TRC1605

Evaluating the Usage of Culverts and Bridges by Wildlife in Arkansas

Madison Srebalus, Field Botanist

Arkansas Department of Transportation
Environmental Division, Natural Resources Section

Final Report

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16. Abstract

Vehicle collisions with animals threaten the lives and safety of wildlife and motorists. In an attempt to reduce vehicle collisions with animals, additional infrastructure was installed under bridges and within culverts to allow wildlife to pass beneath sections of highway. Photo evidence suggests that wildlife will readily use these structures, and a reduction in roadkill near these passages suggests that wildlife may prefer these safer routes as opposed to passing through traffic. These results should encourage the further study and development of wildlife crossings for the protection of motorists and environmental integrity.

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SI* (MODERN METRIC) CONVERSION FACTORS

APPROXIMATE CONVERSIONS TO SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
		LENGTH		
in	inches	25.4	millimeters	mm
ft	feet	0.305	meters	m
yd	yards	0.914	meters	m
mi	miles	1.61	kilometers	km
		AREA		
in^2	square inches	645.2	square millimeters	mm^2
ft^2	square feet	0.093	square meters	m^2
yd^2	square yard	0.836	square meters	m^2
ac	acres	0.405	hectares	ha
mi^2	square miles	2.59	square kilometers	km^2
		VOLUME		
fl oz	fluid ounces	29.57	milliliters	mL
gal	gallons	3.785	liters	L
ft^3	cubic feet	0.028	cubic meters	m^3
yd^3	cubic yards	0.765	cubic meters	m^3
		NOTE: volumes greater than 1000 L shall be shown in m^3		
		MASS		
oz	ounces	28.35	grams	g
lb	pounds	0.454	kilograms	kg
T	short tons (2000 lb)	0.907	megagrams (or "metric ton")	Mg (or "t"
		TEMPERATURE (exact degrees)		
°F	Fahrenheit	5 (F-32)/9 or (F-32)/1.8	Celsius	°C
		ILLUMINATION		
fc	foot-candles	10.76	lux	lx
fl	foot-Lamberts	3.426	$candela/m^2$	cd/m^2
		FORCE and PRESSURE or STRESS		
lbf	poundforce	4.45	newtons	N
lbf/in^2	poundforce per square inch	6.89	kilopascals	kPa

APPROXIMATE CONVERSIONS FROM SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
		LENGTH		
mm	millimeters	0.039	inches	in
m	meters	3.28	feet	ft
m	meters	1.09	yards	yd
km	kilometers	0.621	miles	mi
		AREA		
mm^2	square millimeters	0.0016	square inches	in^2
m^2	square meters	10.764	square feet	ft^2
m^2	square meters	1.195	square yards	yd^2
ha	hectares	2.47	acres	ac
km^2	square kilometers	0.386	square miles	mi^2
		VOLUME		
mL	milliliters	0.034	fluid ounces	fl oz
L	liters	0.264	gallons	gal
m^3	cubic meters	35.314	cubic feet	ft^3
m^3	cubic meters	1.307	cubic yards	yd^3
		MASS		
g	grams	0.035	ounces	oz
kg	kilograms	2.202	pounds	lb
Mg (or "t")	megagrams (or "metric ton")	1.103	short tons (2000 lb)	T
		TEMPERATURE (exact degrees)		
°C	Celsius	1.8C+32	Fahrenheit	°F
		ILLUMINATION		
lx	lux	0.0929	foot-candles	fc
cd/m^2	$candela/m^2$	0.2919	foot-Lamberts	fl
		FORCE and PRESSURE or STRESS		
N	newtons	0.225	poundforce	lbf
kPa	kilopascals	0.145	poundforce per square inch	lbf/in^2

*SI is the symbol for the International System of Units. Appropriate rounding should be made to comply with Section 4 of ASTM E380.
(Revised March 2003

Contents

Executive Summary

Vehicle collisions with animals threaten the lives and safety of wildlife and motorists. In an attempt to reduce vehicle collisions with animals, additional infrastructure was installed under bridges and within culverts to allow wildlife to pass beneath sections of highway. Photo evidence suggests that wildlife will readily use these structures, and a reduction in roadkill near these passages suggests that wildlife may prefer these safer routes as opposed to passing through traffic. These results should encourage the further study and development of wildlife crossings for the protection of motorists and environmental integrity.

Chapter 1: Introduction

1.1 Wildlife-Vehicle Collisions

Anthropogenic infrastructure continues to expand in conjunction with population growth (Torres et al., 2016). This urbanization reduces natural areas and fragments habitats (Benítez-Lopéz et al., 2010; Forman & Alexander, 1998; Torres et al., 2016; Wilson et al. 2016). As a result, human-wildlife conflicts are increasing, and potentially dangerous encounters, such as wildlife-vehicle collisions, are on the rise (Groot Bruinderink & Hazebroek, 1996). Deer and other ungulates are relatively large, often migratory animals, making them particularly susceptible to vehicle collisions (Groot Bruinderink & Hazebroek, 1996).

