The Road to Connectivity: Designing a Framework for Actor Engagement in Wildlife-Vehicle Conflict Mitigation

Cayley Santella[1]; Sofia Politte[1]; Jordan Green[2], and John P Swaddle[1]

[1] Institute for Integrative Conservation, William & Mary, Virginia, USA

[2] Virginia Department of Wildlife Resources, Virginia, USA

E-mail: jpswad@wm.edu

Date completed *(December 17, 2024)*

Summary of the report

Wildlife-vehicle conflict (WVC) impacts wildlife conservation efforts, driver safety, and has costly economic implications. For successful mitigation of WVCs, coordination is required among various actors which can be challenging due to the lack of a clear framework for effectively engaging those actors. My goal is to understand and document the best practices for engaging diverse actors in WVC mitigation, using Loudoun County (Virginia, USA) as a case study. We conducted interviews of key state and local actors, along with background research and a literature review on successful implementation, to identify the best methods of actor engagement. Research findings are incorporated into a translational framework model. My findings include the primary barriers and motivators of key actors with funding and public support being the most crucial. This report aims to increase local knowledge and accessibility of information related to local level decision making related to WVC mitigation strategy implementation.

Keywords: *Wildlife-Vehicle Conflicts, Implementation, Decision-Making Process*

1. Introduction

Wildlife-vehicle conflicts (WVCs) are increasing, particularly in developing areas, causing harm to wildlife, posing safety risks to drivers, and incurring significant financial implications (Huijser, 2022). Such conflict arises because roads intersect wildlife habitat. The road-effect zone (i.e., “the area over which the ecological effects of roads and traffic extend into the adjacent landscape” (Van, D.R, 2015)) results in habitat loss, habitat degradation, movement barriers, and wildlife mortality. Notably, wildlife movement across these roads often leads to WVCs and wildlife death or injury. In the U.S, road accidents kill an estimated 365 million mammals annually, highlighting the

immense scale of WVCs (Jones, 2022). Not only do WVCs have a significant impact on wildlife, but it is also a pressing issue for driver safety. Vehicle collisions with wildlife can result in human injuries and even death. There are approximately 200 human deaths per year, along with 26,000 injuries as a result of wildlife-vehicle collisions (Huijser, 2008). In addition to negative safety and conservation consequences, there are also negative financial effects. Specifically, the national cost of damages from these incidents is around 8 billion dollars annually (Huijser, 2008). Given the rising incidence of WVCs and the threats they pose, effectively implemented mitigation strategies are essential for creating safer roads and protecting both humans and wildlife (Jones, 2022).

There are many cases of effectively implemented mitigation strategies throughout the United States (NDOT Research Report, 2022); however, the process of implementing a mitigation strategy is especially difficult and complex. There are many strategies that could be implemented to reduce wildlife-vehicle collisions, including overpasses, underpasses, culverts, roadside fencing, or signage. Culverts and bridges may be modified, along with overpasses specifically for wildlife crossing, to mitigate wildlife from crossing the roads by providing a safe alternative route, with fencing, to help guide wildlife to use the crossing structures. Dynamic road signage is targeted to alert drivers in areas of high collision frequency (Donaldson & Kweon, 2019). Despite the recognized benefit of these mitigation strategies, the process from start to finish of planning, designing, and implementing these mitigation structures may take years to complete, require numerous resources, and have various constituents involved in the process, each with differing involvement levels at different stages. Effectively engaging with diverse constituents and navigating through this process can be exceptionally challenging, limiting our ability to mitigate WVC.

WVC mitigation is a multi-dimensional process that can vary on a case-by-case basis. Not only are there various constituents involved in the process, but the involved actors will vary in each situation. Additionally, each constituent has specific priorities, values, goals, and timelines that must be considered. Further, there may be different barriers and motivators of constituent involvement/approval, such as political, economic, or ecological concerns. Barriers may include conflicting priorities, lack of funding, timeline constraints, feasibility of strategy type, or poor collaboration between constituents (NDOT Research Report, 2022). However, there are factors that may motivate a constituent to approve or support a WVC mitigation project. Motivators may include community advocacy in support of a proposed project/issue, available funds, sufficient supporting data, and an alignment of goals between involved organizations (NDOT Research Report, 2022). Essentially, situations vary on a case-by-case basis, and implementing mitigation strategies requires effective engagement of all constituents and efficient navigation through the approval process.

Notably, there is a clear lack of knowledge at the municipal level that identifies and examines the influencing factors of the approval process in order to efficiently navigate through the decision-making process. This is why it is crucial for research that examines the complex dynamics of local-level decision-making procedures. Specifically, research is needed to identify the key actors involved in the process at the local level, along with the possible barriers and motivations relevant for each constituent. We used my research findings to formulate a replicable framework for diverse constituents to efficiently navigate through the decision-making process. This

would improve the success of establishing mitigation strategies in areas where they are needed. A framework that includes relevant information on the actors involved in the process would help streamline the process for a conservation-interested actor with a potential WVC project. Additionally, having all of the relevant information in one place for the proposer to utilize would conserve time in the process, helping to expedite the process of implementation and WVC efforts.

In particular, a framework for successful implementation is especially important for Loudoun County, Virginia (USA). Loudoun County is becoming increasingly developed and has the 7th highest rate of wildlife-vehicle collisions in the nation (Donaldson & Kweon, 2019). Currently, there are efforts by the Virginia Department of Wildlife Resources and partners to reduce wildlife-vehicle collisions in Loudoun, which are highlighted in Virginia's Wildlife Corridor Action Plan (DWR, 2023). Specifically, previous research has identified ten key priority areas where mitigation strategies would effectively reduce WVC's if implemented (Busby, 2023). However, this research needs to be further explored to identify the specific sites where a strategy should be implemented. Additionally, there is a need to understand how communities and municipalities can go from identifying the need for a road crossing to the implementation of the mitigation strategy. Currently, there is a lack of clear understanding of who is involved in the implementation process and the ways in which the approval process can be navigated. Using Loudoun County as an example, this research aims to bridge the gap between awareness of WVC, data collection, and decision-making, resulting in positive outcomes by understanding the best practices and strategies for successful WVC mitigation. The goal of this project is to identify the actors involved in the decision-making process at the local level, along with understanding the factors that would influence their approval, in order to help conservation-interested actors in progressing to the implementation phase of mitigation efforts. Notably, there are variations between localities for decision-making, so there is no standard, consistent model. However, there are general similarities between municipalities that are useful to incorporate in a transferable model that is applicable to multiple localities.

1.3 Research Objectives

This project aims to help interested constituents reduce WVC by studying the key factors that influence the implementation process. Using Loudoun County as a case study, this research aims to understand the dynamics of decision-making and develop a county-to-county translational model to identify what circumstances can lead to effective implementation of mitigation measures to address the prevalent problems associated with WVC.
The objectives of this research are to:

- Identify and examine the primary actors involved in the local decision-making process, specifically relating to mitigation strategies, along with understanding the connection between actors and their values.
    - Identify the specific role the actor plays in the county decision-making process.
    - Identify and examine the values of identified actors.
    - Identify the connection between primary actors and established jurisdictions.

- Identify and analyze the barriers and motivations of decision-makers that influence the implementation of mitigation structures.
- Examine the influence that constituents/citizens have on affecting the implementation processes and pathways that lead to the implementation of a WVC mitigation structure.
- Utilize collected data on key actors to develop a translational framework to help implement mitigation strategies in varying counties.

2. Methods

The primary data was collected in Loudoun and Fairfax counties in Virginia. These regions are located in Northern Virginia and experience a high level of WVC. This research consists of three main components with complementary methodologies.

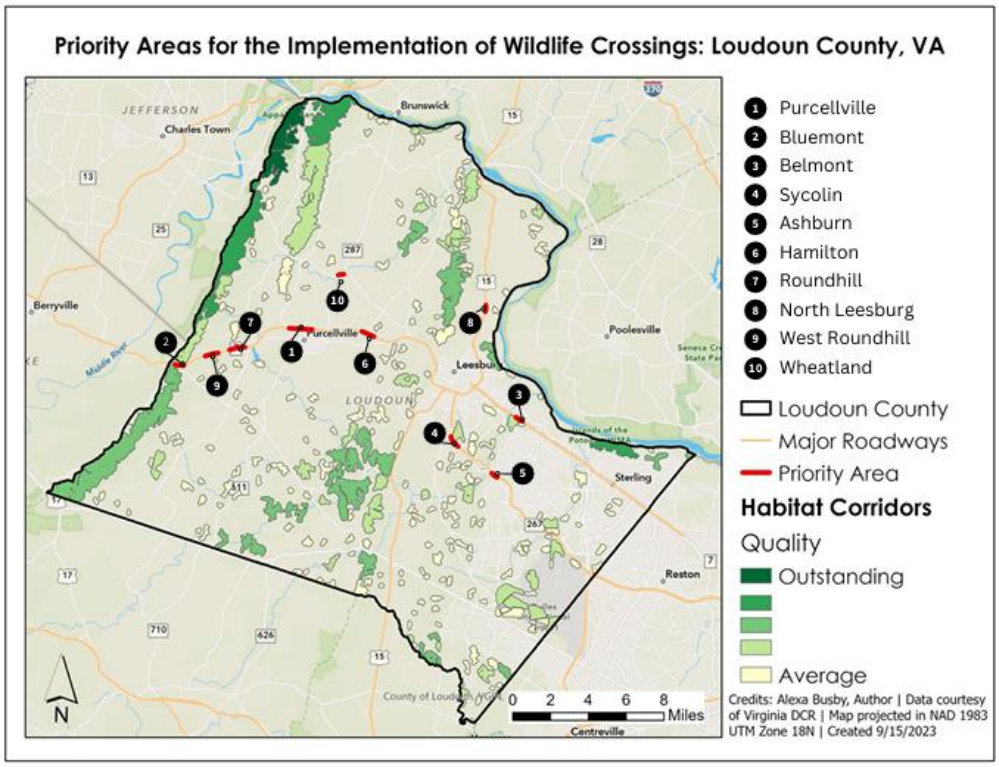


Figure 1. Map showing priority areas (Busby, 2023)

