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.....Animal-Vehicle Collision Reduction

EVALUATION OF MEASURES TO MINIMIZE WILDLIFE-VEHICLE COLLISIONS AND MAINTAIN WILDLIFE PERMEABILITY ACROSS HIGHWAYS IN ARIZONA, USA

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Problem Statement

Major construction upgrades are underway along a 28km section of State Route 260 in central Arizona that exhibits a high incidence of collisions (e.g., >4km/year) between wildlife, primarily Rocky Mountain elk (*Cervus elaphus*), and vehicles. As this highway is being upgraded from a narrow two-lane roadway to a four-lane divided highway, 12 sets of large underpasses (in addition to 5 sets of bridges) are being constructed to facilitate wildlife passage across the highway corridor and minimize the incidence of wildlife-vehicle collisions. Construction is being accomplished in stages (5 total), with the first 8-km section with two underpasses completed in 2001 and the second 12-km section with five underpasses nearing completion. Limited elk-proof fencing has been erected in association with the completed underpasses and those under construction, and alternatives to fencing (e.g., large boulder rip-rap and steep cut slopes) are also being applied. Our research focuses on evaluating the effectiveness of the underpasses, fencing, and other measures in reducing the incidence of wildlife-vehicle collisions and maintaining wildlife permeability. Our findings are being applied through adaptive management to make modifications to underpass design and fencing to increase use by wildlife.

Project Objectives

The primary objectives of our research project, ongoing since 2002, are to:

- 1) Determine the effectiveness of the full complement of measures to minimize the incidence of wildlife-vehicle collisions along State Route 260.
- 2) Evaluate the degree to which wildlife permeability across the highway is maintained.
- 3) Provide ongoing construction implementation guidance to Arizona Department of Transportation (ADOT) project managers throughout all construction phases.

Funding Source and Total Budget

Funding through 2004 for our current research project is provided by a grant from ADOT's Transportation Research Center (\$217,000), our Federal Aid in Wildlife Restoration Act Project W-78-R (\$120,000), and from the USDA Forest Service, Tonto National Forest (\$31,500). An agreement with ADOT for funding through 2006 (\$259,000) is near finalization. The Federal Highway Administration has also contributed \$40,000 toward this research project.

Methodology

To assess the overall effectiveness of measures to reduce wildlife-vehicle collisions, we employed a standardized, multi-agency wildlife-vehicle collision tracking form. This tracking, ongoing since 2000, allows us to assess changes in collision rates pre- and post-highway upgrade, as well as against control areas.

To assess the effectiveness of underpasses as well as elk-proof fencing, escape jumps and one-way gates on the completed highway section, both video camera monitoring and prepared track bed counts are being used. Cameras and track beds have been placed inside the two underpasses, at the mouth of the underpasses, and approximately 60m away to determine relative rates of passage by approaching wildlife. At each underpass, we installed four-camera infrared video monitoring systems with multiple triggers. Camera systems have also been deployed at the terminus of the fencing to assess wildlife passage around the end of the fence. In addition to counting and identifying individual animals recorded on videotape, we also characterize behavioral response by wildlife when approaching and using the underpasses.

To assess wildlife crossing patterns in relation to the highway and its upgrade, 30 elk have been instrumented with global positioning satellite (GPS) receiver collars, including five with ARGOS satellite data transmission capabilities. Information from these collars, though preliminary in nature, has been used to assess the extent to which fencing should be constructed in association with underpasses. Geographic information system (GIS) analysis has been employed to identify elk highway crossings and concentration areas immediately adjacent to the highway.

Summary of Findings

A total of 181 collision reports have been logged to date. For the section where construction is complete, no change in the number of collisions has occurred post- versus pre-construction. This may reflect the limited amount of fencing associated with the two underpasses, allowing animals to cross the highway along most of the section.

GIS analysis of GPS locations for nine collared elk identified 675 highway crossings between May 2002 and July 2003; data from all collared elk yield >2,500 identified crossings. Only six percent of the crossings occurred at the two underpasses on the completed section; additional fence may be needed to increase underpass use and reduce the collision rate. These data have shown highway engineers the relative efficacy of different fencing options in terms of the probability of intercepting elk crossing the highway. On the next section of highway to be constructed, GPS data show that 72 percent of elk crossings could be intercepted by fencing only 25 percent of the section.

To date, 1,730 animals have been recorded by video monitoring of the two underpasses, including 1,435 elk and 257 white-tailed deer (*Odocoileus virginianus*). Elk passage rates (74% versus 51%) and numbers of animals through the underpasses (700 versus 184), as well as behavioral response (e.g., 11% versus 28% alarmed flight from underpasses) were significantly different, and appear to be tied to underpass design. To date, only one deer has successfully crossed the underpasses, and instead, they typically pass around the fence terminus ($n=170$). Insights from this monitoring have been used to modify future underpass design at other sections along State Route 260. A significant relationship between underpass crossings and traffic volume suggests that elk do not cross through either underpasses when traffic volume is greater than seven vehicles/minute. Since completion in late-2001, overall use of the two completed underpasses has increased steadily, and now approaches 90 percent for both underpasses combined. However, a drop in passage rate occurred during spring 2003, possibly reflecting “uneducated” migrating, non-resident elk encountering the underpasses as they moved to summer range; it is anticipated that a similar decline will occur in the fall as migrating elk move toward winter range.

Implications for Future Research

As additional sections of State Route 260 are completed, increasing the number of underpasses that we will evaluate, our ability to correlate wildlife use to underpass design will also increase. Obtaining GPS data from all 30 collared elk (May 2004) will allow us to more definitively identify where fencing should be constructed to optimize its potential to funnel animals toward underpasses and reduce the incidence of collisions, while at the same time maintaining wildlife permeability across the highway. A TEA-21 enhancement grant has been submitted to retrofit the Preacher Canyon with additional fencing (1.5km) to funnel a greater proportion of elk toward underpasses and bridges; post-fencing monitoring will be conducted for two years to assess the change in elk crossing behavior. Electronic animal detection/motorist alert systems will also be placed at the ends of fencing to attempt to modify motorist behavior. Ultimately, our adaptive management efforts with ADOT will result in increased highway safety and use of crossing structures by wildlife.

For more information on this project: www.gf.state.az.us.wildlife_conservation/research

Biographical Sketch: Norris Dodd is a research biologist and has worked for Arizona Game and Fish for 24 years, addressing highway-wildlife relationships the past three years.

Jeff Gagnon has worked for Arizona Game and Fish for six years and currently is a research technician. He is pursuing an M.S. degree at Northern Arizona University, studying wildlife-highway relationships.

Ray Schweinsburg has served as a research program supervisor with Arizona Game and Fish for 10 years and previously was a private consultant and a research biologist with the Canadian Wildlife Service.