

1                                   **Reducing Wildlife-Vehicle Collisions by Building Crossings:**  
2                                   **General Information, Cost Effectiveness, and Case Studies from the U.S.**

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4                                   *Written and researched by the Center for Large Landscape Conservation*  
5                                   *Commissioned by The Pew Charitable Trusts*  
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7   **Impacts of Wildlife-Vehicle Collisions (WVCs):**

8   A 2008 Report to Congress found that WVCs “are a growing problem and represent an increasing percentage of  
9   accidents on our roads”.<sup>1</sup> At the time of the report, over the most recently reported 15-year period, WVCs had  
10   increased by 50%, from less than 200,000 to 300,000, even though the overall number of collisions remained  
11   roughly steady over the same period.<sup>1</sup> These collisions pose a serious safety hazard for people and wildlife and are  
12   economically costly. WVCs often result in substantial damage to vehicles, injury to their occupants, and are  
13   almost always lethal to the animal. WVCs occur when a vehicle strikes an animal, but animals on roads may also  
14   be the secondary cause of additional crashes, such as when a vehicle swerves to avoid an animal in the roadway  
15   and instead drives off the road or into the oncoming lane.<sup>2</sup> Reported collisions between motorists and wildlife  
16   cause more than 200 human fatalities and over 26,000 injuries each year, at an annual cost to Americans of more  
17   than \$8 billion.<sup>1</sup> In addition to the human toll, an estimated 1-2 million large animals are killed by motorists every  
18   year, and these numbers do not include smaller species that do not present a threat to human safety.<sup>1</sup>

19   Roads also fragment the landscape and create a barrier to wildlife moving to locate water, food, mates, shelter and  
20   to fulfill other needs. Roads that are barriers may reduce gene dispersal and undermine long-term population  
21   viability.<sup>1</sup> Road mortality is documented as one of the major threats to the survival of 21 federally-listed  
22   threatened or endangered species in the U.S; and, every one of the 11 states covered by the U.S. Department of  
23   Interior Secretarial Order 3362, *Improving Habitat Quality in Western Big-Game Winter Range and Migration*  
24   *Corridors*, concluded that roads were an impediment to the migration and movement of iconic western big game  
25   species such as elk, pronghorn, and mule deer.<sup>1,3</sup>

26   Researchers have conservatively estimated that the average cost of a deer-vehicle collision is \$8,190, an elk-  
27   vehicle collision is \$25,319 and a moose-vehicle collision is \$44,546 in 2018 U.S. dollars.<sup>4,5</sup> These estimates are  
28   based solely on property damage, human injuries and fatalities, and the lost revenue from a hunting license for the  
29   species involved.<sup>4</sup> They do not factor in any other values such as those associated with biodiversity conservation  
30   or lost revenues from wildlife-related tourism and recreation. Thankfully, there are well-researched and effective  
31   solutions to mitigate WVCs.<sup>1,6,7,8</sup> The most effective method to reduce WVCs, while at the same time maintaining  
32   or improving habitat connectivity, is to construct wildlife crossing structures – overpasses and/or underpasses -  
33   that allow them to cross safely under or over roads.<sup>1,2</sup> When combined with wildlife fencing to keep animals off  
34   the road and funnel them towards the structures, wildlife crossings have consistently resulted in >80% reductions  
35   in WVCs.<sup>1,6,7,8</sup>

36   Although costly, properly sited wildlife crossings can pay for themselves where situated along highways that  
37   experience 1) an average of five or more collisions between motorists and deer per mile per year, 2) an average of  
38   two or more collisions with elk per mile per year, or 3) an average of one or more collisions with moose per mile  
39   per year.<sup>4</sup> In those cases, in which the total economic costs associated with wildlife-vehicle collisions along a  
40   given highway segment exceed the expense of building a structure that allows animals to safely cross the road, **it**  
41   **actually costs society less to solve the problem of WVCs than it costs to do nothing.**<sup>4</sup>

42   In addition to constructing new wildlife crossings, enlarging existing deficient culverts and bridges to allow for  
43   terrestrial safe passage along the riparian areas not only benefits wildlife, but also makes our infrastructure more

1 resilient to climate change and extreme weather events, such as flooding. This protects our infrastructure  
 2 investments in the long-term and ultimately saves taxpayers money. Dedicating federal funding to infrastructure  
 3 projects that at the same time reduce wildlife-vehicle collisions and maintain or improve ecological connectivity  
 4 provide benefits in the form of job creation, infrastructure resiliency, and sustainable natural resources.<sup>9,10</sup>

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 6 **Costs of WVCs to States**

