METHODS USED BY THE ARIZONA DEPARTMENT OF TRANSPORTATION TO REDUCE WILDLIFE MORTALITY AND IMPROVE HIGHWAY SAFETY

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Abstract
The Arizona Department of Transportation (ADOT) has responded reactively to increasing accidents involving elk and deer on state route 260 over the last five years. Efforts to reduce these accidents have included signing, and vegetation treatments such as thinning to improve visibility and chemical treatments to reduce attractant vegetation. With new construction planned for S.R. 260, opportunities to proactively plan to reduce wildlife mortality and improve highway safety are occurring. Field research and accident data have been used to determine locations of wildlife travel corridors, use of existing bridges by elk and deer, and diet preference. Bridges are being constructed over these corridors to allow wildlife to pass beneath the roadway through their preferred movement routes. Fence, along with escape ramps and one-way gates, will be constructed to encourage wildlife to cross the roadway under bridges. Re-vegetation with palatable vegetation in movement corridors, along with >guzzler= tanks and salt stations, will be added to further attract deer and elk into safe crossing areas. Re-vegetation of the road shoulders with unpalatable plants, plus a larger clear zone will make the road shoulders less attractive to foraging wildlife. Habitat enhancement projects including controlled burns and re-vegetation with nutritional forage will take place off of the right -of -way to improve forest habitat for both deer and elk. A five-year monitoring plan to evaluate the effectiveness of fence, bridges, gates, ramps, and habitat improvements in reducing wildlife accidents and improving wildlife movement on the Mogollon rim area of Arizona has been drafted.

Introduction

The state of Arizona faces many challenges in its attempts to improve habitat connectivity and reduce highway wildlife mortality. A rapidly expanding human
Population and the need to improve the highway infrastructure to meet the corresponding increase in average daily traffic have resulted in a yearly construction budget of nearly one billion dollars. Rural two-lane roads are rapidly being converted to four- lane divided highways which can create nearly impenetrable barriers restricting the movement of wildlife, and resulting in hazardous driving conditions when unsuspecting motorists come in contact with large mammals attempting to cross the road. Further complicating this is the highly diverse nature of the State of Arizona. Arizona is the sixth largest state in the United States. Comprised of 114,000 square miles, Arizona contains 15 biotic communities (Brown1994). This community diversity has resulted in 138 species of native mammals
(Hoffmeister 1986), which are trying to survive in rapidly decreasing habitats.

Problem Statement

In the early 1990=s, Arizona entered a period of drought and rapid human population growth resulting in increased wildlife movement and wildlife related accidents. In 1994, Arizona State Route 260 was identified as a route requiring immediate action to reduce rapidly increasing accidents involving mule deer (*Odocoileus hemionus)*, white-tailed deer *(*Odocoileus virginianus), and elk (*Cervus elaphus).* These three *Cervidae*, were responsible for 458 of 1433 or 32% of all accidents between milepost 250 and 340 on State Route 260 from 1992-1997. Arizona State route 260 is an east -west roadway, which provides access to Interstate 40 and the Mogollon Rim country of Arizona. From the town of Payson and an elevation of 5000 feet, 260 travels eastward through dense Petran Montane Coniferous forests consisting mostly *of Ponderosa Pine (*Pinus poderosa), Gambel oak (*Quercus Gambeli*), and quaking aspen (*Populous tremuloides*). The route reaches its peak elevation of 7700 feet on top of the Mogollon Rim, just west of Heber Az. This area is used heavily as an outdoor recreation area and has several forest service campgrounds and lakes. Residents travel from the metropolitan areas of the state to take advantage of the out door recreational opportunities and cooler summertime temperatures.
As 260 travels east, onto the Mogollon Rim, it interrupts the natural movement of elk and deer moving on and off of the rim to escape extreme cold on top or heat below the rim.

Initial Problem Solution

In 1994 The ADOT joined forces with the Arizona Game and Fish Department, The Arizona Department of Public Safety, and the U.S. Forest Service to implement a multifaceted approach known as Project Elk Alert to reduce accidents involving wildlife, specifically elk. This multi-agency task force implemented a variety of immediate and long-term techniques to reduce accidents. These techniques included: public information and education; vegetation management to improve visibility and reduce the amount of palatable vegetation on the road shoulders; increases in elk hunt permits to reduce elk herd sizes; and stepped-up enforcement of speed laws.

Public education was ranked as an immediate priority and newspapers began reporting on the hazardous driving conditions resulting from wildlife crossing S. R. 260. The U.S. Forest Service sponsored a contest among local school children to come up with slogans for >Burma-Shave= style signs to remind motorists of the dangers of colliding with elk. These unique warning signs were installed in four sign series east and west -bound at the eastern and western edges of the area with the most accidents; Mileposts 282-302. Additionally, a variable message board was located on the west and east ends of this segment to further alert motorists of wildlife on the road.

