A WILDLIFE BARRIER FENCE NORTH OF WENATCHEE, WASHINGTON: LEARNING EXPERIENCES INVOLVING RUGGED COUNTRY AND CUSTOM DESIGNED WILDLIFE GUARDS AND JUMPOUTS

Kelly McAllister, (360-705-7426, mcallke@wsdot.wa.gov), Habitat Connectivity Biologist, Washington Department of Transportation, 310 Maple Park SE, Olympia, WA, 98504-7331, USA

Mitchell Reister, (509-667-6415, Mitch.Reister@chelan.co.us), PE, Director/County Engineer, Chelan County Public Works Department, 316 Washington Street, Suite 402, Wenatchee, WA 98801, USA

Ron Bruno, (509- 679-2359, Ron.Bruno@frontier.com), Board Member, Wenatchee Sportsmen's Association, PO Box 762, Wenatchee, WA 98807, USA

Lawrence Dillin, (509-667-6415, Lawrence.Dillin@co.chelan.us), Engineer, Chelan County Public Works Department, 316 Washington Street, Suite 402, Wenatchee, WA 98801, USA

David Volsen, (509- 663-9764, David.Volsen@dfw.wa.gov), District Wildlife Biologist, Washington Department of Fish and Wildlife, 1550 Alder Street, Ephrata, WA 98823-9699, USA

Matt Wisen, (509-667-3021, wisenm@wsdot.wa.gov), Regional Biologist, Washington Department of Transportation, 1551 N. Wenatchee Ave., Wenatchee, WA 98801-1156, USA

ABSTRACT

A nine mile stretch of U.S. 97 Alternate Route (US97A), north of Wenatchee, has a long history of high rates of collisions between vehicles and deer. In this area, the highway parallels the Columbia River. In 2002, bighorn sheep began frequenting the roadsides attracted, in part, by lush irrigated landscaping plants on properties bordering the highway and lining the Columbia River shoreline. Losses of deer and sheep to collisions concerned everyone, especially the Washington Department of Fish and Wildlife and the local Sportsmen's Association. Annual deer carcass removals from this nine mile stretch of highway were typically 30-50 animals, with a high of 67 in 2003. Some years, as many as nine bighorn sheep were known killed here. Bighorn sheep were also known to create a driver distraction, with drivers slowing or stopping in hazardous locations, likely contributing to additional accidents. Although bighorn sheep do not comprise a significant portion of the wildlife mortalities on US 97A, their visibility, uniqueness, and relatively small numbers endear them to the public.

Construction of a barrier fence was considered beneficial to both bighorn sheep and deer. Prior to making the decision to pursue funding and public support for constructing such a fence, the Washington Department of Fish and Wildlife determined that the animals did not need to cross the highway to get to water or other important resources in the narrow strip of land between the road and the river. Obtaining funding and permits and securing a route for the fence took years. However, a nine mile fence was eventually built, in two phases. Each phase came with its share of challenges that included excessively rocky, often steep terrain, oppositional landowners, quite a few intersecting side roads and the need to consider how to get animals out of the right-of-way once they found their way in. Contractors, engineers

and biologists all had input into fence design and construction. The budget implications of designing the fence to contain bighorn sheep contributed to a cost increase on the order of 100% (or more) due largely to the ability of sheep to traverse very steep, rocky terrain. The total cost of the project was $2.8 million.

We are now almost two years past completion of the last phase of fence construction. Fence ends and several wildlife guards and jumpouts have been monitored with motion-triggered cameras, with some interesting results. Reviews of carcass removal data show a 79% reduction in deer vehicle collision rates since construction was started. Collisions with bighorn sheep continued during fence construction but have ceased since the last section of fence was completed. For a more robust evaluation of fence performance, several more years of carcass removal data need to be collected and analyzed.

