RELATING WILDLIFE CRASHES TO ROAD RECONSTRUCTION

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Disclaimer

Preface

Animal-vehicle crashes are a growing trend in America, and Wyoming in particular. The focus of this thesis is to determine the effect of road reconstruction on the number of wild animal crashes using changes in the reported animal-vehicle crash rates.

Multiple literature sources are reviewed to assess the work previously accomplished in the field of animal-vehicle crashes, with a focus on the work performed in Wyoming and the Rocky Mountain West. Using GIS tools, the Wyoming highway system is analyzed to locate sections of roadway with either animal-vehicle crash rates or frequencies that are higher than average. From these sections, 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 dataset, and it was determined that wild animal-vehicle crash rates experienced increases following reconstruction. During this same time 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.

This report describes a research effort conducted at the University of Wyoming by R. Young, assistant professor, and graduate student Chris Vokurka.

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EXECUTIVE SUMMARY

Introduction

Animal-vehicle crashes are a concern for many areas of the country but are a particular concern for rural areas such as Wyoming. While there is considerable literature available on the effectiveness of various animal-vehicle countermeasures, such as fencing and signing, there is currently little quantifiable data on the effects of roadway reconstruction on these types of crashes. The main-objective of this research is to look at past reconstruction projects to determine the effects various design aspects of these projects have on both animal-vehicle crash rates and the overall crash rates.

Statewide Animal-Vehicle Crash Analysis

The first task for this research effort was to undertake a statewide analysis of animal vehicle crashes. A dataset containing all reported animal-vehicle crashes statewide for a ten-year period from 1995 through 2005 was imported into a Geographic Information System (GIS). GIS was then utilized to analyze the crashes on the basis of both frequency per lane mile and a crash rate per million vehicle miles traveled. Statewide color-coded maps were generated that graphically showed the hot spots around the state for animal-vehicle crashes.

Individual Project Selection and Data Collection

The next task was to select past roadway reconstruction projects for further study. The State Transportation Improvement Program documents over the past decade were reviewed to compile a list of 36 candidate projects. Projects were selected that had significant roadway work as part of the reconstruction effort and also were located in areas where animal-vehicle crashes were shown to occur in the statewide analysis. From the candidate list, the following seven projects were selected by the state safety engineer for further study:

- WY 130 Centennial East Section – between Centennial and Laramie from milepost 21.32 to 27.431. Reconstruction was started in November of 1996.
- US 14/16/20 Hanging Rock Section – between Yellowstone National Park and Cody from milepost 19.4 to 27.6. Reconstruction was started in June of 1998.
- US 189 Round Mountain Section – between Kemmerer and LaBarge from milepost 45.78 to 59.02. Reconstruction was started in April of 1999.
- US 14/16 Clearmont North Section – between Sheridan and Gillette from milepost 38.61 to 45.96. Reconstruction was started in November of 1999.
- WY 34 Morton Pass Section – between Bosler Junction and Wheatland from milepost 9.69 to 16.53. Reconstruction was started in March of 2001.
- US 89 Astoria Section – between Alpine Junction and Jackson from milepost 136.65 to 140.69. Reconstruction was started in March of 2000.
- US 26/85 Torrington West Section– between Torrington and Lingle from milepost 94.60 to 102.93. Construction was started in October of 1997.

Background information and data was then collected on each of these projects. The first piece of background data that was reviewed was reconstruction plans that showed the geometric changes to the roadway, such as lane width widening, shoulder width widening, curve radii changes, etc. Site visits to the study locations were also performed to determine additional information not easily obtained from the plans, such as fencing conditions, surrounding vegetation, and potential wildlife passage areas under existing bridge structures. Wildlife data was obtained from the Wyoming Game and Fish department in the form of historical herd population estimates in the vicinity of the study projects. Historic traffic volume data and crash history data for the project sites were also compiled. Lastly, speed data for the project locations were also obtained.

Data Analysis

The next task was to utilize the project data to determine overall trends in the animal-vehicle crashes. Three main areas of data analysis were performed to investigate these trends. The first two utilized the aggregated project data while the third looked at each project individually.

Using an analysis that compared the changes in crash rates for each of the seven sections in aggregate, several trends were identified as to the changes in risk following the reconstruction.

- The crash rate involving the animal-vehicle crashes was observed to **increase**.
- The crash rate for all crashes not involving wild animals (that is all crashes except animal-vehicle crashes) was observed to **decrease**.
- The overall crash rate (all crashes including animal-vehicle crashes) was observed to **decrease**.

Next, an analysis was performed to determine the effect of the following design variables: design speed, design speed with shoulder and lane width speed reductions, lane width, shoulder width, and overall pavement width. An additional variable, animal population density, was also included to account for changes in animal population.

Three separate statistical tests were performed, and the only variables found to be statistically significant were animal population density and design speed.

The last analysis effort attempted to quantify the changes in crash rates for each of the individual sections. Only a few of the study sections contained crash frequencies on their own high enough to state with confidence a noticeable trend. Only the Astoria section demonstrated with high probability that the animal-vehicle crash rate increase was not due to chance. In the rate of all other crashes (non animal-vehicle crashes), the Morton Pass section, the Clearmont North section, and the Round Mountain section demonstrated high likelihoods that the decrease in rate was not due to chance. Lastly, the Morton Pass section and the Round Mountain section showed that the decrease in total crash rate was not due to chance. The results of the individual section analyses illustrate the importance of sample size in making statistically sound conclusions. This is why the aggregate analyses performed first had higher levels of statistical confidence.

Conclusions

Based on the research effort, the following conclusions about animal-vehicle crashes were made:

- ArcGIS proved valuable for the analysis and selection of high animal-vehicle crash areas and selecting potential study sections.
- Animal-vehicle crash rates were observed to increase.
- Non-wild animal-vehicle crash rates were observed to decrease.
- The total crash rates were observed to decrease.
- Animal population density and roadway design speed were significant variables in affecting animal-vehicle crash rates.

- When studying individual sections independently, there was less statistical confidence in the results as opposed to looking at all seven sections in aggregate.

So while it was observed that animal-vehicle crash rates increased, the overall level of safety of the roadway increased. It is also interesting to note that a Michigan study also found an increase in animal-vehicle crashes after a project was reconstructed but observed a return to baseline for these types of crashes five years after the project was completed. It would be interesting to follow up on the seven Wyoming projects as more post-reconstruction crash data become available to see if the increase in animal-vehicle crashes is also temporary and that a reduction in these crashes will occur after the animals become habituated to the changes.

1. INTRODUCTION

Anyone who drives frequently throughout Wyoming or almost any other rural area inevitably will have a close call with some sort of wild animal, most likely a deer. For most of us, the potential crash is avoided and simply becomes an interesting story to tell. Still, this is not always the case.

In rural areas, some of the most common types of vehicular accidents involve large animals. There are over 1.5 million impacts with deer every year, resulting in 150 human lives lost and more than one billion dollars in damage (IIHS, 2004). In Wyoming alone, there were more than 16,000 reported accidents involving wild animals between 1995 and 2005 according to data collected for this research effort. These collisions resulted in 14 human deaths. This same data indicate that this problem is increasing by the year. Figure 1.1 illustrates the increases that have occurred over the past decade.

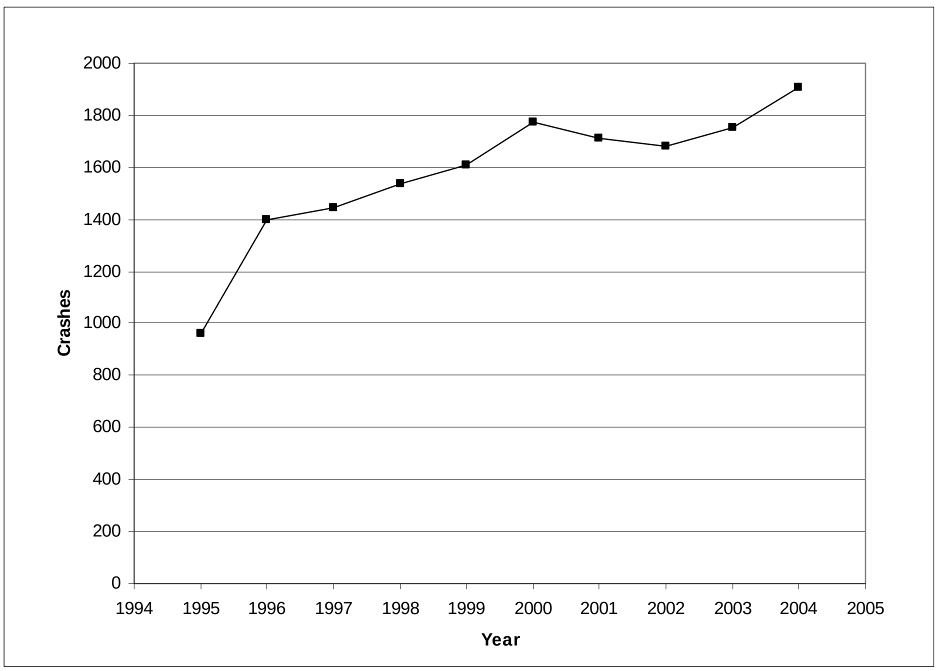

Figure 1.1 Reported Wild Animal Collisions in Wyoming from 1995-2004
(Source: WYDOT Highway Safety Program)

During this nine-year period, recorded animal-vehicle crashes (AVCs) have increased 99%, from 959 in 1995 to 1,910 in 2004. While total vehicle miles have increased from 4.7 billion miles per year to 6.2 billion miles per year (WYDOT, 2004) during the same period (a difference of 33%), one cannot assume this is wholly responsible for the increase in animal crashes.

The reported accidents may not also accurately describe the problem in terms of ecological impact. The actual number of impacts is most likely far higher, as many accidents of this nature go unreported. If the damage to the car is minimal, or if there are other factors involved, this can prevent drivers from reporting their accidents to the police. These additional factors can include things such as alcohol involvement or other types of intoxication, a desire to keep the information from impacting one's insurance rates, or simply not knowing that one is supposed to report these incidents.

Previous studies undertaken in this field focused on active measures to reduce the number of collisions between automobiles and game. These activities can be broken down into two broad categories: those measures which seek to reduce the number of wild animals that cross the roadway, and those that aid the driver in recognizing and avoiding impacts with game.

In the first group, the most studied technique is to build crossing structures that allow animals to cross the road without entering the traveled way. These can be purpose-built structures or a design modification of structures that were already necessary for the highway. Other methods in this group include installing high fences to prevent deer from crossing the road and actively culling herds to reduce animal populations in sensitive areas.

The second group, which seeks to lessen the probability of drivers from colliding with animals, has several active fields of study as well. The most common method of alerting drivers is through the use of deer crossing signs. Other techniques that have been explored include the use of lighting to make deer more visible to drivers and the reduction of speed limits to give drivers more time to react to animals on the road.

While much research has been performed to study the use of active deer crash measures, little has been done to examine the effect the general design of highways has on the rate that deer and other big game are hit. Although several sources have stated the need for research in this area, no quantifiable information was found regarding this subject. If this is known, designers may be able to make changes to highway design in areas that are known for high numbers of AVCs.

1.1 Problem Statement

The lack of information concerning the geometric design of roads and the number of wild animal crashes is clear. 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 has been concerned with the addition of lane and shoulder width or changes to the horizontal or vertical curvature of a roadway.

1.2 Research Objectives

The main objective of this research effort is to determine what features of a reconstructed highway may have an effect on the number of AVCs.

1.3 Research Tasks

A Geographical Information System (GIS), containing both crash records and traffic volumes provided by WYDOT, is used to identify areas of particular interest of this project.

Once particular highway corridors have been identified as being of concern, state records and the guidance of highway officials are used to locate several segments of highway that have had significant modifications to the geometric characteristics of the roadway. Specific geometric attributes that have been changed on each of the highways are identified for further analysis.

A statistical model is developed to determine whether there is a correlation between changes to roadway design and the number of wild animal crashes. This model also accounts for factors not related to roadway reconstruction, such as changes in traffic volumes and animal populations.

In summary, the major tasks involved in this research are the following:

- Locate high animal collision areas using GIS software using both crash rates and frequencies.
- Identify several high collision areas in which there has been major reconstruction work in the past ten years.
- Determine the changes to major roadway attributes on the selected projects that may have an impact on the frequency of Animal-Vehicle collisions.
- Correlate the changes made to the roadways to the number of crashes that have occurred within the given stretches of highway.
- Draw conclusions and make geometric design recommendations, if applicable, as a result of the data analysis.

1.4 Thesis Format

The various objectives of this research will be broken down into the following chapters:

1. Introduction
2. Literature Review
3. Data Collection
4. Project Location Description
5. Analysis and Results
6. Summary and Conclusions

Chapter 2 illustrates the methods already being used to describe and mitigate the problems associated with animal collisions. Chapter 3 describes collection and sources of the data for this effort. Chapter 4 gives a description of each of the reconstruction sections and the data collected for each section. Chapter 5 provides analysis of the data as well as the results of this effort. Chapter 6 provides conclusions and recommendations based on the analysis of the data.

2. LITERATURE REVIEW

This chapter provides an overview of previous efforts used to mitigate the dangers of animal-vehicle collisions. The chapter is broken down into five broad sections: the first section describes the nature of the problem, and includes times and seasons that are more dangerous for animal-vehicle collisions, the age of animal that is most likely hit, and habitat considerations. Within Wyoming, the most common animals struck by vehicles are mule deer, and this section also includes a description of the habitat conditions that are most conducive for mule deer populations. The second section describes active measures to keep animals out of the traveled way. Fencing, over and underpasses, and other related features are included in this section. The third discusses the use and potential improvement of animal warning signs. The fourth section describes measures that can be taken to prevent drivers from hitting animals on the roadway. The last section discusses the problem of underreporting of AVCs.

2.1 Animal-Vehicle Collision Factors

The following section gives a description of factors that make an AVC more likely to occur. These factors include time of day, season, age of the animal, and various habitat features that attract animals to a particular location.

2.1.1 Time of Day

The time of day has a large effect on the probability that a driver will strike an animal. Most game animals tend to be more active during early morning, dusk, and evening hours and use these times to do a large portion of their feeding. A study of AVCs performed in Utah on data collected between 1999 and 2001 shows that the most likely times for impacts to occur were between 6 and 10 PM, with a smaller peak at around 6 AM. Figure 2.1 shows the distribution of animal impacts by the time of day (Perrin, 2003).

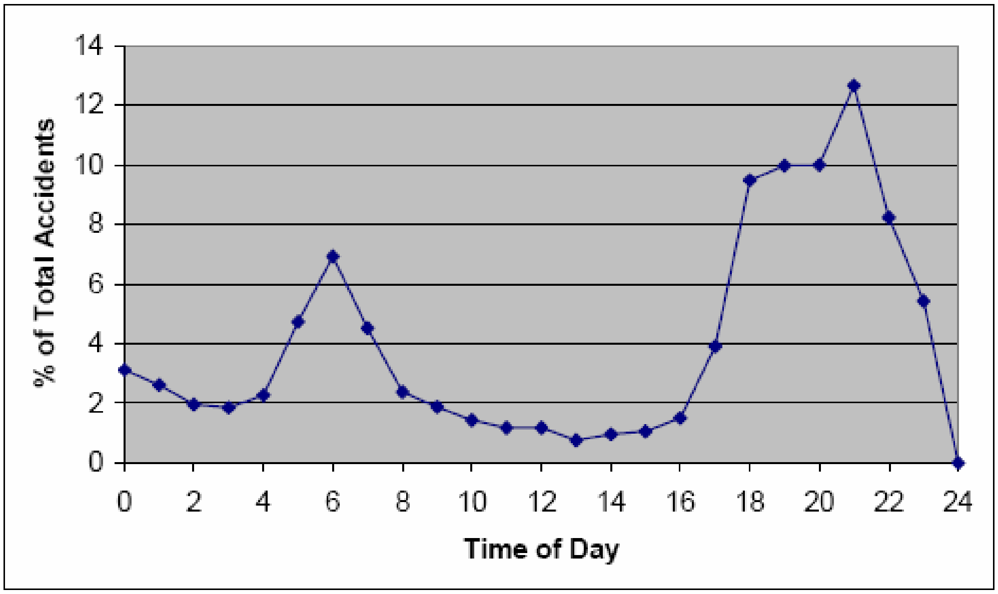

Figure 2.1 Animal Crashes by Time of Day
(Source: Utah Department of Transportation Research and Development Division)

2.1.2 Season

The time of year also impacts the number of AVCs. Fall is the worst time of year for crashes involving animals. This seems to be the case for several reasons: first, it is the mating season for most big game animals, and this causes activity to increase during this time period. Second, it is hunting season, and this too might cause the activity level of the animals to go up. Finally, this is the time of year when animals typically are migrating from their summer foraging areas to their winter habitat (Perrin, 2003).

2.1.3 Age

The age of the animal can also affect the probability that it will be impacted along the road. Younger, less experienced animals are not as aware of the hazards that highways pose and are more apt to be hit. Some data on this subject have been collected regarding deer. A study performed in Pennsylvania recorded a total of 170 deer strikes within the study area in the early seventies. Of those 145, 85% of all impacts involved either fawns or yearling deer (Bellis and Graves, 1971).

2.1.4 Habitat and Migration

The habitat adjacent to the roadway is a major contributor to the number of AVCs in a given stretch of highway. In Wyoming, the species that is most problematic is mule deer (WYDOT, 2005). This is due to a combination of their size and presence in large numbers throughout the state. The two most important things that make an area suitable to deer are cover and forage suitability. In addition, other factors might make the habitat surrounding a roadway more desirable, including the possible use of the corridor for migration purposes and mineral deposits adjacent to the road.

Several different types of cover are needed for the survival of mule deer. The most important is protection from predators, known as hiding cover. Hiding cover is “any vegetation capable of hiding 90 percent of deer from human view at a distance equal to or less than 200 feet” (Olson, 1992). Several types of trees and shrubs, such as ponderosa pine, juniper, willow, and similar species tend to make good hiding cover. In addition to the vegetation in the area, mule deer seem to prefer areas that have rocky, rough terrain.

A second type of cover, especially important in summer and winter months, is known as thermal cover. This type of cover is used to protect the animal from the elements, including cold, wind and the heat of the summer. Ponderosa pine, juniper, cottonwood, aspen, and several shrub species make good thermal cover at various times of the year (Olson, 1992).

The second necessary attribute that makes an area desirable for deer is adequate forage. What mule deer prefer to eat is highly dependent on the time of year. During the winter, they depend on trees and shrubs, as most everything else is either dead or covered in snow. Once spring starts, deer tend to switch to grasses and forbs (broad leaf herbs such as clover), as they have a much higher nutritional value than the winter forage. During the summer, grasses tend to dry out, and forbs tend to make up much of their diet. When frosts start to occur in the fall, shrubs begin to make up the majority of their diet.

In Wyoming, the conditions required for good habitat can be available year around in some areas, while other areas require that the mule deer migrate to different locations over the course of a year. In Figure 2.2, one can see the various ranges throughout Wyoming that mule deer occupy (Utah State GIS Laboratory, 2006).

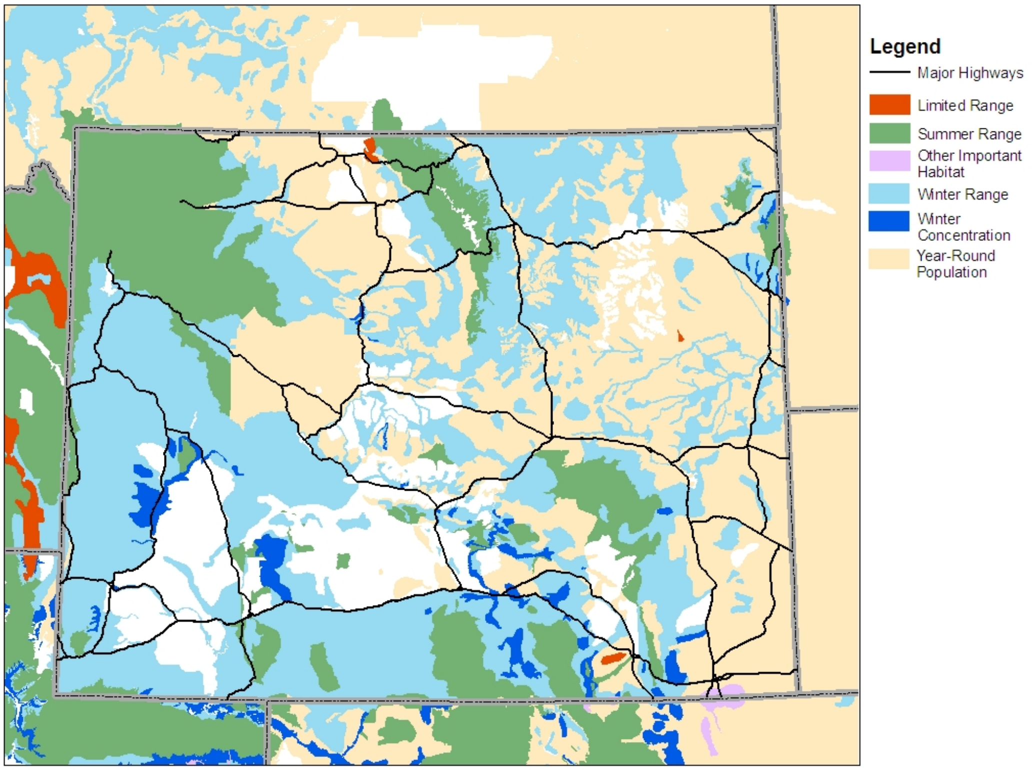

Figure 2.2 Wyoming Mule Deer Habitat
(Source: Utah State GIS Laboratory)

The migration of big game animals can have large impacts on specific highway corridors. At Trapper's Point, near the town of Pinedale, Wyoming, natural features and development force large numbers of animals through a very narrow passage. Pronghorn antelope using this area can migrate up to 320 miles, the longest overland migration pattern in the lower 48 states. These animals are often required to cross US 191, creating a very hazardous situation.

A similar situation exists on US Highway 30 between Kemmerer and Cokeville in an area called Nugget Canyon (Feeney, 2004). This area is a historical mule deer migration corridor several miles in length that now has a highway bisecting it. Exclusionary fencing and an underpass are currently used to prevent deer from entering the roadway. Additional fencing and six more underpasses are proposed for construction in 2008.

Other habitat features may play a small but influential role on how many game animals are found along roadsides and therefore how many may get hit. An article in the journal *Public Roads*, "Of Moose and Mud" details how animals are attracted to mineral deposits often found along roadways referred to as "licks." These muddy pits have high quantities of sodium and other minerals that are often lacking in the deer's diets. The article also refers to studies being performed evaluating the de-icing compounds used by transportation departments (Rea, 2005).

2.2 Measures to Keep Wild Animals off Highways

This section of the literature review explores active measures used to keep animals off the roadway, including the use of fencing and the additional features that make fencing a practical proposition. These include the use of underpasses and methods of returning wayward animals that have breached the fence to the other side. In addition, there are other methods of keeping animals off roads that have met with varying degrees of success, such as deer whistles and reflectors.

2.2.1 Fencing

The most effective measure used appears to be fencing, reducing the mortality rate by 60% to 97% (Knapp, 2004). While effective, the use of exclusionary fencing can also create issues with wildlife management. If not properly designed or used extensively, exclusionary fencing can fragment and isolate wildlife populations as well as hinder animal migration (Sawyer and Rudd, 2005). Several additional measures that maximize the usefulness of fencing include ways for wayward animals that have breached the fence to leave the right-of-way (ROW) and ways to connect side roads to the highway while excluding animals from the highway ROW.

Exclusionary wire woven fencing is one controlling measure that has been proven to be an effective reducer of AVCs (Ward, 1982). In order for fencing to be effective, several other things must be done. The fence must be of sufficient height to prevent the animals from jumping the fence. To effectively prevent mule deer from jumping fences, a fence height of 7.8 feet or greater is required (Ward, 1982). Typical ROW fences on Wyoming highways vary between 45 and 50 inches (See Appendix A) in height, meaning that a normal ROW fence is inadequate to prevent deer from crossing into the ROW. As deer are known to test fences for weaknesses (Ward, 1982), the fence must also be of considerable strength.

In addition to the height of the fence, several studies have shown that the length of the fence plays a large role in its effectiveness. Deer are known to travel large distances in order to gain access to a fenced-in area. The distance depends on the patterns of movement that the animals are already demonstrating. A study of a 7.8 mile segment of Interstate 80 was undertaken to investigate the effectiveness of exclusionary fencing on mule deer (Ward, 1982). The original fence length was 6.7 miles. Six underpasses were configured to allow deer to cross the highway as well as one-way gates to allow deer that do get within the right-of-way to leave the area successfully.

The typical migration patterns caused approximately 1,000 deer to cross the study area annually, and 37 to 60 deer vehicle crashes (DVCs) occurred from 1973 to 1976. Fifty-three deer were killed in the study area the year prior to the installation of the mitigation measures. In the first year following the installation of the fence, 59 deer crashes were reported. During this time period, 55% of the impacts occurred just outside the fence boundaries. The fence was then extended on the east side of the segment by 1.1 miles. During the next three years only one carcass was found on the side that had its length increased. The deer collision rate did not change for the side that did not have its length increased. It was determined that a proper fencing/crossing system can reduce DVCs within the affected area by more than 90% (Ward, 1982).

Underpass usage also appears to increase over time. In the first winter that the fences were in place, 525 deer were seen on the south (summer range) side of I-80, and only 86 deer were seen on the north (winter range) side of the highway. Radio-collared deer tracking indicated that the animals were taking between two weeks and three months to cross the highway.

During the migration the following year, several of the underpasses were baited to encourage deer to use the underpasses. This baiting was deemed necessary for only that year, and following this, the deer seemed willing to use the underpasses. The locations of radio-collared deer indicate that the animals now often spend only a few days near the highway.

Ward also emphasized the importance of regular maintenance on the fence, especially during migration season. During the duration of the study, several holes in the fence large enough for deer to squeeze through enabled them to gain access to I-80. Deliberate actions, such as poaching, and random acts, such as truck tires being sent through the fence, drifting snow, or erosion can provide deer with an opportunity to enter the highway. In the case of erosion, 31 deer entered the roadway before a small washout under the fence was discovered and filled (Ward, 1982).

In addition to exclusionary fencing, WYDOT uses several other types of fencing to control its Right-Of-Way (ROW). Other types of fencing WYDOT typically uses are designed to be permeable to game crossing. The species of most concern in this regard are deer, elk, moose, and pronghorn (Wilson and Karhu, 2004).

In regard to deer, the most important factor is the height of the fence (Wilson and Karhu, 2004). In situations where deer movement is to be allowed, the height of the fence should not be more than 42 inches. WYDOT, however, requires that all fencing be at least 45 inches in height when bordering highway ROW. Wyoming Game and Fish (WGF) also recommends that the spacing between the top wire and the next wire be at least 10 inches in an effort to prevent jumping deer from becoming entangled in the fence. A 12-inch gap is preferred. The fence type preferred by WGF on WYDOT ROW in regard to deer is standard fence type E, which is 45 inches in height and has a 12-inch gap between the two highest wire strands. This fence type can be observed in Appendix A (Wilson and Karhu, 2004).

When elk or moose are to be considered, the height is still the greatest concern. Calf elk have difficulty jumping fences over 38 inches. WGF also recommends placing a wooden rail on top of the fence to increase the visibility of the fence to elk and moose. Along highway ROW, WGF again recommends the use of WYDOT Type E fencing. While no WYDOT standard fence plans include a top rail, WGF still recommends this (Wilson and Karhu, 2004).

Pronghorn antelope are more likely to crawl under fences rather than jump over them. WGF recommends keeping the bottom wire of fence no less than 10-inches above the ground level to allow for pronghorn movement. They also recommend that the bottom wire be smooth rather than barbed to help facilitate pronghorn movement. WYDOT standard fence Type E also accommodates movement of this nature (Wilson and Karhu, 2004).

Several other types of fencing may be used along WYDOT ROW depending on the land-use of the adjoining property. These types of fences can be seen in Appendix A.

2.2.2 Other Features Related to Fencing

One point made clear from research is that fencing should be combined with other measures to ensure success. The additional measures found to be the most effective are one-way gates, escape ramps, and ways for animals to cross the highway right-of-way without encountering traffic. With exclusionary fencing, these improvements tend to act as a system that can effectively reduce the number of AVCs on a given segment of road.

While a fencing system may do an adequate job in keeping ungulates off the road, animals are known to test fences regularly and will exploit any weakness in the fence quickly (Ward, 1982). It is then important to provide some method for the animal to get back on the other side of the fence when this occurs. One method of letting animals back to the other side of the fence is one-way gates. These systems allow a deer to cross through the fence in one direction, without allowing movement in the other direction.

The second common method used to serve this purpose are earthen escape ramps. These are mounds of dirt, recommended to be five feet tall adjacent to the control fence (Bissonette and Hammer, 2001). The fence is typically lowered to the same level as the ramps at these locations. This allows the deer to climb the mound and jump to the other side of the fence while providing a barrier for those animals that wish to gain access to the highway right-of-way.

A study was performed in Utah that compared the usage rates of both the one-way gates and the earthen escape mounds (Bissonette and Hammer, 2001). In 1997, nine ramps were placed along US 91 along with 10 one-way gates. The following year seven ramps and eight gates were placed on US 40 along two, 1.5 mile segments. At the conclusion of the investigation, the researches determined the ramps were used eight to 11 times more than the gates. The observed frequency of carcasses along US 91 also decreased following the installation of the ramps (Bissonette and Hammer, 2001).

A second issue with deer fencing is how to address the situation when a secondary road crosses the road that is to be fenced. One option that has been implemented is the use of modified cattle guards to prevent deer from entering the fenced-in portion. In the seventies, Colorado researchers performed several tests to gauge the effectiveness of cattle guards. Reed found that while a 12-foot long guard was adequate in preventing mule deer from jumping, the deer were able to walk across the deer guard using the tips of their hooves and their dew claws (Reed, 1974). Reed did not recommend the use of deer guards in this manner.

A second study was performed in Texas in regard to white-tail deer (Sebesta, 2000). This team found that white-tail deer are willing and able to jump a guard similar in dimensions to the one used by Reed. They found that it took a 5.5 m (18 ft) long guard to prevent jumping. Rather than walk on the rails, the deer in this study preferred to walk between the rails of the guard, using the ground. In an effort to prevent this, a test was performed where the center portion of the guard was raised an additional 0.6 m (2 ft) above ground, with ramp sections at either end. This was effective at preventing white-tailed deer from using the guard. Researchers concluded that this type of guard should be effective for larger ungulates with increased spacing of the rails.

Deer guards have been implemented in Florida to protect the endangered key deer, but their effectiveness could not be determined (Braden et al., 2005). This research was able to show six of the eight total deer observed within the fenced portion after construction used the guards to enter, but no data prior to the construction of the guards was available to use for comparison. A picture of a deer guard used to protect the key deer in Florida can be seen Figure 2.3.

Figure 2.3 Deer Guard in the Florida Keys (Source: *Public Roads, 2004)*

2.2.3 Crossing Structures

If one wishes to reduce the possibility of large animals entering the traveled way with exclusionary fencing, then an alternative crossing point to allow game to get across the right-of-way must be provided. In areas that have been fenced, the number of collisions do go down. Research performed by Ward shows more than a 90% reduction, but the frequency of accidents near the ends of the fence tends to increase as well (Ward, 1982). This is attributed to animals that follow traditional migration patterns being diverted by the fences along the ROW and crossing at the first possible opportunity (Ward, 1982). In response to this problem of maintaining habitat connectivity, wildlife over and underpasses, also called crossing structures, were developed.

In conjunction with fencing, either underpasses or overpasses are often added to allow migrating animals to cross a roadway that has been fenced. Several factors should be taken into account when adding crossing structures to a roadway (Barnum, 2003). The most important factor that must be taken into account is the location of the crossing. It is considered prudent to study the natural migration patterns of the species in question and place structures in locations that conform to the routes preferred by the animals.

The most important factor when building a crossing structure is to place it in habitat that the species in question uses on a regular basis. Working with the Colorado Department of Transportation, Barnum found that even in areas where the habitat is suitable throughout a corridor, there are stretches where large game crossings are far more common than others (Barnum, 2003). Barnum identified three main criteria that can reduce the crossing of a roadway by wildlife. The first is barriers that prevent the crossing of animals. Concrete barriers, guardrails, and steep cuts can prevent game from entering a given section of roadway, but seemed to provide less of an obstruction to game trying to leave the roadway.

The second major factor is the distance to cover. Animals prefer to cross in areas that have forest cover near the roadway. This does not mean that the foliage must extend right to the road to allow for the crossing of game. The research was not able to correlate the likelihood of crossing with any distance of cover less than 90 m (295 ft) from the traveled way.

The final, and often most important factor in crossing structure location, is the presence of "Linear Guideways." The two most common types of Linear Guideways are drainages and ridgelines. Drainages have a larger influence than ridges in crossing patterns, as they tend to be more distinct than their ridge counterparts and typically contain more desirable habitat. These guideways can encourage animals to use a given stretch of roadway for crossing (Barnum, 2003). Using these guidelines can help to find the most practical place to locate a crossing structure.

The design of the structure must also be considered. Generally speaking, the larger the game crossing, the larger the quantity of species and their populations that will use it (Hartmann, 2003). Animals seem to prefer crossing structures with daylight at the far end of the underpass that can be seen from the entrance, and wider structures appear also to have a positive effect. While overpasses seem to be preferred by most species of wildlife, they are far more expensive than underpasses, and it may be more cost-effective to spend the money required to construct a single overpass for multiple underpasses.

A study performed in 2005 compared the costs of building overpasses and underpasses (Sawyer and Rudd, 2005) for use by pronghorn antelope in Wyoming. The authors believed that underpasses were the better value in this situation. The research estimated the cost of an overpass at 3.5 to 5 million dollars, while the cost for an underpass in the same situation was estimated at 1.4 to 2 million dollars. The authors were also concerned with whether or not pronghorn would use an overpass, as this method has not been tested in areas considered to be a within ideal pronghorn habitat. With either underpasses or overpasses, proper site selection was deemed critical for pronghorn usage.

A study was performed for WYDOT to determine the best size for an underpass when mule deer usage is of concern (Gordon and Anderson, 2003). The researchers started with an underpass built for mule deer usage under US 30 between Kemmerer and Cokeville in Nugget Canyon. The underpass is 20 feet wide, 11 feet high, and the tunnel is 60 feet long. Plywood walls were built so the effective dimensions of the underpass could be restricted.

While 76% of the deer would enter the structure with its original dimensions, researchers quickly determined that reducing the width of the underpass below the original width of 20 feet greatly reduced the number of mule deer entering the underpass, to 44% for 15 feet, and 12% for 11 feet The later tests for height acceptance were all performed with a width of 20 feet (Gordon and Anderson, 2003).

Height proved to be less important than width for mule deer acceptance. More deer used the underpass at a height of 8 feet than at a height of 11 feet (85% vs. 76%) (Gordon and Anderson, 2003). The researchers believed this anomaly might be due to the higher number of deer approaching the underpass at the 11-foot height. It was not until the height was reduced to 6 feet that a significant decrease in the percentage of entering mule deer was observed (Gordon and Anderson, 2003).

The final variable studied was the openness factor of the underpass (Gordon and Anderson, 2003). This factor takes in account not only the width and height of the structure, but also the length. The openness factor, as defined by Gordon and Anderson, is:

$$\text{Openness} = [\text{Height (m)} * \text{Width (m)}]/\text{Length (m)}$$

The researchers concluded that the openness factor should be greater than 0.8 m for acceptance by mule deer. When deer are highly motivated to enter the structure, a lesser ratio may be accepted, but the research concluded that the 0.8 m figure was the most desirable (Gordon and Anderson, 2003).

Finally, the cover in and around the structure seems to have an effect on its usage. Vegetation can be used to attract animals to the crossing site and guide them through it. Using natural materials on the bottom of the underpass may make animals feel more comfortable using it (Hartmann, 2003).

2.3 Other Methods to Prevent Crossings

Several other methods have been used to prevent deer from crossing a road, most notably the use of deer whistles and roadside reflectors.

Deer whistles placed on vehicles produce an ultrasonic noise. This sound is intended to draw the attention of deer and prevent them from crossing roads when a whistle-equipped vehicle is present. Much of the evidence supporting the use of whistles is non-scientific in nature and can be called into question (Knapp et al., 2004). This is due to the fact that most of the studies are limited in size, do not factor the variability of deer population, or do not acknowledge that drivers involved in the studies have increased awareness of the crash threat. Some of the studies yield conflicting results about the effectiveness of deer whistles (Knapp, 2004).

A question raised with deer whistles is whether deer are affected by the sounds produced by the whistles. For example, a study was performed in Utah to gauge mule deer response to a truck with and without a deer whistle (Ronin and Dalton, 1992). A total of 300 passes were made on 150 groups of deer, first without a whistle, then with the whistle activated. When completed, 61% of the animals did not respond to the truck without the whistle, while 69% did not respond to the truck with the whistle activated. Therefore, more deer responded to the “quiet” pass than to the “loud” pass (Ronin and Dalton, 1992).

A second common method used to discourage deer from crossing roads is roadside reflectors specifically designed to create a visual barrier for animals at night. Several studies have been performed to test the effectiveness of these devices, including one in Wyoming. This study, performed on a segment of US 30, alternated weeks with the reflectors covered and the reflectors visible (Reeve and Anderson, 1993). At the end of the 2.5 year study, 64 roadkill deer were counted when the reflectors were covered and 126 were counted when they were visible. The researchers concluded that the reflectors had no effect on deer-vehicle collisions. The other studies available generally report similarly negative results, or show a quick deer habituation to the light reflected toward them (Knapp, 2004).

2.4 Warning Signs

One of the most common methods used to mitigate the dangers of AVCs is to place warning signs along stretches of road known to have problems with animal impacts. While no specific studies gauging the effectiveness of the standard static “DEER XING” sign seem to have been performed, it seems to be the general consensus of transportation agencies that the presence of this sign does not lower driver speeds or reduce the number of animals hit by cars (Knapp, 2004).

There have, however, been several studies in the Rocky Mountain region that address the usage of special signs with flashing lights that either work throughout the evening or are activated by the presence of a deer. These measures have met with varying degrees of success.

One of the first attempts to improve driver awareness to deer crossing signs was to improve their visibility with lights and/or animation. A study done in 1971 on Colorado State Highway 82 compared the effectiveness of two different lighted message signs on the average speed of vehicles (Pojar et al., 1972). The first sign contained the message “DEER XING” in neon lettering. The second was an animated picture of a deer jumping with a small auxiliary “DEER XING” sign posted below. The first, written, sign was installed but was turned away from traffic for 16 days. It was then faced to traffic and operated for 28 days. The animated sign was then used for four days. Using magnetic loop detectors, the speeds of passing cars were measured. A small reduction in speed was measured for each of the sign types tested. They also found no habituation to the signs over the small time frame used (Pojar et al., 1972).

A more detailed investigation was performed by Pojar over in 1972 and 1973 using the animated deer sign (Pojar et al., 1975). Vehicle speed was recorded at a distance of 0.15, 0.65 and 1.5 miles past the sign. Data was collected from 6:00 PM to 10:00 PM in dry conditions, and a spotlight survey of deer was performed each night one hour after sunset. The number of nightly crossings was assumed to be twice the number of deer counted that evening. Weeks when the sign was activated were alternated with weeks when the sign was placed away from traffic. From this study the difference between deer-vehicle crashes when the sign was active and not active did not prove to be statistically significant. In fact, during the first year, the ratio of road kill to estimated crossings was higher when the sign was activated (Pojar et al., 1975).

In Wyoming, a study was also performed relating to the effects of deer crossing signs (Gordon et al., 2001). On US Highway 30 in the southwest part of the state, a seven-mile segment of fencing was installed, leaving a 300 foot opening to allow for the annual migration of mule deer. From December of 2000 to May of 2001, a dynamic sensor system was tested in this gap to determine the accuracy and reliability of different types of sensor equipment, the effects of the signing system on vehicle speed, and the corresponding effects of vehicle speed when a deer decoy was included.