Previous research has been conducted in Loudoun County, identifying ten key priority sites for mitigation efforts, such as roadside fencing (Busby, 2023). This research aims to build on the previously mentioned research. Loudoun is the primary focal study area, but research in Fairfax will also be conducted in order to effectively formulate a replicable framework that could be applied in other counties in Virginia (and perhaps other US states).

2.1. *Literature review and background research*

We conducted extensive background research on Loudoun County and Fairfax County, along with more general research on mitigation strategies. Research aimed to identify the different types of strategies, such as mitigation structures, signage, or fencing, potential costs for each strategy, and past mitigation projects that had successful implementation. Additionally, we examined the decision-making process itself along with the factors that influence decision-making. We conducted research in order to identify the specific actors in each county that are key figures in the decision-making process. This consisted of exploring relevant county websites and investigating the county structures/organization. Specifically, exploring individuals within the Board of Supervisors, varying commissions and committees (planning and environmental), and other relevant departments, along with collecting information on contact information. An additional research avenue was identifying and examining the varying state organizations of Virginia that may influence WVC mitigation. This included organizations such as the Virginia Department of Transportation (VDOT), Virginia Department of Wildlife Resources (DWR), along with various other community-based organizations such as the Virginia Master Naturalists (VMN) and Loudoun Wildlife Conservancy (LWC). Lastly, we conducted a case study review of implemented mitigation strategies and the incorporation of wildlife considerations into transportation projects. This research aimed to identify successful and unsuccessful aspects of previously implemented mitigation projects, with the goal of improving the success of future projects and highlighting key factors for integrating WVC considerations into transportation planning.

2.2. *Interviews and community engagement*

We conducted interviews with the identified key actors to determine the barriers and motivations of decision-making for mitigation structure implementation. These interviews will also be used as a tool to further examine the specific role of the interviewee in the county structure and possible influence over approving and implementing mitigation efforts. Additionally, these interviews attempt to identify the potential fund pools that may be available for mitigation strategies. We formulated differing interview questions for specific interviewees depending on their role in the decision-making process. We collected interview data on a mobile recording device. Interviews took place either in person, over a phone call, or via Zoom. Then, we analyzed the data to identify the key themes and points of information that were relevant to this research. The interview questions are attached as an appendix to the proposal. Additionally, we identified local community organizations and interviewed members in order to further understand the community's role in the decision-making process, along with their personal values and opinions on mitigation efforts. These efforts will directly impact the community, so it is crucial to understand their perspective on the issue and identify how this would impact possible mitigation implementation.

2.3. *Construction of framework model*

Using the gathered data, we developed a county-to-county translational model. This model will act as a guide for counties to utilize to effectively navigate through the county decision-making process in order to streamline the implementation process, specifically for wildlife-vehicle collision mitigation. Loudoun County is the

primary study area for information gathering. Additionally, we examined Fairfax to increase the model's applicability to other counties.

3. Key Findings

The findings are organized as themes in the framework. The framework includes the involved actors of the decision-making process for the local level, along with the specific barriers and motivations that influence their involvement, support, or approval for WVC projects or considerations. Additionally, the priority of the actors' involvement is highlighted in the framework. Lastly, the established or potential relationships between actors are stated.

3.1. Barriers and motivations

An important part of the framework is understanding the barriers and motivations to the approval process. Specifically, each organization or actor will have their own set of barriers/motivations that influence their involvement in WVC mitigation strategy implementation. The major barriers that may inhibit or prolong a project's approval are a lack of funding, agency culture, no legislative mandate, a lack of political support, a lack of wildlife data, and different priorities of various actors with differing timelines, budgets, and goals (NDOT Research Report, 2022). For example, timelines allow for improved communications between organizations and departments, goal prioritization, and project structure. However, it can be challenging if a proposed project's timeline conflicts with another organization's timeline. Conflicting timelines may present a number of issues, such as conflicting resource allocation or current and future project completion. The dynamics of these numerous factors make efforts for actual implementation challenging since they all need to align with the goals of mitigation efforts (Anderson, 2022). For example, the VDOT may prioritize road expansion projects in order to reduce traffic in developing areas, while the DWR may have goals that are more specific towards wildlife conservation, such as mitigation structure projects as opposed to roadway expansion. Local citizens may also have conflicting opinions, since traffic reduction through road expansion may be appealing to some, but reducing collisions and improving driver safety through mitigation structures may also be a priority.

Funding also plays a crucial role in implementation (NDOT Research Report, 2022). The process from data collection to implementation requires a budget and a fund pool. WVC mitigation strategies, such as overpasses, underpasses, warning signs, fencing, or even speed limit changes, can be costly. In order to effectively implement a mitigation strategy, there needs to be set budgets along with available funding for the project. Different steps of the process may pull from different funding pools. A mitigation strategy may be funded by a private donor, non-profit organization, businesses, local government, state government, or the federal government. Examining the possible fund pools and establishing a budget is a crucial part of effective mitigation strategy implementation.

Political barriers also play a major role in the decision-making process. A difference in political agendas or political priorities may create problems for the effective implementation of mitigation strategies. Certain participants in the decision-making process may prioritize constituent or economic interests, which may conflict with wildlife conservation efforts. Additionally, opposing political party prioritizations may also create conflict that hinders

implementation (Anderson, 2022). This is why it is important to engage with members of the political process and understand the potential barriers, along with possible conflict resolution.

All of these possible barriers have the ability to stop a WVC mitigation effort at any phase in the decision-making/approval process. However, there are factors that would act as motivators to the approval process as well. A project is more likely to be approved if you have supporting data, a specific location and strategy, calculated associated costs, and know who would be involved in the process, preferably before bringing it to the attention of decision makers (Cramer et al., 2022). Thorough preliminary planning is crucial for effective implementation. Additionally, a crucial factor for successful implementation is strong advocacy or community support, which play a vital role in securing project approval, particularly from government entities. If funding is available for the project, it is also more likely to be approved at each phase in the decision-making process. A project may still be approved without funding, as it is not a requirement for approval, but a readily available source of funding may significantly increase the likelihood of approval. Also, it is important for a proposed strategy to align with the priorities or goals of the involved actors.

Table 1. Table highlighting prevalent barriers and motivations

PREVALENT BARRIERS AND MOTIVATIONS OF INVOLVED ACTORS	
Barriers	**Motivations**
Lack of Funding	Available Funding
Lack of WVC Data	Relevant Supporting Data
Lack of Public Support	Public Advocacy and Support
Pre-existing Priorities Not Related to WVC Mitigation Efforts	Recommendation from Other Actors
Lack of Legistlative Mandate for WVC Mitigation Efforts	Guidance Document for WVC Consideration in Planning

3.2. Constituents

A key aspect of a decision-making framework is the identification of the different involved actors and their differing priorities, along with particular barriers and motivations associated with WVC mitigation. For local level implementation, the main actors include VDOT with various levels of organization (state & local office), the county government consisting of the Board of Supervisors, Environmental Commission, planning commission, and a local transportation department, along with a state wildlife agency such as the DWR, the Northern Virginia Transportation

Authority (NVTA), and the public including citizen science organizations. Key data for each actor/organization are crucial considerations for the framework.

Figure 2. Diagram of actors involved in the implementation process. Bolded actors are a high/extremely high priority.

