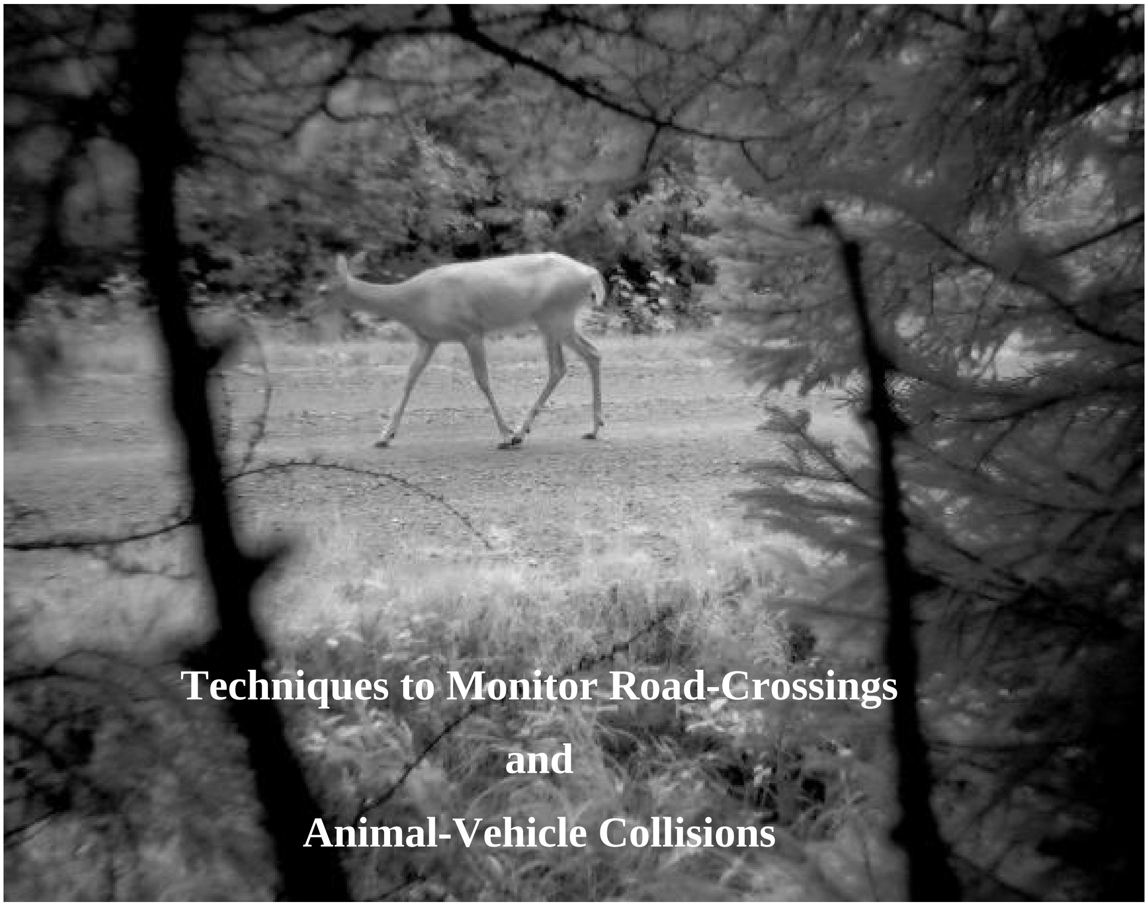

Techniques to Monitor Road-Crossings and Animal-Vehicle Collisions

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Summary

Motor vehicle accidents caused by deer and moose cause property damage and deaths each year. The most recent estimate of the number of deer-vehicle collisions across the U.S. was more than 1 million, with costs of deer-vehicle collisions nationwide are more than $3.5 billion dollars. We developed and tested a self-powered video camera observation system to monitor roadways and wildlife crossing areas. We contrast use of a video system to use of trail cameras. The data collected with this system will enable identification of animal species crossing roads, the frequency of road crossings, animal behavior on and near roads, and vehicle (human) response to potential animal dangers.

