MONTANA MDT DEPARTMENT OF TRANSPORTATION

RESEARCH PROGRAMS

Scope of Work

Date: 3/15/2023	**Champion:** Deb Wambach	**Technical Panel Members:** • Bill Semmens (Co-Chair) • Deb Wambach (Co-Chair) • Phill Balsley • Jake Goettle • Ted Jones • Jeremy Terry • Joe Weigand • Matt Strizich (FHWA)
Solicitation Number: 22-013	**Sponsor:** Rob Stapley	
Project Number: 10325-900	**Research Project Manager:** Vaneza Callejas	

Maximum Project Cost: $405,000

Project Title: Evaluate MDT Electrified Wildlife Deterrent Mats

Project URL: https://www.mdt.mt.gov/research/projects/deterrent-mats.aspx

Project Background: Wildlife-vehicle collisions (WVC) can cause motorist fatalities, injuries, and property damage to vehicles. One way to reduce the risk of these collisions is through the use of wildlife exclusionary fence (fence) in conjunction with wildlife crossing structures. To ensure that wildlife utilize crossing structures, rather than cross at grade, wildlife fence is used to guide animals to the structures or to safer crossing locations. Wildlife fence in combination with crossing structures has been determined to be the most effective and robust strategy to improve human safety through reducing collisions with large mammals, and to provide safe crossing opportunities for wildlife. Deterring wildlife from entering the "highway side" of the fence and addressing wildlife end-runs of the fence are important considerations in proper implementation of this strategy. Although wildlife fence is effective in reducing WVC, limited research is available on the effectiveness of state-of-the-art technology fence end treatments such as electrified wildlife deterrent mat systems installed to deter wildlife from entering the "highway side" of the fencing.

Benefits/Business Case/Impact: Given MDT's commitment to wildlife accommodations and public engagement, a better understanding of the performance and effectiveness of electrified wildlife deterrent mats to prevent wildlife from entering the "highway side" of the fencing at the fence ends is essential to reduce the risk of WVC. Evaluating this innovative technology in a timely manner is needed to inform cost-effective and efficient wildlife accommodation recommendations within MDT's transportation program.

Documenting the effectiveness of the wildlife deterrent mats will be useful to MDT, other departments of transportation, and stakeholders considering wildlife accommodation implementation with transportation projects. The intent is to understand the effectiveness of the mats and evaluate benefits of the investment in this innovative technology as a component of a wildlife accommodation strategy that will reduce risk for wildlife-vehicle conflict in treated areas and increase motorist safety.

Objectives: This research will study the effectiveness of embedded electrified concrete mat in deterring wildlife from entering the "highway side" of the fencing; wildlife behavior at the mats and the end of the fencing; and the performance of the wildlife deterrent mats under various environmental conditions. While the focus of the behavioral

research will be on wildlife, human interactions with the mats, if any, will be included in the study. This study will use video cameras, thermal imaging, and analytic software to examine the following:

1. The effectiveness of embedded electrified concrete mat in deterring wildlife from entering the "highway side" of the fencing.
2. Wildlife behavior at the mats and the end of the fencing.
3. Human behavior at the mats and the end of the fencing.
4. The performance of the wildlife deterrent mats under various environmental conditions.
5. The performance and efficiency comparison between the MT 200 (solar) and MT 287 (power) sites.

To answer the research questions, the team will investigate the electrified concrete mat wildlife deterrent systems recently installed on MT 200 (East of Thompson River - East) and MT 287 (Toston Structures). The research will use thermal imaging and analytic software to recognize wildlife or human forms and trigger video recording. This is an important component of the research as the detection zone is adjacent to the roadway and screening the traffic/vehicles from animal movement is critical to efficient and accurate analysis. Video clips will allow researchers to conduct qualitative and quantitative data analysis of the interaction between wildlife, the road and fence ends, and electrified mats. Imaging should observe wildlife behavior within the detection zones at the fence ends including a) the right of way (approach adjacent to the road), b) the roadway, and c) the electrified mat.

The research team should be comprised of members or firms with expertise and experience in the following areas: Technology (IT), Road Ecology/Wildlife, and Research Analysis and Technical Report Writing. The IT members should include a Vendor who can provide the appropriate analytics and components to achieve the research goals and objectives.

Tasks:

Tasks to meet the project objectives are expected to include, but may not be limited to, the activities listed below. Alternate tasks may be proposed to achieve the same result.

1. Establish an appropriate detection zone (dimensions) to observe wildlife behavior at the three target areas described as a), b), c) in Objectives.
2. Use thermal sensors and real time analytics to accurately detect medium size and larger animal and human presence ("medium size" animal defined as 2.5 feet tall at the top of shoulder) within the detection zones 24 hrs/day 7 days/week over the research period.
3. Collect thermal data (video clips) of wildlife and human activity when wildlife/human is detected in areas a, b & c above.
4. Collect and store the thermal video clip data of animal and human detection events and animal and human behavior in the detection zone(s) and provide a link to the research co-chairs for viewing.
5. Evaluate animal behavior including number of road crossings, number of road approaches, number of mat approaches, number of mat repels, number of mat avoidances, number of apparent mat deterrent shock delivery, number of mat crossings, direction of mat crossings, general classification of animal (deer, moose, elk, sheep, etc.), with data presented in charts and tables and with contextual analysis.
6. Evaluate human behavior including number of mat approaches, number of mat avoidance, number of apparent mat deterrent shock delivery, and number of mat crossings.
7. Include a method and apparatus for measuring the accuracy of the system employed for detecting wildlife (i.e., false positive and false negative rates of the detection system).
8. Include a method for confirming the operating condition of the mats and operating voltage (kV) during recorded interactions with wildlife and humans.
9. Download and analyze the data to determine and discuss the four objectives identified above.

