

## **Summary of FHWA-WY-15/03F: “Effects of Wildlife Warning Reflectors (Deer Delineators) on Wildlife-Vehicle Collisions in Central Wyoming”**

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### **Background**

The purpose of this study was to provide the Wyoming Department of Transportation (WYDOT) with information about (1) the effectiveness of Streiter-Lite wildlife warning reflectors that have been installed in three locations within Wyoming’s District 5, and (2) preliminary analysis of patterns of deer-vehicle collisions across Wyoming.

In Wyoming, more than 5,000 wildlife-vehicle collisions (WVCs) have been documented every year, on average, over the last three years. These collisions pose a serious threat to highway safety – accounting for 15-18% of all reported collisions. They also have significant negative impacts on wildlife populations – reducing their numbers and impeding their movements through their seasonal ranges and along their migratory corridors. Further, these collisions are costly. All together, deer-vehicle collisions in Wyoming (which make up >85% of all WVCs in the state) total approximately \$24-29 million per year in injury and damage costs and an additional \$20-23 million per year in lost wildlife value. The Wyoming Department of Transportation continues to work extensively to mitigate wildlife-vehicle collisions. Exploring and testing new mitigation strategies and understanding where mitigation measures are most needed are both important parts of achieving WYDOT’s strategic goals of keeping people safe on the state transportation system and exercising good stewardship of our resources.

### **Effectiveness of Reflectors**

Roadside “wildlife warning reflectors” (“deer delineators”) are being used in Wyoming and around the United States to try to reduce WVCs. Although wildlife warning reflectors are appealing for their simple technology and moderate cost (compared to much more expensive technologies such as crossing structures), their effectiveness has remained the subject of debate. The Strieter-Lite corporation (which distributes them in the US) reports a 78-90% reduction in deer-vehicle collisions. However, the results of research on their effectiveness are mixed, with many studies showing little to no effect while other studies show substantial effect.

We tested reflector effectiveness at four locations in central Wyoming (WYDOT’s District 5). We evaluated reflector effectiveness in terms of their ability to reduce deer-vehicle collisions (measured as carcass counts) and modify deer road-crossing behavior (observed using thermal video cameras). Using a series of experimental manipulations of reflectors, we showed that reflectors reduced deer-vehicle collisions by 32% relative to posts covered with non-reflective black bags and significantly reduced the number of high-risk deer road crossings (those in which deer ran into the road as a car was approaching). However, covering reflectors with white canvas bags – initially done with the intent of creating a control treatment that neutralized the reflectors – proved even more effective than leaving the reflectors exposed. White bags on posts resulted in 33% fewer collisions than when reflectors were exposed and similarly reduced the number of high-risk deer road crossings. In other words, white bags appear to reduce deer-vehicle collisions by 65% (Figure 1). We suggest that the white bags are more visible or reflective to deer than the red wildlife warning reflectors and are thus substantially more effective than reflectors. A cost-benefit analysis suggests that the benefits of reflectors outweigh their initial materials and installation costs but may not outweigh the net costs once maintenance is taken into account. The behavior-modifying effects of white bags suggest

possible future technologies that can be used to more effectively “warn” deer of oncoming vehicles and prevent them from making unsafe road crossings.

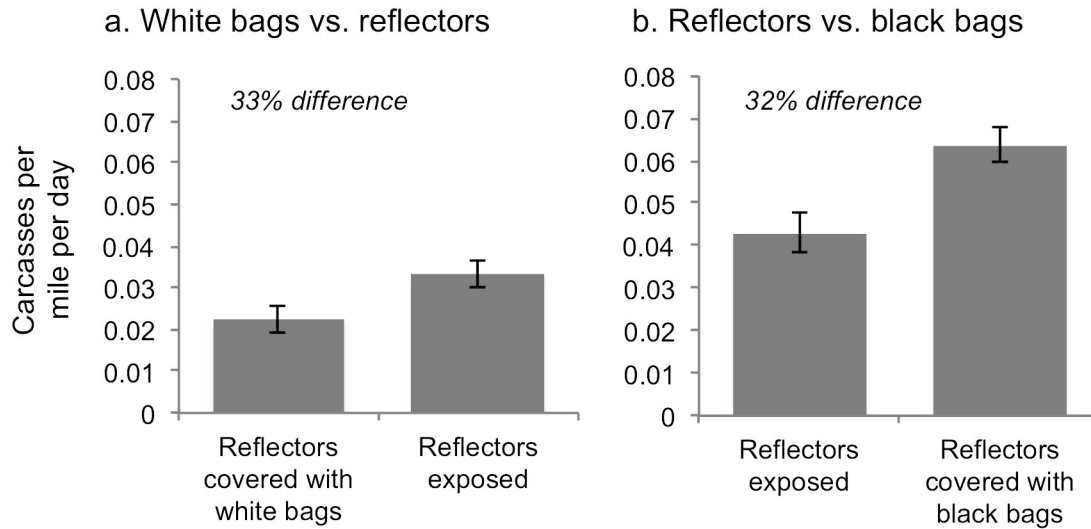


Figure 1. Carcasses per mile per day in experimental treatments (a) white bags vs. reflectors and (b) reflectors vs. black bags.

