TRAPPER’S POINT WILDLIFE DETECTION SYSTEM: TECHNOLOGICAL AND INSTITUTIONAL CHALLENGES

Rhonda Young, University of Wyoming
Trappers Point

- On 6000 year migration path from summer grounds in Grand Teton NP to winter grounds in Red Desert
12’ Lanes, 4’ Shoulders

Speed Limit = 65 mph
Trapper’s Point

- 29 reported accidents between 1995 and 2005
  - 23 (79%) involved collisions with animals
    - 1 antelope
    - 1 cow
    - 21 deer
  - ~ 2.3 animal-vehicle collisions per year

- 93 carcasses were collected between 1999 and 2005
  - 92% mule deer
  - ~ 15.8 animal-vehicle collisions per year
Trapper’s Point

- Traffic volumes increasing
Trapper’s Point

- Pronghorn, mule deer, elk, and moose inhabit the area.
- Mule deer population between 22,000 and 36,000.
Trapper’s Point

- Trapper’s Point Coalition
  - More than 30 members
    - Gas Industry Officials, Ranchers, WYDOT, WY Game & Fish, Governor’s Office,
  - Decided to construct a wildlife-sensing driver warning system to reduce deer-vehicle collisions.
    - Used technology similar to system at Nugget Canyon
    - Installed in October, 2005.
    - Cost approximately $1,000,000.
Technology

- **Wildlife detection system**
  - **EIDS (Electronic Intrusion Detection System)**
    - Developed by Telonics, Inc for the military
    - System worked at Nugget Canyon, WY
  - Geophones (seismic) and Passive Infrared sensors
Technology

- Active Driver Warning System
  - 3 Signs in Each Direction
  - Originally set to flash for 2 minutes for each detection but later reduced to 30 seconds
Data Collection

- Detection Data
  - Requires detection on two sensors (geophone and infrared) to qualify
  - Relays data to storage device
    - Printer
    - Laptop

```
2007.04.10 19:15:28 0135 QUAL/VEH 50 ?
2007.04.10 19:19:24 0011 QUAL/PED 28
2007.04.10 19:19:25 0005 QUAL/PED 35
2007.04.10 19:20:18 0001 QUAL/PED 10
2007.04.10 19:28:35 0001 QUAL/PED 11
2007.04.10 19:34:42 0001 QUAL/PED 44 ?
```
False Detections

- Passing tractor trailers were causing false positive detections
  - At the time, two infrared sensors and two geophone sensors were attached to each processor / transmitter.
  - A detection could be caused when two infrared sensors or two geophone sensors were tripped.
    - Unforeseen software loophole

- Major change in layout
  - Processors were consolidated so that only one infrared sensor and one geophone were attached to each.
Old System Layout
Current System Layout

Source: Kevin Cox, WYDOT
False Detections

- Infrared Filters
  - Added to limit false detections during sunrise, sunset.

![Breakdown of Detections by Transmitter 1 by half-hour periods, April 9th, 2007](chart.png)
False Detections

- Qualify Times have varied between 2 and 10 sec.
  - WYDOT, Telonics, and UW have adjusted many times
  - Telonics recommended a qualify time of 4 to 5 seconds.
  - UW set all of the sensors to the following:
    - Qualify Time = 5 seconds
    - IR Sensitivity = 4
    - Geophone Sensitivity = 5

- Problematic sensors were identified.
  - Qualify time lowered to 2 seconds
  - Geophone and infrared sensitivity lowered to 3
Handheld Radio Issues

- Handheld radio was not receiving signals from most of the sensors
- Metal cabinet was causing poor reception.
- Added an external antenna
Data Collection

- Effectiveness of Wildlife Detection System
  - Camera, DVR, Detection Data
  - False Negative
    - System fails to detect wildlife when wildlife are present
    - Random sampling of DVR data
    - Site visits at dusk during migration periods
  - False Positive
    - System detects something other than wildlife
    - Review of DVR data

- Effectiveness of Driver Warning System
  - Speed Sensors, Detection Data
  - Impact of Flashing Signs on Observed Speeds
Effect on Driver Behavior

- Avg speed and total volume for each half hour period was calculated in three locations.

