DEVELOPMENT OF A WARNING SYSTEM FOR THE REDUCTION OF ANIMAL/VEHICLE COLLISIONS

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ABSTRACT

Every year collisions between motor vehicles and large animals, such as deer, elk, and moose, account for a large quantity of motor vehicle accidents. The result of these accidents is a significant cost in terms of property damage, personal injury, and loss of life.

Finding countermeasures to this problem that are both economical and effective continues to be a challenge. In Saskatchewan, a new approach to this problem has been developed which integrates a number of existing technologies to create an intelligent system for application in rural areas. The presence of a vehicle will trigger warning devices in the animal corridor designed to frighten animals away from the roadway, allowing vehicles to safely pass through the area.

The selective warning approach has two advantages. By using selective activation of the system, animals can still cross the roadway freely when traffic is not present. The other advantage is that animals are less likely to become accustomed to the warning devices if their activation is irregular and infrequent.

A test system was deployed in 2000 in an area with a history of incidents. The test system was used to evaluate several technology options for possible integration into the system. Based on the successful results of the testing and the technology evaluation, a design has been developed for deployment. This paper will discuss the development, testing, and operation of the wildlife warning system.

INTRODUCTION

Every year collisions between motor vehicles and large animals, such as deer, elk, and moose, account for a large quantity or motor vehicle accidents. The result of these accidents is a significant cost in terms of property damage, personal injury, and loss of life. The most common animal involved in these accidents are deer, which will be the emphasis of much of the information presented, although the information may also apply to other animals as well.

The number of animal-vehicle collisions continually increased during the 20th century as traffic volumes, vehicle speed, and deer populations all increased. In 1980 approximately 200,000 deer were killed on U.S. roadways in deer-vehicle collisions and by 1991 the total number of deer killed as a result of deer-vehicle collisions that year was estimated at 538,000 (Danielson and Hubbard, unpublished). This estimate was based on collision data from only 36 states and did not include the many deer-vehicle collisions that occur and are not reported (Danielson and Hubbard, unpublished). It also does not include collisions with other large animals such as moose and elk. It is currently estimated that approximately 726,000 deer-vehicle accidents occur annually in the U.S. (Danielson and Hubbard, unpublished). In Iowa alone, an estimate of approximately 13,500 deer-vehicle collisions occurred in 1998 (23% increase in 3 years), resulting in an annual total of more than $10 million in personal injury and property damage to Iowa motorists (Danielson, Hubbard, Murray, and Van Helden, unpublished).

Deer-vehicle collisions have also been steadily increasing in Canada, especially in the province of Saskatchewan. A total of 47,058 reported deer-vehicle collisions have occurred in Saskatchewan from 1988 to 2000 (TAIS, unpublished). This results in an average of 3,620 collisions per year. With an estimated population of one million, one in every 276 person in Saskatchewan will be involved in a deer vehicle collision each year. This number is very high when the number of children, adults, and seniors who do not drive are taken into account.

Not only do deer-vehicle collisions result in injury and loss of life, but they result in great economic costs to society as well. Since the number of deer-vehicle collisions can be estimated, the economic costs associated with those collisions can also be estimated. In the United States, approximately 29,000 human injuries, 211 human fatalities, and over $1 billion in property damage occur annually as a result of deer-vehicle collisions (Danielson and Hubbard, unpublished). Similar to the continually increasing animal-vehicle collisions, the cost of each accident is also increasing. In 1978, the average cost of a deer-vehicle accident in Michigan was estimated at $648 and by 1996 in Iowa the average cost of a deer-vehicle accident had rose to over $1,000 (Danielson and Hubbard, unpublished). Currently nationwide, the average vehicle damage costs have been estimated at approximately $2,000 per collision (Danielson and Hubbard, unpublished).

It is obvious that something needs to be done to reduce the number of deer-vehicle collisions. Some different methods that exist in reducing deer-vehicle collisions include wildlife warning reflectors and mirrors, car mounted deer whistles, extra signing along

roadways, feeding programs, and fencing. Newer solutions use technology to detect the presence of animals and to use this information to provide messages to approaching drivers. Thus far, no system has emerged as a solution that is economical and effective for all applications.