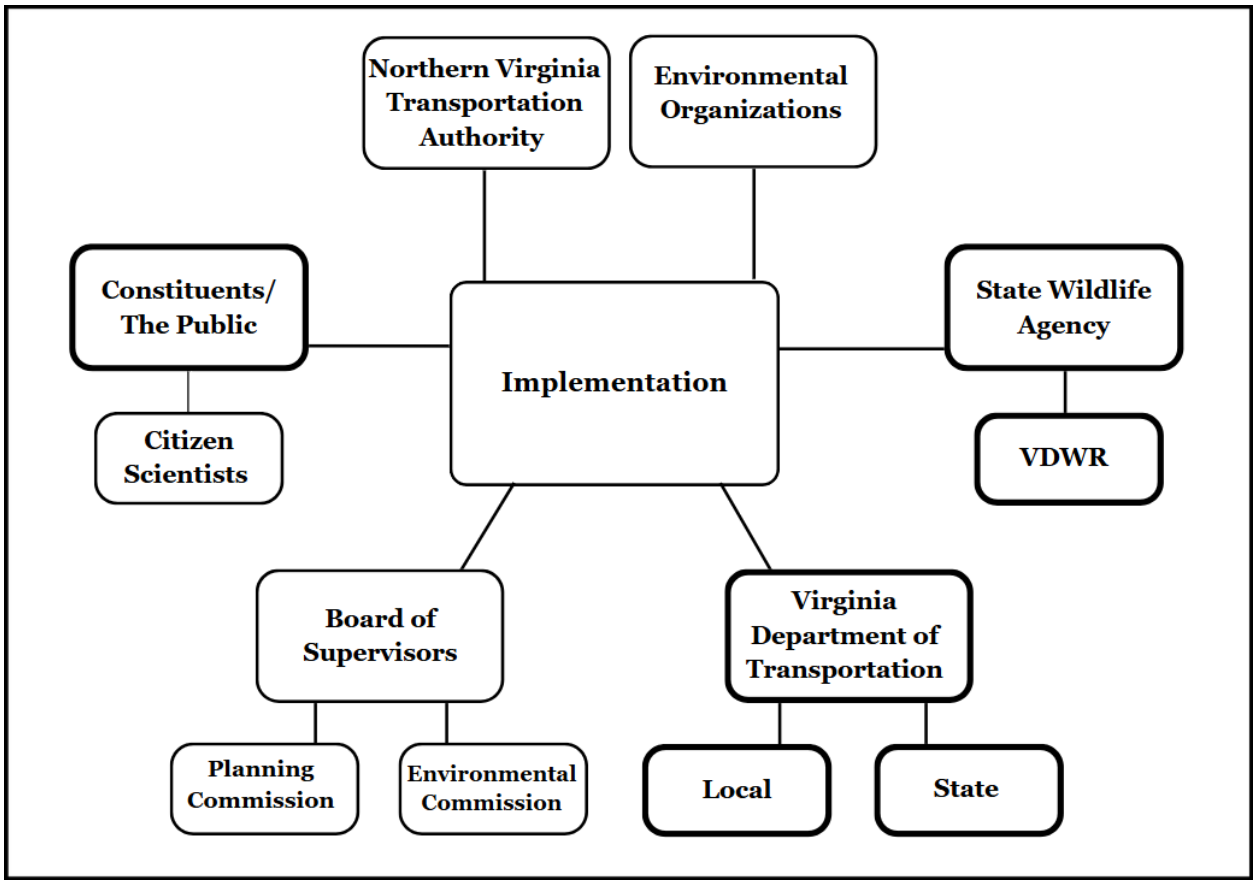


Table 2. Table summary of relevant actors and their involvement in implementation

ACTOR	ROLE	PRIORITY	TIMELINE (MAY VARY)
VIRGINIA DEPARTMENT OF TRANSPORATION (VDOT)	Approval required Research & data collection, construction, maintenance	Extremely High	Data Collection Phase/ Beginning Stage
STATE WILDLIFE AGENCY (VDWR)	Provides project recommendations, notably to VDOT Research & data collection, advisory body, project advocacy	High	Data Collection Phase/ Beginning Stage
THE PUBLIC	Support is primary motivator for approval May be involved in data collection and advocacy	Extremely High	Data Collection Phase/ Beginning Stage
ENVIRONMENTAL ORGANIZATIONS	Raises awareness and public understanding of projects, as well as advocacy efforts and coalition building.	High	Data Collection Phase/ Beginning Stage
BOARD OF SUPERVISORS	Provides recommendations, notably to VDOT Approval body for county decision-making (applicable to mitigation efforts on county owned roads)	High	End of Data Collection Phase/ After a Mitigation Strategy is Chosen
ENVIRONMENTAL COMMISSION	Advisory Body Provides recommendations to BOS	Medium	Data Collection Phase/ End of Data Collection Phase
NORTHERN VIRGINIA TRANSPORTATION AUTHORITY (NVTA)	Develops long-range transportation plan for NOVA Can act as a partner to VDOT in transportation planning	Medium	End of Data Collection Phase/ Mitigation Strategy Location Selection Phase
PLANNING COMMISSION	Advisory Body Provides information to BOS	Low	Mitigation Strategy Location Selection/ End of Data Collection Phase

3.2.1. Virginia Department of Transportation

Role and Responsibilities: The Virginia Department of Transportation is a critical actor in the decision-making process. Although the level of involvement in the process may vary, there will be VDOT oversight on installation and approval, especially since most roads are owned and maintained by VDOT. The department may be involved in research and data collection, such as identifying the priority areas for WVCs, evaluating possible strategies to implement, and calculating associated costs. They may also be involved in the design process for crossing structures, along with their implementation. Additionally, they may play a role in the long-term maintenance of the mitigation strategy (NDOT Research Report, 2022). Notably, VDOT has state and local offices, along with many divisions and various responsibilities.

Barriers: A primary barrier for VDOT is the budget. There are many competing priorities of VDOT, such as road expansion, repair projects, or other infrastructural priorities, where funding would be a priority as opposed to a WVC. For further clarity, this does not necessarily imply that WVC mitigation is not a priority of VDOT, especially since legislation for the Virginia Wildlife Corridor Action Plan involves VDOT in WVC mitigation efforts. However, the department has limited time and budget, which makes it extremely difficult to construct/implement a WVC mitigation strategy unless it aligns with their priorities. This stresses the importance of involving the department early in the process and aligning mitigation efforts with their priorities. Additionally, there is a general lack of data regarding WVC. Specifically, identifying priority sites, specific strategies, and understanding the driver safety risks are needed, as there is a lack of prioritized data and data solely on deer collisions as a metric for driver safety for traffic safety engineers. Notably, there is also no clear process on how to involve VDOT in the decision-making process or an organized system for implementation, which can create complications in the implementation process. There is no system to decide on where strategies would be implemented, how that would occur, or where to allocate funds. Further engagement with VDOT may be a beneficial step in figuring out a clear process. Currently, there are also differences in whether approval would be successful depending on the department level, highlighting a need for approval and engagement of the leadership level, not just the local, in order to effectively implement a WVC. For additional information on the project process for local VDOT projects, refer to Appendix 2 in this report, which includes a link to the Locally Administered Projects (LAP) manual.

Motivations: Available funding would be a primary motivator for a project's approval. Considering that the responsibility of construction and maintenance belongs to VDOT, providing funding for that would increase the chances of approval, especially since VDOT has various goals that would get funding priority over WVC. Additionally, a project at a local or regional level would be more feasible for VDOT. A more minimal approach, such as a roadside fence compared to an overpass construction, would also be feasible for implementation. Although numerous factors affect the cost of a particular mitigation strategy, such as scale, dimensions, materials, and required maintenance, mitigation efforts like roadside fencing along a pre-existing mitigation structure are generally cheaper than constructing a new mitigation structure (e.g., culverts or bridges), making them more feasible (Huijser

et al., 2022). Since VDOT is also a state agency, community support would act as a motivator for VDOT's involvement (appendix 2). A cooperative agreement between agencies, such as VDWR and VDOT, and a plan for who would maintain the structure would be beneficial. Having specific data on a location, strategy, costs, and associated implications for driver safety is an important motivator. Specifically, carcass removal data would be useful in highlighting the effectiveness of the proposed strategy. Lastly, a guidance document on how to involve VDOT in the process, along with specific information for the project plan, would be useful. One feasible method of WVC implementation is incorporating the project into a transportation plan so it would be a collaborative project that aligns with the goals of the department (NDOT Research Report, 2022).

Relationship to other Actors: VDOT has a hierarchical structure that includes a state, district, and local level, along with various divisions. The department may communicate with members of the Environmental Commission, the state wildlife agency, or the planning commission. The Northern Virginia District Office of VDOT (NVDO) may also communicate with the county department of transportation, which acts as a communication link between VDOT and the Board of Supervisors. Communication between counties and VDOT offices may vary depending on the district. The public may also reach out to their local VDOT office. Additionally, VDOT works closely with NVTA as a planning partner (VDOT, n.d.). However, there is no data proving that VDOT and NVTA would partner for a WVC project specifically, since there is no established process for implementing a WVC in this area. As a recommendation, a partnership between these two organizations could be a method to improve the efficiency of WVC project implementation or incorporate wildlife considerations into a transportation planning process.