INTRODUCTION

WSDOT has long recognized the safety issues associated with high rates of collisions with mule deer on US97A north of Wenatchee. Annual deer carcass removals from the worst nine mile stretch of highway were typically 30-50 animals, with a high of 67 in 2003. Traditional (signage) and innovative (deer reflectors) attempts to reduce these collisions had failed to yield measurable benefits. In 2002, bighorn sheep began frequenting the roadsides, attracted to lush vegetation planted and maintained by residents living along the Columbia River. Some years, as many as nine Bighorn Sheep were known killed here. Bighorn sheep were also known to create a driver distraction, with drivers slowing or stopping in hazardous locations, likely contributing to additional accidents. Although bighorn sheep do not comprise a significant portion of the wildlife mortalities on US 97A, their visibility, uniqueness, and relatively small numbers endear them to the public.

WSDOT, at the conclusion of its US97A Safety Study, concluded that additional collision reduction measures were needed. At about the same time, Tom McCall, a biologist with the Washington Department of Fish and Wildlife (WDFW), became inspired about safe wildlife crossings during a vacation trip to Banff National Park in Alberta, Canada. He saw the fenced Transcontinental Highway with wildlife crossing structures and he learned about the reductions in collisions that have resulted. He took this experience and sought to apply it on US97A. Tom's interest was also stimulated by a growing and highly valued bighorn sheep herd that had begun frequenting areas along the highway, contributing to elevated concerns about collisions, for the sake of both motorists and wildlife. Like most wildlife biologists working for government agencies, Tom found that money was simply not available to do anything close to what he had seen in Banff. However, Tom tipped off the Wenatchee Sportsmen's Association to his idea and its president, Ron Bruno, took on the project as a worthy challenge. It took years but, with appeals to agency heads and legislative leaders, Ron made sure that the project got the political support it needed.

METHODS

Fence Design and Construction

For WSDOT, the project was the first of a new type of project, incorporating non-traditional transportation technologies to solve a highway safety problem caused by the natural habits of two

distinctly different species of wildlife. The project came with considerable complexity created by multiple stakeholders, landowners, and design objectives.

In the end, nine miles of 2.4 m (8 ft) tall fence were built using steel posts and woven wire. Steel posts were chosen for their longer lifespan, ease of installation in rocky ground, and resistance to fire damage. The steel posts cost more but were less expensive to install so the end result was a similar cost compared to wood posts.

To install fence posts in solid rock, pneumatic and gas-powered drills were used to bore 15 cm (3 in) diameter holes. Anchoring and bracing the posts, on exceedingly steep ground, was accomplished with chains fastened to a "deadman", a combination of steel and concrete buried underground.

The fence was built in phases. Four and one half miles of fence were constructed between July and December 2009. An additional mile of fence was added during September to October 2010 and the final stage, involving three miles of fence, was constructed between July and September 2011.

In many places, access through the fence, for people, had to be accommodated. For people travelling on foot, one-way push gates were installed. These were placed in draws at roughly 610 m (2,000 ft) spacing. Wildlife guards, of varying dimensions, were custom designed and built wherever a private or county road intersected the highway. The evolution of design of these guards was one of the more interesting aspects of the project and will be treated in greater detail later.

Easements and access

Easements through private land had to be obtained prior to constructing the fence. Establishing the right-of-way for the fence brought its own set of significant challenges. WSDOT required that the fence be built outside of the WSDOT-owned right-of-way. Therefore, WDFW would hold title to the lands the fence passed through. WDFW, by policy, does not take lands by eminent domain. Therefore, the project needed willing sellers. Over the course of the project, some willing sellers who supported the project sold their land to new owners who opposed the project, creating a need to revisit the route of the fence.

In addition, a late and unexpected determination was made by the Bureau of Land Management (BLM) to require an Environmental Assessment for the entire project, not just the three BLM parcels impacted by the fence. To maintain the project schedule, the fence had to be re-routed, with associated increased costs for additional property negotiations, survey, and design. On the whole, though, most landowners were agreeable. There were relatively few instances where the fence had to be routed around lands where easements were unavailable or impractical to obtain.

Wildlife Guards installed on intersecting side roads

Ten frequently used side roads access the highway in the fenced stretch. These roads vary in their widths and, rather than purchasing pre-fabricated and commercially available cattle guards, WSDOT chose to design its own. The guards that were built ranged from 4.9 m (16 ft) to 9.8 m (32 ft) in width. The dimension in the direction of travel was consistently 4.9 m (16 ft). For the base of the guards, 0.9 meter (3

ft) deep holes were excavated and concrete forms constructed inside each one (Fig. 1). Anchor bolts were installed in the concrete base for affixing the steel grate surface. Wildlife guards were flanked, on each side, by 4.9 m (16 ft) wide rigid cattle panels.