Two different sensor types were evaluated during this study. The FLASH infrared beam based system performed well at first but quickly became unreliable. During the study, video footage demonstrated that more than 50% of the detections proved to be false. Birds and various effects of snowfall seemed to lead to many of these false positives. A combination of geophones and infrared scopes always detected the deer and did not give false detections.

Vehicle speeds were studied for each of the following situations (Gordon et al., 2001):

- An average vehicle speed was recorded when the sign was continuously operated. The sign read “Attention: Migratory Deer Crossing.”
- The sign was changed to “Deer on Road When Light are Flashing,” but the lighting was still continuously operated.
- A mounted and stuffed deer was added 10 feet from the traveled way; otherwise, the second situation was unchanged.
- The decoy deer was then left on the highway, but the light was deactivated.

- The second situation was repeated with the deer detection lighting being activated only in the presence of vehicles, giving drivers the impression that the system was working.
- The system was fully active, and vehicle speeds were summarized and compared when the flashing lights were on and there was a deer present.
- The system was fully active and vehicle speeds were summarized and compared when the lights were off and no deer was present.
- The final condition tested driver responses when there was a false activation of the system.

The results of this study are summarized in Table 2.1.

Table 2.1 Results of FLASH Sign Study (Knapp, 2004)

Situation	Flashing Light Operation	Sign Legend	Actual or Decoy Deer Present?	Average Speed Reduction (miles per hour)[1]	Sample Size[2]
1	Continuous	"Attention: Migratory Deer Crossing"	No	1.2	NA
2	Continuous	"Deer on Road When Lights are Flashing"	No	2.3	NA
3	Continuous	"Deer on Road When Lights are Flashing"	Decoy Deer Present	12.3	NA
4	Deactivated	"Deer on Road When Lights are Flashing"	Decoy Deer Present	8.0	NA
5	Remotely Activated	"Deer on Road When Lights are Flashing"	No	4.7	NA
6	FLASH Sensor Activated	"Deer on Road When Lights are Flashing"	Actual Deer Present	3.6	655
7	Not Activated	"Deer on Road When Lights are Flashing"	No	0.7	8,153
8	FLASH Sensor Activated	"Deer on Road When Lights are Flashing"	No	1.4	1,965

[1] Average speed reduction is the average of the differences in measured vehicle speeds inside and outside of the study area. Average speed reduction for Situations 1 to 5 is for passenger cars only. The average speed reduction for Situations 6 to 8 is for all vehicles.
[2] NA = not available or documented.

By far the most effective treatment in this case was the continuous flashing of lights in the presence of a stuffed decoy deer, yielding an average speed reduction of 12.3 miles per hour. The similar case with the decoy deer but without the flashing light yielded a speed reduction of 8.0 mph, suggesting that the lights are responsible for a 4 mph speed reduction. Changing the message on the sign from “Attention: Migratory Deer Crossing” to “Deer on Road When Lights are Flashing” also seems to have a slight positive effect (Gordon et al., 2001).

While researchers are able to statistically prove that the system produces a drop in speeds, they do not believe the reductions are high enough to reduce the AVC and did not find a reduction in the number of carcasses while using this system (Gordon et al., 2001).

2.5 Roadway Changes

This section describes four strategies that involve changes to the right-of-way (ROW) or geometrics of a given section of highway. The first involves making animals more visible to the driver. Measures that have been investigated include the use of lighting, as well as increasing the amount of clear space adjacent to the roadway, to make animals visible before they enter the traveled way. The second strives to make the ROW less attractive to animals. The hope is that wildlife will avoid the area altogether. Strategies pursued in this area include planting species of plants deemed unappetizing to game and eliminating vegetation and other types of features that can attract animals. Third, studies have determined the effect of changes in posted speed limits on the number of animals that are hit. Finally, this section will discuss the effects that geometric changes have on AVCs.

2.5.1 Roadway Lighting

One option that may seem obvious, but has not been extensively studied, is the use of roadway lighting. As the majority of AVCs occur during either twilight or evening hours, the use of roadway lighting could help to make animals more visible, and to reduce the number of collisions. One roadway lighting study performed in Colorado near Glenwood Springs on State Highway 82 was completed in 1977 (Knapp, 2004). Three objectives were investigated during the course of the project. The first was to find out whether roadway lighting would reduce the number of AVCs within the project area. Another objective was to see if roadway lighting had any effect on the number of deer that attempted to cross the highway. The last objective was to see if the lights had any effect on average vehicle speed. To accomplish this, nine lights were placed along a 0.3 mile roadway segment, and two additional lights were placed 0.2 miles from both ends of the main segment to act as transition lighting (Reed, 1981).

During the four years studied, there were 2,611 deer crossings with the lights on and 2,480 crossings with the lights turned off. While there were more crossings with the lights on, there were fewer deer collisions with the lights on (39 vs. 45). This resulted in an 18% reduction of AVCs with the lights on. Reed, however, did not believe the reduction in crashes was significant due to the random nature of animal crossings. The average speed that cars traveled varied between 49.1 and 49.5 mph, varying as much by direction as by whether the lights were on or off. Considering that lighting rural sections of highway can be very expensive, Reed did not recommend that lighting be used as an AVC countermeasure, except possibly in extremely localized areas (Reed, 1981).

2.5.2 Vegetation and Plant Removal

Only a few studies directly relate to the effects of vegetation removal on the number of AVCs. The most prominent study in vegetation removal was performed in Sweden by Jaren. The study related the clearing of vegetation to the number of moose that were hit by passing trains (Jaren et al., 1991). In Sweden, the type of vegetation that moose prefer tends to grow in open areas adjacent to forests. As a result of railroad construction, the area surrounding the ROW that was cleared quickly becomes populated with the types of vegetation that attract moose. Jaren wished to know what the effect of clearing this brush has on the number of moose that are hit by trains.

To find the effect of vegetation clearing, a 60.8 km (37.8 mi) section that is known to have a high rate of moose-train crashes was identified. Twenty-two km (13.7 mi) of this area were selected for treatment, leaving the rest as a control section. Within the treatment areas, the vegetation within 20 m (66 ft) of either side of the track was removed. Low branches were also removed from adjacent trees for an additional 10 m (33 ft). In areas with limited sight distance, the plant removal was extended up to 60 m (200 ft) from the track. These treatments were performed during 1984. In 1986, the cleared areas were sprayed with herbicide to prevent regrowth (Jaren et al., 1991).

During the project, 183 moose were killed within the study area. In the control sections, the first four-year period crashes varied from four to 23, while in the treatment area the crashes ranged from four to 37. In the second four-year period, the ranges were four to 10 and zero to 16 respectively. The author stated that vegetation removal related to a 56% reduction in crashes in the treated section, with an uncertainty of 16%. This makes the effect of removing vegetation somewhere between a 40% to 72% reduction in moose-train crashes (Jaren et al., 1991).

The ultimate goal of this project was to predict the cost-benefit ratio of removing the food sources for moose from the track area and to find the point where removal of plants would be economically justified. Jaren found that if more than 0.28 moose are killed per kilometer per year, vegetation removal is justified (Jaren et al., 1991).

While this project is not directly applicable to the conditions found in Wyoming, this cost-benefit methodology could be used to test any number of treatment options, provided that suitable study locations could be determined.

2.5.3 Speed Limits

It appears there is a relationship between the number of animals hit on a particular segment of road and the speed limit of the section. Two studies have been found that attempt to quantify this relationship. One study performed in Yellowstone National Park compared the different speed limits as a group to show how the different speed limits affected AVCs (Gunther et al., 1998). The second, in Jasper National Park, Alberta, was a before and after study to determine how changing the speed limit impacts the frequency with which both big horn sheep and elk are struck by automobiles (Bertwistle, 1999).

The Yellowstone study was performed with data from 1989 to 1996, recording the numbers and locations of roadkill found in the park’s road system. The data were then sorted by the speed limit at the particular locations. When compared to the total percentage of mileage for a given speed limit, conclusions could be drawn as to the dangers associated with that speed limit (Gunther et al., 1998). Table 2.2 summarizes the effects the different speed limits seem to have on AVCs.

Table 2.2 Speed Limit Effects on Roadkill

Speed Limit (mph)	Miles of Roadway	Percent of Total Roadway Mileage	Number of Roadkills	Percent of Total Roadkills
15	1.1	0.4	3	0.3
25	18.6	7.0	42	4.5
35	24.9	9.3	59	6.3
40	24.5	9.2	35	3.7
45	178.3	66.6	418	44.5
55	20.2	7.5	382	40.7
Total	267.2	100.0	939	100.0

Source: "Speed Limit Reduction," 2006

As can be seen from Table 2.2, the sections posted at 55 mph contain 40.7% percent of the total roadkill, yet make up only 7.5% of the total mileage within the park. While this is a striking figure, traffic volumes were not taken into account, possibly invalidating the conclusion that high posted speeds result in more AVCs (Guther et al., 1998).

Speed data was also collected to compare the posted speed on a given segment to the average running speed. It was found that the running speed for 55 mph segments average between nine and 16 mph higher than the posted limits. The running speed for segments that have a speed limit of either 35 or 45 mph was only one to three mph more than the posted limit (Gunther et al., 1998).

The second study, performed by Bertwistle in 1999, was a before and after study attempting to relate a reduction in speed limits on three segments of highway to the number of reported crashes involving elk and big horn sheep. The speed limit prior to the change was 90 kmph (55 mph) and the limit following the change was 70 kmph (42 mph). The three roadway segments had similar geometric characteristics and traffic volumes (Bertwistle, 1999).

The changes in animal populations in this area were also taken into account. From 1983 to 1998, the elk population was believed to have increased by 132%. The big horn sheep population was generally believed to be stable (Bertwistle, 1999).

The results of the statistical analyses of the relationships between crashes and speeds for two different species are conflicting. The conclusion regarding elk-vehicle collisions is that while the frequency of crashes increases slightly, the reduction in speed limit results in a lower frequency of elk-vehicle crashes, taking the elk population increases into account (Bertwistle, 1999).

The statistical analysis of big horn sheep crash records actually conclude that the decrease in speed limits causes more sheep to be hit. The author believes this is due to the sheep becoming habituated to the lower speeds on the road and, consequently, spending more time in the roadside environment (Bertwistle, 1999).

2.5.4 Geometric Design

Geometric features such as the area cleared of vegetation, stopping sight distance, traveled way width, shoulder width, measured speed, clear zone size, and roadway signage may all play a role in how many animals are struck (Knapp et al., 2004). Gunther states that the speed most drivers travel within Yellowstone National Park is dictated more by the design of the road rather than posted speed limits (Gunther et al., 1998). The author also believes that a road design with narrower lanes and more curvilinear design could reduce AVCs.

Some sources have also attempted to relate the number of AVCs to the widening of a highway from a two-lane road to one with a divided median. These studies have produced varied results. A study published in 1976 found that within ten high deer crash counties in Michigan, there were almost three times as many accidents on two-lane paved roads as on divided highways (Allen and McCullough, 1976). There was no attempt to account for the differences in total quantities of the two kinds of roads or for traffic volumes.

An earlier Michigan study looked at the number of deer crashes following the completion of I-75 in Mackinac County (Reilly and Green, 1974). The interstate highway was completed in 1963, roughly adjacent to the existing two-lane road, US 2. While locations on highways within the region were not noted, the region experienced a quadrupling (from 10 crashes to 40) of deer crashes in the year following completion of the interstate. Traffic and deer populations remained constant through this period. One note is that deer crashes returned to the original baseline within five years of the completion of the interstate.

Beyond this, very little hard data relating geometric design parameters and AVCs were located. Knapp identifies this as an area of study that needs further investigation, but is concerned that much of the information could be site-specific (Knapp et al., 2006).

2.6 Under-Reporting of AVCs

One problem that must be acknowledged is that many vehicle collisions with wild animals go unreported. This may be due the fact that if there are no injuries to the occupants, or little vehicle damage, the driver may not want to face any possible legal or insurance ramifications of the collision. Marcoux, of Michigan State University, performed a mail survey asking whether the respondent was involved in an AVC, and whether it was reported to either the police or the driver’s insurance company (Marcoux et al., 2005). The survey found that 53.7% of respondents who had a collision with an animal did not report it to the police. More than 70% of these people felt it was not necessary to report the crash. Of those who responded, 47.9% also did not report the crash to their insurance companies.

A phone survey performed in 1990 in New York indicated that half of all animal-vehicle collisions were not reported to the police, and less than half all of crashes were reported to the insurance company (Curtis et al., Hedland et al., 1990).

This under-reporting issue has the potential to greatly underestimate the benefits of measures taken to reduce AVCs.

3. DATA COLLECTION

This chapter describes three key parts of this research effort. The first section is a general description of data used in this project, including crash records, volume data, wildlife population estimates, and several aspects of vehicle speed. The second section describes the methodology used to quantify animal-vehicle collisions (AVCs) statewide, the identification of areas with high frequencies and/or rates of AVCs, and the selection of reconstruction projects in these areas for further study. The third section discusses underreporting of animal-vehicle collisions in Wyoming by comparing the reported crashes with the animal vehicle carcasses reported by maintenance personnel.

3.1 Data Description

This research effort utilizes several datasets, including those containing crash information, vehicle speeds and volumes, and wildlife populations. The following sections provide information about the various datasets that were used.

3.1.1 Crash Records

The crash record dataset provided by WYDOT include all crashes reported in the State of Wyoming from 1995 through 2005. Prior to 1995, crash records were stored in a separate, incompatible database and were not available for this research effort. The crash dataset contain crashes on all roadways in the state, regardless of the responsible agency, except for some federally managed roads, such as those within the National Parks.

Two different versions of this database are used in this study. For the initial selection of candidate projects, a subset of the crash records containing only the incidents related to wild animals are used. This dataset consists of 16,328 records from 1995 to 2005. The full crash record is utilized for sites that were selected for more detailed investigation. The full crash record for the state consists of 173,241 records from 1995 to 2005. To more easily manage a database of this size, the data are divided into separate files for each project, and only those crashes on the roadways in question are retained. The project crash records can be found in Appendix B.

The WYDOT crash record database contains many different attributes for each crash. The most pertinent entries for this research effort are the route, milepost, date, year, and the first harmful event. The first harmful event column lists the first impact that the vehicle made. If a particular animal is associated with this crash, the species is listed as the first harmful event. For this research effort, crashes involving domestic animals such as horses or cattle are not included. In addition to the fields most important to this research effort, other important characteristics such as injuries and fatalities, road surface conditions, and the weather are also included within this database.

3.1.2 Volume Data

To account for differences in traffic flow within each study site, volume data are compiled for each section. WYDOT maintains a database of volumes by route and milepost. Included within this database are starting and ending mileposts, section length, Average Daily Traffic (ADT), and vehicle miles traveled (VMT) figures for the years 1993 to 2003. Numbers for 2004 can also be obtained from a printed version of this database. Figures for 2005 have not yet been released.

In some cases, more than one section of volume data is applicable to the sections that were selected for further study. In those cases, all available volume figures are used in analysis of the section. Further explanation of traffic patterns in each of the study sections can be found in Chapter 4. The traffic volumes for each of the sections can also be seen in Appendix C.

3.1.3 Wildlife Data

The Wyoming Game and Fish Department maintains a database of the populations of all managed game herds within the state of Wyoming. Species of concern include mule deer, white-tailed deer, pronghorn antelope, elk, and moose. These are also the species that are of the greatest concern in regard to AVCs. Each species has been broken down into specific herd units for management by Game and Fish, often delineated by watersheds or roadways. Population estimates are made yearly for each herd unit, primarily to determine the number of hunting licenses needed to maintain populations within each herd unit near stated population objectives.

Population estimates for the herd unit(s) in the vicinity of the study sections were obtained from Wyoming Game and Fish. The township and ranges of particular roadway sections were needed for Game and Fish officials to match up the herd units to a particular roadway section. The data for each herd include a year, herd code, herd unit name, population estimate, and population objective. Data were obtained for the years 1990 to 2005 for all applicable herd units. A sample of the information obtained from Game and Fish can be seen in Table 3.1. The remainder of the wildlife data can be viewed in Appendix D.

Table 3.1 Mule Deer Populations for the Centennial East Section

			Population	
Year	**Herd Code**	**Mule Deer Herd Unit**	**Pop. Est.**	**Pop. Obj.**
2005	539	Sheep Mtn.	11,000	15,000
2004	539	Sheep Mtn.	9,987	15,000
2003	539	Sheep Mtn.	10,885	15,000
2002	539	Sheep Mtn.	11,081	15,000
2001	539	Sheep Mtn.	13,512	15,000
2000	539	Sheep Mtn.	13,942	15,000
1999	539	Sheep Mtn.	13,536	15,000
1998	539	Sheep Mtn.	15,754	15,000
1997	539	Sheep Mtn.	13,518	15,000
1996	539	Sheep Mtn.	14,635	15,000
1995	539	Sheep Mtn.	11,591	15,000
1994	539	Sheep Mtn.	11,246	15,000
1993	539	Sheep Mtn.	11,360	15,000
1992	539	Sheep Mtn.	16,568	15,000
1991	539	Sheep Mtn.	15,102	15,000
1990	539	Sheep Mtn.	12,788	15,000

3.1.4 Vehicle Speed Data

Two different types of vehicle speed data were needed for this research effort. These are speeds before the construction and those after the construction. If the before speed data were not available, they had to be estimated. The following sections describe each of these datasets.

3.2 After Speeds

To collect after speeds, Jamar Trax RD pneumatic tube traffic counters were placed at areas determined to be of interest for a minimum of 48 hours. These counters, using two tubes placed at an 8-foot spacing, calculate the speed of a vehicle using the time it takes for one axle of a vehicle to travel the distance between the two tubes. The speeds of all vehicles crossing the tubes are compiled, and a speed profile is established. For this study, the 85^{th} percentile speed was determined. This is the speed that 85% of the drivers are traveling at or below. The counters also provide minimum, maximum, mean, and median speeds.

The traffic counters are powered by batteries and solar panels. In some cases during this research, the solar panels did not adequately recharge the batteries, so a full 48 hours of data were not obtained. The speed summaries of each counter can be seen in Appendix E.

3.3 Before Speeds

WYDOT does not often perform speed studies in rural areas. Consequently, little before speed data are available for this effort. WYDOT speed studies were obtained for two of the areas selected for further study. Each of the two studies obtained contains several measures of vehicle speed in the area. These include the 85^{th} percentile speeds, 50^{th} percentile speeds, and mean vehicle speeds for several locations within the projects. Appendix F contains the speed reports obtained from WYDOT.

In cases where prior speed studies are not available, the before speeds had to be estimated based on the geometric conditions of the roadway. The methodology for estimating changes in speeds is based on the 2000 *Highway Capacity Manual* and the software HCS+ by McTrans. Utilizing the two-lane highway capacity methodology, an average travel speed can be estimated based on variables such as traffic volume and classification, lane and shoulder width, as well as general terrain characteristics. The previous road layout can then be compared with the reconstructed layout and the differences in before and after speeds can be estimated. Vehicle speed datasets for individual sections are discussed in Chapter 4. Appendix G contains the HCS+ reports for the estimated speeds.

3.4 Design Speeds

One design element chosen for analysis was the design speed of each section. While the design speeds for the reconstructed sections could be taken from the plans themselves, the age of the previous road designs meant that a contemporary design speed had to be ascertained.

The primary factor for selecting a design speed for a given section was to locate the smallest radius curve and assume that it had a superelevation (e) of 8%, the highest typically used in

Wyoming. From there, a current design speed for the curve can be determined using the AASHTO "Green Book." Additional curves are used to confirm this speed.

As a check, vertical curvature was also examined by calculating several curves' "k" value. The "k" value is a function of the length of a vertical curve and the change in grade of the curve during this length. The higher the "k" value, the higher speed that the roadway can accommodate.

3.5 Project Selection

To relate changes in road reconstruction to the number of AVCs, it is necessary to locate areas of Wyoming that have high frequencies or rates of crashes of this type. Within these high AVC areas, roadway sections that have had recent reconstruction can be selected for detailed study. The following section describes the process undertaken to select areas and roadway sections for further study.

3.5.1 Use of ArcGIS for Crash Analysis

ArcGIS is a powerful piece of computer software that can relate spatial data over large regions. A "Shapefile," a dataset that includes both pertinent information about an entity and its location in space, can be used to model an entire road system. A shapefile of the Wyoming State Highway System was provided by WYDOT for this effort. A view of this shapefile can be seen in Figure 3.1, overlaid on top of a shapefile containing the counties of Wyoming.

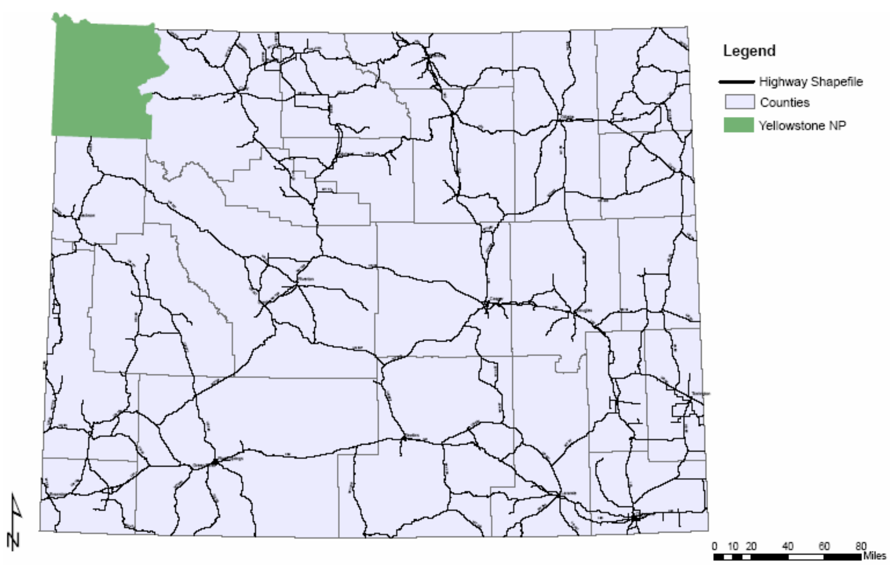

Figure 3.1 Wyoming Highway System Shapefile

ArcGIS also provides a way to locate specific events along a linear shapefile such as a road system. This is known as a Linear Referencing System (LRS). Provided that both the highway shapefile and the data to be added contain milepost references and matching names for each of the roads, a LRS can locate crashes in their precise locations on a road.

An Excel spreadsheet of all AVCs from 1995 to 2003 as well as their location was also provided by WYDOT to link with the highway dataset. The crash database was not GIS compatible as initially received and had to be manipulated to be displayed within GIS.

The third piece of data necessary for this research is a measure of the amount of traffic along each stretch of road, so that crash rates can also be calculated. As with the crash data, this information was provided in the form of an Excel spreadsheet. The primary use of this dataset is to find the Average Vehicle Miles Traveled (AVMT) for each section of the Wyoming highway system. As the data for specific years was not needed for a general analysis of the system, the yearly AVMT numbers for each road section are averaged for the nine-year period:

$$AverageAVMT = \frac{\sum AVMT(1995-2003)}{9}$$

This data is then combined with the WYDOT base map using the LRS to obtain a spatial representation of the traffic data.

Matching the crash data to the road map is a more difficult and laborious task than linking the traffic data to the highway base data. This is largely because the naming conventions used in the two datasets is slightly different, preventing ArcGIS from being able to match a crash to its location.

There is a small difference between the most applicable route naming field on the crash data when compared with the map provided by WYDOT. Within the accident file, the field that is best suited for use with the LRS is the “FEDERAL” number. This field lists the letter, such as P for Primary, representing the function of the road followed by its route number (P20, S0710, I25). The corresponding field within the highway database is “ROUTE”; however, this column does not contain the initial letter given in the “FEDERAL” field of the accident records (20, 710, 25). This small difference is enough to prevent ArcGIS from matching the vast majority of crashes with their locations. While an automatic method of changing the map field could be developed, there are too many further small discrepancies to make this practical. One good example of this is the crashes that should have been assigned to US Highway 85. The route in the map file is correctly identified as “85,” but all the crash records had the route listed as “25.” This is especially confusing, as I-25 also traverses the state. Other problems areas that are difficult to identify and fix involve locations where several different highway designations are associated with the same roadway.

After the accident record was changed so that ArcGIS is able to determine the location of the record on the map, a count of AVCs for each traffic roadway section is created in ArcGIS. This is a technique known as “Spatially Joining.” In this process, ArcGIS locates and counts all crashes along a given section of road and creates an additional field within the database for this information. The first iteration of the matching is where problems arose. The crashes were matched to the base WYDOT map without VMT records, and when the crashes were matched to the combined VMT and highway data, ArcGIS refused to recognize that the crashes were on the roadway. This created a need to combine the highway shapefile and the traffic data prior to adding the AVC records to the system. A second iteration was then performed by combining the VMT data with the highway base map prior to matching the crashes. Only then could rates be determined for each VMT section.

3.5.2 Crash Frequency Calculations

One of two common methods of assessing AVC risks on a statewide basis is to determine the frequency, or crashes per mile, of animal-related incidents for each of the roads on the state highway system over the nine years of data used for this analysis.

To create an accurate representation of the AVC frequencies along the road system, a practical method of dividing the roads into sections must be developed. Since the risks associated with AVCs can vary greatly over the course of only a few miles, the highway system is divided along the VMT sections that have already been assigned by WYDOT.

Two ways of representing crash frequency data are available using the data provided by WYDOT. The first is to calculate frequencies by the total mileage of the section. The second is to utilize the total number of lane-miles in the section. Lane-miles are the total mileage of each through lane in a given section of road, rather than centerline length of the section. On a one-mile section of road, a two-lane roadway would contain two lane-miles, and a four-lane roadway would contain four lane-miles. Using lane miles for the basis of frequency causes interstate highways and other four-lane roads to be treated more like two separate, two-lane roads. Given the limited number of four-lane highways in the state of Wyoming, finding the frequency in terms of lane-miles seems to provide a better representation of problem areas when selecting potential project locations.

A map showing the state of Wyoming lane-mile AVC frequency broken down by VMT section can be seen in Figure 3.2. Several locations throughout the state show a propensity for AVCs. The areas surrounding Jackson and Pinedale in the western region of the state have many highway sections that show a high frequency of AVCs. Likewise, the Sheridan region in the northern part of Wyoming has high frequencies of wildlife crashes. Other regions throughout the state that have higher than average animal crash frequencies include the areas surrounding Casper, Worland, and the road between Lander and Riverton.

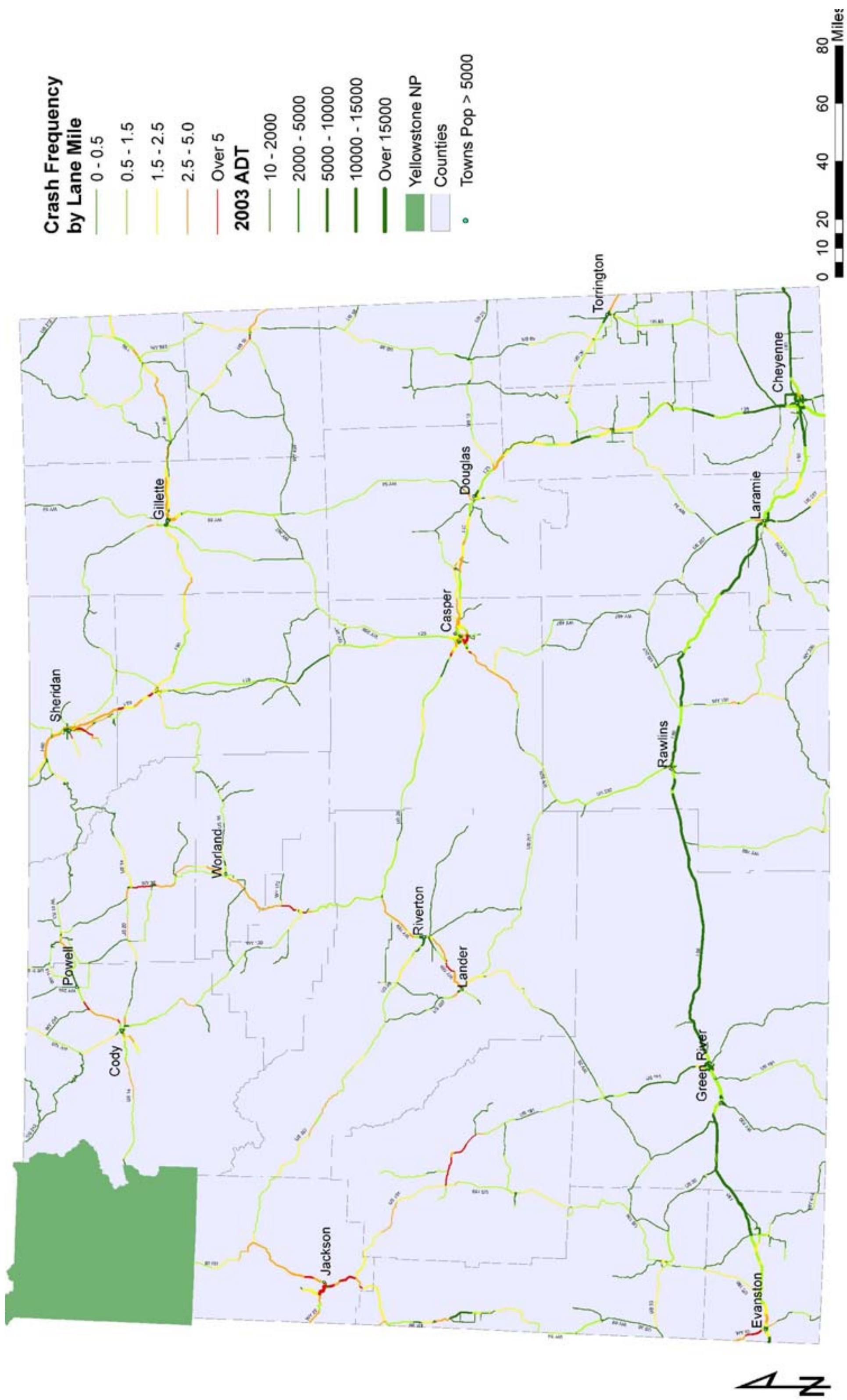

Figure 3.2 Wyoming Reported AVC Frequency by Lane Mile

3.5.3 Crash Rate Calculations

Crash rates are based on traffic volumes, rather than the number of lane-miles in the given section of road. Crash rates account for the exposure of an animal to crashes by using average AVMT as the exposure variable. Some roadways may have hazardous conditions but low crash frequencies because few people travel the roadway. Looking at the crash rates accounts for higher crash frequencies through time, due solely to increased traffic on the roadway. Typically, looking at both crash frequencies and crash rates provides a more complete picture of how hazardous the roadway is.

The accident rates for each section of road cannot be determined until the AVC records and traffic volume data are joined with the shapefile containing the spatial data of the Wyoming highway system. Once this task is completed, finding the rates for each section is a simple task. Using the average AVMT calculated in section 3.2.1, the following equation is used to determine the rate of AVCs in terms of million VMT.

$$\frac{AccidentCount}{Aver.AVMT * 365 * 9} * 1{,}000{,}000$$

The use of VMT sections for the basis of both crash rates and frequencies allow for each section of road to be compared on a one-to-one basis for both criteria. Figure 3.3 shows the resulting AVC rates for each roadway in the Wyoming state highway system. As a crash rates analysis considers crash history by using the total vehicle miles traveled in a section, rather than just the section length, this analysis identifies many parts of the state traveled less frequently. As with the frequency analysis, the rate analysis singled out the areas near Pinedale and Sheridan as high AVC locations. Problem areas not identified through frequency analysis, but included within the rate analysis, include the areas surrounding Wheatland in the southeast part of the state, Kemmerer in the southwest part of the state, and large portions of northeastern Wyoming.

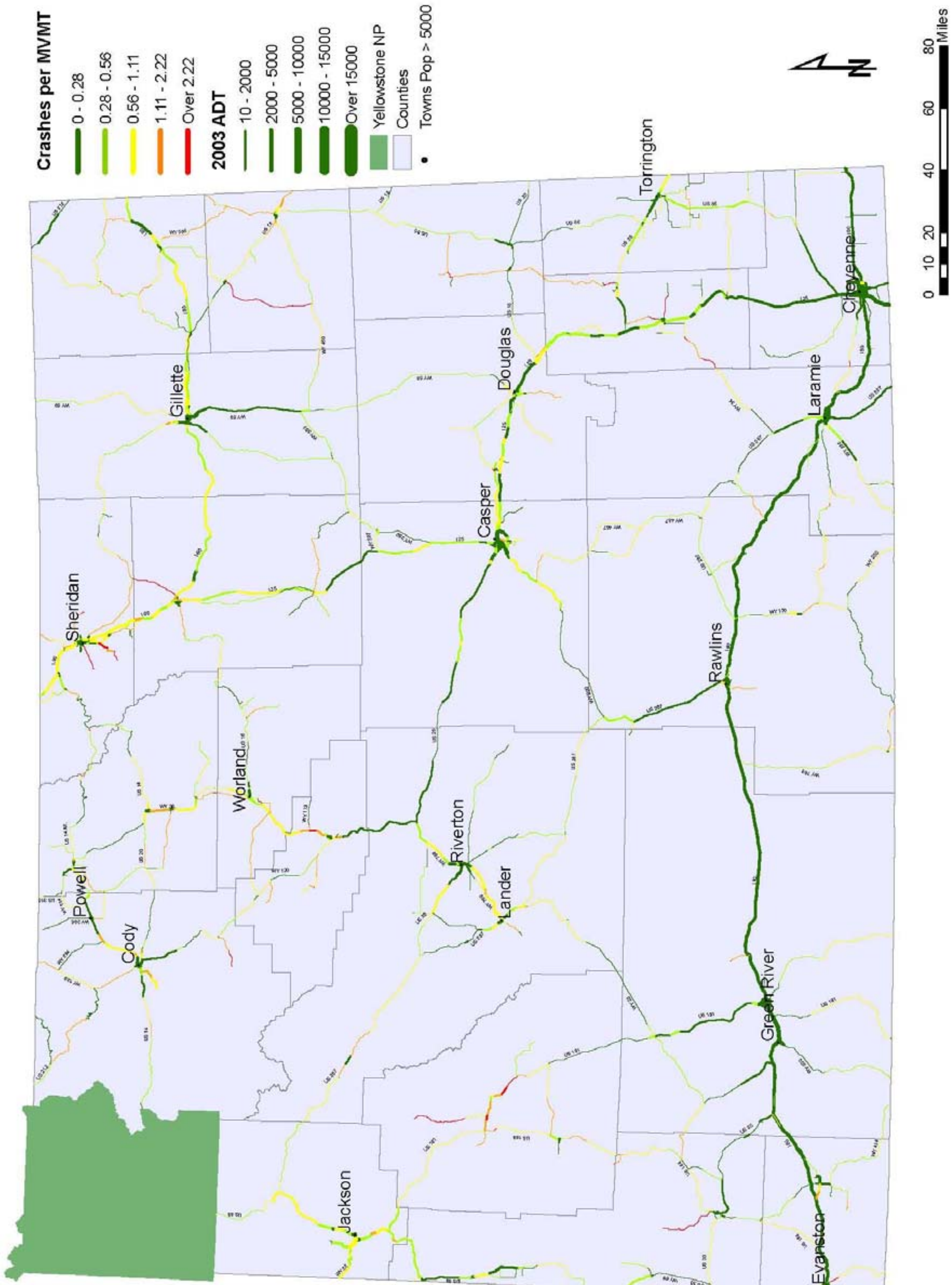

Figure 3.3 Wyoming Reported AVC Rate

3.6 Candidate Site Selection

Once the areas across the state having the highest likelihood of an AVC are visually represented, the next step is to find recent road reconstruction projects that are located in these areas. To do this, the State Transportation Improvement Programs (STIPs) from the years 1997-2002 were examined to find projects that were planned for construction in high AVC areas. Each record of a WYDOT construction project was studied, eliminating those which did not include reconstruction elements. A table of 36 candidate projects was created on the basis of projects that occurred in locations with either high AVC crash frequencies or rates. Any reconstruction project with a frequency of more than 1.5 animal-vehicle crashes per lane mile over the nine-year study period, or an animal-vehicle crash rate greater than 0.6 crashes per million vehicle miles traveled (MVMT) became a potential study candidate. The projects meeting this criteria can be seen in Table 3.2. A map containing the 36 separate locations can be seen in Figure 3.4. Potential study candidates were distributed throughout the state. With the exception of two projects, a four-lane road between Torrington and Lingle and a game underpass between Cokeville and Kemmerer, all projects involved construction work on two-lane highways on the Wyoming state highway system.

The findings of this assignment were then presented to Matt Carlson, state safety engineer for WYDOT, who returned a shortened list of seven projects that he felt would be worthy of further study. The seven projects are spatially distributed throughout Wyoming and contain at least three miles of reconstruction.

Table 3.2 Potential Study Locations by Frequency or Rate

Map Ref	Highway Number	Location	Begin Ref Marker (N	Length (Mi)	Character of Work	Rate	Frequency
1	WY 34	Bosler-Wheatland	28	8.4	Reconstruction	2.34	1.9
2	WY 130	Snowy Range-Centennial East	21.4	6.35	Reconstruction	2.39	1.4
3	US 14/16/20	Yellowstone-Cody Hanging Rock	19.5	8	Reconstruction	1.52	1.1
4	WY 585	FourCorners-Sundance Sundance South Section	18.52	8.57	Reconstruction/3R	1.20	0.6
5	US 189	Kremmerer-Labarge Round Mountain Section	46	7	Reconstruction	0.66	0.6
6	WY 585	FourCorners-Sundance County Line North Section	9.68	8.84	Reconstructon/3R	1.72	0.7
7	WY 24	Hulett-Aladin East Forrest Boundary Section	31	4.5	Reconstruction	1.21	1.2
8	WY 450	Newcastle-Reno junction Skull Creek Section	13	8.08	Reconstruction/3R	0.89	0.32
9	WY 130	Snowy Range Road Karstoft Section	62.6	5.5	Reconstruction	0.94	0.7
10	US 14/16	Sheridan-Gilette Clearmont North Section	38.6	7.3	Reconstruction	0.70	0.42
11	WY 192	Kaycee-Sussex 15 Mile Draw section	4.8	4.8	Resurface/Minor Wide ChipSeal	1.42	0.23
12	WY 450	Newcastle-Reno junction Mush Creek section	8	8.16	Reconstruction/3R	0.89	0.3
13	WY 93	Orpha Road Douglas Northwest	0.11	8.51	Reconstruction	0.70	0.4
14	WY 34	Bosler-Wheatland morton Pass section	9.69	7.21	Reconstruction	0.80	0.7
15	US 189	Kremmerer-Labarge Kremmerer North Section	38.12	3.6	Reconstruction	0.91	1.1
16	WY 335	Big horn Rd	0	4.2	Reconstruction	4.97	9.1
17	WY 172	Thermopolis-Worland County Line north Section	146.53	10.11	Widen/Lev/Ovly/Grading/Chip SL	1.01	2.75
18	WY 1176	Upton South Soda Butte Section	8	5.5	Widen/Mill/Overlay/Ext Culver/3R	2.22	0.3
19	WY 270	Manville-Lance Creek Manville North Section	99.77	5.03	Reconstruction	1.66	0.2
20	US 30	Sage Junction-Kremmerer Game Underpass	30.05	5.15	Game Underpass	0.84	2.4
21	US 14	Sheridan-Ucross Jim Creek Hill Section	14.29	6.04	Reconstrction	1.44	1.1
22	US 14A	Cody-Powell Shoshone River Section	5.49	1.99	Reconstruction	0.69	4.8
23	WY 170	Hamilton Dome Road Section 1	0.13	5.97	Reconstruction/3R	1.34	0.31
24	WY 24	Hulett-Aladin Aladdin Section	35.19	5.31	Winden and Overlay/4R	1.21	1.2
25	WY 789	Lander-Hundson	81.2	9.81	widen and Overlay/Guardrail	1.54	14.1
26	WY 316	Wheatland East Antelope Gap road	1.64	10.27	Widen/Overlay/Iso-Reconstruction/Str	2.43	0.4
27	WY 51	Gilette-Moorcroft Coal Mine relocation	130	2.5	New Construction	0.71	2.4
28	US 14	Greybull-Burgess Jct Greybull East	1.2	6.6	Reconstruction	0.99	1.9
29	WY 120	Cody-Montana Line	133	4.53	Widen/Overlay/Iso-Reconst	1.76	1.6
30	US 89	Alpine Jct-Hoback Jct Elbow Creek Section	127	4.97	Reconstruction	0.34	1.75
31	US 89	Alpine Jct-Hoback Jct Alpine section	118.3	2.6	Reconstruction	0.34	1.75
32	US 89	Alpine Jct-Hoback Jct Astoria Section	136.94	3.72	Reconstruction	1.14	6
33	US 89	Alpine Jct-Hoback Jct Wolf Creek Section	120.9	6.1	Reconstruction	0.34	1.75
34	US 89	Alpine Jct-Hoback Jct Cabin Creek Section	131.97	4.97	Reconstruction	0.49	2.5
		Special Cases					
35	US 30	Sage Junction-Kremmerer Game Underpass	30.05	5.15	Game Underpass	0.84	2.4
36	US 26	Torrington-Lingle (4 lane section)	95.01	8.4	Reconstruction	0.48	1.6

Following are short descriptions of the seven projects selected for further study. The number in parenthesis is the original project number from the full list of 36 candidate projects in Table 3-2.