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Introduction

Motor vehicle accidents caused by deer and moose cause property damage and deaths each year. In accidents with smaller animals like rabbits and raccoons, the vehicle is undamaged and it is probably safe to assume that the animal dies. Accidents with larger animals like deer (*Odocoileus* spp.) and moose (*Alces alces*) are more likely to be reported because of the increased risk of vehicle damage and human injury. A recent estimate from Utah was that deer-vehicle collisions cost about $7.5 million dollars per year between 1996 and 2001, with an average cost of $3,450 per incident (Bissonette *et al.*, 2008). The most recent estimate of the number of deer-vehicle collisions across the U.S. was more than 1 million (Conover *et al.*, 1995), which would mean costs of deer-vehicle collisions nationwide are more than $3.5 billion dollars. Costs are certainly higher than this because deer populations have increased significantly since the 1990’s, especially in the Midwest (SWUC-AFWA.(Sustainable Wildlife Use Committee of the Association of Fish and Wildlife Agencies) & Southwick, 2008).

There are also intangible costs associated with deer-vehicle collisions when human injuries or fatalities occur. Deer-vehicle collisions result in about 1 injury or fatality per 100 reported accidents, while moose-vehicle collisions result in about 10 injuries or fatalities per 100 accidents (Haikonen & Summala, 2001). In collisions between deer and vehicles, the deer is often hit and then the body remains on the road (Fig. 1). Human injuries and fatalities are higher with moose-vehicle collisions because longer legs lead to the body of the moose having a much higher probability of going over the hood of the car and either through the windshield or landing on the roof. Injuries, fatalities, and economic costs provide a strong incentive to identify ways to decrease the number of collisions between wildlife and vehicles.

Figure 1. Examples of road-killed animals. A white-tailed deer (*Odocoileus virginianus*) hit by a vehicle on a divided highway in central Minnesota, and a lynx (*Lynx canadensis*) hit by a car on a rural road in northeastern Minnesota.

Both wildlife behavior and human behavior have been considered in efforts to reduce wildlife-vehicle collisions, but there are few studies which have been conducted in which behavioral response to approaching vehicles of deer or other wildlife has been monitored. In one of the few studies in which behavior of deer was observed, reflectors designed to scare deer from highways using light from headlights do not appear to work (D'Angelo *et al.*, 2006). In part the paucity of results from a lack of available technology which would make observational studies logistically feasible.

Instead, most analyses have focused on accident reports and an analysis in either time or space. Most moose-vehicle accidents occurred at night in Alaska (Garrett & Conway, 1999). The most refined analysis in time indicates that the highest probability of accidents between deer and vehicles occurred within 2.5 hours of sunset (Haikonen & Summala, 2001). Unlike other studies, times were accurate to 10 minutes and were adjusted for solar sunset. Around sunset was consistent with analyses using data with less temporal detail in Maine and Michigan (Farrell *et al.*, 1996; Allen & McCullough, 1976).

Habitat and deer densities have also been considered as a predictor of deer-vehicle accidents, with varying success and a range of predictor variables. In Spain, forested area was positively related to accidents, while agricultural lands and building density were negatively related (Malo *et al.*, 2004). In suburban areas around the Twin Cities, building density was negatively related while the area of land in public ownership was positively related (Nielsen *et al.*, 2003). The land in public ownership variable was probably related to wooded areas such as parks within an urban/suburban area. Amount of forest cover was significant in moose-vehicle collisions in Sweden (Seiler, 2005), as were intersections, road density, and moose abundance. Deer abundance, agricultural crops, and forested area were significant in South Dakota (Grovenburg *et al.*, 2008). Agricultural crops interspersed with forested areas in combination with bridges (surrogates for movement corridors) predicted deer-vehicle accidents in Iowa (Hubbard *et al.*, 2000).

Other than economic costs associated with accidents, a factor that is of importance is modifications to highway design for wildlife crossings (Fig. 2). These crossings add significantly to the cost of construction projects, and in some cases may be required when threatened or endangered species are present. Animal deaths should be reduced with wildlife crossings built into bridge projects that widen underpasses for animal movement. This type of modification often happens only if a highway project affects a species protected by the Endangered Species Act and federal monies are involved in the project. Costs increase by millions of dollars when wildlife crossings are installed, yet their effectiveness remains untested. One species that is currently classified as Threatened under the Endangered Species Act is the Canada lynx. Radiotelemetry data indicate that lynx use areas around roads, and will often cross highways that are present within their home range (Fig. 3).

