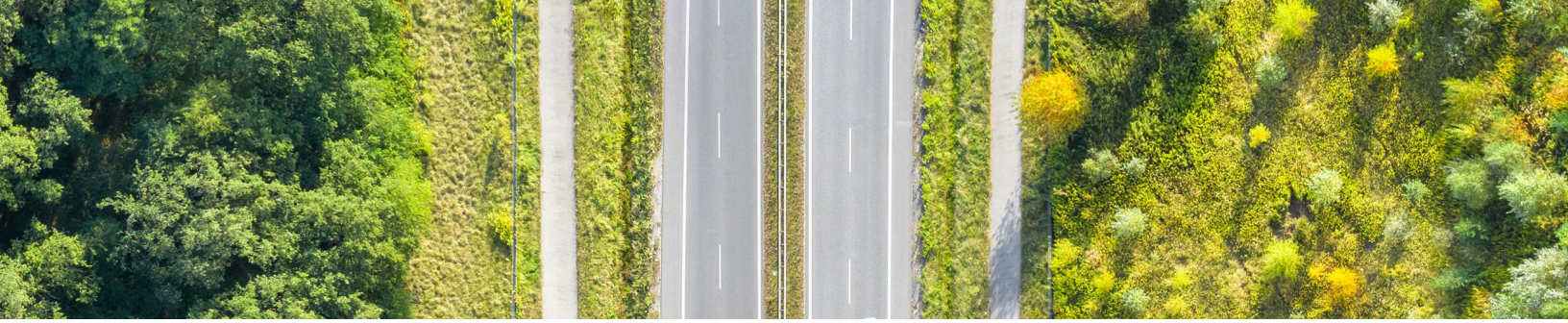
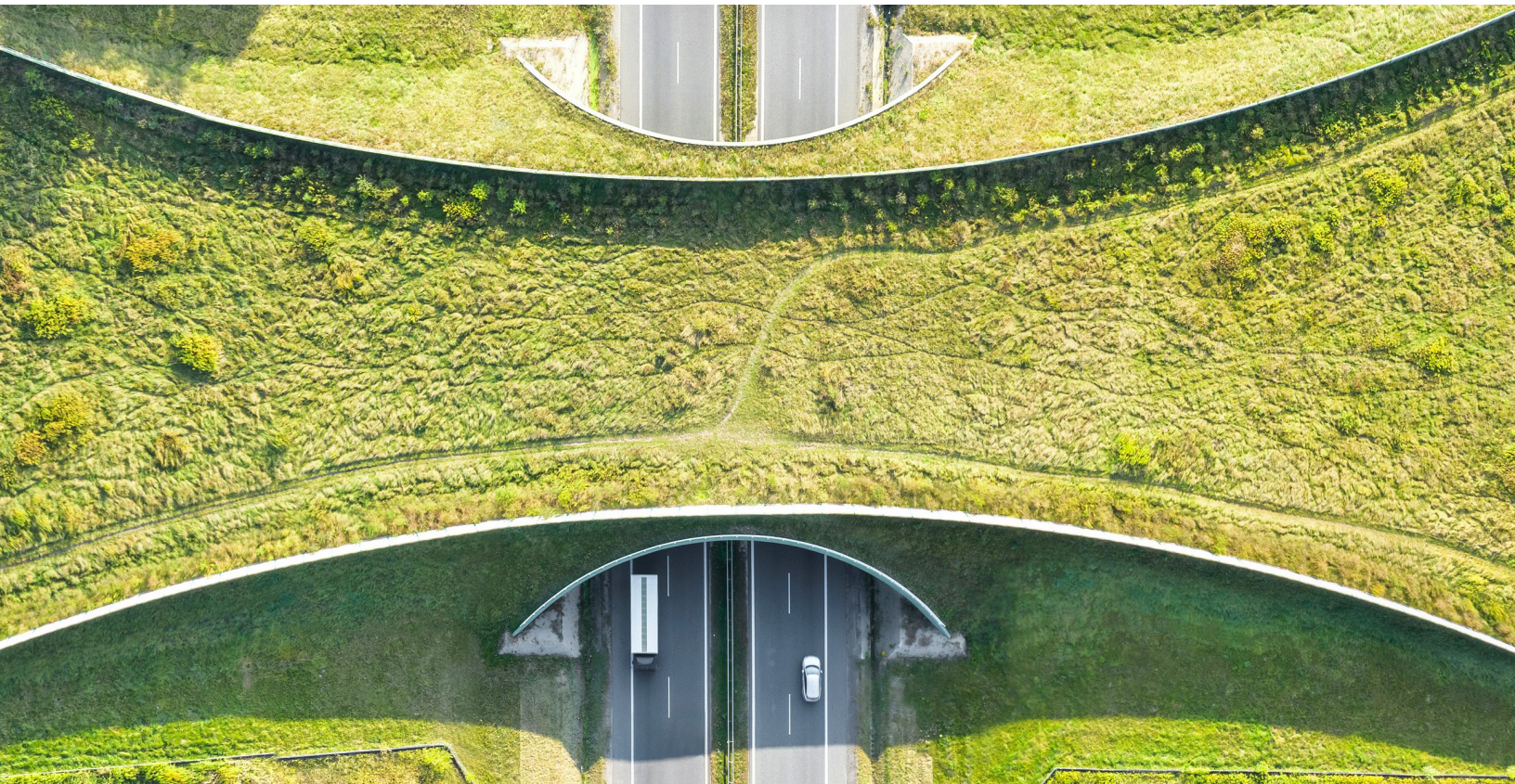