- WY 130 Centennial East Section (2) – between Centennial and Laramie from milepost 21.32 to 27.431. Reconstruction was started in November of 1996.
- US 14/16/20 Hanging Rock Section (3) – between Yellowstone National Park and Cody from milepost 19.4 to 27.6. Reconstruction was started in June of 1998.
- US 189 Round Mountain Section (5) – between Kemmerer and LaBarge from milepost 45.78 to 59.02. Reconstruction was started in April of 1999.
- US 14/16 Clearmont North Section (10) – between Sheridan and Gillette from milepost 38.61 to 45.96. Reconstruction was started in November of 1999.
- WY 34 Morton Pass Section (14) – between Bosler Junction and Wheatland from milepost 9.69 to 16.53. Reconstruction was started in March of 2001.
- US 89 Astoria Section (32) – between Alpine Junction and Jackson from milepost 136.65 to 140.69. Reconstruction was started in March of 2000.
- US 26/85 Torrington West Section (36) – between Torrington and Lingle from milepost 94.60 to 102.93. Construction was started in October of 1997.

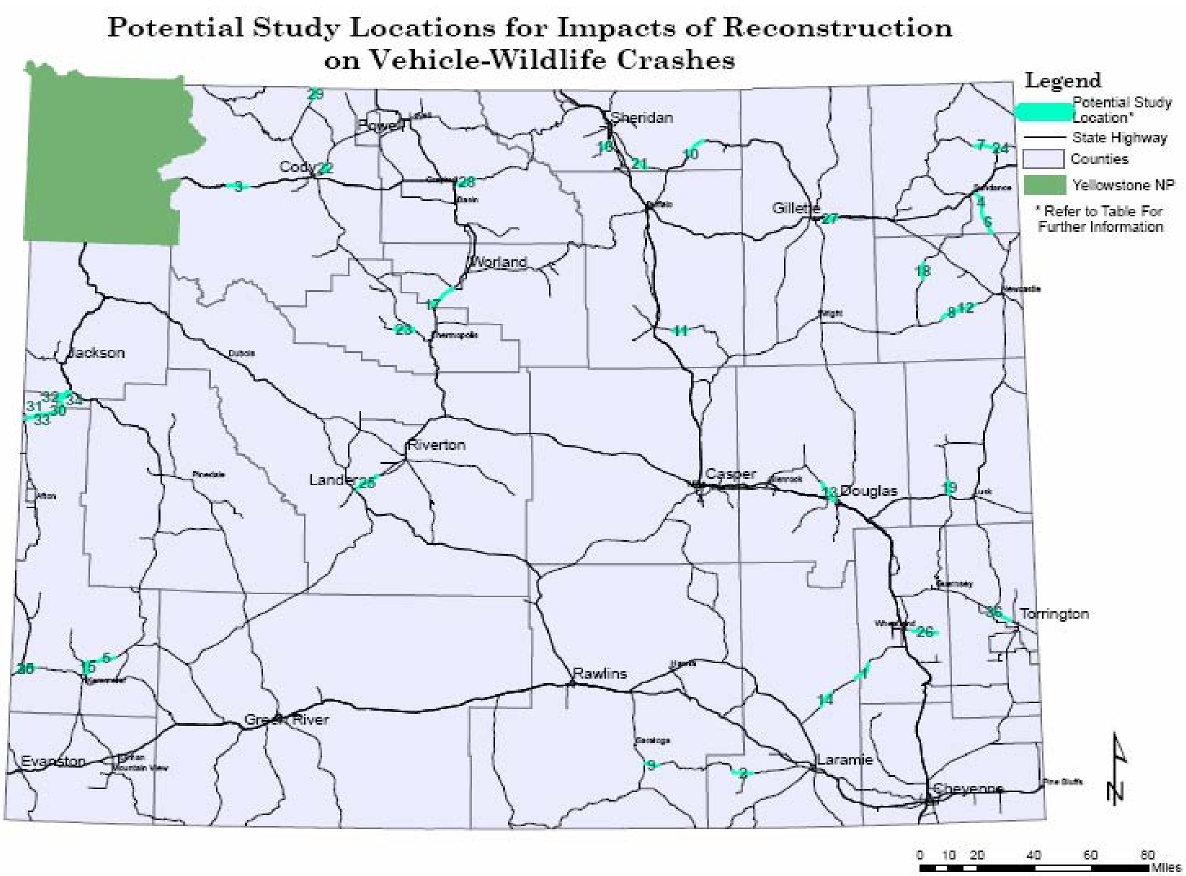

Figure 3.4 Potential Study Locations

Reconstruction plans for the seven selected projects were then obtained from the WYDOT archives, so that the changes to each of the roadways could be ascertained. Chapter 4 describes these projects in detail. Figure 3.5 is a map showing the projects selected for in-depth study.

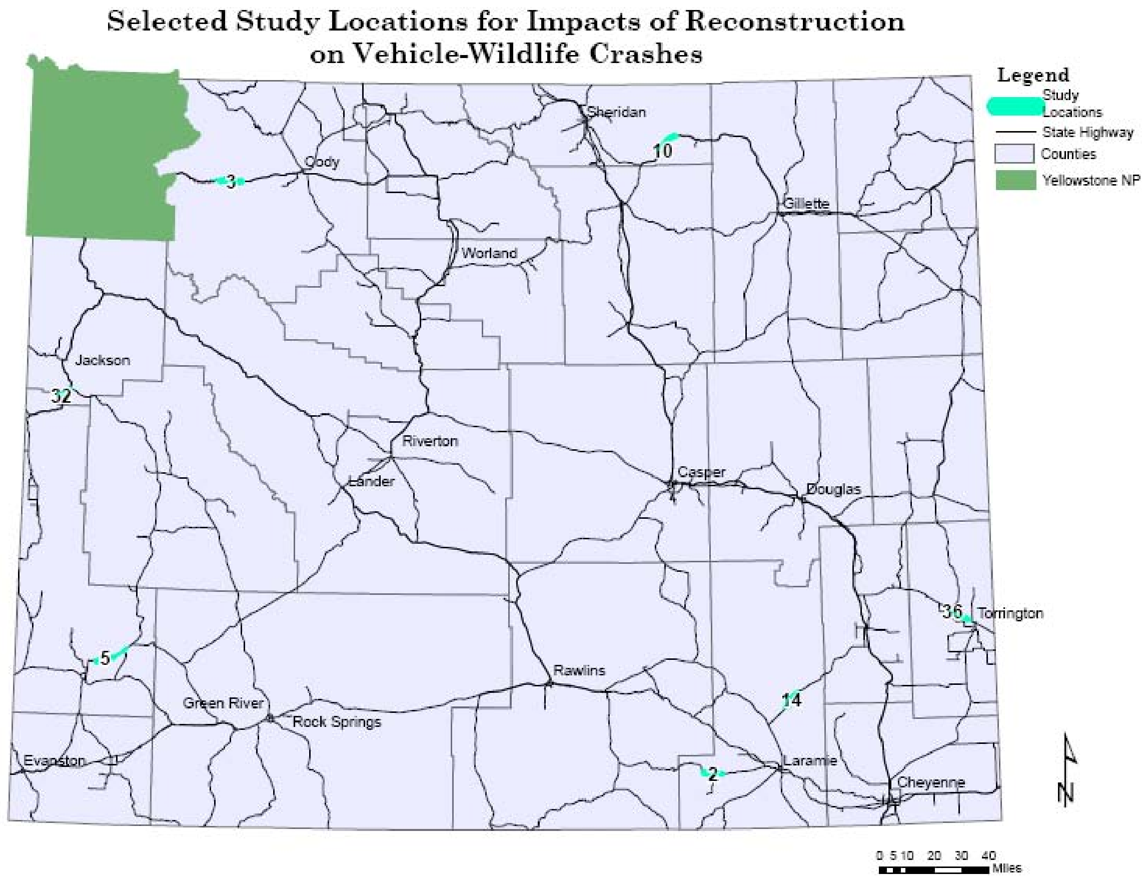

Figure 3.5 Selected Projects

3.7 Wildlife-Vehicle Crash Underreporting

The purpose of this effort is to examine the under-reporting of animal-vehicle crashes in the state of Wyoming by comparing the carcass data and reported crash data.

3.7.1 Carcass Dataset

The carcass dataset contains all reported animal carcasses from Wyoming Department of Transportation (WYDOT) crews from October 1997 to May 2005 and includes 10,500 records. Each county has a different reporting time line as can be seen in Table 3.3. Niobara and Washakie counties do not report any of their carcasses. Also note that not all of the counties maintained their carcass records continuously throughout the time period shown in Table 3.3.

Table 3.3 Carcass Dataset Timelines by County

County	1st Record	Last Record
Albany	26-Apr-04	14-Nov-04
Big Horn	21-May-04	25-Feb-05
Campbell	15-Jan-04	31-Dec-04
Carbon	6-Jan-04	8-Mar-05
Converse	9-Sep-04	22-Feb-05
Crook	21-Jun-04	15-Feb-05
Fremont	4-Jan-04	28-Feb-05
Goshen	28-Jun-04	15-Nov-04
Hot Springs	2-Jul-04	27-Jan-05
Johnson	22-Oct-03	31-Dec-04
Laramie	21-Jul-03	14-Dec-04
Lincoln	16-Oct-87	30-Mar-05
Natrona	1-Jan-04	28-Feb-05
Niobara	---	---
Park	22-Dec-03	28-Feb-05
Platte	22-Dec-03	1-Feb-05
Sheridan	17-May-04	29-Dec-04
Sublette	10-Jun-91	25-Feb-05
Sweetwater	10-Mar-97	25-Feb-05
Teton	6-Jan-96	9-Feb-05
Uinta	5-Jan-97	24-Feb-05
Washakie	---	---
Weston	6-Jan-04	28-Feb-05

The following information was documented for each carcass record: the crew that picked up the carcass, the county in which the carcass was found, date, species, sex, age class, route, milepost, cause of death, and type of fence in the area where the carcass was discovered. The reporting of carcasses is done when the maintenance crews spot the animals while performing other maintenance duties as well as when the public or highway patrol reports them.

The carcass dataset is geo-referenced to the highway shapefile similar to the process described in Section 3.5 and over 10,400 of the records are matched by route and milepost. The results are shown in Figure 3.6. Not all animals from the carcass dataset are used for this study since the carcass dataset includes a few records for smaller animals such as dogs, owls, and badgers. After screening out the records, 8,264 records remained.

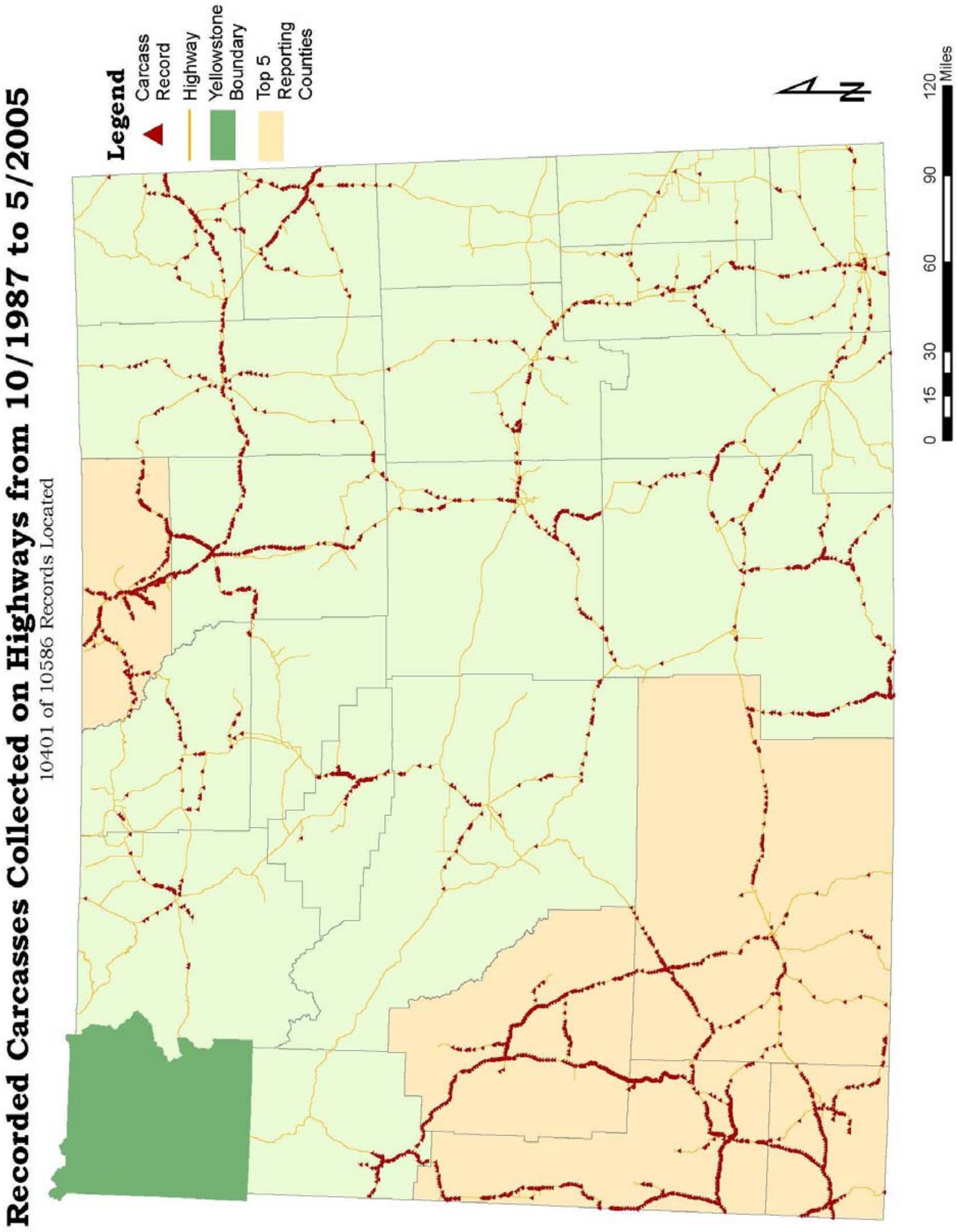

Figure 3.6 Map of Reported Carcass Data

3.7.2 Matching of Carcass and Crash Datasets

The next step is to match the carcass and crash datasets. First, records are removed from crash dataset that are located in the two counties that do not report their carcass data to the state (Niobara and Washakie). Second, crashes in the other counties are removed that fall outside the carcass reporting timeline for their respective counties (Table 3.3). This leaves 4,246 crash records that can potentially be matched to carcass records.

The remaining crash records are then matched to the reported carcass records. To perform this task, decision rules regarding matching were created since it was likely that there are differences between the reported crash location and the carcass location. There are also likely differences between the reported crash date and the carcass record date. The milepost of the carcass record should be no more than five miles from the crash record and within five days of the reported crash time. These values were selected to provide a conservative estimate for underreporting by giving significant leeway between the two datasets.

After the data is analyzed, 573 carcass records can be matched to 8,264 crash records, resulting in an underreporting estimate of 93.2%. On the reverse side, only 566 of the 2,878 (20%) of the reported crashes are matched. This is most likely due to the discontinuous time periods that counties maintained their carcass records. No attempt was made to filter out the crash records for these intermediate gaps in the carcass dataset.

4. PROJECT DESCRIPTIONS

The following chapter describes the seven projects selected for in-depth study and provides the site specific information and data needed to determine whether changes in geometric design parameters affect the number of wildlife related crashes in that area (see Section 3.3). The first part of each section gives a general description of the site, including location, terrain, and vegetation to be found in the area. Following this is a description of the geometric changes made to the road during recent construction, including lane and shoulder width, bridges and other structures, fencing, etc. Third, each section gives the wildlife data for the project, including game species present and the population estimates for those species. Fourth, traffic volumes on the roadway before and after construction are provided. The fifth section describes the traffic speeds that occur on each section, including a summary of speed data collected as part of recent site visits, as well as any previous information about speed, where available. The final part of each section discusses both the wild animal related crashes and the total crashes found at each site, both before and after reconstruction.

4.1 Centennial East Section

Wyoming State Highway 130 (WYO 130) connects the town of Centennial to Laramie in the southeast corner of the state. The section of road being studied begins 6.1 miles to the east of Centennial, near the junction with WY 11, extending from milepost 21.320 to 27.431. The section ends at the eastern edge of Centennial. The vegetation in the region consists primarily of short-grass prairie, with riparian areas adjacent to the few permanent watercourses in the region. The Snowy Range Mountains begin immediately to the west and south of the area. A map of the area can be seen in Figure 4.1. Two typical views of this roadway section can be seen in Figure 4.2.

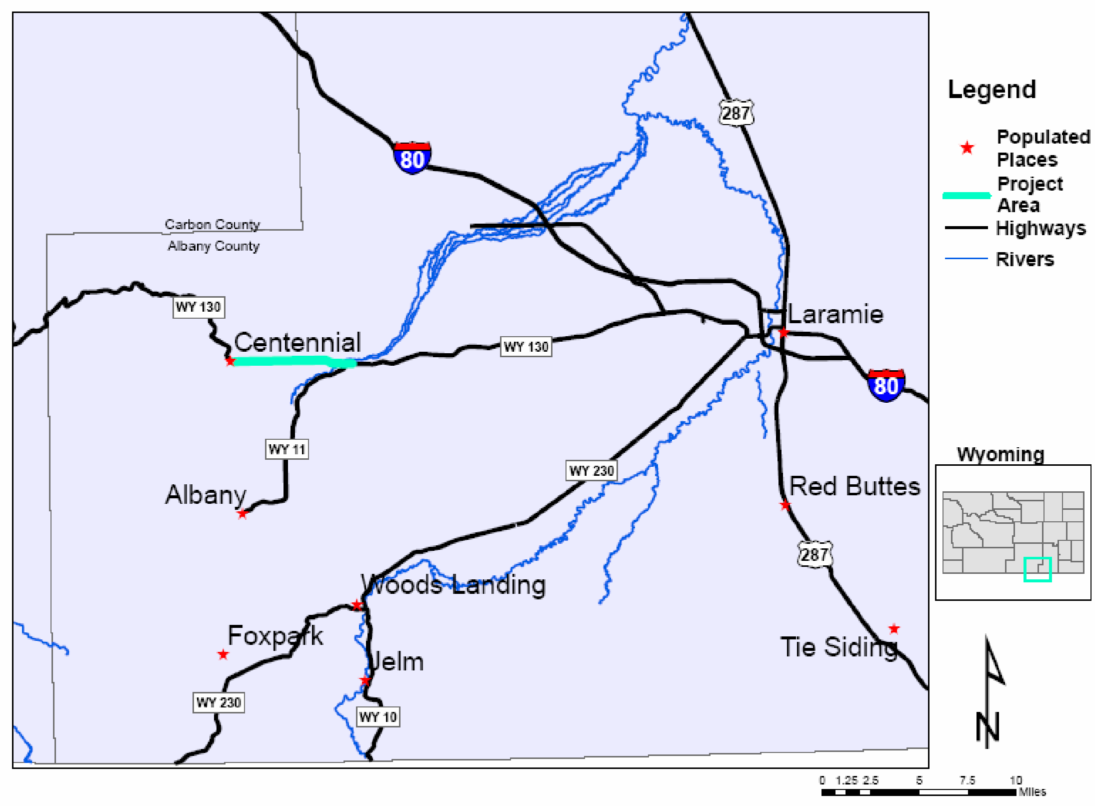

Figure 4.1 Centennial East Section

Figure 4.2 Centennial East View – North Fork Little Laramie River Looking West (L) and East (R)

4.1.1 Geometric Changes

The road reconstruction project was started in November 1996 and was accepted by the state in May 1999. The majority of the project consisted of widening of lanes and the addition of shoulders.

This section is mostly straight, containing only two curves throughout its length. These two curves were reconstructed to be slightly flatter than the existing plan. The easternmost curve was increased from a radius of 1640 feet to 2860 feet. The 2004 “Green Book” speed for the new curve using a superelevation (e) of 5.6% and an e_{max} of 8% is 60 mph (AASHTO, 2004). Using the same superelevation characteristics for the old radius, the speed would be 45 mph. The radius of the westernmost curve is very similar to the original, both with radii of 2860 feet. Using an e of 5.6%, the “Green Book” speed would be 60 mph. The modified curves relocate the new pavement adjacent to and south of the old pavement.

Prior to the reconstruction, the roadway had two 11-foot lanes and no shoulders. The road was rebuilt with 12-foot lanes and 6-foot shoulders.

There are two bridges along this section of roadway. Crossing the Little Laramie River, there is a three-span girder bridge approximately 100 feet in length. The second structure is a single-span girder bridge that crosses the North Fork Little Laramie River that is approximately 60 feet in length. Both bridges were in existence prior to the reconstruction and were not changed as part of the construction. The bridge decks are 36-feet wide.

From the literature review on usability of bridges as wildlife structures, the bridge crossing the North Fork may be too short to be readily used by wildlife. The bottom of the bridge girder is only approximately five feet above the river bottom. Mule deer studies have demonstrated that bridge heights less than eight feet are unlikely to be used. A picture of this bridge structure can be seen in Figure 4.3.

Figure 4.3 North Fork Little Laramie Bridge

From initial inspection, the bridge crossing the main stem of the Little Laramie River appears to be much more hospitable to crossing game. However, the south side of the structure is fenced across the width of the river, as seen in Figure 4.4, presumably by a rancher in the area, since the adjacent land is used for ranching.

Figure 4.4 Little Laramie Bridge

From the reconstruction plans and crashes associated with fencing found in the crash database, it appears there was ROW fence of unknown type prior to the reconstruction of the road. The fence type placed during the project was WYDOT Type E (45" high, four-strand wire fence with smooth bottom wire). A standard detail of this fence type can be found in Appendix A.

4.1.2 Wildlife Data

According to the Wyoming Game and Fish department, there are two big game species inhabiting this area. The Sheep Mountain herd unit contains a population of mule deer, while the Centennial herd unit is made up of pronghorn antelope. The regions occupied by these two units can be seen in Figure 4.5.

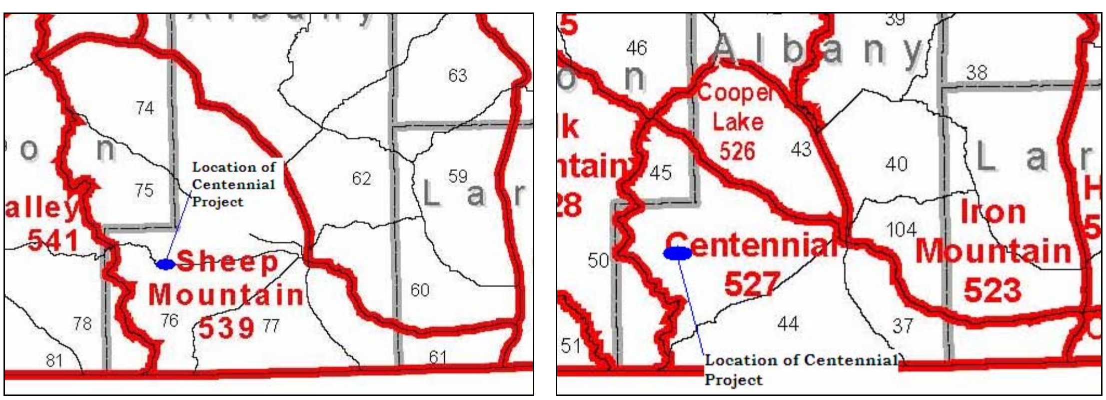

Figure 4.5 Centennial East Herd Units
Sheep Mountain Mule Deer Herd (left) and Centennial Pronghorn Antelope Herd (right).

The mule deer population for the Sheep Mountain Unit appears to be relatively stable, as indicated in Figure 4.6. Prior to construction, the number of animals was approximately 12,000. The deer population rose to its peak of 15,750 during construction, and dropped to approximately 10,000 by 2004.

The pronghorn antelope population has a significantly different trend than mule deer during the time period observed. As seen in Figure 4.6, the antelope population prior to and during construction seems to average around 10,000 animals. After the construction is finished, the population rises dramatically to over 27,000 pronghorn by 2003.

Figure 4.6 Sheep Mountain Mule Deer and Centennial Pronghorn Populations

4.1.3 Traffic Data

As seen in Figure 4.7, traffic on this section of road experienced a 40% increase following the reconstruction, rising from an ADT of 500 to 700.

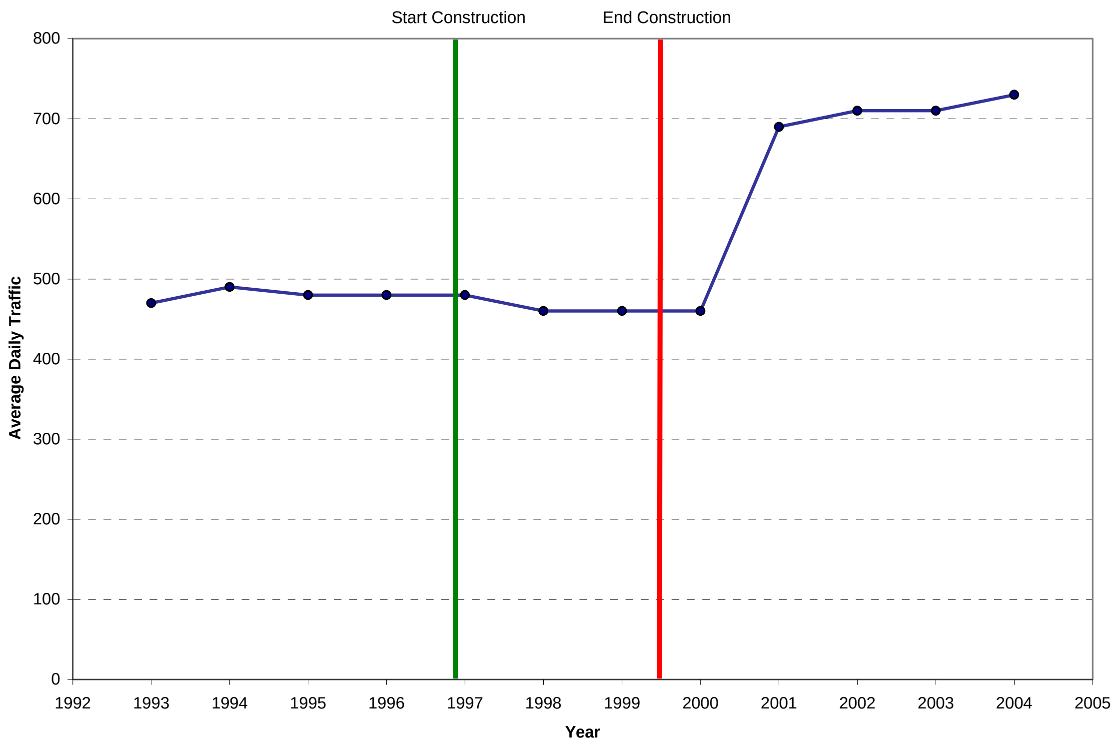

Figure 4.7 Centennial ADT

4.1.4 Speed Data

Two different types of speed data were collected for the Centennial East section as part of this research effort. The first was current speed data collected at two locations on-site. The second uses Highway Capacity Manual methodology to determine changes in Free-Flow Speed.

Two sets of traffic counters were placed on this section of road in August 2006. The first was placed at the crossing of the Little Laramie River at milepost 22.1, approximately 0.75 miles from the east end of the project. The second counter was placed at the crossing of the North Fork Little Laramie River at milepost 26.7, 0.7 miles from the west end of the project. The counters were placed on Monday, August 7, and removed two days later.

The posted speed limit for the majority of the project is 65 mph. The last 0.1 miles entering Centennial has a posted speed limit of 30 mph. Both traffic counters were placed within the 65 mph speed limit sections.

The easternmost counter has a substantial difference in speeds between the two directions. The 85^{th} percentile speed for the eastbound traffic is 80 mph, significantly higher than the posted limit. The westbound traffic has an 85^{th} percentile speed of 71 mph. Combining both directions, the 85^{th} percentile speed is 76 mph, 11 mph faster than the speed limit.

The westernmost counter was within a mile of Centennial and exhibits speeds that are far more consistent with the speed limit. The 85th percentile for the both the eastbound and westbound directions was 65 mph. The 85th percentile speeds are summarized in Table 4.1.

Table 4.1 Centennial East 85th Percentile Speeds

	Posted Speed Limit (mph)	Westbound Speed Average/85th Per.	Eastbound Speed Average/85th Per.	Combined Speed Average/85th Per.
Eastern Counter	65	65/71	74/80	69/76
Western Counter	65	54/65	54/65	54/65

Using Highway Capacity Manual methodology and the HCS+ software program, changing the roadway from 11-foot lanes and no shoulders to 12-foot lanes and 6-foot shoulders would increase the free-flow speed of the roadway by 4.7 mph.

4.1.5 Crash Data

Roadway reconstruction started in November of 1996, and WYDOT's current crash record database only goes back to the start of 1995. Therefore, the full three years of crash data prior to reconstruction is not available for this project. In this case the post-construction time period is adjusted to match the pre-construction time period. In the 23 months prior to reconstruction, there were a total of 12 crashes, four related to wild animals. During the 2.5 years of construction, there were a total of 10 crashes, two involving wild animals. In the two years after the new road was accepted, there were 10 crashes, seven related to hitting wild animals. The animal-vehicle crash data is summarized in Figure 4.8. A summary of the crash data can be found in Appendix B.

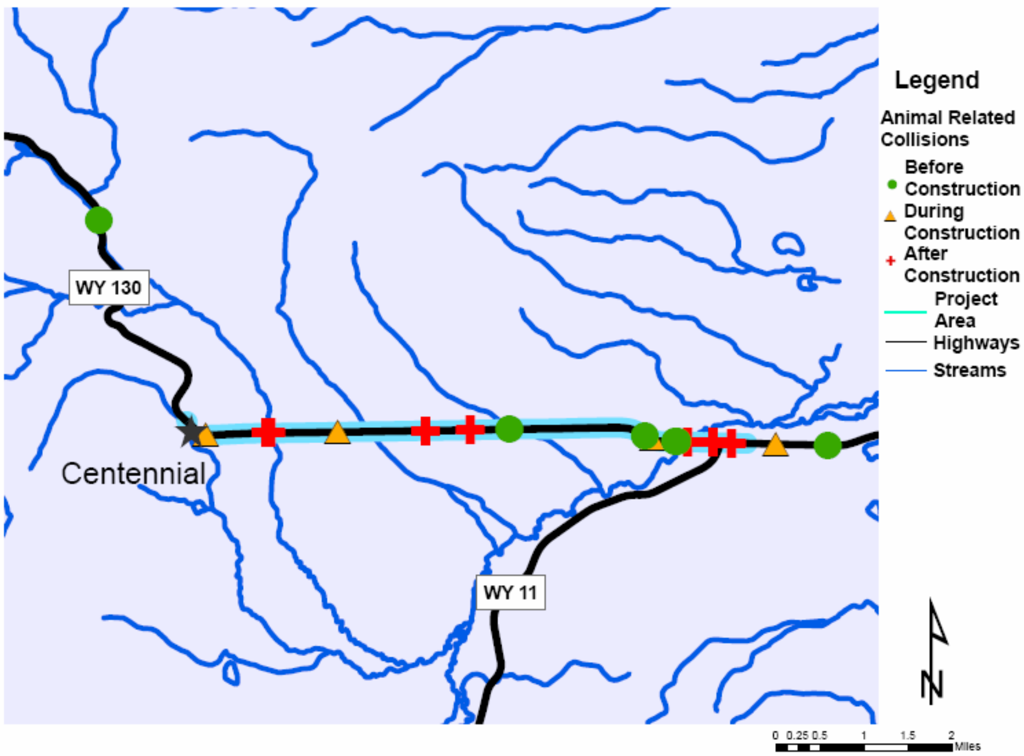

Figure 4.8 Centennial East Animal-Vehicle Crashes

4.2 Morton Pass Section

The Morton Pass Section is located in the southeast part of the state on WY 34 east of US 30/287 in Albany County. The high point of this section is Morton Pass, and the section continues for several miles beyond the pass to the east, including a portion of Sybille Canyon. This 6.8 mile project runs from milepost 9.69 to milepost 16.53.

Vegetation in this area is largely sagebrush, with some patches of coniferous forest cover to the east of Morton Pass. A map of the region surrounding this section can be seen in Figure 4.9. A picture taken west of Morton Pass can be seen in Figure 4.10.

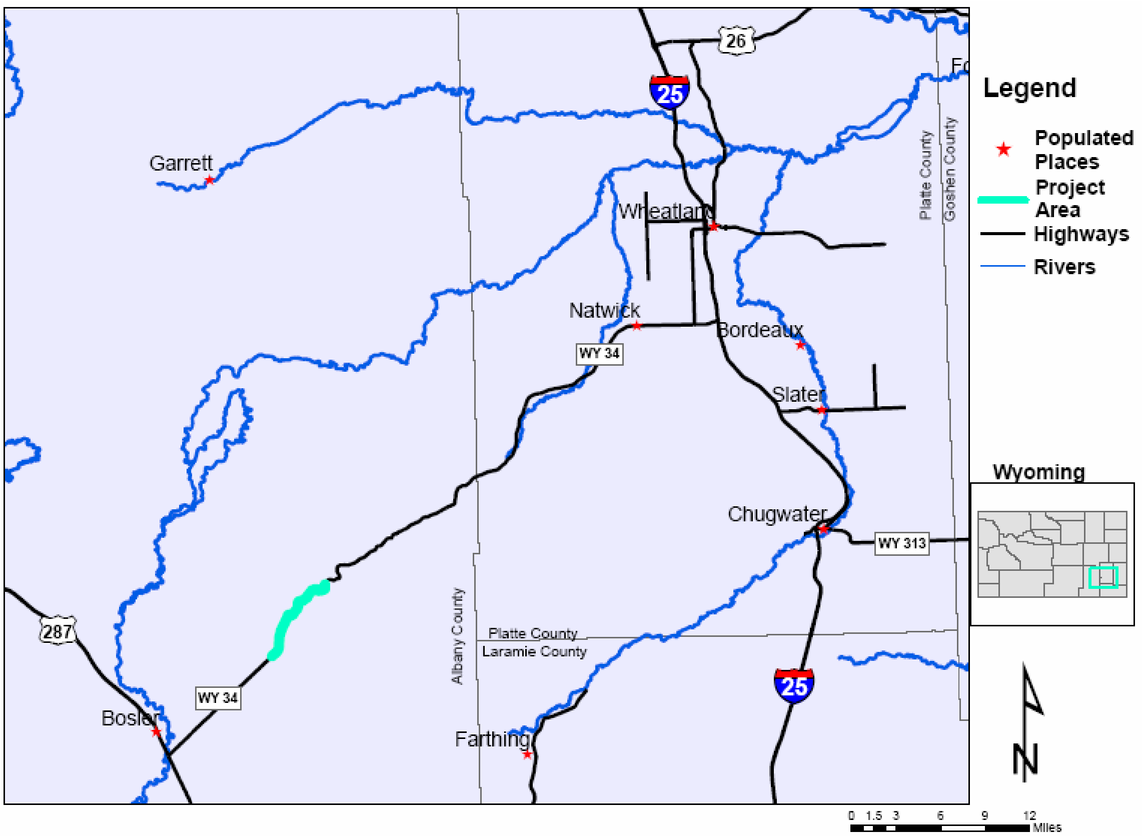

Figure 4.9 The Morton Pass Region

Figure 4.10 Morton Pass from the West

4.2.1 Geometric Changes

The Morton Pass reconstruction was started in March 2001 and completed in September 2002. The main reconstruction tasks performed during this project were to add lane and shoulder width to the roadway and to realign the roadway east of Morton Pass.

Little change to horizontal and vertical alignment was made to the westernmost three miles of the project. Once the roadway approaches Morton Pass, a new alignment was created for the road. Within this area of the section, several of the previous curves had radii less than 500 feet, and would have a current “Green Book” speed of 35-40 mph. Vertical alignment seems to confirm this. When rebuilt, all the section curves were changed to a minimum radius of 1150 feet and a design of speed of 55 mph.

Changes were also made to the cross section of the roadway. The previous cross section had two 11-foot travel lanes with no shoulders. Several miles of this cross section design still exist to the east further down the canyon and outside the study area. The new cross section was constructed with two 12-foot travel lanes and 4-foot shoulders.

No structures that function as wildlife crossings are located in this section. Sybille Creek runs roughly parallel to the highway east of Morton Pass but is not crossed by the roadway over the length of the project.

The fencing installed during this project along the highway right-of-way (ROW) was WYDOT Type F (48” High, four-strand barbed wire). A standard detail of this fence type can be found in Appendix A. The plans indicate that the previous alignment had a barbed wire fence of unknown type.

4.2.2 Wildlife Data

Wyoming Game and Fish provided population estimates for two different game species for the Morton Pass section, mule deer, and pronghorn antelope. The antelope herd has been consistently managed as a single herd unit, Iron Mountain. Prior to 2004, the mule deer population in the area was managed as two herd units, Laramie Peak and Iron Mountain. During the year of 2004 the two herds were joined to form the Laramie Mountains Herd Unit. The current herd units can be viewed in Figure 4.11.

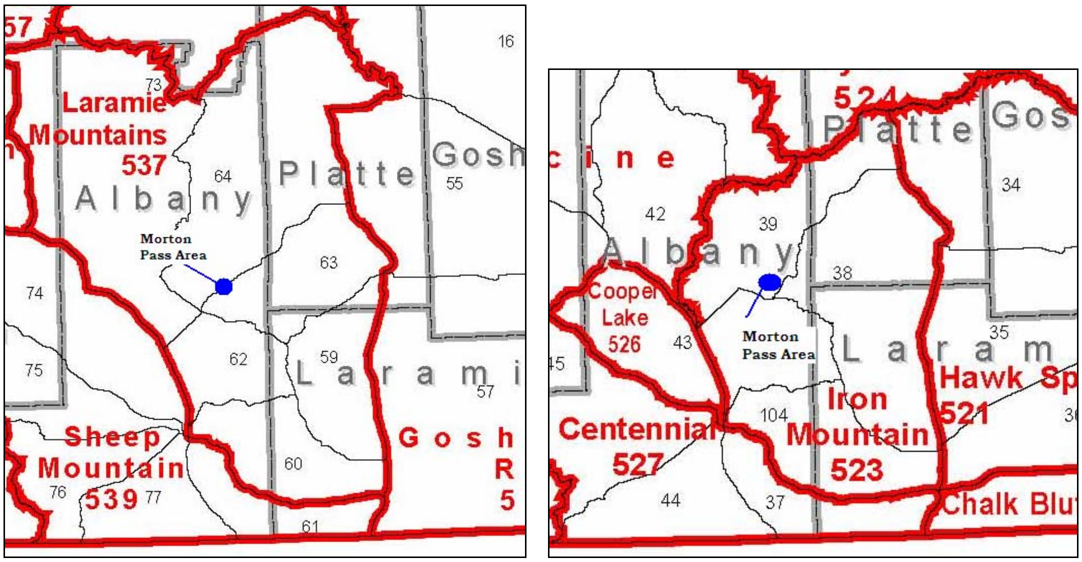

Figure 4.11 Morton Pass Herd Units
Laramie Mountains Mule Deer Herd (left) and Iron Mountain Pronghorn Herd (right).