Figure 2. Example modification of a bridge to encourage wildlife use of an underpass. On the left is the original bridge, on the right is a widened bridge span with room for animals to cross underneath. Photo credit: Mn/DOT.

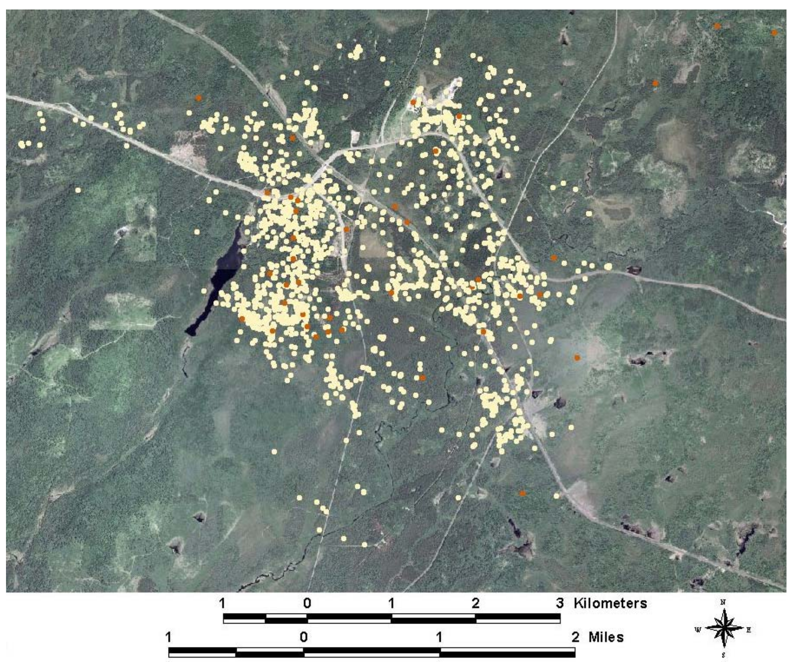


Figure 3. Example of locations of Canada lynx from GPS radiotelemetry in relation to transportation network. On this 2003 photograph are locations from 2 different Canada lynx, the intersection of 2 highways, several gravel roads, and a railroad. Despite all of the locations on and near the highway, there is no evidence that either of the lynx indicated here were killed by a vehicle collision. One lynx was hit and killed by a train near the center of this picture.

Increased understanding of animal and human behavior on roads would help to reduce the number of wildlife-vehicle collisions, and also make it possible to justify and test effectiveness of wildlife crossings. Recent developments in remote monitoring technology have resulted in a range of options. The simplest solution is remote trail cameras that are available at retail stores. These systems are limited in capabilities compared to a continuous monitoring system using multiple cameras simultaneously (Scheibe *et al.*, 2008; Huckschlag, 2008). The most expensive solution (about $12,000) is a real-time solution which can transmit images via satellite to a website for download (Locke *et al.*, 2005). A cost-effective and comprehensive monitoring system at areas where deer and moose cross roads would improve understanding of responses by both animals and vehicles (Reed *et al.*, 1975; Cain *et al.*, 2003), and ultimately could help reduce the number and severity of deer/vehicle collisions.

Animal monitoring systems could be used to test the effectiveness of Mn/DOT wildlife crossings. Problem Statement 170 in the Center for Transportation Studies Mn/DOT RFP for fiscal year 2007 dealt specifically with testing the effectiveness of wildlife crossings. We proposed to develop and test a self-powered video camera observation system to monitor roadways and wildlife crossing areas. The data collected with this system will enable identification of animal species crossing roads, the frequency of road crossings, animal behavior on and near roads, and vehicle (human) response to potential animal dangers. The system will implement many of the suggestions in reviews of wildlife crossings (e.g., (Clevenger & Waltho, 2003; Little, 2003).