The Wildlife Warning System (WWS) has been developed by IRD in response to problems in Saskatchewan and involves an original and unique method of reducing deer-vehicle collisions. Although not a remedy for all problem locations, the WWS shows promise as another tool to be applied to reduce the number of animal/vehicle collisions on rural roads with lower volumes of traffic.

OPERATION OF THE WILDLIFE WARNING SYSTEM

IRD's Wildlife Warning System (WWS) provides a new approach to reducing the number of deer-vehicle collisions by integrating a number of existing technologies to create an intelligent system that will alert wildlife at an animal crossing that a vehicle is approaching. The approaching vehicle will trigger a sensor in advance of the crossing area. The sensor will send a signal to remote units which are strategically placed along the crossing area of the roadway. The remote units will provide a means to repel wildlife by means of sounds, lights, and/or scent. The WWS is based on the idea of alerting wildlife of an oncoming vehicle before the vehicle reaches the animal(s). When the WWS is activated, animals shall be frightened away from the roadway, allowing vehicles to safely pass through the area. Figure 1 illustrates a sample WWS layout and shows the basic operation of the WWS. From Figure 1 we are able to see how the detector and transmitter units detect an oncoming vehicle and then transmit a signal to remote warning devices placed further down the roadway.

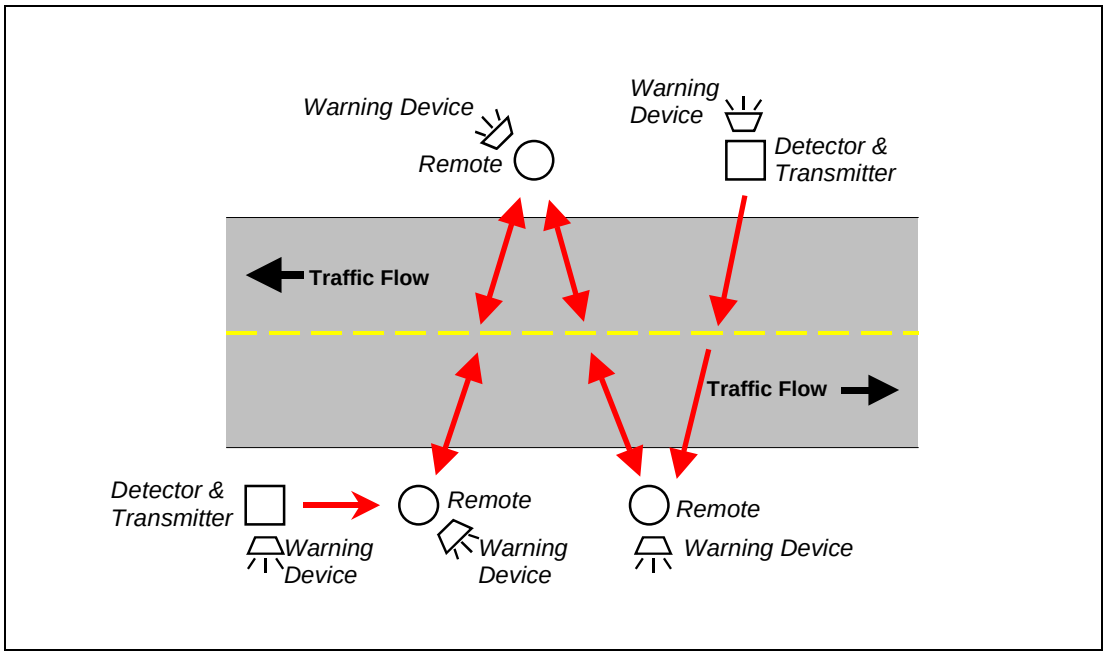

Figure 1 Sample Wildlife Warning System Layout

Each unit is equipped with detection, communication, and activation capability so that the same unit can be used for a number of tasks. For example, each unit on the end of the layout can be used for detection so that vehicles entering the conflict area from either direction will activate the system. The end unit will trigger the activation of the system for vehicles from one direction, and will simply receive communication and be activated for vehicles from the other direction.

