Reducing Animal-Vehicle Collisions

It turns out that the human brain is still the best tool we have to reduce animal-vehicle collisions. The trouble is, we aren't making as much use of the tool as we should.

It's a tricky game. Animals LOVE to be in the roadway. Groundhogs, squirrels, rabbits, turtles, and on and on. They cannot be content with their side of the road and they seem to pick the most inopportune time to make the journey. The squirrels, of course, are the worst – they get out half way, shoot you a glance, then dart back in the direction they came, and then, just when you think everything is going to be okay, they turn around and go for broke, directly in your path. Jerks.

So now you're doing the dance. Your wheel goes right; nope, nothing but ditch and trees that way. You pull back to the center; that on-coming pickup truck is even worse. Ah, heck, maybe you can straddle the thing if he just holds still. Well, you can imagine the rest and it probably doesn't end well for the squirrel, but hopefully you got through it without a road departure or a centerline crossing or another maneuver that can endanger you, your fellow passengers, other drivers, or even pedestrians and cyclists nearby.

Squirrels, rabbits, and turtles are one thing, but the bigger beasts pose a much greater danger for us, especially when hunting season comes around and they are on the move a good deal more. Deer are our biggest worry here in Delaware – it could be worse; we could be overrun with bears and moose. Deer are 150-300 pound animals that leap in front of us with a grace that is inspiring and a suddenness that is maddening.

Across the United States, an estimated 1-2 million large animal and vehicle collisions occur annually. In those crashes, some 29,000 humans are injured and approximately 200 fatalities occur. The estimated direct cost to society for these crashes is $8 billion annually in the U.S. Hence, there is incentive for the highway engineering community to find cost effective solutions. In an October 30, 2019 (free) webinar, Rob Ament (Western Transportation Institute at Montana State University) spoke on a National Center for Rural Road Safety webinar about efforts to reduce so-called animal-vehicle crashes (AVCs) and a pooled-fund research project on the topic. The webinar was recorded and is now available for viewing (along with a couple dozen other recorded webinars) at their archive site.

Ament addressed three categories of AVC mitigation measures: influencing driver behavior; influencing animal behavior or population size; and separating animals from the road. Spoiler

alert – there was no magic bullet.

In an AVC situation, the human has the larger brain to body mass ratio and should come out the winner and from the animal's perspective we often do. But in a Towards Zero Deaths world, we would like to see these crashes as avoidable and implement strategies that will continuously reduce them. Public information can take the shape of public service announcements on radio, television, or social media, billboards, flyers, newspaper or e-newsletter articles (not unlike this one), and roadside signs. Researchers find it difficult to quantify the effectiveness of these measures. Standard animal crossing signs, according to Ament, are generally not effective at reducing AVCs, but seasonal and targeted warnings using variable message signs have been found to reduce crashes by 9-50% (admittedly a pretty broad range).

Similarly, signs with flashing beacons (e.g., "Deer Crossing When Flashing") that are only triggered when animals are on or near the roadway have reduced AVCs in the range of 33-97%, and are most effective when they are technologically advanced and well maintained. Lasers and infrared instruments are common in these systems and there are many design factors to minimize false triggers. LIDAR and other sensors are making their way into vehicle designs as detection systems. Roadway lighting can extend the range of visibility beyond the vehicle headlights in some instances.

Cutting back roadside vegetation has had some mixed results, generally with the goal of allowing more time for drivers to see and react to animals near the roadway. It is thought that wider edge striping may make it easier for drivers to spot animals on the edge of the roadway, but this still hasn't been rigorously studied.

All of these and other measures are designed to give the motorist more time and ability to see the animal and take evasive action or, better yet, reduce speed during the heightened risk period and lower the overall chance of collision. After all, the stopping sight distance at 55 mph is 495 feet and increases to 730 feet at 70 mph (AASHTO "Green Book"; Table 3-1), and that is on level roadways. Yet, the Delaware Motor Code only requires that headlamps reveal persons and vehicles at a distance of 100 feet (standard or

Influence Driver Behavior

Measure	Effectiveness in reducing collisions with large mammals	Effectiveness in reducing the barrier effect of roads and traffic
Mitigation measures aimed at influencing driver behavior		
Public information and education	None	None
Standard wildlife warning signs	None	None
Large and other nonstandard wildlife warning signs (VMS)	None	None
Seasonal wildlife warning signs	9-50%	None
Roadside animal detection systems (RADS)	33-97%	None
On-Board Vehicle Warning Systems	?	None
Increase visibility: roadway lighting	57-68%	None. May increase barrier effect for some species
Increase visibility: vegetation removal/brushing	≤50%	None. May increase barrier effect for some species
Increase visibility: wider road striping	?	None
Reflective ear tags, collars, and/or ankle bracelets	? (≤48% for bicyclists)	None
Reduce traffic volume on road network	?	Potential to reduce barrier effect
Seasonal closure	100% during closure	Reduces barrier effect of traffic but not the road itself (during closure only)
Reduce speed by reducing posted speed limit	(Almost) none (for through roads, given their design speed)	None
Reduce speed by reducing night-time posted speed limit	None	None
Reduce speed with traffic calming measures	≤50%	None

lowermost setting) or 350 feet at the high beam setting (Delaware Code, Title 21, Chapter 43, §4349).

