WILDLIFE CROSSING STRUCTURE HANDBOOK
Design and Evaluation in North America

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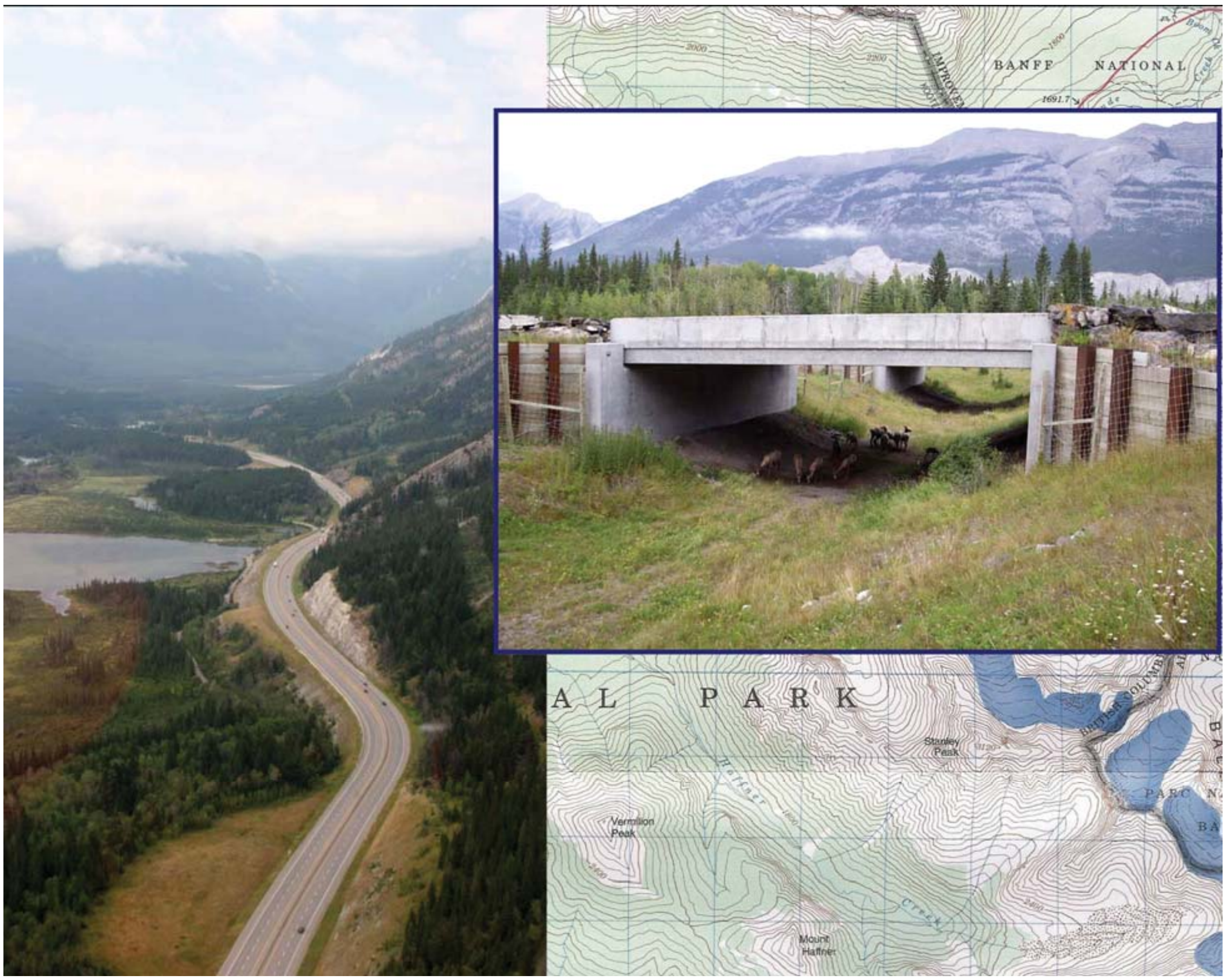

U.S. Department of Transportation
Federal Highway Administration

Federal Lands Highway
Commitment to Excellence

Central Federal Lands Highway Division
12300 West Dakota Avenue
Lakewood, CO 80228

FOREWORD

The Federal Highway Administration (FHWA) encourages programs that protect both wildlife and roadway users when the two groups eventually interact. An ever increasing human population demands safe and efficient access to their facilities, but this often comes with the need to mitigate the compromises to the animal habitats. Safety of drivers and preservation of animals are important components that when they successfully mesh we achieve major program goals for improved safety, enhanced livability, and protection of the environment.

This FHWA report called the *Wildlife Crossing Structure Handbook* offers key background information on defining the overall wildlife-vehicle interaction problem, the needs to be addressed, and offers a multitude of tangible solutions to plan, design, construct, monitor and maintain effective critter crossings. This handbook is for all transportation, environmental, wildlife resource, and stakeholder officials who strive to preserve and reweave safe corridor passages for animals and vehicle travelers.

F. David Zanetell, P.E., Director of Project Delivery
Federal Highway Administration
Central Federal Lands Highway Division

Notice

Quality Assurance Statement

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Anthony P. Clevenger and Marcel P. Huijser

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16. Abstract

This handbook provides numerous solutions to wildlife-vehicle interactions by offering effective and safe wildlife crossing examples. It initially describes the critter crossing problem and justifies the need to solve it. Project and program level considerations are identified for planning, placement and design of wildlife crossing structures. Key design and ecological criteria, construction and maintenance guidelines, and effective monitoring techniques are shown and described in this handbook's practical application examples called Hot Sheets.

17. Key Words
ANIMAL MOVEMENT BARRIERS, HABITAT CONNECTIVITY, HABITAT LOSS, ROAD ECOLOGY, WILDLIFE CROSSING, WILDLIFE MORTALITY, WILDLIFE-VEHICLE INTERACTION

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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)

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