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Where the Mountain Lions and Bighorn Sheep Roam

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Projects aimed at helping wildlife cross roadways without harm aim to conserve natural resources while making highway travel safer.



Fences along the edges of Twin Peaks Road, outside Tucson, Arizona, funnel animals to the crossings beneath the roadway that were built especially for them. © Psomas
September 29, 2015—When the California Department of Transportation (Caltrans) recently unveiled an architectural rendering of a proposed wildlife crossing over busy U.S. Highway 101 near the city of Agoura Hills, just west of Los Angeles, it drew attention to the growing number of wildlife-only crossings that are becoming part of transportation projects.

Such crossings address a serious problem: There are more than 1.2 million collisions each year between vehicles and deer alone in the United States, resulting in thousands of injuries, about 200 deaths, and \$4 billion in property damage. When all species are considered, the annual property damage figure rises to a staggering \$8 billion.

Providing wildlife with an alternative path by which to cross a highway is a "conservation strategy that has been going on for 20-plus years in the West," according to Shawn Lowery, a regional project supervisor at the Arizona Game and Fish Department. But the conversation has been advanced by such high-visibility projects as the Hoover Dam Bypass, which included [three crossings](#)

over Highway 93 for bighorn sheep. "When we start to see [successful] projects with bridges facilitating safe passage for wildlife...that have bighorn sheep moving over them ...people see the need," Lowery says. "Those success stories really start to sell the idea to the public."

The U.S. 101 overcrossing near Agoura Hills has been under discussion for more than a decade, according to Barbara P. Marquez, a senior environmental planner with Caltrans. The department recently completed a project study report and has begun the next phase, which will include preparation of environmental documents and engineering design work to the 30 percent mark. The design was developed by architect Clark Stevens, APA, who serves as the executive officer of the Resource Conservation District of the Santa Monica Mountains, one of the environmental groups championing the crossing.



The Arizona Game and Fish Department places cameras at wildlife crossings to determine which animals, such as this family of javelinas, are utilizing the crossings and if the design requires adjustments. Courtesy the Arizona Game and Fish Department

"The beauty of an overcrossing is that it does allow for the widest range of species to use it," Marquez says. "Mountain lions are one of our primary targets for the crossing because they need such large home ranges to survive and breed. Their home range size is 25 or more square miles. They are in the most danger of becoming extinct within this particular area."

The National Park Service has extensively studied the movement of mountain lions in the area, tracking them, in some cases, with radio collars. The animals frequently approach the freeway in the proposed bridge site, drawn by the topography and the undeveloped areas on either side.

Although the project is in an early phase, Caltrans estimates that the bridge will cost approximately \$30 million. Initial plans are for a concrete box structure, engineered to a level similar to a light-capacity vehicular bridge, in part for seismic safety reasons. The bridge will likely feature extensive vegetation, including trees, as well as large sound walls to isolate wildlife from the highway noise and light below.

This will be the first wildlife bridge project for Caltrans, which has, to this point, used the far more common type of wildlife crossing: modified drainage tunnels. Alejandro Angel, Ph.D., P.E., a principal of the engineering firm Psomas, headquartered in Los Angeles, is familiar with the engineering challenges presented by these tunnels. The first is optimizing site selection, he says. "When we go through the process, we identify the hot spots for animal crossing activity, and

determine which spots should be designed to accommodate crossings and which should be blocked," Angel says.

Another challenge is predicting future development in the area. "If there is a hot spot in an area zoned for retail [development], that spot might work today, but in the future it won't be very attractive for wildlife," he says. "So we avoid the crossing there and funnel animals to a better spot."



Mountain lions are one of the primary species targeted by this proposed wildlife crossing over busy U.S. Highway 101 near the city of Agoura Hills, just west of Los Angeles. © Clark Stevens/Raymond Garcia for the Resource Conservation District of the Santa Monica Mountains

Although to passing motorists the sight of a dead animal near the roadway might appear random, mortality studies indicate that is not the case. Rather, the deaths occur primarily in specific corridors corresponding to natural roaming grounds, migratory pathways, and water sources used by animals. Computer modeling that overlays species terrain preferences with geographic information system mapping is one way to identify such hot spots. Another way is to utilize radio telemetry data as primary data sources, and secondary to that is surveying and collecting wildlife mortality data points. Over the course of a year, this data can also indicate places where animals routinely attempt but fail to cross a road safely.

"You collect these mortality data points to define focal hot spots and over time the points tend to aggregate based on landscape variables," Lowery explains. "Along with mortality data, we also collect track counts. We work to find where the hot spots are and work with municipalities and planning engineers to apply proper mitigation structures into those localities," Lowery says.

Angel notes that modifying a drainage tunnel or culvert to serve as a wildlife crossing can be difficult because sometimes the designs are at cross purposes. "What might be best for drainage is not necessarily best for wildlife. With drainage you might have scour issues, which means you want a hard surface: concrete. But many species don't like concrete surfaces," Angel explains. "So we came up with a design where we put concrete on the crossings, but created our own detail to build up sediment. So there will be concrete below, but there will be enough sand built up that the animals will use it."

Lowery points out that culvert designs must take natural animal behaviors into account as well. "Every animal is looking to have safe passage, with predator avoidance," Lowery says. "They are going to be looking for any ambush sites—ledges and associated vegetation that would give them

the sense that there is a potential predator nearby. [So] we want to oversize the culverts and fit them appropriate to the species."

For a project on Tangerine Road in Tucson, Arizona, for example, that meant upsizing several culverts from 6 to 9 ft in height, Angel says. For another project on nearby Twin Peaks Road, smaller drainage structures were replaced with larger arched culverts. "At both the inlets and outlets there has to be a clear line of sight for the animal to be comfortable," he says.

The Arizona Game and Fish Department monitors such crossings with cameras and has gone back to redesign some that are underutilized. Often, a small modification, such as removing a ledge surface near an entrance, makes an enormous difference.

The choice between a tunnel and a bridge is often a reflection of the surrounding terrain and the target species. In areas such as the site in California, a bridge is most effective. In areas in which engineers can achieve the line-of-sight requirements with a culvert, that option is often less costly, even though it does carry a 40 to 50 percent cost premium over a standard drainage feature.

It's important that with either option, the crossing is surrounded by species-specific fences that both protect the roadway from incursions and funnel wildlife to the crossings.

Lowery explains that the dual benefits of enhanced public safety and natural resource conservation are making it easier for the crossings to gain public acceptance. "We have imposed our transportation networks on top of what are existing wildlife movement corridors," he says. "Through proper, prudent planning, we can assess where those movement corridors are and try to work with engineers to facilitate the movement of wildlife."