The mule deer population in this area appears to be experiencing an upward growth trend, but this is difficult to ascertain due to the discrepancy between the sum of the populations in the two previous herds and the population of the combined new herd. The population numbers can be viewed in Figure 4.12.

The antelope population in the region surrounding Morton Pass has generally been between 15,000 and 20,000 animals, with a brief spike up to 24,000 in 2004 as seen in Figure 4.12.

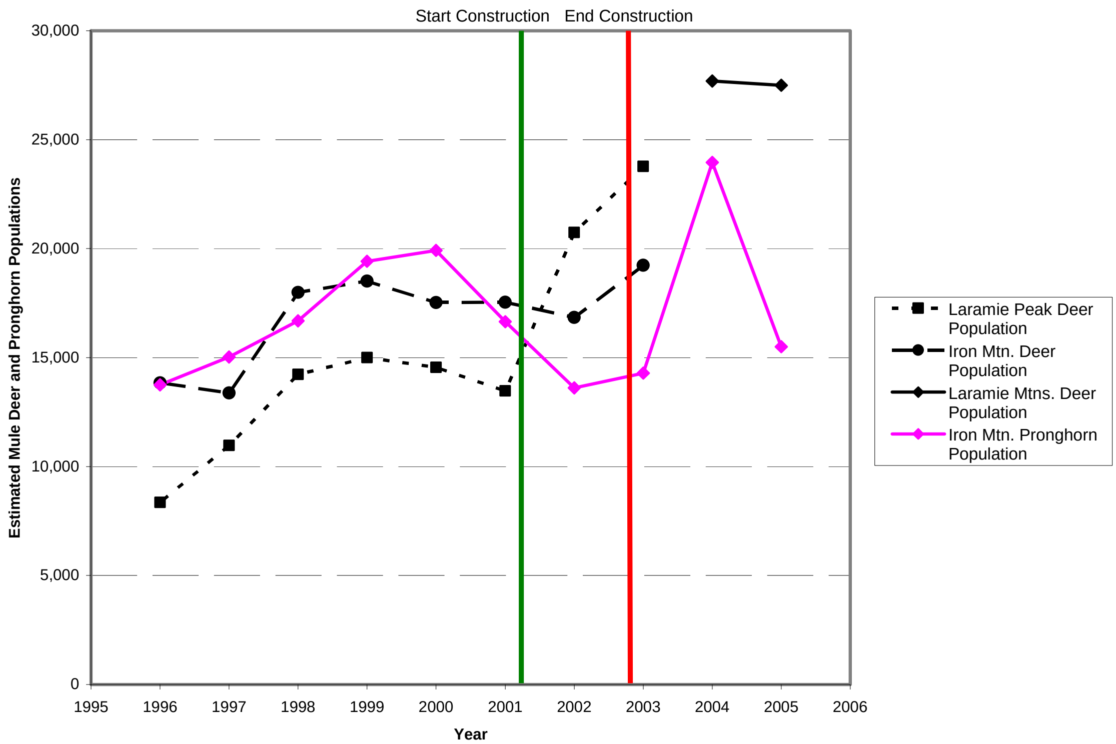

Figure 4.12 Morton Pass Mule Deer Populations

4.2.3 Traffic Data

Traffic seems to be increasing on this section, but, as can be seen in Figure 4.13, it is somewhat erratic over the course of the last ten years. The last five years of data show traffic volumes dropping from their high of 630 ADT in 2000 to 520 in 2004.

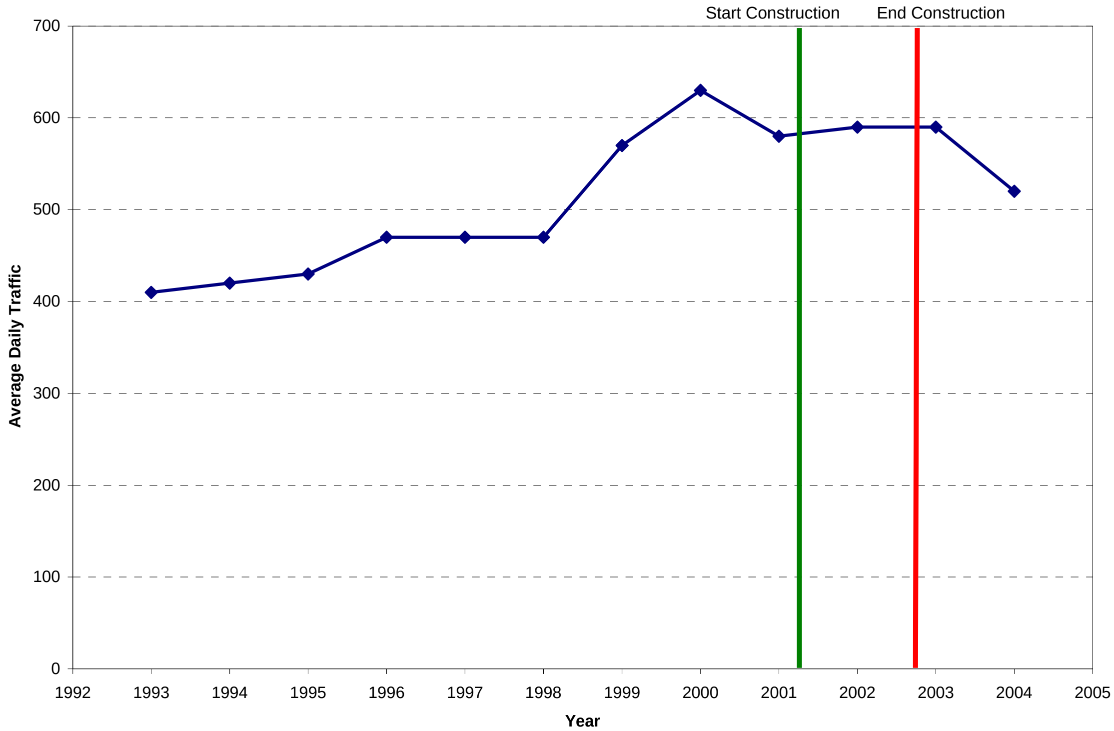

Figure 4.13 Morton Pass ADT

4.2.4 Speed Data

Two different types of speed data were collected for the Morton Pass section as part of this research effort. The first was current speed data collected at two locations on-site. The second uses Highway Capacity Manual methodology to determine changes in Free-Flow Speed.

The speed limit changes halfway through the project at milepost 12.5, with the area to the west being posted at 65 mph. The area east of this location is posted at 55 mph.

Two traffic counters were placed in this section. One was located approximately 1.5 miles west of Morton Pass at milepost 12.0; the second was located halfway between Morton Pass and the East end of the project at milepost 14.8. The westernmost counter was located in the 65 mph speed limit zone, while the easternmost counter was placed within the 55 mph speed limit zone.

The counters were on site from the afternoon of Monday, August 7, 2006 to the afternoon of Thursday, August 10. However, the eastern counter switched off, most likely due to a lack of battery power during the evening of August 9. The data for this counter only reflects 48 hours of traffic, rather than the 72 hours given by the western counter.

The speeds obtained from the eastern counter, located within the 55 mph zone, did not show that drivers were adhering to the posted limit. The westbound direction had an 85th percentile speed of 69 mph, while the eastbound traffic had an 85th percentile speed of 76 mph. In this case, the eastbound traffic was traveling at a 5% downgrade. The combined 85th percentile speed for this section was 72 mph.

The western counter was placed less than a half mile from the western edge of the 65 mph zone. The westbound traffic at this location showed an 85th percentile speed of 73 mph, and the eastbound 85th percentile speed was 76 mph. The combination of the two leads to an 85th percentile speed of 74 mph. The 85th percentile speeds are summarized in Table 4.2.

Table 4.2 Morton Pass 85th Percentile Speeds

	Posted Speed Limit (mph)	**Westbound Speed Average/85th Per.**	**Eastbound Speed Average/85th Per.**	**Combined Speed Average/85th Per.**
Eastern Counter	55	61/69	68/76	64/72
Western Counter	65	65/73	69/76	68/74

Using lane width change from 11 to 12 feet and a shoulder width change of zero to four feet, HCS+ determined that there would be an increase of 3.4 mph in free-flow speed following reconstruction.

4.2.5 Crash Data

Frequency of reported crashes appears to be low in the Morton Pass area, but due to the low traffic volumes the crash rate is somewhat on the high side.

Within this section in the three years prior to reconstruction, there were a total of 19 crashes, but none of these was related to wild animals. During the year and a half of construction there were five total reported crashes, two involving wild animals. In the three years following the acceptance of the section, there were seven crashes, and two list a wild animal as the first harmful event. The wild animal related crashes can be viewed in Figure 4.14. A summary of the crash data can be found in Appendix B.

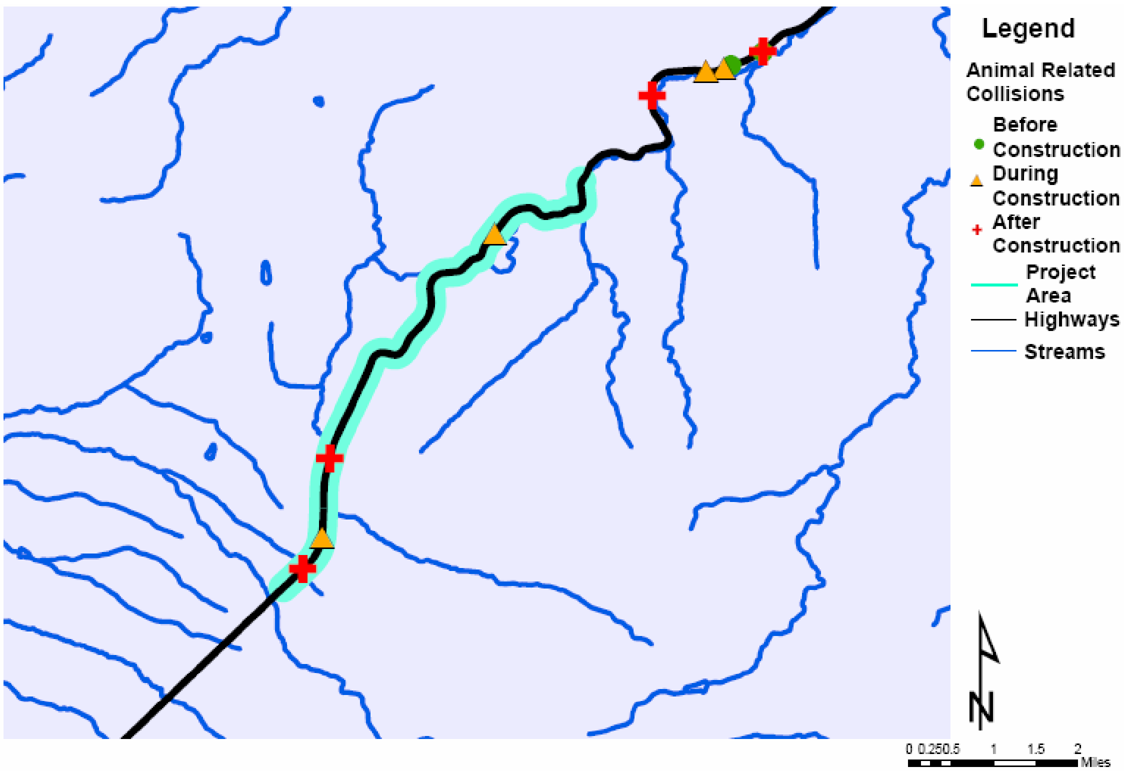

Figure 4.14 Morton Pass Animal-Vehicle Crashes

4.3 Clearmont North Section

The Clearmont North Section of road is located east of Sheridan on US 14/16, which connects Sheridan and Buffalo with Gillette. The section starts at the town of Clearmont, and runs north and east to Leiter. This 7.4 mile section of highway was reconstructed between mileposts 38.61 and 45.96. A map of the region is shown in Figure 4.15.

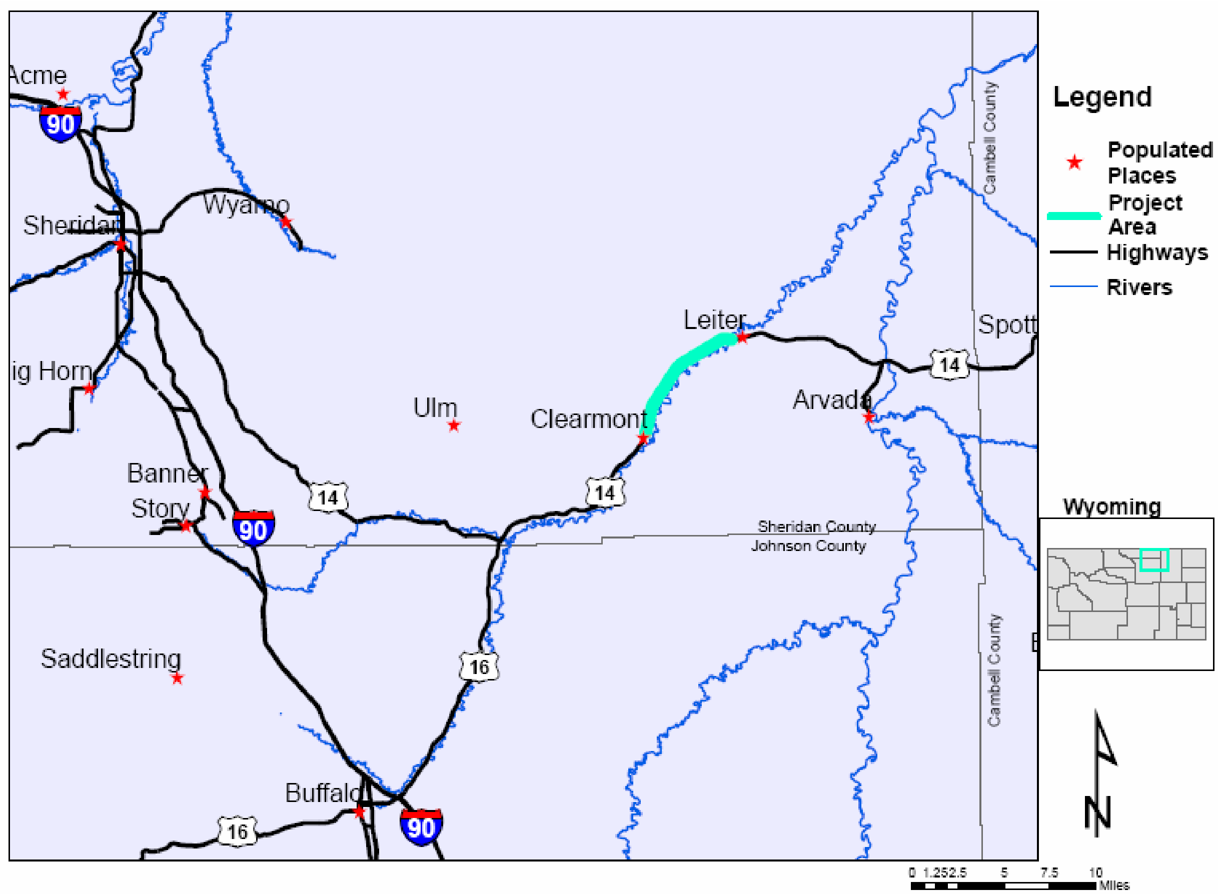

Figure 4.15 Clearmont North Section

The terrain in this area contains sagebrush on either side of the Clear Creek Valley. Within the valley, there are large areas of irrigated hay fields. A picture showing the general terrain of the section, as viewed from Leiter looking west, can be seen in Figure 4.16.

Figure 4.16 Clearmont North View

There is also an active railroad line paralleling the road to the west for the southern five miles of the highway project.

4.3.1 Geometric Changes

The Clearmont North reconstruction project started in November, 1999, and was accepted by the state in November of the following year. The primary change made to this road was to add additional width to both the lanes and the shoulders.

The new roadway largely parallels the old road, just to the east of the previous alignment, with the centerline of the new alignment near the old pavement edge. One slight horizontal curve takes the new pavement off the old roadway alignment at the start of the section near Clearmont. The final horizontal curve is slightly flatter than the original and brings the new centerline back to the centerline of the existing roadway. This also appears to be the limiting curve within this section. At a radius of 1430 feet, the old curve would have required a superelevation in excess of 8% to have a current “Green Book” speed of 65 mph. The curve that replaces it has a radius of 3000 feet and is designed for 65 mph. By today’s standards, the vertical alignment prior to reconstruction would have resulted in design speeds below 45 mph in several locations. This is no longer the case.

The first tenth of a mile and last two-tenths of a mile of this section already had 12-foot lanes and 4-foot shoulders, and the reconstruction project matched this cross section. The remainder of the project had 11-foot lanes and no shoulders prior to reconstruction. A view of the current lane design can be seen in Figure 4.17.

Figure 4.17 Clearmont North View

Several large culverts are in the section and one three-span bridge is located just outside the project section, immediately adjacent to the east end. This structure crosses Clear Creek, and the study section roughly parallels the creek to the west. The Clear Creek bridge has a center span in excess of 30 feet, and is approximately 12 feet above the surface of the water. This would make this structure a likely candidate for use as a game crossing structure and may already function as such. A view of this bridge can be seen in Figure 4.18.

Figure 4.18 Clear Creek Bridge

One location near the middle of the project at milepost 43.84 contains a small creek crossing the roadway. There is a notable relationship between the railroad track and the road at this location. With a width greater than 20 feet and a height over 15 feet, the railroad crosses the creek on a bridge that seems a practical crossing structure for deer. A set of three 10-foot x 7-foot box culverts is used to convey the creek under the road. These boxes do not meet the 20-foot minimum width to function as a practical game crossing structure. (See literature review section for more information.) It is possible that the combination of a natural drainage and the railroad bridge serve to funnel the deer to this location, where they are then forced to cross over the highway. Pictures of the culvert and railroad bridge can be seen in Figure 4.19.

Figure 4.19 Culvert and Railroad Bridge at Creek Crossing

There is another large drainage structure on the section, located at milepost 39.43. This structure, composed of three 9 foot x 9 foot box culverts, is also smaller than the 20-foot minimum width.

The majority of the fencing installed during this project was WYDOT Type A fencing (See Appendix A for construction detail). This 48-inch high fence has two barbed wires on the top of the fence over a woven wire mesh making up the bottom 32 inches of the fence. While no record of fencing prior to the reconstruction is available, it is likely that some type of fencing was in place.

4.3.2 Wildlife Data

Wyoming Game and Fish provided population data for both mule deer and white-tailed deer for this area. Both the mule and white-tailed deer herds are known as the Powder River Unit, but the area covered by the two units are quite different. The differences between the two units can be seen in Figure 4.20.

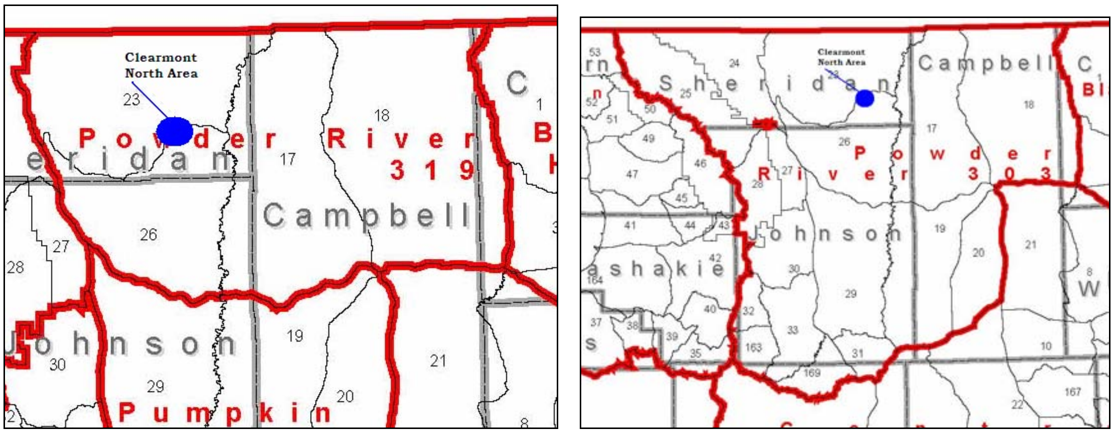

Figure 4.20 Clearmont North Herd Units
Powder River Mule Deer Herd (left) and Powder River White-Tailed Deer Herd (right).

Mule deer populations in this area are generally stable, varying between 40,000 and 50,000 animals. The population numbers for the years 1995-2004 can be seen in Figure 4-21.

White-tailed deer population numbers are increasing in this region. Between 1995 and 2004, populations have risen from a low of 6,860 in 1997 to a peak of 17,271 in 2001. While there has been some yearly variation, as can be seen in Figure 4.21, the trend is clearly increasing.

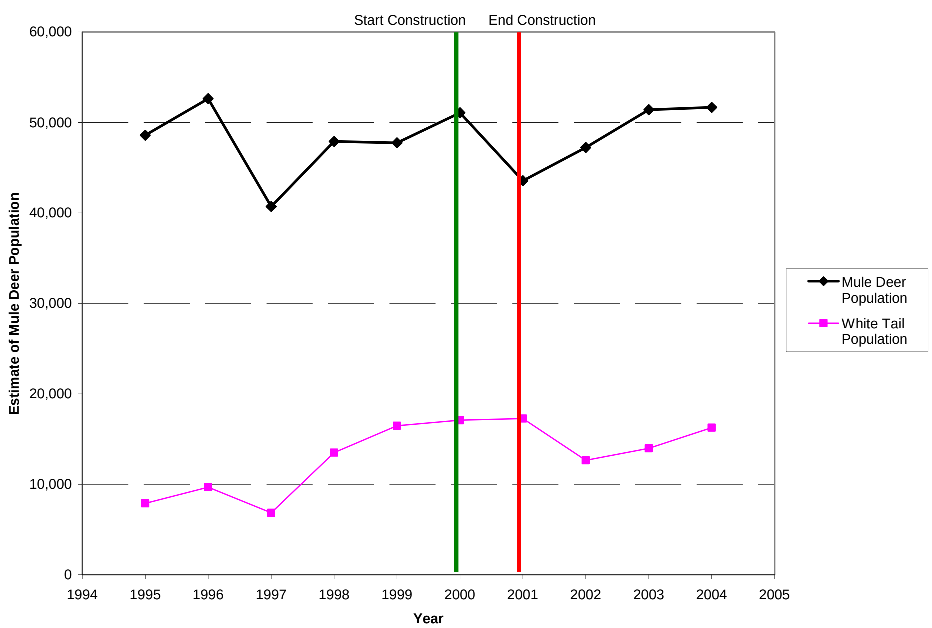

Figure 4.21 Clearmont North Mule Deer Population

4.3.3 Traffic Data

Traffic in this section experienced a large increase during the construction period, and then dropped slightly in the year following construction as can be seen in Figure 4.22. From there, traffic grew at a fairly steady rate of approximately 15% per year for the next two years.

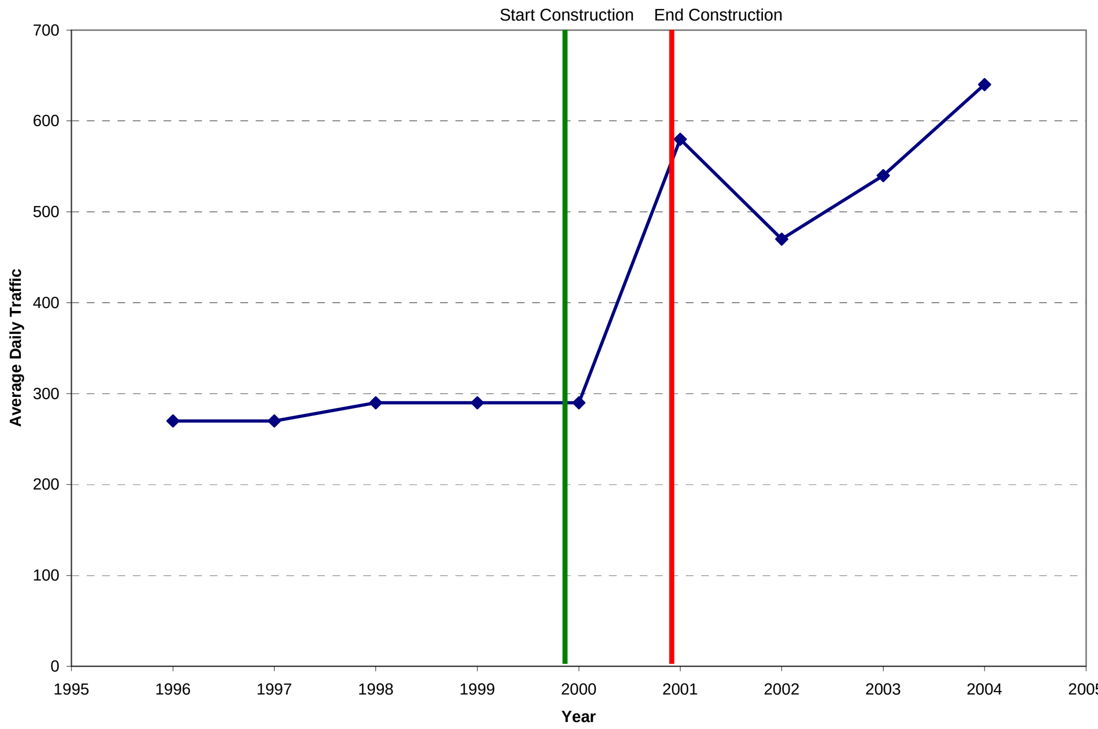

Figure 4.22 Clearmont North ADT

4.3.4 Speed Data

Two different types of speed data were collected for the Clearmont North section as part of this research effort. The first was current speed data collected at two locations on-site. The second uses Highway Capacity Manual methodology to determine changes in free-flow speed.

The speed limit at the beginning of this section starts at 30 mph and is increased to 65 mph at the northern edge of Clearmont at milepost 39.0. Two traffic counters were placed in the 65 mph section, and data were collected for more than 72 hours. The counters were placed on Monday, August 14, 2007 and retrieved on the evening of Thursday, August 17.

The western counter was placed at milepost 43.84, near the site of the railroad bridge and culvert crossing mentioned in the previous section. The 85th percentile speed for both directions was 76 mph, far in excess of the posted 65 mph speed limit.

The eastern counter was placed at the end of the project adjacent to the bridge over Clear Creek. The 85th percentile speeds at this counter are somewhat lower than the western counter, but still much higher than the posted speed limit. The 85th percentile speeds for this counter were 73 mph for both directions. The 85th percentile speeds for each of the counters are summarized in Table 4.3.

Table 4.3 Clearmont North 85th Percentile Speeds

	Posted Speed Limit (mph)	Westbound Speed Average/85th Per.	Eastbound Speed Average/85th Per.	Combined Speed Average/85th Per.
Eastern Counter	65	66/73	66/73	66/73
Western Counter	65	68/76	69/76	69/76

Using Highway Capacity Manual methodology and the HCS+ software program, changing the roadway from 11-foot lanes and no shoulders to 12-foot lanes and 4-foot shoulders would increase the free-flow speed of the roadway by 3.4 mph.

4.3.5 Crash Data

During the three years prior to reconstruction, there were a total of six crashes, and only one involved a wild animal. During construction there were a total of three crashes, none of them involving animals. In the three years following the reconstruction of the road, there were seven crashes, five involving a wild animal. The locations of each of the animal-vehicle crashes can be seen in Figure 4.23. A summary of the crash data can be found in Appendix B.

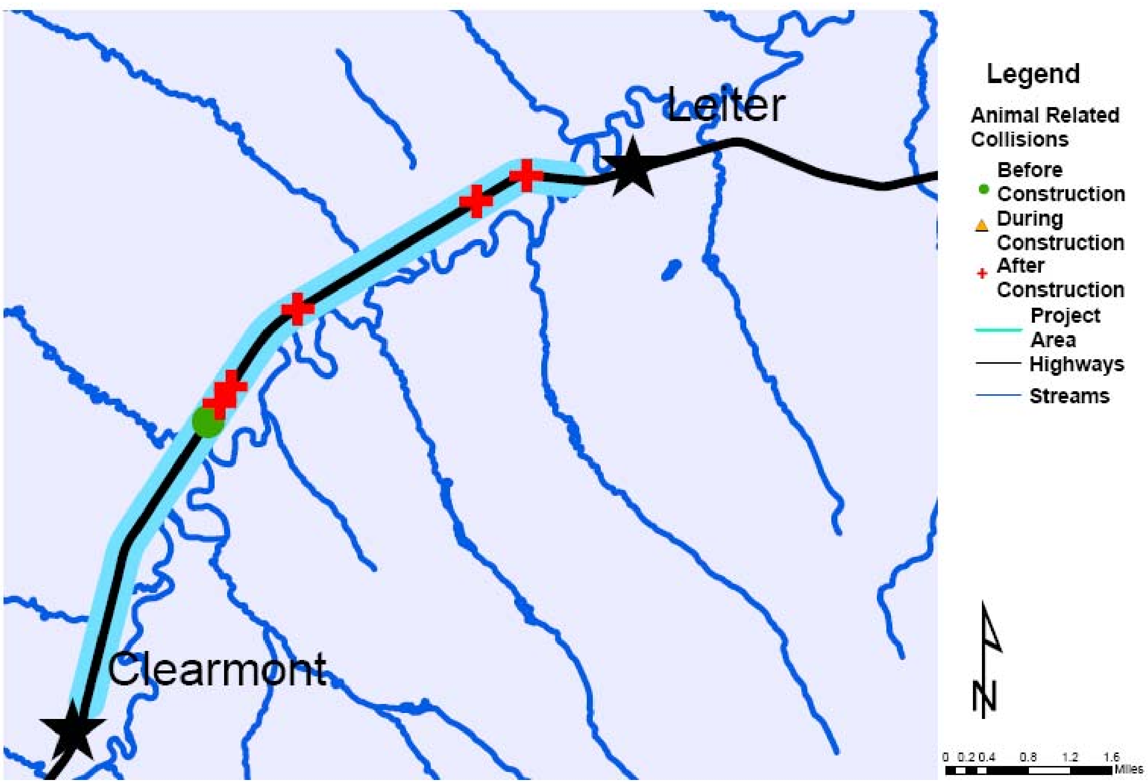

Figure 4.23 Clearmont North Animal-Vehicle Crashes

4.4 Hanging Rock Section

The Hanging Rock Section is located on US 14/16/20 between Yellowstone National Park and the town of Cody. The length of the project is 8.2 miles, from milepost 19.4 to milepost 27.6. The road is adjacent to the North Fork of the Shoshone River and runs parallel to the south of the river for all but the westernmost mile of the project. A map of the area can be seen in Figure 4.24.

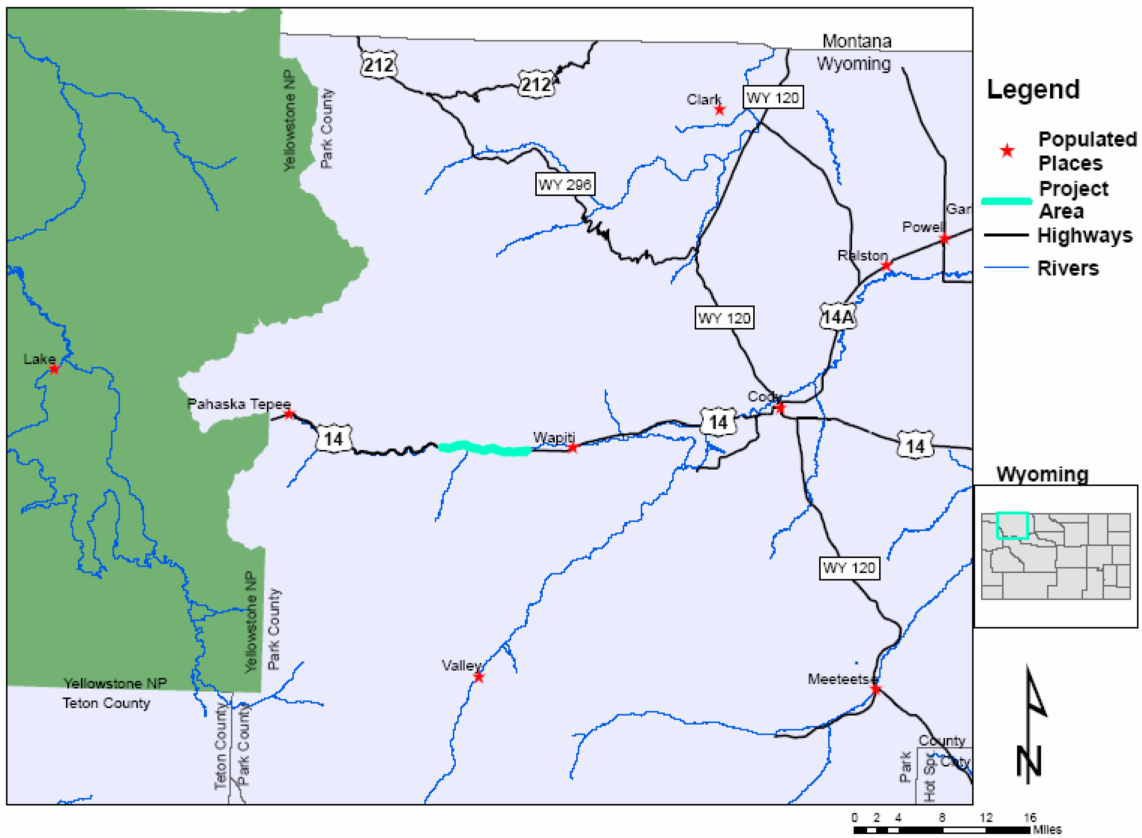

Figure 4.24 Hanging Rock Section

The road travels through United States Forest Service land, and coniferous forests start within a hundred yards of the highway in many locations. The valley itself is narrow and flat, with deciduous riparian habitat along the river and cliff faces on either side of the roadway. A typical view of the valley and the highway can be seen in Figure 4.25. This photograph is taken from the western end of the section looking east.

Figure 4.25 Hanging Rock View

4.4.1 Geometric Changes

The reconstruction of this road began in June 1998. It was accepted by the WYDOT in December 1999. This section of road was completely redesigned.

Significant changes were made to the horizontal and vertical alignments. The new design utilizes large cuts, rather than following the existing terrain, to create a straighter roadway. The previous alignment was constructed in the 1930's, and little change was made until the reconstruction started in 1998. The old alignment consisted of straight sections interspersed with curves of a very tight radius. According to Bob Bonds and Ed Douma of WYDOT, many of these tighter curves would have had radii well under 500 feet and contemporary design speeds ranging from 20-30 mph. When rebuilt, the design speeds for all curves within this segment were 50 mph or greater. The new alignment appears to be located farther from the North Fork of the Shoshone River, which also runs through this valley.

The existing typical cross sections for the previous alignment were not given in the plans for the new road, but research in WYDOT archives indicates that the previous alignment had 11-foot lanes and no shoulders. According to Ed Douma, the project designer with WYDOT, this 22-foot pavement width was achieved in open sections, while the more constricted areas had pavement widths of 20 feet or less. The new typical cross section has two 12-foot travel lanes with 6-foot shoulders. Several new passing zones are within this section, adding either one or two additional 12-foot lanes. In these sections the shoulder width was typically four feet for the direction(s) with passing lanes. In areas with guard rail, the shoulder width varies from two feet to six feet.

Four new bridge structures are within this section of highway (see Figure 4.26). One structure crosses the North Fork of the Shoshone River, while the other three cross tributaries of the river. All four of the bridges appear to be large enough to accommodate the crossing of game animals. Each of the bridges has end spans that are at least 20 feet in width, which, according to the literature reviewed, is the minimum recommended width for the passage of mule deer. The height of each of the spans over the water surface is greater than six feet, which was the limiting height in the same study.

Figure 4.26 Hanging Rock Section Bridges
Clockwise from upper left: Clocktower Creek (MP 24.84), Elk Fork (MP 22.05), North Fork Shoshone River (MP 20.31), Clearwater Creek (MP 19.74).

Several retaining walls are in this section, many over 20 feet tall, generally located in areas where the road is positioned between the river and a steep cut in the cliff. An example of this can be seen in Figure 4.27. These areas typically would not make good crossing points for game, as there is no approach to the roadway from either side.

Figure 4.27 Hanging Rock Section Retaining Wall

No fencing was observed in this section, either on the reconstruction plans or during the site visits.

4.4.2 Wildlife Data

Wyoming Game and Fish identified two big game species that inhabit the area surrounding the Hanging Rock section: mule deer and elk. Between the years 1993 and 2004, each species was placed in a single herd unit. The mule deer unit is known as the Upper Shoshone Herd, while the elk unit is known as the Cody herd. The regions occupied by each herd unit can be seen in Figure 4.28.

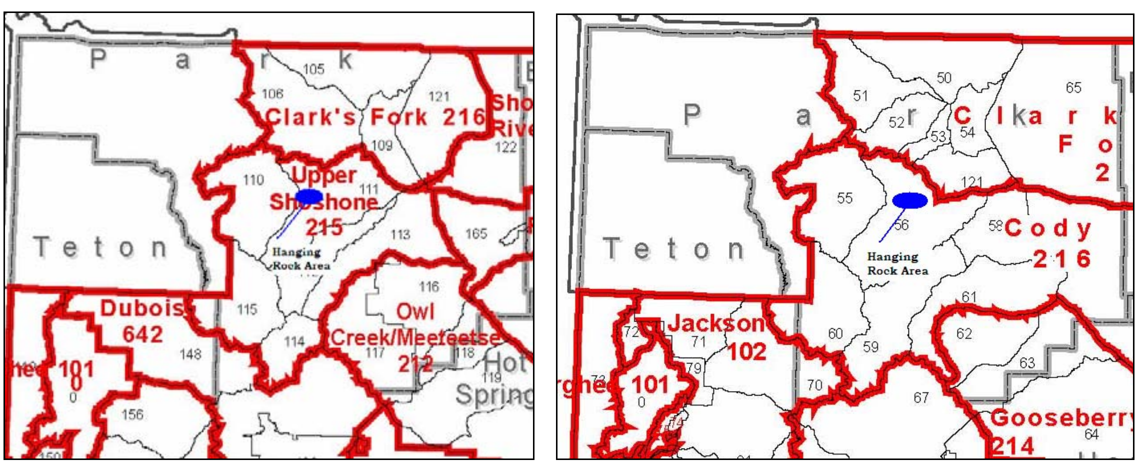

Figure 4.28 Hanging Rock Herd Units – Upper Shoshone Mule Deer Herd (L) and Cody Elk Herd (R)

Mule deer populations during the years 1993 to 2004 were relatively stable, varying from a low of 10,100 in 1996 to a maximum of 13,250 in 1995, as can be seen in Figure 4.29.

Figure 4.29 Hanging Rock Mule Deer Population

Elk populations in the Hanging Rock section between 1993 and 2004 show slightly decreasing, but fairly stable, numbers. The years 1993 to 1999 show populations oscillating between 7,000 and 8,000 elk. Following 1999, populations decreased slowly toward 6,000 animals. The changes in elk population can be seen in Figure 4.29.

4.4.3 Traffic Data

Traffic volumes were relatively constant from 1994 to 2001 in this segment, with a drop-off during the last three years. As can be seen in Figure 4.30, 2003 had the lowest volumes recorded over the last ten years.

One thing that must be noted is that approximately 19 miles to the west of this section, within Yellowstone National Park, a major reconstruction project was undertaken during the summer of 2006, causing road closures of up to a half an hour. This forced much of the eastbound traffic to be grouped into large platoons. By the time they reached this section of roadway, they would likely be spread out, although it is possible that some platooning remained and might affect the collected vehicle speed data.

