RESEARCH PROGRAMS USE ONLY

RESEARCH IDEA NO: 21-011
DATE OF RECEIPT: Apr 30, 2020
TOTAL MDT COST W/ICAP:

**Montana Department of Transportation**

Stage 2 - Research Topic Statement

**RESEARCH PROGRAMS**

Please submit completed forms via e-mail to MDTResearch@mt.gov. All fields are required, except the last field: XVIII, Sponsor(s). Incomplete forms will not be accepted.

**TITLE (required):** Effective wildlife fences through better functioning barriers at access roads and jump-outs

Wildlife fences in combination with wildlife crossing structures are the most effective and robust measure to improve human safety through reducing collisions with large mammals, and to provide safe crossing opportunities for wildlife. However, in multi-functional landscapes, access roads for agriculture, dispersed housing, and other roads result in openings in the fence. Along US Hwy 93 North on the Flathead Indian Reservation, wildlife guards (similar to cattle guards) at access roads have proven to be a substantial barrier to deer species (about 80% to nearly 100% barrier), but unfortunately they are quite permeable to species with paws, including bear species (about 50% to nearly 100% permeable). In addition, animals that do end up in the fenced road corridor must be able to escape quickly. Earthen mounds built up against the fence allow animals to jump down to the safe side of the fence. However, deer use of these wildlife jump-outs has been low (only about 32% use by mule deer, only about 7% use by white-tailed deer). This means that these animals spend more time inside the fenced road corridor before they exit, either at one of the jump-outs or at a fence-end. To further improve human safety, and to reduce direct road mortality of wildlife, including grizzly bears, additional measures are needed at access roads, and deer species need to use the jump-outs more readily.

1. **Barriers at access roads for species with paws**
   We propose to investigate barrier types that are likely to keep species with paws out of the fenced road corridor at access roads. The measure likely depends on the type of use and the traffic volume of an access road. The measures may include physical barriers (gates), electrified wildlife guards, and electrified gates. We propose to select sites with very low traffic volume and interested landowners first, before increasing complexities with higher volume public roads. Because of our initial focus on very low volume access roads and single land owners, we will include relatively low-cost barriers, including ones that come from ranching (e.g. fiber glass poles on a spring mechanism with electrified strings that hang down and that closes automatically, gates that are a physical barrier) and African wildlife reserves (e.g. electrified wires on a spring mechanism). To our knowledge these types of barriers have not been tested for wildlife (especially species with paws) in North America. While barriers at higher volume access roads or barriers on the main highway at fence-ends, likely require more complex and more expensive measures (e.g. “electricity off” switch on a timer for equestrian use and an extra safe guard for pedestrians and bicyclists), the initial focus on low volume access roads has the potential to result in the greatest benefits at the lowest costs. Existing gates and existing wildlife guards can be left in place; they would either be an integral part of the “treatment” (e.g. for existing wildlife guards) or the could be left open during the testing of the alternative barrier (e.g. for existing gates).

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Experimental barriers can be removed after the conclusion of the experiment. The effectiveness of the barrier would be quantitatively evaluated with wildlife cameras facing towards the safe side of the barrier. Animals that approach (e.g. within about 7 ft (2.1 m)) can be evaluated for their behavior (cross or not cross), allowing the barrier effect to be expressed as a percentage.

2. More effective wildlife jump-outs
The longer an animal is present inside the fenced road corridor, the higher the probability of a collision. We propose to reduce the height of selected wildlife jump-outs (perhaps reduce height from about 6 ft to about 4.5-5.0 ft) and to install a wooden or metal bar between 12-20 inches above the soil on top of the mound. This reduces the effective height of the jump-outs for animals that need to jump down to the safe side of the fence. At the same time, because of the wooden or metal bar, it should remain difficult for animals to jump up into the fenced road corridor. Lowering the jump-outs without adding the wooden or metal bar on top of the jump-out would make it easier for animals to jump up into the fenced road corridor, which is associated with increased risk for human safety and potential liability. The main objective is to increase the use of the jump-outs for animals that are caught in the fenced road corridor, while continuing to discourage animals from jumping up into the fenced road corridor. A secondary objective could be to investigate the optimal height of the wooden or metal bar above the ground, though this likely depends on the target species. An additional question that may be investigated can include whether having short sections of perpendicular fence on top of the jump-out are helpful in encouraging animals to exit the fenced road corridor at the jump-out. Finally, the landing area at the bottom of a jump-out may be sloped which can affect the effective height of a wildlife jump-out. Behavioral research into where different animal species land after they have jumped down, and where they may jump up from (distance from the face of the jump-out) can provide insight on wildlife jump-outs can be better designed given the local topography of a site. The effectiveness of the jump-out would be quantitatively evaluated with wildlife cameras facing towards the face of the jump-out. Animals that show up on top of the jump-out can be evaluated for their behavior (jump down or not), allowing the use of the jump-out to be expressed as a percentage. Similarly, the cameras would also record animals on the safe side of the jump-out and whether they jump into the fenced road corridor.