7 Many states collect data on (large animal) WVC incidences. Some collect only the number of crashes reported by  
 8 their state’s law enforcement agencies (these are typically only crashes resulting in significant property damage or  
 9 human injuries/fatalities), others also record carcass data collected by their transportation agency’s maintenance  
 10 personnel when they remove carcasses from the roadside. Another source of data used by some states is motor  
 11 vehicle insurance claim records. A study of deer-vehicle collisions (DVCs) from Virginia found that, according to  
 12 deer carcass removal records, the number of DVCs in the evaluated areas was up to 8.5 times greater than what  
 13 was documented in police crash reports.<sup>11</sup> Most likely the total number of WVCs is actually much higher than  
 14 carcass records indicate, since not all carcasses are retrieved, and by some estimates as many as 50 percent of  
 15 animals struck by vehicles leave the road or right-of-way before dying and so are never recorded.<sup>2,12</sup>

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 17 There are two different values that states and others have used to determine the costs associated with WVCs:  
 18 1) the estimates produced in the analysis by Huijser et al. 2009 (as seen in the previous section), or,  
 19 2) United States Department of Transportation (USDOT) equivalency values for different types of crash severities  
 20 (e.g., property damage only vs. major injury).

21  
 22 In the table below, we have compiled WVC cost information from several states using these methodologies. The  
 23 values for Washington state and Montana were calculated by the authors of this report using the state’s WVC  
 24 records, while the values for Wyoming, Virginia, and California were calculated and documented in reports by  
 25 researchers in the respective states.<sup>16,11,17</sup> In addition, State Farm Insurance publishes annually statistics on the  
 26 likelihood of a licensed driver being involved in a collision with an animal by state – we also report this ranking  
 27 as a reference (NOTE: this is the likelihood of hitting an animal, so it is influenced by the number of drivers in the  
 28 state; for reference 1/50 is the state with the highest likelihood of hitting an animal).<sup>13</sup>

State	Records Used for Analysis	Species Included	Value of Incident Huijser et al. 2009* values -or- USDOT equivalency values by crash severity	State Farm Ranking 2019 <sup>13</sup>	Total Cost Annual Cost Estimate
Washington <sup>14</sup>	Carcass Only	Deer, Elk	Huijser et al. 2009	44/50	\$46 Million
Montana <sup>15</sup>	Carcass Only	Deer, Elk, Moose	Huijser et al. 2009	2/50	\$42 Million
Wyoming <sup>16</sup>	Crash and Carcass (duplicates removed)	Deer	Wyoming DOT cost estimates	6/50	>\$50 Million
Virginia <sup>11</sup>	Insurance claims	Deer	USDOT equivalency values	12/50	\$533 Million
California <sup>17</sup>	Crash and Carcass (duplicates removed)	All large wildlife	USDOT equivalency values	47/50	\$232 Million

30 \*The values from this paper were adjusted to reflect their equivalency in 2018 dollars. They were originally reported in 2007 dollars.<sup>5</sup>

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1           **COST-EFFECTIVENESS OF WILDLIFE CROSSINGS: CASE STUDIES FROM THE U.S.**

2           The following case studies are some recent examples of large-scale wildlife mitigation projects in the  
3 U.S. These are cases in which crossing structures are combined with fencing throughout the project area  
4 with other mitigation measures such as gates and/or cattle-guards to keep animals from entering the right-  
5 of-way at access roads. In order for wildlife crossings to be most effective they must be combined with  
6 fencing to keep animals from entering the right-of-way and coming into contact with traffic.

7           **Case Study 1: State Highway 9, Grand County, Colorado**

8           In 2015-2016 the Colorado Department of Transportation constructed seven large wildlife crossings with  
9 wildlife funnel fencing along over 10 miles of State Highway 9 in the Lower Blue Valley in Grand  
10 County, Colorado as part of a larger road improvement project. The wildlife mitigation measures  
11 consisted of 2 overpasses, five large arch underpasses, and 10.4 miles of wildlife fencing and other design  
12 features on both sides of the road at a cost of roughly \$10M (Julia Kintsch/CDOT, personal  
13 communication). During the five winters previous to the start of construction in 2015, WVCs with mule  
14 deer and elk were the most common type of accident on this stretch of highway, accounting for 60% of all  
15 accidents reported to law enforcement. Four percent of the reported WVCs during this timeframe resulted  
16 in human injuries. During the same 5 years before construction, carcass counts conducted by Colorado  
17 Parks and Wildlife and the Blue Valley Ranch reported an average of 56.4 mule deer and elk carcasses  
18 each year, at a cost of over \$500,000/year depending on the ratio of deer vs. elk. Since construction of the  
19 mitigation measures, the number of carcasses within the project area has decreased by 89%, and the  
20 project is projected to pay for itself in approximately 22 years, long before the end of the structures'  
21 projected 75-year lifespan.



22           **Case Study Sources:**

23           Kintsch, J., Cramer, P., Singer, P., Cowardin, M., & Phelan, J. (2019). *State Highway 9 Wildlife Crossings*  
24           *Monitoring—Year 3 Progress Report*. Colorado Department of Transportation Study Number 115.01.

25           Huijser, M. P., Duffield, J. W., Clevenger, A. P., Ament, R. J., & McGowen, P. T. (2009). Cost–benefit analyses of  
26           mitigation measures aimed at reducing collisions with large ungulates in the United States and Canada: a decision  
27           support tool. *Ecology and Society*, 14(2).