3.2.2. State Wildlife Agency (Virginia Department of Wildlife Resources)

Role and Responsibilities: The Virginia Department of Wildlife Resources is a governmental department of Virginia that helps regulate wildlife conservation. Specifically, they may help collect data regarding WVC and formulate mitigation strategy ideas. Additionally, they may share suggestions or highlight certain areas of need for mitigation with other actors, such as VDOT, as a guide for wildlife conservation efforts. They may also aid in grant funding selection criteria, such as state or federal funding, if DWR has a role. Overall, the wildlife agency can offer data, expertise, advocacy, and political backing to transportation agencies seeking to address wildlife needs (NDOT Research Report, 2022)

Barriers: A primary barrier for the department is a lack of funding for mitigation efforts. Additionally, information gaps in WVC intensity, frequency, and species (non-deer collisions) may act as barriers.

Motivations: As a department that is focused on regulating wildlife conservation, they may be inclined to support or be involved in a WVC project since it is directly related to wildlife conservation. Specifically, they would be inclined to protect ecologically robust areas called "ecological cores" by reducing WVCs in high collision locations.

Relationship to other Actors: The Virginia Department of Wildlife Resources may have communication with the public on issues concerning wildlife or conservation, including WVCs. They may also communicate with VDOT,

although there may be variation in the individuals or departments that are in communication. Members of the department may also be involved with individuals or departments of the local government, including the Environmental Commission.

3.2.3 The Public

Role and Responsibilities: The public plays various important roles in the decision-making process. Constituents are a key factor in the approval process since most county government positions are elected bodies or are formed in order to serve and advocate for public needs. They also make up the citizen science organizations that may play a role in the data collection process, as well as project advocacy. They can voice their opinions on a project to their local decision-makers.

Barriers: A potential barrier to public support is that a majority of the population is simply not interested in WVC efforts. More specifically, if funding were to be sourced from taxpayers, there may be pushback from individuals who do not support a mitigation project. A lack of knowledge on the issue of wildlife-vehicle conflicts may be a reason for a lack of support**.** There may also be other priorities for citizens, such as pedestrian safety projects that would come first. One barrier specific to community citizen science organizations, supporting a WVC project, could be late involvement in the project. An organization may be more inclined to support and advocate for a project that they have been involved with or since the early stages and have an interest in.

Motivations: There may be many different motivators for the public, considering the broad range of individuals this term encompasses. One motivator for an individual may be a personal interest in WVC. They may have an interest due to the ecological, economic, or human safety aspect. Importantly, proposing the project in a way that is engaging and easily understandable is an additional factor to consider for gaining community support. The community, along with citizen science organizations, is also more likely to have an interest and support if a project they have been involved in since the early stages, as there may be a greater desire to see the project completed.

Relationship to other Actors: The public has connections with every other actor involved in the process. They can directly communicate with the Board of Supervisors, Environmental Commission, Planning Commission, county department of transportation, DWR, and VDOT. They may connect with members of each organization through emails, attending public meetings, or phone calls. The public can advocate for and support a project. Importantly, local citizen science organizations may communicate with other involved actors to spread awareness and advocate for a specific project.

3.2.4. Environmental Organizations

Role and Responsibilities: Environmental organizations play a major role in advocacy, education, and lobbying for environmental efforts, such as WVC mitigation. They may involve diverse actors and connect with various partners, building coalitions and collaborative efforts. These organizations help to get the public involved in certain issues as

well. Oftentimes, environmental organizations take on the needs of state agencies when they are unable to do it themselves and assist efforts by lobbying. ***

Barriers: Currently, the biggest barrier is funding. There is a lack of federal funding and funding for infrastructure. Additionally, even if funding is available, efforts by environmental organizations to push for a project may be rejected by decision-makers in the approval process.

Motivations: Environmental organizations are specifically designed to help environmental efforts, such as WVC mitigation; however, combining WVC efforts with other environmental issues, such as projects dealing with flood resilience, stream crossing, or climate change, can help to advance WVC mitigation efforts as well. Additionally, framing WVC mitigation efforts based on long-term effectiveness and savings is an effective way to gather support.

Relationship to other Actors: Environmental organizations, such as Wild Virginia, act primarily in partnerships with local or state governments, but may also act as an advisory body in certain cases. Importantly, efforts are mostly collaborative. They may also form formal or informal partnerships with other non-governmental organizations.

3.2.5. Board of Supervisors

Role and Responsibilities: The Board of Supervisors is an elected governing body. The Board sets county policies, adopts ordinances, appropriates funds, approves land rezonings and special exceptions to the zoning ordinance, and carries out other responsibilities set forth by the Virginia State Code. One role of the Board in WVC implementation is pushing project initiatives to VDOT. If a project is proposed to the Board, they would have staff assess the project for factors such as costs, planning, zoning, constituent opinions, etc., and if approved by the Board, it would be sent to VDOT to consider. Projects may be proposed to the Board by another committee, the public, or by a Board member themselves through a board member's initiative. A board member's initiative usually occurs if a project is of special interest to the Board member or directly aligned with their values/goals.

Barriers: The main barriers to approval for the Board of Supervisors are a lack of community support for the project, extremely high costs associated with the strategy, a lack of funding, and conflicting priorities. While there are many projects in the county, projects that might directly compete with WVC reduction projects include pedestrian safety projects, green space projects, or development projects. These projects may act as primary competitors in the area of road projects, secondary to general transportation.

Motivations: A primary motivator of approval is strong community support and advocacy for a proposed project. Additionally, supporting data is also an important factor for consideration. Projects would only be approved if they are expected to be effective, which is why it is important to have data to support a mitigation project. Available funding is also a motivator for approval, especially if it is found outside of county funds.

Relationship to other Actors: The Board is directly connected to the public. There are a multitude of ways that the Board communicates with the public, including meetings, letters, or emails. Citizen scientist organizations play a

vital role in advocacy and pushing initiatives to the Board. The Board also meets with the Environmental Commission, where project ideas may be pushed to the Board. They also communicate with the planning commission and the county department of transportation. The Board may directly communicate with the NOVA district office of VDOT, but communication is primarily through the county department of transportation and the Northern Virginia District Office of VDOT. Additionally, the Board communicates with the NVTA. Two Board members are also members of NVTA.

3.2.6 Environmental Commission

Role and Responsibilities: The Environmental Commission is an advisory body to the Board, communicating recommendations on policies and practices related to environmental issues. The commission is not involved in the approval process but has the role of examining certain issues and creating recommendations that may help push a project forward. When a specific project is proposed by staff and approved by the Board, it is likely that the Environmental Commission would be consulted on implementation, but not required. They work closely with county staff for recommendations. Notably, all topics recommended by the commission to be included in the county's environmental work plan, including wildlife corridors, were approved by the Board. Also, the Environmental Commission has been consulted by staff on the implementation of some projects in the work plan.

Barriers: There are no technical barriers to approval since they are an advisory board. However, there may be barriers that prevent a project from being examined or recommended by the commission. Most suggestions for the commission to evaluate are approved by the county administrator before examination. If the county administrator or county staff do not approve or push for a project, then it would not make it to the Environmental Commission. The Board may also not approve of a commission recommendation, inhibiting the implementation process. Additionally, the Environmental Commission has a budget, but funding for a mitigation strategy, even cost-effective fencing, would not be provided by this fund pool.

Motivations: Community advocacy through means of letters, meeting attendance, or public hearing inputs may motivate the Environmental Commission to examine and recommend a project. Specifically, advocacy from a citizen science organization may hold weight when pushing for a project. The Board may also suggest a project for the commission to examine. A project is more likely to be recommended if it is a feasible strategy and related to the county's comprehensive plan.

Relationship to other Actors: The Environmental Commission communicates directly with county staff to make recommendations to the Board of Supervisors. Project ideas may be pushed to the Board from the commission, or the Board may suggest an idea for the Board to review. The public may also communicate with the Board. Members of the Environmental Commission may also communicate with DWR. The commission may also have communication with the local district office of VDOT, but this may not be consistent.

3.2.7. Northern Virginia Transportation Authority (NVTA)

Role and Responsibilities: The Northern Virginia Transportation Authority is a regional body that develops the long-range transportation plan for Northern Virginia. They evaluate and fund multimodal transportation projects (NVTA, n.d.).

Barriers: A project that conflicts with pre-existing priorities of the council may act as a barrier. Specifically, this organization prioritizes reducing traffic congestion, so this will be its top priority compared to WVC mitigation.

Motivations: Involvement in a WVC project may be motivated by recommendations from the Board of Supervisors or high amounts of public support for the project.

Relationship to other Actors: The NVTA works closely with VDOT as a planning partner for planning processes. They may coordinate on a WVC mitigation project or incorporate wildlife considerations into the transportation planning process. The NVTA coordinates with the BOS, with some individuals being members of the NVTA and a Supervisor.

Additional Information: There are many possible motivations, barriers, and potential relationships that are unknown due to a lack of data. Importantly, there are not enough WVC mitigation projects at the county level for this study area to establish a clear role and involvement of the organization. Additional data is needed to better understand factors influencing their involvement in WVC mitigation efforts.

3.2.8. Planning Commission

Role and Responsibilities: The planning commission is an advisory body to the Board of Supervisors, appointed by the Board. They have the ability to make final decisions on certain projects, but primarily make recommendations to the Board of Supervisors. The planning commission holds public hearings for all land use cases that come before it.

