Ecopassage Reduces Roadkills

Barrier and Underpass in Florida Preserve Animal Lives

J. DARRYLL DOCKSTADER AND PETER D. SOUTHALL

Dockstader is Technology Transfer Manager, Florida Department of Transportation, Tallahassee; Southall is Environmental Scientist, Florida Department of Transportation, Lake City.

A wildlife barrier and underpass in Paynes Prairie, a biodiverse Florida State Preserve, has reduced the numbers of animals killed on a section of U.S. 441, which transects the parkland, by 64.2 percent.

In 1971, Paynes Prairie was established as the first state preserve in the Florida park system. Encompassing 21,000 acres south of Gainesville, the preserve is home to 20 distinct ecological communities, including wet prairie, pine flatwoods, hardwood hammocks, and ponds. Paynes Prairie supports a biodiversity of more than 720 plant species—one-fifth of the total in the state—plus more than 100 types of animals, including waterfowl, hawks, snakes, alligators, rodents, bobcats, wild horses, and bison.

Problem

Two major highways, Interstate 75 and U.S. 441, transect Paynes Prairie. Constructed in the 1920s, U.S. 441 carries more than 10,000 cars daily. The abundant wildlife and the heavy traffic have rendered this segment of U.S. 441 one of Florida's deadliest roads for animals. A 2-mile (3.2-kilometer) stretch of the highway has more documented roadkills than any other roadway segment in the state.

The primary reason for the high rate of animal mortality is that the roadway crosses prime habitat, or home range. The animals must be able to move back and forth across the roadway to preserve the viability of their species—to gain dispersal and to prevent genetic isolation.

PHOTO: U.S. GEOLOGICAL SURVEY.

Profile of barrier wall during construction.

In 1996, the Florida Department of Transportation (DOT) investigated constructing an ecopassage—a wildlife barrier and underpass system—to reduce the high rates of animal mortality. In 1998, Florida DOT convened a multidisciplinary working group with representatives from the department, natural resource agencies, environmental groups, and the University of Florida to provide suggestions on ways to reduce the animal mortality rate.

With feedback from the working group, Florida DOT District Two engineers designed and constructed a 1.8-mile (2.9-kilometer) ecopassage. The structure consists of a 3.5-foot-high (1.1-meter-high) gravity wall with a 6-inch (15.24-centimeter) lip, to prevent animals from climbing over, and a series of culvert underpasses to facilitate animal crossings. Florida DOT, however, needed to determine the effectiveness of the system.

Solution

In July 1998, Florida DOT contracted with the U.S. Geological Survey to conduct a two-phase study to investigate pre- and post-construction highway-related animal mortality and animal movement through existing and added culverts. Under the leadership of C. Kenneth Dodd, Jr., the research team first established preconstruction roadkill levels and determined the kinds and numbers of animals that were using the box culverts already in place.

Researchers conducted weekly, 3-day-sampling-period road surveys along the entire 2-mile road segment from August 1998 through August 1999. The sampled area included the median and the entire road surface in both directions, extending 10 to 13 feet (3 to 4 meters) into the grassy shoulders.

On the first day of the sampling period, the investigators marked and counted all road kills; on days two and three, they recorded all of the road kills from the previous 24-hour periods. Researchers recorded a total of 3,365 vertebrates killed: 1,333 frogs, 1,291 snakes, 374 turtles, 265 birds, 72 mammals, 29 alligators, and 1 lizard.

The investigators were not able to monitor all of the existing box culverts [each 7 ft 10.5 in. × 7 ft 10.5 in. (2.4 m × 2.4 m)], because two box culverts were completely inundated throughout the study. Funnel traps and hardware cloth traps were used at the other sites. In addition, researchers examined animal tracks and used active infrared cameras at the dry culverts.

Researchers documented 28 species that used the culverts, with river otters, nine-banded armadillos, raccoons, and opossum making frequent crossings. This demonstrated that a significant variety of animals were using the culverts and that the construction of additional structures would be beneficial.

The ecopassage construction was completed in February 2001. Phase 2 of the study began in March 2001 and ended in March 2002. The four new culverts, 3 feet (0.9 meter) in diameter, were sampled using commercial crayfish traps; otherwise, the general survey methods were similar to those in Phase 1.