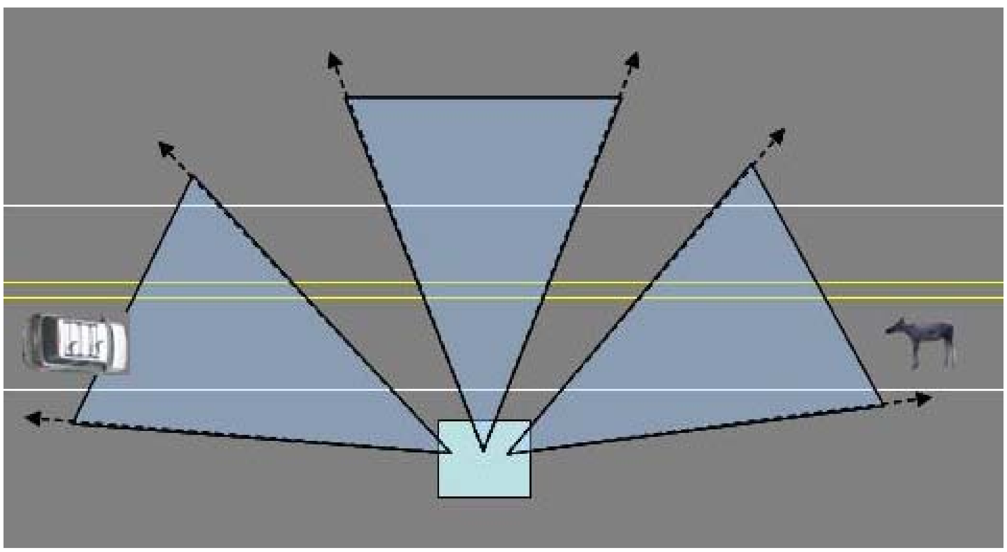
Methods

We include results from both trail cameras and a custom video system in this report. Trail camera use was not part of the original proposal. Purchase of trail cameras and analysis of trail camera results was completed under other funding, but results can be usefully contrasted with the video system developed here. The least expensive trail cameras were tested and I do not believe they are suitable for use in an evaluation of animal behavior or wildlife-vehicle collisions. These cameras have too long of a response time and are also not as sensitive to animal movements as more expensive cameras.

The trail camera that we do include in results and discussion is manufactured by Reconyx. We have used both black and white IR (Silent Image) and color IR (RC55 RapidFire) Reconyx cameras. These cameras have a rapid response time, capture at least 1 image per second, and can be deployed in the field for weeks with a single set of lithium batteries. Images are stored on Compact Flash cards, with thousands of images being stored. Costs of these cameras are about $500-$800.

We also developed a self-powered custom system that implemented multiple cameras simultaneously. System design enabled monitoring multiple views from the same location (Fig. 1). We had used similar camera equipment with lower power and shorter focusing range to monitor activity on captive Canada lynx in 2004 (Palakovich-Carr, 2007). The video sampling rate is adjustable and we reduced the frames per second to balance storage availability, data analysis time, and sampling frequency. Video at the full frame rate resulted in data redundancy, high storage needs (~48 GB / 24 hours), and long data processing times.

Figure 4. Figure 1. Schematic of video camera setup. Video cameras record in color during the day and have a 90’ infrared distance in darkness. 4 cameras (3 shown in schematic) fed simultaneously into a recorder. We will focus on the roadway and the approach to capture traffic volume, vehicle response, and animal activity.



System components and approximate costs are shown in Figure 5. Similar systems are described in two recent publications (Scheibe *et al.*, 2008; Huckschlag, 2008). Total system costs vary with cameras used and whether wireless or wired camera connections were used. Costs could range from $500 to $1,000 depending on capabilities. Costs for some system components are less now (2009) than when originally purchased. A cheap portable BW TV ($25) was used in the field to test equipment setup. The recorder and power supply (12-volt deep-cycle batteries) were stored in waterproof plastic bins. Cameras can be connected with cable connections to the recorder, or a wireless transmitter can be used to deploy cameras remotely (up to about 400 m distance).