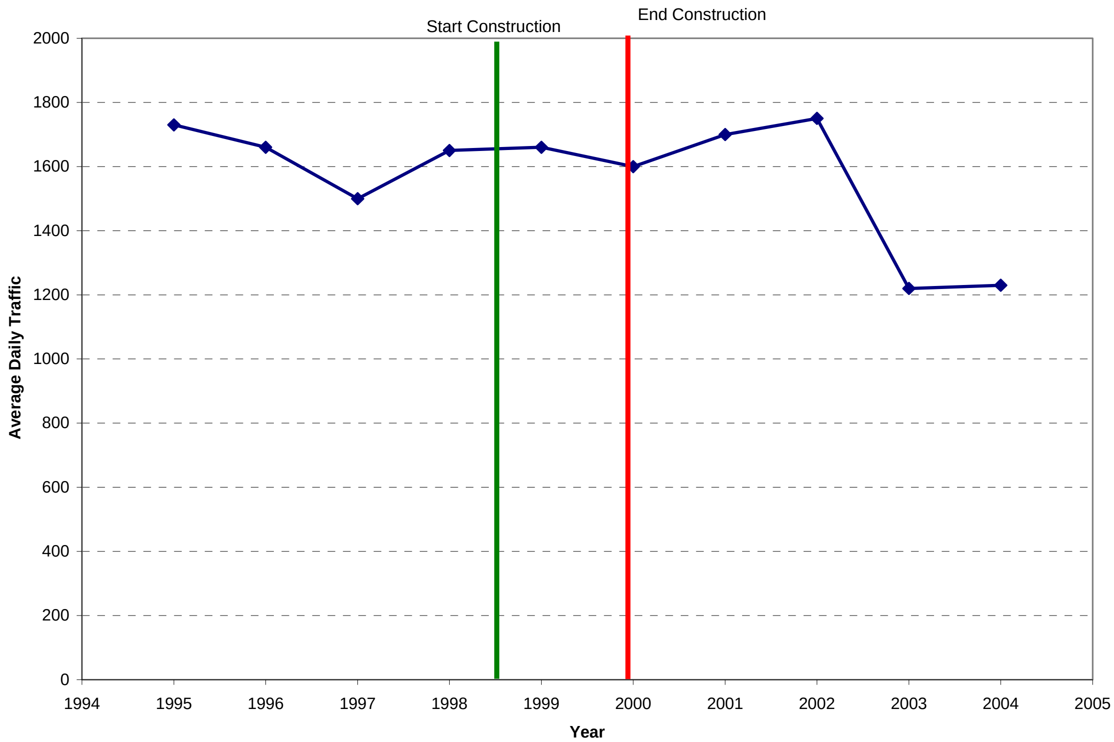

Figure 4.30 Hanging Rock ADT

4.4.4 Speed Data

Speed can be studied three different ways within this section. The first were speed studies undertaken by WYDOT in 1992 and 2004. The second would be speed data collected as a part of this research effort. The third is an analysis using HCM methodology.

Two different speed studies were performed by WYDOT within this section. The first was performed in 1992 when the speed limit was 55 mph. The second was collected in 2004 following the reconstruction of the section. The speed limit was raised to 65 mph in 1996 following the removal of the national speed limit, as was typical of two-lane highways in Wyoming. No studies were found on this section during the period of 1996-2004.

Only one of these locations is directly comparable between the two studies, MP 22.5 WB. The recorded speeds at this location were identical between the two time periods. This is in a straight area with a length of approximately one mile. The results of this speed study can be seen in Table 4.4.

Table 4.4 WYDOT Hanging Rock Speed Studies

		Average Speed (mph)	50% Percentile Speed (mph)	85% Percentile Speed (mph)
July 6-9 1992	**MP 20.0 EB**	53.6	51	58
	MP 20.0 WB	46.4	44	51
	MP 22.5 WB	48.5	46	53
	MP 24.0 EB	52.5	50	56
	MP 24.0 WB	52.5	51	56
	MP 26.5 EB	43.1	41	45
	MP 26.5 WB	43.7	41	48
May 25-26 2004	**MP 16.6 EB**	59.9	59	68
	MP 16.6 WB	56.8	56	62
	MP 22.3 EB	57.7	57	64
	MP 22.3 WB	55.5	56	60
	MP 22.5 WB	48.5	46	53
	MP 26.8 EB	57.4	57	61
	MP 26.8 WB	54.7	54	59

An interesting issue with this section is the speed limit of the road. Starting at the beginning of the section traveling west at approximately milepost 28, the speed limit is lowered from 65 mph to 50 mph. This change was made to limit the environmental impact on this largely wild area. For this reason, traffic counters were placed at the extreme ends of the project in an effort to determine the change in speed over the course of the highway section.

Two counters were placed within this section on the afternoon of Tuesday, August 15, 2006. The counters were retrieved 48 hours later.

The eastern traffic counter was placed at milepost 27.5, approximately 0.25 miles west of the lowering of the speed limit to 50 mph. It was also 0.1 miles from the eastern start of the section. The 85^{th} percentile speeds for this counter were in excess of the posted 50 mph speed limit. In the westbound direction, the 85^{th} percentile speed was traveling at 63 mph. Going east, the 85^{th} percentile speed was 58 mph. The combined 85^{th} percentile speed for this counter was 61 mph.

The western traffic counter was placed 0.25 miles east of the west end of the segment at Milepost 19.7. The 85^{th} percentile speed for both directions was 65 mph. This indicates that posted speed limits are not the governing factor for speed within this area. A table summarizing the 85^{th} percentile speeds on this section of highway can be observed in Table 4.5. The complete speed summaries of these two sections can be seen in Appendix E.

Table 4.5 Hanging Rock 85th Percentile Speeds

	Posted Speed Limit (mph)	Westbound Speed Average/85th Per.	Eastbound Speed Average/85th Per.	Combined Speed Average/85th Per.
Eastern Counter	50	56/63	52/58	54/61
Western Counter	50	58/65	59/65	58/65

The previous lane and shoulder widths were analyzed using HCM methodologies and the HCS+ software. Comparing a roadway with 11-foot lanes and no shoulders to one with 12-foot lanes and 6-foot shoulders yields an estimated difference in free-flow speed of 4.7 mph.

4.4.5 Crash Data

In the three years prior to construction, there were a total of 12 crashes in this section, with two related to wild animals. During construction, there were a total of eight crashes, two involving animals. In the three years after the project was completed, there were an additional eight crashes, four related to wild animals. The distribution of the animal related crashes can be seen in Figure 4.31. A summary of the crash data can be found in Appendix B.

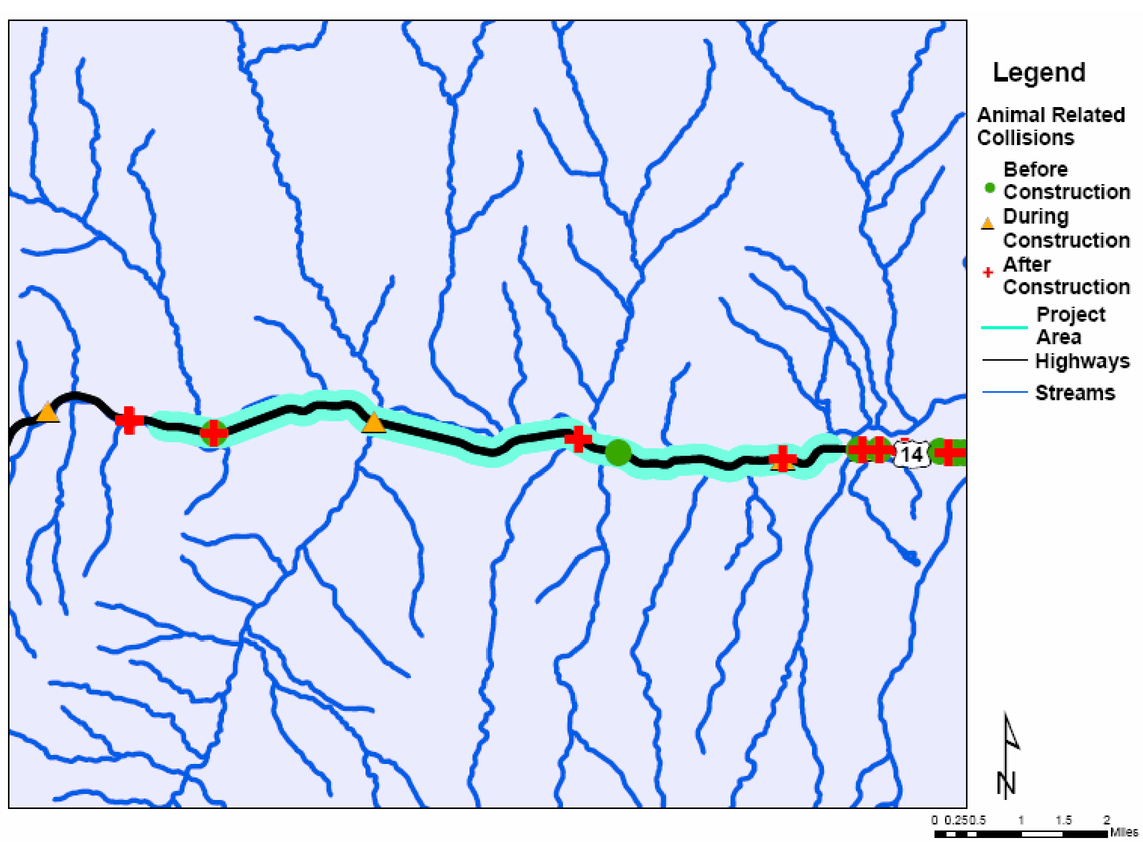

Figure 4.31 Hanging Rock Animal-Vehicle Crashes

4.5 Astoria Section

The Astoria section is on US 89, immediately to the south of Hoback Junction, near Jackson, in the Snake River Canyon. This four-mile section runs from MP 136.65 to MP 140.89. The smallest section to be studied, it also has the highest frequency of animal-vehicle collisions. A map of the area can be seen in Figure 4.32.

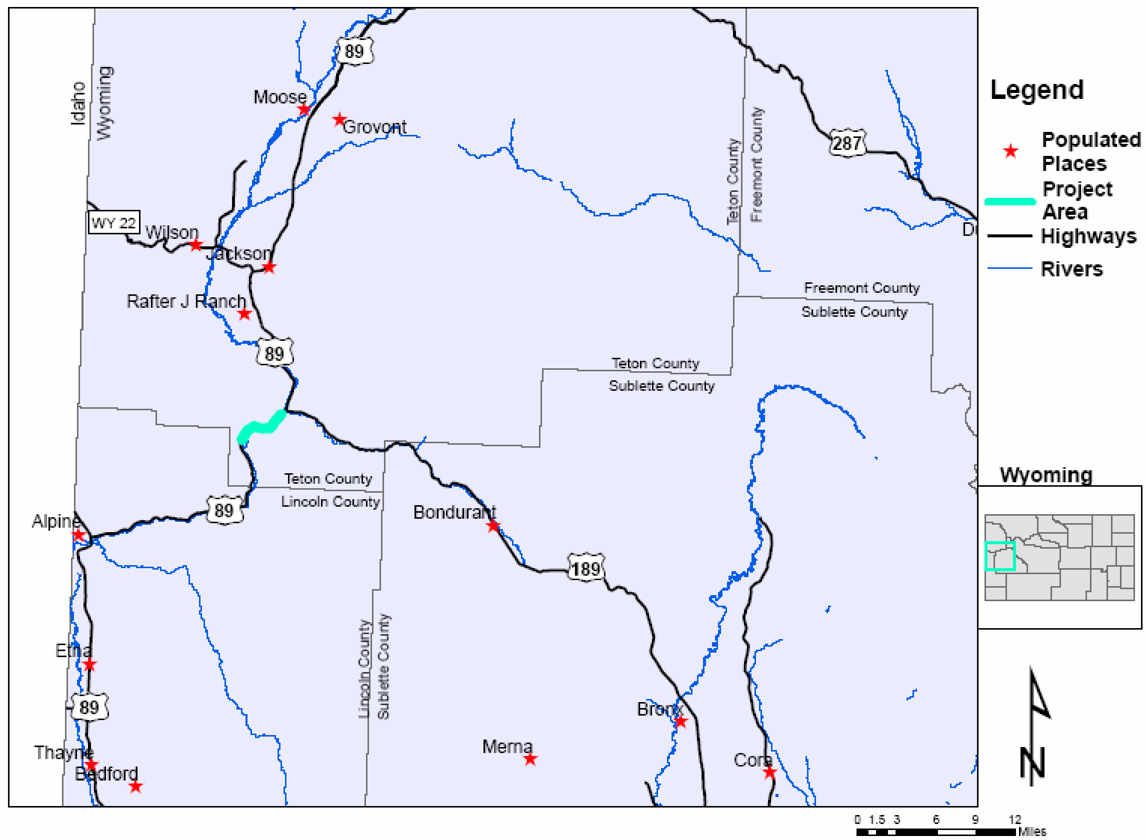

Figure 4.32 Astoria Section

The first mile traveling north has mixed coniferous/deciduous forest on both sides of the road. There are passing lanes in both directions in this area. The rest of this section is located higher on the valley slopes above the river and has a more curved alignment. Several 10- to 20-foot high retaining walls are in this section, and most of this area has guardrail on the river side of the road. Throughout the section, the road parallels the west side of the Snake River. The characteristics of the two different sections are shown in Figure 4.33.

Figure 4.33 Astoria Views
Near the South End of the Section Looking North, (left) and Center of the Section Looking West (right)

4.5.1 Geometric Changes

The Astoria Section of US 89 was rebuilt starting in March 2000, with the project being accepted by WYDOT in November 2001. The primary purpose behind this project was to add additional width to both the lanes and shoulders and to add passing lanes in both directions to the road. Some changes to alignment were also made.

The first mile of the project traveling north runs concurrent with the existing roadway. At milepost 138.2, one mile north of the start of the project, the new roadway alignment diverges from the old alignment. While slight adjustments to curves did occur, the radii of most curves stayed approximately the same. One 300-foot long curve with a radius of 1,640 feet was removed during construction in favor of a straight section. The design speed for the reconstructed section was 55 mph, and in terms of horizontal curvature, the old section would be very similar to the new.

Vertical curves were examined on the previous design to determine current “Green Book” speeds as well. Only one sag curve was found to have a contemporary “Green Book” speed of between 45-50 mph. The remainder of the vertical curves are in excess of 55 mph by today’s standards.

The existing typical section shows that the previous design had two 11-foot lanes with no shoulders. The general dimensions of the rebuilt section have two 12-foot lanes with 8-foot shoulders. The section width was increased to four 12-foot lanes for the first mile of the project to provide passing lanes in both directions. In this section, the shoulder width was decreased to four feet.

No bridges or large culverts are within this section except for a large pipe arch culvert for the Fall Creek Crossing. There are, however, several segments in the northern half of the project that have 10- to 20-foot retaining walls. Generally located on the river side of the road, the walls are used in locations that have particularly steep slopes. These walls would effectively block game passage in those areas.

Fencing in this section is sporadic. Traveling north from the start of the project, the first 0.8 mile is located within US Forest Service property and had no fencing installed after reconstruction. Prior to the reconstruction, a buck and pole style fence ran along the east side of the road for the first 0.8 miles. This was removed and replaced by barrier rock meant to prevent vehicles from straying more than 30 feet from the traveled way. The next 0.5 mile has WYDOT Type E (45" high, four-strand, bottom wire smooth) fencing on both sides of the road. See Appendix A for fence details. The following two miles is also within USFS property and has no fencing. The remainder of the four-mile project has previously installed wire fencing on both sides of the road.

4.5.2 Wildlife Data

Wyoming Game and Fish maintains records for three different species in this area: mule deer, elk, and moose. No moose-related crash reports occurred on the section in question, so the data for this species will not be included in further analyses.

There is one herd unit in this location for both elk and mule deer. The elk unit is known as the Fall Creek Herd and the mule deer unit is known as the Sublette Herd. Figure 4.34 shows the boundaries for each of the herds.

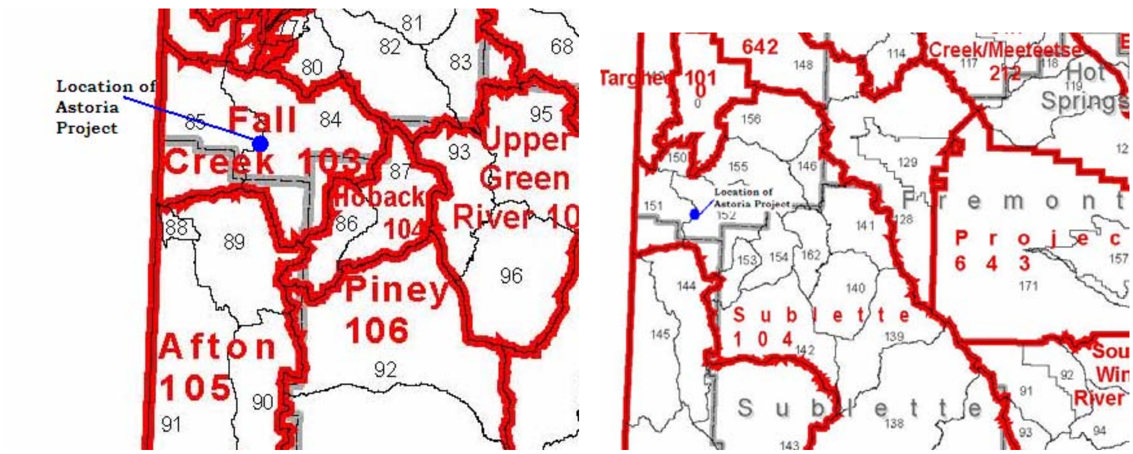

Figure 4.34 Astoria Herd Units – Fall Creek Elk Herd (left) and Sublette Mule Deer Herd (right)

Elk populations from 1996-2005 show a rather stable population, averaging around 5,000 animals. There is a slight, but noticeable, upward trend to the numbers, as the population in the late 1990's averages near 4,500 animals, while the populations for the years after 2003 are higher than 5,000 elk. Elk population numbers can be observed in Figure 4.35.

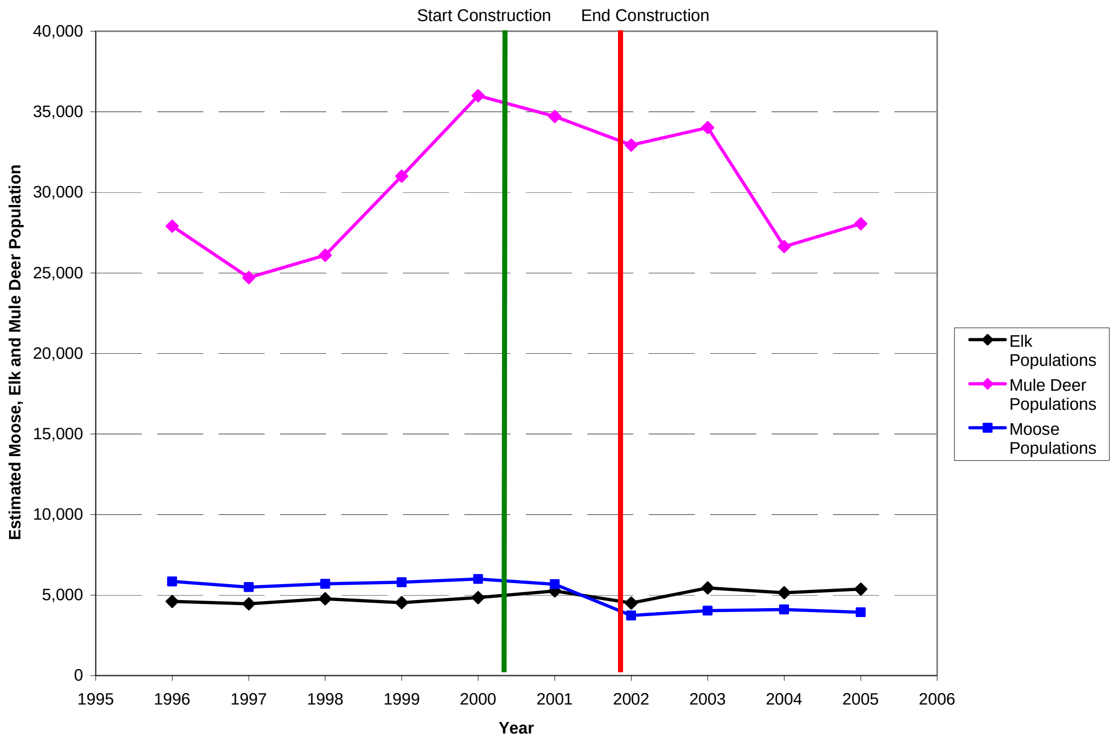

Figure 4.35 Astoria Elk Populations

Moose populations in the area are very similar to those of elk, averaging around 5,000 animals during the period observed. During the construction period, populations dropped from a peak of 6,000 animals in 2000 to a minimum of 3,726 animals in 2002. The changes in moose population can be seen in Figure 4-35.

Mule deer in this area show a large variation in population in the years 1996-2005. In 1996-1998, the deer population was near 25,000 animals. Following 1998, there is an increase in mule deer population, reaching a maximum of 36,000 animals in the year 2000. From there, the population drops, reaching a minimum of 26,600 mule deer in 2004. The changes in mule deer population can be seen in Figure 4-35.

It is also important to note that during the study period the Dog Creek Elk Feedground location was changed from a location on private property west of the roadway to forest service land. The original feedground was located very close to the highway and therefore could have an effect on the animal-vehicle collisions that occurred during the study period.

4.5.3 Traffic Data

WYDOT uses two different traffic volume zones in the area of this project. The south zone is valid for the southernmost 1.3 miles of the project. This includes the passing zone, as well as the area with the most AVCs. The northern section covers the remainder of the project, as well as the rest of US 89 to Hoback Junction. Traffic on the two sections trend very similarly, with volumes on the southern section slightly lower than the northern. Traffic on the southern section grew slightly faster than the northern. By 2004, the difference between the two sections could be considered negligible. As is demonstrated in Figure 4.36, the two segments had consistent growth between 1997 and 2004, with a combined average yearly growth of nearly 4%.

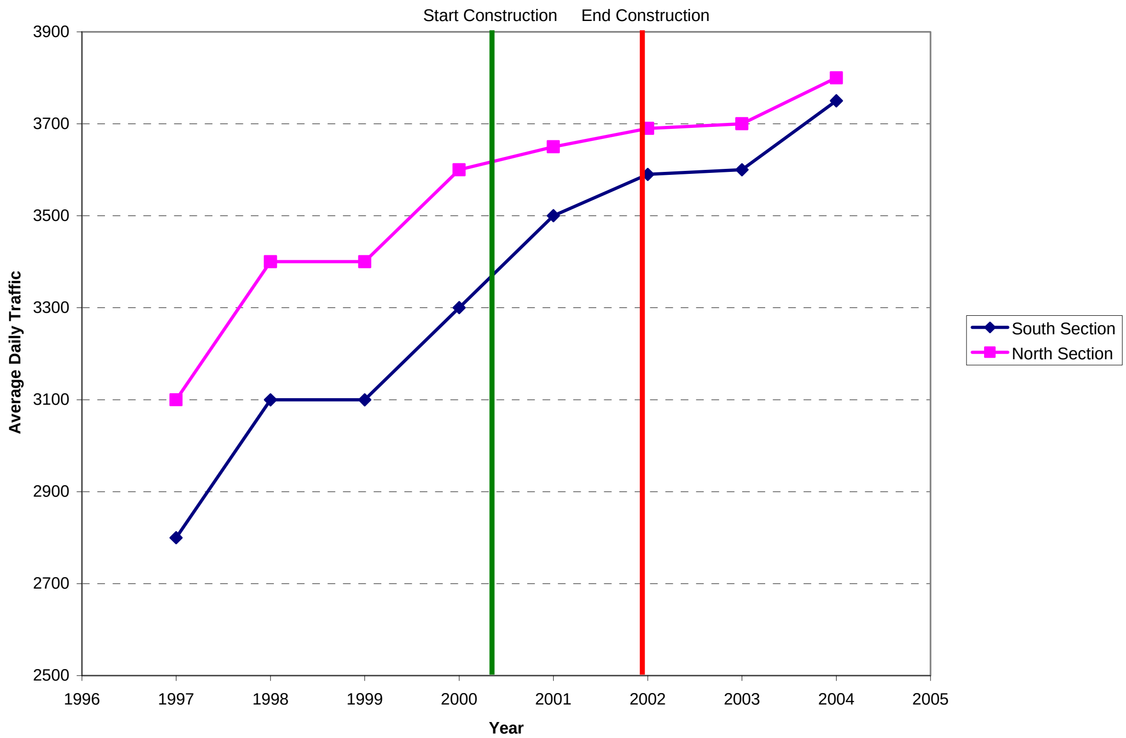

Figure 4.36 Astoria ADT

4.5.4 Speed Data

Two different types of speed data were collected for the Astoria section as part of this research effort. The first was current speed data collected at two locations on-site. The second uses Highway Capacity Manual methodology to determine changes in free-flow speed.

The speed limit in this section is posted at 55 mph. Two counters were placed within this section: one at the north end of the passing lanes, the second at the center of the project another 1.5 miles down the road from the passing zone. The counters were installed on the morning of Tuesday, August 22, 2006 and picked up two mornings later on the August 24. One of the counters shut down prior to its retrieval, most likely due to battery failure, and only collected data for the first 12 hours.

The easternmost counter was placed next to a road pull-out near the center of the project at milepost 138.9. This is in the more curvilinear section of this project. The 85th percentile speed in both directions at this location as determined by the traffic counter was 63 mph.

The westernmost counter was placed at the north end of the long passing zone at the start of the project. This site, at mile post 137.5, was within the transition between four lanes of traffic and two. This was the counter that malfunctioned prior to retrieval that only collected twelve hours of data before it shut itself down. The 85th percentile speeds from this location still compare favorably with those from the other counter. In the westbound direction, the 85th percentile speed was 61 mph. The 85th percentile speed for the eastbound direction was 64 mph. When combined the 85th percentile was 62 mph. A summary of the 85th percentile speeds can be seen in Table 4.6.

Table 4.6 Astoria 85th Percentile Speeds

	Posted Speed Limit (mph)	**Northbound Speed Average/85th Per.**	**Southbound Speed Average/85th Per.**	**Combined Speed Average/85th Per.**
Northern Counter	55	58/63	59/63	58/61
Southern Counter	55	59/64	57/61	58/62

Two small maintenance events were being undertaken in the area while the counters were in place. The bridge just beyond the east end of the project was being worked on. There is no reason to believe that this would affect the speed recorded by the traffic counters, as the first construction sign did not occur for the eastbound traffic until well after the tubes were crossed. This should not affect the speeds of either counter, however, as the disruption was small in scale and more than a mile from either counter. The second disruption was a mowing operation that appeared to cover the length of the project. The effects of this work are hard to judge, but most likely it would only cause changes in speed at the location that was being mowed at that moment.

Using lane width change from 11 to 12 feet and a shoulder width change of zero to eight feet, HCS+ determined that there would be an increase of 4.7 mph in free-flow speed following reconstruction.

4.5.5 Crash Data

In the three years prior to the reconstruction of this section, there were a total of 25 crashes, with four of these incidents involving wild animals. During construction, there were 14 total reported crashes with three related to wild animals. In the three years following the acceptance of this section there were 33 crashes, 16 involved wild animals. A display of the animal-related crashes before, during, and after construction can be viewed in Figure 4.37. A summary of the crash data can be found in Appendix B.

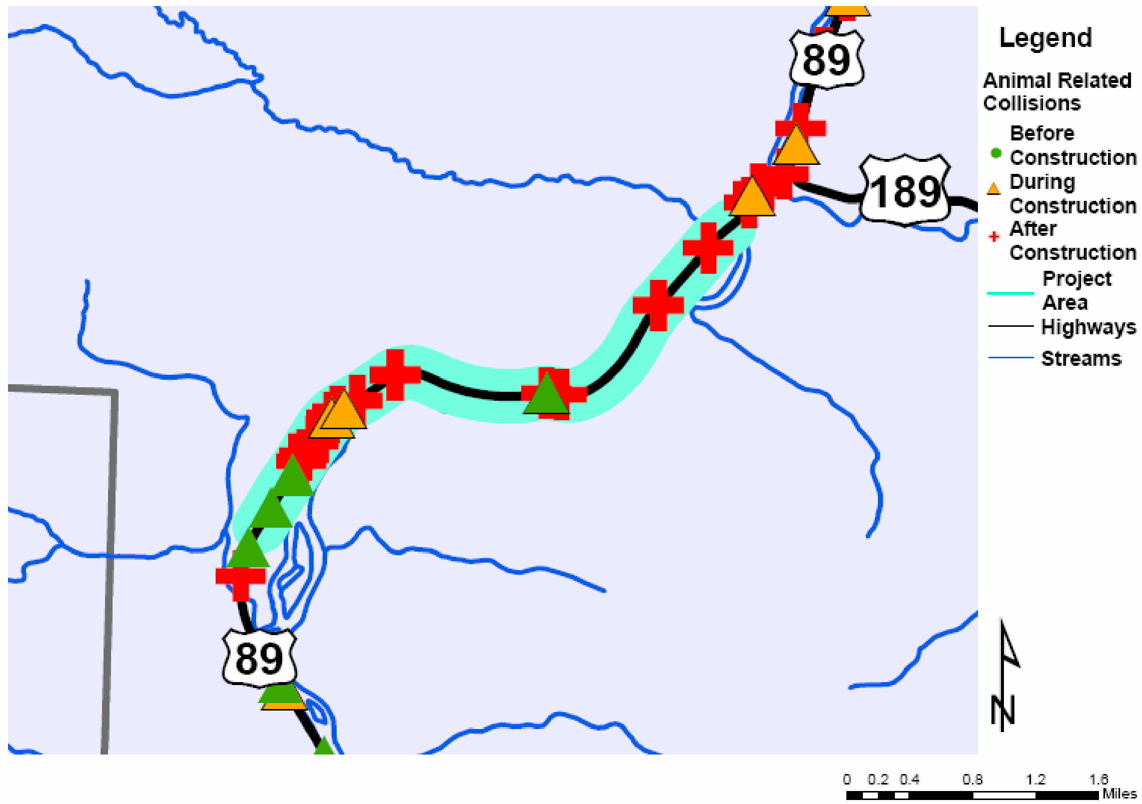

Figure 4.37 Astoria Animal-Vehicle Crashes

4.6 Round Mountain Section

The Round Mountain section of US 189 is approximately 10 miles north of the town of Kemmerer. This projected included 7.6 miles of roadway reconstruction and an additional 5.6 miles of ROW and fence work. The project starts at milepost 45.8, and the road reconstruction ends at milepost 53.4. The fencing and ROW work continues until milepost 59.0. A map of the area can be seen in Figure 4.38.

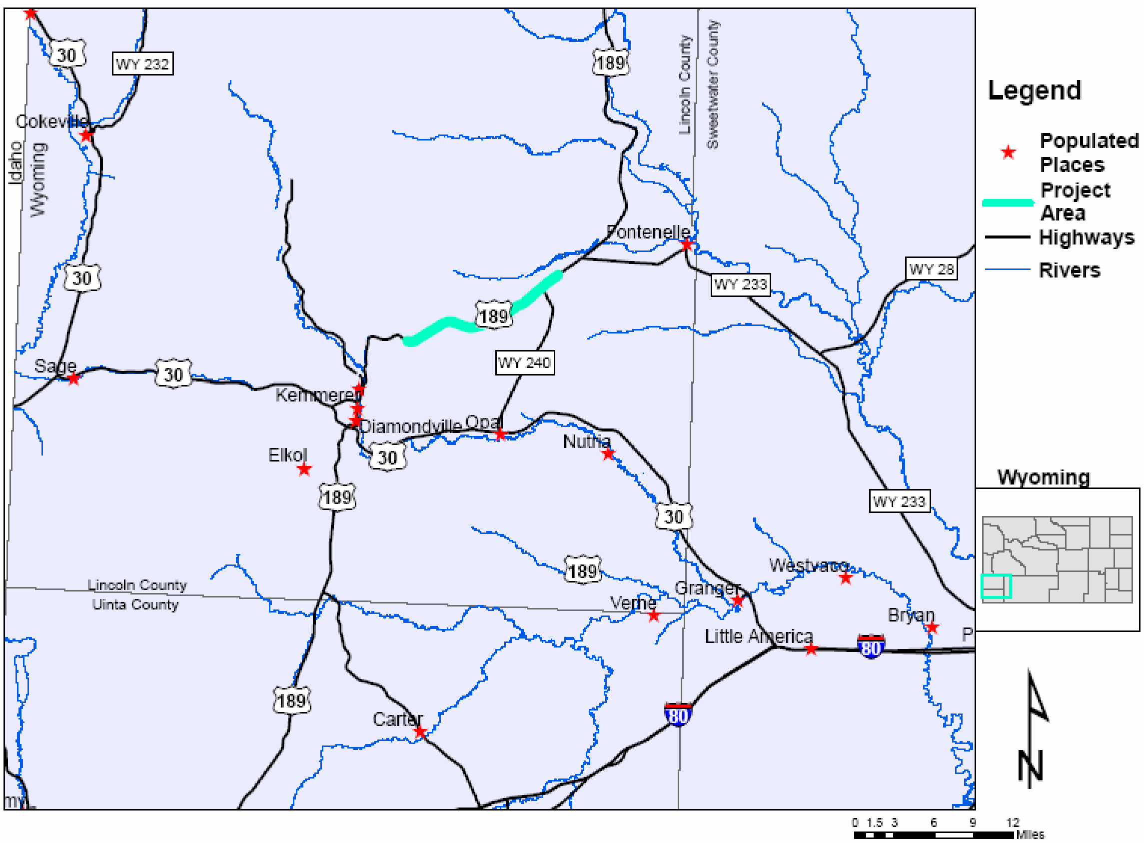

Figure 4.38 Round Mountain Section

The terrain consists of rolling hills dominated by sagebrush. There is no visible cover within sight of the highway. No bodies of water were observed from the roadway in this section. A typical view of the area can be seen in Figure 4.39.

One interesting feature of this project is that ROW fence was added for several miles to the north and east of the reconstruction. The road in this part of the project had been previously built to the same standards as the adjoining reconstruction.

Figure 4.39 Round Mountain View

4.6.1 Geometric Changes

The reconstruction project was started in April 1999 and accepted by WYDOT in October 2000. The primary purpose of this reconstruction was to add additional width to the pavement and to make minor changes to the alignment of the road.

The changes to the horizontal alignment of this road section were very minimal. Only two curves had noticeable changes. The first, near the beginning of the project, moved the new roadway to the south of the existing pavement. Throughout most of the project, the outer edge of the new pavement was coincident with the inner edge of the old pavement. The final curve of the reconstruction portion of this project then brought the two pavement surfaces back together. While some minor improvements to the vertical curvature were made, the 65 mph design speed for the reconstructed road would also be applicable to the previous design.

The existing cross section consisted of two 11-foot lanes with 2-foot shoulders. The reconstruction improved the cross section to 12-foot travel lanes and 6-foot shoulders.

There was only one major drainage structure in the entire segment, a 10-foot by 10-foot box culvert crossing a dry wash. The primary use for this structure appears to be as a stock crossing. This structure would most likely discourage deer use, as it was much smaller than the 20-foot minimum width recommended in the literature review for the use of mule deer. This point may be unimportant, as the south entrance was blocked by two vertically hung metal gates. A picture of this culvert can be seen in Figure 4.40.

Figure 4.40 Round Mountain Crossing

From the high frequency and wide distribution of cattle related crashes prior to construction, it was assumed that there was no ROW fencing throughout the section. This was confirmed by the maintenance foreman of Kemmerer (Bowen, Personal Correspondence). As part of the project, fencing of a type not listed on the plans was added throughout the segment. Comparing pictures taken from the site to the WYDOT standard plans indicates that the new fence is WYDOT Type E, with a height of 45”, four-wire strands and a barbless bottom wire. (See Appendix A for fencing details.) A close-up of a typical fence found on this project can be viewed in Figure 4.41.

Figure 4.41 Round Mountain Fencing

4.6.2 Wildlife Data

Wyoming Game and Fish identifies two different game species that occupy this area. The mule deer herd is referred to as the Wyoming Range Herd, while the Pronghorn population was broken down into two herds until 1998. Prior to 1998, the two herds were the Sublette Herd and the West Green River Herd. In 1997, Game and Fish combined the West Green River Pronghorn herd and the Sublette Herd, and following this, only the Sublette name is used. The two herd units now used can be seen in Figure 4.42.

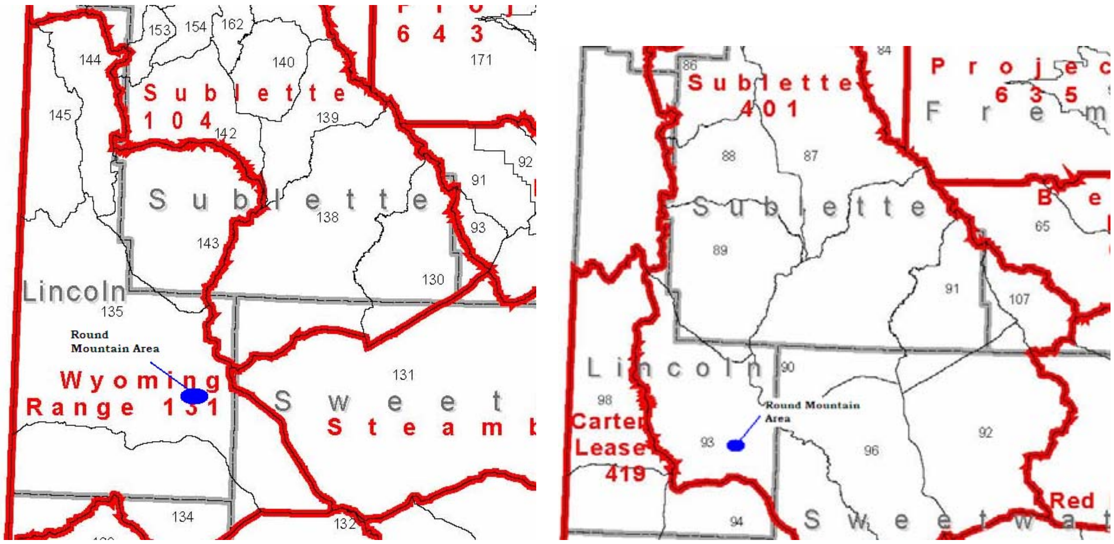

Figure 4.42 Round Mountain Herd Units
Wyoming Range Mule Deer Herd (left) and Sublette Pronghorn Herd (right)

Mule Deer Populations in the Wyoming Range Herd experienced much variation between the years 1995-2005. The first several years saw populations averaging around 35,000 animals. In 1998 and 1999, the population grew quickly, reaching a maximum estimated population of almost 48,000 animals. By 2004, however, the population had dropped to under 30,000 animals. The changes in mule deer population can be seen in Figure 4.43.