Each unit only needs to communicate with the adjacent unit in the system to receive directions for activation. When a unit is activated, it also passes on an activation message to the next unit. With this arrangement, there is no limit to how many units can be installed, so as many units as needed can be deployed to cover the conflict area.

The WWS approach has several advantages over other potential solutions. By using selective activation of the system, animals can still cross the roadway freely when traffic is not present. Another advantage is that animals are less likely to become accustomed to the warning devices if their activation is irregular and infrequent. This will reduce the common effect of animals becoming desensitized to repetitive/uniform deterrent devices, which ultimately renders those devices ineffective. Thirdly, the flexibility in deployment and cost for covering an area of conflict is an advantage over other potential solutions such as fencing.

DEVELOPMENT TESTING

The development of the WWS began when IRD was approached with the problem and a potential solution by Saskatchewan Government Insurance (SGI), the public insurance agency in Saskatchewan responsible for licensing and insuring of all motor vehicles. As insurer for motor vehicles and drivers, SGI has an interest in technology that will reduce animal/vehicle collisions and reduce the claims for damage that it receives. IRD took on the task of developing a product to meet the need for an economical and effective animal deterrent. Product development of the WWS began during the fall of 2000. IRD tested a number of options to determine the best technology and system requirements for the system. The options considered included vehicle detection, animal deterring devices, system power, and system controllers.

A test site was selected for implementation of the WWS. The selected site is located 10 minutes outside of Saskatoon, Saskatchewan, on Highway 7 headed West towards the community of Vanscoy. Figure 2 illustrates the location of the test site.