A Toolkit for Developing Effective Projects Under the Federal Wildlife Crossings Pilot Program

By: Kylie Paul, Anna Wearn, Rob Ament, Elizabeth Fairbank & Zack Wurtzebach

December 2021

CENTER for LARGE LANDSCAPE CONSERVATION



A Toolkit for Developing Effective Projects Under the Federal Wildlife Crossings Pilot Program

This document highlights best practices, examples, and resources for designing effective wildlife crossing projects in accordance with the criteria for the new federal "Wildlife Crossings Pilot Program."

For questions, contact Kylie Paul, Road Ecologist, at kylie@largelandscapes.org or Anna Wearn, Director of Government Affairs, at anna@largelandscapes.org.

CENTER for LARGE LANDSCAPE CONSERVATION

Suggested citation:
Paul, K., A. Wearn, R. Ament, E. Fairbank, and Z. Wurtzebach. 2021. A Toolkit for Developing Effective Projects Under the Federal Wildlife Crossings Pilot Program. Center for Large Landscape Conservation: Bozeman, MT, U.S.

TABLE OF CONTENTS

What is the “Wildlife Crossings Pilot Program”?

The Infrastructure Investment and Jobs Act (H.R. 3684), which became law in November 2021 (Public Law 117-58, also known as the “Bipartisan Infrastructure Law”), provides new federal funding for projects and research to reduce wildlife-vehicle collisions (WVCs) and improve habitat connectivity. One of the key provisions is the establishment of a new $350 million Wildlife Crossings Pilot Program (“grant program”), with $60 million in grant funding available in fiscal year 2022 (which began in October 2021), $65M in FY23, $70M in FY24, $75M in FY25, and $80M in FY26 (Sec. 11101(d)(1)).

For a detailed explanation of the other fish and wildlife provisions, including funding for wildlife crossings and habitat connectivity available under other federal transportation programs, refer to pp. 7-8 of this toolkit and the resources provided by ARC Solutions.

What is the purpose of the program?

The primary purpose of the Wildlife Crossings Pilot Program is to encourage states to adopt “wildlife-vehicle collision safety countermeasures” (Sec. 11123(b)(1)). To that end, Congress directed the U.S. Department of Transportation (USDOT) to distribute funds via a competitive grant program to projects that reduce the number of wildlife-vehicle collisions and, in support of that primary aim, projects that improve terrestrial and aquatic habitat connectivity.

What is the status of the program?

The Act states that “an eligible entity shall submit to the Secretary an application at such time, in such manner, and containing such information as the Secretary [of USDOT] may require” (Sec. 11123(d)(1)). Such requirements have yet to be established. The Federal Highway Administration (FHWA) is currently developing the process for soliciting and reviewing grant applications and awarding funding. FHWA has created a website with information about the Bipartisan Infrastructure Law, including an overview of the new statute (see p. 26 for the summary of the Wildlife Crossings Pilot Program). While the Bipartisan Infrastructure Law affords USDOT discretion in implementing the program, it also sets forth a foundational set of eligibility criteria, as summarized below.

Who is eligible?

Eligible Applicants — State transportation agencies and federal land management agencies are allowed to directly apply for a grant under the program. Metropolitan planning organizations, units of local governments, tribes, and regional transportation authorities (or public authorities with a transportation function, such as port authorities) are also eligible to receive grants, but they must document that they consulted with the relevant state transportation agency. Any group of these "eligible entities" (i.e., applicants) can also jointly apply for funding. Additionally, the legislation states that, "to enhance consideration of current and reliable data, eligible entities may obtain guidance from" a state fish and wildlife agency (Sec. 11123(b)(1)).

Eligible Partners — Grant funding, once received, may be provided to "eligible partners," including the entities listed above, as well as foundations, non-governmental organizations, institutions of higher education, and other federal, tribal, regional or state government entities (or any group of "eligible partners"). A grant recipient that enters into a partnership via a project agreement must establish measures to verify that any partners receiving funds comply with the requirements of the grant program.

Grants received by tribes and federal land management agencies will be administered by FHWA. All other grants will be administered by the relevant state transportation agency. At least 60 percent of the grant funding will go towards projects located in rural areas.

What are the application criteria?

In evaluating applications, FHWA will consider first and foremost how likely the project is to reduce WVCs and improve habitat connectivity. Second, the agency will consider the extent to which the project leverages federal funding with non-federal funds, supports local economic development, incorporates innovative technology, provides educational opportunities, and monitors project effectiveness.

