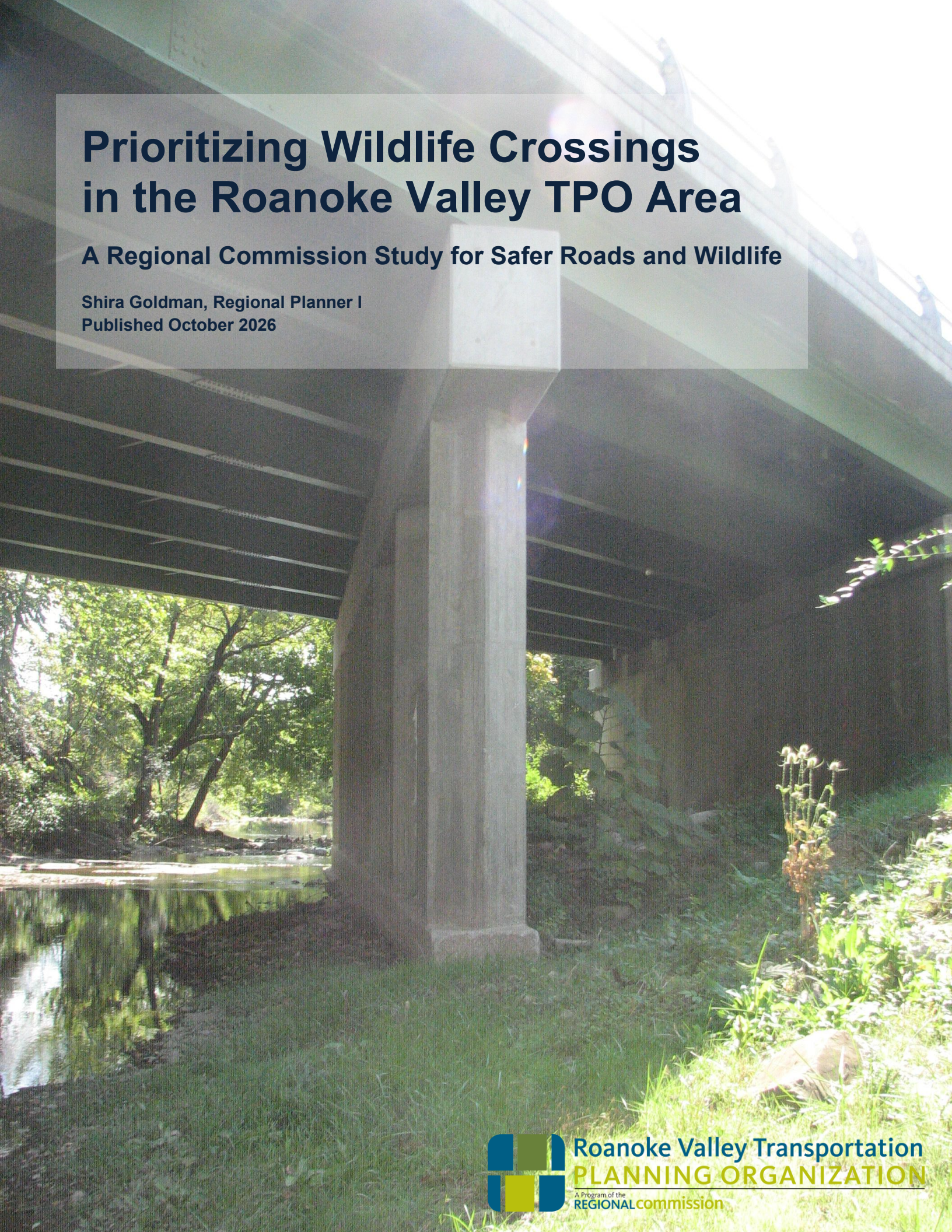

Prioritizing Wildlife Crossings in the Roanoke Valley TPO Area

A Regional Commission Study for Safer Roads and Wildlife

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Roanoke Valley Transportation PLANNING ORGANIZATION
A Program of the REGIONAL commission

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Executive Summary

This study identifies planning-level opportunities to reduce wildlife-vehicle conflicts and improve habitat connectivity through wildlife crossing improvements on VDOT infrastructure within the Roanoke Valley Transportation Planning Organization (RVTPO) study area. The analysis focuses on bridges and culverts located within the overlap of the 2050 RVTPO boundary and Virginia Wildlife Corridor Action Plan Nexus Areas. It also considers other wildlife crash countermeasures when using existing infrastructure is not possible. Localities included in this study are Botetourt County, Roanoke County, City of Roanoke, and City of Salem.

Key Issues

- Wildlife-vehicle collisions cause driver safety concerns and economic impacts for Virginia drivers and communities.
- Road infrastructure often fragments wildlife habitat, forcing wildlife to move across roads to fulfill their food, water, shelter, or mating needs. Habitat connectivity ensures the health and diversity of wildlife species.

Virginia's Wildlife Corridor Action Plan identifies Nexus Areas where the benefits of reducing wildlife-vehicle conflict and improving habitat connectivity overlap. The Plan notes that over 60,000 deer-vehicle collisions have occurred in Virginia annually since 2015. This costs the Commonwealth and its citizens around $533 million annually.

Within the RVTPO study area, bridge underpasses and culverts were screened based on their location within Nexus Areas, proximity to high wildlife-vehicle conflict roads, traffic volume, speed limit, surrounding habitat, and apparent fencing feasibility. Three priority crossing locations were identified for wildlife fencing. Other sites were recommended for wildlife warning interventions based on tiered criteria. All sites should be advanced for field verification to determine logistical feasibility, with priority on the fencing sites.

1. Introduction

1.1 Purpose of the Study

The purpose of this study is to identify planning-level opportunities for wildlife crossing improvements in the 2050 RVTPO region, with an emphasis on locations that support transportation safety and habitat connectivity. The study supports transportation safety by reducing wildlife-vehicle conflicts on high-risk road segments, and habitat connectivity by improving movement opportunities across road barriers. The Roanoke Valley-Alleghany Regional Commission's work program scope was to build on Virginia's Wildlife Corridor Action Plan, identify areas of high wildlife-vehicle conflict in the region, and identify possible projects to improve and reduce conflict on the region's roadways.

1.2 Study Area

The study area (Figure 1) consists of the 2050 RVTPO (MPO) boundary. Thus, VDOT infrastructure was analyzed in the areas within the boundary, which includes parts of Botetourt County, Roanoke County, Montgomery County, Bedford County, and the cities of Roanoke and Salem. When possible, infrastructure in high wildlife-vehicle conflict areas (shown in purple) was prioritized, especially when located in the 25 square-mile Nexus

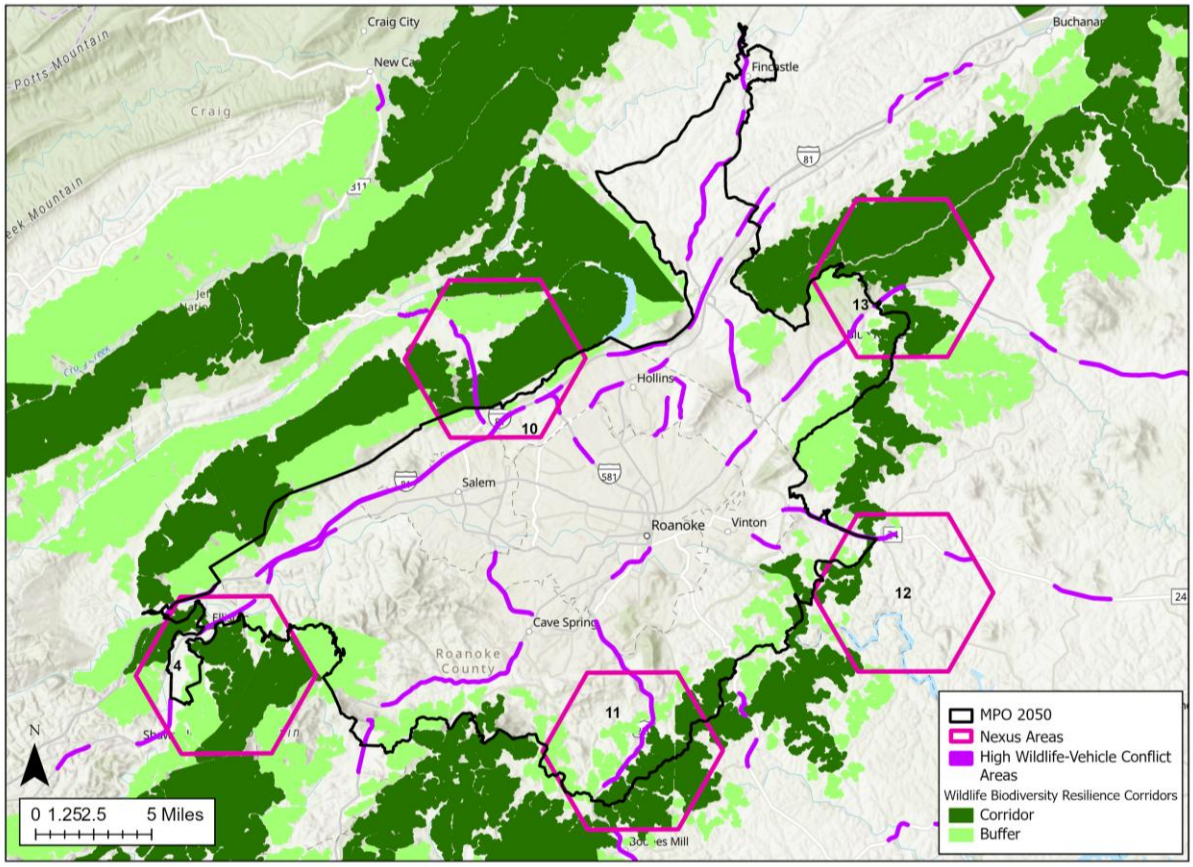


Figure 1. Roanoke Valley 2050 TPO area and intersecting Nexus Areas.

Areas identified by the Virginia Wildlife Corridor Action Plan (VWCAP). The numbered Nexus areas in Figure 1 include those that overlap with RVARC's served localities in the RVTPO. There are three additional Nexus Areas in Franklin County, but they are not near the RVTPO boundary as the county is not included within the Transportation Planning Organization. West Piedmont Planning District Commission also serves Franklin County and handles rural transportation planning. They may want to look further into the three Nexus Areas. The RVTPO boundary was used because this regional planning entity has authority to plan for future transportation needs within the local urbanized area, where vehicle-wildlife interactions generally occur more often. The mitigation recommendations are also likely to affect localities bordering the RVPO boundary, since the high-crash areas being addressed often extend into those localities and may benefit them by reducing vehicle-wildlife crashes.

1.3 Study Need and Existing Conditions

Every year, Virginia is ranked among the top ten states in the country for wildlife-vehicle collisions, costing Virginians an estimated $533 million. The average cost of a deer-vehicle collision in Virginia is $41,000 (Virginia Department of Wildlife Resources et al., 2023). In 2025, the reported collision risk odds were approximately 1 in 82. Drivers are most likely to collide with an animal in October, November, and December (State Farm Editorial Team, 2025).