Fulfill the following minimum requirements to meet the research goals and objectives:

1. Thermal video camera mounted at a proper height and distance to view detection zones a), b), and c), simultaneously; one camera for each side of road at each mat location. Cameras and other equipment may be mounted to existing roadside infrastructure with prior approval from MDT.
2. Video analytics software to detect wildlife and humans and trigger video recordings. This software will screen wildlife and humans from vehicles and other non-target moving objects.
3. Use analytics with capability to produce a maximum of 10% false positives (false positive = detection event and corresponding video clip when a medium or larger size animal is not present) and a maximum of 5% false negatives (false negative = medium or larger size animal present without evidence detection event or video clip recorded) in all weather conditions. Note: Detection of one or multiple vehicles without the presence of wildlife is considered a "false positive".
4. Operate 24/7/365 in all weather conditions for duration of the 2-year data collection period with less than 3% down time following an installation and validation period of 30 days.
5. Provide adequate independent power supply (may be solar or other) for continuous uninterrupted autonomous operation of system 24 hours per day 365 days per year with reserve power for 48 hours, in case of power/energy supply failure.
6. Store up to 6 weeks of data on-site with provisions for on-site data retrieval and data storage clearance for subsequent data accumulation cycle by researchers visiting the site.
7. Incorporate thermal sensors with sufficient quality of resolution within the target area to support accurate detection utilizing real time algorithms and to facilitate accurate human interpretation of animal behavior video clips.
8. Provide appropriate environmentally controlled cabinet to support normal operations and life expectancy of equipment in cabinet throughout the project period. Site and secure the control cabinet to house and control the electronics in a manner to minimize risk of damage and deter theft.
9. Provide and install all required equipment to complete the system including camera pole(s), sensors, cabinet(s), wiring and solar power stations within MDT ROW meeting MDT Specifications. Equipment that is large enough to be considered a fixed object must be mounted per 1. above, on a breakaway system, or behind guardrail.
10. Provide design documents for the system layout and components for review and input from the Research Team.

NOTE: The Toston location has ample existing power and cabinet storage capacity for the research equipment. The Thompson Falls location might need supplemental power and storage capacity.

Acceptance: N/A.

Cooperators, Stakeholders, Partners:

- Gabe Priebe, MDT Traffic & Safety

Communications: N/A**.**

Data Requirements: The researcher should provide data as described in the research tasks above and include a summary report of observations with each delivery.

IT: Thermal video cameras, video analytics software, electronic hardware (laptops, wiring, etc.), cabinet, power connections. Include the purchase of the equipment, analytics, and all components in the proposal. Ensure all analytics, components, and apparatuses meet “Buy America” requirements (23 CFR 635.410).

The electrified wildlife deterrent mats installed at the two project sites under investigation were developed and installed by Cross Tek Wildlife Solutions. MDT is only aware of one Vendor (Cross Tek Wildlife Solutions) who can provide the appropriate analytics and components to achieve the research goals and objectives. The researcher should coordinate with Cross Tek Wildlife Solutions regarding the technology requirements for the research investigation.

Intellectual Property: The researcher should describe any potential intellectual property issues with the project. Ensure any telecommunications or video surveillance equipment, services, or systems used or installed comply with 2 CFR 200.216.

MDT and /Technical Panel Involvement: The researcher should detail any assistance that may be required from MDT and the research project Technical Panel, include the timeframe(s) in which this assistance is required.

Deliverables:

- Design documents for system layout and components
- Progress reports (including links to videos)
- Task Reports
- Draft Final Report
- Final Report
- Project Summary report
- Implementation meeting and report
- Project Poster
- Final Presentation
- Project Webinar

Risks: The research objectives and data collection methods are straight forward and efficient, therefore we expect a high probability of success with low risk. There is the normal risk expected with the use of electronics.

Implementation: If the proposed electrified wildlife deterrent mats are effective in keeping wildlife out of the "highway side" of the fence, they will continue to be recommended as an integral part of wildlife accommodation strategies. Specific project recommendations will follow MDT Wildlife Accommodation Process.

Performance Measures: The research to be conducted should include both qualitative and quantitative performance measures to the greatest extent possible. Performance measures include such improvements as cost and time savings; improved process, safety, environmental considerations, efficiency, quality, and service; and user benefits. As much as possible, these benefits need to be quantified. Provide quantitative performance measures derived from the Tasks section above; specifically, tasks 2, 5, 6, 7, 8, and 9. This is an indication of the value of the research. Consideration needs to be given to the data that will need to be collected to report performance measures. The proposal must describe how performance measures will be quantified.