Specifically, the "considerations" (i.e., evaluation criteria) set forth in the statute (Sec. 11123(b)(1)) are as follows:

> *"**Primarily**, the extent to which the proposed project of an eligible entity is likely to protect motorists and wildlife by reducing the number of wildlife-vehicle collisions and improve habitat connectivity for terrestrial and aquatic species.*
>
> ***Secondarily**, the extent to which the proposed project of an eligible entity is likely to accomplish the following:*
>
> > *(A) Leveraging Federal investment by encouraging non-Federal contributions to the project, including projects from public-private partnerships.*
> >
> > *(B) Supporting local economic development and improvement of visitation opportunities.*
> >
> > *(C) Incorporation of innovative technologies, including advanced design techniques and other strategies to enhance efficiency and effectiveness in reducing wildlife-vehicle collisions and improving habitat connectivity for terrestrial and aquatic species.*
> >
> > *(D) Provision of educational and outreach opportunities.*
> >
> > *(E) Monitoring and research to evaluate, compare effectiveness of, and identify best practices in, selected projects.*
> >
> > *(F) Any other criteria relevant to reducing the number of wildlife-vehicle collisions and improving habitat connectivity for terrestrial and aquatic species, as the Secretary determines to be appropriate…"*


Nevada Department of Wildlife

Other Fish and Wildlife Provisions in the Bipartisan Infrastructure Law

“Wildlife Crossing Safety” Policy Elements

In addition to the Wildlife Crossings Pilot Program, the “Wildlife Crossing Safety” section of the new statute (Sec. 11123(c)(1) of the Infrastructure Investment and Jobs Act) contains a suite of policy provisions meant to reduce wildlife-vehicle collisions (WVCs) and improve habitat connectivity. The legislative language directs USDOT to:

- Update and expand the 2008 “Wildlife Vehicle Collision Reduction Study,” including the Report to Congress and the Best Practices Manual. Create workforce development and training courses for transportation and fish and wildlife professionals, based on the WVC Reduction Study.

- Develop a standardized methodology for collecting and reporting wildlife collision and carcass data. Provide a template to help states voluntarily implement the guidance.

- Establish guidance that includes a threshold to determine whether a highway should be evaluated for potential projects to reduce WVCs and improve habitat connectivity.

- Consult the 2011 FHWA “Wildlife Crossing Structure Handbook” when developing design criteria for new construction or rehabilitation of a federal highway.

- In consultation with state transportation agencies, determine if upgrades to bridges and tunnels should include measures to improve habitat connectivity. Train bridge and tunnel inspectors to assess passage for terrestrial and aquatic species.

Additional Funding Opportunities

Along with providing *dedicated* funding in the Wildlife Crossings Pilot Program, the Bipartisan Infrastructure Law stipulates that wildlife crossing projects are eligible for funding under a suite of other federal transportation programs. The following are key additional funding opportunities:

- The maximum amount available under the **Federal Lands Transportation Program** for projects to reduce WVCs while maintaining terrestrial and aquatic habitat connectivity has been doubled from $10 million to $20 million per year.

- Wildlife crossing projects are eligible for funding under the **Surface Transportation Block Grant Program** and the **Nationally Significant Freight and Highway Program**. Each of these programs will distribute billions of dollars over the next five years.

- Projects to improve aquatic habitat connectivity (e.g., address barriers to aquatic organism passage) are eligible for funding under the **Bridge Investment Program**; the **Collaborative-based, Aquatic-focused, Landscape-scale Restoration Program**; the **National Culvert Removal, Replacement, and Restoration Grant Program**; and the **Forest Service Legacy Roads and Trails Remediation Program**. Collectively, these programs will also distribute billions of dollars over the next five years.

- Projects to enhance pollinator habitat, including planting native vegetation, are eligible under the **Pollinator-friendly Practices on Roadsides and Highway Rights-of-Way Program**, which will distribute a total of $10 million over the next five years.

To learn more about these provisions and how to take advantage of these additional funding opportunities, see the FHWA overview of the Bipartisan Infrastructure Law and materials from ARC Solutions.

Suggestions for Getting Engaged

In the coming months, FHWA will provide further guidance on how and when to apply for funding. In the meantime, FHWA is seeking public input on implementation of the Bipartisan Infrastructure Law. If you would like to submit comments, you may do so by following the instructions in the "Request for Information" notice posted in the Federal Register on December 1st, 2021. Feedback will be accepted on an ongoing basis (there is no deadline to submit comments) and FHWA plans to begin implementation while the docket remains open.

State transportation agencies: Establish an understanding of the extent to which your agency has undertaken or is willing to undertake projects to reduce wildlife-vehicle collisions and improve habitat connectivity. Examine the status of wildlife data collection and of internal policies, politics, and other key considerations related to wildlife crossing and habitat connectivity projects.