Increased suburbanization results in a loss of wildlife habitat as impervious surfaces replace it. All RVARC localities, except Alleghany and Craig Counties, have seen a decrease in forested land in the last 10 years (MRLC, n.d.). Urban sprawl into habitat corridors forces animals to cross roads to access habitat, increasing collisions and

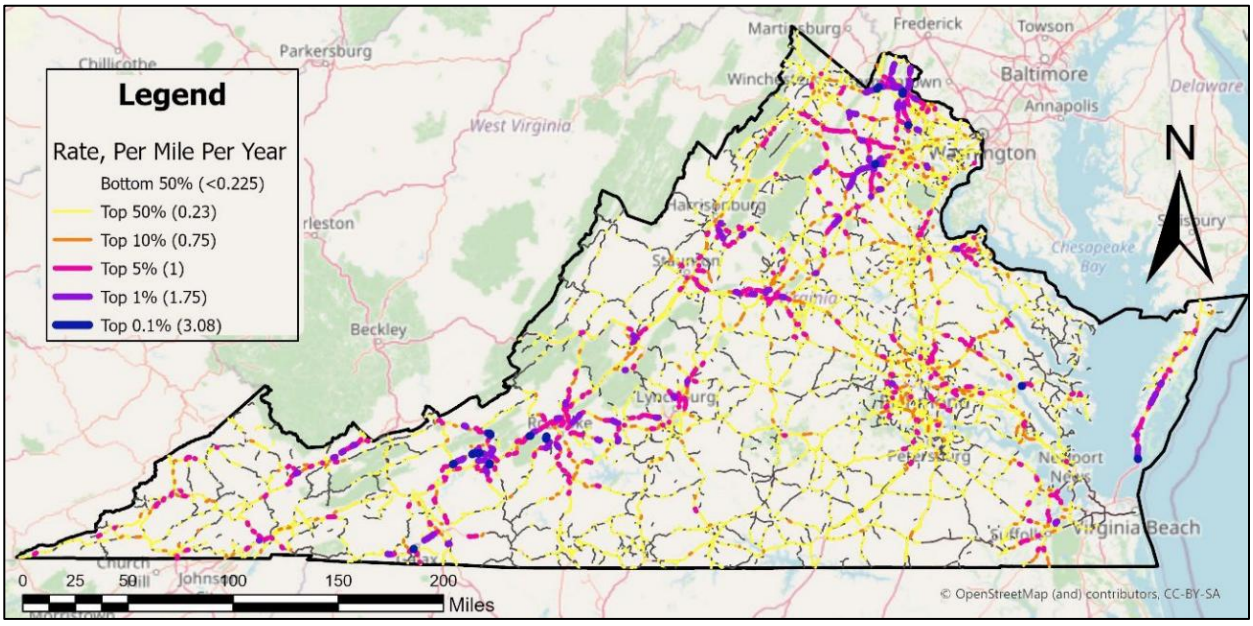


Figure 2. Reported deer crash rate segments for the years of 2013 to 2020. Most crashes in the RVARC region are deer-related. Source: Virginia Department of Wildlife Resources et al., 2023

endangering wildlife. It also degrades the quality of fragmented ecosystems, making them less resilient to natural disasters.

The Virginia Wildlife Corridor Action Plan used a statewide GIS-based screening approach to identify both wildlife-connectivity opportunities and areas with elevated wildlife-vehicle conflict. To map wildlife corridors, the Plan relied primarily on the Virginia Natural Landscape Assessment (VaNLA) and ConserveVirginia, both maintained by the Virginia Department of Conservation and Recreation. These datasets were used to identify connected natural lands with high-quality habitat, biodiversity value, and long-term resilience.

To analyze driver safety, the Plan analyzed 61,688 wildlife-vehicle conflict records from 2013 through 2020, using Virginia Roads and Virginia Smart Roads collision data compiled from Virginia State Police reporting. The roadway analysis focused on Interstates, U.S. highways, freeways/expressways, principal and minor arterials, and major collectors; minor collectors and local roads were excluded. Roads were also filtered to those with a minimum speed of 45 mph. The Plan evaluated wildlife-vehicle collision (WVC) occurrence density, WVC rates by roadway segment, and statistically significant hotspots to identify Areas of High Wildlife-Vehicle Conflict Occurrences.

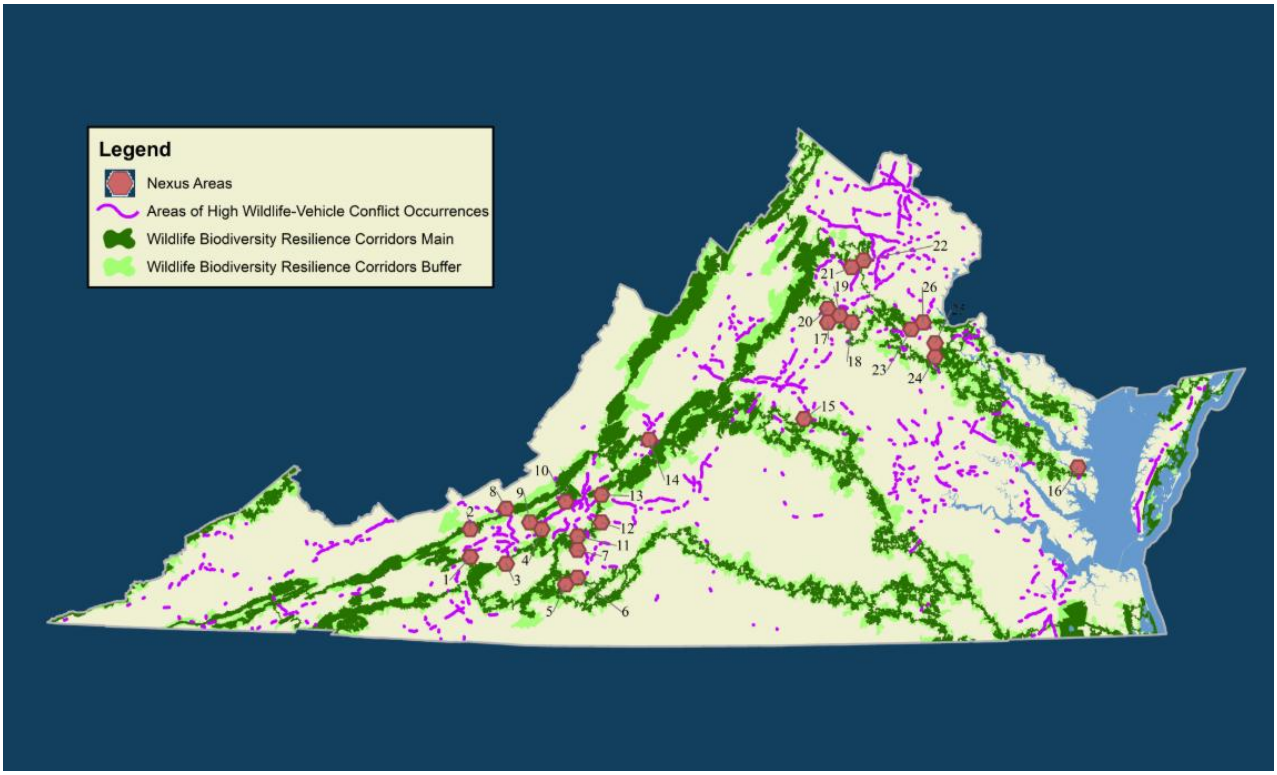


Figure 3. Areas of High Wildlife-Vehicle Conflict represent the top 10% of road segments experiencing the highest WVC occurrence rates. Source: Virginia Department of Wildlife Resources et al., 2023

Finally, the Plan overlaid the WBRC network with Areas of High WVC Occurrences in GIS to identify 26 Nexus Areas, or coarse-scale 25-square-mile areas where wildlife-connectivity needs and documented motorist-safety concerns overlap (Figure 3). As seen in Figures 1 and 2, the overlay analysis proved there is a strong demand for determining appropriate wildlife crash countermeasures in our region.

The green colors in Figure 3 display Wildlife Biodiversity Resilience Corridors and Buffers. These are lengths of natural habitat that connect patches of similar habitat. The methodology identified connected natural lands with high-quality habitat, ecological integrity, biodiversity value, environmental diversity, and long-term climate resilience. Corridors were then strengthened by including nearby ecological cores and habitat fragments, which provide additional habitat and buffer around the primary connection. While not precise, animal travel paths, they offer planning-level guides where animals might be moving or might move in the future if habitat conditions change.

According to Wild Virginia (2021), “The outdoor recreation industry generates $1.2 billion in state and local tax revenue in Virginia each year, driven in part by activities dependent on healthy wildlife populations, such as fishing, birdwatching, and hunting. Enhancing habitat for native wildlife through wildlife corridors will help sustain the state’s natural resources that are central to the 197,000 jobs and $6.5 billion in wages and salaries generated by outdoor recreation in Virginia.”

Wildlife crossings aim to mitigate collision costs as well as promote sustainability throughout the Commonwealth.

2. Policy, Planning, and Regulatory Context

2.1 Federal Context

The Wildlife Crossings Pilot Program, under the Infrastructure Investment and Jobs Act, is a grant program that prioritizes proposed projects that will both reduce wildlife-vehicle collisions and improve wildlife corridors. $350 million was awarded in Fiscal Years 2022 to 2026 through the Department of Transportation. It funded WVC reduction plans and studies, wildlife fencing, and increasing culvert sizes in several states and Tribes. The Wildlife Corridor Action Plan was created with this grant funding.

There are also funding sources related to bridge and culvert replacement which could be relevant to terrestrial as well as aquatic connectivity. These are listed on page 46 of The Wildlife Corridor Action Plan.

2.2 Virginia State Context

Virginia’s Wildlife Corridor Action Plan was completed in 2023 but needed a permanent funding source to implement the crossings in the plan’s focus areas. The Wildlife Corridor

Fund bill was signed into law on April 14, 2026. HB597 established the Wildlife Corridor Grant Fund. This fund is meant to reduce costs associated with wildlife-vehicle collisions by supporting wildlife crossing projects highlighted in the Wildlife Corridor Action Plan.

Virginians now have the option to donate through two voluntary mechanisms to support wildlife crossing and habitat connectivity projects. They can donate when completing electronic DMV transactions or income tax return filings. This bill will make Virginia more competitive for private grants as there will be federal matching funds.

2.3 Regional and Local Planning Context and Studies

According to Wild Virginia, wildlife crossings have been proven to reduce wildlife-vehicle collisions by 96% where implemented (Fowler, 2026). Below are Virginia case studies in the Virginia Wildlife Corridor Action Plan that highlight statewide efforts to advance the mutual benefits of wildlife corridor connectivity and driver safety.

Fort Belvoir Wildlife Crossings

In 1995, the U.S. Army installed the first intentional wildlife crossing structures in Virginia. Two large box culverts were installed. They were designed for medium-to-large wildlife species to cross roads safely. Both culverts include a metal grate in the ceiling that spans the median between the roads above to allow in natural light.

