

SECTION X CONNECTIVITY RELATED PROJECTS



In anticipation of Arizona's population increase and the associated increase in highway utilization, safe conveyance for commuters, commercial vehicles, tourists and recreationists must continue to be provided. The incidence of collisions between vehicles and wildlife presents a continuing highway safety problem, particularly since accidents with large ungulates cause millions of dollars in property damage, human injury, and loss of life each year nationwide. For wildlife, the toll is heavy. They rarely survive an encounter with vehicles. The costs of indirect impacts to a particular species are difficult to measure as population and genetic diversity decline over time in response to habitat fragmentation.

To provide for highway safety, increase permeability and reduce habitat fragmentation, wildlife passage structures are being constructed to allow large game mammals such as elk and deer, as well as coyote and javelina to pass beneath certain roads that are known to obstruct established wildlife movements. In some cases, specially designed fences are also installed to encourage wildlife to utilize safe crossing areas, such as underpasses or culverts, or to guide them to areas with higher visibility where collisions are less likely to occur. Studies of the effectiveness of structures and the movements of wildlife are being conducted statewide.



Wildlife Research

Arizona's Award-Winning Work on Rocky Mountain Elk, *Cervus elaphus* on State Route 260

In some areas where fencing is used parallel to a highway, one-way gates and escape ramps are installed to allow large mammals to escape the roadway should they become caught on the 'wrong' side of the fence. A good example of a project that incorporates such design is the reconstruction of State Route (SR) 260 in Gila County, Arizona. During the past nine years, nearly 400 accidents involving large mammals have been documented on this stretch of roadway. These accidents have resulted in human injuries and fatalities, and hundreds of thousands dollars in property damages, medical expenses, and loss of economically valuable game species.

Currently, the construction of major upgrades to SR 260 (extending 17 miles from Payson to the Mogollon Rim) continues. Since this stretch of highway has a very high incidence of vehicle and wildlife collisions (primarily with elk), the Arizona Department of Transportation (ADOT) has made a tremendous commitment to reducing wildlife-vehicle collision risk and enhancing safe wildlife permeability across this route.

A comprehensive application of measures will continue to be employed along SR 260; including 11 sets of bridged wildlife underpasses (in addition to six sets of larger bridges), wildlife-proof fencing, and other structures. The first of five different sections of upgraded highway in the vicinity of Preacher Canyon was completed during 2001, with 2 underpasses. The Preacher Canyon segment of road construction represented the first of its kind in Arizona to incorporate



wildlife permeability measures and to also employ research simultaneously to assess the effectiveness of the measures. Construction is nearing completion on the Christopher Creek section with 4 underpasses and 2 bridges. Construction on the Kohl's Ranch section is well underway, and should be completed in 2005; this section has a crucial underpass and 2 bridges. Prior to completion of the Preacher Canyon Section, none of the measures to reduce the incidence of wildlife-vehicle collisions had previously been implemented in Arizona or evaluated for effectiveness. A cooperative study between ADOT, Arizona Game and Fish Department (AGFD), the Federal Highway Administration (FHWA) and the USDA Forest Service is changing that.



Since January 2002, the AGFD has contracted with ADOT's Transportation Research Center to conduct a scientific evaluation of the effectiveness of collision reduction methods and structures (two sets of wildlife underpasses, elk-proof fencing, three escape ramps, and one-way gates) that have been implemented along the Preacher Canyon Section. Integrated infrared video camera systems, and track (count) stations are being used to assess wildlife use of underpasses and other measures designed for safe passage of animals. A standardized interagency collision tracking form to record



collisions along the various highway sections has also been developed. Global positioning satellite (GPS) receiver collars have been placed on 60 elk along all sections of the highway to assess places where elk cross the roadway corridor and use of passage structures.

To date, valuable insights have been gained relative to the effectiveness of the underpasses and other structures on SR 260, and the application of limited elk-proof fences and barriers. This has resulted in structural improvements and better management strategies that can be and have been utilized by ADOT project design and construction managers in the subsequent construction segments as well as projects throughout the state. Such information is being made available to other highway agencies elsewhere in the country.

Enhancement Funds will facilitate the retrofit of the Preacher Canyon section. Additional fencing is planned to intercept known wildlife crossing areas determined from the ongoing research data. This will include rights-of-way fence extensions and the integration of ElectroBraid fencing, which is an electrified fence. The first of its kind in this state, a wildlife crosswalk is being installed as well.