Other state, local, tribal, regional, and federal agencies: Determine whether your agency has a formal partnership agreement with the state transportation agency outlining the official process for cooperating on wildlife and transportation issues. If such a partnership does not yet exist, explore opportunities for beginning to share data and collaborate on projects. Consider, for instance, hosting a joint wildlife and transportation summit.

Other "eligible partners": As described above, foundations, non-governmental organizations, and institutions of higher education can also enter into a project agreement to receive funding from a grant recipient (e.g., a state transportation agency). Explore whether there is already a state or regional coalition that focuses on wildlife and transportation issues, such as those in Montana, Virginia, and Colorado. If not, consider reaching out to existing partnerships in other states to glean lessons learned and embark upon establishing a similar partnership in your area.

State legislators: Connect with your state transportation and wildlife agencies. Determine what staff capacity and resources are needed to advance these efforts, such as liaison positions between wildlife and transportation agencies. Consider relevant state legislation and policies related to science, planning, funding, best management practices, and partnerships for wildlife and transportation projects. Finally, set up a fund to begin pooling non-federal funding to contribute to the project.

A Reader's Guide to this Toolkit

The following material in this toolkit identifies each criterion listed in the Wildlife Crossings Pilot Program and an associated list of select best practices, examples of how they have been applied, and key resources for learning more about the principles of designing and implementing wildlife crossing projects. For each criterion, the Center for Large Landscape Conservation (CLLC) has included the following components:

Criteria — direct quotes from the Infrastructure Investment and Jobs Act (now the Bipartisan Infrastructure Law)

Best Practices — recommendations compiled by CLLC from review of road ecology literature and materials

Examples — some of the most relevant examples of how a specific set of best practices have been applied in designing, funding, constructing, and monitoring successful wildlife crossing projects

Key Resources — relevant publications with supporting evidence and more detailed recommendations from wildlife and transportation experts, compiled by CLLC from review of road ecology literature and materials

The options and suggestions outlined here do not reflect statutory or regulatory guidance. These recommendations are based on CLLC's expertise, examining road ecology literature, and consulting experts in the field. CLLC is not suggesting that eligible applicants and partners should adopt every single best practice within a section. Rather, this toolkit offers a menu of potential options for consideration in designing wildlife crossing projects and proposals under the federal grant program.

LIST OF GRANT CRITERIA

A note on navigation: This toolkit is designed and intended as an interactive resource. Click on a title in the List of Grant Criteria to proceed to that section within the document.

Reducing Wildlife-Vehicle Collisions and Improving Habitat Connectivity

Encouraging Non-federal Investment

Supporting Local Economic Development and Tourism

Incorporating Innovative Technology

Providing Educational and Outreach Opportunities

Monitoring and Evaluating Project Effectiveness

Criteria

*"**Primarily**, the extent to which the proposed project...is likely to protect motorists and wildlife by reducing the number of wildlife-vehicle collisions and improve habitat connectivity for terrestrial and aquatic species."*

Best Practices

Undertake analyses to identify and prioritize locations for mitigation. Some analyses examine only wildlife-vehicle collision (WVC) data, while others also include wildlife movement and habitat data. A project will address safety and conservation needs most effectively if locations with the highest collision risk and/or highest conservation priority are identified.

- *Include multiple data sources and types*. WVC hotspots and locations with high value for habitat connectivity do not always overlap, so data on both a) locations of WVCs and b) areas of habitat connectivity or wildlife movement patterns are important. Traffic and landscape characteristics, such as volume and speed of vehicle traffic on roads, help further assess the risk of WVCs.

- *Include landscape-scale, long-term habitat considerations*. To benefit habitat connectivity, project locations should take into consideration the context of the broader landscape, including locations that can reduce movement barriers between protected areas, currently identified habitat connectivity areas, locations where habitat is likely to remain intact over time, and/or locations where multiple species would benefit. Long-term security of the lands on either side of wildlife crossing opportunities and their functioning as habitat and wildlife corridors for multiple species are critical to the long-term benefits of the crossing infrastructure.

- *Consider additional criteria during prioritization and decision-making*. Further technical and social information helps inform decision-making, such as the present and future status of land adjacent to the crossing structures, political viability, key partner support, and technical feasibility.

Create standardized, transparent planning and implementation processes to identify problem areas for WVCs, prioritize actions, and create cost-effective solutions. Including procedures and/or operations that promote consideration of wildlife within various divisions of state transportation agencies ensures that wildlife is considered in all relevant aspects of transportation decisions and projects. By codifying them into transportation planning processes, there is a stronger probability these procedures and/or operations will persist through budget and political fluctuations.

Select appropriate mitigation measures. There are many tools that can reduce WVCs and improve habitat connectivity, including wildlife underpasses or overpasses, bridges, culverts, or animal detection systems. While design considerations are site- and species-specific, there are some key best practices:

- The most effective solutions are wildlife crossing structures combined with fencing that funnels wildlife toward the safe crossings. Without fencing, the structures are less effective. Relatedly, fencing without structures allowing animals to cross the road safely does not provide for wildlife movement and habitat connectivity.

