion of pedestrian facilities.
- **Segment 2:** Low density land use with limited pedestrian infrastructure.

Broad Street (US 250) – Sheet 1 of 4

Community: Henrico County
VDOT District: 4 (Richmond)

Corridor Description

- **Segment 1:** 6-lane median divided roadway with low density commercial land uses. **AADT: ~25,000 to 40,000; Speed Limit: 45**

Recommended Countermeasures

- **Segment 1:** Pedestrian signal heads at signalized intersections, high visibility crosswalks, and raised median islands at pedestrian activity centers; certain mid-block locations may be suitable for PHBs.

Notes

- **Segment 1:** Area does not contain significant pedestrian infrastructure, and roadway width presents crossing challenges.

Broad Street (US 250) – Sheet 2 of 4

Community: Henrico County
VDOT District: 4 (Richmond)

Corridor Description

- **Segment 1:** 6-lane median divided roadway with low density commercial land uses. **AADT: ~25,000 to 40,000; Speed Limit: 45**

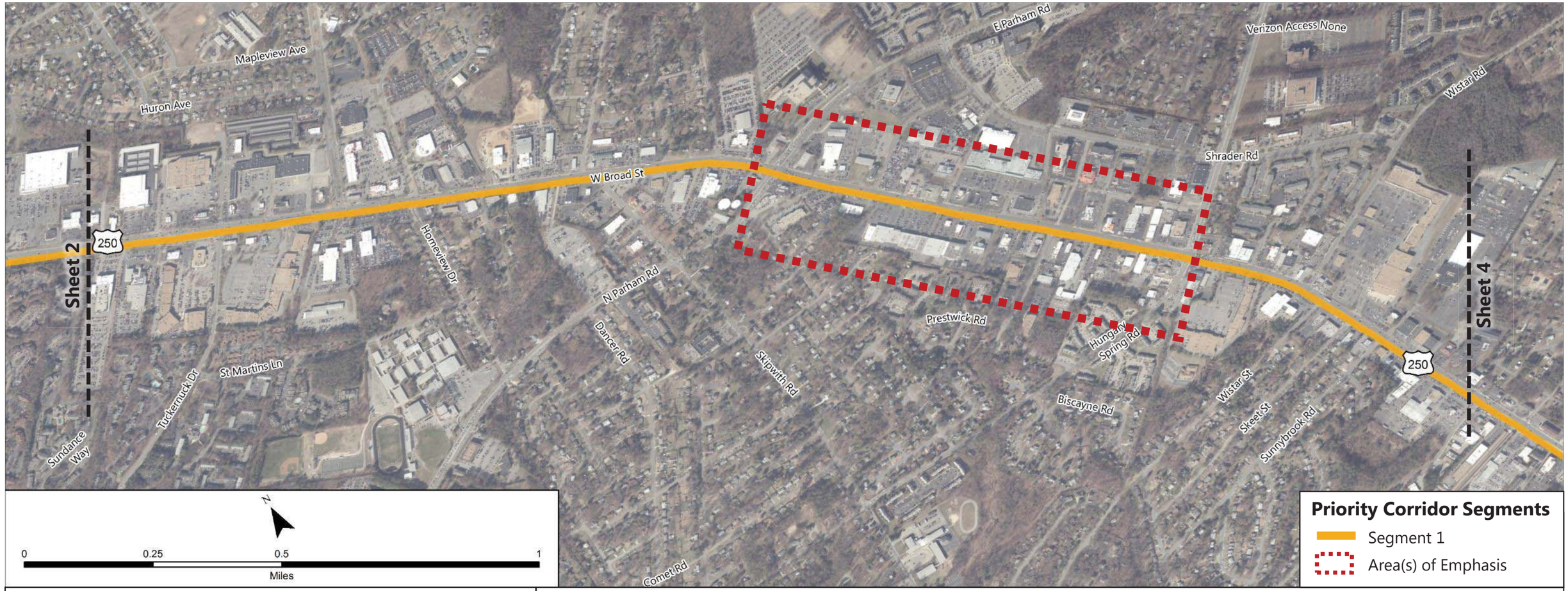
Recommended Countermeasures

- **Segment 1:** Pedestrian signal heads at signalized intersections, high visibility crosswalks, and raised median islands at pedestrian activity centers; certain mid-block locations may be suitable for PHBs.

Notes

- **Segment 1:** Area does not contain significant pedestrian infrastructure, and roadway width presents crossing challenges.

Broad Street (US 250) – Sheet 3 of 4



Community: Henrico County
VDOT District: 4 (Richmond)

Corridor Description

- **Segment 1:** 6-lane median divided roadway with low density commercial land uses. **AADT: ~25,000 to 40,000; Speed Limit: 45**