Figure 4. Deer exiting a culvert as seen on a wildlife camera.
Source: Virginia Department of Wildlife Resources et al., 2023

In a camera monitoring study, deer used the larger culvert with a high frequency, and fifteen wildlife species used it. The study concluded that structures that are properly sized and in high-crash areas receive heavy use by wildlife, thus reducing potential wildlife-vehicle conflict. The study found that underpasses twelve feet or taller were best at facilitating deer passage. From 1995 to 2004, there were only five documented deer-vehicle collisions within a 2.5-mile road segment where the culverts of this study are located (Virginia Department of Wildlife Resources et al., 2023). There was little to no fencing along the roads adjacent to the culverts. This study suggests that even one piece of infrastructure, like a box culvert or wildlife-designed fencing, can substantially reduce WVCs.

Southern Albemarle Mountains Wildlife Connectivity Project

Southern Albemarle Mountains Wildlife Connectivity Project was a result of Albemarle County's Biodiversity Action Plan. Albemarle County identified the Southern Albemarle Mountains as a Conservation Focus Area because of its large, intact forest blocks and high ecological value. Route 29 South divides this landscape and was identified as a likely barrier to wildlife movement. In response, County staff, the Virginia Transportation Research Council (VTRC), and VDOT began evaluating existing bridges and culverts that could be retrofitted to be wildlife crossings.

Since 2021, the County has been collecting wildlife data using trail cameras to identify the wildlife using underpasses and the frequency of successful crossings under Route 29. They determined three priority crossing sites based on the wildlife data, which would improve connectivity. Based on the camera monitoring of wildlife in the underpasses, enhancements to bridges or culverts that might encourage more crossings include:

- Creating or improving dry wildlife paths
- Clearing vegetation and debris at structure entrances and sediment inside
- Adding directional fencing to guide animals toward crossings
- Improving interior lighting
- Replacing structures where necessary

The success of the wildlife fencing and cameras study on the nearby Route 29 underpass inspired the I-64 project methods. Wildlife activity was monitored at the underpasses and along the road before and after installation of wildlife fencing to guide wildlife to the structures. The I-64 fencing resulted in an average deer crash reduction of 92% and an increase in wildlife use of the structures up to 410% (Virginia Safe Wildlife Corridors Collaborative, 2026; Virginia Department of Wildlife Resources et al., 2023).

Figure 5. 8-foot-high wildlife fencing along I-64, several feet from areas which need to be mowed or accessed. Jumpouts should be included every 0.25 miles of fencing for wildlife, allowing animals to escape if they get onto the road side of the fence. Source: Donaldson, 2022

Wildlife crashes are severely underreported as police reports are often used for collision data. VTRC found that deer carcass removals along portions of I-64 and I-81 in several Virginia counties were four to nine times greater than the number of police-reported deer crashes (VTRC, 2022). To supplement reported crash data and better identify collision locations, Albermarle County partnered with Virginia Master Naturalists to conduct a year-long survey along Route 29. Volunteers documented live and deceased animals they saw along the highway through an online app.

Loudoun County Wildlife Corridors Study

In 2023, Loudoun County developed a wildlife corridors prioritization study similar to this study. The County developed a local GIS-based method to identify ten priority areas based on driver-vehicle collision hotspots. The areas were then ranked based on fencing suitability, underpass suitability, and habitat value. The County used kernel density estimation to identify road segments that repeatedly fell within the top 10% of driver-vehicle collision hotspots across ten years. They also recruited citizen science volunteers from Virginia Master Naturalists to survey major Loudoun roadways for wildlife to help improve the accuracy of crash data. This data is used to justify wildlife crossings and mitigate wildlife-vehicle collisions in the area.

3. Study Methodology

This study was drawn from the Virginia Wildlife Corridor Action Plan methodology (see section 1.3). It used the VWCAP Areas of High WVC Occurrences, Nexus Areas, and ecological corridor and buffer spatial datasets. VDOT bridge and culvert data were used to identify existing structures within the RVTPO area. First, the feasibility of installing fencing around bridges and culverts in Nexus Areas with high WVC segments was analyzed. The RVTPO intersects Nexus Areas 4,10,11,12, and 13, shown in Figure 1. These sites take the highest priority because they represent an overlap of documented WVC risk and wildlife-connectivity value. Where an existing structure is suitable and continuous fencing can be installed, retrofitting the structure with wildlife fencing is a high-impact, cost-effective countermeasure compared to replacing a structure. There are no VDOT bridges or culverts within Nexus Area 12; therefore, no crossing recommendations were developed for that area.

Second, high WVC segments within or adjacent to Nexus Areas in the Roanoke Valley TPO were evaluated for other mitigation items like animal detection signs (ADS) or changeable message signs (CMS). These locations represent both documented motorist-safety concerns and potential wildlife crossing opportunities in wildlife corridor locations, even when fencing retrofits are not feasible, likely due to interruptions (like driveways) on both sides of the road.

Third, high-WVC road segments outside Nexus Areas were evaluated where average daily traffic (ADT) exceeded 20,000 vehicles per day, and the speed limit is over 45 mph. These locations were screened as high motorist-exposure areas, where wildlife collisions may affect a greater number of road users. Seasonal changing message signs are recommended for these sites, as there is not a specific crossing point for wildlife to either guide wildlife toward or warn drivers of, but it is still a relatively short yet high crash area.

Finally, high-WVC road segments with posted speed limits of 45 mph or greater outside of Nexus Areas were evaluated because higher speeds increase the potential severity of wildlife-vehicle collisions and reduce driver reaction time.

ADT and posted speed were used as supplementary safety-screening criteria for Tier 3 and 4. WVC occurrence and wildlife-connectivity context remained the primary factors for identifying candidate mitigation locations. High WVC areas with none of the above criteria should still be evaluated but are likely a lesser risk to driver safety.

Table 1. Ranking criteria for sites. Tier 1 is highest priority and Tier 4 is lowest priority using the associated rationale.

Tier	Required Criteria	Rationale
1	High WVC + Nexus Area proximity + existing structure/fencing feasibility	Highest combined safety and connectivity benefit. Evaluated for fencing retrofit to structure.
2	High WVC + Nexus Area proximity, but no feasible fencing retrofit	Evaluate ADS or CMS in high safety and connectivity opportunity areas.
3	High WVC + outside Nexus Area + ADT ≥ 20,000 + speed limit ≥ 45 mph	Highest non-Nexus safety exposure: many drivers exposed and higher potential crash severity. Mostly longer stretches, which are evaluated for CMS.
4	High WVC + outside Nexus Area + speed limit ≥ 45 mph + ADT < 20,000	Retains high-speed crash-risk locations with fewer daily motorists exposed.

3.1 Improvement Types Considered

Multiple studies prove that wildlife fencing is a cost-effective wildlife-vehicle collision mitigation strategy. This strategy is usually logical only when there is a pre-existing culvert or bridge that may already facilitate wildlife crossings. VDOT estimates the average costs of a fencing site (including site preparation, traffic control, fencing, and maintenance) to be $265,409 (Donaldson & Elliott, 2020). This estimate assumes a mile of fencing on each side of the road, or two miles. The Virginia Transportation Research Council determined that the benefits from crash reduction “exceeded the fencing costs in 1.8 years, and fencing resulted in an average saving of >$2.3 million per site over the 25-year lifetime of the fencing” (Donaldson & Elliott, 2020). Fencing increases wildlife use of underpasses, although sometimes there is increased wildlife activity at the ends of the fencing. Some studies suggest that adding animal detection systems to the ends might reduce wildlife-vehicle collisions in those discrete locations (Virginia Department of Wildlife Resources et al., 2023).

Effective fencing length varies by study and species, but its effectiveness is likely to increase with length. A literature review study found that fenced road sections over 5 km (3.1 miles) reduced large-mammal vehicle collisions over 80% of the time. Fenced sections less than 5km reduced collisions by about 53% (Huijser et al., 2016). Thus, the recommended sites in section 4.1 likely would still be relatively effective in reducing WVCs.

Fencing without an accessible underpass can fragment the landscape further. This can be detrimental to wildlife populations that need access to resources on both sides of the road (Fahrig, 2003).

Changeable message signs aim to alert drivers and reduce their speed. Reducing speed has been found to decrease the number and severity of crashes. A VDOT study using CMS on I-64 resulted in a 51% reduction in deer crashes on the days the signs were posted (Donaldson, 2022). The sign messaging should be displayed during peak deer activity, which is October and November between 5 P.M. and 9 A.M (Donaldson & Kwon, 2018). The warning messages should refer to the specific animal, the length of the high-risk road segment, and should be displayed on high-crash days.

	Phase 1	Phase 2
Permanent CMS	DEER CROSSING NEXT XX MILES	WATCH FOR DEER NEXT XX MILES CALL 511 FOR INFO
Portable CMS	WATCH FOR DEER	NEXT XX MILES

Figure 6. Example of messages to display on changeable message signs.
Source: Donaldson, 2022

Animal detection systems sense large animals as they approach roads and alert drivers of their presence. When an animal's body blocks a sensor, a warning system, such as flashing lights, alerts drivers. While they do not provide benefits to wildlife connectivity, they have been found to reduce deer crashes by up to 90% in some cases (Donaldson, 2022). Static deer warning signs have been found ineffective at reducing speeds and WVCs (U.S. Department of Transportation, 2008).