Barriers: Since the planning commission is mainly an advisory board, there are not many barriers associated with approval. The primary barriers that may prevent an issue from being recommended or approved by the commission are a lack of community support or a lack of support from other government bodies, such as the Board of Supervisors.

Motivations: As mentioned, as an advisory board, there are not many motivators. However, it should be noted that advocacy at the board office level, public engagement, Board support, and coordination between the county department of transportation and state department of transportation were mentioned to be factors to help facilitate effective implementation.

Relationship to other Actors: The planning commission has a direct connection to the Board of Supervisors since they are an advisory board. A project may be pushed to the commission from the Board for evaluation, or the commission may suggest a recommendation to the Board. The public may be involved in projects that the planning

commission is evaluating, especially through public hearings. The commission may also communicate with the Environmental Commission if relevant to the project at hand.

4. Discussion

4.1 Understand actors and their values and motivations

The first step in the framework is understanding who is involved in the process and how to engage them. It is important to understand their values, motivations, and the factors that would lead to their approval/support or disapproval of a proposed project. For this report, this was done through a literature review and interviews with key actors. For readers who want to apply our approach to new localities, our recommendation is to systematically map the relevant constituents and actors in their decision-making process. Our model (Figure 2) might be a helpful starting point.

4.2 Funding is the primary barrier

One of the primary barriers that was a constant throughout the interviews and literature review is funding (NDOT Research Report, 2022). Mitigation strategies, even a roadside fence, are costly. Many organizations have built-in budgets; however, they have various priorities for which funds are allocated, which often do not include WVC mitigation. A lack of funding for a mitigation strategy can be an inhibitor of the approval process, especially for organizations that would be responsible for the cost and maintenance (e.g., VDOT). This is why examining and identifying funding for a mitigation strategy is a key factor of effective implementation and should be done as soon as possible in the process. Refer to Appendix 5 for possible funding sources recommended in the 2022 NDOT Research Report (NDOT Research Report, 2022) (Appendix 5).

4.3 Citizen science and community engagement are key

One of the primary motivating factors for the approval of all organizations is community support and advocacy for a WVC. At the local level, most state or government agencies are designed to serve constituents and advocate for their interests (Anderson, 2022). If the community strongly supports a project, there is a better chance of approval. There are many ways that a community can advocate for a project they support, one being through citizen science organizations (Appendix 2). Recommendations by citizen science organizations hold weight in the decision-making process for local governmental bodies, including the Environmental Commission and Board of Supervisors. Engaging with constituents and citizen science organizations should be done, if possible, during the data collection process to help foster connections and build support for the project. Involving citizen scientists in the research and data collection process is a key method to involve the community in the beginning stages of the project (Politte, 2025).

4.3 Further examine the process specifically for VDOT.

VDOT is one of the main actors involved in the implementation process. Even if all other actors approve of the project, it most likely will not be implemented if it is not approved by VDOT. State transportation agencies are involved in the planning, design, data collection, monitoring, maintenance, and public promotion of wildlife mitigation (NDOT Research Report, 2022). However, the responsibility of the department for WVC mitigation efforts is divided among the different divisions in the department. Therefore, there is no specific person or department that helps support and guide WVC mitigation efforts. Supporting data suggests that VDOT is the actor that would cause a roadblock for WVC mitigation implementation. The main challenge is the various priorities that VDOT has, such as road repairs and expansion, which take priority over WVC mitigation. Significantly, the Virginia Wildlife Corridor Action Plan (VWCAP) does emphasize WVC efforts in the department and interagency relationships through state legislation, but does not actually require any mitigation strategy to be constructed (VWCAP, 2023). Therefore, there is no legislation requiring VDOT to fully implement and maintain a mitigation strategy. Additionally, there is no clear path in the decision-making process for VDOT, specifically for WVC mitigation, or even knowledge of the full extent of their involvement for the different types of mitigation strategies. There have not been enough WVC mitigation projects in this study area to establish a clear process. This is why it is crucial to further understand how to involve VDOT in the process, gain their support, and what the process of decision-making specifically for VDOT. Lastly, the NVTA is a state agency that works closely with VDOT in the planning process (VDOT n.d.). As mentioned, a collaboration between NVTA and VDOT on WVC mitigation efforts may serve as a tool for effective implementation.

4.4 Importance of mitigation strategy type

A main consideration that will impact the likelihood of a project's approval is the mitigation strategy type. A mitigation strategy may be an overpass, underpass, culvert, dynamic road sign, or roadside fence connected to an existing underpass, or a combination of several of these. Although it is still costly, a roadside fence alongside a pre-existing mitigation structure would be the most cost-effective option, alongside signage. Certain mitigation strategies may be more effective for a specific location; however, feasibility and likelihood of approval must be considered along with ecological considerations.

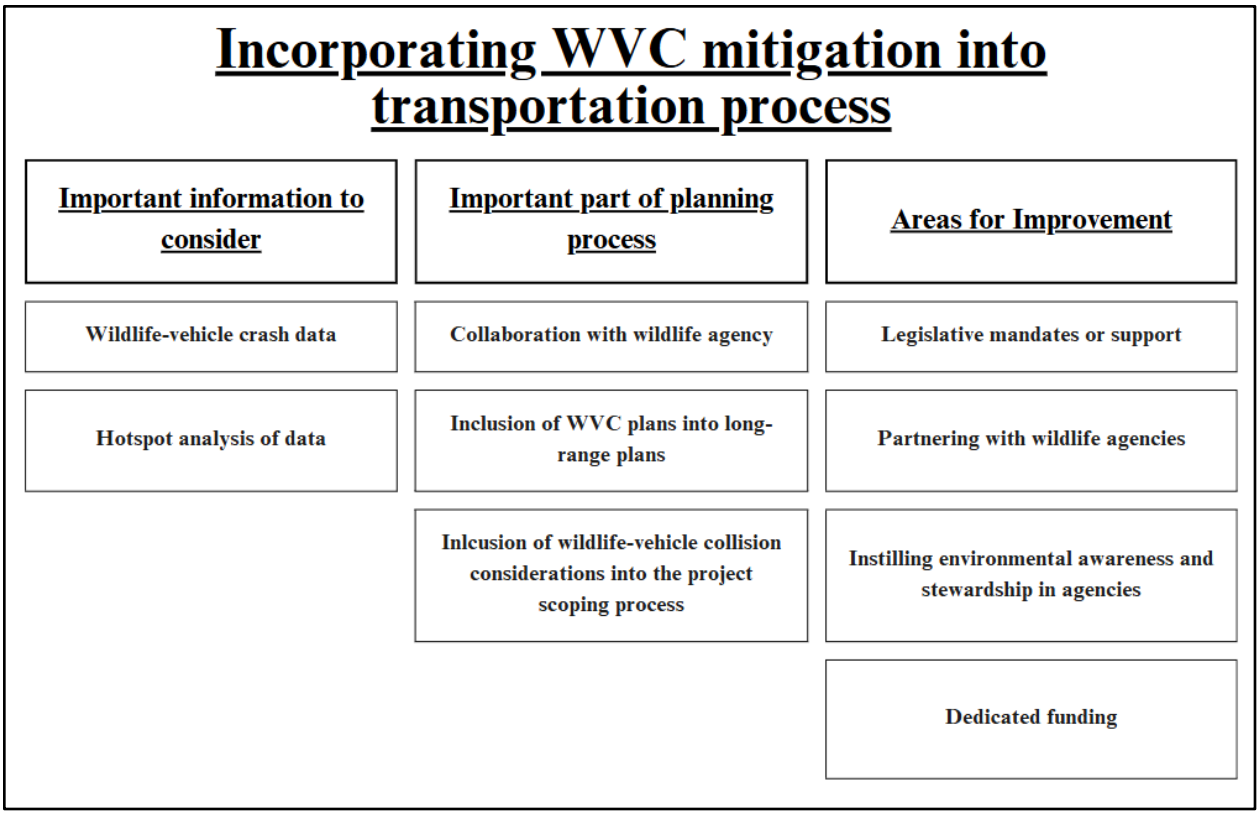
5 Recommendations

5.1. Integrate the project into the transportation process

Based on the research findings highlighted in this report, implementing a standalone mitigation strategy may be challenging. Funding, along with conflicting priorities, acts as a barrier to approval. One recommendation based on collected data is to integrate a WVC mitigation project into the transportation process. Generally, the transportation process is complex and long, over many years. If a mitigation project is already designed, then one method of implementation could be to incorporate it into a transportation plan if the situation allows for it. Specifically, the target location for the mitigation effort and the transportation plan would have to overlap. There are many different

scenarios in which this could happen, but a general recommendation is to consider this as an option when designing a mitigation project and researching ongoing transportation plans. On a more general scale, another recommendation is to incorporate wildlife considerations into transportation planning, which is currently prompted by Virginia's Wildlife Corridor Action Plan. Overall, considerations for wildlife and WVC in the transportation process should be standardized and would help mitigation efforts. For any mitigation effort that is related to the transportation planning process or a transportation plan, timing is a critical factor to consider, especially since these are projects that may be planned years in advance and take years to complete, depending on the situation. This may be done by effective collaboration between a state wildlife agency and the Department of Transportation. Additionally, local jurisdictions also do long-term transportation planning that incorporates a WVC. One successful example of effective collaboration is a memorandum of understanding between wildlife agencies and the state department of transportation (NDOT Research Report, 2022) (Appendix 4). Although this is not a legally binding document, it is an agreement to state that the goals of both organizations include focusing on the mitigation of WVC. Additionally, studies highlight the importance of WVC crash data and other relevant supporting data, dedicated funding, WVC-related legislation aimed at making transportation agencies address WVC mitigation efforts, and agency culture on environmental stewardship, specifically from the top down, as key considerations for integrating wildlife needs into transportation planning (NDOT Research Report, 2022). As an example, as roads are repaired and/or upgraded, are there opportunities to install wildlife crossing structures to minimize the costs of the mitigation structures? Similarly, when new roads are planned, can WVC mitigation be considered part of the original design? In some cases, there could be alignment between wildlife crossing structures and infrastructure that helps to manage stormwater.