We tested a Digital Video Recorder (DVR) and a time-lapse VCR with a multiplexor. The DVR is newer technology that also requires less power (Scheibe *et al.*, 2008; Huckschlag, 2008), while the VCR/multiplexor combination is based in VHS videotapes. An advantage of the DVR was supposed to be that hard drives would be field swappable and we would be able to simply replace hard drives in the field. However, the DVR capabilities at that time were not quite suitable for field replacement and direct import into a Windows computer. The DVR recorded to a proprietry file format and a non-standard disk format, requiring that we bring the DVR into the office to transfer data to MPG files manually. Thus, preparing video for analysis for both the VCR and the DVR was similar: Bring equipment to office, write the MPG via video conversion hardware (Pinnacle USB MovieBox) to hard drive, and then create a DVD for permanent storage.

Figure 5. Components and approximate costs of the video camera setup. Some items can be purchased off the shelf from hardware stores or department stores. Other items (e.g., cameras, DVR) are available from stores that sell security camera systems.

The system was tested at the Advanced Sensor Research Laboratory facility on I-35 south of Cloquet and at a residence on West Pike Lake Road (near Duluth, MN) with 110-volt electrical power. After equipment setup and initial testing, the system was deployed in areas without 110-volt power near Duluth and on Highway 2 north of Two Harbors, MN.

Results

We deployed the system for 1 week at the I-35 facility, for 4 weeks at the residence on West Pike Lake Road, and for portions of several weeks as a battery-powered system. No animal activity was detected at the I-35 facility, where we had expected to obtain images of deer crossing the interstate as in the past we had seen road-killed along this corridor. The low numbers of animal events was not expected (Table 1). The area around the residence does have known deer crossings, but no deer crossed the road during the period when the cameras were active. We know the camera system was functioning because we identified images of cars, pedestrians, and bicyclists.

Table 1.Example observation periods at the I-35 and residence sites. Surprisingly few animals were seen, although observers were able to see cars on the I-35 site, and cars, bicyclists, and pedestrians at the residence indicating that cameras were functioning and resolution was adequate to identify animals.

Day	Location	Hours	Comments
1	I-35	4	1 crow
2	I-35	13	No animals
3	Residence	24	1 deer
4	Residence	24	4 deer, 1 cat/dog
5	Residence	24	1 deer (camera dark), 1 bird
6	Residence	24	No animals, raining, can’t see part of tape
7	Residence	24	1 Squirrel, 2 birds

We picked up images of deer at the residence, and identified a Canada lynx walking on Highway 2 (Fig. 6). Animal images were recognizable on the DVR and VHS images. While processing the video the observer had to monitor 4 cameras simultaneously. The amount of time required to process video was larger than expected at about 4 hours per 24 hour camera period, and observers found it difficult to process an entire 24-hour period in one sitting due to eye-strain. When an event was identified, the observer would convert the TV monitor from 4 panels to 1 full-screen panel and record start and stop time for the event.

Figure 6. Images recorded on video camera setup. Cameras were set up on Highway 2 north of Two Harbors. The top 2 cameras were physically connected to the recorder. The bottom 2 cameras were set up with wireless connection. Camera 3 (CH 3) had poor reception on the wireless channel during part of the camera deployment, while Camera 4 picked up a Canada lynx walking north on Highway 2.

Small scale images could be magnified with both DVR and VCR systems, resulting in images that were recognizable to species (Fig. 7). The deer image was taken at an approach to the road, rather than crossing the road. Usable distance will depend on cover that is available where the camera is located. I usually attached the camera (which is really a lens (Fig. 5)) to a branch with a cable tie. Some placements resulted in partial obstruction from vegetation, other placements had a long field of view (Top left figure in Fig. 6). Deer moving at the farthest distance (500 m) would probably not be visible at this resolution with the lens used. Telephoto lenses could be used to get locations at longer distances, but would not provide night-time illumination which was limited to about 30 m. At night-time eye-shine from the tapetum lucidum of deer was clearly evident when animals looked at the camera (Fig. 7).

Figure 7. Animal images from field recordings. On the left is a larger resolution image of a Canada lynx, on the right is an image of a white-tailed deer as it approaches the road.