- Designing crossing structures to meet the movement and habitat needs of multiple species creates the most impact for biodiversity. Different species respond differently to wildlife crossing structure placement, design, and size.

- Protection and management of the land surrounding a crossing structure should provide suitable habitat for the long term.

- Not all projects must involve the creation of new infrastructure; retrofitting existing infrastructure to create safe passage opportunities (e.g., upsizing culverts to allow for successful fish passage as well as for larger animals to cross under the road) can be one of the most expeditious and cost-effective approaches to improving habitat connectivity and reducing WVCs.

Adopt design and construction standards—and ensure that adaptive management is included in those standards. Consider standardized designs for wildlife crossing structures and associated infrastructure, such as wildlife fencing and escape ramps, to deploy proven techniques. Then, cater these plans to the specific site locations and species needs. Furthermore, incorporating adaptive management principles into design and construction to respond to changing conditions remains essential.

- There is no single approach to the construction of wildlife crossing structures, but generalities can be made. Some projects are completed during a discrete period of time, while others are part of phased construction over several years. The phased approach, along with monitoring and evaluating performance, can allow for adjustments to design and construction in the subsequent phases.

Leverage partnerships. Working together with multiple entities across jurisdictions that have pertinent datasets, policies, authorities, and funding pools will ensure a project is relevant, feasible to implement, and has lasting impact. Time and energy should be taken to ensure the right experts, decision-makers, and stakeholders are engaged.

Examples

Vermont's Prioritization Framework (2021)

Arizona Statewide Wildlife-Vehicle Conflict Study (2021)

Pooled Fund Final Report on the Strategic Integration of Wildlife Mitigation into Transportation Procedures (2021)

Blackfeet Nation Animal-Vehicle Collision Reduction Master Plan (2019)

Western Slope Colorado Wildlife Prioritization Study (2019)

Prioritization of Wildlife-Vehicle Conflict in Nevada (2019)

Incorporation of Wildlife Crossings into TxDOT's Projects and Operations (2019)

Teton County Wildlife Crossings Master Plan (2018)

Key Resources

Ament, R., S. Jacobson, R. Callahan, and M. Brocki, eds. 2021. Highway crossing structures for wildlife: opportunities for improving driver and animal safety. Gen. Tech. Rep. PSW-GTR-271. U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station, Albany, CA, U.S.

Clevenger, T. and M.P. Huijser. 2011. Handbook for design and evaluation of wildlife crossing structures in North America. U.S. Department of Transportation, Federal Highway Administration, Washington D.C., U.S.

Huijser, M.P., P. McGowen, A.P. Clevenger, and R. Ament. 2008. Wildlife-vehicle collision reduction study: Best practices manual: Report to Congress. No. FHWA-HEP-09-022. U.S. Department of Transportation, Federal Highway Administration, Washington D.C., U.S.

Huijser, M.P, P. McGowen, J. Fuller, A. Hardy, A. Kociolek, A.P. Clevenger, D. Smith, and R. Ament. 2008. Wildlife-vehicle collision reduction study. Report to Congress. No. FHWA-HRT- 08-034. U.S. Department of Transportation, Federal Highway Administration, Washington D.C., U.S.

Kintsch, J. and P. Cramer. 2015. Permeability of existing structures for terrestrial wildlife: A passage assessment system. Research Report No. WA-RD 777.1. Washington State Department of Transportation, Olympia, WA, U.S.

McClure, M. L., and R. Ament. 2014. Where people and wildlife intersect: Prioritizing mitigation of road impacts on wildlife corridors. Center for Large Landscape Conservation, Bozeman, MT, U.S.

Encouraging Non-federal Investment

Criteria

*"**Secondarily**, the extent to which the proposed project ...is likely to accomplish the following: (A) Leveraging Federal investment by encouraging non-Federal contributions to the project, including projects from public-private partnerships."*

Best Practices

Develop partnerships. Partnering with a variety of groups is important for leveraging funds and reducing the financial burden for any one entity. Interested parties and successful partnerships may include state fish and wildlife agencies; local governments; tribal governments; fish and wildlife conservation groups; outdoor recreation groups (including hunting and angling organizations); other non-governmental organizations; private landowners; land trusts; and livestock producer groups. Identifying and addressing the concerns and shared interests of these stakeholders early in the process will help foster broad financial and social support.

Identify the available suite of non-federal funding sources. These sources can include other public funds available through state and county programs, as well as private funds from private philanthropy, corporate philanthropy, organizations, and individuals.

- Consider ways partners can fund components of the project using their own funding streams. In particular, partners may have access to grant opportunities (e.g., requests for proposals from environmental foundations), open space conservation programs, and other funding sources for mitigation that offsets the ecological impacts of development.