Table 3: Table highlighting important factors for WVC concerns in the transportation process from the NDOT 2022 Report



5.2. Consider factors of this framework in the beginning stages of the project:

One of the main takeaways from this report is to consider these factors in the early stages of the process, preferably when the idea of a WVC project is developing. Many of the actors, especially VDOT and the public, need to be involved or have their role considered in this process from the very beginning. This is especially true if the goal is to integrate the project into a transportation plan or planning process, rather than a standalone project. Additionally, it is important to consider the key factors for successfully incorporating WVC considerations into transportation planning as early as possible, especially when data highlights WVCs as a growing concern. Actors involved in the early stages will be more likely to approve and advocate for a project since they have been involved from the beginning. If there is a consideration of WVC efforts, be sure to understand who would be involved, how to engage with them, what data is relevant to them, where funding may come from, and how to build support for approval in the early stages.

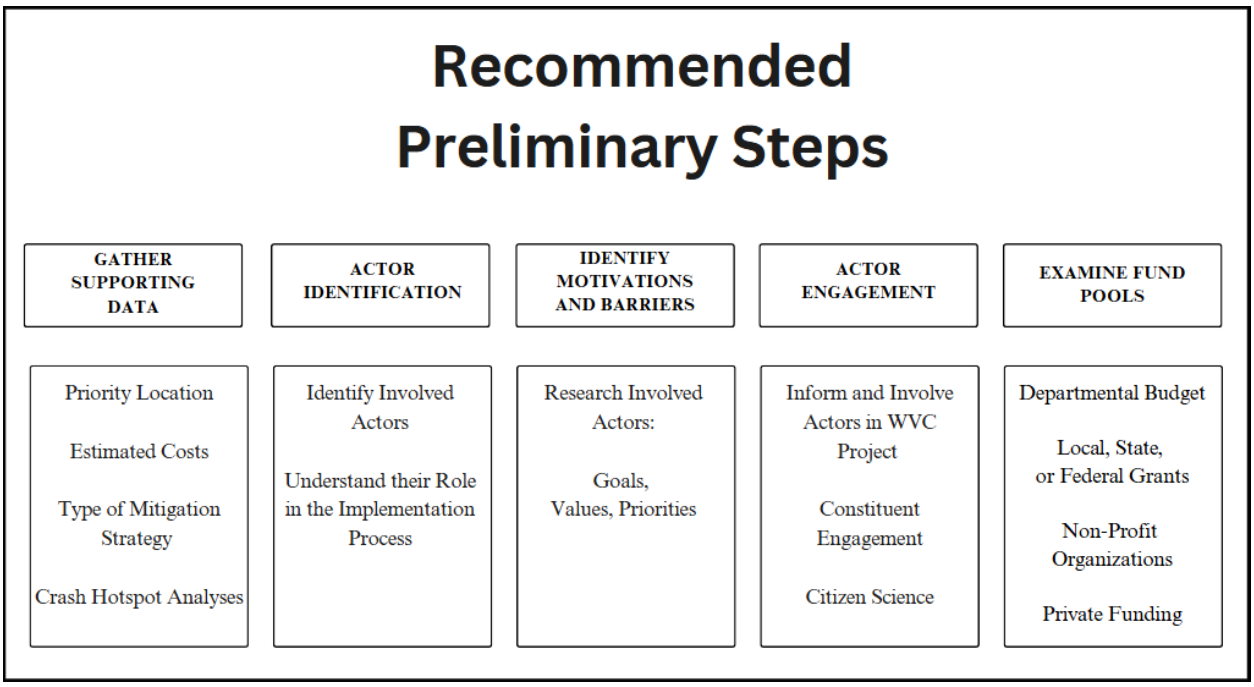


Figure 3. Graphic highlighting the recommended factors to consider in the early project development phase

6. Conclusion

In order to bridge the gap between data collection and implementation, it is necessary to understand how to effectively and efficiently navigate through the decision-making process by understanding who is involved and the associated barriers and motivations. Although there is currently no clear path of navigation for WVC mitigation implementation, there is information on who is involved and what factors may increase the chances of a project's approval. Despite various paths leading to implementation, community support is a consistent primary driving force for the approval process, while funding and conflicting priorities act as barriers. This report should act as a guide to assist interested actors in understanding those factors.

Acknowledgments

This research was possible through the funding of the Institute for Integrative Conservation at William and Mary, along with continuous support from Erica Garroutte. This research was initiated and conducted in collaboration with the Virginia Department of Wildlife Resources. Lastly, this report would not have been possible without the involvement of the interviewees who participated in this research.

References

Allen, S. (2022). Sharing the landscape with white-tailed deer. *Loudoun Wildlife Conservancy*. https://loudounwildlife.org/2022/08/sharing-landscape-deer/

Anderson, J. E., Moyer, J., & Chichirau, G. (2022). *Public policymaking*. Cengage.

Busby, A. (2023). Prioritizing wildlife crossings in Loudoun County, VA. *Research report, Institute for Integrative Conservation*.

Donaldson, B. M., & Kweon, Y.-J. (2019). Deer advisories on changeable message signs as a deer crash mitigation tool. *Transportation Research Record, 2673*(12), 548-557. https://doi.org/10.1177/0361198118823204

Donaldson, B., & Elliott, K. (2021). Human-wildlife interactions: Enhancing existing isolated underpasses with fencing reduces wildlife crashes and connects habitat. *Human-Wildlife Interactions, 15.*

Gerson, K., & Damaske, S. (2021). *The science and art of interviewing*. Oxford University Press.

Huijser, M. P. (2008). *Wildlife-vehicle collision reduction study report to Congress*. U.S. Department of Transportation, Federal Highway Administration.

Huijser, M. P., Duffield, J. W., Neher, C., Clevenger, A. P., & McGuire, T. (Eds.). (2022). *Final report 2022: Update and expansion of the WVC mitigation measures and their cost-benefit model* (Transportation Pooled Fund Study, TPF-5(358)). Nevada Department of Transportation.

Jones, D. N. (2022). *A clouded leopard in the middle of the road: New thinking about roads, people, and wildlife*. Cornell University Press. https://doi.org/10.1515/9781501763724

Nevada Department of Transportation. (2022). *The strategic integration of wildlife mitigation into transportation procedures: A manual for agencies and partners* (Report No. 700-18-803, TPF-5(358)).

Northern Virginia Transportation Authority. (n.d.). *Home*. Northern Virginia Transportation Authority. https://thenovaauthority.org/

Politte, S., Santella, C., Green, J. & Swaddle, J. P.l (2025) Wildlife vehicle conflict in Virginia: How wildlife's use of road crossing structures can inform mitigation of wildlife-vehicle conflict in Loudon County, VA. *Research report, Institute for Integrative Conservation*.

Van Der Ree, R., Smith, D. J., & Grilo, C. (Eds.). (2015). *Handbook of road ecology*. John Wiley & Sons.

Virginia Department of Transportation. (n.d.). *Project planning*. Virginia Department of Transportation. https://www.vdot.virginia.gov/projects/project-planning/

Virginia Department of Wildlife Resources. (2024). *Virginia deer management program*. https://dwr.virginia.gov/wildlife/deer/deer-management-program

Virginia Wildlife Corridor Action Plan. (2023). *Making roads safer for people and wildlife*. https://dwr.virginia.gov/wp-content/uploads/media/Virginia-Wildlife-Corridor-Action-Plan.pdf

Appendix

Appendix 1: Navigating zoning in your County

An individual can conduct research using a county website in order to navigate zoning laws in a specific county. Websites contain information related to the zoning/planning commission or Department of Planning and Development, which are responsible for county zoning, along with relevant documents, including the county zoning ordinances. Contact information for emailing or calling with questions is also available on the county website. For some counties, the planner of the day is the point of contact for zoning questions. Policies and departments will vary by county.