The Arkansas white-tail deer population has grown from an all-time low of less than 500 in the 1930s to one million today (Sutton, 2019). On average, there are approximately 22,000 vehicle collisions with deer every year in the state of Arkansas (Sutton, 2017). Because of this, Arkansas is considered a “high risk” state for wildlife-vehicle collisions (Sutton, 2017). This estimation is just for deer, and only those that are reported. Many wildlife-vehicle collisions go unreported, so it can be assumed that the actual number of wildlife-vehicle collisions is much higher (Gkritza et al., 2010). The average cost per insurance claim on a vehicle involved in a collision with an animal is $3,171.00. Additional cost to Arkansas taxpayers occur from local law enforcement involvement and maintenance crews attending to any damages.

1.2 Wildlife Crossings and their Function

The term “wildlife crossing” is used to denote any type of structure that enables animals to safely traverse a particularly dangerous obstacle, such as busy roadways. Standing water can act as a deterrent to certain animals, discouraging them from travelling underneath existing culverts and bridges. For this reason, culverts and bridges are not sufficient as wildlife crossings without further infrastructure.

“Wildlife crossing,” as it pertains to this project, refers to elevated metal shelving installed along the inside walls of culverts and/or concrete-paved pathways underneath bridges. These wildlife

crossings were installed to encourage animals, such as raccoons and deer, to travel beneath I-40 instead of over and across traffic. The wildlife crossings will reduce the effects of habitat fragmentation and vehicle collisions with wildlife, which will help protect both animals and people alike.

Chapter 2: Implementation

2.1 Installation

Six wildlife crossings were installed under I-40 along an approximate 10 mile stretch; west of Lake Conway. Each culvert/bridge selected remains inundated with water from Lake Conway most, if not, all year. The crossings within culverts were fitted with shelving on either side of the interior walls. This shelving acts as a walkway elevated from the water's surface and allows animals to travel the entire width of the interstate from underneath. The crossings that utilize existing bridges consist of a paved pathway on either side of the water channel that runs beneath the bridges. The paved paths makes it easier for animals, such as deer, to cross beneath bridges without having to traverse rocky, uneven terrain.

2.2 Monitoring

Two wildlife crossing were installed underneath a bridge, and four were installed within culverts. Motion-sensing game cameras were placed at each crossing; two at the entrance/exit of either side, for a total of four at each crossing. In addition, roadkill along I-40 was counted around the wildlife crossings and compared to roadkill counts near culverts/bridges without wildlife crossings. Counting was performed approximately 3 times a week for 5 weeks in early spring of 2022. Culverts and bridges without wildlife crossing were chosen for comparison because of similar size to culverts and bridges with wildlife crossings. Three of the locations are north of the wildlife crossings, while the other three are south.