1 **Case Study 2: Highway 191, Trapper’s Point, Wyoming**  
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3 In 2012, the Wyoming Department of Transportation completed construction of wildlife crossing  
4 infrastructure on Highway 191 outside of Pinedale, WY. The project was built to address a wildlife-  
5 vehicle collision hotspot for pronghorn and mule deer, as well as to protect connectivity along the Path of  
6 the Pronghorn, a millennia-old pronghorn migration route and the first federally designated wildlife  
7 corridor. The project consisted of two overpasses, six underpasses, and wildlife funnel fencing along a 12-  
8 mile stretch of the highway at a cost of roughly \$11M. By the third year following construction, the total  
9 number of wildlife-vehicle collisions dropped by 81%, and pronghorn-vehicle collisions were completely  
10 eliminated. In addition, habitat connectivity was improved, and back-and-forth movements increased by  
11 >60% for mule deer and >300% for pronghorn.  
12

13 Before construction, Wyoming Department of Transportation estimated that wildlife-vehicle collisions at  
14 Trapper’s Point were costing over \$500,000 each year. Now, the crossing structures are used by over  
15 5,000 pronghorn and mule deer as they move from winter to summer range, and the state estimates that  
16 the crossings will pay for themselves in about 17 years, 50+ years before their estimated 75-year lifespan  
17 concludes.  
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19 Photo: One of the Overpasses at Trapper’s Point with Highway 191 running underneath.  
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21 Credit: Renee Callahan

22 Case Study Sources:  
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24 Sawyer, H., Rodgers, P. A., & Hart, T. (2016). Pronghorn and mule deer use of underpasses and overpasses along  
25 US Highway 191. *Wildlife Society Bulletin*, 40(2), 211-216.

26 New Crossings Help Wildlife. (2012). WY Game and Fish Department, WY Dept. of Transportation. Available at:  
27 <http://www.pinedaleonline.com/news/2012/11/Newcrossingshelpwild.htm>

1 **Case Study 3: US Highway 30, Nugget Canyon, Wyoming**

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3 US Highway 30 in Nugget Canyon, Wyoming bisects crucial winter range and an important  
4 migration route for mule deer, and had long been recognized as a problem for human and  
5 wildlife safety due to WVCs. In 2001, WY Department of Transportation constructed one  
6 underpass and seven miles of wildlife-exclusion fencing to address the issue, and in 2008  
7 expanded the mitigation by constructing an additional six underpasses and an additional seven  
8 miles of wildlife exclusion fencing. The completed project now consists of seven large  
9 underpasses and over 13 miles of exclusion fencing at a cost of roughly \$5M. Previous to any  
10 mitigation, an average of 9.75 deer carcasses were reported each month in the project area (117  
11 DVCs/year). After mitigation was completed the number of deer carcasses dropped by 81% to an  
12 average of 1.82/month (~21DVCs/year). The cost savings resulting from the drop in DVCs  
13 amounts to over \$500,000/year, meaning that the mitigation measures would pay for themselves  
14 in less than 10 years, long before the estimated 75-year lifespan of the crossing structures.  
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17 Photo: Mule deer using one of the underpasses on US 30 in Nugget Canyon.  
18 Credit: Hall Sawyer

19 Case Study Sources:

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21 Sawyer, H., Lebeau, C., & Hart, T. 2012. Mitigating roadway impacts to migratory mule deer—a case study with  
22 underpasses and continuous fencing. *Wildlife Society Bulletin*, 36(3), 492-498.

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24 Huijser, M. P., Duffield, J. W., Clevenger, A. P., Ament, R. J., & McGowen, P. T. 2009. Cost-benefit analyses of  
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- <sup>2</sup> Riginos, C., Fairbank, E., Hansen, E., Kolek, J., and Huijser, M. 2019. Effectiveness of Night-time Speed Limit Reduction in Reducing Wildlife-Vehicle Collisions. FHWA-WY-1904F. <https://rosap.ntl.bts.gov/view/dot/42488>.
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- <sup>5</sup> Bureau of Labor Statistics, CPI Inflation, [https://www.bls.gov/data/inflation\\_calculator.htm](https://www.bls.gov/data/inflation_calculator.htm)
- <sup>6</sup> Sawyer, H., Rodgers, P. A., & Hart, T. 2016. Pronghorn and mule deer use of underpasses and overpasses along US Highway 191. *Wildlife Society Bulletin*, 40(2), 211-216.
- <sup>7</sup> Sawyer, H., Lebeau, C., & Hart, T. 2012. Mitigating roadway impacts to migratory mule deer—a case study with underpasses and continuous fencing. *Wildlife Society Bulletin*, 36(3), 492-498.
- <sup>8</sup> Kintsch, J., Cramer, P., Singer, P., Cowardin, M., & Phelan, J. (2019). *State Highway 9 Wildlife Crossings Monitoring—Year 3 Progress Report*. Colorado Department of Transportation Study Number 115.01.
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