Cooperation between these land management agencies has been unprecedented on the SR 260 project and is a model of how we can work together to make highways safer and more wildlife friendly in the future. The FHWA's *Exemplary Ecosystem Initiative Award* was bestowed upon the SR 260 project as one of three conferred in 2003.

The *Exemplary Ecosystem Initiative Award* is part of the FHWA's "vital few goals" to increase ecosystem and habitat conservation. This award identifies projects that are unique or highly unusual in their (a) geographic scope; (b) use of cutting edge science or technology; (c) high level of environmental standards; (d) high quality of results achieved; and/or (e) recognition by environmental interests as being particularly valuable or noteworthy.

The Hoover Dam Bypass Bighorn Sheep, *Ovis canadensis* Study

Another collaborative project now underway is the Hoover Dam Bypass research project. AGFD wildlife managers are collaring bighorn sheep with GPS satellite transmitters so that data can be gathered on their movement within the area of United States (US) Highway 93 in northwestern Arizona. Bighorn sheep are another species whose populations have been significantly impacted by habitat fragmentation in Arizona. Once



enough data is gathered, wildlife researchers and highway planners can determine the best locations for underpasses and/or overpasses. The FHWA and ADOT have provided significant funding for the Hoover Dam Bypass project. One of the largest herds of Bighorn Sheep in the western United States resides near the northwest corner of Arizona. US 93 approaching the Hoover Dam and the Colorado River bisects this area.

As part of the plan to widen US 93, a research study was developed by the FHWA, the AGFD, the National Park Service (NPS) and ADOT, to study these magnificent animals and their travel patterns. Funding for this study came from FHWA and ADOT. Radio collars have been placed on some of the sheep to accurately monitor and collect data relating to their travel patterns. This information will aid in the design of the highway by identifying crossing locations currently being used by the sheep.



Photograph by Kevin Morgan

Approximately 10 percent of the \$60,000,000 projected construction project cost of the bypass has been set aside to construct crossing structures and fence the 15-mile highway improvement. This is in pursuit of creating a safer corridor for all travelers, protecting our native wildlife, preserving to the maximum extent possible natural habitat, and to avoid further fragmentation of remaining habitat through the recognition of habitat connectivity values. AGFD Habitat Program Manager Kevin Morgan believes that this effort will leave the habitat in better condition than currently exists today.



Yuma's Area Service Highway Study on the Flat-tailed Horned Lizard, *Phrynosoma mcallii*

Currently ADOT, in conjunction with FHWA and the Yuma Metropolitan Planning Organization are completing a Design Concept Report and Environmental Assessment for a proposed new highway from the Mexican border to the City of Yuma, Arizona. The potential alignment of this proposed project (referred to as the ASH) would impact the flat-tailed horned lizard. This species was recently proposed for listing under the Endangered Species Act. This lizard is also managed under a conservation agreement by regional land-managing agencies.



Photo courtesy of Ron Horloff <http://www.pbase.com/ronhrl>

During the initial ASH study it became apparent that habitat connectivity for the lizard had to be addressed, but there was little information on proven techniques for facilitating lizard movements across roadways. Of particular concern was the flat-tailed horned lizard's behavior of basking on roadways for warmth and remaining motionless as a defense mechanism when danger approaches. Because of this behavior it was apparent that connectivity of viable fragmented habitats would need to focus on keeping the lizard off the roadway.

One likely candidate for facilitating the movement of lizards across roadway rights-of-way is through the use of culverts. The use of

culverts by lizards may be influenced by many factors, including the length and diameter, size of the opening, amount of available light within the culvert, location of the culvert within the habitat, temperature disparity between the inside and outside of the culvert, culvert type and the substrate on the floor of the culvert. During the ASH study extensive coordination was carried out between the sponsors of the ASH proposal and the land management agencies, but agreement could not be reached concerning what an effective culvert design would be for facilitating flat-tailed horned lizard movements. Therefore, a study was needed to determine if culverts could indeed be used to facilitate habitat connectivity for lizards in association with highways.