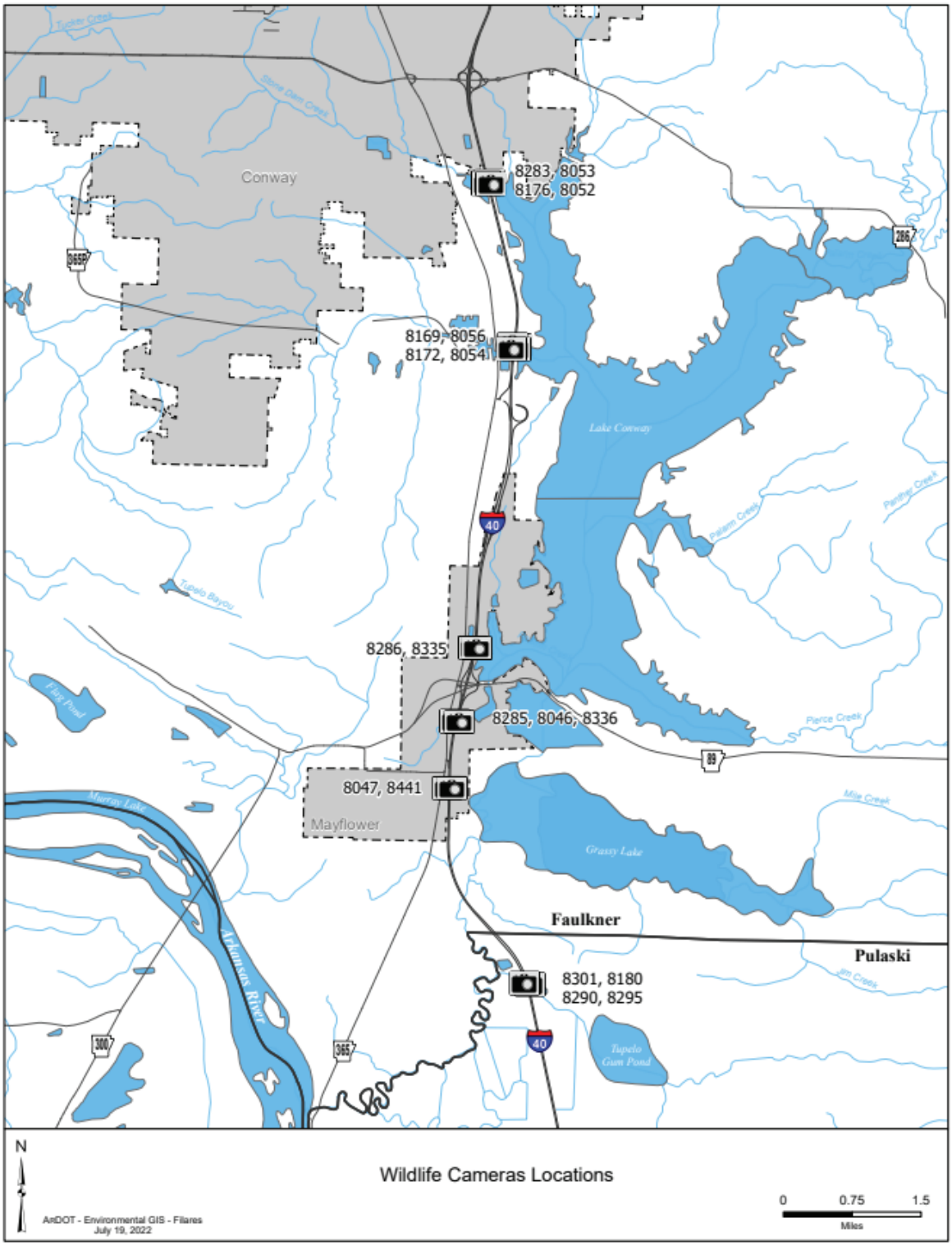

Figure 1. Placement of game cameras at either end of the six wildlife crossings

Chapter 3: Results

Complications with the game cameras have made it difficult to quantify the success of the wildlife crossings using pictures alone. The sensors within the cameras were not always accurate in capturing animal activity, but anecdotal evidence from the images suggests that the wildlife crossings are frequently used and can confidently be considered a success. The culvert shelves appear to be the more successful between the two types of wildlife crossings analyzed in this project. Raccoons and opossums are the most frequent visitors, but the culvert shelves do not accommodate larger animals, such as coyotes and deer. Larger animals can be seen using the wildlife crossings underneath bridges but are likely discouraged by an apparent increase in human activity. The smooth, paved pathways have attracted the attention of fisherman, who often set camp along the wildlife crossings for several hours into the night; ultimately discouraging use by wildlife.

Roadkill counts reveal that culverts/bridges with wildlife crossings may have an influence on the number of animal fatalities along I-40. The average number of roadkill within +- 0.5 miles of culverts/bridges were the same regardless of the presence of wildlife crossings, but the raw data indicates that an increase in sample size may shift results in favor of wildlife crossings.

Culverts with Wildlife Crossings	Roadkill Number +- 0.5 miles	Culverts without Wildlife Crossings	Roadkill Number +- 0.5 miles
129.9	2	140.9	3
131.7	2	141.7	3
135	2	142.8	2
135.9	1	122.3	1
136.6	1	120.3	2
139	2	119.5	2
average	2	average	2

Figure 2. Data from roadkill counts; each culvert or bridge is named after their logmile location

Chapter 4: Conclusion

In summation, wildlife crossing installation is a worthwhile endeavor. It can save the lives of both people and animals, while promoting a healthier ecosystem where wildlife can travel un-inhibited. (See examples of confirmed wildlife crossing usage on next page). Wildlife crossings have the potential to lower tax-payer costs in the process of reducing wildlife-vehicle collisions. Improvements recommended for this project would include further roadkill counts during a time of increased animal activity, such as during fall. In addition, each wildlife crossing should be paired with two comparable areas based on type of structure (culvert or bridge), seasonality of water flow underneath the structure (ephemeral stream or permanent water body), road width/lane number, and general habitat surrounding the entrances of the culverts and bridges (Pagany, 2020). Further study is needed to determine what factors most influence the success of wildlife crossings.


2018-02-04 11:57:11 AM M 2/3
48°F
PC800 PROFESSIONAL
RECONYX


2017-10-28 1:49:45 AM M 1/3
39°F
PC800 PROFESSIONAL
RECONYX


2017-11-20 8:57:32 AM M 2/3
44°F
PC800 PROFESSIONAL
RECONYX

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