Establish processes to engage with partners and receive external funds. Set up clear processes for government agencies to engage partners in supporting and financially contributing to a project. Wildlife crossings have generated substantial philanthropic interest in recent years and creating donation mechanisms, such as a foundation or fund, for efficiently channeling those private dollars is key to securing diverse funding sources.

Examples

Wildlife crossing at Liberty Canyon/US Highway 101 in California: The vast majority (estimated 80%) of the cost for the Liberty Canyon wildlife overpass is being privately funded.

Wyoming funding tools:

- Wyoming Wildlife and Natural Resource Trust: In 2005, the Wyoming Legislature created a trust fund to conserve wildlife habitat and natural resources across the state. A portion is set aside for wildlife mitigation projects.

- Wyoming Wildlife Conservation License Plate: Monies received go to the WYDOT Wildlife Crossing Fund to be used for efforts related to the transportation system, such as wildlife crossings, wildlife road signage, and game fences.

- Donations to the trust fund and to the WYDOT fund have been made by the public and by conservation organizations.

- Teton County Special Purpose Excise Tax - In November of 2019, Teton County, Wyoming voters passed a ballot measure authorizing a special purpose excise tax to generate $10 million for wildlife crossing structures and related tools.

Oregon has established a specialty license plate called the Watch for Wildlife License Plate. Monies received from the plate sale and renewal fees are received by a Watch for Wildlife Fund with the Oregon Wildlife Foundation that will support projects that help wildlife migrate safely within their range and between habitat patches.

Key Resources

Ament, R., S. Jacobson, R. Callahan, and M. Brocki, eds. 2021. Highway crossing structures for wildlife: opportunities for improving driver and animal safety. Gen. Tech. Rep. PSW-GTR-271. U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station, Albany, CA, U.S.

ARC Solutions. 2020. Wildlife crossing success stories in the Western states. ARC Special Publication.

Kociolek, A.V., R. Ament, R. Callahan, and A.P. Clevenger. 2015. Wildlife crossings: the new norm for transportation planning. Institute of Transportation Engineers (ITE) Journal 85(4): 45-47.

McGuire, T.M., A.P. Clevenger, R. Ament, R. Callahan, and S. Jacobson, eds. 2020. Innovative strategies to reduce the costs of effective wildlife overpasses. Gen. Tech. Rep. PSW-GTR-267. U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station, Albany, CA, U.S.

Return to List of Grant Criteria

Supporting Local Economic Development and Tourism

Criteria

*"**Secondarily**, the extent to which the proposed project ... is likely to accomplish the following:... (B) Supporting local economic development and improvement of visitation opportunities."*

Best Practices

Undertake a comprehensive wildlife crossing structure cost-benefit analysis. Cost-benefit analyses can estimate the costs of wildlife-vehicle collisions (WVCs) at specific locations and the benefits of mitigating the impacts of roads on wildlife.

- Increasingly, such cost-benefit analyses are being applied by transportation agencies. Assessments that address the safety and financial benefits of reducing WVCs provide information important for convincing decision-makers to invest in measures to provide safe passage for wildlife.

- Cost-benefit analyses can demonstrate how reducing WVCs and carcasses on highways helps reduce economic impacts and lower insurance claims by decreasing property damages and the number of injuries (including fatal ones).

- Cost-benefit analyses are also increasingly taking into consideration the value of the wildlife conserved by reducing road mortality. The outdoor recreation industry—a key economic driver in many states—relies in part on healthy wildlife populations. New metrics are emerging to capture not only the consumptive values of wildlife (e.g., hunting) but also the passive use or intrinsic values of wildlife. Projects that reconnect habitats and allow wildlife to safely cross roads sustain wildlife-related recreation and thus support local economies.

Consider proposing a wildlife crossing project on a highway to provide safer access to public lands for outdoor recreationists, natural resource industries, and communities that depend on resources within those lands. Providing safer passage for motorists and wildlife on these highways can benefit these communities as well as connect important habitat. Additionally, such wildlife crossing projects may be eligible for additional federal funding under the Federal Lands Transportation Program and Federal Lands Access Program.

Plan to employ local firms, engineers, road ecologists, and construction crews to design and build a wildlife crossing project. To ensure opportunities for local hiring and for current and future public engagement, this should be planned early on in project development.

Use local construction materials. The Infrastructure Investment and Jobs Act has a “Buy America” requirement that any iron, steel, manufactured products, and construction materials purchased for projects using federal funding under the new statute must be produced domestically (Sec. 70914). Sourcing such materials as locally as possible would promote the economic development of the community where the project is built.

Examples

Wyoming’s Wildlife Tourism for Tomorrow business partnership

Western Slope Colorado Wildlife Prioritization Study 2019, including benefit-cost tool and analysis

University of California at Davis’ Wildlife Crossing Calculator

Key Resources

Duffield, J. and C. Neher. 2019. Incorporating wildlife passive use values in collision mitigation benefit-cost calculations. Cost Effective Solutions TPF-5(358). Transportation Pooled Fund, Nevada Department of Transportation.