We created a data entry form in Excel. Data was first entered onto the data entry form by hand, and then entered into Excel with conversion to Access/Dbf format for analysis of data. Excel was useful because it is possible to easily calculate duration of an event by difference between two date and time fields. Data fields that were stored were both animal and vehicle related (Table 2).

Table 2. Fields that are recorded in the data entry form while observing video or image series.

Data Field	Description
Time and Date	Recorded for all events
EventType	Start analysis, End analysis, Species in, Species out Vehicle in, Vehicle out
Behavior	Cross, Walk, TurnBack, Wait
Vehicle	Vehicle type, Direction
Duration	Length of event (In – Out)

Because we obtained very few images of animals, we were not able to estimate time required to obtain sufficient deer crossings to analyze animal behavior. It would require a much longer time of deployment of cameras, or movement of the cameras to areas with higher frequency of deer crossings, to measure responses of deer to vehicles with adequate sample size for statistical analysis. We missed one deer-vehicle accident by 10 m at the residence. It occurred at night and was just out of range of the IR illumination.

As part of another project we had also been using a high-end trail camera (Reconyx) to monitor road use in a pilot experience. We deployed collars on a gravel road with vehicle speeds typically of about 50 mph. Cameras were deployed in woods for security reasons, which degraded the night-time image quality because infrared beam was focused on branches rather than on the animal which triggered the event. However, we were still able to obtain multiple images of several species in both day and night (Fig. 8). An advantage of the Trail camera approach is that fewer images were recorded because the camera was triggered by a combination of motion and IR heat differential. The disadvantage of this approach is that because images are not recorded continuously, one does not know if events are missed.

The Reconyx is the best commercially-available camera for this purpose because the start-up time is very short, which reduces the chance of missing events. For the vehicle images shown, the camera went from detection mode to taking a picture quickly enough to get images of the bed and rear wheels of pick-ups that were probably going at least 50 mph. In one case the Reconyx camera picked up a small motorcycle. Even with this quick response time, there were multiple images on the compact flash card that were empty. These empty images could have been missed vehicles or they could have been triggered by a combination of solar-heated vegetation and leaf movement in the wind. Removing branches and leaves would have reduced false images, but the branches were used to hide the camera in the brush.

Figure 8. Animal images from Reconyx camera on road. In (a) a Canada lynx (Lynx canadensis; (b) gray wolf (Canis lupus); (c) black bear (Ursus americanus); (d) white-tailed deer; (e) Pickup; and (f) trailer on semi-trailer truck. Vehicle speeds unknown but most likely about 50 mph.

Discussion

We designed a system that met design specifications of being a self-powered camera system that would function under field conditions and could monitor roads to record crossings of animals such as white-tailed deer. The system is very similar to continuous monitoring systems that recently appeared in peer-reviewed journals (Scheibe *et al.*, 2008; Huckschlag, 2008). Camera monitoring systems such as this could be applied to several research topics. A primary function would be to increase understanding of animal movements with respect to deer-vehicle accidents. The system is also flexible enough to be used for other purposes. For example, wildlife crossings are sometimes built into highway construction projects (Fig. 2). These crossings add significantly to the cost of projects but their effectives has yet to be evaluated.

One issue that will vary among study designs is whether to use a custom system such as we designed, or to use a trail camera that can be purchased at retail stores. Any trail camera should meet minimum specifications with respect to start-up time. Most trail cameras, especially inexpensive models, have a start-up time that would result in missing vehicles or animals crossing the field of view. These cameras are designed to observe events like deer at feeding stations, where the animal remains in the camera field of view for much longer than an animal or car would be in view when a camera is monitoring a roadway. Start-up specifications should meet or exceed the specifications for the Reconyx camera that we used. A disadvantage of high-end trail cameras could be cost: at $500 or more per camera, a custom alternative such as developed here could be a more cost-effective solution because 4 cameras can be deployed simultaneously with a DVR and a VCR system that would provide a much broader coverage area. Similar coverage with a Reconyx trail camera solution would cost at least $2,000.