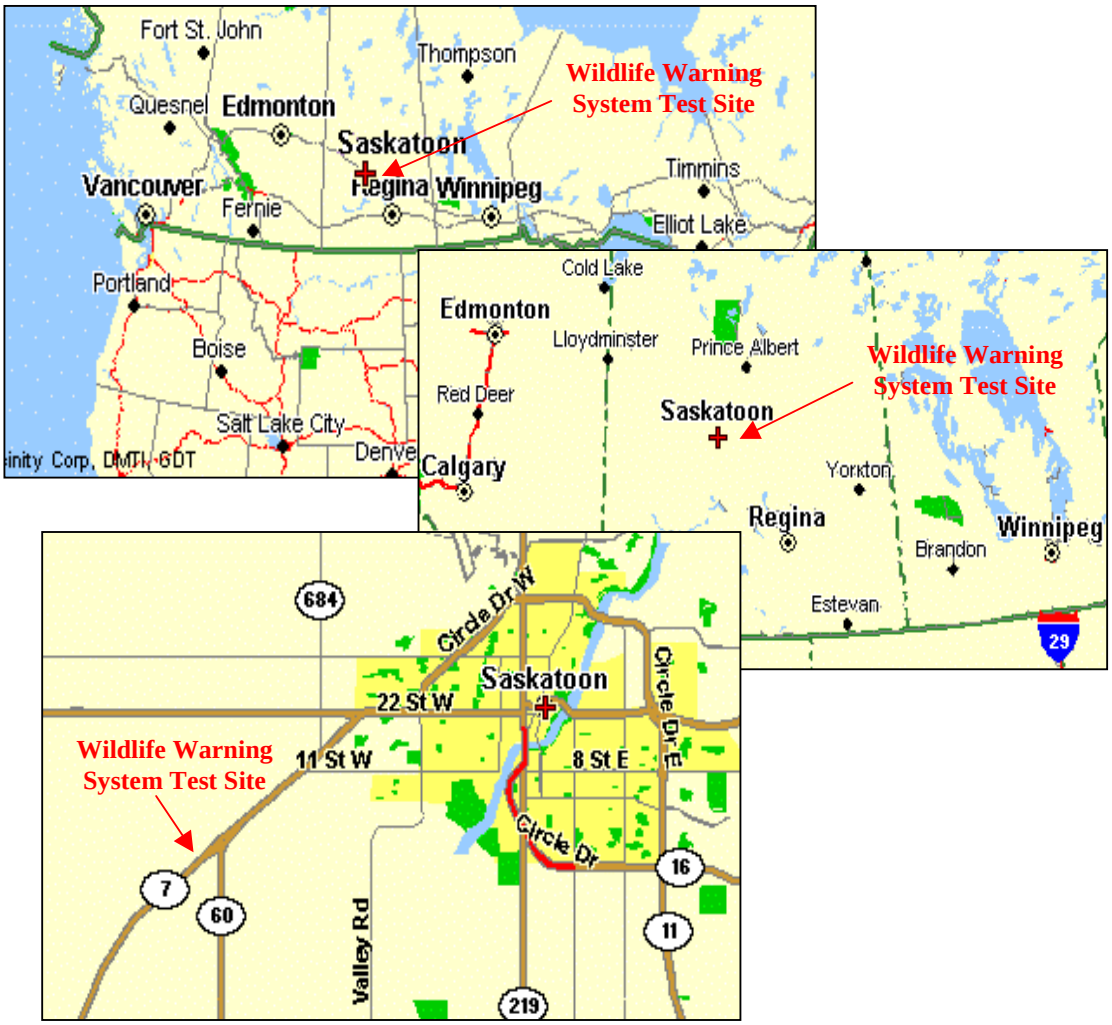

Figure 2 Location of the Wildlife Warning Test Site

The test site consists of a two-lane highway with high grass and bushes adjacent to the roadway, making it hard for drivers to see approaching deer. The highway intersects the animals natural travel routes for bedding, watering, and feeding, leading to the conflicts that are seen in this area. Figure 3 is a photo taken at the Highway 7 test site.

Figure 3 Wildlife Warning System Test Site

Past statistics have shown a high deer-vehicle collision rate on the chosen section of highway. From 1995 to 2000 there have been 86 reported cases of property damage, 4 reported personal injury claims, and one fatality on the chosen stretch of highway. It should be noted that the preceding numbers only take into account the reported number of collisions, and many collisions may go unreported for various reasons. A local resident who owns much of the property adjacent to the WWS test site on Highway 7 reported that an average of 30 to 50 deer are killed along that stretch of roadway each year.

CURRENT PROJECT STATUS

A number of WWS units using the new technology have been built. These systems are fully operational and are undergoing operational testing. Each WWS unit is capable of detecting vehicles, emitting/transmitting a signal to/from other units, and contains a warning device that is activated when necessary. In operation the WWS units will be set up along the selected highway in such a manner that the first unit along the roadway will detect the oncoming vehicles and simultaneously activate the warning device on that unit as well as emit a signal to the next unit further down the highway. Oncoming vehicles are detected by a microphone sensor while warning devices currently being used for testing consist of built in deer-repelling horns as well as flashing light emitting diodes (LEDs). The units are built with several additional input and output channels so that other external triggering devices and alarm devices can easily be integrated into the system. The units are battery operated, with a compact solar panel provided to ensure long term operation of each unit.

CONCLUSION

Collisions between animals and vehicles is an on-going problem that is only getting worse as development, traffic volumes, and deer populations increase. This problem is widespread throughout North America and results in significant costs in terms of property

damage, injury, and death. Although many potential solutions are available to address this problem, none has been proven to be economical and effective for all applications.

The WWS provides another tool to be used to increase safety for man and animals as they share the highway The WWS is a simple, flexible, and easy to implement solution that can be adjusted to suit the particular conditions of a site and takes a new approach to the problem. By using selective activation, the system has the potential to maintain freedom of movement for animals on their travel routes, while at the same time being effective at deterring animals from being on the roadway when traffic is present.

ENDNOTES

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