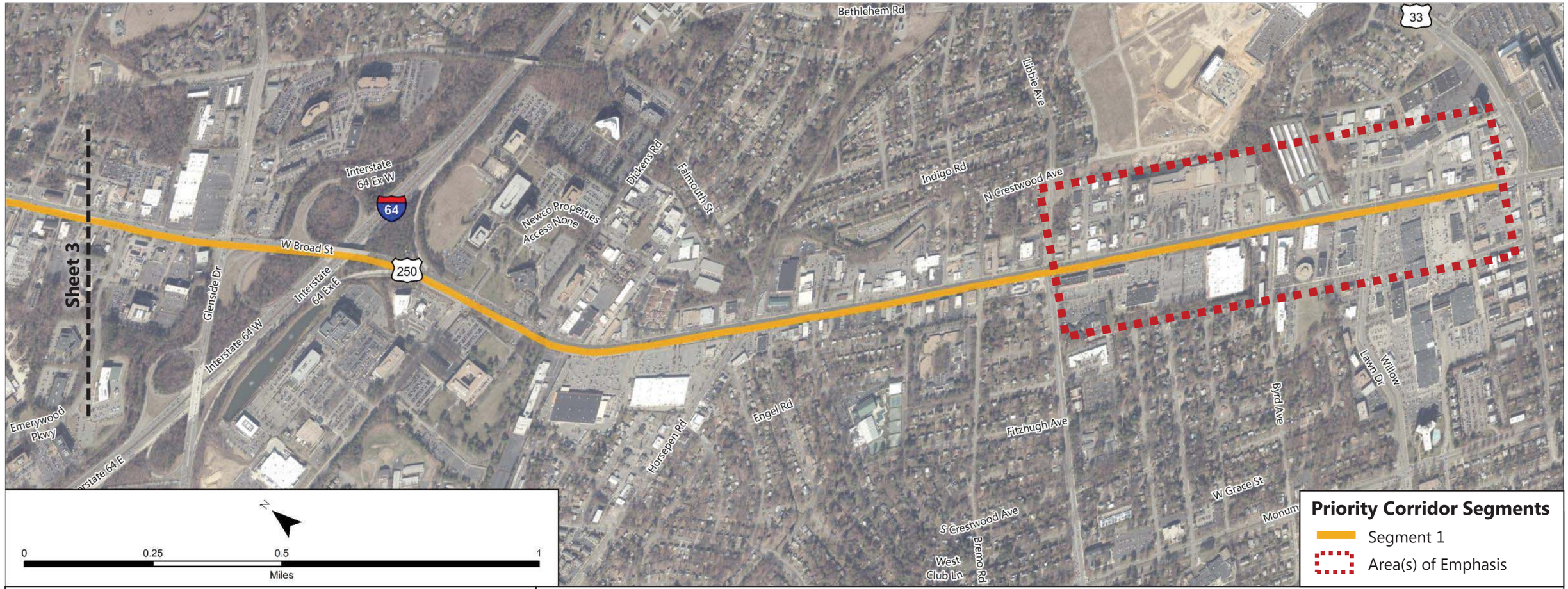
Recommended Countermeasures

- **Segment 1:** Pedestrian signal heads at signalized intersections, high visibility crosswalks, and raised median islands at pedestrian activity centers; certain mid-block locations may be suitable for PHBs.

Notes

- **Segment 1:** Area does not contain significant pedestrian infrastructure, and roadway width presents crossing challenges.

Broad Street (US 250) – Sheet 4 of 4



Community: Henrico County
VDOT District: 4 (Richmond)

Corridor Description

- **Segment 1:** 6-lane median divided roadway with low density commercial land uses. **AADT: ~25,000 to 40,000; Speed Limit: 45**

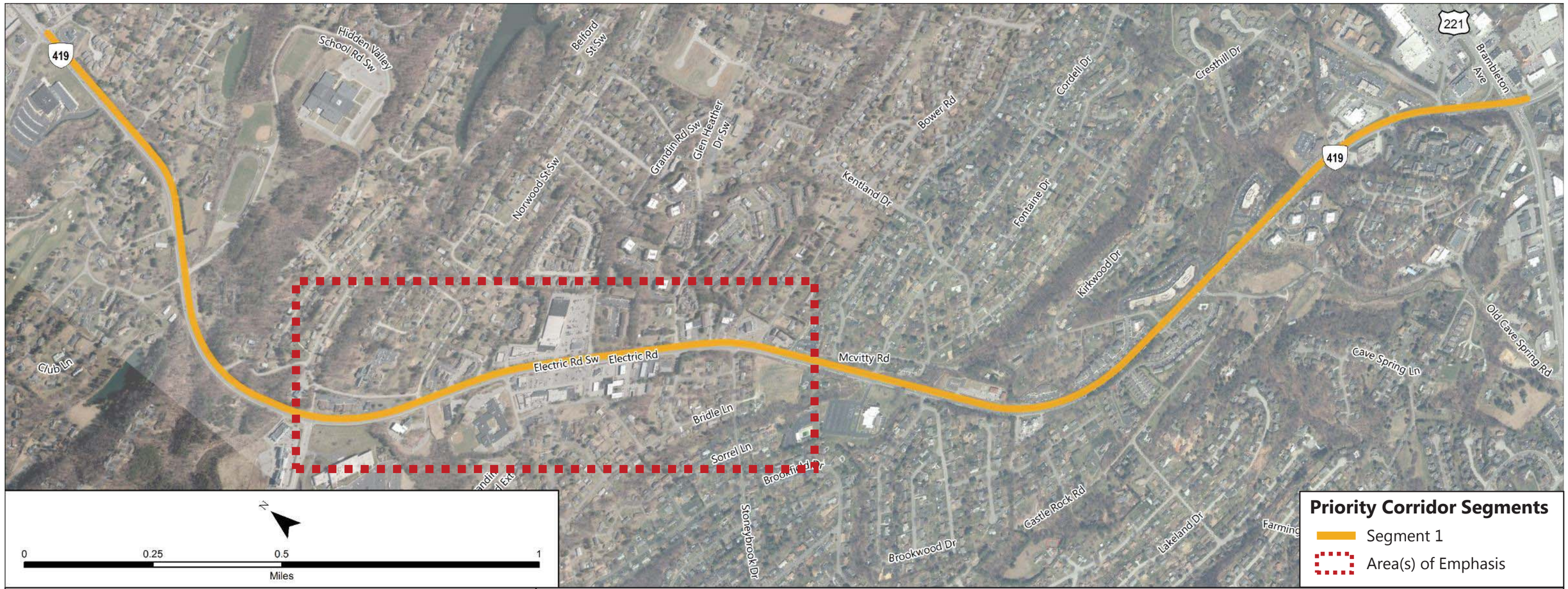
Recommended Countermeasures

- **Segment 1:** Pedestrian signal heads at signalized intersections, high visibility crosswalks, and raised median islands at pedestrian activity centers; certain mid-block locations may be suitable for PHBs.

Notes

- **Segment 1:** Area does not contain significant pedestrian infrastructure, and roadway width presents crossing challenges.

Electric Road (SR 419) – Sheet 1 of 1



Community: Roanoke County
VDOT District: 2 (Salem)

Corridor Description

- **Segment 1:** 4-lane median divided roadway with minimal pedestrian crossings and mixed low density residential and commercial land uses. **AADT: ~25,000; Speed Limit: 45**