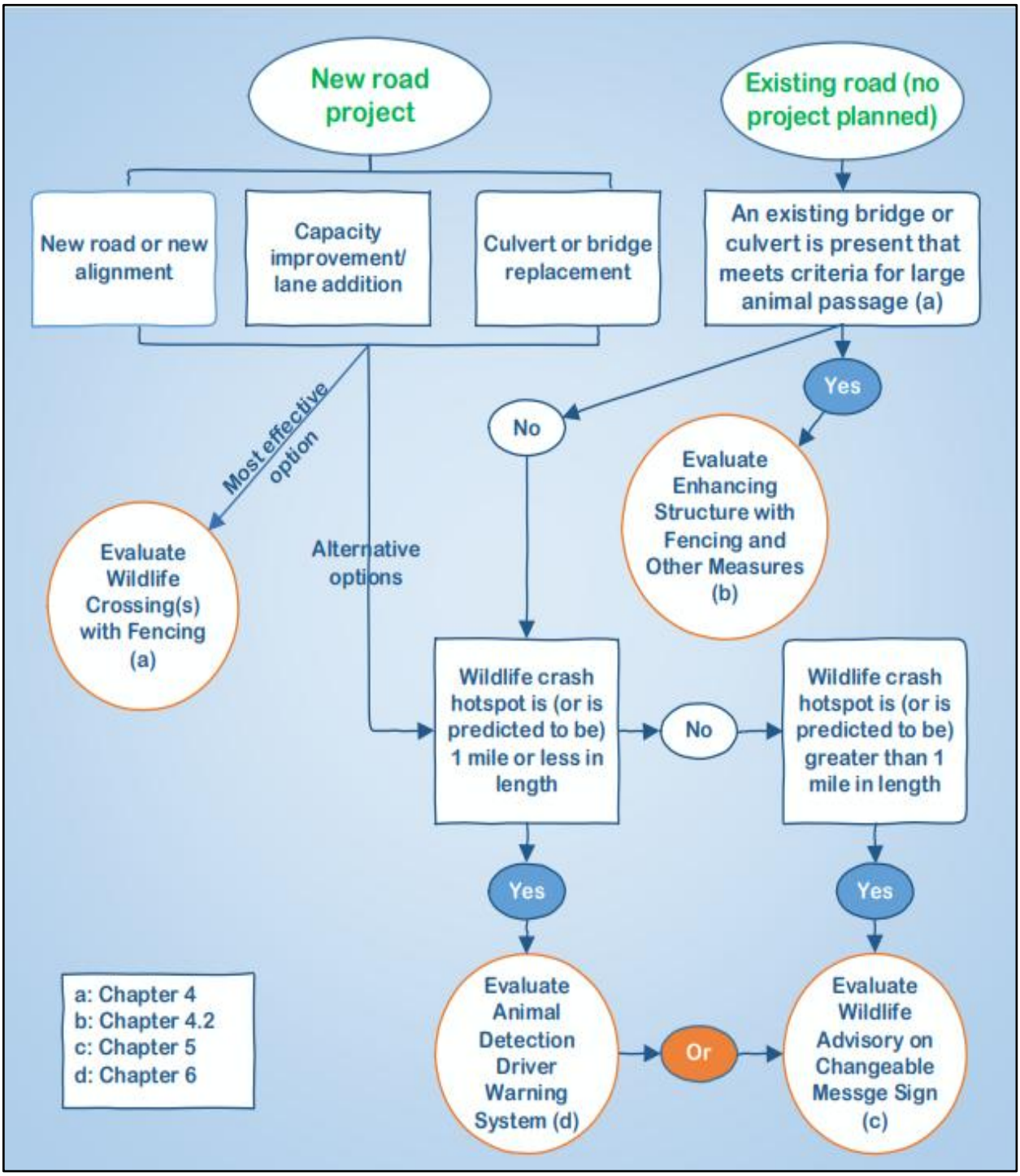


Figure 7. VDOT countermeasures for reducing wildlife crash risk. This study follows this methodology as closely as possible. Source: Donaldson, 2022

3.2 Constraints and Assumptions

The data used in this study, such as the high wildlife-vehicle conflict and Nexus Areas, were taken from VWCAP. Thus, this study did not analyze crash data points comprehensively. VWCAP defined the high wildlife-vehicle conflict layer as 2013-2020 crash data. To place ADS points, individual wildlife crash data points from 2017 to March 2026 were occasionally referenced to find probable higher crash areas within the high WVC zones. High crash areas still seem to remain the same as the VWCAP high wildlife-vehicle conflict areas when visualizing the updated points as a heat map, with the highest crash areas being I-81 through Roanoke County and Highway 220 through Botetourt County, both within the RVTPO boundary.

Studies show mixed results about ideal continuous fence length. In this study, the structures in Tier 1 were evaluated for half a mile of fencing on both sides of the structure on both sides of the road, or one mile on each side of the road with the structure in the middle. This follows VDOT recommendations (Donaldson, 2022). There were no stretches of land on both sides of the culverts or bridges that were uninterrupted by driveways, parking lots, or other structures in the RVTPO-intersecting Nexus Areas. The study area was expanded to include all structures in the high WVC areas, and this constraint held. This study did not consider the current condition of the Tier 1 structures. To facilitate wildlife crossing, the underpasses must be unobstructed, relatively dry, well-lit, and ideally twelve feet tall and three feet wide or greater (Virginia Department of Wildlife Resources et al., 2023). Because data on bridge and culvert height and width are limited, the structures need to be verified in person.

Structure enhancement is also an option, but this study did not address it, as fencing and signage are often more cost-effective and provide shorter-term mitigation.

4. Analysis and Findings

Priority locations are sites where fencing can be applied to facilitate use of either a culvert or bridge. However, it is unclear if the structures are all fit for large-mammal crossings. Larger structures are most effective at facilitating large mammal passage, although deer have been known to use structures as small as 10 ft wide by 6 ft high (Donaldson & Elliott, 2020). The fencing should also be a minimum of 8 ft tall unless the fence can be installed in a depressed area, which will make it look less intrusive. Plantings in front of the fence would also help the fence look more inconspicuous (U.S. Department of Transportation, 2011). Site visits are necessary for the following recommendations to determine further fencing feasibility.

Table 2. Table showing Tier 1, or priority sites to be evaluated for wildlife fencing. Associated roads are defined as the roads within the top 10% of road segments experiencing the highest WVC occurrence rates and are identified by VDOT codes.

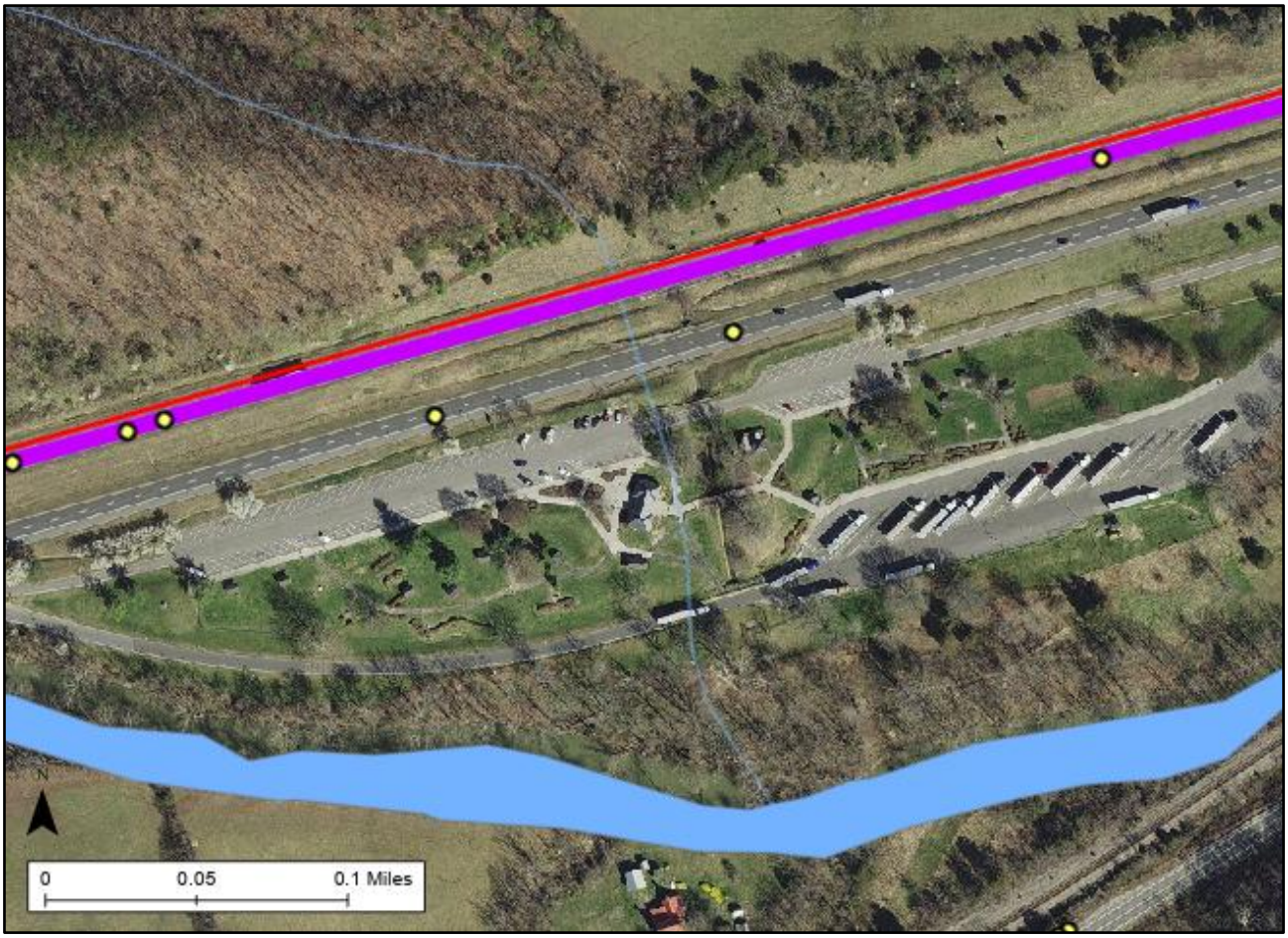
Nexus Area #	County	Site #	Associated Roads	VDOT Infrastructure	Lat/Long	Annual Avg Daily Traffic Volumes	Speed Limit
10	Montgomery County	1	I-81 NB/SB between mile markers 129.6 and 128.7	Bridge – Good	37.239782, -80.224587	61,000 vehicles/day	60 mph
4	Montgomery County	2	US-11 NB/SB between Enterprise Dr and Gardner St	Bridge – Fair	37.227592, -80.208899	7,900 vehicles/day	55 mph

4.1 Tier 1 Locations

1. I-81 NB at Rest Area Drainage / Pedestrian Bridge area – Site 1

This site is in Nexus Area 10 and associated with a high-WVC roadway; interstate traffic volume and 65 mph speed make the potential safety benefit significant. The site benefits from adjacent wooded corridor habitat, the North Fork Roanoke River corridor, and I-81, which has no driveway interruptions for over half a mile on each side of the culvert on the southbound priority segment side. There have been eleven reported wildlife-related crashes since 2017 within half a mile on each side of the culvert on the Southbound side. Culverts cut through the rest area but are likely not too wet for large mammal passage. These culverts, along with the culvert intersecting the northbound road, may require guiding fencing to connect the culverts. Field verification and VDOT coordination would be needed to determine whether fencing can be constructed within the rest area.