- Number of detections per half hour was calculated.
  - Detections that occurred within 30 seconds of last detection were eliminated.
  - Represents the number of times that flashing lights were activated during each half hour.
Effect on Driver Behavior

- If the system has an effect on driver behavior:
  - Higher numbers of detections = lower average speed
  - Lower numbers of detections = higher average speed

- Linear regression analysis
  - Response variable = average speed per half hour at a particular sign
  - Predictor variables:
    - Number of detections per half hour.
    - Traffic volume per half hour.
    - Lighting condition (Day = 1, Night = 0)
  - The number of detections per half hour was not significant in any of the models. ($\alpha=0.05$)
Effect on Driver Behavior

- Volume per half hour and detections per half hour are not linearly independent.
- The wildlife detection system is detecting traffic.
- \( R^2 = 0.629 \), Pr>F = <0.0001

(Refer to the chart for visual representation of detections vs. volume for different zones and periods.)
Effectiveness of Detection System

- Detections that occurred outside the camera’s field of view were not considered.

- 5 hour-long periods that corresponded to handheld radio data were randomly selected and viewed.
  - Meant to provide data on false negatives.
  - No wildlife was seen in any of the periods.
Effectiveness of Detection System

- Only 4 of the 14 sensors detected wildlife; remaining detections were all false positives.

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<th>DETECTION ZONE</th>
<th># OF TRUE DETECTIONS</th>
<th># OF FALSE POSITIVE DETECTIONS</th>
<th>% FALSE POSITIVE DETECTIONS</th>
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</table>
Effect on Crashes

- Total # of Reported Crashes
Effect on Crashes

- Total # of Animal-Vehicle Crashes
Effect on Crashes

- Animal-Vehicle Crashes Rate

![Graph showing the trend of Animal-Vehicle Crash Rate from 1994 to 2008. The rate starts at around 2 crashes per million vehicle miles traveled (crashes per MVT) and shows an increase until around 2002, followed by a decrease.]
Conclusions

- While visual trends indicate a reduction in animal-vehicle crashes the difference in crashes (both frequency and crash rates) was not statistically significant.
Conclusions

- Number of detections per half hour does not have a significant effect on the average speed
  - Drivers do not respect signs and may have become accustomed to them.
    - Likely Cause: too many false detections

- The majority of detections by the wildlife detection system are false detections
  - Number of detections related to traffic volumes
Conclusions

- System Maintenance was high due to the large number of sensors.
- Snow cover appears to make geophones insensitive and cause wiring breaks.
- Infrared sensors appear to be sensitive to sun and clouds (east-west orientation problematic).
- Lack of communication and remote location make detecting system errors difficult.
- WYDOT personnel with knowledge and resources to maintain system not locally available.
Need for animal-vehicle countermeasure at location verified. Six potential future actions:

1. Keep system in its current state and operate year round with dedicated maintenance staff
2. Keep system in its current state and operate during migration periods
3. Reduce scale of system and use fencing to funnel animals to detection zones
4. Remove geophones and use only infrared sensors for detection
5. Use other animal detection technology such as “break the beam” systems
6. Use a wildlife under or overpass
Things to consider

- Who will maintain the technology and how close are they to the site?
- How will you know when there’s a problem with the system?
- Can the technology be minimized while keeping the function of the system?
- Can the technology be located more ideally? (snow cover and drifting, east/west direction, on curves, separation from roadway)
Final Report

- Evaluation of an Active Wildlife-Sensing and Driver-Warning System at Trapper's Point - FHWA-WY-09/03F

- Available on WYDOT Web Page
  http://www.dot.state.wy.us/wydot/planning_projects/studies_plans/research_center_reports_3
QUESTIONS

Rhonda Young

Associate Professor, Dept. of Civil & Arch. Engineering, Univ. of Wyoming

(307) 766-2184
rkyoung@uwyo.edu