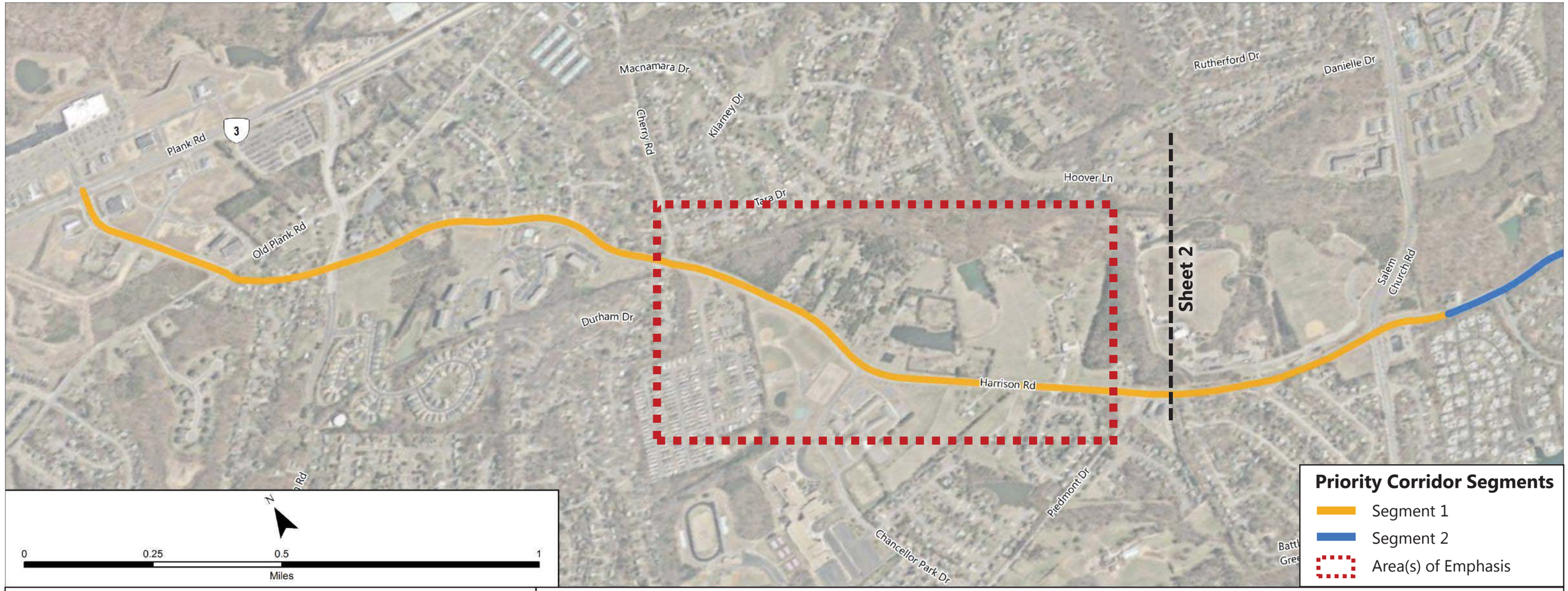
Recommended Countermeasures

- **Segment 1:** Review land uses and pedestrian activity for provision of sidewalk or shared use path in the area, implement pedestrian countdown signals and median raised island at signalized intersections, and consider PHB at key mid-block crossings.

Notes

- **Segment 1:** Little to no existing pedestrian crossing infrastructure and wide crossing distances.

Harrison Road (SC 620) – Sheet 1 of 2



Community: Spotsylvania County
VDOT District: 6 (Fredericksburg)

Corridor Description

- **Segment 1:** 4-lane undivided roadway with moderate density commercial and residential plus institutional land uses. **AADT: ~20,000; Speed Limit: 45**
- **Segment 2:** 2-lane undivided roadway with low density residential, commercial, and agricultural land uses. **AADT: ~13,000; Speed Limit: 40**

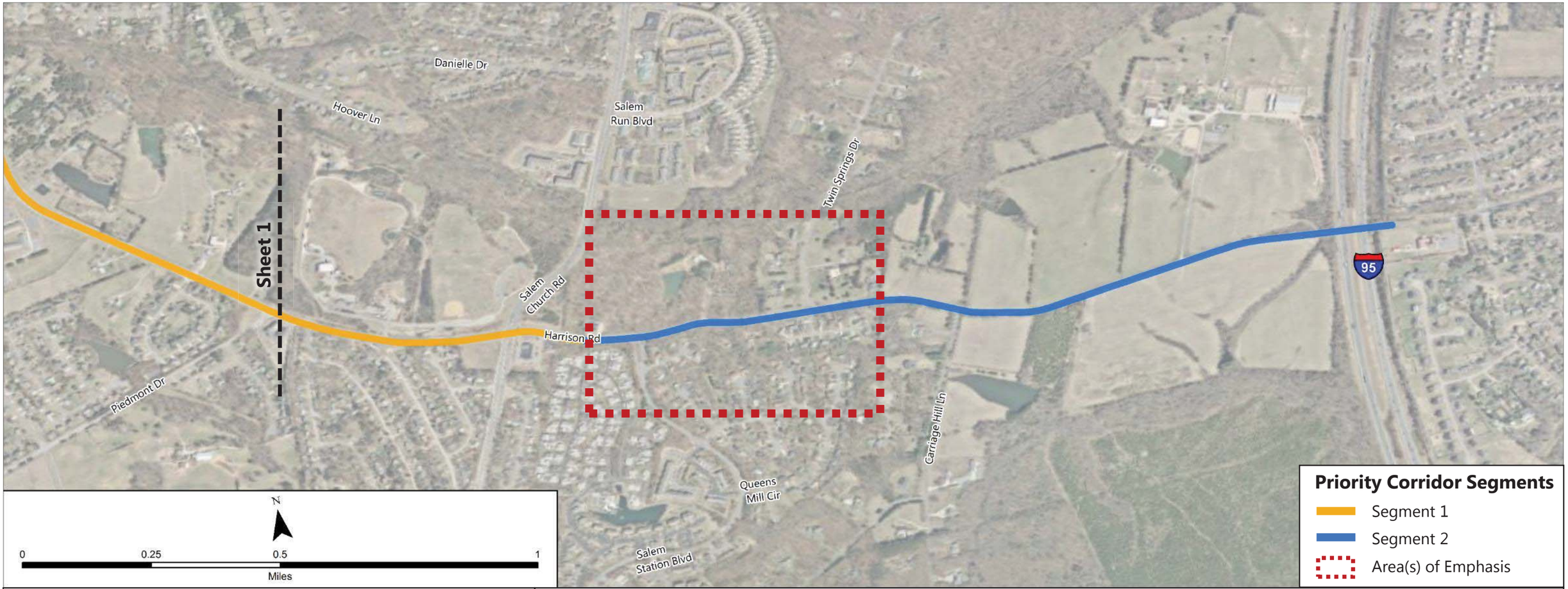
Recommended Countermeasures

- **Segment 1:** Raised median islands at signalized intersections, pedestrian signal heads, high visibility crosswalks, and advanced stop lines at signalized intersections.
- **Segment 2:** High visibility crosswalks, and advance warning signage near pedestrian activity centers.

Notes

- **Segment 1:** Wide crossing distances with pedestrian supporting land uses and lack of pedestrian crossing facilities.
- **Segment 2:** Minimal pedestrian crosswalk facilities present.

