



Caltrans Division of Research,  
Innovation and System Information

# Research



# Results



Environmental

DECEMBER 2010

**Project Title:**

Endangered San Joaquin Kit Fox Research.

**Task Number:** 1095

**Completion Date:** December 31, 2010

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## San Joaquin Kit Fox Road Effects: Responses to Four-Lane Highways

Comprehensive study on the effects of four-lane divided highways on kit fox movements: inhibition, crossing rates, use of culverts, and passage structure.

### WHAT IS THE NEED?

Among the California Department of Transportation's (Caltrans) strategic goals are providing the safest transportation system in the nation and preserving California's environmental resources. It is well known that roads and wildlife can affect each other. For instance, road-kill can directly reduce wildlife populations and in some circumstances, it is a major cause of wildlife mortality. Additionally, roads can limit the ability of wildlife to move to find necessary habitat, maintain genetic diversity, reestablish extirpated populations, and migrate as climatic conditions shift.

The San Joaquin kit fox (*Vulpes macrotis mutica*) is an endangered species found in the San Joaquin Valley and adjacent areas. The law requires Caltrans to construct and manage the highway system in a way that helps preserve this animal. Caltrans is planning highway expansion projects in San Joaquin kit fox habitat. In an effort to maintain necessary wildlife movement Caltrans has already incorporated wildlife crossing features in highway projects. However, limited information is available on what rate of passage across the highway system is needed to maintain healthy kit fox populations, whether kit foxes use below grade passages such as culverts, and how to design wildlife crossings to facilitate use by the foxes. Therefore, Caltrans has sponsored this research to determine how kit foxes cross four lane highways and how this movement can be enhanced. The research team included Angela Kociolek and Anthony Clevenger of the Western Transportation Institute at Montana State University and Brian Cypher of the California State University, Stanislaus Endangered Species Recovery Program.

### WHAT DID WE DO?

The research team conducted a literature study and a series of field studies for this task. Because of the small size of the San Joaquin kit fox population the research team performed a literature survey to determine if the closely related conspecific



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desert kit fox (*Vulpes macrotis arsipus*) and congeneric swift fox (*Vulpes velox*) could be used in their home ranges as surrogates for the study of San Joaquin kit foxes. Field studies included using radio and GPS collars, tracking stations, and camera traps to ascertain fox movements.

Given the similar stature, behavioral characteristics, general habitat requirements, and common conservation threats, the research team concluded that inferences can be made from observations of desert kit fox, swift fox, and San Joaquin kit fox movements relative to highways.

In general, the four-lane highways of the study areas were not barriers to the movement of the swift foxes and desert kit foxes studied. Sustainable mortality rates due to vehicle strike are likely to occur in core population areas of San Joaquin kit fox range. However, in non-core and marginal population centers mortality due to vehicle strike could pose a risk for long-term population persistence.

## WHAT WAS THE OUTCOME?

While small sample sizes prevented the research team from determining the optimal wildlife crossing design for the San Joaquin kit fox, they were able to provide some guidelines for this subspecies.

According to the research team, the best practice would be to install as many culverts or wildlife crossing structures as possible within San Joaquin kit fox range and where local habitat conditions are favorable. Given the average home range size of San Joaquin kit foxes (5.9 km<sup>2</sup> with 2.7 km diameter), we recommend a minimum of one culvert or crossing structure every 0.5 km (0.3 mi). This would result in multiple opportunities for below grade crossings in each fox home range. Culverts and crossing structures should be variable in size but a minimum diameter of 61 cm (24 in). In larger culverts, crossing structures and underpasses, escape dens should be constructed.

The research team recommends solid median

barriers not be used in San Joaquin kit fox range because the barriers may restrict at grade movement and make the fox susceptible to a vehicle strike on the highway. Rather, they suggest using other median barrier designs that allow freer wildlife movement while reducing cross median accidents. The research team also suggests that fencing to prevent foxes from entering the travelled way be restricted to highway segments with solid median barriers. The fences can then help guide foxes to below grade crossing opportunities.

## LEARN MORE

### View the Final Report

<https://dot.ca.gov/-/media/dot-media/programs/research-innovation-system-information/documents/f0016600-ca10-1095-final-report.pdf>