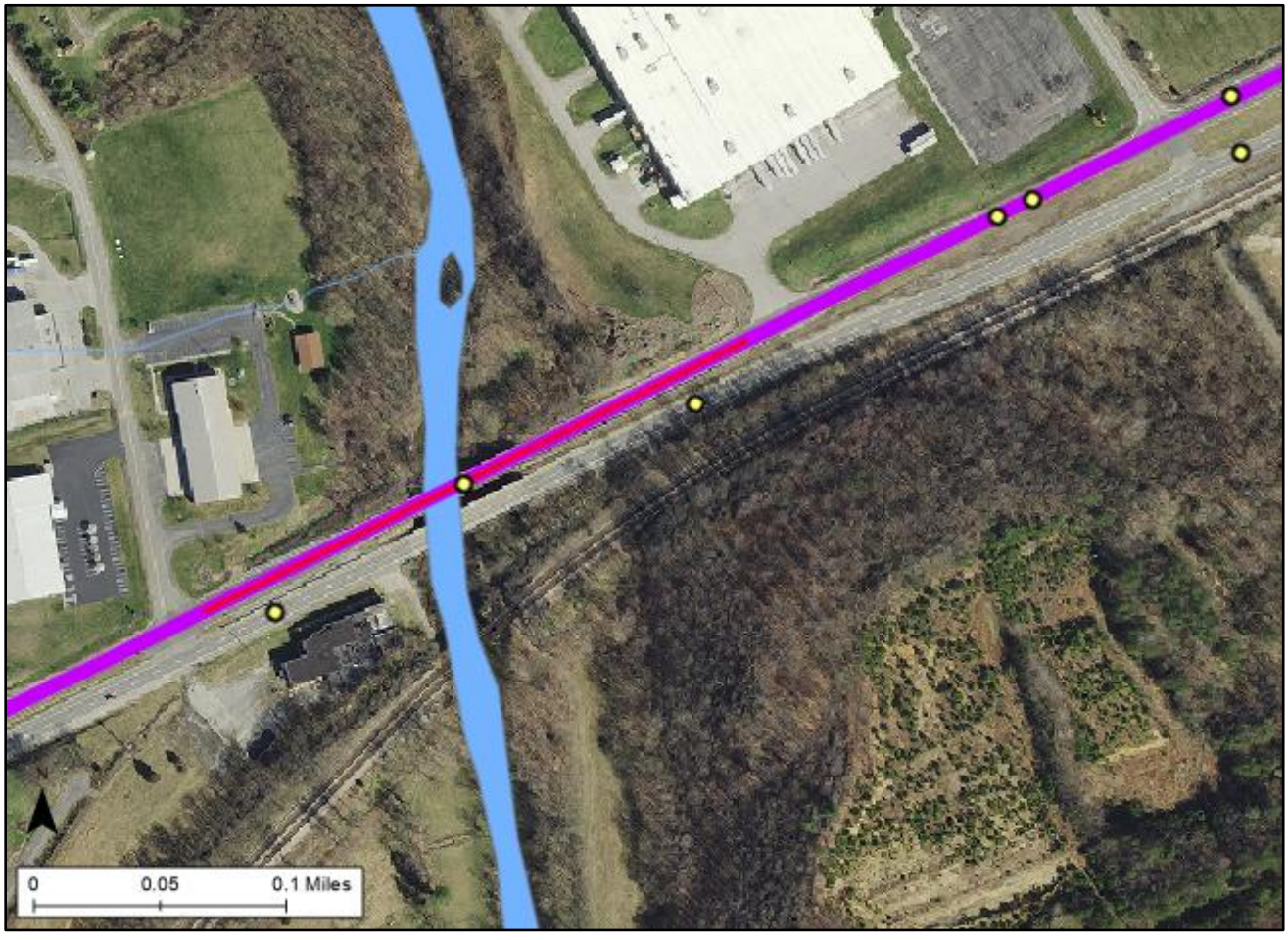
Based on the average cost published by VDOT, this project would cost around $199,056 for an estimated mile and a half of fencing.



2. US-11 SB at South Fork Roanoke River – Site 2

This site is associated with a high WVC road and is in a Nexus Area. Field review is necessary to confirm the dry passage potential. The road corridor does not appear uninterrupted for the full desired half mile on each side, but there is a substantial wooded block southeast of the road (northbound). There are a substantial number of wildlife-related crashes on the northbound road as well, so guiding fencing, even if shorter than half a mile on each side of the bridge, may provide some benefit there too. The wildlife corridor passes through both roads, meaning migratory species are likely to pass through this area quite often, as this is important habitat for them.

Based on the average cost published by VDOT, this project would cost around $92,893 for 0.7 total miles of fencing.

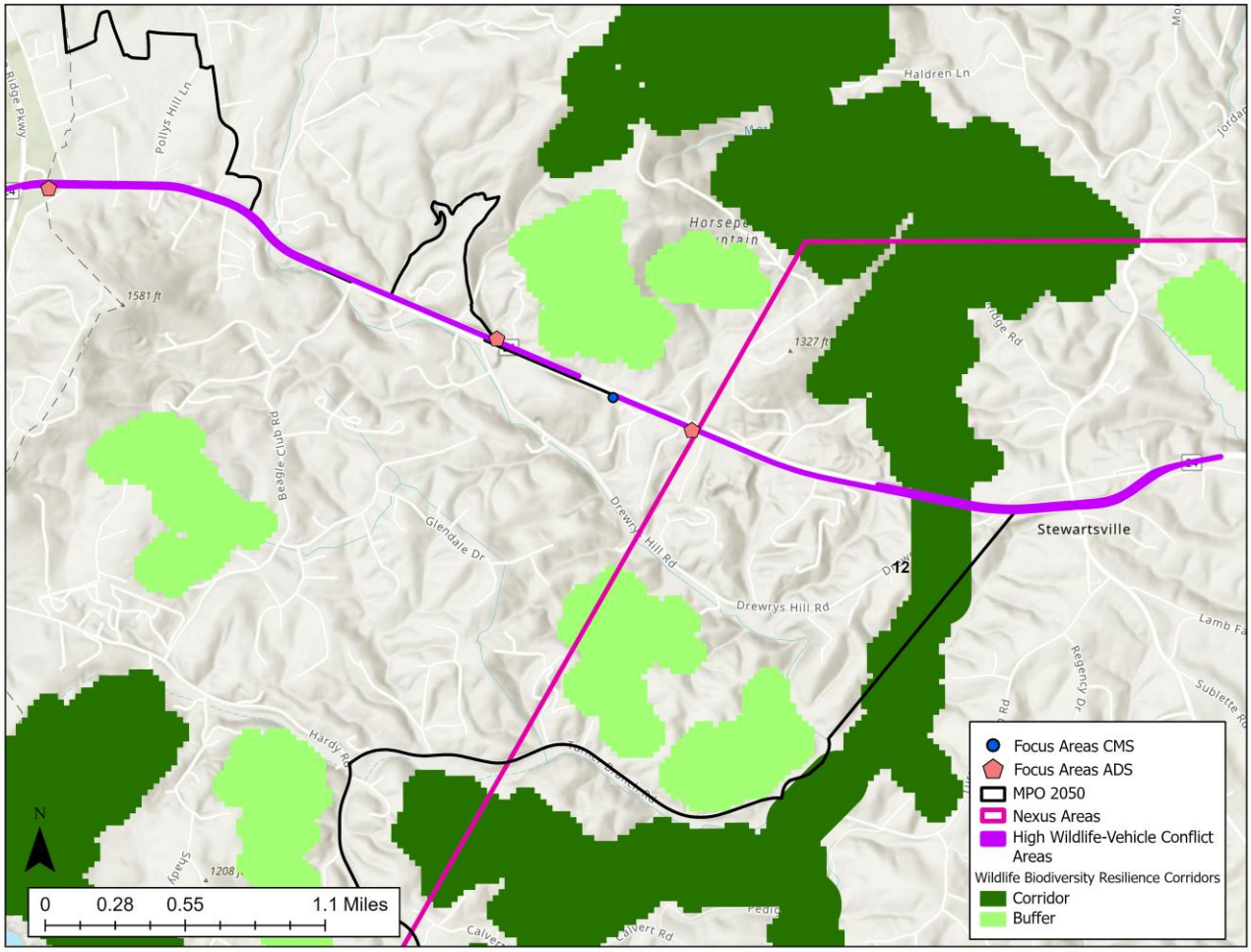


4.2 Tier 2 Recommendations

High wildlife-vehicle collision road segments that intersected or were adjacent to mapped wildlife corridors and within the study area were evaluated for ADS of CMS treatments, as these locations represent both documented motorist-safety concerns and potential wildlife-connectivity opportunities. The maps below show these points.

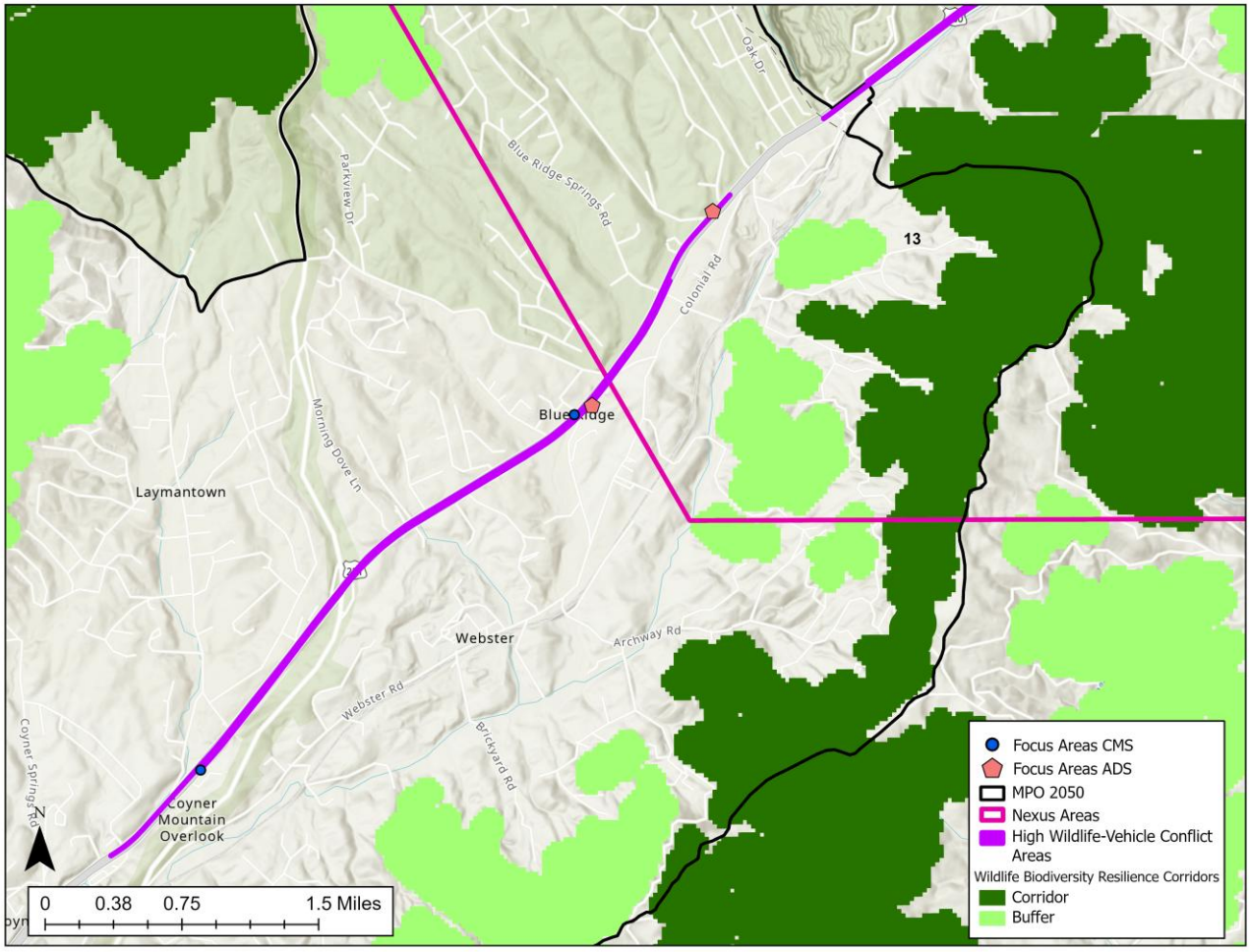
1. **Nexus 12.** Stewartsville (Rt 24) EB/WB in Bedford County along high WVC roads.

These recommendations include multiple animal detection signs for high-crash north and southbound segments, as well as a changeable message sign for the westbound segment in a high-crash area on the road. This section of Stewartsville Rd stretches, in segments, from the Stonebridge Dr (WB) and the Blue Ridge Parkway Access Road (EB) and E Washington Ave intersection half a mile past the Jordantown Rd (WB) and Goodview Rd (EB) intersection with Stewartsville Rd. This stretch generally has a lower ADT but has speed limits from 45 to 55 mph.