Harrison Road (SC 620) – Sheet 2 of 2



Community: Spotsylvania County
VDOT District: 6 (Fredericksburg)

Corridor Description

- **Segment 1:** 4-lane undivided roadway with moderate density commercial and residential plus institutional land uses. **AADT: ~20,000; Speed Limit: 45**
- **Segment 2:** 2-lane undivided roadway with low density residential, commercial, and agricultural land uses. **AADT: ~13,000; Speed Limit: 40**

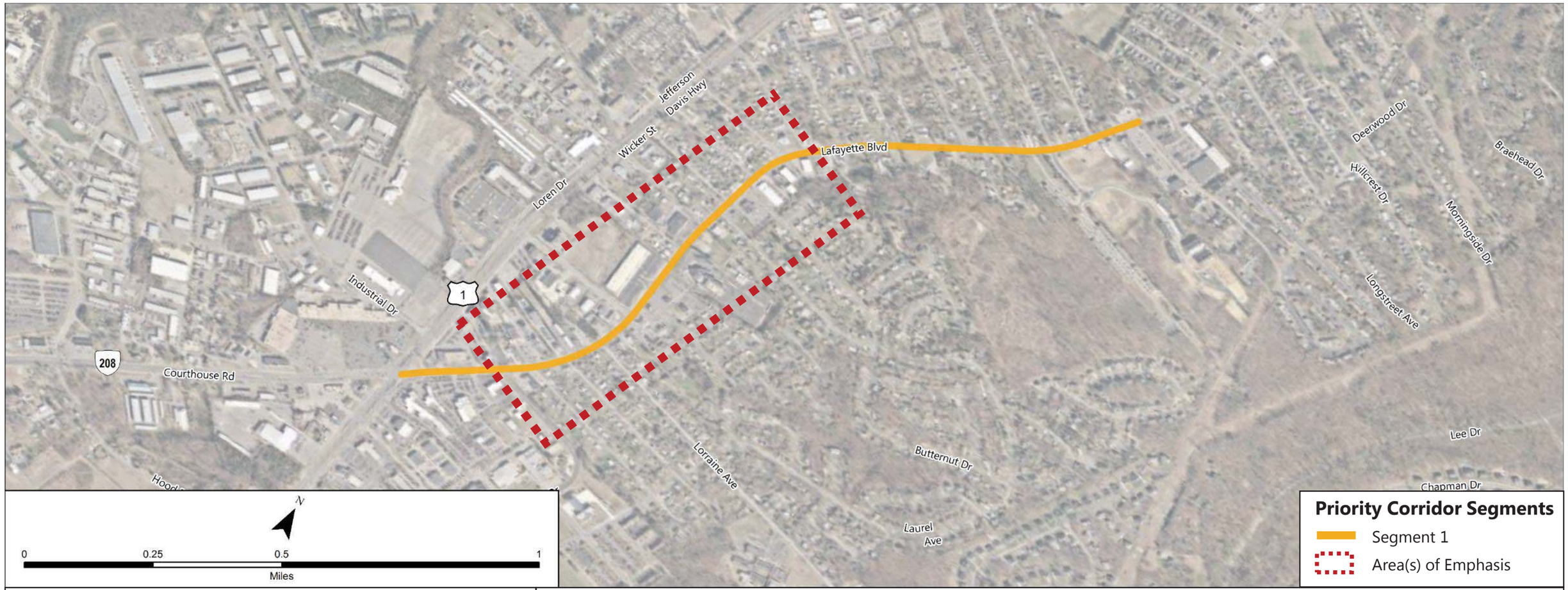
Recommended Countermeasures

- **Segment 1:** Raised median islands at signalized intersections, pedestrian signal heads, high visibility crosswalks, and advanced stop lines at signalized intersections.
- **Segment 2:** High visibility crosswalks, and advance warning signage near pedestrian activity centers.

Notes

- **Segment 1:** Wide crossing distances with pedestrian supporting land uses and lack of pedestrian crossing facilities.
- **Segment 2:** Minimal pedestrian crosswalk facilities present.

Lafayette Boulevard (BUS 1 US 1) – Sheet 1 of 1



Community: Spotsylvania County
VDOT District: 6 (Fredericksburg)

Corridor Description

- **Segment 1:** 2-lane turning lane median divided roadway with low density residential and commercial development. **AADT: ~23,000; Speed Limit: 40**

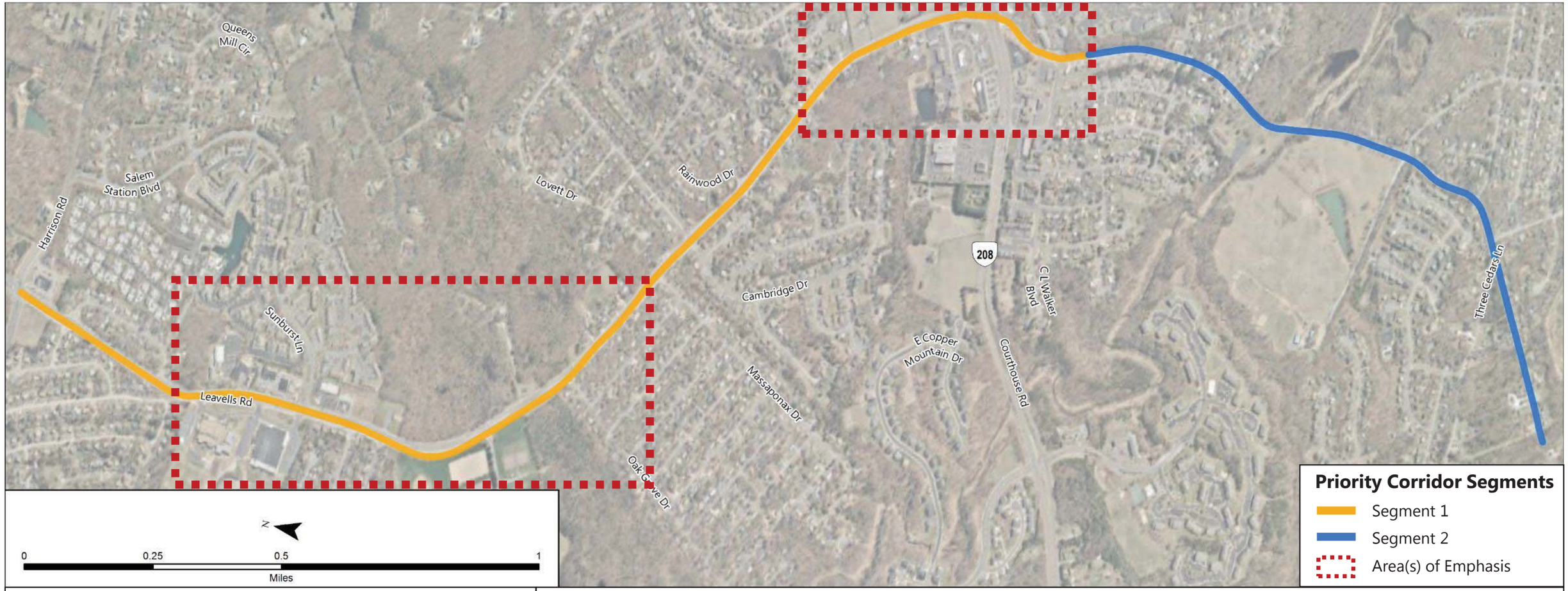
Recommended Countermeasures

- **Segment 1:** Pedestrian signal heads and countdown signals at signalized intersections, high visibility crosswalk materials and patterns at unsignalized intersections, and PHBs key at midblock crossings.