The survey area extended 200 meters beyond the ecopassage at either end of the barrier wall and included a 400-meter section that bordered private property with a thrie-beam guardrail barrier instead of a concrete wall, because of the limited right-of-way. The barrier is a standard guardrail installed backwards, with the bottom of the guardrail touching the ground.

During Phase 2, 1,992 vertebrates were found dead along U.S. 441: 1,647 frogs, 149 snakes, 101 birds, 83 mammals, 7 turtles, 4 lizards, and 1 alligator. If the numbers of birds and tree frogs—affected minimally by the wall—are excluded, 157 animals were killed after construction, compared with the 2,411 animals killed before construction.

Researchers found that 64 percent of the non–tree frog deaths occurred along the guardrail fencing and at an access gate access adjacent to the southbound lanes on the north side of the prairie. Another finding was that small mammals, snakes, and frogs could cross the barrier along vegetation that grew up the wall from the prairie side.

After construction, the number of species using the culverts increased from 28 to 51, including 9 fish species. One of the new culverts was wet regularly, but the others were wet or dry according to prairie water levels. Although the total number of animals using the culverts after construction of the ecopassage has not been documented, the decrease in animals crossing the road suggests an increase in the number of culvert users.

Benefits

Eliminating highway-related animal mortality may be impossible, particularly for species that can fly, climb, or jump over constructed barriers. Nevertheless, the research confirmed the need for—and proved the general effectiveness of—the Paynes Prairie ecopassage.

Overall, researchers recorded a 41 percent reduction in wildlife mortality between the pre- and post-construction survey periods for the entire survey area, which extends beyond the ecopassage. But if the survey area is limited to the prairie basin directly adjacent to the concrete wall, the effects of the ecopassage become more pronounced, achieving an overall 64.2 percent reduction in mortality. Excluding tree frogs raises the figure to 90.1 percent, and excluding tree frogs and birds raises the effectiveness of the system to 93.5 percent. The finding that most of the roadkills—except for tree frogs—occurred in the limited area in which the wall was not installed increases confidence in the effectiveness of the structure.

Regular maintenance and improved drainage at the guardrail barrier to eliminate washout from erosion will improve the effectiveness of the system, as will routine maintenance of the vegetation. Motorists will benefit from the reduction of collisions with wildlife and from the improved aesthetics of far fewer animal carcasses along the roadside.

Previous, unpublished research by Richard Franz of the University of Florida determined that only 1 of 17 snakes that attempted to cross the road was successful. The ecopassage barrier deters animals from attempting to cross and forces use of the culverts. Animals are no longer crossing on the highway surface of U.S. 441 at the barrier wall area.

The demonstrated success of the ecopassage system, which received a Globe Engineering Award, may justify use as a model for similar efforts, both nationally and internationally.

For further information contact Peter Southall, Environmental Scientist, Florida Department of Transportation, 1901 South Marion Avenue, MS 2007, Lake City, FL 32025-5814 (telephone 386-961-7470, fax 386-961-7508, e-mail peter.southall@dot.state.fl.us).

EDITOR'S NOTE: Appreciation is expressed to G. P. Jayaprakash, Transportation Research Board, for his efforts in developing this article.

Suggestions for "Research Pays Off" topics are welcome. Contact G. P. Jayaprakash, Transportation Research Board, 500 Fifth Street, NW, Washington, DC 20001 (telephone 202-334-2952, e-mail gjayaprakash@nas.edu).

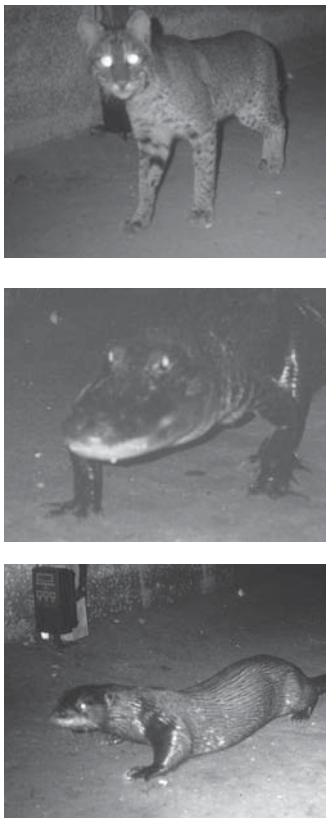

PHOTO: U.S. GEOLOGICAL SURVEY.

Motion-sensor photographs of animals in box culvert; *from top*, bobcat, alligator, and otter.