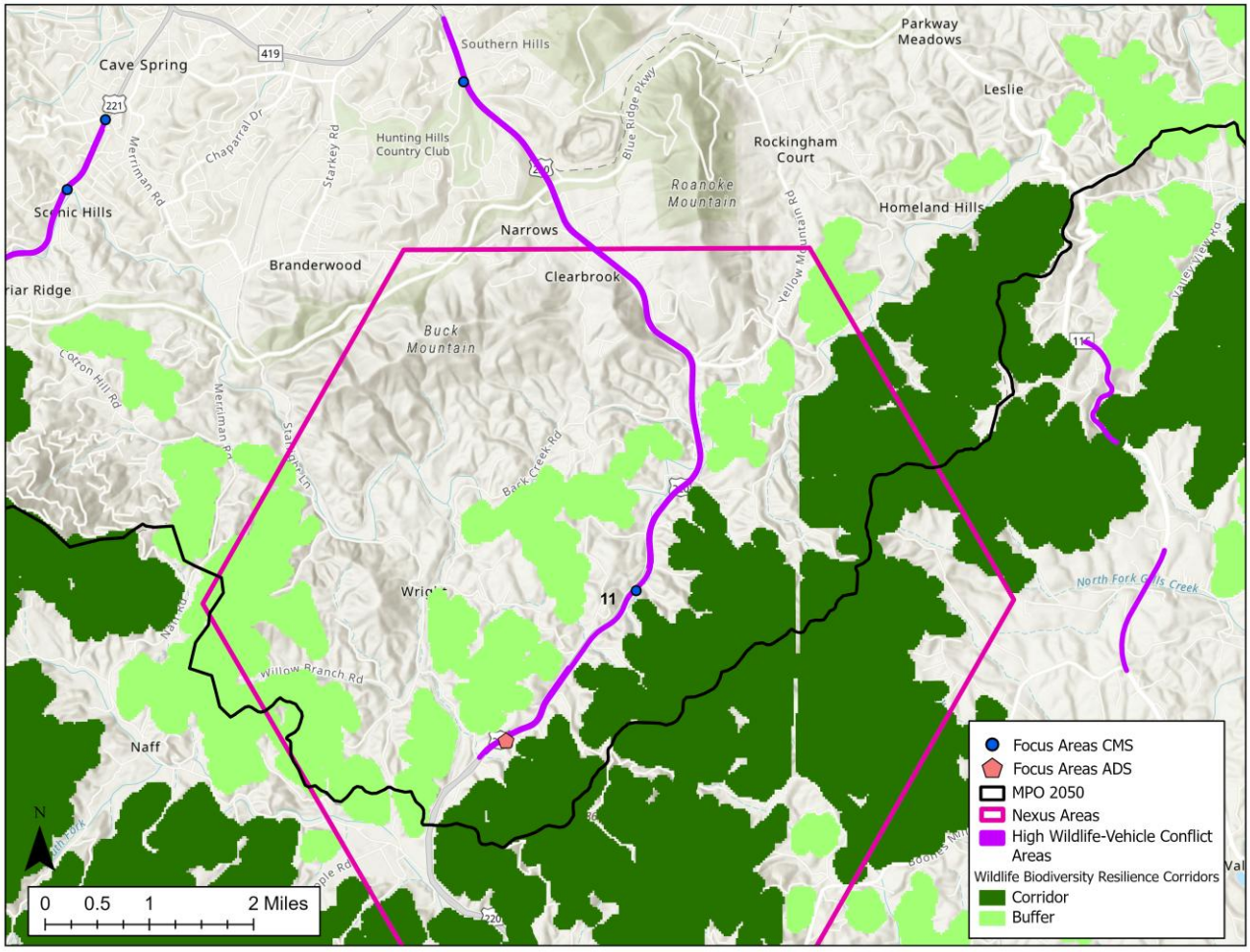
2. **Nexus 13.** Blue Ridge Blvd (221 EB/WB) in Botetourt County and a small section of Bedford County along high wildlife-vehicle conflict roads.

These recommendations include multiple animal detection signs for high-crash north and southbound segments, as well as a changeable message sign for a short segment where the habitat corridor overlaps with a high-crash area on the road. This section of Blue Ridge Blvd stretches, in segments, from Brookfield Ln to around Thornblade Way (WB) intersections with Blue Ridge Blvd and the Chestnut Hill Trail to Blue Ridge Springs Rd (EB) intersections with Blue Ridge Blvd. These high WVC segments are also highly trafficked, with an ADT of 27,000 and a speed limit of 55 MPH.



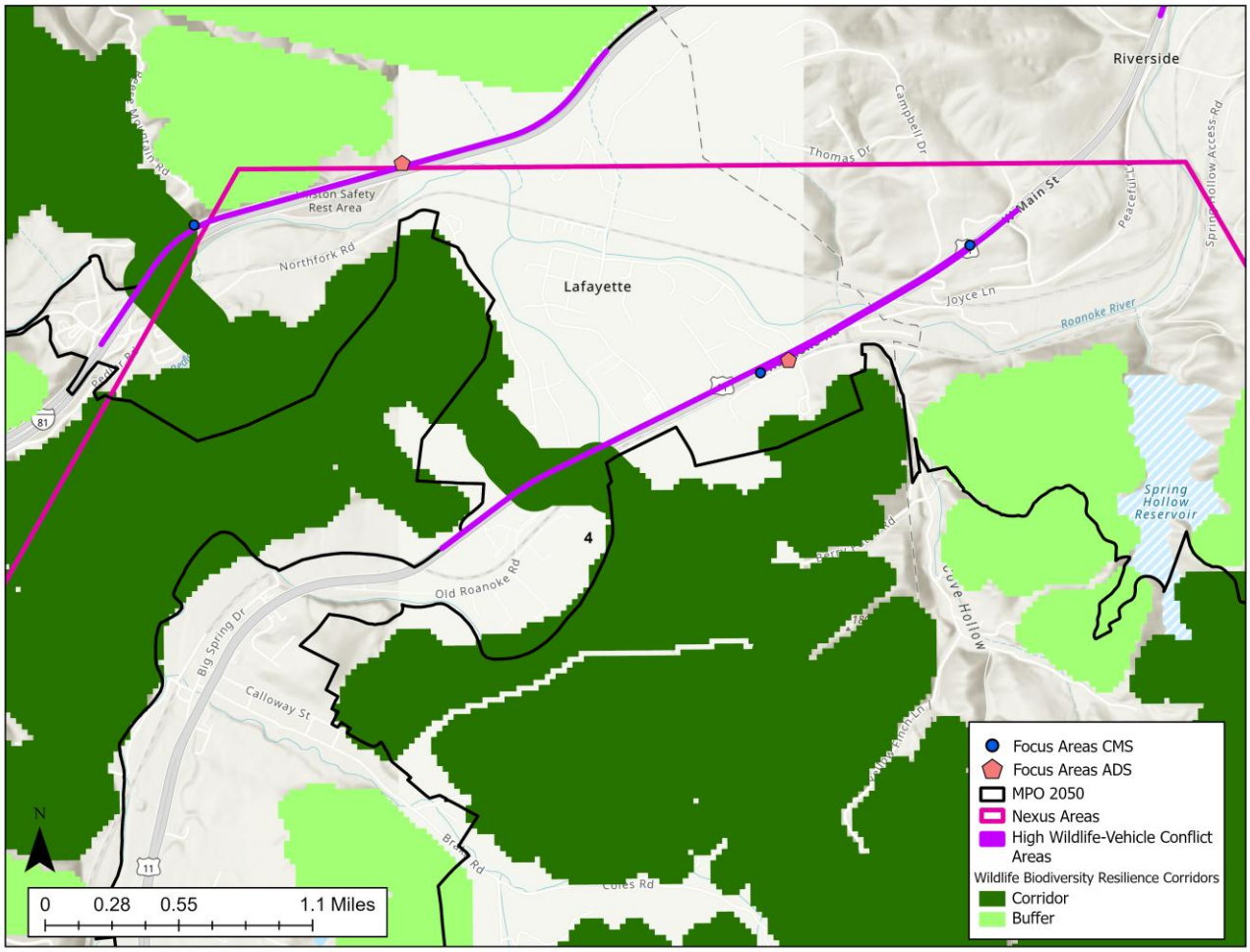
3. **Nexus 11.** Franklin Rd (220 NB/SB) in Roanoke County, which extends outside of the Nexus Area.

These recommendations include one animal detection sign for a high-crash northbound segment, as well as two changeable message signs for the high-crash segments of Route 220 around Nexus 11. This section of Franklin Rd stretches, in segments, from the Valley Rd and Franklin Rd intersection to the Willow Branch Rd and Franklin Rd intersection (SB), and the northbound section stretches from just northeast of Willow Branch Rd to the Southern Hills Dr SW intersection with Franklin Rd (NB). The high WVC segments are also highly trafficked, with an ADT of 29,000 and a speed limit of 45 to 55 MPH.



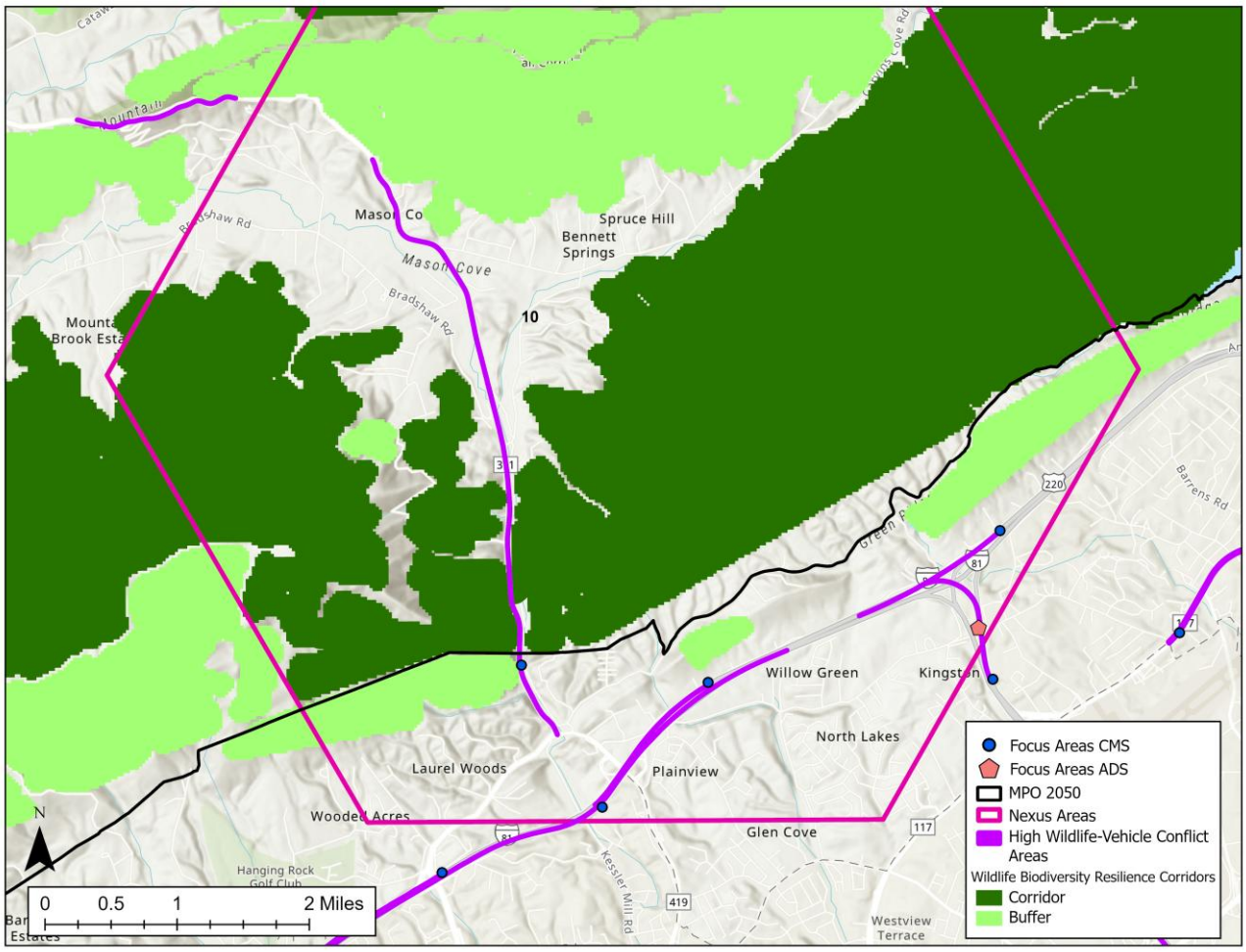
4. **Nexus 4.** W Main St (Route 11) in Montgomery and Roanoke Counties and I-81 SB beginning around 37.246564N 80.208402W and ending around exit 128. The Route 11 northbound segment begins around Lee Hwy and Cove Hollow Rd and continues past Peaceful Dr. The southbound segment begins around Marshall Dr. and continues to 80.2181141W 37.2228940N, where the bridge crosses over the railroad.