Notes

- **Segment 1:** Limited pedestrian infrastructure (i.e. sidewalks) along corridor, minimal markings for crosswalks at currently marked locations, and few signalized intersections with pedestrian signal heads.

Leavells Road (SC 639) – Sheet 1 of 1



Community: Spotsylvania County
VDOT District: 6 (Fredericksburg)

Corridor Description

- **Segment 1:** 4-lane median divided roadway with low density residential, commercial, and institutional land uses. **AADT: ~25,000; Speed Limit: 45**
- **Segment 2:** 2-lane undivided roadway with low density residential and agricultural land uses. **AADT: ~5,000 to 10,000; Speed Limit: 35**

Recommended Countermeasures

- **Segment 1:** Advanced stop/yield signage paired with high visibility crosswalk markings, pedestrian hybrid beacon near sensitive land uses, and pedestrian signal heads at currently signalized intersections.
- **Segment 2:** Advanced stop/yield signage paired with high visibility crosswalk markings.

Notes

- **Segment 1:** Lack of pedestrian crossing infrastructure despite existing sidewalks and sensitive land uses.
- **Segment 2:** Land use patterns indicate low demand for pedestrian amenities and area lacks existing marked crosswalks.

Appendix C: Countermeasure Glossary

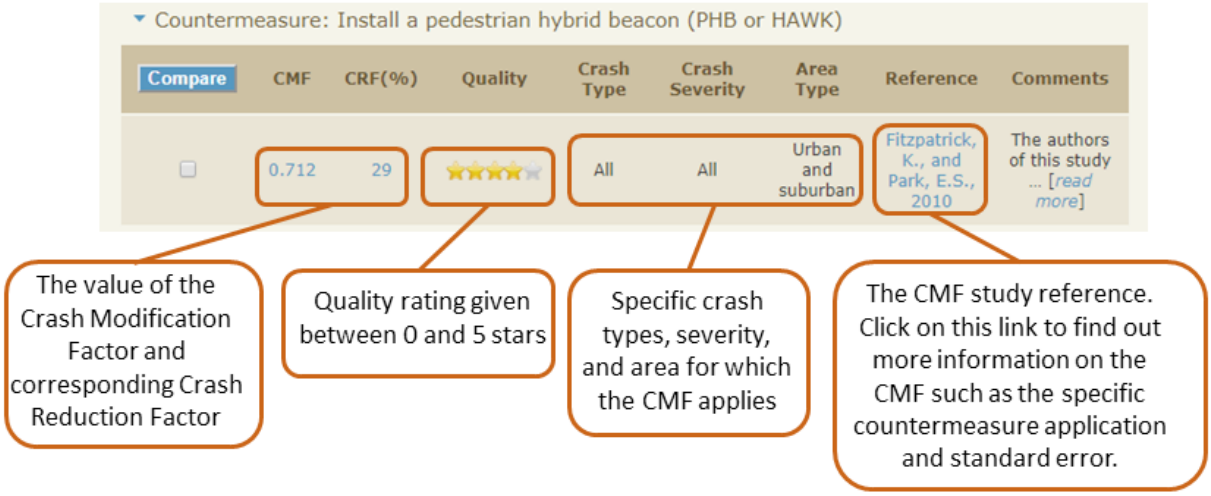
This glossary contains brief descriptions of common pedestrian countermeasures. Elements provided for each treatment include a description, potential crash reduction, and MUTCD information.

The countermeasures in this glossary are color-coded and organized into the following categories:

- Signage and Pavement Markings (pg. 2)
- Speed Management and Traffic Calming (pg. 6)
- Pedestrian Signals (pg. 7)
- Lighting (pg. 10)
- Transit (pg. 10)
- Design (pg. 11)

When choosing a countermeasure, practitioners should understand the potential impact on crashes. Detailed crash reduction information can be found in FHWA's CMF Clearinghouse (http://www.cmfclearinghouse.org/). When choosing a CMF from the Clearinghouse, practitioners should pay careful attention to the prior condition, site characteristics, specific description of the treatment, target crash type, and quality rating of the CMF.

The following figure illustrates some of the the detailed CMF information in the CMF Clearinghouse.



Signage & Pavement Markings

Advance stop or yield lines and pedestrian yield signs

Placement of a vehicle stop line back from the crosswalk at signalized and midblock crossings. At signalized intersections, placing an advance stop/yield line, with corresponding signage, 4 feet from the crosswalk allows pedestrians and drivers to have a clearer view of each other and more time in which to assess each other's intentions.

CRF: 20% to 25%

Situation: Yielding behavior

MUTCD Reference: VA MUTCD 2011 Section 3B.16

Advance warning for motorists (ped-activated, flashing yellow beacons)

A blinking pedestrian warning sign that is placed before a marked pedestrian crossing. The sign can be activated with pushbuttons or by automated pedestrian detection (e.g., video or infrared), and should be unlit when not activated.

CRF: 18%

Situation: Awareness of crossing

MUTCD Reference: MUTCD Chapter 4L

High-visibility crosswalk (includes continental crosswalks)

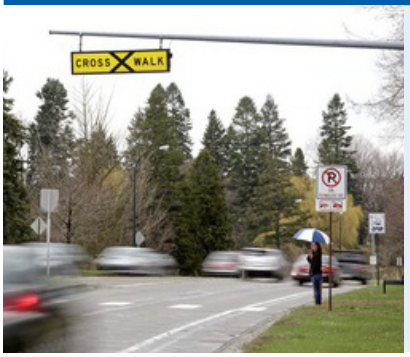
Marked crosswalks that use high-visibility surface markings to indicate optimal or preferred locations for pedestrians to cross and help designate right-of-way for motorists to yield to pedestrians. Crosswalks are often installed at signalized intersections and other selected locations with appropriate levels of pedestrian and vehicle traffic.

CRF: 19% to 40%

Situation: Visibility

MUTCD Reference: VA MUTCD 2011 Section 3B.18

High-vis crosswalk in conjunction with illuminated overhead crosswalk sign



The combination of a high-visibility crosswalk pattern and materials with illuminated signage spanning above the travel lanes. The illuminated overhead sign may read "CROSSWALK" and hang from an extended mast arm.

CRF: Unknown

Situation: Visibility

MUTCD Reference: Crosswalk - VA MUTCD 2011 Section 3B.18

Signage & Pavement Markings

Improved conspicuity of signs

Modifications made to a sign that improve its ability to stand out among other objects in and adjacent to the roadway. Improvements to the sign may include size, color, reflectivity, message, illumination, and placement.

