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Abstract: Animal-Vehicle Crashes are a growing trend in America, and Wyoming in particular. The focus of this research effort is to determine the effect of road reconstruction on the number of animal-vehicle crashes using changes in the reported animal-vehicle crash rates. Using GIS tools, the entire Wyoming highway system was analyzed using 10 years of reported crash data to determine both the frequency and crash rate of animal-vehicle crashes on each roadway segment. Seven reconstruction projects were selected for the study. Statistical analyses were performed with a focus on crash rates. The seven sections were analyzed as an aggregate data set, and it was determined that wild animal-vehicle crash rates experienced increases following reconstruction. During this same period, those crash rates not associated with animal-vehicle crashes, as well as the overall crash rate, were generally observed to decrease. An analysis of changes in roadway design attributes was performed, and the only attribute observed to have a statistically significant impact on the animal-vehicle crash rate was design speed.

Background and Purpose

There lack of information concerning the geometric design of roads and the effect on animal-vehicle crashes. There have been few attempts to correlate changes in road design, and these are primarily concerned with the addition of lanes of traffic to a highway. None of these have been concerned with the addition of lane and shoulder width or changes to the horizontal or vertical curvature of a roadway. The main objective of this research effort is to determine what features of a reconstructed highway may have an effect on the number of animal-vehicle crashes.

Methods

The research effort collected background data on seven reconstruction projects in the state of Wyoming including geometric features (lane widths, shoulder width, curve radii, superelevation, and bridge and culvert structures), traffic volumes, wildlife population estimates, speeds (current, before speeds in available, and estimated change in speeds) and crash records. The before and after crash frequencies and crash rates were calculated for each project. A crash rate that accounted for wildlife population number was also calculated.

Three types of analyses were performed on the data set. A general analysis comparing before and crash after rates for the aggregated data set, a analysis on the aggregated dataset that considered project attributes such as design speed, lane width, shoulder width, and pavement width, and individual analyses of the project segments. The general analysis performed paired t-test to determine if there was a statistically significant change in crash rates for animal-vehicle crashes, animal-vehicle crashes accounting for changes in animal populations, non-animal-vehicle crashes, and total crashes.

For the aggregate analysis with project attribute variables, a single variable regression analysis was performed on each of the six project variables (animal population density, design speed, lane width, shoulder width, pavement width, and design speed with estimated speed reductions). A model that combined the significant attributes was then generated using stepwise regression.

The last analysis that was performed was using the individual segments before and after crash rates assuming a Poisson distribution. Each of the seven projects were analyzed separately to determine if the crash rates has a significant increase or decrease in crash rates.

Preliminary Results

The general analysis comparing before and after crash rates of the aggregated data found that there was a statistically significant increase in the animal-vehicle crash rates at the 97% confidence level. When the animal population values were accounted for there was still a significant increase in the animal-vehicle crash rates at the 96% confidence level. The non-animal-vehicle crash rate was observed to decrease at the 95% confidence level. The total crash rate was observed to decrease at the 87% confidence level.

The aggregate analysis with project attribute variables the important attributes were determined to be animal density of the herds and the design speed of the project. The final model that included the animal density and design speed variables has a R^2 value of 0.55, suggesting that significant variation remained unexplained.

Due to small sample size issues the individual analyses were less conclusive than the aggregate analyses. All seven projects showed an increase in animal-vehicle crash rates, although only one of these increases was statistically significant. Five of the seven projects showed a decrease in non-animal-vehicle crash rates, although only three of these decreases were statistically significant. The total crash rate results were the most varied with four of the seven

showing decreased crash rates. Two of these were statistically significant decreases. None of the increased rates were found to be statistically significant.

Next Steps

The next step to this research effort is to apply the empirical bayes methodology to the data set utilizing a rural two-lane highway safety prediction algorithm. The use of this methodology will correct for regression-to-the-mean bias and improve the precision of the statistical analyses.