Given the existing fences, wildlife guards at access roads, and wildlife jump-outs along US Hwy 93 North on the Flathead Indian Reservation, and the desire to further reduce collisions, including collisions with grizzly bears, we propose to conduct the research in this area. However, it is possible to expand the research to other areas as well. There is an opportunity for co-funding this research through a pooled fund study, led by the Nevada DOT. In addition, the Confederated Salish & Kootenai Tribes (CSKT), US Fish & Wildlife Service, and other stakeholders have expressed their interest and support in preliminary talks about this research idea. The objectives of this project are also consistent with the Memorandum of Agreement (2000) between the Federal Highway Administration, the Montana Department of Transportation, and CSKT. Finally, the Montana Department of Transportation is already preparing to connect short sections of wildlife fences north of St. Ignatius, and there are access roads here that need to be dealt with, both for deer species and grizzly bear.

RELATED RESEARCH SUMMARY FROM STAGE 1:
While there are several studies that investigated the barrier effect of wildlife guards and other barriers at access road, none of them have investigated low cost electrified barriers for low volume access roads with single interested land owners, and none of the efforts were specifically directed at keeping species with paws, including bear species, out of the

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fenced road corridor. Most of the barriers and associated studies were primarily designed for ungulates (species with hoofs such as deer and elk), and the electrified barriers that have previously been investigated were relatively high cost and designed for high volume public roads.

The effectiveness of wildlife jump-outs has been investigated in several areas, but there are currently no clear guidelines on what the optimum height of wildlife jump-outs is for deer, specifically not for white-tailed deer. These studies have led to the suggestion of researcher for designing jump-outs with a height of about 5 ft in combination with a metal or wooden bar about 12-20 inches above the ground on top of the jump-out. Careful monitoring and testing of this suggested design is warranted as this design should not be allowed to result in an increase in animals jumping up into the fenced road corridor as that poses a safety issue.

RESEARCH PROPOSED:

Electrified bump-gates

This proposal includes the purchase and installation of 5 electrified bump gates (about $300 each), associated solar panels and batteries (about $300 per gate). The electrified bump gates will likely be similar to this design: https://www.amazon.com/Drive-Thru-Electric-Gate-13ft-19ft/dp/B00079PI38 (potentially with custom longer electrified strands) or this design with electrified metal wires a few inches above the ground level https://www.marcelhuijserphotography.com/wildlifeguards/wildlifeguards/africa/wildlifeguards/hdd72e3d0#. A wildlife camera will be installed at each of the gates. The cameras will be recording wildlife that come within e.g. 2 m (or 5 m) of the wildlife guards and electrified bump gates, day and night (no glow infrared flash). The researchers will then calculate the barrier effect for each species based on the number of approaches, and the number of pass vs. no-pass events across the electrified wildlife guards.

Requirements for the sites:
• Access road must be at a gap in the wildlife fence, wildlife fence extends to both sides of the access road.
• Wildlife guard must already be present (modified bridge grate material), not electrified. These wildlife guards are known to be a substantial barrier to ungulates, but they are a poor barrier to species with paws (Allen et al., 2013; Huijser et al., 2016).
• Single interested and willing landowner; very low traffic volume.
• Known or suspected high presence of species with paws (especially black bear).

Specifics:
• Local landowner(s) must be willing and interested in the project.
• The Confederated Salish & Kootenai Tribes have already provided a permit for this proposed work.
• The US Fish & Wildlife Service has already determined that no “take permit” is required as the measures at the gaps in the fence are designed for species with paws in general, rather than grizzly bears in specific.
• The bump gates may only be operational in summer months when bears are most active.
• It would be helpful if MDT assists with the installation of the gates, solar panels and batteries that power the electrified strands.
• It would be helpful if MDT assists with signage for the public, and potentially a “turn off electricity” button to allow pedestrians etc. to cross safely.
• WTI-MSU will install Reconyx wildlife cameras (0.2 s trigger time, no glow infrared).
• WTI-MSU will change memory cards and batteries (anticipated once per month), download memory cards onto a hard disk, and conduct vegetation management (cut tall grasses in front of cameras).
• WTI-MSU will interpret and enter the data obtained from the images into a database.
• WTI-MSU will conduct data analyses and reporting.