CRF: 21% to 29%

Situation: Visibility

MUTCD Reference: VA MUTCD 2011 Section 2B.11

In-roadway/curbside yield signs

A sign either in the roadway or on the curb that reminds motorists of applicable yield requirements when encountering pedestrians. The sign may be affixed to the pavement surface with a flexible mount to withstand contact with vehicles.

CRF: Unknown

Situation: Yielding behavior

MUTCD Reference: VA MUTCD 2011 Section 2B.11

"Look" pavement stencils

A ground-level marking that encourages pedestrians to look for vehicles and to enter the road cautiously. All pavement word and symbol markings require periodic maintenance and replacement after resurfacing.

CRF: Unknown

Situation: Visibility

MUTCD Reference: N/A

Marked crosswalk

Pavement markings that indicate optimal or preferred locations for pedestrians to cross and help designate right-of-way for motorists to yield to pedestrians. Various crosswalk marking patterns include transverse lines, ladder, and continental markings.

CRF: Unknown

Situation: Visibility

MUTCD Reference: VA MUTCD 2011 Section 3B.18

Signage & Pavement Markings

No left turn

A sign indicating the prohibition of left turns. This could help to reduce the number of turning vehicle conflicts.

CRF: 64% to 68%

Situation: Turning vehicle conflicts

MUTCD Reference: MUTCD Section 2B.18

No turn on red

A regulatory sign that prohibits right turns during the red signal phase, and it is often installed in areas of high pedestrian volumes or during exclusive pedestrian phases. Together with a leading pedestrian interval, the signal changes can benefit pedestrians with minimal impact on traffic.

CRF: Unknown

Situation: Turning vehicle conflicts

MUTCD Reference: MUTCD Section 2B.54 (R10-11, -11a, -11b)

Pedestrian Hybrid Beacon (PHB)

A beacon that is used to warn and control traffic at unsignalized marked crosswalks. Key design components of PHBs include: overhead beacons with circular yellow signal indication centered below two horizontally aligned circular red signals facing both directions on the major street; overhead signs labeled “CROSSWALK STOP ON RED” to indicate that the location is associated with a pedestrian crosswalk; a marked crosswalk; countdown pedestrian signal heads; and pedestrian pushbuttons.

CRF: 18% to 37%

Situation: Midblock crossings

MUTCD Reference: MUTCD Section 4F

Pedestrian warning signs

Highly visible signs that indicate the presence of pedestrian crossings to motorists. Pedestrian warning signs should be used in combination with marked crosswalks at signalized and unsignalized crosswalk locations.

CRF: 4% to 15%

Situation: Awareness of crossing

MUTCD Reference: VA MUTCD 2011 Section 2C.50 and 7B

Signage & Pavement Markings

Rectangular Rapid Flashing Beacon (RRFB)

Source: Town of Davidson, NC

The RRFB is a high-frequency blinking pedestrian warning sign that is used in tandem with a pedestrian cross sign. The flashing pattern can be activated with pushbuttons or automated pedestrian detection (e.g., video or infrared), and should be unlit when not activated.

CRF: 47%

Situation: Midblock crossings

MUTCD Reference: IA-21

Restrict parking near intersections

The removal of parking space, through signage and pavement markings, a minimum of 20 feet from an intersection to improve pedestrian and motorist sightlines. Removing a parking space also frees up roadway space for other uses such as curb extensions, sidewalk furniture, and bicycle parking.

CRF: 22% to 26%

Situation: Visibility

MUTCD Reference: VA MUTCD 2011 Section 2B.46

Restrict Right-Turn-On-Red (RTOR) by time-of-day

A regulatory sign that prohibits right turns during the red signal phase, and it is often installed in areas of high pedestrian volumes or during exclusive pedestrian phases. A part time restriction during the busiest times of the day may be sufficient to address vehicle and pedestrian conflicts.

CRF: Unknown

Situation: Turning vehicle conflicts

MUTCD Reference: MUTCD Section 2B.54 (R10-20aP)

Turning vehicles yield to pedestrians

Signage at an intersection that serves to remind turning drivers to yield to pedestrians.

CRF: Unknown

Situation: Turning vehicle conflicts

MUTCD Reference: VA MUTCD 2011 Section 2B.53 (R10-15)

Speed Management & Traffic Calming

Yield Here to Pedestrian signs (no markings)

Regulatory signage to remind drivers to yield to pedestrians. Signs can include a variety of messages. A "Turning Vehicles Yield to Pedestrians" could be placed at the intersection. A "Yield Here to Pedestrians" sign can be placed in advance of a marked crosswalk that crosses an uncontrolled multi-lane approach.

CRF: Unknown

Situation: Yielding behavior

MUTCD Reference: VA MUTCD 2011 Section 2B.11

Lower speed limits

Source: J. Maus, BikePortland

A systematic reduction of the posted speed limit to decrease vehicle speeds and improve pedestrian safety. Lowering the speed limit may require enacting state or local legislation.

CRF: 15% to 44%

Situation: Speed reduction

MUTCD Reference: MUTCD Section 2B-13

Radar speed display/dynamic speed feedback signs

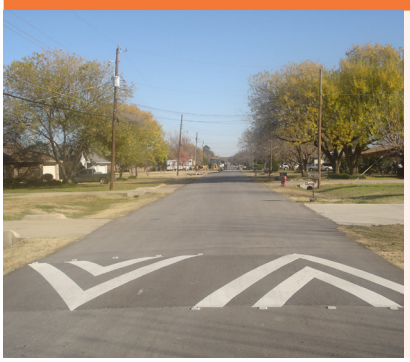
A sign board, screen, or similar device that is used by police departments and transportation agencies as educational tools to enhance speed compliance enforcement efforts. Speed radar trailers are best used in residential areas and may be used in conjunction with Neighborhood Speed Watch or other neighborhood safety education programs.

CRF: 5% to 7%

Situation: Speed reduction

MUTCD Reference: MUTCD Section 2B-13

Speed humps/cushions/table



Paved vertical traffic control measures approximately 3 to 4 inches high at their center and 12 to 22 feet long that extend the full width of the street with height tapering near the drain gutter. Speed humps have the effect of reducing motorist speed and can also be used to enhance the pedestrian environment at pedestrian crossings.

CRF: 40% to 50%

Situation: Speed reduction

MUTCD Reference: N/A

Speed Management & Traffic Calming

Road Diet (lane reduction)/Lane re-utilization


Source: Richard Drdul

The conversion of a roadway that features a reduction of travel lanes. A common Road Diet treatment reduces a four-lane road to two lanes with a two-way left-turn lane in the center. Reclaimed pavement from the reduction in travel lanes can be used for a variety of purposes—such as on-street parking, transit access, and bicycle and pedestrian amenities—depending on the community's needs.