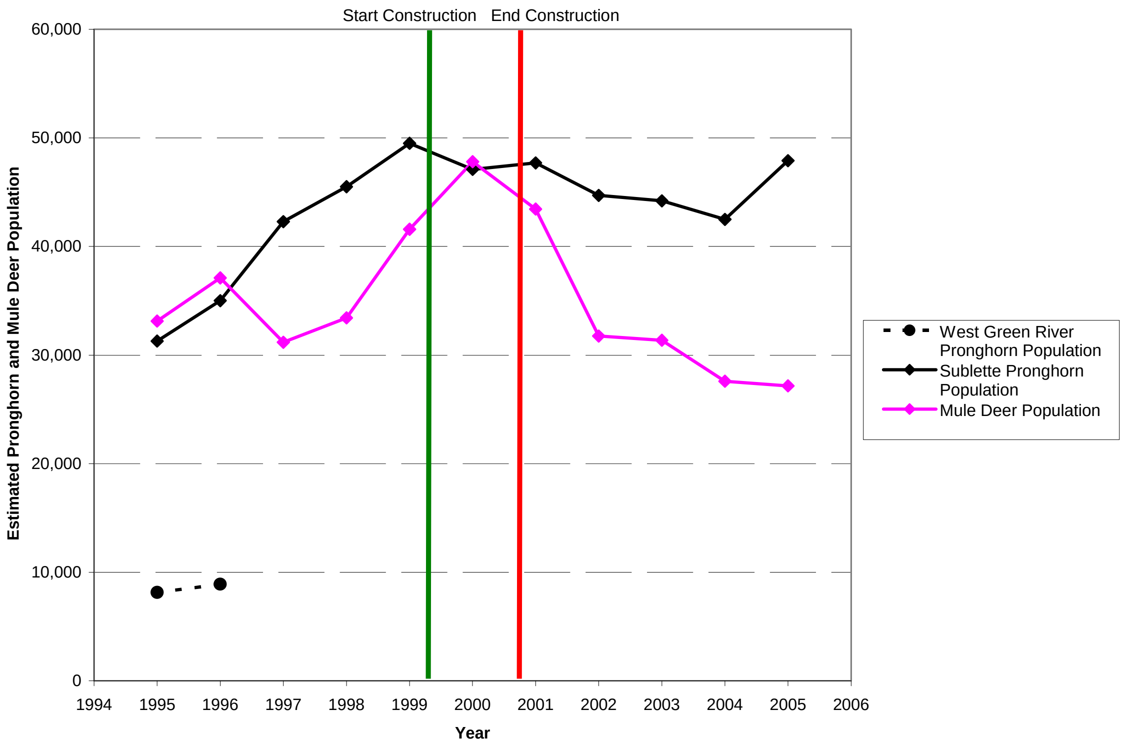

Figure 4.43 Round Mountain Mule Deer Population

The pronghorn antelope population in the Round Mountain Area was broken down into two herds through 1996. In 1997 the West Green River Herd was combined with the Sublette Herd, and following this, the area is covered exclusively by the Sublette herd. This could explain the large jump in population for the Sublette herd in 1997.

The population of pronghorn in this area is stable, varying between 40,000 and 50,000 animals. The population increased until 1999, and from there the trend is generally decreasing. The changes in antelope population can be seen in Figure 4.43.

4.6.3 Traffic Data

The years prior to and during construction saw almost constant traffic volumes, as can be seen in Figure 4.44. Following the reconstruction, traffic volumes were more variable, but showed a generally increasing trend.

Figure 4.44 Round Mountain ADT

4.6.4 Speed Data

Two different types of speed data were collected for the Round Mountain section as part of this research effort. The first was current speed data collected at two locations onsite. The second uses Highway Capacity Manual methodology to determine changes in free-flow speed.

The posted speed limit throughout this section is 65 mph. Two traffic counters were installed on Monday, August 21, 2006, to find the speed of vehicles. The counters were retrieved two days later on August 23. The first was placed near the center of the reconstruction portion of this project, the second at the dividing line between the reconstruction portion and the area consisting only of ROW work.

The first counter was placed 1.6 miles from the start of the reconstruction work at milepost 47.4. The road in this location is straight with a slight upward grade traveling east. The 85^{th} percentile speed going east was 79 mph, while the speed in the westbound direction was 76 mph. The combined 85^{th} percentile speed for both directions was 78 mph. This is significantly higher than the posted limit of 65 mph.

The second counter was placed within a tenth of a mile of the boundary between roadway reconstruction and ROW-only work at milepost 58.9. This part of the roadway section consists of sweeping horizontal curves over rolling hills. The 85^{th} percentile speeds are similar to those found at the western counter. In the eastbound direction the 85^{th} percentile was 78 mph, while in the westbound direction it was 73 mph. The combined 85^{th} percentile speed was 76 mph. The speeds observed in this section can be seen in Table 4.7.

Table 4.7 Round Mountain 85^{th} Percentile Speeds

	Posted Speed Limit (mph)	**Northbound Speed Average/85th Per.**	**Southbound Speed Average/85th Per.**	**Combined Speed Average/85th Per.**
Northern Counter	65	71/78	68/73	70/76
Southern Counter	65	71/79	70/76	70/78

Using Highway Capacity Manual methodology and the HCS+ software program, changing the roadway from 11-foot lanes and 2-foot shoulders to 12-foot lanes and 6-foot shoulders would increase the free-flow speed of the roadway by three mph.

4.6.5 Crash Data

In the three years before the reconstruction project started, there were 33 crashes within the area to be reconstructed. The number of crashes increases to 37 if the area of fence installation is also included. Of these, three and four crashes, respectively, were associated with wild animals. Of the remaining crashes, 21 were vehicle-cattle crashes over the length of the entire project. During construction, there were three crashes within the entire project, two of these occurring in the reconstruction zone. None of the three crashes involved wild animals or cattle, but one involved a horse. In the three years following the construction work, there were 10 crashes in the reconstruction zone and 16 when the fence work area was included. When only the wild animal related crashes are considered, there were four and six crashes, respectively. During this time period, there were no records of cattle being hit. The AVC records are graphically represented in Figure 4.45. A summary of the crash data can be found in Appendix B.

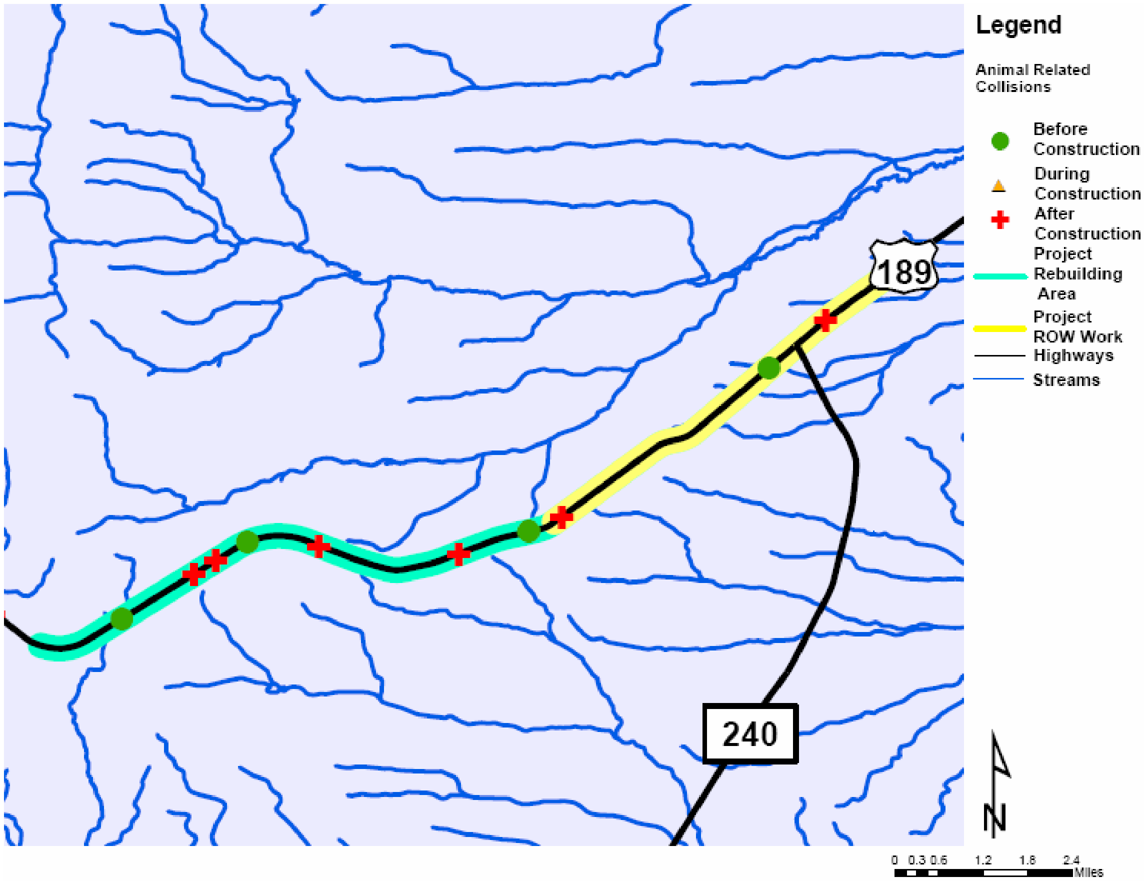

Figure 4.45 Round Mountain Animal-Vehicle Crashes

4.7 Torrington West Section

The Torrington West section is a combined section of US 26 and US 85 running between the towns of Lingle and Torrington in the southeast part of Wyoming. The length of this project is 8.33 miles, extending from milepost 94.6 to milepost 102.93. A map of the area can be seen in Figure 4.46.

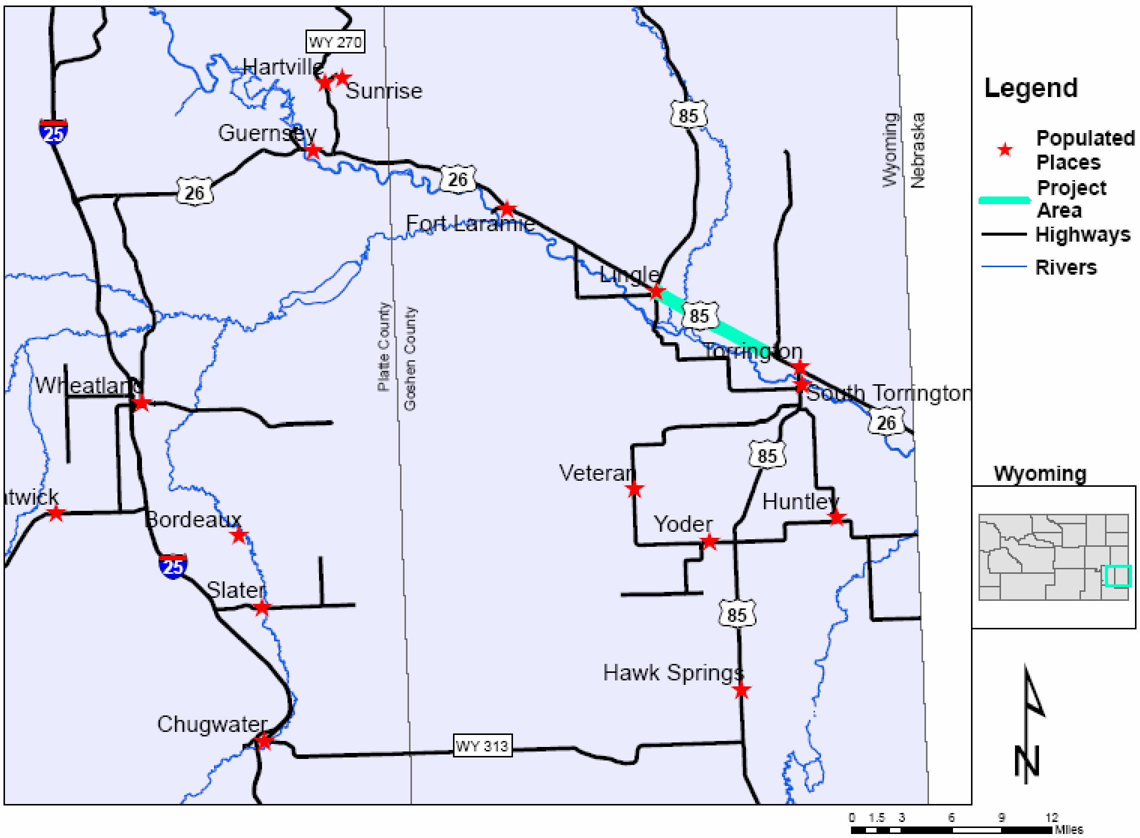

Figure 4.46 Torrington West Section

This section of highway is notable because it was rebuilt with two lanes in each direction. Throughout the segment, there is also a 12-foot wide, center, two-way left turn lane, making the roadway five lanes in width. The segment starts on the outskirts of Torrington at mile marker 94.6. The first two miles have a posted speed limit of 45 mph and contain a couple of larger radius sweeping turns. Following this, there are two miles posted with a 55 mph speed limit. This part of the highway is straight. Both the 45 and 55 mph sections of the highway contain curb and gutter. According to Buck Klemola, WYDOT resident engineer for the region, the 45 and 55 mph posted sections were chosen to decrease the probability for errant vehicles to "trip" when striking the curb and gutter. The remaining portion of the highway in question has a posted speed limit of 65 mph and is straight. Two typical views of this section can be seen in Figure 4.47.

Figure 4.47 Torrington West Views
US 85 Looking East 1 Mile East of Lingle (left) and US 85 Looking East within the Curbed 55 mph Section (right)

The highway runs adjacent to a single track railroad located immediately to the south of the highway ROW. The North Platte River flows parallel to the highway, approximately one mile to the south. In the 65 mph section to the east of Lingle, there are irrigated fields on both sides of the highway. Within the 55 mph section, the area adjacent to the south side of the highway contains similar fields, with single family homes and horse properties to the north. The adjacent terrain on both sides of the 45 mph section is similar to the north side of the 55 mph section, with some light industry in isolated areas.

4.7.1 Geometric Changes

This project started in October 1997 and was accepted by WYDOT in December 1999. While few alignment changes were made, the cross section of the road was changed dramatically.

Traveling east, the centerline of the new road is located along the center of the west bound lane of the previous alignment for the first five miles of the project. From there to the end of the project, the centerlines of the two pavements are in the same approximate location.

The previous road was a two-lane highway, while the new alignment has two lanes in each direction with a center median lane. The typical section of the existing road given in the reconstruction plans was not specific about lane markings, only stating that there were 14 feet of pavement in each direction. The most logical division is to have 12-foot lanes with 2-foot shoulders.

For the reconstructed roadway, the first half mile traveling east acts as a transition from a four-lane road with curb and gutter and no median within Lingle, to a section which has no curb and gutter but adds a center lane as it travels east. The next five miles towards Torrington contain 12-foot lanes (including the center lane) and 6-foot shoulders. The speed limit is 65 mph in this area. The last three miles of this section have the same dimensions, but curb and gutter is added to the roadway. The speed limit is 55 mph through most of this section, dropping to 45 mph near the end.

There is only one stream crossing within the segment, Rawhide Creek, which is located at milepost 101.77, one mile east of Lingle. While the bridge span is more than 30 feet long, the maximum height above the surface of the water is approximately six feet. This would make this a borderline structure for use by mule deer, especially due to the fact that this 6-foot height is achieved for only the 10-foot width of the creek. While the predominant species in this area is white-tailed deer, the small passage useable in this structure would likely preclude any big game use. A view under this bridge can be seen in Figure 4.48.

Figure 4.48 Rawhide Creek Bridge

The fencing throughout this section is varied. Several types of fencing were installed on the north side of the ROW. There was existing barbed wire fence through the entire 65 mph portion of this section, replaced mostly with WYDOT type F (48" high with four strands of barbed wire) fencing. See Appendix A for fencing details. Other types of 48" fencing, including some woven wire fencing, were also used in short stretches.

The south side of the ROW did not see any fencing changes as a result of construction. However, almost all of the south side has fencing on the far side of the railroad track.

4.7.2 Wildlife Data

Wyoming Fish and Game identifies two big game species in the Torrington to Lingle corridor: mule deer and white-tailed deer. Prior to 1998, each species had two or three herds located in this area. Mule deer were grouped into three herd units: Goshen Rim, Muskrat, and Goshen Hole. From 1998 onward, all mule deer were part of the Goshen Rim Herd. White-tail deer were organized into two herds prior to 1998, the Southeast Wyoming Herd and the Laramie River Herd. These herds were combined under the name Southeast Wyoming Herd. The current herd boundaries can be viewed in Figure 4.49.

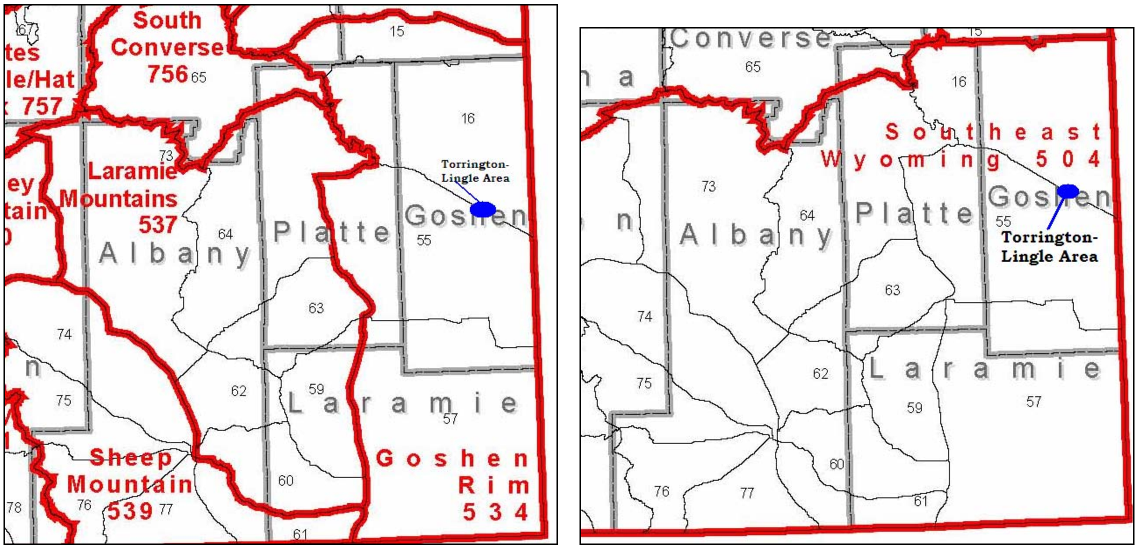

Figure 4.49 Torrington West Herd Units
Goshen Rim Mule Deer Herd (left) and Southeast Wyoming White-Tailed Deer Herd (right)

Mule deer populations prior to 1998 were organized into three units: Goshen Rim, Muskrat, and Goshen Hole. Note, as shown in Figure 4.50, that there was no data for the Goshen Rim section for the years 1996 and 1997. For the year 1998 and after, the three units were combined into the Goshen Rim Herd Unit.

An exact trend is hard to determine, but it appears that mule deer populations in the area have been growing from the years 1998-2004. Total mule deer numbers are impossible to determine in 1996 and 1997, as no data is available for the Goshen Rim unit in this period.

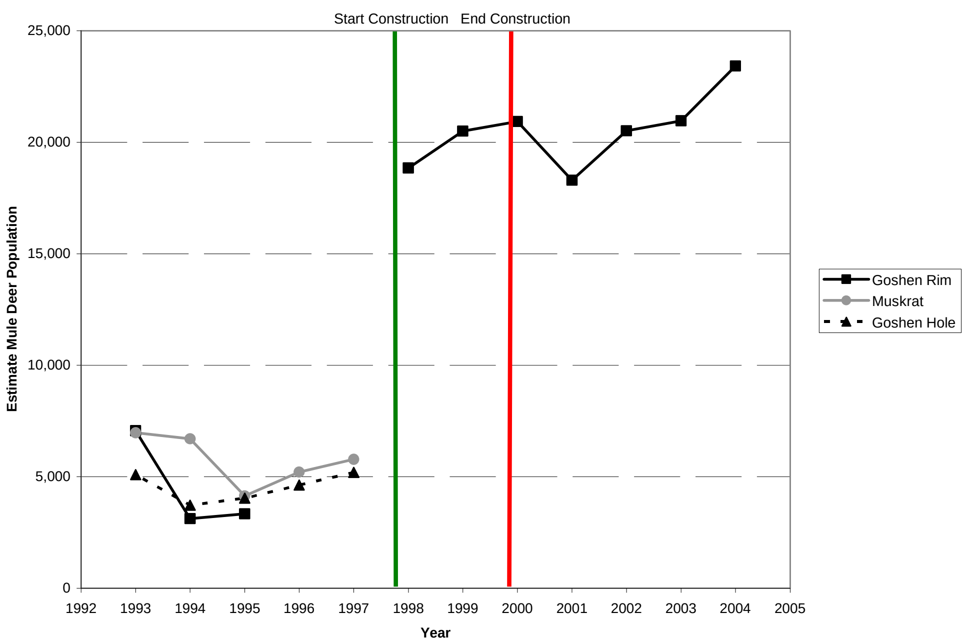

Figure 4.50 Torrington West Mule Deer Population

White-tailed deer population trends cannot be determined, as no data exists for either herd unit after 1995. For the year 1994, Wyoming Game and Fish estimated 1,256 deer in the Laramie River unit and 3,697 in the Southeast Wyoming Herd. This is a total of 4953 animals. In the year 1995, estimates for the Laramie River Herd were 1,258 deer and 3,635 deer in the Southeast Wyoming Herd. This is a total of 4,893 animals, a slight decrease from the year before.

4.7.3 Traffic Data

WYDOT collects traffic volume data for three sections in this area, each section covering about one third of the project. As can be seen in Figure 4.51, the east zone has the highest volume, as it is the closest to Torrington. The volumes become lower as the distance from Torrington increases. In general, traffic volumes for all three sections are almost constant through the end of the reconstruction project. After the end of construction there is a small increase in traffic in all the zones.

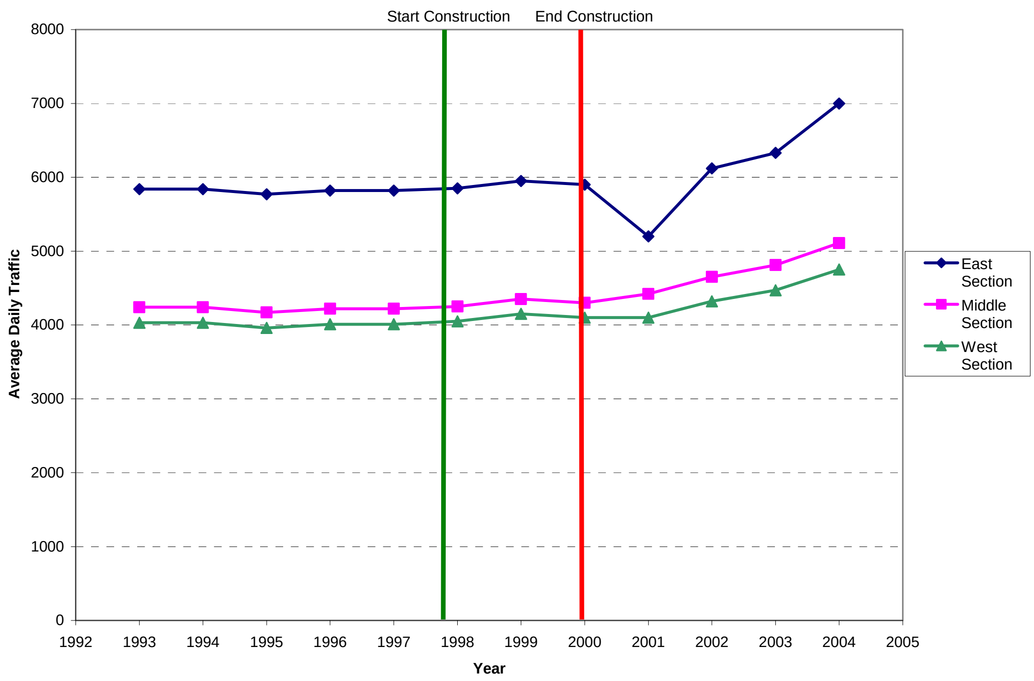

Figure 4.51 Torrington West ADT

4.7.4 Speed Data

Three different types of speed data were collected as part of this research effort. The first are the results of a speed study performed by WYDOT in 1993. The second is speed data collected as part of this research effort. The final information collected is the differences in free-flow speed as estimated through the Highway Capacity Manual (HCM).

A speed study was performed by WYDOT between July 6 and 7 in 1993. Only the counter at MP 97.95 was within the project boundary. The speed limit, which at that location was 55 mph, has now been raised to 65 mph. Table 4.8 shows the results of the speed study.

Table 4.8 WYDOT Speed Study

	Posted Speed Limit (mph)	Average Speed (mph)	50% Percentile Speed (mph)	85% Percentile Speed (mph)
MP 95.43 WB/NB	40	45.5	43	51
MP 95.43 EB/SB	40	43	40	47
MP 97.95 WB/NB	55	58.1	56	64
MP 97.95 EB/SB	55	55.4	53	60
MP 102.7 WB/NB	30	38.8	36	43
MP 102.7 EB/SB	30	36.9	35	40

As this was a four-lane section of highway, four traffic counters were placed in pairs at two locations within the project. One counter was used for each direction of traffic. The first set was placed flanking the bridge crossing Rawhide Creek (milepost 101.79). The second set was placed approximately one mile to the east of the location where the speed limit was lowered from 65 mph to 55 mph (milepost 96.7). The counters were placed on Monday, September 18, 2006, and retrieved on the September 21.

The eastern counters were placed in the 55 mph zone. The 85th percentile speeds for eastbound and westbound respectively were 61 mph and 59 mph. The combined 85th percentile speed was 60 mph.

The western counters were placed the 65 mph zone. The 85th percentile speeds for eastbound and westbound respectively were 65 mph and 69 mph. The combined 85th percentile speed was 67 mph. A table summarizing the 85th percentile speeds can be seen in Table 4.9.

Table 4.9 Torrington West 85th Percentile Speeds

	Posted Speed Limit (mph)	Westbound Speed Average/85th Per.	Eastbound Speed Average/85th Per.	Combined Speed Average/85th Per.
Eastern Counters	55	54/59	56/61	55/60
Western Counters	65	65/69	60/65	63/67

The differences in free-flow speed were estimated using HCM methodology and the HCS+ software program developed by Mc Trans. The highway was upgraded from two 12-foot lanes and 2-foot shoulders to a highway containing four 12-foot lanes, 6-foot shoulders and a continuous 12-foot two-way left turn lane. According to HCS+, this would yield a change in free-flow speed of 2.6 mph.

4.7.5 Crash Data

A full three-year period of crash data could not be utilized due to the fact that WYDOT does not have a compatible computerized database of crash records prior to 1995 and that a three-year period would go two months into 1994. Therefore, the post-construction period was shortened by two months to match the pre-construction period. This section had a total of 67 recorded accidents in the pre-construction period from January 1, 1995, through October 13, 1997. Eleven of these crashes were related to deer. During construction there was a total of 54 reported crashes, 11 of which involved deer. In the post-construction period, there was a total of 72 crashes, and 11 of those were related to deer. A map showing the locations of the AVCs can be seen in Figure 4.52.

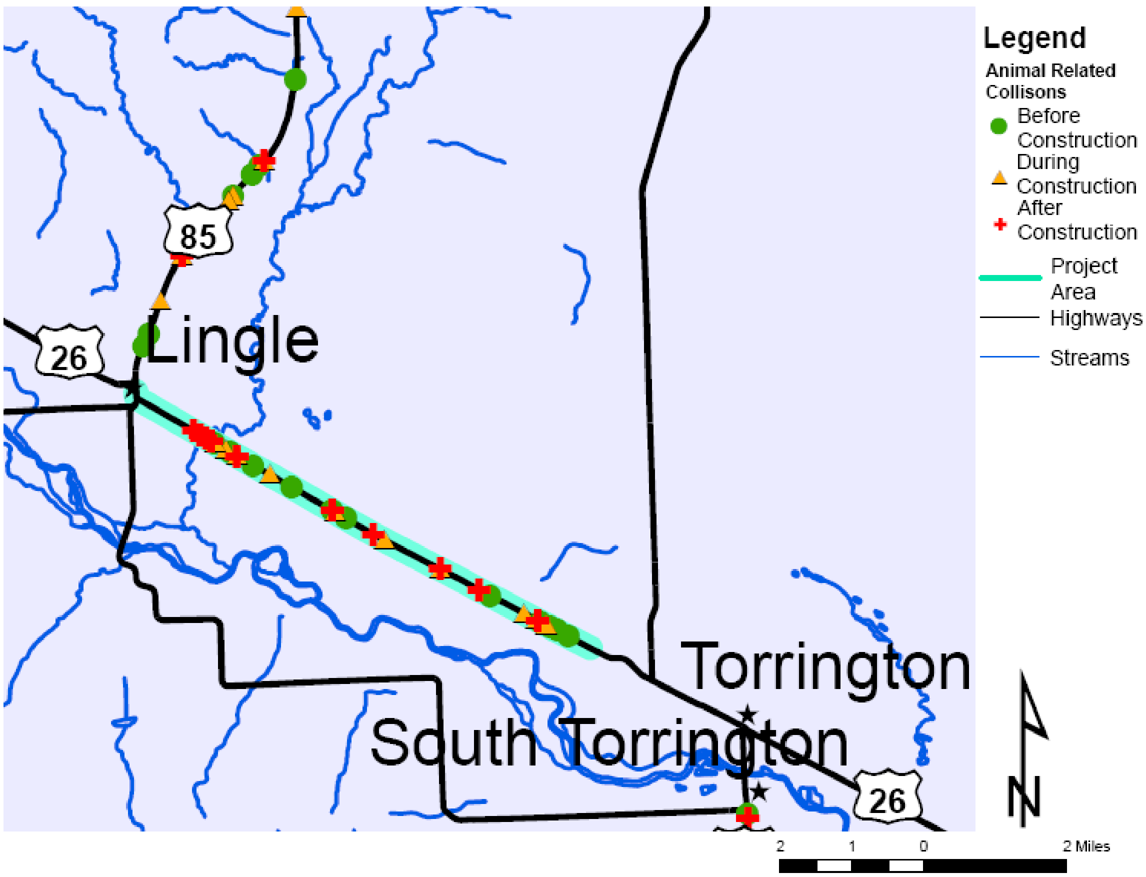

Figure 4.52 Torrington West Animal-Vehicle Crashes

5. ANALYSIS AND RESULTS

This chapter describes the work performed to statistically examine and draw conclusions about the seven reconstruction sections studied in this research effort. This is performed both by analyzing the data as a whole and at each section individually.

Three different approaches are taken to analyze the data. The first is to determine whether general trends in crash rate can be determined by looking at the seven reconstruction projects as a whole. The second was to use the aggregated data for all projects to determine whether specific roadway attributes can be identified as having a significant role in the crash rate associated with wild animals. The final analysis attempts to find whether any statistically significant conclusions can be made about individual reconstruction sections.

5.1 Aggregate Analysis of Crash Rates

One way of examining the data is to look at the reconstruction projects as a group to determine what information can be found. This aggregate analysis consists of the crash rates determined for each of the sections as a single entity. This data can be seen in Appendix H. The rates in this analysis are in terms of crashes per Million Vehicle Miles Traveled (MVMT). The aggregate of each of the seven study locations is examined using a paired t-test. This is performed to determine whether there is a statistically significant change in crashes, both wild-animal related and unrelated.

5.1.1 Methodology

The paired t-test relates groups of data in which the before and after data points for a particular roadway section are associated with each other. The method accomplishes this by comparing the changes in rates, rather than the rates themselves. A standard independent sample t-test would treat each of the before-after rate pairs as individual samples, rather than related rates. Due to this fact, a standard t-test would not recognize the before-after properties of this data.

The hypothesis used in this analysis is that crash rates do not change as a result of construction. Values of the t-statistics determined to be different than zero indicate that that this null hypothesis can be rejected. As there are seven data points corresponding to the seven project sections, there are n-1, or six, degrees of freedom. Using an alpha value of 0.05, the t-value must be equal to or greater than 2.447 to indicate that the changes are statistically significant at a confidence level of 95%, using a two-tailed test. The alpha value is the probability of committing a type I error, which is where the null hypothesis is rejected when in fact it is true.

Four different paired t-tests were performed on the crash rate data determined as part of this research effort. The first is a comparison of wild-animal related crashes in the before and after reconstruction periods. The second test is similar to the first, but also factors in the population density of wild animals in each of the regions. The third test compares all collisions other than those related to wild animals, before and after reconstruction. The final t-test compares changes in the overall crash rate for each of the reconstructed sections.

5.1.2 Wild-Animal Crash Rate

As was previously mentioned, the 14 rates, two from each of the seven reconstruction projects evaluated, were arranged in before and after pairs. The differences between the rates were then taken and the t-statistic determined for these changes. The results can be seen in Table 5.1.

Using n-1, or six, degrees of freedom, the t-value of 2.82 obtained is significant to the 0.03 level. The mean of the differences is greater than zero to a confidence level of 0.97 or 97%. From this, it can be reasonably stated that animal-vehicle crash rates increased in these sections following the reconstruction effort.

Table 5.1 Wild Animal t-Test

	Before Rate*	After Rate*	Diff. in Rate	(Diff. in Rate)^2
Centennial East	1.9485	3.4396	1.4911	2.2234
Morton Pass	0.0000	0.4747	0.4747	0.2253
Clearmont North	0.4402	1.2004	0.7602	0.5779
Hanging Rock	0.2087	0.4017	0.1930	0.0372
Astoria	0.2790	0.9780	0.6990	0.4886
Round Mountain	0.6565	0.7940	0.1375	0.0189
Torrington West	0.2856	0.3069	0.0213	0.0005
		Mean of diff.	0.5395	
		SSdiff.	1.5341	
		s^2	0.2557	
		σMd	0.1911	
		t -stat	2.8230	

*All rates calculated in Animal-Vehicle Crashes per Million Vehicle Miles Traveled.

5.1.3 Wild-Animal Crashes Using Animal Populations

The previous analysis does not factor in changes in animal population, which may have an effect on the number of crashes occurring on a given section. It would be expected that if animal populations increase, the number of animal-vehicle collisions will increase regardless of any roadway factors. Because this research effort is attempting to isolate the impacts of roadway factors on animal-vehicle crashes, it is necessary to try to remove the animal population effects. The method selected for accounting for animal population effects is to use herd population data provided by the Wyoming Game and Fish Department (WGF). As the herd data varies widely among the projects with regard to area, animal population density (animals/square mile) was used rather than the straight population numbers. The area of each of the herds was determined using ArcGIS shapefiles provided by WGF. The animal population data are described for each project in Chapter 4, and the complete animal population dataset can be seen in Appendix D. To account for animal populations, the wild-animal crash rates are divided by the population density of animals for each of the sections. The results of this analysis can be seen in Table 5.2.

The t-statistic of this analysis is somewhat lower than that of the initial analysis at 2.68, but still indicates a confidence level of 0.96 that the mean of the change is greater than zero. This indicates that the reconstruction efforts may have led to an increase in animal-vehicle collisions even when changes in animal herd numbers are accounted for.

Table 5.2 Ratio of Wild Animal Crash Rate to Animal Population Density t-Test

	Before Rate*	Animal Population Density	Before Ratio	After Rate*	Animal Population Density	After Ratio	Difference in Rate	(Diff. in Rate)^2
Centennial East	1.9485	11.0156	0.1769	3.4396	15.7830	0.2179	0.0410	0.0017
Morton Pass	0.0000	14.6687	0.0000	0.4747	13.0431	0.0364	0.0364	0.0013
Clearmont North	0.4402	10.9752	0.0401	1.2004	11.6162	0.1033	0.0632	0.0040
Hanging Rock	0.2087	7.5556	0.0276	0.4017	7.5419	0.0533	0.0256	0.0007
Astoria	0.2790	12.1628	0.0229	0.9780	13.1622	0.0743	0.0514	0.0026
Round Mountain	0.6565	10.1496	0.0647	0.7940	10.5915	0.0750	0.0103	0.0001
Torrington West	0.2856	2.8561	0.1000	0.3069	4.0091	0.0765	-0.0235	0.0005
						Mean of diff.	0.0292	
						SSdiff.	0.0050	
						s^4	0.0008	
						σMd	0.0109	
						t-stat	2.6819	

*All rates calculated in Animal-Vehicle Crashes per Million Vehicle Miles Traveled.

5.1.4 Non-Wild Animal Crash Rate

A second point of interest in regard to these reconstructed sections is how the crashes other than those associated with wild animal-vehicle changed. An analysis similar to the first is performed, using the crash rates of the other collisions. The results are tabulated in Table 5.3.

The t-statistic for this analysis is -2.40, yielding a 94.7% confidence interval that the mean of the difference of non-wild-animal collisions is different than zero. This is just shy of the accepted 0.05 convention typically used in statistics, but still can be considered rather significant in this case. The negative sign of the t-value indicates that the non-wild-animal related crash rate on these sections was lowered, rather than increased.

Table 5.3 Non-Wild Animal Crash Rate t-Test Overall Crash Rate t-Test

	Before Rate*	After Rate*	Diff. in Rate	(Diff. in Rate)^2
Centennial East	3.8971	1.4741	-2.4229	5.8706
Morton Pass	5.7534	1.1867	-4.5667	20.8545
Clearmont North	2.2011	0.4802	-1.7210	2.9618
Hanging Rock	0.3479	0.4017	0.0538	0.0029
Astoria	1.4649	1.0392	-0.4258	0.1813
Round Mountain	6.5646	1.1910	-5.3736	28.8756
Torrington West	1.4540	1.7018	0.2478	0.0614
		Mean of diff.	-2.0298	
		SSdiff.	29.9686	
		s^2	4.9948	
		σMd	0.8447	
		t -stat	-2.4029	

*All rates calculated in Animal-Vehicle Crashes per Million Vehicle Miles Traveled.

5.1.5 Total Crash Rate

The final way that the rates of the individual sections are analyzed is by comparing the total crash rates for each of the sections. The results of this analysis can be seen in Table 5.4.

As with the crash rate involving other types of crashes, the negative sign of the t-value indicates that the crash rate was lowered. A t-value of -1.75 would be statistically significant to the alpha = 0.13 level or 87% confidence. This does not meet either the conventional alpha value of 0.05 or the more liberal alpha value of 0.1, but does seem to indicate a relationship between roadway reconstruction and overall crash rate, trending in a downward fashion.

Table 5.4 Overall Crash Rate t-Test

	Before Rate*	After Rate*	Diff. in Rate	(Diff. in Rate)^2
Centennial East	5.8456	4.9138	-0.9318	0.8683
Morton Pass	5.7534	1.6614	-4.0920	16.7444
Clearmont North	2.6414	1.6806	-0.9608	0.9232
Hanging Rock	0.5567	0.8035	0.2468	0.0609
Astoria	1.7440	2.0172	0.2733	0.0747
Round Mountain	7.2210	1.9849	-5.2361	27.4165
Torrington West	1.7396	2.0087	0.2691	0.0724
		Mean of diff.	-1.4902	
		SSdiff.	30.6151	
		s^2	5.1025	
		σMd	0.8538	
		t-stat	-1.7455	

*All rates calculated in Animal-Vehicle Crashes per Million Vehicle Miles Traveled.

5.1.6 Results

Four tests were performed to determine whether the seven reconstruction sections examined had statistically significant changes in crash rates involving wild animals, ratios of wild animal crash rates to animal densities, crashes not involving wild animals, and overall crash rate. Table 5.5 summarizes the results of these four tests.

Table 5.5 Summary of t-Tests

Test	Change	Confidence Level
Wild Animal Crash Rate	Increase	97%
Wild Animal Crash Rate/Animal Density	Increase	96%
Other Crash Rate	Decrease	95%
Total Crash Rate	Decrease	87%

As seen in Table 5.5, it can be stated with statistical significance that the wild animal crash rates increased while all other crashes decreased on the seven sections in question. The somewhat lower confidence level in that total crash rates decreased may be explained by the fact that animal-vehicle crash rates increased while the rate of the other crashes decreased.

5.2 Roadway Attribute Analysis

To determine what attributes of the reconstruction efforts may have had a discernable effect on the wild-animal crash rate, a single variable regression analysis was performed for six different variables. These include the effects of animal population, design speed, lane width, shoulder width, overall pavement width, and the estimated design speed reduction due to lane and shoulder width changes. This type of analysis explores the possible relationship between the response variable (crash rate) to each of the roadway factors. This is done by establishing a linear relationship between the predictors and the response, then determining how significant the relationship is. Being linear, the equation takes the form of:

$$y= mx_1 + mx_2 + \dots +mx_j +b$$

Chapter 4 and Appendix I describe the variables and the values for each of the seven projects. This analysis is accomplished with two tasks. The first is the creation of individual regression models for each of the potential roadway attributes, in an effort to identify those attributes most important in determining the likelihood of wild-animal collisions. The second is the building of a single regression model, using the features that have the most impact on wild-animal collisions.

5.2.1 Methodology

A single variable regression analysis is performed with each of the six variables against the wild-animal related crash rate to see if any one of these variables distinguishes itself as worthy of further analysis. The small sample size also limits the validity of multiple regression analysis. The data entered for each of the variables can be seen in Appendix I. Table 5.6 lists the R^2 value and t-statistic of each of the variables tested in the first two columns under Crash Rate. The R^2 value is a representation of the correlation between the predictor and response variables. It is a function of the error between the individual data points and the prediction model. The closer the R^2 value is to 1.0, the better the correlation of the data is to the predictive model. The t-statistic of the slope is generally used to determine whether the correlation is due to the predictive capabilities of the model or simply due to chance. The use of many single linear regressions for the variables limits the usefulness of the t-values as a quantifiable statistic; however, the relative values for each variable are useful as a measure of comparison. In this way, the importance of the individual variables can be compared in a qualitative fashion.