Appendix 2: WVC Project Advocacy

In order to show support for a local WVC project, please reach out to your local government officials, including the Board of Supervisors, natural resource and land conservation trust non-government organizations (NGOs), DWR, or VDOT officials. This may be done through emailing, letters, telephone calls, or attending public meetings. Contact information for departments and individuals may be found on the county or the Virginia Department of Transportation website.

Link to VDOT website: Home | Virginia Department of Transportation

Link to general VDOT contact information: Contact VDOT | Virginia Department of Transportation

Link to VDOT district information: Districts | Virginia Department of Transportation

Link to VDOT Public Involvement: https://www.vdot.virginia.gov/doing-business/technical-guidance-and-support/technical-guidance-documents/locally-administered-projects-manual/chapter-12/#chapter-12-4

Link to VDOT Locally Administered Project Manual: Locally Administered Projects Manual | Virginia Department of Transportation

Appendix 3: Example Interview Questions

1. In what situations could a county initiate a wildlife crossing project with VDOT, and how would that work in a best-case scenario?
2. How do counties get involved with VDOT projects? Does VDOT have carte blanche authority to implement road projects without county oversight or partnership? If not, what does that partnership look like, and when do counties get involved?
    a. Alternatively, when there is a county road project, when does VDOT get involved? Does the county have carte blanche authority to manage its own projects without VDOT oversight?
3. What would you say is the prioritized criteria for earning a spot on the department's agenda for a wildlife crossing or any other wildlife-vehicle conflict mitigation strategy? Specifically, could you describe the

process of how something, such as a mitigation structure/wildlife crossing, becomes a finalized project for the department?

   a. How would a wildlife-vehicle conflict mitigation strategy, such as roadside fencing or signs, garner the attention of the department and become a part of the department's agenda?

4. In the event of a wildlife-vehicle conflict mitigation measure within a road system managed solely or primarily by VDOT, would the county be involved in:
   a. Modifications to current infrastructure
      i. Installation of fencing parallel to the road to funnel wildlife movement under existing bridges and culverts
      ii. Modify culverts or bridges in such a way to make them more attractive/accessible to wildlife while maintaining all necessary engineering requirements for structural integrity and storm water management.
   b. Seasonal placement of changeable message signs
   c. Potential construction of an overpass designed specifically for wildlife crossing over a road, with fencing parallel to the road to funnel wildlife through the overpass.
5. What information or support might the department have to help guide partners in the wildlife conflict mitigation process, and what is the scope of who those partners are?
6. What are the primary barriers or influencers to implementing certain wildlife-vehicle conflict mitigation strategies? Please include any possible barriers/influencing factors, including internal ones within the department, along with external factors that may influence departmental decisions.
   a. Roadside fencing
   b. Road signs
   c. Overpass/Underpass
7. Are you aware of any other potential individuals or organizations that may be involved in the implementation process, specifically for mitigation strategies?
8. Are you aware of available funding mechanisms for work relating to wildlife-vehicle conflict mitigation? How do you typically hear about funding opportunities available for public projects?

Appendix 4: Example of Memoranda of Understanding (Sourced from NDOT Report, 2022)

Link to website where MOU was sourced: The Strategic Integration of Wildlife Mitigation into Transportation Procedures: A Manual for Agencies and Partners - TRID

Link to download the report where the MOU was sourced: https://pooledfund.org/Document/Download?id=11854

Memoranda of Understanding and Agreement

This appendix presents three Memoranda of Understanding (MOU) and an Agreement (MOA) from Colorado. The MOU and MOA are between the state transportation and wildlife agencies, spelling out how they will work together to minimize wildlife-vehicle collisions and provide connectivity for wildlife.

COLORADO MEMORANDUM OF UNDERSTANDING
BETWEEN THE COLORADO DEPARTMENT OF
TRANSPORTATION AND THE COLORADO DEPARTMENT OF
NATURAL RESOURCES DIVISION OF PARKS AND WILDLIFE

Whereas, the Colorado Department of Transportation, hereinafter referred to as CDOT, is charged under the laws of the State of Colorado with the construction and maintenance of the state's highways, and

Whereas, a significant number of aquatic and terrestrial wildlife inhabit or cross highway rights-of-way under the administration of CDOT, and
Whereas, the Department of Natural Resources Division of Parks and Wildlife, hereinafter referred to as CPW, is charged under the laws of the State of Colorado with the management and enhancement of the state's wildlife resources, and

Whereas, it is the mutual desire of these agencies to manage aquatic and terrestrial wildlife within highway rights-of-way in a cooperative manner to satisfy their respective charges for the best interests of the people of Colorado and its visitors, and

Whereas, on August 21, 2019, Colorado Governor Jared Polis signed Executive Order D 2019 011, Conserving Colorado's Big Game Winter Range and Migration Corridors directing CDOT and CPW to develop and Memorandum of Understanding (MOU) outlining their collaboration and support for the Wildlife and Transportation Alliance and the implementation of big game crossings over and under roadways in Colorado.

Now Therefore, CDOT and CPW agree:

Background:

CDOT exists to ensure that Colorado has a safe and efficient highway system by building and maintaining interstates, U.S. highways and state highways. CPW's mission is to perpetuate the wildlife resources of the state, to provide a quality state parks system, and to provide enjoyable and sustainable outdoor recreation opportunities that educate and inspire current and future generations to serve as active stewards of Colorado's natural resources. It is for the economic, social, cultural and recreational

benefit of Colorado's citizens and visitors that CPW and CDOT collaborate for the common purpose of maintaining and improving Colorado's transportation systems while simultaneously protecting and managing Colorado's fish and wildlife resources and their associated habitats. This MOU embodies the idea that these goals are not mutually exclusive and so establishes a program of cooperation between the agencies.

This MOU supersedes the previous MOU (198), entitled, "Memorandum of Understanding between the State of Colorado Departments of Highways and Natural Resources Divisions of Highways and Wildlife." It does not invalidate any other MOUs or other agreements between CPW and CDOT regions.

Authority:
This MOU is entered into pursuant to the authority of Colorado Revised Statutes Sec. 331-105(e) & 43-1-105, and Colorado Governor Executive Order (EO) D 2019 011.

SPECIFIC AREAS OF COLLABORATION:
Implementation of EO D 2019 011, Conserving Colorado's Big Game Winter Range and Migration Corridors

Both parties agree:
1. To cooperate to determine possible mitigation for Wildlife-Vehicle Collisions (WVCs) during all phases of transportation planning and transportation project implementation.
2. To Identify priority areas for the implementation of big game crossings over and under roadways in Colorado using the best available science.
3. To continue to support the Wildlife and Transportation Alliance (Alliance), and to use the Alliance to raise awareness, forge partnerships, and identify potential public and private funding opportunities to construct new wildlife crossing structures.

Wildlife/Vehicle Collisions (WVC)
CDOT shall:
1. Have primary responsibility for removal and disposal of roadkill elk, deer, and antelope from federal and state highways in Colorado (see CDOT Procedural Directive 1005.1).
2. Remove from the road prism to avoid attracting public attention roadkill bear,

mountain lion, bobcat, lynx, bighorn sheep, mountain goat, moose, wolverine and wolf. Within 24 hours of removing one these species from the road prism and prior to moving the carcass off site, CDOT maintenance staff shall report to local CPW staff the species and location, and coordinate with CPW on proper carcass disposal.

3. Report animals killed on the roadway to the nearest 1/10 mile by the most efficient and accurate means available, and entered into its statewide database quarterly.

4. Encourage a photo be taken of unknown, but identifiable, roadkill and sent to CDOT's Regional or HQ biologist for positive identification, particularly if one of the aforementioned species is suspected.

5. Provide CPW Regional Managers and Terrestrial Section Manager (Appendix B Contacts) an electronic copy of CDOT's Quarterly Roadkill Report.

6. Inspect and repair any deficiencies found in existing wildlife fencing or other wildlife mitigation feature within 30 calendar days or as conditions allow.

CPW shall:

1. Remove from federal and state highways roadkill elk, deer and antelope first discovered by CPW staff that present a clear hazard to human health and safety. Locations of roadkill elk, deer and antelope removed by CPW staff shall be reported to CDOT to the nearest 1/10 mile for its statewide roadkill tracking database.

2. Coordinate with local CDOT staff on reports of roadkill bear, mountain lion, bobcat, lynx, bighorn sheep, mountain goat, moose, wolverine and wolf.

3. Inform the appropriate CDOT Region or HQ Biologist of deficiencies in existing wildlife fencing or other wildlife mitigation feature(s).

Data Access and Information Sharing

CDOT shall:

1. Respond to individual requests from CPW for transportation system information within 30 calendar days unless otherwise coordinated.

2. CDOT HQ biologist will respond to individual requests from CPW for roadkill information collected by CDOT's maintenance crews and law enforcement agencies within 2 weeks unless otherwise coordinated.

3. upon request, include individuals from CPW on the distribution of quarterly and annual roadkill reports.

4. Map and share individual requests for animal/vehicle conflict areas.

5. Inform the appropriate CPW Regional Manager, or designee, of future projects which have the potential to obstruct wildlife movement beyond current baseline levels, and provide the opportunity to comment or advise on possible measures to mitigate the impacts.
6. Comply with the terms of the data sharing agreement provided in Appendix A when utilizing project-specific data provided by CPW.