Wildlife Jump-outs

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We propose to lower and manipulate the height of selected wildlife jump-outs along US Hwy 93 on the Flathead Indian Reservation. Based on historic data (Huijser et al., 2016), the team will select jump-outs with the highest deer presence on top of the wildlife jump-outs (white-tailed deer and mule deer combined). We propose to select 10 wildlife jump-outs and modify them by lowering the height from about 6-9 ft to about 5 ft by removing soil and concrete blocks from the top, and placing a wooden or concrete bar about 12-20 inches above the ground on the top of the jump-out (1 treatment, the same treatment for all 10 jump-outs). Note that we have historic data that can serve as controls: about 6-9 ft high, no wooden or concrete bar. The effectiveness for animals jumping down is calculated (per species) as follows: the number of individuals that jump down divided by the number of individuals that show up on top (jump down and turn back combined). The effectiveness for animals jumping up is calculated (per species) as follows: the number of individuals that pass by at the bottom and that do not jump up divided by the number of individuals that show up on the bottom (jump up and do not jump up combined). Note that for the animals recorded at the bottom, different categories may be used based on proximity to the jump-out and behavioral parameters suggesting they are exploring the jump-out and are potentially interested in jumping up.

Requirements for the selected jump-outs:
- Must have a high deer presence (white-tailed deer and mule deer) on top of jump-out based on historic data (Huijser et al., 2016).
- The “landing area” (for animals that have jumped down) and “launch area” (for animals that are jumping up) must be level (or made level) with the bottom of the jump-out to obtain a consistent height of around 5 ft.
- The area on top of the jump-out and at bottom of jump-out must have short vegetation that is unlikely to hinder wildlife movements and is unlikely to deter them from jumping down. Regular vegetation management in the growing season will be required.

Specifics:
- Local landowner(s) must be willing and interested in the project.
- The Confederated Salish & Kootenai Tribes have already provided a permit for this proposed work.
- It would be very helpful if MDT maintenance personnel could assist with equipment (e.g., a bobcat) to reduce the height of the selected jump-outs. The removed soil can potentially be used at the bottom of the jump-out to level the area out.
- Local landowner(s) must be willing and interested in the project, especially with regard to leveling out the bottom of the jump-out.
- The area that needs to be level with the bottom of the jump-out will be based on how far out, away from the retaining wall, animals (deer species) land and jump up.
- WTI-MSU will install Reconyx wildlife cameras (0.2 s trigger time, no glow infrared). Cameras will be placed facing the retaining wall of the jump-outs. This allows for the recording of large wild mammals on top as well as the bottom of the jump-out.
- WTI-MSU will change memory cards and batteries (anticipated once per month), download memory cards onto a hard disk, and conduct vegetation management (cut tall grasses in front of cameras, top of jump-outs, and bottom of jump-outs).
- WTI-MSU will interpret and enter the data obtained from the images into a database.
- WTI-MSU will conduct data analyses and reporting.

References
RESEARCH PERIOD (Time to complete research project):

Field work: 1 May 2020 (or as soon as possible) through 31 December 2021.
Data analyses and reporting: 1 May 2020 (or as soon as possible) through 30 September 2022

IT COMPONENT: Identify if the project includes an IT component (purchasing of IT hardware, development of databases, acquisition of existing applications, etc.). If so, describe IT component in as much detail as possible.

There is no need for IT equipment from MDT

FEASIBILITY, PROBABILITY OF SUCCESS, AND RISK:

Both the installation of the electrified bump gates and the modifications of the jump-outs seem very feasible. The researchers expect that the electrified bump gates will substantially increase the barrier effect of the existing wildlife guards for species with paws, and also for ungulates. The researchers also expect that the modifications of the jump-outs will result in substantial higher use of the jump-outs by deer species, especially by white-tailed deer. The probability of being able to draw conclusions about the effectiveness of the proposed measures is high. For the electrified barriers, signs may need to be installed as a warning to the public. Potentially a "switch off" button on a timer needs to be installed at each of the gates to allow for pedestrian use. The risk associated with lowering the height of the jump-outs is that more large mammals may be able to jump up into the fenced road corridor. The expectation is however that the added metal or wooden bar on top of the jump-outs will discourage animals from jumping up.