Table 5.6 Summary of Single Variable Analysis

	Crash Rate		Crash Rate w/Animal Population Density	
	R^2	t-value	R^2	t-value
Animal Density	0.290	2.218	NA	NA
Design Speed	0.213	1.804	0.430	3.011
Lane Width	0.067	0.929	0.122	1.292
Shoulder Width	0.084	1.051	0.072	0.962
Pavement Width	0.002	0.148	0.027	1.232
Design Speed w/ HCM Reductions	0.226	1.871	0.428	2.99

After the initial analysis, it was clear that the most important factors were the population density of the herds and the design speeds associated with each of the reconstruction projects.The herd data was not one of the study objectives important to this research effort, and an attempt to remove this factor from consideration was made. This is accomplished by dividing the crash rate by the population density of each of the projects, in the same manner as the previous analysis. This ratio is then used as the predictor variable for an additional single variable regression. The results of this can be seen in the last two columns of Table 5.6 under Crash Rate with Animal Population Density.

5.2.2 Model Building

The final task was to build a model, using the variables previously discussed, that predicts the data in the best fashion. To accomplish this, a statistical analysis software package, SAS, is used to perform a stepwise regression analysis. This process adds the most significant variable to the model, provided the variable is significant to an alpha value supplied by the user. It then checks that all variables currently in the model are significant to a second user-supplied alpha value. This is repeated until no more significant variables according to the entry alpha are available, and all variables in the model are still considered significant to the level specified by the retention alpha.

Several different attempts at modeling speed are performed with this data. The first uses only the design speed of the reconstructed project and the estimated design speed calculated for the previous design of each section. The second uses the same design speeds as the first method, reducing the design speeds by the lane and shoulder reduction calculated using HCM methodology. The third method uses the recorded contemporary speeds for the after speeds, adding the same percent change experienced between the new design speed and the new actual speeds to the old design speed. The last method is similar to the third, but uses changes in mph rather than percent difference. The first two methods are able to explain much more of the variation in animal-vehicle crash rate than the last two, and the third and fourth methods are excluded from further analysis.

The initial model was created using an alpha value of 0.5 for both model entry and retention. This corresponds with a confidence interval of 50%. Using the data presented in Appendix I, it was determined that two variables, animal population density and design speed, were the only variables significant enough to be added into the model. The process was then repeated, using the more stringent alpha values of 0.05 for entry and 0.15 for retention in the model. Again, only the variables of animal population density and design speed were retained. The output of the SAS program for this process can be seen in Appendix J. The model of the resulting linear regression model is as follows:

$$y = 0.13169(\text{Animal Density}) + 0.03902(\text{Design Speed}) - 2.72070$$

The R^2 for the model is 0.55 with an adjusted R^2 of 0.45. The adjusted R^2 accounts for the fact that adding more than one variable, even an unrelated one, will increase the overall R^2 of the model. The adjusted R^2 is always lower than the overall R^2.

A second model was built, using the ratio of crash rate to animal population density as the response variable, in an effort to eliminate the need to use animal population density as a predictor variable. The stepwise algorithm was then applied with both the 0.5-0.5 and 0.05-0.15 alpha values as used previously. The only variable selected for the model in both cases was design speed. The output of the SAS program for this process can be seen in Appendix J. The equation of the resulting linear regression model is as follows:

$$y = 0.00346(\text{Design Speed}) - 0.12478$$

The resulting R^2 for this model is 0.43. As there is only one variable entered into this model, the adjusted R^2 value is the same as the overall R^2. Although these models are interesting descriptions of the data, they should not be used as predictive models for decisions about roadway design. The objective of this research is to determine whether roadway design elements have an effect on animal-vehicle crashes. Additional research would be necessary to generate a predictive model that could be used to quantify the expected number of animal-vehicle crashes given particular design decisions.

5.2.3 Results

From the previous section, two variables come to the forefront as being important to the number of wild animal-vehicle crashes. The first is the number of wild animals that live in a given area. The second is the design speed of the roadway in question.

The number of wild animals living in a particular area would logically have an impact on the number of animals being hit. The number of possible opportunities for this type of collision would stand to be a proportion of the number of animals and the traffic on the road.

The animal population data is regional in nature, as many of the individual herds cover thousands of square miles. It stands to reason that local variations independent of the broader herd population could occur. If the populations' specific to each of the areas of reconstruction were better quantified, more of the variation in crash rates could be accounted for.

The design speeds in this analysis prove to be the only roadway feature that has a significant impact on the wild animal-related crash rate. The design speeds for the reconstruction effort are taken from the plans themselves. The design speeds for the previous construction efforts are estimated from the horizontal and vertical curvature, and determining the contemporary design speeds for the old sections was not an exact process.

In this case, design speed most likely is not the best estimate of actual speeds. While actual speeds were measured for each of the reconstructed sections, only two of the previous sections had measures of actual speed, and would not be sufficient to build any solid conclusions around. It was in this light that design speed is used as the predictor of speed.

The fact that animal population density and design speed have been identified as having a significant impact on the rate of wild animals being hit does not preclude the impact of other factors on the wild animal crash rate. The limited sample size of this research effort prevents the identification of other significant variables, and further study may identify other factors important to the wild animal crash rate. In addition, other factors, such as lane width and shoulder width, may have impacts on the speed of vehicles independent of the design speed determined from curvature and superelevation.

It is not recommended that the two models used in this analysis be used to predict the animal-vehicle crash rate in any given area. The small sample size and the low correlation of the data to the models limit the predictive capabilities of said models.

5.3 Individual Section Analysis

In addition to what can be said for the seven reconstruction projects as a whole, this research effort also examines if anything can be determined by looking at the project sections individually.

5.3.1 Methodology

The method chosen for this analysis is based on the assumption that the count of the crashes obeys the Poisson Probability Law, which requires that the variance (average of the square of the distance of each datum point from the mean) and the mean itself be equal (Hauer, 2002). This allows for probability of rare events (crashes) to be determined when given a rate of occurrence. The following equation was developed from this principle.

$$\text{Test Statistic} = \frac{{n_1}/{MVMT_1} - {n_2}/{MVMT_2}}{\sqrt{\left({1}/{MVMT_1} + {1}/{MVMT_2} \right) \frac{(n_1 + n_2)}{(MVMT_1 + MVMT_2)}}}$$

The variable n_1 is the number of crashes in the before period, while n_2 is the number of crashes in the after period. Correspondingly, MVMT1 and $MVMT_2$ are the Million Vehicle Miles Traveled in the same time periods. The numerator is simply the change in crash rate during the before-after period. The denominator was developed with the Poisson Probability Law. Its derivation can be seen in Appendix K. The denominator is the standard deviation of the distribution, and removing the square root gives the variance. In this case, the distribution is assumed to be an approximation of the normal distribution, and the value obtained from this equation can be used to find a probability value (p-value) for the rate in question using a two-tailed test. The p value is the probability of getting our observed differences in results given that there is no real effect associated with changes in the roadway. The following sections describe the results of the analysis of each section in terms of the wild animal crash rate, the crash rate of all other crashes, and finally the overall crash rate.

5.3.1 Centennial East Section

The Centennial East section experienced an increase in the wild animal crash rate during the after period over the before period, but experienced a decrease in both the remainder of the crashes and in the crashes as a whole. This can be seen in Table 5.7. The high values of each of the p values determined (none meeting the alpha= 0.1 criterion) show that little can be significantly demonstrated from this section.

Table 5.7 Probabilities of the Centennial East Section

	Animal Strikes	Other Incidents	Total	MVMT	Animal Rate	Other Rate	Total Rate
Before	4	8	12	2.05282328	1.948535968	3.89707194	5.845607905
After	7	3	10	2.03509128	3.439649153	1.47413535	4.913784505
				Numerator	-1.49111319	2.42293658	0.9318234
				Denominator	1.622664047	1.62266405	2.294793502
				Test Statistic	-0.91892908	1.49318437	0.406059804
				2-tailed normal p-value	0.3581	0.1354	0.6847

5.3.3 Morton Pass Section

In the Morton Pass section, there were no wild animal related crashes prior to reconstruction, and two in the period after. During the two periods, there was a dramatic drop in the crash rates for both the other crashes and the crash rate as a whole. This can be seen in Table 5.8. The very small (<0.01) p values of both the other and total crash rates indicate that the decreases in rate are unlikely to be due to chance.

Table 5.8 Probabilities of the Morton Pass Section

	Animal Strikes	Other Incidents	Total	MVMT	Animal Rate	Other Rate	Total Rate
Before	0	17	17	3.302418	0	5.147743	5.147743
After	2	4	6	4.213406	0.474675411	0.94935082	1.42402623
				Numerator	-0.474675411	4.19839218	3.72371677
				Denominator	0.379124923	1.22850516	1.28567517
				Test Statistic	-1.252029033	3.4174803	2.89631228
				2-tailed normal p-value	0.2106	0.0006	0.0038

5.3.4 Clearmont East Section

The Clearmont East section experienced a tripling of its wild animal crash rate in the after period of reconstruction and a four-fold decrease in the remainder of the crashes during this same time. The changes can be seen in Table 5.9. Only the rate of non-wildlife crashes indicates a significant change.

Table 5.9 Probabilities of the Clearmont North Section

	Animal Strikes	Other Incidents	Total	MVMT	Animal Rate	Other Rate	Total Rate
Before	1	5	6	2.271554	0.440227357	2.20113678	2.64136414
After	5	2	7	4.165289	1.20039687	0.48015875	1.68055562
				Numerator	-0.760169513	1.72097804	0.96080852
				Denominator	0.796327225	0.86013171	1.17216194
				Test Statistic	-0.954594405	2.00083082	0.81968924
				2-tailed normal p-value	0.3398	0.0454	0.4124

5.3.5 Hanging Rock Section

The Hanging Rock section experienced a doubling of the wild animal crash rate following construction and a small increase in the rate of other accidents during this time. This can be seen in Table 5.10. Little can be stated about the three different rates for this section, as all the values are in excess of the 0.1 alpha value.

Table 5.10 Probabilities of the Hanging Rock Section

	Animal Strikes	Other Incidents	Total	MVMT	Animal Rate	Other Rate	Total Rate
Before	3	5	8	14.3713926	0.208748037	0.3479134	0.556661433
After	6	6	12	14.9353025	0.401732742	0.40173274	0.803465483
				Numerator	-0.1929847	-0.0538193	-0.24680405
				Denominator	0.204769286	0.22638096	0.30525203
				Test Statistic	-0.94244946	-0.2377379	-0.8085255
				2-tailed normal p-value	0.346	0.8121	0.4188

5.3.6 Astoria Section

The Astoria section experienced a tripling of the wild animal-vehicle crash rate in the period following the reconstruction of the highway. The crash rate of all other crashes in the section dropped by approximately one-third during the same time. The results of the analysis can be seen in Table 5.11. The likelihood of getting an increase in the animal-vehicle crash rate of the given magnitude, if there was no effect due to the roadway reconstruction, is very low. Otherwise, little can be said about this section.

Table 5.11 Probabilities of the Astoria Section

	Animal Strikes	Other Incidents	Total	MVMT	Animal Rate	Other Rate	Total Rate
Before	4	21	25	14.3351704	0.279034005	1.4649285	1.74396253
After	16	17	33	16.3591893	0.978043579	1.0391713	2.017214881
				Numerator	-0.699009574	0.4257572	-0.27325235
				Denominator	0.292033504	0.4025404	0.497315138
				Test Statistic	-2.393593761	1.0576757	-0.54945513
				2-tailed normal p-value	0.0168	0.2902	0.5827

5.3.7 Round Mountain Section

The Round Mountain reconstruction section experienced a small increase in wild animal crashes, but had a large decrease in the number of other accidents. As can be seen in Table 5.12, much of this is due to the complete elimination of cattle related accidents. When cattle strikes are factored, there is little chance this change could be observed without the reconstruction having any effect. This is also true for the overall crash rate. Nothing can be stated about the animal-vehicle crash rate or the remaining crash rate without cattle strikes.

Table 5.12 Probabilities of the Round Mountain Section

	Animal Strikes	Other Incidents w/cattle strikes	Other Incidents w/o cattle strikes	Total	MVMT	Animal Rate	Other Rate w/cattle strikes	Other Rate w/o cattle strikes	Total Rate
Before	3	30	9	33	4.569988	0.65645688	6.564568775	1.969370632	7.221025652
After	4	5	5	9	5.037923	0.793978	0.992472501	0.992472501	1.786450502
					Numerator	-0.13752112	5.572096274	0.976898131	5.43457515
					Denominator	0.55139869	0.779795511	1.350645445	1.350645445
					Test Statistic	-0.24940415	7.145586496	0.723282439	4.023687469
					2-tailed normal p-value	0.803	< 6 E^ -7	0.4695	5.752 E^ -5

5.3.8 Torrington West Section

In the Torrington West section, a four lane section, the frequency of animal-related crashes did not change, but rates increased slightly due to a reduction in vehicle miles traveled. The rate of the remaining crashes also increased slightly during this time. The results of the analysis can be seen in Table 5.13. Nothing can be stated with statistical significance about any of the three different crash rates examined in this section.

Table 5.13 Probabilities of the Torrington West Section

	Animal Strikes	Other Incidents	Total	MVMT	Animal Rate	Other Rate	Total Rate
Before	11	52	63	38.51385	0.28561153	1.350163596	1.63577513
After	11	54	65	35.84362	0.30688861	1.506544084	1.81343269
				Numerator	-0.02127708	-0.156380488	-0.17765757
				Denominator	0.126239977	0.27710126	0.30450228
				Test Statistic	-0.1685447	-0.564344196	-0.58343591
				2-tailed normal p-value	0.8662	0.5725	0.5596

5.3.9 Results

Each of the seven sections is examined for three attributes. The first is the change in wild animal-vehicle crash rates, the second is the crash rate not associated with wild animals, and the final is the overall crash rate. Table 5.14 shows the p-values associated with each section and the corresponding confidence interval. As can be seen, the confidence associated with each section varies widely.

The crash rate for wild animals is shown to increase for each of the sections. Using a confidence interval of 0.90, only one section, Astoria, meets this criterion. When the much more tolerant interval of 0.60 is used, the number of sections that meet this requirement is increased to five. Two sections, Round Mountain and Torrington West, fail to meet this requirement. While no statistical significance can be determined from such a lower confidence interval, it can show there is a likelihood that crash rates involving wild animals increased on the five sections that met this criterion.

When the crash rate for those crashes not involving wild animals are considered, the decrease in rate is somewhat more significant than that of the wild animal crash rate. Using the same criteria as the wild animal crash rate analysis, three of the sections, Morton Pass, Clearmont North, and Round Mountain, meet the requirements of the 0.90 significance level. When the statistical significance is reduced to 0.60, the Astoria section is also added. All four of these sections show a decreasing trend.

It is difficult to make any definitive statements about the overall crash rate. Four of the sections decrease, while three increase. The conflicting trends of the wild animal crash rate and the rate of the remaining collisions tend to prevent any discernable patterns from appearing. Only two of the sections meet either the 0.90 or 0.60 confidence intervals: Morton Pass and Round Mountain. The reduction within the Round Mountain section appears to be likely due to the elimination of cattle strikes within the section through the installation of a right-of-way fence.

Table 5.14 Summary of the Probabilities of the Individual Sections

Section	Wild-Animal Crash Rates		Crash Rates (Not Associated with Wild Animals)		Total Crash Rate	
	p-value	Trend	p-value	Trend	p-value	Trend
Centennial East	0.358	Increase	0.135	Decrease	0.685	Decreasing
Morton Pass	0.211	Increase	**0.001**	**Decrease**	**0.004**	**Decrease**
Clearmont North	0.340	Increase	**0.045**	**Decrease**	0.412	Decrease
Hanging Rock	0.346	Increase	0.812	Increase	0.419	Increase
Astoria	**0.017**	**Increase**	0.290	Decrease	0.583	Increase
Round Mountain	0.803	Increase	**0.000**	**Decrease**	**0.000**	**Decrease**
Torrington West	0.866	Increase	0.573	Increase	0.560	Increase

Statistically significant results shown in bold.

6. SUMMARY AND CONCLUSIONS

The following chapter relates the conclusions reached as a result of this research effort. The first section provides a brief description of the reconstruction site candidate selection, as well as the projects that were ultimately selected. The second part of this chapter gives the general trends in crash rate observed for study sections. The third section gives the roadway design variables studied for significance, as well as the overall fit of an estimated model. The fourth part is an analysis of what can be said about the individual reconstruction sections. Finally, two recommendations for further study are proposed.

6.1 Project Selection

The first aspect of this research effort was the selection of candidates for study. ArcGIS proved to be a powerful tool in locating sections of roadway that experience either a high frequency or rate of reported wild animal crashes. Statewide maps showing the animal-vehicle crash rates and crash frequencies were created using this tool. With the aid of the State Transportation Improvement Programs (STIPs) created over the past decade, it was a straight-forward process to identify seven recent reconstruction projects on segments that experience a higher than normal number of wildlife crashes. The seven reconstruction projects were as follows:

1. WY 130 Centennial East Section – between Centennial and Laramie from milepost 21.32 to 27.431. Reconstruction was started in November of 1996.
2. US 14/16/20 Hanging Rock Section – between Yellowstone National Park and Cody from milepost 19.4 to 27.6. Reconstruction was started in June of 1998.
3. US 189 Round Mountain Section – between Kemmerer and LaBarge from milepost 45.78 to 59.02. Reconstruction was started in April of 1999.
4. US 14/16 Clearmont North Section – between Sheridan and Gillette from milepost 38.61 to 45.96. Reconstruction was started in November of 1999.
5. WY 34 Morton Pass Section – between Bosler Junction and Wheatland from milepost 9.69 to 16.53. Reconstruction was started in March of 2001.
6. US 89 Astoria Section – between Alpine Junction and Jackson from milepost 136.65 to 140.69. Reconstruction was started in March of 2000.
7. US 26/85 Torrington West Section– between Torrington and Lingle from milepost 94.60 to 102.93. Construction was started in October of 1997.

6.2 Overall Trends

Using an analysis that compared the changes in crash rates for each of the seven sections, several trends were identified as to the changes in risk following the reconstruction.

6.2.1 Wildlife Crash Rate

The crash rate involving the animal-vehicle crashes is observed to increase. An increase in the animal-vehicle crash rate is observed in all seven of the reconstruction projects studied. The level of confidence for this claim is in excess of 97%. When changes in the size of the wildlife population are considered, the level of confidence is somewhat lower but still 96%.

6.2.2 Other Crash Rate

The crash rate for all crashes not involving wild animals (all crashes except animal-vehicle crashes) is observed to decrease. Five of the seven studied projects experienced this trend. The two that did not were the Hanging Rock section, located west of Cody, and the Torrington West Section, a roadway that was widened from two lanes to four lanes and connects Torrington to Lingle. The downward trend in the other crashes is confident to the 95% level.

6.2.3 Total Crash Rate

The overall crash rate (all crashes including animal-vehicle crashes) for the seven sections as a whole is observed to decrease. While this trend is observed on the whole, it is only seen on four of the seven sections. In addition to the two sections that experienced an increase in the non-wildlife related crash rate (see section 6.2.2), the Astoria Section south of Jackson can be included in this case. The confidence level that the overall crash rate decreased is 87%. The lower confidence in this statement may be due, in part, to the conflicting trends between the wildlife-related crash rate and the rate of all other crashes.

6.3 Roadway Attribute Analysis

An analysis was performed to gauge the effect of several roadway design variables. These included design speed, the design speed with shoulder and lane width speed reductions, lane width, shoulder width, and overall pavement width. The design speed for the reconstructed projects was taken from the construction documents, while for the previous sections it was estimated using the horizontal and vertical curvature of the roadway. An additional variable, animal density, was used to account for changes in animal population.

Through three different tests, the only variables deemed to have a statistically significant factor in the rate of animals being hit are animal population density and design speed. When the two variables are modeled using linear regression, the adjusted R^2 value (a measure of actual data points fitting the model, as well as accounting for multiple variables) is 0.45. As the maximum value of this R^2 value is 1.0, only 45% of the variation of the crash data are accounted for in these two variables. While more localized animal populations, as well as a more accurate measure of true driver speed, may account for more of the variation, it is likely that other variables are important to wild animal crash rates.

6.4 Individual Analysis of Sections

An attempt to quantify the changes in crash rates for each of the individual sections was made. This was performed using a variation of the Poisson distribution. The Poisson distribution is used in situations where the events, in this case, animal-vehicle crashes, occur independently. This assumption appears to be reasonable for this data.

Few of the study sections contain crash frequencies on their own high enough to state with confidence a noticeable trend. Concerning wild animal crash rates, only the Astoria section demonstrates a high probability (98.3%) that the crash rate increase is not due to chance. In the rate of all other crashes, the Morton Pass section (99.9%), the Clearmont North section (95.5%) and the Round Mountain section (approaching 100%) demonstrate high likelihoods the decrease in rate is not due to chance. Finally, only the Morton Pass section (99.6%) and the Round Mountain (approaching 100%) section show that the decrease in total crash rate is not due to chance.

6.5 Summary of Conclusions

- ArcGIS proves valuable for the analysis and selection of high animal-vehicle crash areas and selecting potential study sections.
- Animal-vehicle crash rates are observed to increase.
- Non-wild animal-vehicle crash rates are observed to decrease.
- The total crash rates are observed to decrease.
- Animal population density and roadway design speed are significant variables in affecting animal-vehicle crash rates.
- When studying individual sections independently there is less statistical confidence in the results as opposed to looking at all seven sections in aggregate.

6.6 Recommendations for Further Study

While this study indicates that design speed is the most important variable, only seven locations are considered as a part of this research effort. It is possible the additional conclusions could be drawn regarding the impact of roadway features with a larger sample size. Two directions have been identified that may help to further clarify the situation. The first would be a continuation of this research effort, increasing the number of reconstruction projects examined. The second would be to focus on the hypothesis that vehicle speed is the primary roadway factor contributing to the rate of wild animals being hit.

The most obvious direction to take in the continuation of this research effort would be to expand upon the data already collected. The addition of more reconstruction sections would allow for more certainty in the conclusions reached, and allow for the testing of further roadway attributes.

If this direction is taken, the selection of reconstruction sections might be better served by using wild animal crash frequency, rather than rate, as the primary selection factor. This may allow for more to be concluded about specific sections of highway. While the use of crash rate as the primary choice factor allowed for the sections selected in this effort to have a wide geographical distribution, the low volume nature of many Wyoming roads lowers the usefulness of these sections in a statistical sense. This is due to the fact that it may only take a change of only a few crashes to significantly raise or lower the rate of a specific section.

If the primary focus for further examination is deemed to be confirming the role that speed plays in the wild animal crash rate, a study should be developed that eliminates other variables from consideration. A possible direction in this fashion would be to look at changes in posted speed limit. As with design speed, posted speed limit does not directly quantify the actual speed of drivers, but may function as a suitable surrogate to gauge the effect of speed on the number of wild animal crashes.

While localized changes in speed limit are rare, one case presents itself as a possible opportunity to examine large portions of the roadway system in a reasonably controlled situation. Following the removal of a nationally mandated speed limit, Wyoming raised the speed limit of the majority of its rural highway system; rural Interstate Highway speed limits were raised from 65 mph to 75 mph, while most two-lane highway speed limits were raised from 55 mph to 65 mph. In the case of Wyoming, this occurred at a very specific time: December 8, 1995. For those sections that did not experience an increase in the posted speed limit, it may be possible to use these sections as a control of the study.

While this situation presents an opportunity to examine the effect of increased speed on the number of wild animal related crashes, several difficulties must be addressed to make this study practical in nature.

- The before-after nature of this study would require data from the years before and after the change in posted speed limit. During the course of this research effort, attempts to obtain crash records from the period prior to 1995 were unsuccessful. It would be beneficial in determining trends to gain access to this data, especially the years of 1993 and 1994.
- Posting a roadway at a given speed limit does not ensure compliance with that speed. It would be beneficial to examine before and after recorded vehicular speed in several locations containing speed limit increases, to determine the actual changes in speed. The current research effort was able to find actual speeds prior to construction for only two of the seven reconstructed sections, raising concerns as to the availability of this data.
- Roadway sections that experienced reconstruction or other improvements to geometry would introduce additional variables into the exploration. Sections that had roadway improvement during either the before or after periods should be identified and removed from consideration.

If the aforementioned challenges are addressed, this investigation may provide an opportunity to determine, with some degree of certainty, what the effects of speed on wild animal-vehicle crash rates are.

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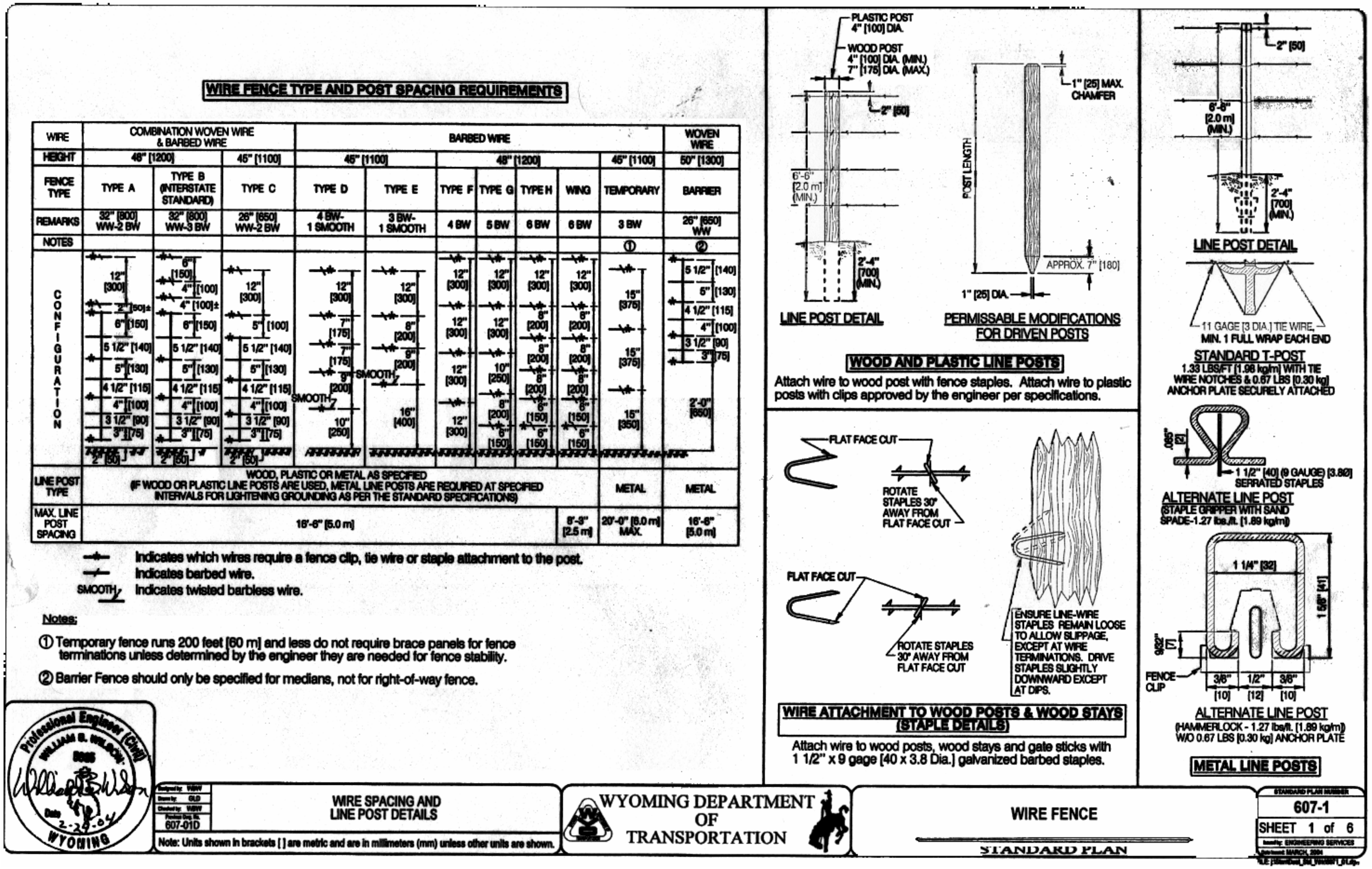
APPENDIX A.

WYOMING DEPARTMENT OF TRANSPORTATION STANDARD FENCE TYPES



WIRE FENCE TYPE AND POST SPACING REQUIREMENTS

WIRE	COMBINATION WOVEN WIRE & BARBED WIRE			BARBED WIRE							WOVEN WIRE
HEIGHT	48" [1200]		45" [1100]	45" [1100]		48" [1200]				45" [1100]	50" [1300]
FENCE TYPE	TYPE A	TYPE B (INTERSTATE STANDARD)	TYPE C	TYPE D	TYPE E	TYPE F	TYPE G	TYPE H	WING	TEMPORARY	BARRIER
REMARKS	32" [800] WW-2 BW	32" [800] WW-3 BW	26" [650] WW-2 BW	4 BW-1 SMOOTH	3 BW-1 SMOOTH	4 BW	5 BW	6 BW	6 BW	3 BW	26" [650] WW
NOTES										①	②
LINE POST TYPE	WOOD, PLASTIC OR METAL AS SPECIFIED (IF WOOD OR PLASTIC LINE POSTS ARE USED, METAL LINE POSTS ARE REQUIRED AT SPECIFIED INTERVALS FOR LIGHTENING GROUNDING AS PER THE STANDARD SPECIFICATIONS)									METAL	METAL
MAX. LINE POST SPACING	16'-6" [5.0 m]								8'-3" [2.5 m]	20'-0" [6.0 m] MAX.	16'-6" [5.0 m]

Indicates which wires require a fence clip, tie wire or staple attachment to the post.
Indicates barbed wire.
SMOOTH: Indicates twisted barbless wire.

Notes:

① Temporary fence runs 200 feet [60 m] and less do not require brace panels for fence terminations unless determined by the engineer they are needed for fence stability.

② Barrier Fence should only be specified for medians, not for right-of-way fence.

APPENDIX B:

BEFORE AND AFTER CRASH RECORDS FOR EACH RECONSTRUCTION PROJECT

(Animal-Vehicle Crashes are in **Bold**)

Centennial East Section - Before Crashes

BASE_KEY	YEAR	REPORT_	HIGHWAY_SY	FED_	ROAD_SGN	MP	HIGH_ELE	DATE_	DAY	TIME	DRIVER	VEH	PER	PEDS	INJ	KILLED	HIT___RUN
9513833	95	13833	SECONDARY	S0103	WY130	25.00	NONE	92095	WEDNESDAY	06:45	01	01	01	00	00	00	N
9513684	95	13684	SECONDARY	S0103	WY130	24.05	NONE	81295	SATURDAY	22:30	01	01	02	00	00	00	N
9503592	95	03592	SECONDARY	S0103	WY130	26.46	DRIVEWAY	22595	SATURDAY	16:35	02	02	04	00	04	00	N
9501911	95	01911	SECONDARY	S0103	WY130	22.14	NONE	12895	SATURDAY	08:40	01	01	07	00	00	00	N
9501224	95	01224	SECONDARY	S0103	WY130	22.50	NONE	12195	SATURDAY	17:30	01	01	02	00	00	00	N
9518291	95	18291	SECONDARY	S0103	WY130	22.12	NONE	121095	SUNDAY	16:45	01	01	01	00	00	00	N
9518993	95	18993	SECONDARY	S0103	WY130	25.20	NONE	122195	THURSDAY	09:00	01	01	01	00	00	00	N
9600579	96	00579	SECONDARY	S0103	WY130	25.05	NONE	10896	MONDAY	13:45	01	01	01	00	00	00	N
9600992	96	00992	SECONDARY	S0103	WY130	25.50	NONE	11196	THURSDAY	11:20	01	01	02	00	01	00	N
9601677	96	01677	SECONDARY	S0103	WY130	22.00	NONE	12896	SUNDAY	12:00	02	02	03	00	00	00	N
9613106	96	13106	SECONDARY	S0103	WY130	23.45	NONE	82596	SUNDAY	03:50	01	01	01	00	01	00	N
9615849	96	15849	SECONDARY	S0103	WY130	22.34	NONE	100696	SUNDAY	01:00	01	01	01	00	00	01	N

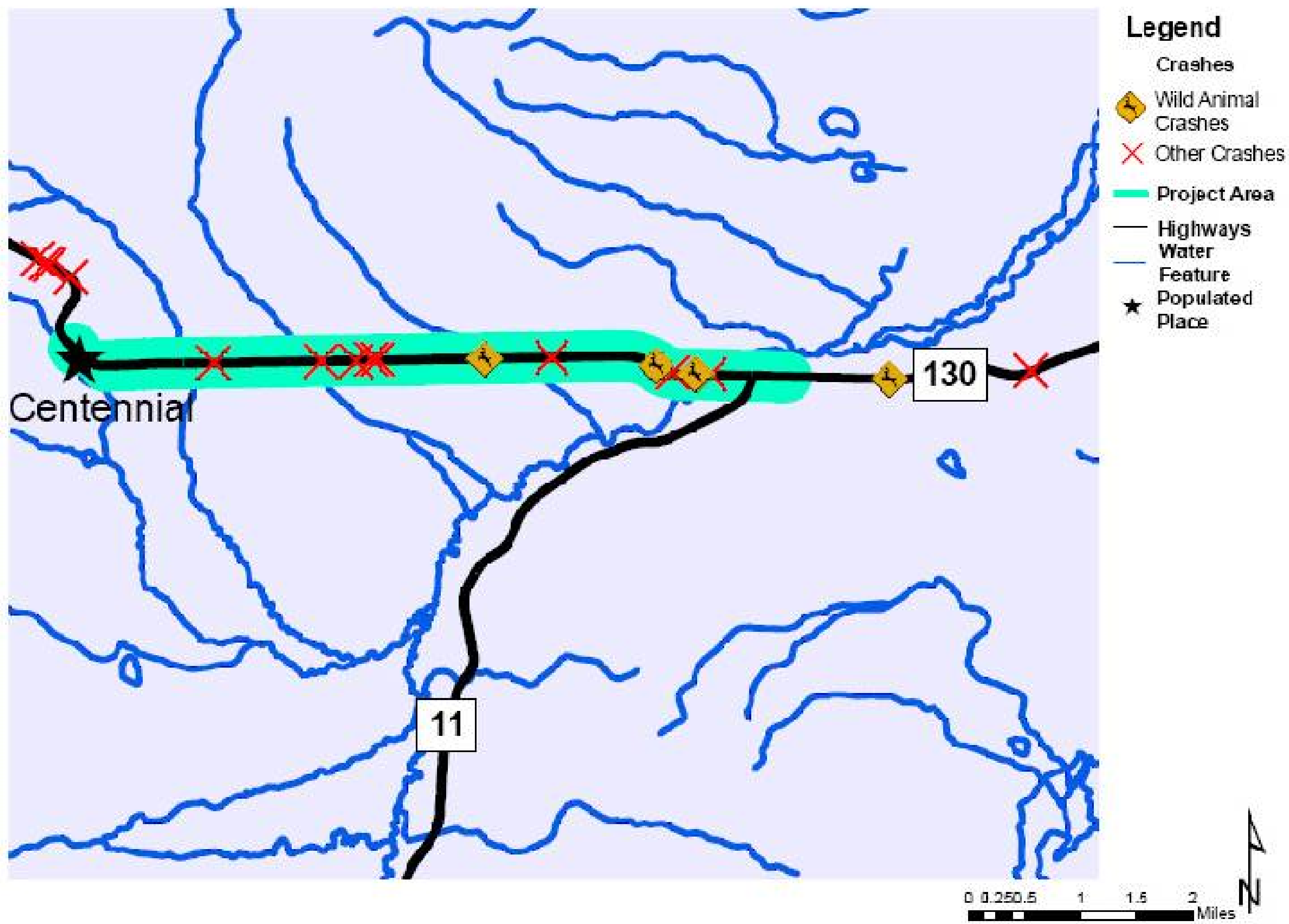
BASE_KEY	ROAD_SUR	LIGHTING	ROAD_CON	WEATHER	RD_ALIGN	TRAFCONT	RD_JUNCT	1ST_HARM	JUNCTION	ADV_COND
9513833	BLACKTOP	DARK UNLIGHTED	ICY	SNOWING	STRAIGHT LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	OVERTURN	OFF ROADWAY	NONE
9513684	BLACKTOP	DARK UNLIGHTED	DRY	CLEAR	STRAIGHT LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	DEER	ON ROADWAY	NONE
9503592	BLACKTOP	DAYLIGHT	DRY	CLEAR	STRAIGHT LEVEL	PAVEMENT MARKINGS	DRIVEWAY ACCESS	MV-MV	ON ROADWAY	NONE
9501911	BLACKTOP	DAYLIGHT	ICY	CLEAR	STRAIGHT UPGRADE	PAVEMENT MARKINGS	NON-JUNCTION	DEER	ON ROADWAY	NONE
9501224	BLACKTOP	DAWN OR DUSK	DRY	CLEAR	STRAIGHT HILLCREST	PAVEMENT MARKINGS	NON-JUNCTION	DEER	-	-
9518291	BLACKTOP	DAYLIGHT	DRY	CLEAR	STRAIGHT DOWNGRADE	PAVEMENT MARKINGS	NON-JUNCTION	DEER	ON ROADWAY	NONE
9518993	BLACKTOP	DAYLIGHT	ICY	CLEAR	STRAIGHT LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	OVERTURN	OFF ROADWAY	NONE
9600579	BLACKTOP	DAYLIGHT	ICY	GROUND BLIZ	STRAIGHT LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	OVERTURN	OFF ROADWAY	NONE
9600992	BLACKTOP	DAYLIGHT	ICY	GROUND BLIZ	STRAIGHT LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	OVERTURN	OFF ROADWAY	NONE
9601677	BLACKTOP	DAYLIGHT	ICY	GROUND BLIZ	STRAIGHT LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	MV-MV	ON ROADWAY	NONE
9613106	BLACKTOP	DARK UNLIGHTED	DRY	CLEAR	STRAIGHT DOWNGRADE	PAVEMENT MARKINGS	NON-JUNCTION	OVERTURN	OFF ROADWAY	NONE
9615849	BLACKTOP	DARK UNLIGHTED	DRY	CLEAR	CURVED DOWNGRADE	PAVEMENT MARKINGS	NON-JUNCTION	FENCE	OFF ROADWAY	NONE