But even when seasonal or nighttime speed limits are posted, research shows that drivers tend to drive at or near the road's design speed and/or the speed that they perceive is safe given the road's geometry and other physical factors. In a recent Riginos, et al. study cited by Ament, the researchers found that when the posted speed limit was changed from 70 mph to 55 mph at night for this purpose, the actual vehicle speeds only reduced by 3-5 mph.

In short, their research showed that efforts to influence driver behavior with regard to AVCs had dismal results as seen in their summary chart.

Influence Animal Behavior or Population

Measure	Effectiveness in reducing collisions with large mammals	Effectiveness in reducing the barrier effect of roads and traffic
Mitigation measures aimed at influencing animal behavior or population size		
Lines of visual or audio signals along roadside	None	None
Deer whistles installed on vehicles	None	None
Olfactory repellants	26-43% for target species only	None. Would increase the barrier effect for target species
Hazing	?	None. Hazing would increase the barrier effect.
Wildlife crossing personnel	? for large mammals	None
Deicing- alternatives to salt	?	None
Influence species via nutritional value of Right-of-Way vegetation	?	None; May increase barrier effect for some species
Habitat alteration outside ROW, Intercept Feeding	?	None
Expanded median	?	None. Increased width of road corridor may increase barrier effect.
Wildlife culling	49-84%	None
Wildlife relocation	9-22%	None
Anti-fertility treatment	Reduction proportional to reduction in population size	None

Influencing the animals was even tougher. Warning reflectors ($8-10,000 per mile) showed a 32% reduction in AVCs in Riginos et al.'s Wyoming study, but note this – when the reflectors were covered with white bags, the reduction increased to 65% (so who knows). Deer responded no differently to vehicles with or without whistles. Olfactory repellants showed 26-43% reduction in AVCs. Various hazing, harassing, and aversive conditioning of wildlife (e.g., a researcher would respond with a pickup of dogs that would chase the wildlife and in time, he simply had to show up with the pickup) showed some response, but implementation provides challenges. Reducing the nutritional or other value of roadside vegetation has been examined but there are concerns that the diversity of flora will be affected. There have been attempts to establish feeding grounds away from roadways. Expanded road medians may provide a refuge for crossing animals, but then the palatable vegetation in the median may be an attractant.

Interestingly, there has yet to be research to determine if deicing salts and brines are an attractant.

Wildlife culling through hunting, trapping, or euthanizing can decrease AVCs by 49-84%. There are more aggressive strategies as well, including anti-fertility treatments, but hunting appears to be the most dependable and the other strategies were largely unreliable, as shown in their summary chart.

Physically separating animals from the roadway can be quite effective and quite expensive. Some barrier designs have shown 80-100% reduction in AVCs. However, there are concerns about limiting range of wildlife so

Separate Animals from the Road

Measure	Effectiveness in reducing collisions with large mammals	Effectiveness in reducing the barrier effect of roads and traffic
Mitigation measures that attempt to separate animals from the road		
Wildlife barriers (fencing/walls/boulders)	80-100% (83% on average)	None. Fences alone make the road into more of a barrier than without fences
Underpasses and overpasses	Varies greatly depending on structure/location	Barrier effect can be reduced
Underpasses/overpasses and fencing	80-100% (83% on average)	Barrier effect can be reduced

Cost-Benefit Analysis:

National WVC Reduction Study

Mitigation Measure	Cost ($ / km / year)	% DVC Reduction
Deer reflectors and mirrors	$495	0%
Deer whistles	$23.5	0%
Standard warning signs	$18	0%
Seasonal wildlife warning signs	$27	26%
Vegetation removal	$500	38%
Fence with gap and crosswalk	$5,585	40%
Population culling	$2,508	50%
Relocation	$10,260	50%
Anti-fertility treatment	$61,702	50%
Animal detection systems (ADS)	$31,300	82%
Fence (including dig barrier)	$3,760	87%
Fence with gap and ADS	$9,930	82%
Fence with underpasses	$5,860	87%
Fence with overpasses	$26,458	87%
Fence with under- and overpasses	$7,510	87%

Huijser et al. 2007

severely and the effects on their long-term sustainability. Underpasses and overpasses can effectively separate the animals and the roadway if the design allows the animals to find them.

While the physical separation techniques can be expensive, seemingly prohibitively so, when a life cycle cost evaluation is done, these can actually become more attractive, particularly when designing a new or expanded highway system that will have a long service life and the safety benefits can be realized over that lengthy period. Huijser et al. assembled representative costs and illustrated that, for example, underpasses on a cost per year could be reasonably low while the effectiveness in reducing AVCs could be quite high.

Hence, for some of our highest profile roads, physical separation may be feasible, but so far, other strategies have shown low or unpredictable effectiveness. The greatest hope is that the self-preservation impulses of the human will begin to better develop some of those techniques discussed earlier.

The recording of this webinar is now available at the National Center for Rural Road Safety's website, so why not give it a look?

[No actual squirrels were harmed in the hyperbole developed in this article and the author apologizes for impugning the character of squirrels and other road crossing animals.]