FIGURE 1. Custom designed foundation for one of ten wildlife guards built for the project

The earliest wildlife guard design used 12 cross pieces of square tubular steel. To accommodate snow plow clearing of snow build-up on the guards, narrow strips of steel were fastened across the top of each guard at right angles to the tubular steel. The blade of the snow plow would slide over the surface of the steel strips. Unfortunately, this feature to allow snow clearing made it too easy for wildlife to step across the guard. Even without the narrow steel strips, the square tubular steel provided too much flat surface that animals could exploit to get across.

Efforts to test the effectiveness of the wildlife guard design included leading a pet goat over a guard (Fig. 2). The goat was able to cross fairly easily. A retrofit was implemented, removing the strap steel and welding angle iron across the tubular steel so that sharp right angles on each cross-piece pointed skyward, creating more precarious footing. Monitoring with trail cameras showed that mule deer were generally wary, usually turning away but sometimes bounding across. Rabbits, bobcat and a cougar were also observed, by camera, crossing over the wildlife guards. In response to these results, the final design substituted cross pieces made from 3-4 inch diameter round pipe (Fig. 3). This final version represents the culmination of a prolonged effort to adaptively respond to perceived or proven weaknesses in the earlier designs.

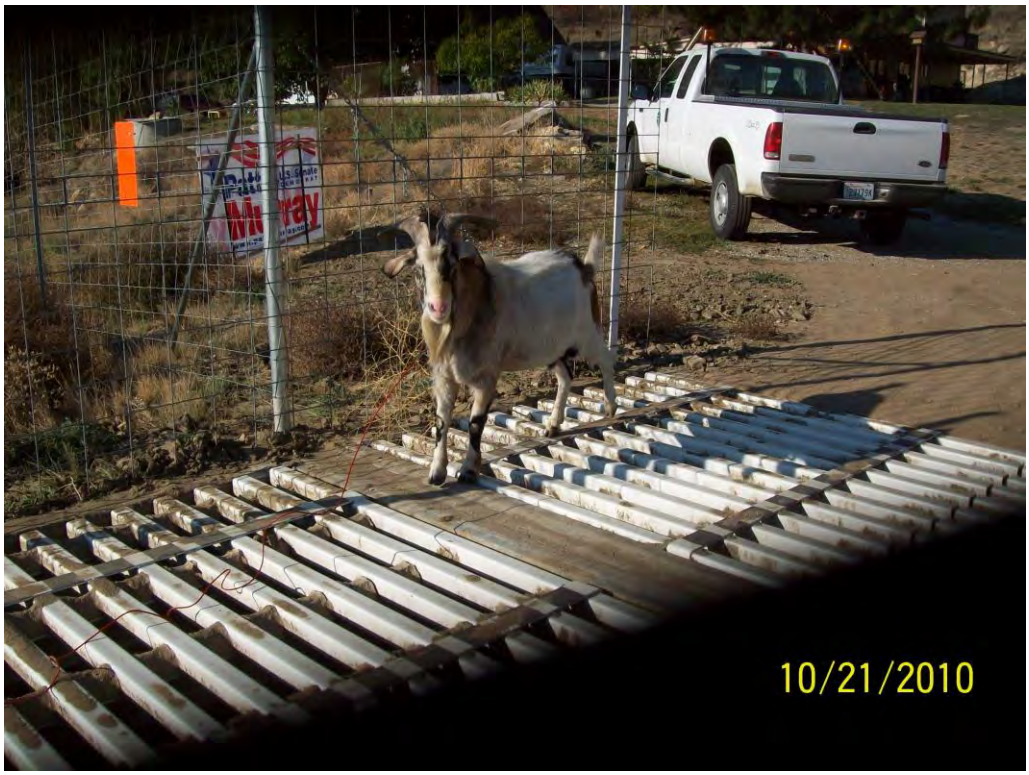

FIGURE 2. Pet goat easily crosses a first generation wildlife guard, designed to accommodate a snow plow blade

FIGURE 3. WSDOT's final wildlife guard design employed round pipe for cross pieces.