CRF: 19% to 47%

Situation: Speed reduction

MUTCD Reference: VA MUTCD 2011 Section 3B.09

Street trees

The intentional placement of trees along the outer edge of the roadway to provide additional separation for motorists and pedestrians, reduce the visual width of the roadway, and provide a pleasant street environment for all. Trees should be trimmed up to at least 8 to 10 feet to ensure that sight distances and head room are maintained and personal security is not compromised.

CRF: 38% to 41%

Situation: Speed reduction

MUTCD Reference: N/A

Transverse rumble strips

A pavement treatment for motorists where either grooves into the surface or strips of material above the surface alert drivers of an area to reduce speed. A vehicle passing over the rumble strips produces noise and vibration and alerts the driver to a potentially hazardous situation.

CRF: 24%

Situation: Speed reduction

MUTCD Reference: MUTCD Section 3J-02

Pedestrian Signals

Accessible Pedestrian Signals (APS)

Signals that provide supplemental information in non-visual formats such as audible tones, speech messages, and/or vibrating surfaces. Signal activation should be placed within reach of pedestrians and located where pedestrians wait to cross.

CRF: Unknown

Situation: Signalized crossings

MUTCD Reference: VA MUTCD Section 4E.09

Pedestrian Signals

Automatic pedestrian detection devices


Source: Dan Burden

A device near an intersection that is able to sense when a pedestrian is waiting at a crosswalk and automatically send a signal to switch to a pedestrian "WALK" phase.

CRF: Unknown

Situation: Signalized crossings

MUTCD Reference: MUTCD Section 4E.08

Convert permissive or permissive/protected to protected left-turn phasing

The protected left-turn phase provides a green arrow for left-turning vehicles while stopping both oncoming traffic and parallel pedestrian crossings. This countermeasure can reduce conflicts with pedestrians crossing parallel to vehicle traffic by eliminating competition between vehicles turning left and pedestrians crossing during the concurrent signal phase.

CRF: Unknown

Situation: Turning vehicle conflicts

MUTCD Reference: as long as installation is MUTCD compliant.

Flashing Yellow Arrow (FYA) for left turns

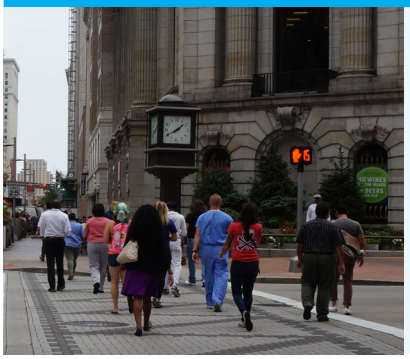
Provides an alternative signal phasing option where left-turning vehicles are given an extended transition before a red arrow to prevent high speed left turns into small gaps of oncoming traffic. Implementing this modification of permissive left-turn phasing can reduce conflicts with pedestrians crossing parallel to vehicle traffic.

CRF: 0% to 14%

Situation: Turning vehicle conflicts

MUTCD Reference: VA MUTCD 2011 Section 4D

Increase pedestrian crossing time



The extension of the "WALK" interval during the pedestrian signal phase that provides ample time for pedestrians to cross the roadway. The length of the crossing time extension may be dependent on pedestrian volumes, behavior, characteristics (such as age), and mobility.

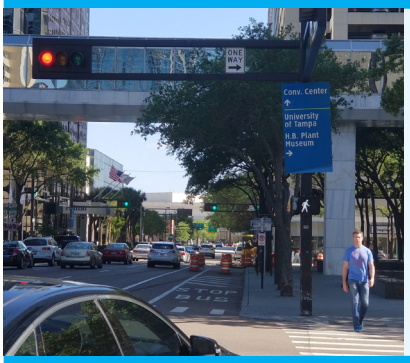
CRF: Unknown

Situation: Signalized crossings

MUTCD Reference: MUTCD Section 4E.08

Pedestrian Signals

Leading pedestrian interval



A signal timing improvement where pedestrians are given an advance walk signal before motorists get a green signal, providing the pedestrian several seconds to start walking in the crosswalk before a concurrent signal is provided to vehicles. This makes pedestrians more visible to motorists and motorists more likely to yield to them.

CRF: 29% to 45%

Situation: Signalized crossings

MUTCD Reference: MUTCD Section 4E.06

Pedestrian countdown signal

A pedestrian signal head that begins a visible and potentially audible countdown at the beginning of the walk phase or at the beginning of the clearance (i.e., DON'T WALK) interval. The incorporation of a pedestrian countdown signal provides pedestrians with information that has been demonstrated to reduce pedestrian crossings when only a few seconds remain.

CRF: 55% to 70%

Situation: Signalized crossings

MUTCD Reference: MUTCD Section 4E

Pedestrian detection to extend crossing time when pedestrian is detected within the intersection

Source: Dan Burden

A system that detects the presence of pedestrians in crosswalks to determine whether the pedestrian phase of a traffic signal or beacon should be extended or canceled. Pedestrian detection systems are typically deployed on multilane roads or areas with a population that has difficulty walking. The goal of the system is to reduce waiting times for both pedestrians and motorists while making sure that slower pedestrians can safely cross the street.

CRF: Unknown

Situation: Signalized crossings

MUTCD Reference: N/A

Pedestrian scrambles (Barnes dance)/exclusive ped phasing

A pedestrian phase that is active only when all conflicting vehicle movements are stopped across an approach to an intersection. Intersections deploying this type of signal phase often feature pedestrian crossing markings indicating that pedestrians may walk diagonally across the intersection.

CRF: –10% to 50%

Situation: Signalized crossings

MUTCD Reference: MUTCD 2011 Section 3B.18

Lighting

Intersection lighting/crosswalk lighting

Inclusion of in-pavement lighting or streetlights that assist motorists in identifying pedestrians at marked crosswalks during times of low light and glare. Lighting improvements may also make the walking area more inviting and safer to pedestrians.

CRF: 8% to 32%

Situation: Visibility

MUTCD Reference: VA MUTCD 2011 Section 4N

Segment lighting

Inclusion of lighting along portions of a roadway to illuminate the roadway; improving visibility of both the roadway and pedestrians along the facility.

CRF: 8% to 32%

Situation: Visibility

MUTCD Reference: N/A

Smart/dynamic lighting

Roadway lighting that is responsive to the level of traffic, weather conditions, presence of pedestrians, and other specified variables.

CRF: Unknown

Situation: Visibility

MUTCD Reference: N/A

Transit

Access to transit

It is important to not only ensure that transit stops are accessbile, but also the routes that transit riders use to access those facilities. This can include sidewalks, crosswalks, and other crossing measures at nearby intersections and connections to local destinations such as shopping centers or residential areas.