These recommendations include two animal detection signs for high-crash segments, as well as three changeable message signs for the high-crash segments of I-81 SB and Route 11 North and Southbound around Nexus 4. The high WVC segments are also very highly trafficked, with I-81's ADT being 51,000 and speed limit typically 65 mph, and Route 11's ADT being around 10,000 with a speed limit of 55 MPH.



5. **Nexus 10**. Catawba Valley Dr. (Route 311) and I-81 NB/SB segments in Roanoke County. The 311 segment begins at the roundabout and continues north to the Dutch Oven Rd intersection, then beyond the RVTPO area. The I-81 NB segment begins around mile marker 141.2 and continues to marker 142.7. The I-81 SB segment runs from about mile marker 144.2 to 143.2, then from 142.2 until 141.3. It also includes the Exit 1S on ramp.

These recommendations include six changeable message signs for the high-crash segments of I-81 Northbound and Southbound and nearby on-ramps, and Route 311 Northbound outside of the RVTPO. The high-WVC segments of I-81 are highly trafficked, with I-81's ADT over 71,000 and a speed limit typically 55 to 60 mph, and Route 311's ADT around 10,000 with a speed limit of 55 MPH. The black boundary line shows the northern limit of the RVTPO.



4.3 Tier 3 Locations

Next, high-WVC road segments outside Nexus Areas but within the RVTPO boundary were evaluated where average daily traffic (ADT) exceeded 20,000 vehicles per day and had a speed limit over 45 mph. These locations were screened as high motorist-exposure areas, where wildlife collisions may affect a greater number of road users. Seasonal changing message signs are recommended for most of these sites, as there is not a specific crossing point for wildlife to either guide wildlife toward or warn drivers of, but it is still a relatively short yet high crash area.

Because installing repeated signs at every location is not feasible, another study should filter the road segments further to determine how to spread the signs out most effectively for seasonal sign placement. For each recommended location, the analysis should also define the length of roadway over which the sign is intended to alert drivers to heightened wildlife-crossing risk. These recommendations are in Appendix B.

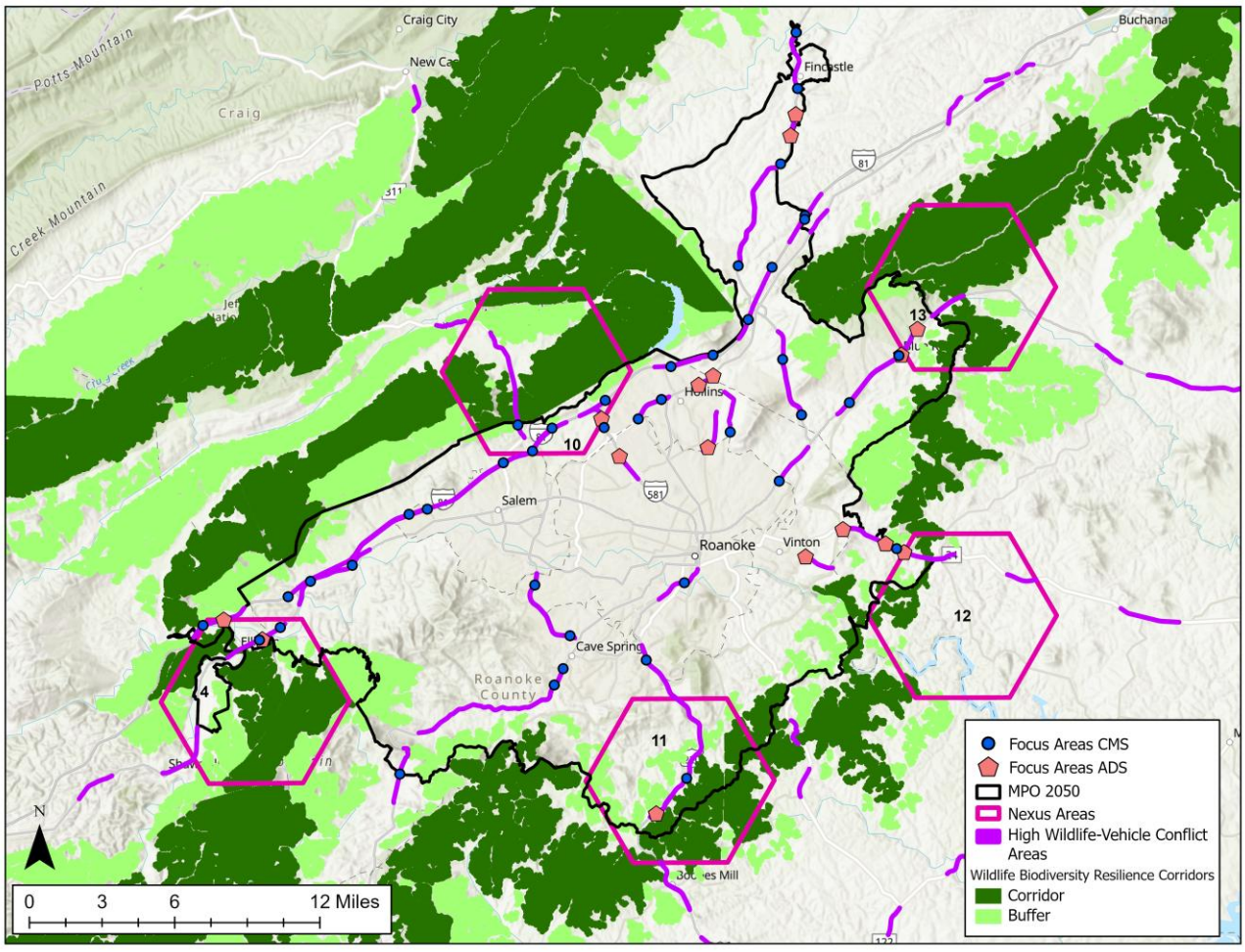


Figure 8. Map showing all CMS and ADS points and wildlife corridors and buffers referred to in the recommendations sections within the RVTPO boundary.

4.4 Tier 4 Locations

Finally, high-WVC road segments with posted speed limits of 45 mph or greater outside of Nexus Areas but within the RVTPO boundary were evaluated because higher speeds increase the potential severity of wildlife-vehicle collisions and reduce driver reaction time. These roads see less than 20,000 vehicles a day. These recommendations are in Appendix B.

5. Implementation Strategy

5.1 Next Steps

A future study should consider all Nexus Areas within the RVARC area, not just within the RVTPO area.

Infrastructure Strategies

All sites should be evaluated by engineers in priority order to determine the feasibility of installing wildlife fencing. They will need to provide a specific design for wildlife fencing and determine the cost of installing it. VDOT may also choose to monitor wildlife at these locations using wildlife cameras. Knowing which species already use underpasses and how often may help prioritize sites further and reduce collisions drastically.

Culverts in the region rated “poor” or otherwise being replaced in the future should consider wildlife underpass designs, such as a dry crossing platform if there’s water flow, and be reconstructed at least 10 ft high (U.S. Department of Transportation, 2011). Expanding culverts where possible would also help with flood resilience. There are currently no “poor” rated culverts in the RVTPO boundary, but that is likely to change as infrastructure ages.

Non-infrastructure Strategies

Citizen science reporting can help improve underreported wildlife-crash data. The quantity and species found attempting to cross the road help to determine where underpasses should be prioritized or advocate for a nearby proposed roadway project to be moved or enhanced to support crossings. Site-specific wildlife road mortality data may also help identify the appropriate type and design of a structure enhancement. Considering habitat connectivity is best practice when planning new roadways, as they may worsen barriers to wildlife movement and make drivers less safe.

There are multiple wildlife crossing funding sources to be aware of that are not currently open. If the Wildlife Crossings Pilot Program reopens, it would be beneficial to apply.