FIGURE 4. Jumpout designed for bighorn sheep was placed atop a rock outcrop.

Accommodations for escaping the right-of-way, one-way gates and Jumpouts

Animals, and people, were provided with options for getting out of the highway right-of way, in some instances providing people with access to public lands. One way swing gates were installed at regular intervals. Each was designed to push up and out, falling back to its original position by force of gravity.

Four jumpouts were built as well, each a different design. One of them, a relatively steep and rocky ramp, was built on top of a rock outcrop, designed specifically to be attractive to bighorn sheep (Fig. 4). Rock-filled gabions were used to form the face of other jumpouts (Fig. 5).

FIGURE 5. Jumpout built with rock gabions and fill.

FIGURE 6. A rigid cattle panel is placed where bighorn sheep might otherwise get around a fence end.

Treatments at rock outcrops and cliff faces

This stretch of highway, paralleling the Columbia River, is bordered by an abundance of rocky slopes, including outcrops of solid rock and some areas with vertical rock faces. These provided significant challenges to building an effective fence, especially given the known ability of bighorn sheep to traverse many of the steepest cliffs. There were instances where a vertical rock face was an adequate barrier to movement of sheep. In these locations, the fence was bolted to the rock at either end of the cliff face. This was accomplished using eye bolts anchored into bored holes using epoxy resin. Where the terrain dropped off almost vertically, rigid 2.4 m (8 ft) cattle panels were extended out over the edge to prevent animals from skirting around the end of the fence (Fig. 6). Chain link fencing was also used, at the base of steep rock faces, because of its greater rigidity and durability to hold up under conditions of frequent rock fall.

RESULTS AND DISCUSSION

The completed wildlife fence and associated infrastructure has proven durable and reasonably effective. One section of the fence survived a fire that swept through in 2010. After the fire had passed, the surviving fence gave evidence that steel post construction was the right choice for this location.

Mule deer and sheep both find their way to the inside of the fence. However, both have been observed getting back out of the right-of-way. Mule deer have used push gates to get out and bighorn sheep have been photographed climbing one of the jumpout ramps.

The budget implications of designing the fence to contain bighorn sheep contributed to a cost increase on the order of 100% (or more) due largely to the ability of sheep to traverse very steep, rocky terrain. The estimated total cost of the project was $2.8 million.