### Patterns of Deer-Vehicle Collisions Across Wyoming

Understanding where and why wildlife-vehicle collisions occur is another important step in mitigating the problem. By understanding the spatial patterns of WVCs, transportation managers can make informed decisions about how to prioritize the spatial location and type of mitigation measures and thus maximize the cost-effectiveness of mitigations. In Wyoming, mule deer home ranges and migration routes crisscross much of the state, intersecting with many of the major highways. Although some areas with high WVC rates are well known, there has not yet been any comprehensive analysis of these patterns or the habitat and road variables associated with them.

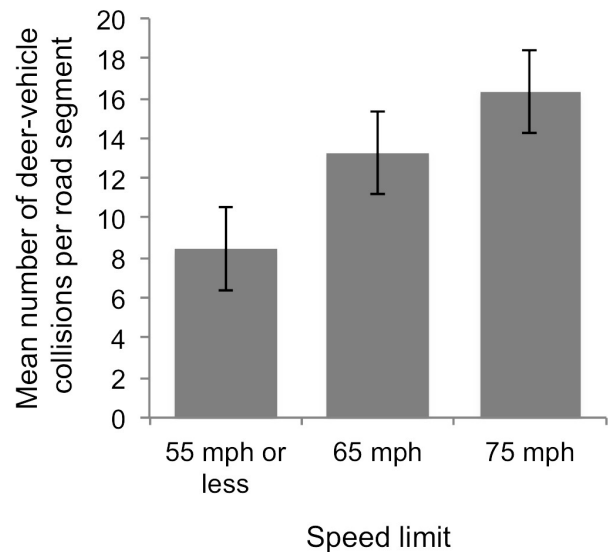


Figure 2. Mean number of deer-vehicle collisions (per 3 mile road segment, over 6 years) in a 3-mi stretch of road with speed limit 55 mph or less, 65 mph, or 75 mph.

We analyzed patterns of deer-vehicle collisions across the state. Our results show that traffic volume, proximity to agricultural land, proximity to deer winter range and migration routes, and high speed limits are all strongly associated with high collision rates. On average, areas with a 55 mph speed limit have 36% and 55% fewer deer-vehicle collisions than areas with speed limits of 65 and 75 mph, respectively. Reducing nighttime

speed limits in high collision areas may be a cost-effective strategy for mitigating deer-vehicle collisions in Wyoming.

## Recommendations

- Streiter-Lite wildlife warning reflectors are costly relative to their effectiveness. These reflectors cost approximately \$23.50 per reflector. The other costs of installation (posts, labor) amount to approximately \$80-\$130. In total, wildlife warning reflectors cost about \$8,000-10,000 per mile to install.
- The benefits of reflectors do appear to outweigh the costs of initial materials and installation. However, there are additional maintenance costs associated with the reflectors, such as replacing broken ones and the extra maintenance staff time needed to mow around the reflector posts. The net costs after considering these additional costs may outweigh the reflectors' benefits.
- There may be other, less expensive and more effective deer vigilance-enhancing technologies. The simple white canvas sample bags used in this study, for example, cost only about \$1.50 per bag, an order of magnitude less than the reflectors (not including the costs of posts and labor, and maintenance costs, which would be similar). Although we recognize that white canvas bags is not a permanent mitigation solution, we highlight this price difference to illustrate that a cheaper technology may exist that is more effective than the reflectors.
- Such vigilance-enhancing technologies are unlikely to ever be as effective as fencing coupled with highway under- and over-passes, which are 80-90% effective. However, even if vigilance-enhancing technologies can reduce deer-vehicle collisions by 30-50%, this would make them substantially more effective than any other currently-available low- to moderate-cost or fence-less mitigation technology.
- Around Wyoming, the highest rates of deer-vehicle collision are typically found under conditions similar to the Thermopolis and Basin areas in this study: around moderately developed areas and agricultural land outside of major towns. Since it may not be possible to install game fencing under these conditions, it is important to consider and continue testing and developing fence-less deer-vehicle collision mitigation technologies for these areas.
- Deer-vehicle collisions are also strongly associated with moderate to high traffic volumes and high speed limits (65 mph and higher). As traffic volumes continue to rise, deer-vehicle collisions are likely to increase as well. Limiting vehicle speeds, especially at night, may be another way to reduce collisions. On average, areas with a speed limit of 55 mph have 36% fewer deer-vehicle collisions than areas with a speed limit of 65 mph. This is comparable to the reductions in deer-vehicle collisions we observed in the reflector treatment areas in Thermopolis. Reducing speed limits to 55 mph at night, dawn, and dusk may be an effective and much less expensive way to reduce collisions.

Reducing deer-vehicle collisions in District 5 and around Wyoming will likely require a suite of different strategies, some of which may be more or less suitable in different areas. These might include fencing, under- and over-passes, animal detection systems, deer vigilance-enhancing technologies, managing vehicle speed, managing road-side vegetation, and managing driver visibility and awareness. In some cases, more than one of these strategies could be combined to achieve greater effectiveness in reducing deer-vehicle collisions.