On aspect of the project that took longer than expected was analysis of the captured video. None of the previous papers on DVR analysis (Scheibe *et al.*, 2008; Huckschlag, 2008) addressed the time required to analyze images. It is clear that there are patterns associated with animals (e.g., the eye-shine from the tapetum lucidum at night, visible in Figs. 7 and 8) that could be searched for via a computer-based algorithm. Other patterns that could be programmed are the general 4-legged shape of mammals, the circular pattern of a tire, and the rectangular pattern of a pick-up truck bed. These patterns could also be identified by difference – as the body of an animal enters the field of view and then moves across the body pattern or tapetum lucidum reflection moves with it. In most cases with the

Reconyx camera we obtain 3 pictures of an animal crossing the field of View. Similar settings are possible with the DVR or VCR system.

One aspect where automated analysis of images would best be augmented with manual analysis is in monitoring behavior. A system similar to the one designed here was set up to evaluate whether reflectors could deter deer from crossing a roadway when vehicles were approaching (D'Angelo *et al.*, 2006). Multiple cameras could be used to cover a long section of a roadway. An automated procedure could be used to locate portions of the video where animals were present. Then, manual description of animal responses could be used to interpret animal behavior in response to oncoming vehicles. The experiment would best be done in an area of very high deer density based on the results of our pilot experiment.

The system described here, or an alternative system using high-end trail cameras, could be used to learn more about how both people and animals respond in situations where an animal-vehicle collision is possible. Given the high cost of deer-vehicle collisions across the United States (Bissonette *et al.*, 2008) and elsewhere, there should be a strong incentive for further research in this area. Mn/DOT personnel were generally favorable to this experimental approach (Appendix 2). We believe there is strong potential for this methodology to be used to investigate human-vehicle-animal interactions, and to be used to investigate use of wildlife crossings by animals.

Acknowledgements

This project was funded by a Northland Advanced Transportation Systems Research Laboratories grant through the College of Science and Engineering at the University of Minnesota Duluth. Reconyx cameras were obtained through a grant from the U.S. National Park Service. We acknowledge Dr. Eil Kwon for inviting us to present results of this project at the Mn/DOT research day in Duluth, MN.

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Appendix 1. Project outcome with respect to Mn/DOT RFP

In this project, Animal-Vehicle Collisions and Road-Crossings—Detecting Responses, we proposed to develop a self-powered portable station that could be used to collect and archive data on human and vehicle responses to animal movements on roadways. Another need identified by Mn/DOT for the system described in this proposal is monitoring the use of specially designed wildlife crossing areas. The RFP topic related to monitoring road crossings (Problem Statement 170 in the Center for Transportation Studies Mn/DOT RFP for fiscal year 2007) was not re-offered after we received this grant.

Several comments from the MnDOT Research Day in Duluth indicated that this project was one that people felt was valuable. The comment sheets are included as part of this report (see Appendix 2). One road-crossing proposal was funded in 2006 (see comments by reviewer in Appendix 2 stating that research project started). To date there are no results available from that project (Jason Alcott, Mn/DOT, phone conversation summer 2008).

Appendix 2. Comments from Mn/DOT Research Days

UNIVERSITY OF MINNESOTA

Duluth Campus

NATSRL

Northland Advanced Transportation
Systems Research Laboratories

College of Science and Engineering

1023 University Drive
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November 16, 2006

TO: **NATSRL Research Day Presenters** To: Ron

FROM: **Carol Wolosz** Carol

SUBJECT: **Feedback Forms**

Thank you for participation in this year's Research Day event. The feedback forms were completed by non-university participants at Research Day. The forms for your session are attached for your information/review.

I look forward to working with you on future projects.

Project Title: **Animal-Vehicle Collisions and Road Crossings – Detecting Responses**

Principal Investigator: **Dr. Ron Moen**

Does this project address important transportation issues or a significant problem?

☒ Yes

☐ Yes, except the following changes should be considered.

☐ No. (Please elaborate.)

Comments: I believe that it is better to have good data on the behavior of animals and ~~[illegible]~~ use this data to make decisions on what to do.

Does the methodology take advantage of the most current approaches and methodologies?

☒ Yes

☐ Yes, except the following changes should be considered.