CPW shall:

1 . When information or data is available, identify and share wildlife seasonal ranges and migration corridors that may affect CDOT activities on a statewide basis.
2. Upon request, cooperate in the development of best-management-practices to minimize CDOT's impact on wildlife and their habitat.
3. Respond to individual requests from CDOT for wildlife related information within a reasonable time, not to exceed thirty calendar days. Unless otherwise coordinated, these requests will not pertain to currently unpublished data, on going research data, or other data with restricted access as noted by CPW.
4. Upon request, CPW shall provide CDOT with annual GIS-based maps of known raptor nests and necessary buffer zones. Given the statutory duty under CORA to protect information related to private lands that would identify, or allow to be identified, landowners or lands, CPW will share the requested data related to private lands with CDOT because, as a state agency, it shares with CPW the duty to protect such information.
5. Respond to CDOT's request for comment on future projects, which have the potential to obstruct wildlife movement beyond current baseline levels within a reasonable time not to exceed thirty calendar days. An indication of 'no comment' is acceptable.

Both parties agree:

1. Unless impractical, sharing data electronically is preferred over hard copy.

Communication and Coordination

Both parties agree:

1. Meet annually to discuss topics of mutual concern. Potential substantative topics include but are not limited to vegetation management, fencing, SB40, Statewide Transportation Improvement Program (STIP), carcass removal, and habitat connectivity.

2. A principle representative(s) will be appointed for each agency and will be responsible for the coordination and continuation of the meetings throughout the lifespan of this MOU.
3. Review and update on an annual basis, a roster of relevant Agency contact information, as listed in Appendix B.
4. Meeting notes will be taken and distributed to CDOT RPEMs, CDOT Maintenance Superintendents, CDOT HQ wildlife program, CPW Regional Managers, Terrestrial and Aquatic section heads and CPW Statewide PIO.
5. Continue to champion the Colorado Wildlife and Transportation Alliance as co chairs. Both agencies will identify resources to ensure its momentum, relevance and success.
6. Look for opportunities to coordinate at both a regional and statewide basis.

Public and Media Relations

Both parties agree:

1. When issuing a press release which may impact or affect the other agency, the affected agency will be given advance notice and provided an opportunity to offer input on the draft press release, before it is released to the public.
2. In situations where media contact is immediate and does not afford communication with the other agency, any statements given in respect to the other agency will be relayed to that agency and an opportunity to clarify those statements to the press will be given.
3. Both agencies agree to use common language and overall speaking points to provide consistency and continuity with the Colorado Wildlife and Transportation Alliance efforts.
4. If promoting work, outreach or information through a variety of communication channels to include social media, traditional press and/or web platforms the primary agency will tag, mention or link to the partnering agency's platforms when appropriate.
5. For all of the above, both parties will coordinate with their respective Director of Communications or designee. See Appendix B.

Training

CDOT shall:

Consider training CPW employees who interact with CDOT on topics that would improve communication and understanding (e.g. development and review of transportation construction plans and specifications, efficacy of

wildlife crossing structures for various species, etc.).

CPW shall:

Consider training CDOT employees who interact with CPW on topics that would improve communication and understanding (e.g. track identification).

Nothing in this MOU by and between CDOT and CPW shall be construed as limiting or expanding the statutory or regulatory responsibilities of either agency or any involved individual acting on behalf of the agency or in performing functions granted to them by law; or as requiring either agency to expend any sum in excess of its respective appropriation. Each and every provision of this MOU is subject to the laws and regulations of the State of Colorado and the United States.

Nothing in this MOU shall be construed as expanding the liability of either party. In the event of a liability claim, each party shall defend their own interests. Neither party shall be required to provide indemnification of the other party. This MOU does not in any way restrict any entity from participation in similar activities with other public or private agencies, organizations, and individuals.

The memorandum of understanding shall become effective when signed by the designated representatives of the parties hereto and shall remain in force until terminated by mutual agreement, or by any party upon thirty days notice in writing to the others of its intention to do so. Amendments to and deviations from this agreement may be proposed by any party and shall become effective upon approval of written supplemental agreements by all parties.

This MOU shall remain in force for ten years from the date of the last signature unless it is mutually extended or formally terminated by either party after thirty (30) calendar days written notice to the other party.

Colorado Department of Transportation

By _____
Chief Engineer

Date _____

Colorado Parks and Wildlife

By _____
Director

Date _____

Appendix 5: Possible Funding Sources from NDOT 2022 Report

Link to website: The Strategic Integration of Wildlife Mitigation into Transportation Procedures: A Manual for Agencies and Partners - TRID

Link to download report: https://pooledfund.org/Document/Download?id=11854

Funding Source - Partner	**Comments**
Local Governments	Counties and cities can conduct surveys, build cattle guards, and raise funds for wildlife mitigation. See Colorado Case Study in Appendix A. Case Studies, and Kintsch et al. 2019.
State and Provincial Wildlife Agencies	These agencies can tap into state, provincial, and federal funding sources, such as Pittman-Robertson Funds in the U.S.
State/Provincial Traffic Safety Funds	This has traditionally been the main source of funding wildlife crossing structures for larger animals that cause more severe crashes with human safety concerns.
Federal Highway Safety Improvement Program	In the U.S. this is the HSIP fund that is available for projects that achieve significant reduction in traffic fatalities and serious injuries.
Federal Tribal Transportation Program	In the U.S. TTP is the largest program within the Office of Federal Lands Highways and is to address the need of Tribal Governments for safe transportation.
Federal Nationally Significant Federal Lands and Tribal Projects	NSFLTP was established with the 2015 Transportation Act provides funding for construction and rehabilitation of nationally significant projects on federal and tribal lands.
Federal Lands Transportation Program for Federal Lands	FLTP funds projects that improve access to federal lands. Within each transportation act, each federal land agency is allocated a set amount for the coming five years. These funds can be accessed for projects on the specific agency's lands.
Federal Lands Access Program	FLAP or Access Program provides for projects on areas that are facilities that are located adjacent or in federal lands. FLAP calls out wildlife passage as a standalone category for funding.

Funding Source - Partner	Comments
Federal Transportation Alternatives Program	TAP was eliminated with the 2015 Transportation Act (FAST Act). It was replaced with set aside Surface Transportation Block Grants Program for transportation alternatives.
Federal Transportation Investment Generating Economic Recovery	TIGER funds for transportation projects are highly competitive and have not typically been used to fund wildlife mitigation projects, but they are not excluded from potential funding.
Non-Profit Organizations	Conservation organizations and sports people groups have helped dedicate funds to wildlife mitigation projects and will continue to do so in areas they deem important to their constituents.
Citizens Organizations and Private Funding	In multiple cases, private citizens have created non-profit organizations and raised tens of thousands to hundreds of thousands of dollars for wildlife mitigation.
Taxation	Citizens have voted to tax themselves for wildlife connectivity and the money has been used to create wildlife crossing structures. See the Pima County Case Study Cramer et al. 2022a.
License Plates	Since 2017 the Wyoming wildlife crossing license plate has raised over $300,000 as of early 2021, dedicated to the construction of wildlife crossing structures and other mitigation options. See URL: http://wildlifecrossingswork.com/

Text from NDOT Report (NDOT Research Report, 2022):

Link to website: [The Strategic Integration of Wildlife Mitigation into Transportation Procedures: A Manual for Agencies and Partners - TRID]

Link to download report: https://pooledfund.org/Document/Download?id=11854

The 2021 U.S. Transportation Infrastructure Law, also known as the Bipartisan Infrastructure Law (BIL, https://www.fhwa.dot.gov/bipartisan-infrastructure-law/), provided several opportunities to fund wildlife crossing structures and other mitigation with federal funds that will be available for these programs in 2022 as a pilot program that may someday become standard in future transportation acts. A manual for helping to develop projects under the federal wildlife crossings pilot program is available at: https://largelandscapes.org/wp content/uploads/2021/12/Crossing-Toolkit_Final.pdf. See Paul et al. (2021). There are ten potential areas of funding at the U.S. federal level that can be tapped into for building wildlife crossing structures. 1. The Wildlife Crossing Pilot Program supplies $350 million toward wildlife mitigation over five years. 2. The Surface Transportation Block Grant Program with $12 billion over five years. 3. Nationally Significant Freight and Highway Projects (INFRA) 4. Federal Lands Transportation Program with $12.2 billion over five years. 5. Bridge Investment Program provides $12.5 billion over five years. 6. Program to Protect Resilient Operations for Transformative, Efficient, and Cost-saving Transportation (PROTECT) helps with climate change adaptations. 7. The National Culverts Program

supplies $5 billion over five years. 8. Forest Service Legacy Roads and Trails Program funds $250 million, focusing on fish passage. 9. Ecosystem Restoration Program, includes Tribal funding and funding for fish passage projects. 10. Pollinator-Friendly Highways provides $10 million over five years, up to $150,000 grants.