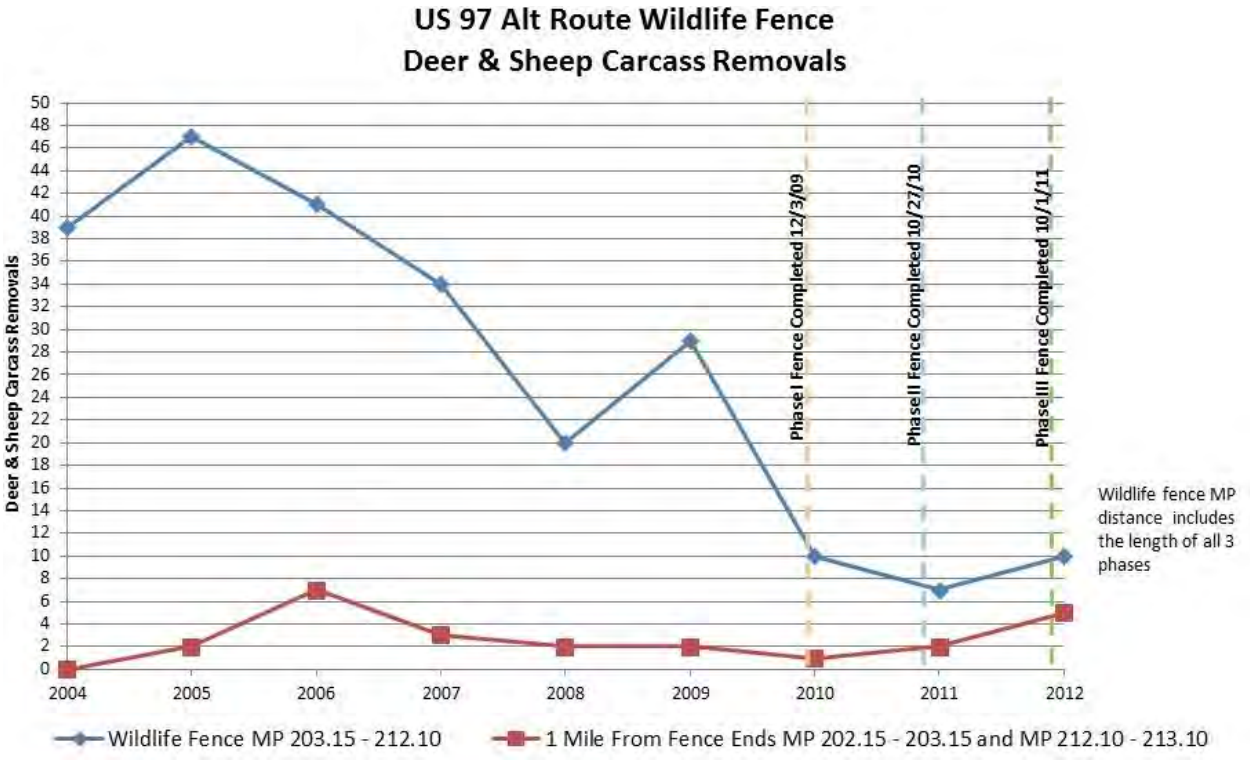

FIGURE 7. Pre and post-construction deer and sheep carcass removals, comparing trend within the fenced area and one mile out at each end.

Deer carcass removals from the fenced stretch of highway appeared to drop off as soon as the first phase of construction commenced in July, 2009 (Fig. 7). From this date through the end of 2012, 27 deer carcasses have been picked up by WSDOT maintenance staff from the section of highway that was fenced. This represents an average of 8 deer per year. From 1995 through June 2009, 589 deer carcasses were removed from this same stretch of highway, an average of 39 per year. Based on these year ranges, average annual deer carcass removals have dropped 79% since the initiation of the fencing project.

Bighorn Sheep collision reduction hasn't been as successful, largely because sheep continued to be hit on the highway during the construction of the fence. Eleven have been known killed since initiation of fence construction in July 2009. Prior to the start of fence construction, from 2004 through June 2009, 20 Bighorn Sheep were known killed. This represents a drop from 3.6 per year to 3.1 per year, a 14% reduction. A more reassuring view comes from the knowledge that no sheep are known to have been killed since the completion of fence construction in September 2011. For a more robust evaluation of fence performance, several more years of carcass removal data need to be collected and analyzed.

BIOGRAPHICAL SKETCHES

Kelly McAllister is a wildlife biologist in the Fish and Wildlife Program of the Washington State Department of Transportation. His work for the agency is dominated by issues related to habitat connectivity and wildlife-friendly highways. Kelly holds a bachelor's degree in Fisheries from the University of Washington and has worked as a wildlife biologist, for Washington State, for 33 years. He was an early member of the team that built the Nongame Program (now Wildlife Diversity Division) of the Washington Department of Fish and Wildlife.

Mitch Reister is a former WSDOT engineer working as Chelan County's Engineering Director.

Ron Bruno was born and raised in Montana, brought up in a family that valued hunting and fishing. His family hunted and fished for meat, not for trophies. Ron has lived in the Wenatchee area since 1977, joining the Wenatchee Sportsmen's Association soon after arriving. Ron's concerns for wildlife come from his family values. His desire to help others is ongoing and the wildlife fence project has allowed him to do good things for wildlife and people at the same time.

Lawrence Dillon is a former WSDOT engineer who now works as an engineer for Chelan County Public Works.

Dave Volsen is the Washington Department of Fish and Wildlife's District 7 Wildlife Biologist, covering Chelan and Douglas Counties.

Matt Wisen is the Washington Department of Transportation's Regional Wildlife Biologist, serving the agency's North Central Region.