An evaluation of accident data showed that most accidents were occurring at night or in low light situations and that about 70% involved elk. Vegetation in this area had encroached onto the clear zone due to years of fire suppression and reluctance to apply herbicides. ADOT crews began thinning these areas of dense vegetation by removing all trees under six inches in diameter breast height (DBH) and pruning branches on trees over 6 inches DBH to a height of eight feet. This practice was continued throughout the twenty mile segment, greatly improving visibility along the road

shoulders and significantly reducing accidents in that highway segment. Thinning has continued eastward along the 260 corridor and the final results have yet to be evaluated.

Additional vegetation treatments in this high accident area have included spot treatments of attractant vegetation such as yellow sweet clover (*Melilotus officinalis*) and alfalfa (*Medicago lupulina*). These two highly palatable plant species are common invaders of the road shoulders of State Route 260 and other Arizona highways. Chemical treatments have had variable success in controlling these unwanted plants.

Results

Accident data indicates that the treatments utilized on the twenty -mile segment with the highest number of hits have been successful. Records show a decrease of 56% from 1992-1997 in accidents involving wildlife between mileposts 282-302 on S.R. 260.

Future Solutions

New Construction

Due to increased traffic, plans are being developed for the rebuild of Arizona State Route 260. Eventually 260 will be converted to a four-lane divided highway. These plans are providing an opportunity for more proactive and complete resolution to our problems with wildlife accidents on S. R. 260. There is an undisputed need for built- in structures to direct wildlife into safe crossing areas. A team of biologists and engineers have been working together to design roadway features, which will allow wildlife to move under the road using well-established movement corridors. Accident data and field investigations have shown that a majority of the elk and deer movement on and off of the Mogollon Rim occurs in or near the north - south flowing perennial and ephemeral stream systems. For this reason, bridges have replaced the culverts of the original design to allow wildlife the opportunity to move along their preferred routes under the road. Team biologists investigated existing bridges on S.R. 260 and other routes through elk habitat to establish a basis for bridge opening requirements that will facilitate elk movement. The biologists found that elk were using only the tallest bridges. Two bridges on S.R.260, which will be used as part of the new road, showed evidence of use by elk. Maximum bridge openness was stressed to project engineers, and a minimum height requirement of twenty feet was specified. A total of 18 bridges will be added to the new roadway providing a wildlife crossing area approximately every 2.5 miles. Designs on all 18 new bridges have not been completed; however, the typical dimensions for the wildlife crossings are 50= wide by 45= long by 35= high. There will be two parallel bridges; one for eastbound traffic and one for westbound.

Wildlife Fence

To funnel wildlife into the bridged crossing areas, wildlife fence will be installed on both sides of the highway throughout the Preacher Canyon section of the S.R. 260 project. The fence design specified is based on a fence used to enclose an aspen (*Populus tremuloides)* grove within the project area .The fence enclosing the aspen grove has not been broken by wildlife in pursuit of the highly palatable aspen throughout it=s five year history. Wildlife fence specified for the S.R. 260 project calls for an 8-foot single panel fence made of high-tensile wire. Wire strands should be six to eight inches apart with vertical stays every 12 inches and should be constructed of no less than 12.5 gauge wire twisted or tied. Two brands were recommended Tightlock and Solid lock. The fence will be supported by T-posts with 3-inch well pipe being used every 100 feet for added strength.

Escape Ramps and one-way Gates

In the event of a breech in the wildlife fence, escape ramps and one-way gates have been specified for the fenced sections of the S.R. 260 project. For an animal to escape the road-way using a ramp; it must travel parallel to the fence; ascend a 3:1 slope to a jump off area where it will be forced to turn by a length of fence perpendicular to the wildlife fence; and jump or drop eight feet to the ground on the forest side of the fence. The one-way gates will work similar to the escape ramp. An animal, traveling parallel to the wildlife fence on the road side, will run into a length of perpendicular fence and be turned into a spring loaded gate which will open allowing the animal to exit onto the forest land, the gate will close automatically once the animal is through the gate. Design details of the ramps and gates have yet to be completed.

Habitat Improvements

Possibly the most important aspect of the S.R. 260 project are the off the right-of-way improvements to the adjacent forest habitat. ADOT field research indicates that elk move across the highway to satisfy their daily needs for water and forage. For this reason, >guzzler tanks=, palatable vegetation, and salting stations will be added to the drainage areas leading into the designated crossings. Additionally, large areas of forestland will be treated with prescribed fire and re-seeded with palatable, nutritional, and native vegetation. Right -of -way rehabilitation will be accomplished through the use of less palatable native vegetation to make the road shoulders less attractive as foraging areas.

Monitoring

The Arizona Department of Transportation has drafted a five-year monitoring plan for S.R. 260 . The plan calls for the use of cameras to monitor wildlife use of bridged crossings, gates, and ramps. On the ground surveys of fence, waters, salt stations, and bridged crossings are also planned. Yearly reports of the monitoring results will be written and submitted for publication.

Conclusion

The excessive number of accidents involving wildlife on S. R. 260 have forced the ADOT to utilize a variety of maintenance and construction techniques. The successes to date cannot be attributed to any one method; However, each method provides some measure of success. With the added features of bridges, fence, and habitat improvements, the future should bring significant decreases in wildlife mortality. ADOT=s on-going monitoring will provide the much-needed information to evaluate the success of each of the treatments and to make necessary improvements.

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