Through the ADOT Transportation Research Board, over \$118,000 was obtained, FHWA being the primary contributor, to look into this question. The study is currently on going with the purpose being to determine if flat-tailed horned lizards will use a culvert and what factors influence this use. The study utilizes a pen with different sized culverts extending from each side of the pen, with a smaller enclosure at the opposite end of each culvert. In addition, some culverts have artificial light introduced and some not. The culverts will be monitored to determine which, if any, culvert configurations seem to be favored by the lizards. A final report on the study is due in 2006.

Monitoring of Existing Structures to Determine Wildlife Usage along SR 80 and SR 90

The ADOT Natural Resources Management Group (NRMG) in cooperation with Sky Island Alliance (SIA) is utilizing motion sensing wildlife cameras to identify species utilizing a variety of structure types. Structures that already exist and facilitate wildlife movement can be incorporated into transportation design where similar conditions exist. This study is also attempting to identify movement corridors that connect areas of suitable habitat and/or habitat to resources necessary for species survival. SIA has worked extensively with wildlife corridors, specifically in the Sky Island Region (mountain islands) of southwestern United States and northwestern Mexico. Roads dissect the Sky Islands; the resulting habitat fragmentation threatens more than the survival of large mammals, it's critical to the ecology of the Sky Islands. Some questions that need to be answered are the characteristics of corridors as they relate to roadways, design of crossing structures, and how roadway dynamics influence these factors are just a few of the critical topics. Wildlife cameras may help answer these questions, eventually facilitating improvements in wildlife movement through transportation planning. Tucson NRMG facilitates camera installation, film replacement, camera maintenance and the management of collected photographic and GPS data.



Road Kill Database

Liability concerns associated with wildlife-vehicle collisions have been heightened by the recent jury award for an elk-vehicle collision along Interstate 40 in 1998 (*Booth v. State of Arizona*, 2002). For wildlife, the costs of the indirect impacts to a particular species are difficult to measure as population and genetic diversity decline over time in response to habitat fragmentation.



The Arizona Game and Fish Department (AGFD), Department of Public Safety (DPS), State Land Department, and the State Attorney General's (AG) office have requested that vehicle/wildlife collision data be collected by ADOT, and standardized and managed cooperatively using a shared data base. Currently, data are collected as part of ADOT's research and management (related to maintenance) charter to investigate problem segments of roadway where there are frequent collisions involving vehicles and animals (wildlife as well as livestock). Standardized data collection and information management will facilitate increased accuracy, reduce redundancy, and provide greater coverage of the state's transportation corridors with respect to motorist safety and wildlife management. The impetus of this multi-agency appeal is to reduce injuries, fatalities, property damage and ecological degradation along Arizona's highways.



ADOT Maintenance and Construction Districts utilize wildlife/vehicle collision data for planning, design, maintenance, and management purposes. Several ADOT Maintenance Districts have been collecting such data since 1990, and the information has been shared with state law enforcement, risk management, and legal organizations. AGFD and the State Land Department currently utilize accident and road kill data for making management recommendations on related agency and collaborative projects. DPS is utilizing the data for tracking and identifying accident increases and/or reductions along the state's highway system. The Arizona Department of Administration's (ADOA) Risk Management office and the AG's office regularly request information pertaining to vehicle and wildlife collisions due to the continual rise in litigation resulting from injury, death, and property damage involving vehicles and animals.



A Steering Committee consisting of state agency representatives is currently recommending that the ADOT Natural Resources Management Group's GIS database be designated as the primary clearing house and repository for all data collected by all other agency stakeholders. Data entry, collection, mapping, and tracking will be the responsibility of all involved parties. Storage, management, and distribution of the data, as proposed, will be the

primary responsibility of the ADOT Natural Resources Management Group and AGFD.



The database will be commonly shared between all interested agencies. It has also been proposed that implementation of one method of data collection and reporting, and the use of one standardized data collection form, be agreed upon by the Steering

Committee. This collaboration is expected to facilitate a data collection and management system that is uniform and will afford all parties access to information essential to their operations.



<http://www.filmtrips.com/adventures.html>

Prior to the formalization of this agreement, the draft Memorandum of Understanding (MOU) will be reviewed through the appropriate legal channels for comment and approval. Vehicle/wildlife collision research and management as well as the sharing of GIS/GPS data is a relatively new and unique undertaking, so a MOU was recommended as the preferred choice of agreement between AGFD and ADOT to accomplish these endeavors together. Specifically, the MOU will allow the two agencies to freely exchange data providing access and use to a joint GIS database for vehicle/wildlife collision research and management.