Appendices

Appendix A. Tier 1 and 2 Locations

Site	Nexus Area #	County	Associated Roads	Mile Marker / Intersection
T1-001	10	Montgomery County	I-81 NB/SB	MM 129.6–128.7; Rest Area Drainage / Pedestrian Bridge area
T1-002	4	Montgomery County	US-11 NB/SB	Enterprise Dr to Gardner St; South Fork Roanoke River
T2-001	12	Bedford County	SR-24 EB/WB (Stewartsville Rd)	Stonebridge Dr (WB); Blue Ridge Parkway Access Rd / E Washington Ave (EB); extends about 0.5 mile past Jordantown Rd (WB) and Goodview Rd (EB)
T2-002	13	Botetourt County; section of Bedford County	US-221 EB/WB (Blue Ridge Blvd)	Brookfield Ln to around Thornblade Way (WB); Chestnut Hill Trail to Blue Ridge Springs Rd (EB)
T2-003	11	Roanoke County	US-220 NB/SB (Franklin Rd)	SB: Valley Rd to Willow Branch Rd; NB: just northeast of Willow Branch Rd to Southern Hills Dr SW
T2-004	4	Montgomery County; Roanoke County	US-11 (W Main St / Lee Hwy) NB/SB; I-81 SB	US-11 NB: Lee Hwy / Cove Hollow Rd past Peaceful Dr; US-11 SB: Marshall Dr to railroad bridge near 37.2228940, -80.2181141; I-81 SB: approx. 37.246564, -80.208402 to Exit 128
T2-005	10	Roanoke County; extends beyond RVTPO area	SR-311 (Catawba Valley Dr); I-81 NB/SB; Exit 1S on-ramp	SR-311: roundabout to Dutch Oven Rd and beyond RVTPO area; I-81 NB: MM 141.2–142.7; I-81 SB: MM 144.2–143.2 and MM 142.2–141.3; includes Exit 1S on-ramp

Appendix B. Tier 3 and 4 Locations

Site	Jurisdiction	Route	Road Name / Mile Marker	Start Long	Start Lat	End Long	End Lat	Nearest Intersection
T3-001	Roanoke County	I-81 NB	131.7 to 141.2	-80.182	37.2518	-80.039	37.3199	
T3-002	Roanoke County	SR-419 SB	Electric Rd	-80.034	37.263	-80.011	37.2322	Keagy Rd/SR-419 to Berry Ln/SR-419
T3-003	Roanoke County	SR-419 NB	Electric Rd	-80.011	37.2322	-80.029	37.2437	Berry Ln/SR-419 to Glen Heather Dr/SR-419
T3-004	Roanoke County	SR-117 EB	Peters Creek Rd	-79.974	37.3354	-79.955	37.3461	Wood Haven Rd/SR-117 to Williamson Rd/SR-117
T3-005	Roanoke County	SR-117 WB	Peters Creek Rd	-79.954493	37.346909	-79.974	37.3355	Williamson Rd/SR-117 to Wood Haven Rd/SR-117
T3-006	Roanoke County	US-221 SB	Brambleton Ave	-80.017607	37.217709	-80.02	37.2129	Ranchcrest Dr/US-221 to Arlington Hills Dr/SR-221
T3-007	Roanoke County	US-221 NB	Brambleton Ave	-80.020203	37.212801	-80.018251	37.216479	Arlington Hills Dr/Ranchcrest Dr/US-221

Site	Jurisdiction	Route	Road Name / Mile Marker	Start Long	Start Lat	End Long	End Lat	Nearest Intersection
T3-008	Botetourt County	I-81 NB	153.7 to 154.7 (not in RVTPO area)	-79.874	37.4311	-79.8635999	37.4432265	
T3-009	Botetourt County	I-81 SB	150.2 to 149.2	-79.905	37.3874	-79.913	37.3745	
T3-010	Botetourt County	I-81 SB	151.8 to 150.2	-79.893	37.4084	-79.905	37.3884	
T3-011	Botetourt County	I-81 SB	153.8 to 152.8	-79.873	37.4329	-79.883	37.4204	
T3-012	Botetourt County	US-220 NB	Roanoke Rd	-79.913307	37.408922	-79.891	37.4557	Valley Rd/US-220 to Trinity Rd/US-220
T3-013	Botetourt County	US-220 SB	Roanoke Rd	-79.890651	37.455836	-79.913745	37.408375	Trinity Rd/US-220 to Valley Rd/US-220
T3-014	City of Roanoke	US-220 NB	Roanoke Rd	-79.949928	37.257981	-79.937	37.265	Franklin Rd Exit to Exit 6 off-ramp of US-220
T3-015	City of Roanoke	US-220 SB	Roanoke Rd	-79.946261	37.258349	-79.961	37.2505	Franklin Rd SW on-ramp to Colonial Ave on-ramp
T3-016*	City of Roanoke	I-581 SB	Route 220 Hwy	-79.984	37.3192	-79.973	37.3078	-79.984, 37.3192 to Exit 3E off-ramp
T3-017	Roanoke & Botetourt Counties	I-81 SB	146.7 to 147.8	-79.954	37.3613	-79.936	37.365	

Site	Jurisdiction	Route	Road Name / Mile Marker	Start Long	Start Lat	End Long	End Lat	Nearest Intersection
T3-018	Roanoke & Botetourt Counties	I-81 SB	148.2 to 146.2	-79.928	37.3666	-79.963	37.3611	
T3-019	Roanoke County & City of Salem	I-81 SB	137.2 to 134.2	-80.1	37.2936	-80.144	37.2703	
T3-020	Roanoke County & City of Roanoke	US-460 EB	Challenger Ave NE	-79.889	37.3067	-79.871377	37.322975	Mexico Way/US-460 to Walmart Access Rd/US-460
T4-001*	Roanoke County	US-11 SB	Williamson Rd	-80.1436311	37.2667939	-80.1753775	37.2481288	Technology Dr/US-11 to Before Harwick Dr/US-11
T4-002*	Roanoke County	US-11 NB	Williamson Rd	-80.1679479	37.2598808	-80.1434796	37.2666887	South of Pleasant Run Dr/ US-11 to Technology Dr/US-11
T4-003	Roanoke County	US-221 NB	Bent Mountain Rd	-80.1154399	37.1671232	-80.1130485	37.1797608	Slings Gap Rd/US-221/ to -80.1130485, 37.1797608
T4-004	Roanoke County	US-221 NB	Bent Mountain Rd	-80.1040047	37.1870419	-80.0202186	37.2127832	-80.0202186, 37.2127832 to Arlington Hills Dr/US-221
T4-005	Roanoke County	US-221 SB	Brambleton Ave	-80.0203536	37.2128385	-80.1039980	37.1870637	Arlington Hills Dr/US-221 to -80.1039980, 37.1870637

Site	Jurisdiction	Route	Road Name / Mile Marker	Start Long	Start Lat	End Long	End Lat	Nearest Intersection
T4-006*	Roanoke County	US-634 EB	Hardy Rd	-79.8729336	37.2713543	-79.8630100	37.2664852	Greenway Landing Pl/US-634 to Temple Dr/US-634
T4-007*	Roanoke County	US-601 NB	Hollins Rd	-79.9342464	37.3211385	-79.9266410	37.3365470	Plantation Rd/US-601 to Beaumont Rd/US-601
T4-008	Roanoke County	US-605 NB	Old Mountain Rd	-79.9179739	37.3298293	-79.9214964	37.3492399	Ashburn Rd/US-605 to Shadwell Dr/Sanderson Dr
T4-009	Botetourt County	US-220 NB	Cloverdale Rd	-79.8755662	37.3381337	-79.8895692	37.3780185	-79.8755662, 37.3381337 to Ridge Rd/US-220
T4-010	Botetourt County	US-220 SB	Cloverdale Rd	-79.8866789	37.3646958	-79.8757934	37.3381811	Aker Ln/US-220 to -79.8757934, 37.3381811
T4-011	Botetourt County	US-220 SB	Roanoke Rd	-79.8876338	37.4575407	-79.8906093	37.4558510	-79.8876338, 37.4575407 to Trinity Rd/US-220
T4-012	Botetourt County	US-220 NB	Roanoke Rd	-79.8904300	37.4556269	-79.8867281	37.4579551	Trinity Rd/US-220 to -79.8867281, 37.4579551
T4-013*	Botetourt County	US-220 NB	Roanoke Rd	-79.8820212	37.4710633	-79.8798412	37.4766968	Shane Ln/US-220 to Brughs Mill Rd/US-220
T4-014*	Botetourt County	US-220 SB	Roanoke Rd	-79.8787069	37.4814554	-79.8823890	37.4704090	-79.8876338, 37.4575407

Site	Jurisdiction	Route	Road Name / Mile Marker	Start Long	Start Lat	End Long	End Lat	Nearest Intersection
T4-015	Botetourt County	US-220 NB	Roanoke Rd	-79.8750864	37.4954564	-79.8781647	37.5199671	Housman St/US-220 to Old Fincastle Rd/US-220
T4-016	Botetourt County	US-220 SB	Roanoke Rd	-79.8784868	37.5201226	-79.8778558	37.4930616	Old Fincastle Rd/US-220 to -79.8778558, 37.4930616
T4-017	Roanoke & Botetourt Counties	US-11 SB	Williamson Rd	-79.9280196	37.3572968	-79.9373651	37.3528496	Industrial Dr/US-11 to Hollins Court Dr/US-11
T4-018	Roanoke & Botetourt Counties	US-11 NB	Williamson Rd	-79.9373373	37.3527314	-79.9265163	37.3585078	Hollins Court Dr/US-11 to Industrial Dr/US-11

*ADS is recommended due to the length of the segment

References

Donaldson, B. (April 2022). Large Animal Crash Countermeasures in Virginia. Virginia DOT. Retrieved August 31, 2026, from https://www.vdot.virginia.gov/media/vdotvirginiagov/doing-business/technical-guidance-and-support/environmental/Large_Animal_Crash_Countermeasures_in_Virginia_April_2022_acc11072024.pdf

Donaldson, B., Elliott, K. (May 2020). Enhancing Existing Isolated Underpasses With Fencing to Decrease Wildlife Crashes and Increase Habitat Connectivity. Virginia DOT. Retrieved August 31, 2026, from http://www.virginiadot.org/vtrc/main/online_reports/pdf/20-r28.pdf

Fahrig, L. (2003). Effects of Habitat Fragmentation. *Annual Review of Ecology, Evolution, and Systematics*, *34:487-515*. https://doi.org/10.1146/annurev.ecolsys.34.011802.132419

Fowler, T. (2026, April 14). *Virginia Governor Signs First Wildlife Corridor Funding Bill Into Law*. Retrieved August 31, 2026, from https://wildvirginia.org/virginia-governor-signs-first-wildlife-corridor-funding-bill-into-law/

Huijser, M. P., Fairbank, E. R., Camel-Means, W., Graham, J., Watson, V., Basting, P., & Becker, D. (2016). Effectiveness of short sections of wildlife fencing and crossing structures along highways in reducing wildlife–vehicle collisions and providing safe crossing opportunities for large mammals. *Biological Conservation*, *197*. https://doi.org/10.1016/j.biocon.2016.02.002.

MRLC (n.d.). MRLC NLCD EVA Tool. Retrieved August 31, 2026, from https://www.mrlc.gov/eva/

State Farm Editorial Team. (2025, September 29). *How likely are you to have an animal collision?* Retrieved from https://www.statefarm.com/simple-insights/auto-and-vehicles/how-likely-are-you-to-have-an-animal-collision

U.S. Department of Transportation (August 2008). *Wildlife-Vehicle Collision Reduction Study*. Federal Highway Administration. Retrieved August 31, 2026, from https://www.fhwa.dot.gov/publications/research/safety/08034/08034.pdf

U.S. Department of Transportation (March 2011). *Wildlife Crossing Structure Handbook Design and Evaluation in North America*. Federal Highway Administration. Retrieved August 31, 2026, from https://www.fhwa.dot.gov/clas/ctip/wildlife_crossing_structures/appendices.aspx

Virginia Department of Wildlife Resources, Virginia Department of Conservation and Recreation, VDOT, & Virginia Department of Forestry (May 2023). *Virginia Wildlife Corridor Action Plan*. Virginia Department of Wildlife Resources. Retrieved August 31, 2026, from https://dwr.virginia.gov/wp-content/uploads/media/Virginia-Wildlife-Corridor-Action-Plan.pdf

Virginia Safe Wildlife Corridors Collaborative (2026, May 5). *Virginia's Habitat Connectivity Hub*. Wild Virginia. Retrieved August 31, 2026, from https://storymaps.arcgis.com/stories/7d09dfd6b426487eb50ac75bb01d81ef