Huijser, M.P., J. Duffield, A.P Clevenger, R. Ament, and P. McGowen. 2009. Cost-benefit analyses of mitigation measures aimed at reducing collisions with large ungulates in North America: a decision support tool. Ecology and Society 14(2): 15.

U.S. Department of Transportation. Federal Lands Transportation Program.

U.S. Department of Transportation. Federal Lands Access Program.

Criteria

*"**Secondarily**, the extent to which the proposed project ... is likely to accomplish the following:... (C) Incorporation of innovative technologies, including advanced design techniques and other strategies to enhance efficiency and effectiveness in reducing wildlife-vehicle collisions and improving habitat connectivity for terrestrial and aquatic species."*

Best Practices

Wildlife mitigation strategies have been deployed for many decades and thus effective measures have been well-documented. There are numerous resources describing proven technologies. Yet there is substantial opportunity to offer a wider array of effective measures, improve existing techniques and designs, and explore cost-effective alternatives.

Understand existing knowledge on the range of effective mitigation tools. Options for reducing WVCs include wildlife crossing structures (overpasses and underpasses), fences, electrified barriers, and animal detection/driver warning systems. Establish an understanding of conventional approaches.

Explore innovative approaches to wildlife crossing structure design, engineering, and materials.

- Recently, fiber-reinforced polymer (FRP) composite materials have been used in wildlife crossing structures. There are many benefits to using FRP materials over conventional ones for wildlife crossing infrastructure. For instance, the composite materials have a high strength-to-weight ratio and are exceptionally durable, allowing for reduced costs in the transportation of materials, construction, and maintenance.

- Structural solutions such as prefabricated bridges, precast arch elements, and steel structural elements are cost-effective and efficient options for addressing stand-alone wildlife crossing structures, especially in the absence of opportunities to upgrade existing structures. Installation can be accomplished quickly and with minimal disruption to traffic flows.

- Geosynthetically reinforced soil technologies and alternative fill materials like geofoam help reduce weight loads, which helps to minimize structural fill.

Incorporating Innovative Technology

Consider the use of innovative monitoring and data collection tools. These include:

- Camera/video systems that use artificial-intelligence-supported animal detection and classification software.
- Mobile device applications for wildlife crash and carcass data collection and other new tools that can be used by transportation agency staff, citizens, and stakeholders to accurately and precisely locate problem areas.
- Data collection tools to keep track of long-term maintenance needs for wildlife crossing structures and fencing.

Examples

Mobile device applications, including:

- ROaDs (Roadkill Observation and Data System) smartphone app
- Watch for Wildlife smartphone app
- Highway 63 Alberta Wildlife Watch smartphone app

Federal Highway Administration's Accelerated Bridge Construction initiatives

Key Resources

ARC Solutions. New materials: Can exploring new materials change how we engineer our highways?

Bell, M., D. Fick, R. Ament, and N. Lister. 2020. The use of fiber-reinforced polymers in wildlife crossing infrastructure. Sustainability 12(4): 1557.

Bell, M., R. Ament, D. Fick and M.P. Huijser. 2020. Improving connectivity: Innovative fiber-reinforced polymer structures for wildlife, bicyclists, and/or pedestrians, A Report for Tasks 1–4 (No. P701-18-803 TO 2). Transportation Pooled Fund, Nevada Department of Transportation, U.S.

Clevenger, T. and M.P. Huijser. 2011. Handbook for design and evaluation of wildlife crossing structures in North America. Department of Transportation, Federal Highway Administration, Washington D.C., U.S.

McGuire, T.M., A.P. Clevenger, R. Ament, R. Callahan, and S. Jacobson, eds. 2020. Innovative strategies to reduce the costs of effective wildlife overpasses. Gen. Tech. Rep. PSW-GTR-267. U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station, Albany, CA, U.S.

Providing Educational and Outreach Opportunities

Criteria

*"**Secondarily**, the extent to which the proposed project...is likely to accomplish the following:...*
(D) Provision of educational and outreach opportunities."

Best Practices

Provide peer learning opportunities to share lessons learned. It is valuable for transportation and natural resource professionals to have opportunities to share their expertise and experiences with addressing wildlife-vehicle collisions (WVCs) and habitat connectivity. Consider hosting webinars, workshops, roundtables, conferences, and meetings that provide the transfer of state-of-the-art knowledge.

Consider convening a wildlife and transportation workshop to catalyze efforts and share information. Several states have initiated workshops or summits between state wildlife and transportation agencies as well as key stakeholders. These events often lead to new formal partnerships and plans for addressing WVCs and habitat connectivity.

Educate and inform the public.

- *Identify affected stakeholders and develop an outreach and engagement plan* that provides ample opportunities for them to share their interests and concerns.

- *Work with communications staff and key messengers to raise public awareness about the project, the need it addresses, and the benefits it will provide*. Partner with community leaders and organizations that have relationships with key stakeholders and may be able to act as liaisons or trusted messengers.