☐ No. (Please elaborate.)

Comments:

How applicable is the research?

☒ Very applicable.

☐ Very applicable, except the following changes should be considered.

☐ Not applicable. (Please elaborate.)

Comments: Animal-Vehicle Collision is a ~~[illegible]~~ big problem in this area.

Has the researcher incorporated technical partnerships and user involvement in the project?

☐ Yes. List partners and relation to the project:

☒ No. ?

Project Title: **Animal-Vehicle Collisions and Road Crossings – Detecting Responses**

Principal Investigator: **Dr. Ron Moen**

Does this project address important transportation issues or a significant problem?

☑ Yes

☐ Yes, except the following changes should be considered.

☐ No. (Please elaborate.)

Comments:

Does the methodology take advantage of the most current approaches and methodologies?

☐ Yes

☑ Yes, except the following changes should be considered.

☐ No. (Please elaborate.)

Comments: The use of GPS & video tracking is beneficial, what are results?

How applicable is the research?

☐ Very applicable.

☑ Very applicable, except the following changes should be considered.

☐ Not applicable. (Please elaborate.)

Comments: If the data is used as a warning for motorists or a standard for designing wild life crossing areas then it will be very applicable

Has the researcher incorporated technical partnerships and user involvement in the project?

☐ Yes. List partners and relation to the project:

☐ No.

Project Title: **Animal-Vehicle Collisions and Road Crossings – Detecting Responses**

Principal Investigator: **Dr. Ron Moen**

Does this project address important transportation issues or a significant problem?

☒ Yes

☐ Yes, except the following changes should be considered.

☐ No. (Please elaborate.)

Comments: ____________________

Does the methodology take advantage of the most current approaches and methodologies?

☐ Yes

☒ Yes, except the following changes should be considered.

☐ No. (Please elaborate.)

Comments: ____________________

How applicable is the research?

☒ Very applicable.

☐ Very applicable, except the following changes should be considered.

☐ Not applicable. (Please elaborate.)

Do you see potential for impact in the next 5 years? 10 years? 20 years?

Comments: YES, WE DO NEED TO KNOW IF ANIMALS USE "KRITTER CROSSING". ALSO, WE NEED DEER CROSSING AVOIDANCE SYSTEM.

Project Title: **Animal-Vehicle Collisions and Road Crossings – Detecting Responses**

Principal Investigator: **Dr. Ron Moen**

Does this project address important transportation issues or a significant problem?

☒ Yes

☐ Yes, except the following changes should be considered.

☐ No. (Please elaborate.)

Comments: Great Question to be answered. "Do animals use modified crossings"

Does the methodology take advantage of the most current approaches and methodologies?

☒ Yes

☐ Yes, except the following changes should be considered.

☐ No. (Please elaborate.)

Comments:

How applicable is the research?

☐ Very applicable.

☐ Very applicable, except the following changes should be considered.

☒ Not applicable. (Please elaborate.)

Comments: No research is being done yet.

Do you see potential for impact in the next 5 years? 10 years? 20 years?

Comments: Yes, long range

Project Title: **Animal-Vehicle Collisions and Road Crossings – Detecting Responses**

Principal Investigator: **Dr. Ron Moen**

Does this project address important transportation issues or a significant problem?

☒ Yes

☐ Yes, except the following changes should be considered.

☐ No. (Please elaborate.)

Comments: this will allow us to see where animals are concentrating + then can place structures. This will help to see what type of structures are working.

Does the methodology take advantage of the most current approaches and methodologies?

☐ Yes

☒ Yes, except the following changes should be considered.

☐ No. (Please elaborate.)

Comments:

How applicable is the research?

☒ Very applicable.

☐ Very applicable, except the following changes should be considered.

☐ Not applicable. (Please elaborate.)

Comments:

Has the researcher incorporated technical partnerships and user involvement in the project?

☐ Yes. List partners and relation to the project:

☒ No.
- A research project through Mn/DOT has just been started on wildlife crossings using cameras + Bridges
- Europe has a lot of various wildlife crossings

Do you see potential for impact in the next 5 years? 10 years? 20 years?

Comments: Need it now