URGENCY, IMPORTANCE, AND EXPECTED BENEFITS/PAY-OFF: Address urgency, timeliness, and importance of the research. Identify if the research is required for any federal or state initiative or compliance. This section must include a description of how this research will help to meet MDT's mission (i.e., serve the public by providing a transportation system and services that emphasize quality, safety, cost effectiveness, economic vitality and/or sensitivity to the environment).

Given the ongoing high grizzly bear road mortality along US Hwy 93, having a higher mortality than the allowable take permitted by US Fish and Wildlife Service, and the need to more effectively mitigate the yet to be reconstructed section of US Hwy 93 North through the Ninepipe area, there is a great need to have more effective measures aimed at keeping wildlife, specifically grizzly bear, out of the fenced road corridor.

Access roads that are mitigated with wildlife guards (similar to cattle guards) are a substantial barrier to ungulates, but not for species with paws such as bears. Lower wildlife mortality along US Hwy 93 North results in fewer wildlife-vehicle collisions and increased human safety for travelers. In addition, lower road mortality of grizzly bears may result in compliance with the allowable take of grizzly bears as defined by the US Fish and Wildlife Service. The knowledge acquired through this effort will also allow for more effective mitigation along the road section through the Ninepipe area, a road section that is scheduled for reconstruction in the coming years. Our proposal prioritizes sites with very low traffic volume and single landowners because: 1. Very low volume access roads with single landowners are less complex compared to high volume access roads allowing the researchers to first focus on the effectiveness of the measures; 2. Very low volume access roads tend to be more numerous than high volume access roads; 3. Measures at low volume roads are typically less expensive than measures at high volume roads; they are relatively cost-effective. Hence, if effective relatively low-cost barriers can address many of the access roads along a highway through a rural area.

The current performance of the wildlife jump-outs for the most hit large wild mammal species along this road is poor; only 32% effective for mule deer and 7% effective for white-tailed deer. Increasing the effectiveness of the jump-outs results in the animals spending less time in the fenced road corridor, and therefore it should also reduce wildlife-vehicle collisions.

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This is especially important for road sections that have relatively short wildlife fences and therefore a low effectiveness in collision reduction as it is. However, lowering the jump-outs must be accompanied by measures that also discourage animals from jumping into the fenced road corridor as this may result in wildlife-vehicle collisions.

IMPLEMENTABILITY, IMPLEMENTATION PLAN, AND RESPONSIBILITY: Address the implementability of the expected results from the proposed project. Identify products that will enhance implementation. Identify any known implementation barriers and how these barriers might be eliminated or reduced. Identify MDT office or entity outside of MDT responsible for implementation. Describe initial implementation plan, include timeframe for implementation.

If the proposed electrified barriers are effective in keeping wildlife, especially species with paws, out of the fenced road corridors, implementation appears straightforward, at least for very low traffic volume access roads with single land users. Higher traffic volume access roads that are accessible to the public and that involve different modes of transportation are more complex and may require "turn electricity off" buttons or dedicated side gates for pedestrian use and other forms of non-motorized transportation.

For design modifications to wildlife jump-outs such as a height of about 5 ft and a metal or wooden bar on top of the jump-out, potential large-scale implementation is probably even more straightforward.

MDT PRIORITY FOCUS AREAS: MDT may, as often as annually, identify priority research focus areas. These focus areas will be listed on http://www.mdt.mt.gov/research/unique/solicit.shtml.

TOTAL COST ESTIMATE (If the project proposal comes in at a higher cost, it may require further approval and may be delayed.):

$ 62,000 (MDT part)

MDT FUNDING SOURCE (If MDT Research, enter SPR):

FUNDING MATCH SOURCE AND AMOUNT: A pooled fund study project administered by NVDOT is likely to dedicate $115,000 for related research questions (decision expected in May 2020)

FUNDING PARTNER(S): NVDOT, and 10 other entities from USA and Canada (mostly DOTs from different USA states)

POTENTIAL TECHNICAL PANEL MEMBERS (At this time, individuals do not necessarily need to be identified; rather, MDT offices and outside entities can be named. However, if known, individuals may be named):
SUBMITTED BY: (required)

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CHAMPION: Must be internal to MDT, feel strongly that the research will benefit the Department, and is willing to chair the technical panel. Note: If a champion is not identified by you or Research staff, this topic statement will not move forward.

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SPONSOR(S) (optional): Must be internal to MDT (Division Administrator or higher) and willing to ensure implementation occurs, as appropriate. If a sponsor is not identified by you or Research staff, this topic statement will not move forward.

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