- *Partner with educators to teach students about the project*. Work with teachers, museums, academic institutions, and other education professionals to develop relevant and engaging content about the project that can be conveyed in school settings. Wildlife crossing projects provide the opportunity to teach students about road ecology, engineering, and habitat connectivity, as well as to engage students through citizen science (e.g., collecting roadkill data) and field trips.

- *Use a range of outreach options and formats*. There are many effective outreach tools such as websites, "story maps," videos/movies, webinars, and lesson plans for teachers. Work with partners to convey information in multiple modalities, employing visual storytelling techniques whenever possible to draw in diverse audiences.

Examples

Films or videos

- Conservation Corridor's compilation of outreach/education videos about transportation ecology around the world
- Nevada Department of Transportation partnership ReConnecting Wild: Restoring Safe Passage film
- I-90 Wildlife Bridges Coalition Cascade Crossroads film
- Florida Wildlife Corridor Expeditions and Documentaries

Summit County Safe Passages story map

CLLC and ARC Solutions' Roadways and Wildlife infographic and Corridors vs. Crossings infographic

The #saveLAcougars campaign

Wild I-70 audio tour

Improving Roads for People and Wildlife webinar

Collaborative summits

- Wyoming Wildlife and Roadways Summit (2017 and 2021)
- Montana Wildlife and Transportation Summit (2018)
- Colorado Wildlife and Transportation Summit (2017)

Key Resources

Anderson, H., K. Dow, R. Lok, P. Jamshid- Moghadam, J. Lawson, C. Murphy, and M. Smirnova. 2021. Green infrastructure toolkit: Enhancing the co-benefits of landscape connectivity. Ryerson University, Toronto, Ontario, Canada.

ARC Solutions. 2021. Wildlife crossings communications toolkit.

Haddock, R. 2014. Trans-Canada highway wildlife and monitoring research, final report 2014 (Part C: Communications and Outreach). Prepared for Parks Canada Agency, Radium Hot Springs, British Columbia, Canada.

Return to List of Grant Criteria

Monitoring and Evaluating Project Effectiveness

Criteria

*"**Secondarily**, the extent to which the proposed project ...is likely to accomplish the following:... (E) Monitoring and research to evaluate, compare effectiveness of, and identify best practices in, selected projects."*

Best Practices

Monitor before, during, and after construction of wildlife crossing structures and associated infrastructure. This is important to assess effectiveness of measures for reducing wildlife-vehicle collsions (WVCs) and improving habitat connectivity. Monitoring across project phases also helps identify cost-effective designs for specific contexts and species.

- *Monitor for a sufficient length of time to evaluate project effectiveness*. Monitoring WVCs and wildlife use of crossing structures for five years prior to construction and five years afterwards is recommended by some researchers. It can take several years for wildlife to become comfortable using new crossing structures; wildlife tend to exhibit a learning curve.

- *Determine the extent of monitoring or research needed*. For standard mitigation strategies and designs, monitor and compare pre- and post-construction WVC rates to evaluate effectiveness. Consider undertaking more in-depth research if a project uses novel mitigation strategies or addresses species for which there is limited available data, such as smaller species, threatened and endangered species, reptiles, or pollinators. Universities or consulting firms can often provide valuable assistance with more in-depth monitoring or research.

Integrate project monitoring with project maintenance. Monitoring studies and regular check-ups on wildlife crossing structures, fences, escape ramps, guards and other project elements provide information critical to proper maintenance and design of the infrastructure.

- *Consider including feedback from maintenance crews in project design and monitoring plans* to identify emerging structural or technical issues with the project as soon as possible. Maintenance teams are critical to the planning, design, construction, and care of infrastructure to increase efficacy and minimize long-term maintenance needs.

Examples

Banff Wildlife Crossings Project website

US 93N Wildlife Crossing Research Project website

Key Resources

Ament, R., S. Jacobson, R. Callahan, and M. Brocki, eds. 2021. Highway crossing structures for wildlife: opportunities for improving driver and animal safety. Gen. Tech. Rep. PSW-GTR-271. U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station, Albany, CA, U.S.

Clevenger, T. and M.P. Huijser. 2011. Handbook for design and evaluation of wildlife crossing structures in North America. Department of Transportation, Federal Highway Administration, Washington D.C., U.S.

Clevenger, A.P. and M. Barrueto. 2014. Trans-Canada Highway wildlife and monitoring research, final report. Part B: Research. Canada, BC: Report to Parks Canada Agency, Canada.

Huijser, M. P., W. Camel-Means, E. R. Fairbank, J. P. Purdum, T. D. H. Allen, A. R. Hardy, J. Graham, J. S. Begley, P. Basting, and D. Becker. 2016. US 93 North post-construction wildlife-vehicle collision and wildlife crossing monitoring on the Flathead Indian Reservation between Evaro and Polson, Montana - Final report.

Michael Baker International. 2021. Arizona statewide wildlife-vehicle conflict study final report. 2021. Prepared for Arizona Department of Transportation.