CRF: Unknown

Situation: Transit

MUTCD Reference: MUTCD Section 2B

Transit

Bus bulb outs

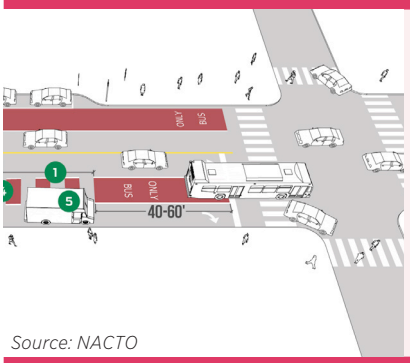
An extension of the sidewalk that allows a bus to stop in-lane. This increases bus reliability since the bus driver no longer needs to wait for a gap in traffic. Bus bulb outs also reduce the potential for conflict when buses re-enter the traffic flow.

CRF: Unknown

Situation: Transit

MUTCD Reference: N/A

Right turn pockets



Source: NACTO

Right turn-only lane to the right of the through transit lane to reduce transit delays. The addition of a right turn pocket usually requires the removal of parking and other curbside uses.

CRF: Unkown

Situation: Turning vehicle conflicts

MUTCD Reference: N/A

Transit stop improvements

The upgrading of a transit stop location to be fully accessible to pedestrians in wheelchairs, with paved connections to sidewalks where landscape buffers exist. Improvements may also include sufficient lighting, sheltered seating and lean bars, trash receptacles, and transit route information.

CRF: Unknown

Situation: Transit

MUTCD Reference: N/A

Design

Choker

Curb extensions that narrow a street by widening the sidewalks or planting strips, effectively creating a pinch point along the street and are intended to slow vehicles at midblock locations. Chokers can be created by bringing both curbs in, or they can be done by more dramatically widening one side of the curb at a midblock location. They can also be used at intersections, creating a gateway effect.

CRF: Unknown

Situation: Speed reduction

MUTCD Reference: N/A

Design

Corner bulb outs and chokers/curb extensions

Source: Richard Drdul

An extension of the sidewalk or curb line out into the parking lane that reduces the effective street width at a location. Curb extensions improve pedestrian crossings by reducing pedestrian crossing distance and exposure, visually and physically narrowing the roadway, improving visibility for pedestrians and motorists, and allowing space for the installation of a curb ramp. Curb extensions are only appropriate where there is an on-street parking lane.

CRF: Unknown

Situation: Midblock and signalized crossings

MUTCD Reference: N/A

Curb radius reduction

The selection of the smallest practical actual curb radii based on how the effective curb radius accommodates the design vehicle. Smaller radii can improve pedestrian safety by requiring motorists to reduce vehicle speed to make the sharper turns, and shortening pedestrian crossing distances, which thereby improves signal timing.

CRF: –16% to 57%

Situation: Speed reduction

MUTCD Reference: N/A

Danish offset (also known as angled median crosswalks and split pedestrian crossover (SPXO))

A "Z"-shaped marked midblock crosswalk that typically crosses four or more vehicular lanes and includes an elongated pedestrian refuge. Pedestrians begin crossing after activating a pedestrian signal at either end of the crossing and use the pedestrian refuge island to orient themselves towards oncoming traffic before completing the crossing. May be installed midblock or at signalized intersections.

CRF: Unknown

Situation: Midblock and signalized crossings

MUTCD Reference: MUTCD Section 4B.04

Install raised ped crossing/raised crosswalks/speed tables

A speed table covering an entire intersection or midblock crossing that also functions as a marked crosswalk. The crosswalk is at the same level as the sidewalk, eliminating the need for curb ramps.

CRF: 30% to 45%

Situation: Speed reduction

MUTCD Reference: VA MUTCD 2011 Section 3B

Design

Install refuge islands/raised median


Source: Richard Drdul

Raised islands placed in the center of the street at intersections or midblock crossings that are intended to help protect crossing pedestrians from motor vehicles. Pedestrian refuge islands allow pedestrians to cross one direction of traffic at a time by stopping in the median refuge to wait for an adequate crossing gap.

CRF: 46%

Situation: Midblock and intersection crossings

MUTCD Reference: MUTCD Section 4B.04

Install/modify design of channelized right turn lane


Source: Dan Burden

A raised island or platform that accommodates waiting pedestrians between a travel lane and channelized right turn lane. The crosswalk should be oriented at a 90-degree angle to the right-turn lane to optimize sight lines. The island should include the same accessibility features as the pedestrian refuge island.

CRF: 44% to 60%

Situation: Visibility

MUTCD Reference: MUTCD Section 3

Neighborhood Traffic Circles

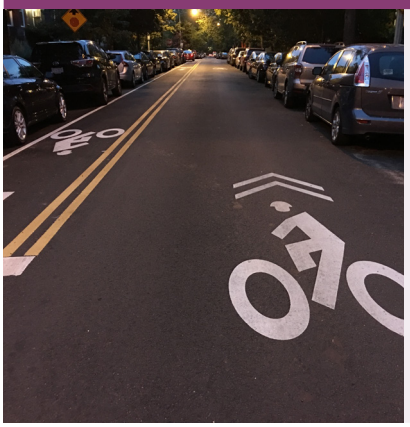
Raised circular islands that are constructed in the center of residential street intersections to reduce vehicle speeds through motorist maneuvering. Neighborhood traffic circles are an intersection improvement and traffic-calming device and can take the place of a traffic signal or four-way stop sign.

CRF: 55% to 88%

Situation: Speed reduction

MUTCD Reference: N/A

On-street bicycle facilities



Shared or exclusive space to indicate where bicyclists can predictably travel along streets. This is intended to create a more predictable traffic environment by reducing conflicts between all modes of travel, including bicyclist–motor vehicle and pedestrian–bicyclist conflicts. On-street bicycle facilities can also be a buffer between pedestrians and motor vehicle traffic, encourage lower motor vehicle speeds, and reduce pedestrian exposure to motor vehicles at crossings.

CRF: 5%

Situation: Mode separation

MUTCD Reference: N/A

Design

On-street parking enhancements/restrictions

The incorporation of parking on the edge of the roadway to encourage lower roadway speeds and narrow the effective crossing width for pedestrians. When designed appropriately, on-street parking can support a pedestrian commercial environment, generate revenue (if parking is priced), and provide a traffic calming function. However, parking should be prohibited where it obstructs pedestrian and motorist sightlines near intersections.

CRF: 20% to 48%

Situation: Visibility

MUTCD Reference: VA MUTCD 2011 Section 2B.46

Sidewalks/shared use paths

Separated space adjacent to the vehicle travel lane and within the public right-of-way that allows pedestrians to walk, run, roll, and play. The sidewalk or shared use path should meet design minimums (i.e., 5 feet wide for sidewalks) and be fully accessible to pedestrians with mobility limitations.

CRF: Unknown

Situation: Mode separation

MUTCD Reference: N/A