UTC Project Information	
Project Title	MPC 432- Finding Innovative Solutions to Prevent Wildlife Access to Highways at Wildlife Guards
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Start and End Dates	January 1, 2013- December 31, 2013
Project Duration	1 Year
Brief Description of Research Project	Wildlife entering roadways can become involved in collisions with vehicles, creating a safety hazard for the motoring public and threatening the survival of wildlife populations. This proposal involves creating innovative strategies to keep wildlife off the road while helping them move above and below roads using culverts and bridges. Wildlife-vehicle collisions (WVC) occur over 1.5 million times each year in the United States causing at least $1.1 billion in vehicle damage and killing an average of 200 humans each year (Huijser et al. 2009). The most cost-effective method to prevent WVC is the placement of wildlife crossing structures with wildlife exclusion fencing (8 feet high) (Hedlund et al. 2004). This fencing keeps wildlife off the road and guides them to culverts and bridges designed to facilitate wildlife passage under (or above) the road. These types of fences are also used to keep deer and other wildlife out of restricted areas such as airports and military bases. If local driveways, roads, and entrance and exit ramps that bisect wildlife exclusion fencing are not designed with an effective deterrent to keep deer, elk, moose (ungulates) and other wildlife from entering the road right of way, the wildlife crossings and fencing become ineffective. These vehicle ingress and egress points that cross the wildlife exclusion fencing have to allow vehicles but deter animals, especially those with hooves. Traditional single cattle guards along these entrance points are not wide enough to deter deer and other large animals; they just jump over cattle guards. The standard cattle guard design for deterring wildlife in these areas is to place double cattle guards or similar wide guards embedded in the road. These other guards include wildlife guards which are as wide as double cattle guards and are created in a metal grid pattern. They also include Electromats®, a plastic strip embedded with copper wiring that

	hold an electrical charge, and placed in the road bed (see Seamans and Helo 2008a, 2008b, Holland-Allen 2011 for efficacy results). Double cattle guards, wildlife guards, and Electromats® costs increase from approximately $30,000 when placed in narrow roads, to $60,000 for wider roads and highway ramps. Utah Department of Transportation (UDOT) estimates four double cattle guards placed on entrance and exit ramps along an interstates interchange cost $240,000 (R. Taylor, UDOT, personal communication). UDOT is looking for innovative solutions that would allow the placement of a single cattle guard with another device that repelled wildlife as well as a double cattle guard but would cost less. This research will explore different types of technologies that could be added to single cattle guards, wildlife guards, and Electromats® that could further repel animals by possibly acting on their hearing, visual, smell, and other senses. These devices could use electric current, sound, scent, or visual movement that would act to repel approaching animals from trying to jump the single cattle guard. It is important to UDOT, other departments of transportation, airports, and military bases to explore the technology options that could be added to single cattle guards to create a situation that would repel approximately 90% of the ungulates that attempt to enter the roadways at those points, while keeping the cost under that of double cattle guards. **Research Objectives:** This study will monitor wildlife approaches to double cattle guards, wildlife guards, and an Electromat® along Utah roads to determine repel rates for these deterrent devices. The study will investigate technological approaches to add to single cattle guards on similar roads that would be less costly than double cattle guards and yet would repel ungulates at rates comparable to the double cattle guards, wildlife guards, and Electromats®. These technologies would work with electric currents, or scents, or visual deterrents to repel animals that approach, while still allowing vehicles to pass. The technological approaches would be applied through a process that examined the animals' behavioral reactions to the devices to find which ones worked best. The hypothesis to be tested is that these new technologies applied with single cattle guards can cost-effectively deter mule deer, elk, and moose at rates comparable (within 5%) to double cattle guards. The study would use cameras traps at these guards to evaluate what each animal approach results in, either animals being deterred, or animals crossing over the guard to enter the road right of way.

Describe Implementation of Research Outcomes (or why not implemented) Place Any Photos Here	
Impacts/Benefits of Implementation (actual, not anticipated)	
Web Links • Reports • Project Website	