Centennial East Section - After Crashes

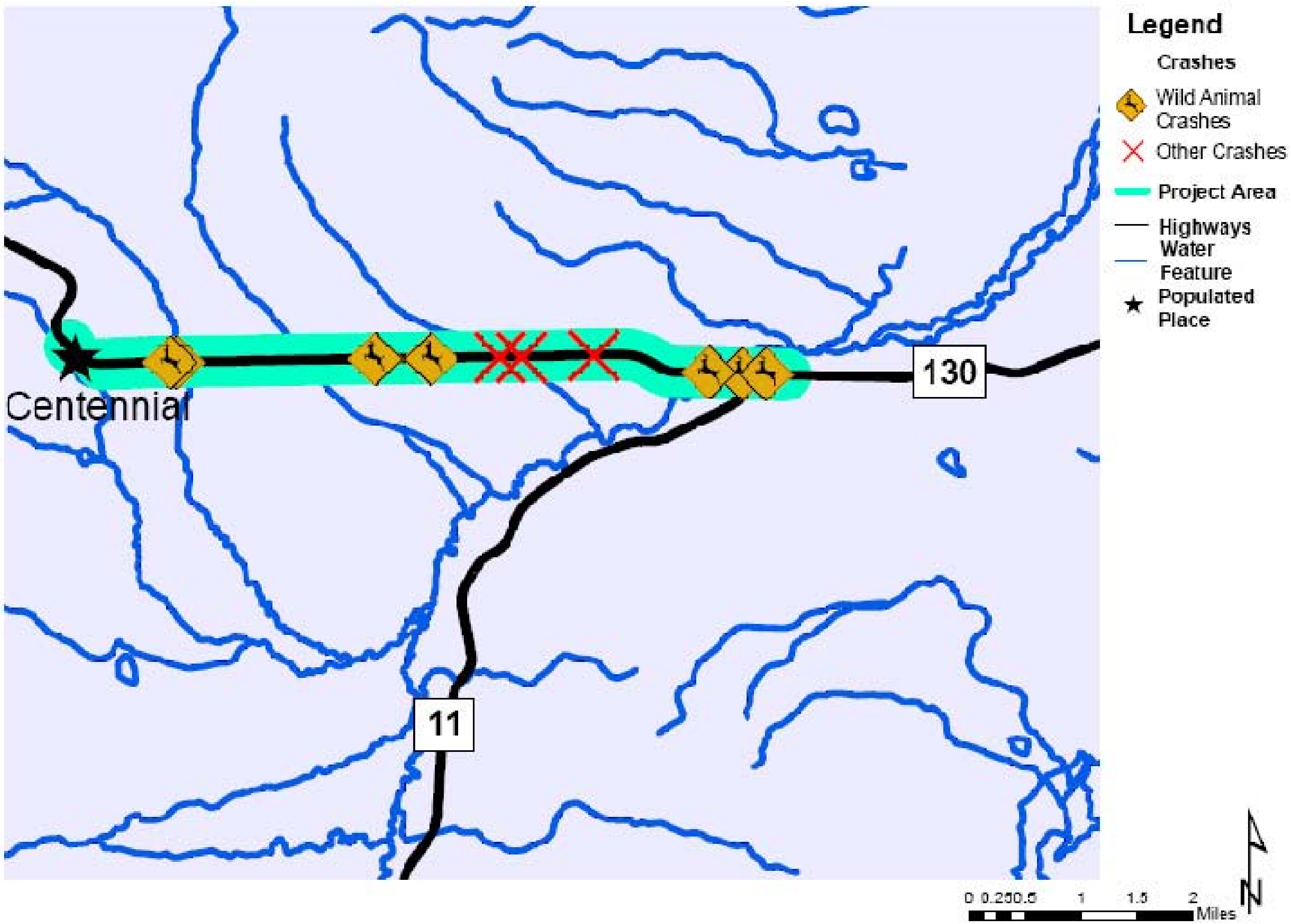
BASE_KEY	YEAR	REPORT_	HIGHWAY_SY	FED_	ROAD_SGN	MP	HIGH_ELE	DATE_	DAY	TIME	DRIVER	VEH	PER	PEDS	INJ	KILLED	HIT___RUN
9915933	99	15933	SECONDARY	S0103	WY130	23.90	NONE	101099	SUNDAY	15:00	01	01	01	00	00	00	N
9916211	99	16211	SECONDARY	S0103	WY130	23.70	NONE	101099	SUNDAY	10:50	01	01	03	00	03	00	N
0106194	01	06194	SECONDARY	S0103	WY130	23.05	NONE	30301	SATURDAY	08:00	01	01	01	00	00	00	N
9915367	99	15367	SECONDARY	S0103	WY130	24.50	NONE	92599	SATURDAY	22:25	01	01	01	00	00	00	N
9913721	99	13721	SECONDARY	S0103	WY130	22.00	NONE	82899	SATURDAY	01:00	01	01	01	00	00	00	N
9907566	99	07566	SECONDARY	S0103	WY130	21.50	NONE	50899	SATURDAY	21:11	01	01	05	00	00	00	N
9911307	99	11307	SECONDARY	S0103	WY130	26.81	NONE	71399	TUESDAY	20:30	01	01	01	00	00	00	N
9910708	99	10708	SECONDARY	S0103	WY130	25.00	NONE	70299	FRIDAY	16:15	01	01	04	00	00	00	N
0010232	00	10232	SECONDARY	S0103	WY130	21.71	NONE	71600	SUNDAY	02:45	01	01	04	00	00	00	N
0016589	00	16589	SECONDARY	S0103	WY130	26.76	NONE	102700	FRIDAY	18:28	01	01	01	00	00	00	N

BASE_KEY	ROAD_SUR	LIGHTING	ROAD_CON	WEATHER	RD_ALIGN	TRAFCONT	RD_JUNCT	1ST_HARM	JUNCTION	ADV_COND
9915933	BLACKTOP	DAYLIGHT	DRY	CLEAR	STRAIGHT DOWNGRADE	PAVEMENT MARKINGS	NON-JUNCTION	OVERTURN	ON ROADWAY	NONE
9916211	BLACKTOP	DAYLIGHT	DRY	CLEAR	STRAIGHT LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	OVERTURN	ON ROADWAY	NONE
0106194	BLACKTOP	DAYLIGHT	DRY	CLEAR	STRAIGHT LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	OVERTURN	OFF ROADWAY	NONE
9915367	BLACKTOP	DARK UNLIGHTED	DRY	CLEAR	STRAIGHT LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	DEER	ON ROADWAY	NONE
9913721	BLACKTOP	DARK UNLIGHTED	DRY	CLEAR	STRAIGHT LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	DEER	ON ROADWAY	NONE
9907566	BLACKTOP	DARK UNLIGHTED	DRY	CLEAR	STRAIGHT LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	DEER	ON ROADWAY	NONE
9911307	BLACKTOP	DAWN OR DUSK	DRY	CLEAR	STRAIGHT UPGRADE	NO PASSING ZONE	NON-JUNCTION	DEER	ON ROADWAY	NONE
9910708	BLACKTOP	DAYLIGHT	DRY	CLEAR	STRAIGHT LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	DEER	-	-
0010232	BLACKTOP	DARK UNLIGHTED	DRY	CLEAR	STRAIGHT LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	ANTELOPE	ON ROADWAY	NONE
0016589	BLACKTOP	DAWN OR DUSK	DRY	CLEAR	STRAIGHT LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	DEER	ON ROADWAY	NONE

Centennial East Before Construction Crashes



Centennial East After Construction Crashes



Morton Pass Section - Before Crashes

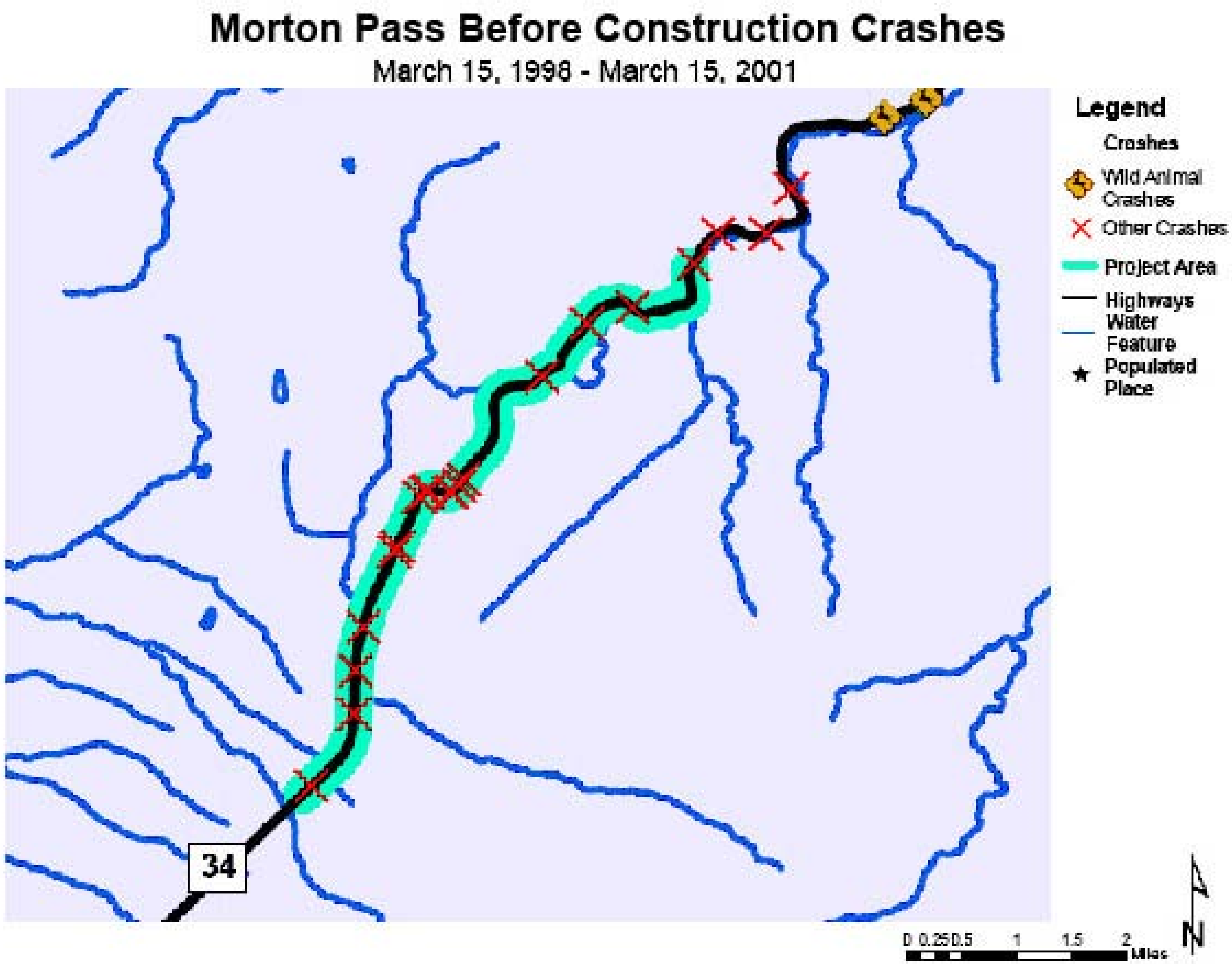
BASE_KEY	YEAR	REPORT_	HIGHWAY_SY	FED_	ROAD_SGN	MP	HIGH_ELE	DATE_	DAY	TIME	DRIVER	VEH	PER	PEDS	INJ	KILLED	HIT___RUN
0018142	00	18142	SECONDARY	S0109	WY34	15.15	NONE	111900	SUNDAY	05:00	01	01	01	00	01	00	N
0018466	00	18466	SECONDARY	S0109	WY34	13.00	NONE	111300	MONDAY	22:00	02	02	02	00	00	00	Y
0015103	00	15103	SECONDARY	S0109	WY34	14.50	NONE	100600	FRIDAY	06:25	01	01	01	00	01	00	N
0015102	00	15102	SECONDARY	S0109	WY34	13.01	NONE	100600	FRIDAY	02:30	01	01	04	00	00	00	N
0014675	00	14675	SECONDARY	S0109	WY34	10.60	NONE	92600	TUESDAY	14:15	01	01	02	00	00	00	N
0005284	00	05284	SECONDARY	S0109	WY34	12.78	NONE	40800	SATURDAY	20:30	01	01	01	00	01	00	N
0005049	00	05049	SECONDARY	S0109	WY34	9.80	NONE	40400	TUESDAY	14:15	02	02	03	00	00	00	N
0005048	00	05048	SECONDARY	S0109	WY34	13.10	NONE	40200	SUNDAY	08:40	02	02	03	00	00	00	N
0005576	00	05576	SECONDARY	S0109	WY34	13.10	NONE	40200	SUNDAY	11:30	01	01	01	00	01	00	N
0101948	01	01948	SECONDARY	S0109	WY34	11.00	NONE	20201	FRIDAY	19:00	02	02	04	00	00	00	N
9919580	99	19580	SECONDARY	S0109	WY34	12.80	PORT/REST AREA	120699	MONDAY	16:50	00	01	01	01	01	00	N
9919217	99	19217	SECONDARY	S0109	WY34	15.65	NONE	120399	FRIDAY	09:45	01	01	01	00	01	00	N
9917946	99	17946	SECONDARY	S0109	WY34	13.17	NONE	111699	TUESDAY	20:30	01	01	01	00	00	01	N
0018940	00	18940	SECONDARY	S0109	WY34	12.15	NONE	112600	SUNDAY	18:45	01	01	01	00	00	00	N
0018939	00	18939	SECONDARY	S0109	WY34	12.20	NONE	112600	SUNDAY	20:30	01	01	01	00	00	00	N
9900449	99	00449	SECONDARY	S0109	WY34	11.40	NONE	11099	SUNDAY	18:00	01	01	01	00	00	00	N
9807506	98	07506	SECONDARY	S0109	WY34	12.70	NONE	52298	FRIDAY	14:50	01	01	01	00	00	00	N

BASE_KEY	ROAD_SUR	LIGHTING	ROAD_CON	WEATHER	RD_ALIGN	TRAFCONT	RD_JUNCT	1ST_HAI	JUNCTION	ADV_COND
0018142	BLACKTOP	DARK UNLIGHTED	SNOWY	GROUND BLIZZARD	STRAIGHT UPGRADE	PAVEMENT MARKINGS	NON-JUNCTION	OTHER	ON ROADWAY	NONE
0018466	BLACKTOP	DARK UNLIGHTED	WET	CLEAR	STRAIGHT DOWNGRADE	PAVEMENT MARKINGS	NON-JUNCTION	MV-MV	SHOULDER	NONE
0015103	BLACKTOP	DARK UNLIGHTED	ICY	FOG	STRAIGHT DOWNGRADE	PAVEMENT MARKINGS	NON-JUNCTION	OVERTU	OFF ROADWAY	NONE
0015102	BLACKTOP	DARK UNLIGHTED	ICY	SLEET/HAIL	CURVED DOWNGRADE	NO PASSING ZONE	NON-JUNCTION	BOULDE	OFF ROADWAY	NONE
0014675	BLACKTOP	DAYLIGHT	DRY	CLEAR	STRAIGHT LEVEL	NONE	NON-JUNCTION	BERM/DI	OFF ROADWAY	NONE
0005284	BLACKTOP	DARK UNLIGHTED	DRY	CLEAR	STRAIGHT UPGRADE	PAVEMENT MARKINGS	NON-JUNCTION	OVERTU	OFF ROADWAY	NONE
0005049	BLACKTOP	DAYLIGHT	DRY	CLEAR	STRAIGHT LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	MV-MV	ON ROADWAY	UNDER REPAIR
0005048	BLACKTOP	DAYLIGHT	SLUSH	SNOWING	CURVED DOWNGRADE	PAVEMENT MARKINGS	NON-JUNCTION	MV-MV	ON ROADWAY	NONE
0005576	BLACKTOP	DAYLIGHT	SLUSH	SNOWING	CURVED DOWNGRADE	PAVEMENT MARKINGS	NON-JUNCTION	OVERTU	OFF ROADWAY	NONE
0101948	BLACKTOP	DARK UNLIGHTED	SNOWY	STRONG WIND	STRAIGHT DOWNGRADE	PAVEMENT MARKINGS	NON-JUNCTION	MV-MV	ON ROADWAY	NONE
9919580	BLACKTOP	DAYLIGHT	ICY	CLEAR	CURVED DOWNGRADE	PAVEMENT MARKINGS	DRIVEWAY ACCESS	PEDEST	OFF ROADWAY	NONE
9919217	BLACKTOP	DAYLIGHT	ICY	SNOWING	STRAIGHT DOWNGRADE	NO PASSING ZONE	NON-JUNCTION	OVERTU	SHOULDER	NONE
9917946	BLACKTOP	DARK UNLIGHTED	DRY	CLEAR	CURVED DOWNGRADE	PAVEMENT MARKINGS	NON-JUNCTION	OVERTU	OFF ROADWAY	NONE
0018940	BLACKTOP	DARK UNLIGHTED	ICY	CLEAR	STRAIGHT LEVEL	NONE	NON-JUNCTION	OVERTU	OFF ROADWAY	NONE
0018939	BLACKTOP	DARK UNLIGHTED	ICY	CLEAR	STRAIGHT DOWNGRADE	NONE	NON-JUNCTION	OVERTU	OFF ROADWAY	NONE
9900449	BLACKTOP	DARK UNLIGHTED	ICY	STRONG WIND	STRAIGHT UPGRADE	PAVEMENT MARKINGS	NON-JUNCTION	OVERTU	OFF ROADWAY	NONE
9807506	BLACKTOP	DAYLIGHT	SLUSH	SLEET/HAIL	CURVED DOWNGRADE	PAVEMENT MARKINGS	NON-JUNCTION	OVERTU	OFF ROADWAY	NONE

Morton Pass Section - After Crashes

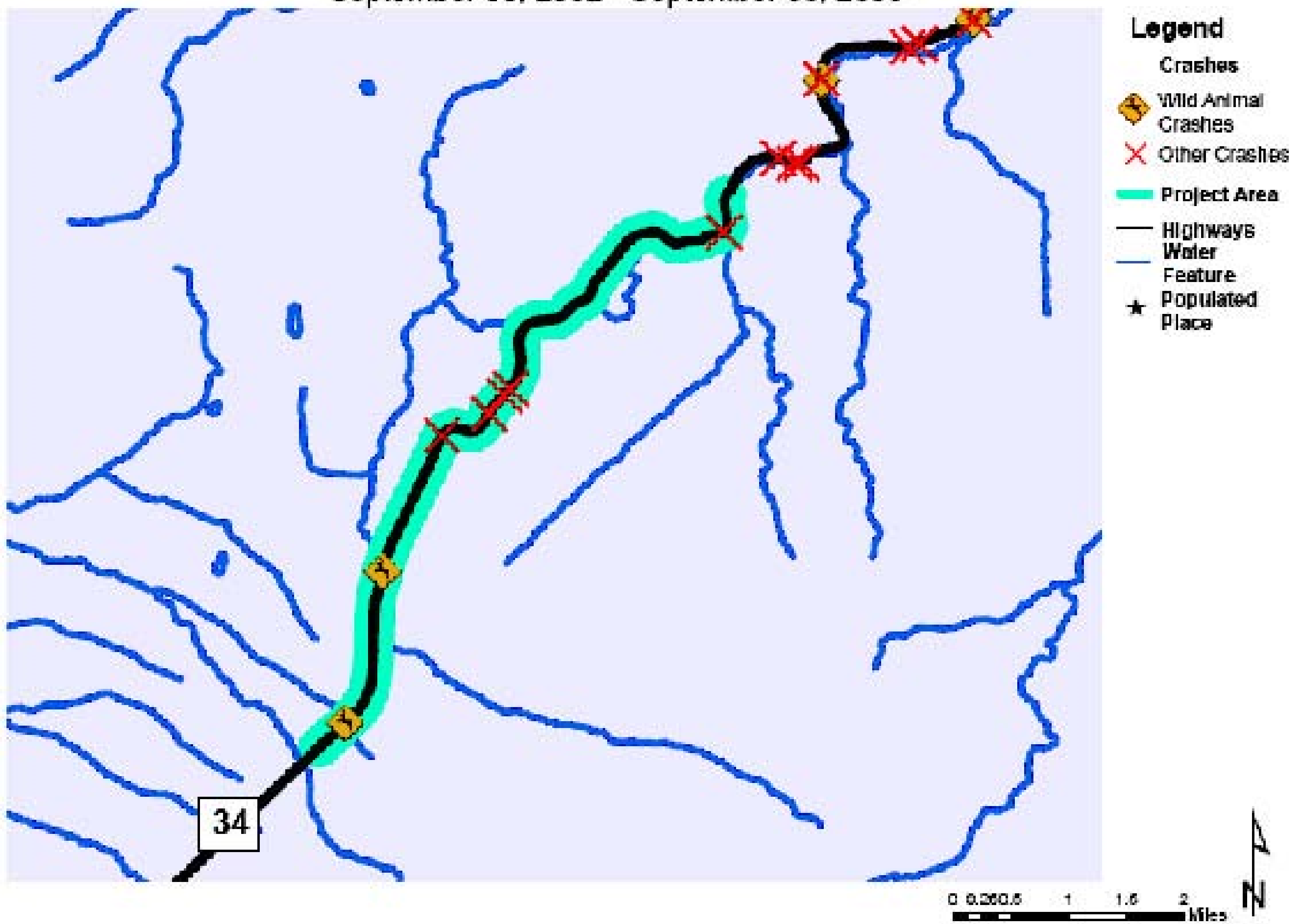
BASE_KEY	YEAR	REPORT_	HIGHWAY_SY	FED_	ROAD_SGN	MP	HIGH_ELE	DATE_	DAY	TIME	DRIVER	VEH	PER	PEDS	INJ	KILLED	HIT___RUN
0506366	05	06366	SECONDARY	S0109	WY34	13.42	NONE	50505	THURSDAY	05:30	01	01	01	00	00	00	N
0505104	05	05104	SECONDARY	S0109	WY34	12.70	NONE	41005	SUNDAY	06:41	01	01	01	00	01	00	N
0402314	04	02314	SECONDARY	S0109	WY34	13.20	NONE	20704	SATURDAY	09:30	01	01	01	00	01	00	N
0319456	**03**	**19456**	**SECONDARY**	**S0109**	**WY34**	**10.00**	**NONE**	**112603**	**WEDNESDAY**	**12:40**	**01**	**01**	**01**	**00**	**00**	**00**	**N**
0311462	**03**	**11462**	**SECONDARY**	**S0109**	**WY34**	**11.40**	**NONE**	**72303**	**WEDNESDAY**	**21:10**	**01**	**01**	**06**	**00**	**00**	**00**	**N**
0312769	03	12769	SECONDARY	S0109	WY34	16.20	NONE	82303	SATURDAY	14:23	01	01	01	00	01	00	N
0310009	03	10009	SECONDARY	S0109	WY34	13.50	NONE	70603	SUNDAY	18:50	02	02	04	00	01	00	N

BASE_KEY	ROAD_SUR	LIGHTING	ROAD_CON	WEATHER	RD_ALIGN	TRAFCONT	RD_JUNCT	1ST_HARM	JUNCTION	ADV_COND
0506366	BLACKTOP	DAWN OR DUSK	DRY	CLEAR	STRAIGHT UPGRADE	PAVEMENT MARKINGS	NON-JUNCTION	OVERTURN	ON ROADWAY	NONE
0505104	BLACKTOP	DAWN OR DUSK	SNOWY	SNOWING	CURVED UPGRADED	PAVEMENT MARKINGS	NON-JUNCTION	OVERTURN	SHOULDER	NONE
0402314	BLACKTOP	DAYLIGHT	ICY	CLEAR	CURVED DOWNGRADE	PAVEMENT MARKINGS	NON-JUNCTION	BERM/DITCH	OFF ROADWAY	NONE
0319456	**BLACKTOP**	**DAYLIGHT**	**DRY**	**CLEAR**	**STRAIGHT LEVEL**	**PAVEMENT MARKINGS**	**NON-JUNCTION**	**OTHER WILD**	**ON ROADWAY**	**NONE**
0311462	**BLACKTOP**	**DARK UNLIGHTED**	**DRY**	**CLEAR**	**STRAIGHT LEVEL**	**PAVEMENT MARKINGS**	**NON-JUNCTION**	**DEER**	**ON ROADWAY**	**NONE**
0312769	BLACKTOP	DAYLIGHT	DRY	CLEAR	CURVED DOWNGRADE	PAVEMENT MARKINGS	NON-JUNCTION	OTHER NON-COLLISION	OFF ROADWAY	NONE
0310009	BLACKTOP	DAYLIGHT	DRY	CLEAR	STRAIGHT UPGRADE	PAVEMENT MARKINGS	NON-JUNCTION	MV-MV	ON ROADWAY	NONE


Morton Pass Before Construction Crashes
March 15, 1998 - March 15, 2001
Legend
Crashes
Wild Animal Crashes
Other Crashes
Project Area
Highways
Water Feature
Populated Place
34
0 0.25 0.5 1 1.5 2
Miles
N

Morton Pass After Construction Crashes

September 30, 2002 - September 30, 2005



Clearmont North Section - Before Crashes

BASE_KEY	YEAR	REPORT_	HIGHWAY_SY	FED_	ROAD_SGN	MP	HIGH_ELE	DATE_	DAY	TIME	DRIVER	VEH	PER	PEDS	INJ	KILLED	HIT___RUN
9915940	99	15940	SECONDARY	S0302	US14	44.20	NONE	100399	SUNDAY	21:00	01	01	01	00	00	00	N
9910712	**99**	**10712**	**SECONDARY**	**S0302**	**US14**	**41.60**	**NONE**	**62799**	**SUNDAY**	**13:30**	**01**	**01**	**01**	**00**	**01**	**00**	**N**
9908565	99	08565	SECONDARY	S0302	US14	40.21	NONE	60299	WEDNESDAY	13:50	01	01	02	00	00	02	N
9901046	99	01046	SECONDARY	S0302	US14	42.10	NONE	10599	TUESDAY	08:45	01	01	01	00	01	00	N
9811326	98	11326	SECONDARY	S0302	US14	45.50	NONE	72498	FRIDAY	14:00	01	01	01	00	00	00	N
9704755	97	04755	SECONDARY	S0302	US14	40.85	NONE	31697	SUNDAY	11:30	01	01	02	00	00	00	N

BASE_KEY	ROAD_SUR	LIGHTING	ROAD_CON	WEATHER	RD_ALIGN	TRAFCONT	RD_JUNCT	1ST_HARM	JUNCTION	ADV_COND
9915940	BLACKTOP	DARK UNLI	DRY	CLEAR	STRAIGHT LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	BERM/DITCH	OFF ROADWAY	NONE
9910712	**BLACKTOP**	**DAYLIGHT**	**DRY**	**CLEAR**	**STRAIGHT LEVEL**	**PAVEMENT MARKINGS**	**NON-JUNCTION**	**DEER**	**ON ROADWAY**	**NONE**
9908565	BLACKTOP	DAYLIGHT	DRY	CLEAR	CURVE AND LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	ROAD APPROACH	OFF ROADWAY	NONE
9901046	BLACKTOP	DAYLIGHT	ICY	CLEAR	STRAIGHT DOWNGRADE	PAVEMENT MARKINGS	NON-JUNCTION	BERM/DITCH	OFF ROADWAY	LESS ROAD WIDTH
9811326	BLACKTOP	DAYLIGHT	DRY	CLEAR	CURVED DOWNGRADE	PAVEMENT MARKINGS	NON-JUNCTION	OTHER NON-COLLISION	SHOULDER	NONE
9704755	BLACKTOP	DAYLIGHT	SLUSH	CLEAR	CURVE AND LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	OVERTURN	OFF ROADWAY	NONE

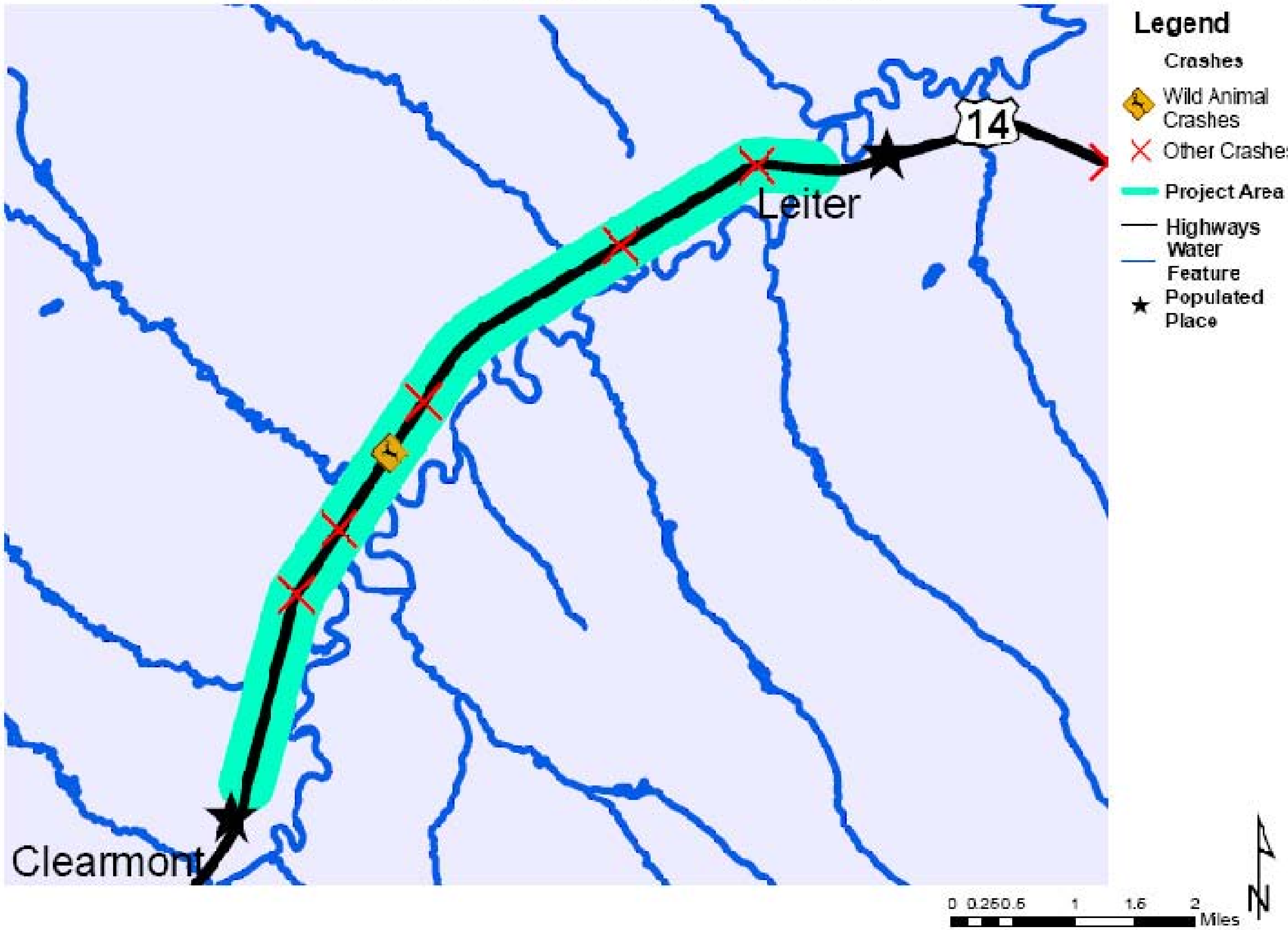
Clearmont North Section - After Crashes

BASE_KEY	YEAR	REPORT_	HIGHWAY_SY	FED_	ROAD_SGN	MP	HIGH_ELE	DATE_	DAY	TIME	DRIVER	VEH	PER	PEDS	INJ	KILLED	HIT___RUN
0220374	**02**	**20374**	**SECONDARY**	**S0302**	**US14**	**43.00**	**NONE**	**112302**	**SATURDAY**	**08:00**	**01**	**01**	**01**	**00**	**00**	**00**	**N**
0216687	**02**	**16687**	**SECONDARY**	**S0302**	**US14**	**45.00**	**NONE**	**102502**	**FRIDAY**	**07:15**	**01**	**01**	**05**	**00**	**00**	**00**	**N**
0214434	**02**	**14434**	**SECONDARY**	**S0302**	**US14**	**45.55**	**NONE**	**91302**	**FRIDAY**	**17:20**	**01**	**01**	**01**	**00**	**00**	**00**	**N**
0120921	01	20921	SECONDARY	S0302	US14	45.10	NONE	123001	SUNDAY	13:55	01	01	07	00	07	00	N
0117155	**01**	**17155**	**SECONDARY**	**S0302**	**US14**	**41.80**	**NONE**	**110901**	**FRIDAY**	**06:30**	**01**	**01**	**02**	**00**	**00**	**00**	**N**
0112062	01	12062	SECONDARY	S0302	US14	44.20	NONE	80901	THURSDAY	23:00	01	01	02	00	01	00	N
0107948	**01**	**07948**	**SECONDARY**	**S0302**	**US14**	**42.00**	**NONE**	**62801**	**THURSDAY**	**23:00**	**01**	**01**	**03**	**00**	**00**	**00**	**N**

BASE_KEY	ROAD_SUR	LIGHTING	ROAD_CON	WEATHER	RD_ALIGN	TRAFCONT	RD_JUNCT	1ST_HARM	JUNCTION	ADV_COND
0220374	**BLACKTOP**	**DAYLIGHT**	**WET**	**CLEAR**	**STRAIGHT LEVEL**	**PAVEMENT MARKINGS**	**NON-JUNCTION**	**DEER**	**-**	**-**
0216687	**BLACKTOP**	**DAWN OR D**	**DRY**	**CLEAR**	**STRAIGHT LEVEL**	**NONE**	**NON-JUNCTION**	**DEER**	**-**	**-**
0214434	**BLACKTOP**	**DAYLIGHT**	**DRY**	**CLEAR**	**CURVE AND LEVEL**	**PAVEMENT MARKINGS**	**NON-JUNCTION**	**DEER**	**ON ROADWAY**	**NONE**
0120921	BLACKTOP	DAYLIGHT	DRY	CLEAR	STRAIGHT LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	OVERTURN	OFF ROADWAY	NONE
0117155	**BLACKTOP**	**DAWN OR D**	**DRY**	**CLEAR**	**STRAIGHT DOWNGRADE**	**PAVEMENT MARKINGS**	**NON-JUNCTION**	**DEER**	**ON ROADWAY**	**NONE**
0112062	BLACKTOP	DARK UNLI	DRY	CLEAR	STRAIGHT LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	GUARDRAIL BY FILL	ON ROADWAY	NONE
0107948	**BLACKTOP**	**DARK UNLI**	**DRY**	**CLEAR**	**STRAIGHT LEVEL**	**NONE**	**NON-JUNCTION**	**DEER**	**-**	**-**

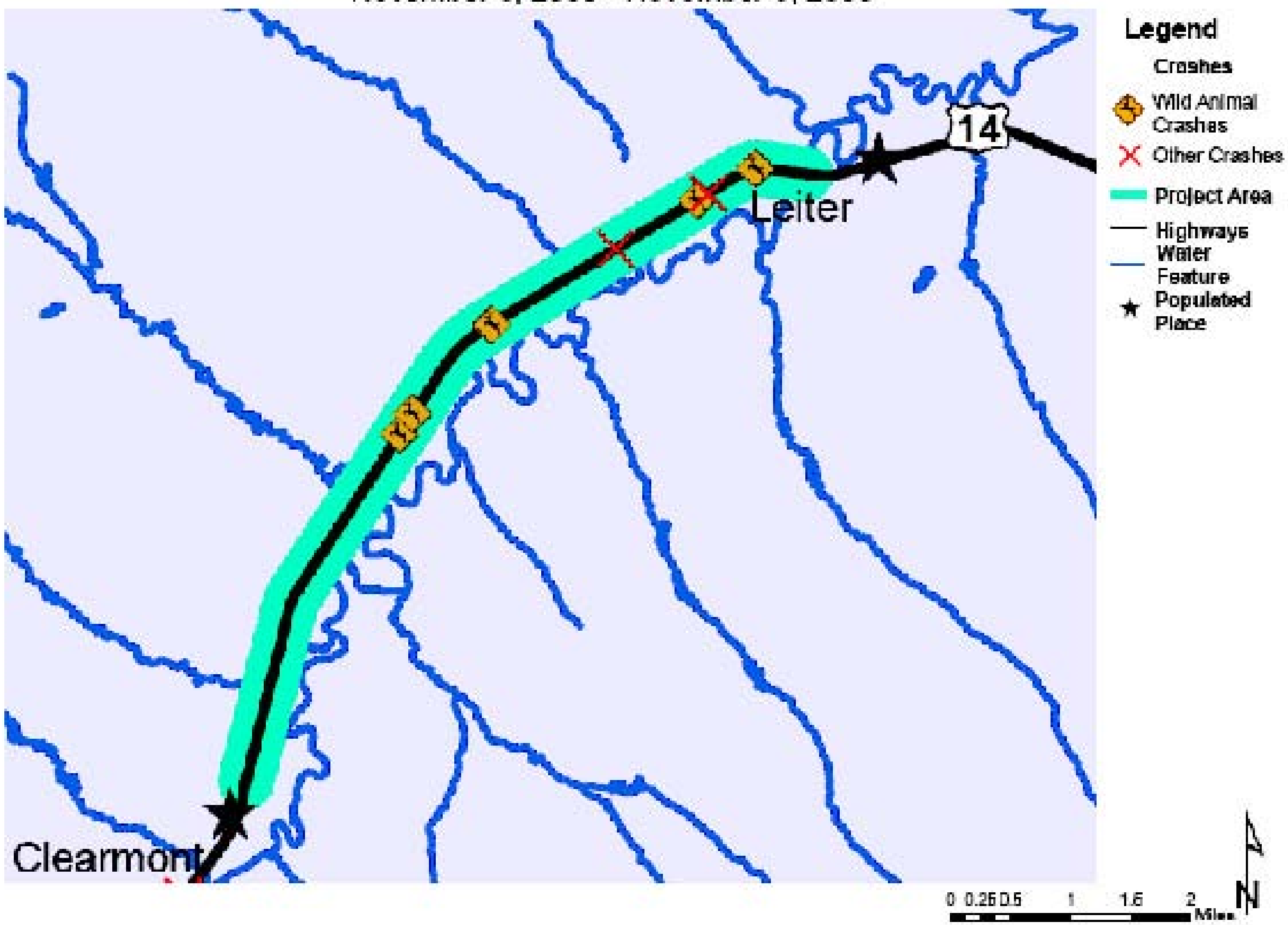
Clearmont North Before Construction Crashes

November 1, 1996 - November 1, 1999



Clearmont North After Construction Crashes

November 6, 2000 - November 6, 2003



Hanging Rock Section - Before Crashes

BASE_KEY	YEAR	REPORT_	HIGHWAY_SY	FED_	ROAD_SGN	MP	HIGH_ELE	DATE_	DAY	TIME	DRIVER	VEH	PER	PEDS	INJ	KILLED	HIT___RUN
9916171	99	16171	SECONDARY	S0302	US14	19.75	NONE	101299	TUESDAY	02:25	01	01	01	00	00	00	N
9914450	99	14450	PRIMARY	S0302	US14	25.40	NONE	90999	THURSDAY	19:20	01	01	01	00	00	00	N
9900404	99	00404	SECONDARY	S0302	US14	26.92	DRIVEWAY	10499	MONDAY	10:40	02	02	03	00	00	00	N
9820088	98	20088	SECONDARY	S0302	US14	20.00	NONE	121898	FRIDAY	11:15	01	01	02	00	01	00	N
9820087	98	20087	SECONDARY	S0302	US14	24.60	NONE	121898	FRIDAY	08:00	01	01	01	00	00	00	N
9816702	98	16702	SECONDARY	S0302	US14	24.56	NONE	102798	TUESDAY	08:35	01	01	01	00	00	00	N
9803857	98	03857	SECONDARY	S0302	US14	23.77	NONE	22798	FRIDAY	06:30	01	01	01	00	00	00	N
9710458	97	10458	SECONDARY	S0302	US14	26.90	NONE	62497	TUESDAY	23:00	01	01	01	00	00	00	N

BASE_KEY	ROAD_SUR	LIGHTING	ROAD_CON	WEATHER	RD_ALIGN	TRAFCONT	RD_JUNCT	1ST_HARM	JUNCTION	ADV_COND
9916171	BLACKTOP	DARK UNLI	DRY	CLEAR	STRAIGHT LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	OVERTURN	OFF ROADWAY	NONE
9914450	BLACKTOP	DAWN OR D	DRY	CLEAR	STRAIGHT LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	DEER	-	-
9900404	BLACKTOP	DAYLIGHT	ICY	CLEAR	CURVE AND LEVEL	PAVEMENT MARKINGS	DRIVEWAY ACCESS	MV-MV	ON ROADWAY	NONE
9820088	BLACKTOP	DAYLIGHT	ICY	SNOWING	CURVE AND LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	OVERTURN	OFF ROADWAY	NONE
9820087	BLACKTOP	DAYLIGHT	ICY	GROUND BLIZZARD	CURVE AND LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	FENCE	OFF ROADWAY	NONE
9816702	BLACKTOP	DAYLIGHT	MUDDY	CLEAR	CURVE AND LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	DEER	ON ROADWAY	NONE
9803857	BLACKTOP	DAYLIGHT	DRY	CLEAR	STRAIGHT LEVEL	NONE	NON-JUNCTION	DEER	-	-
9710458	BLACKTOP	DARK UNLI	DRY	CLEAR	STRAIGHT LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	COW	ON ROADWAY	NONE

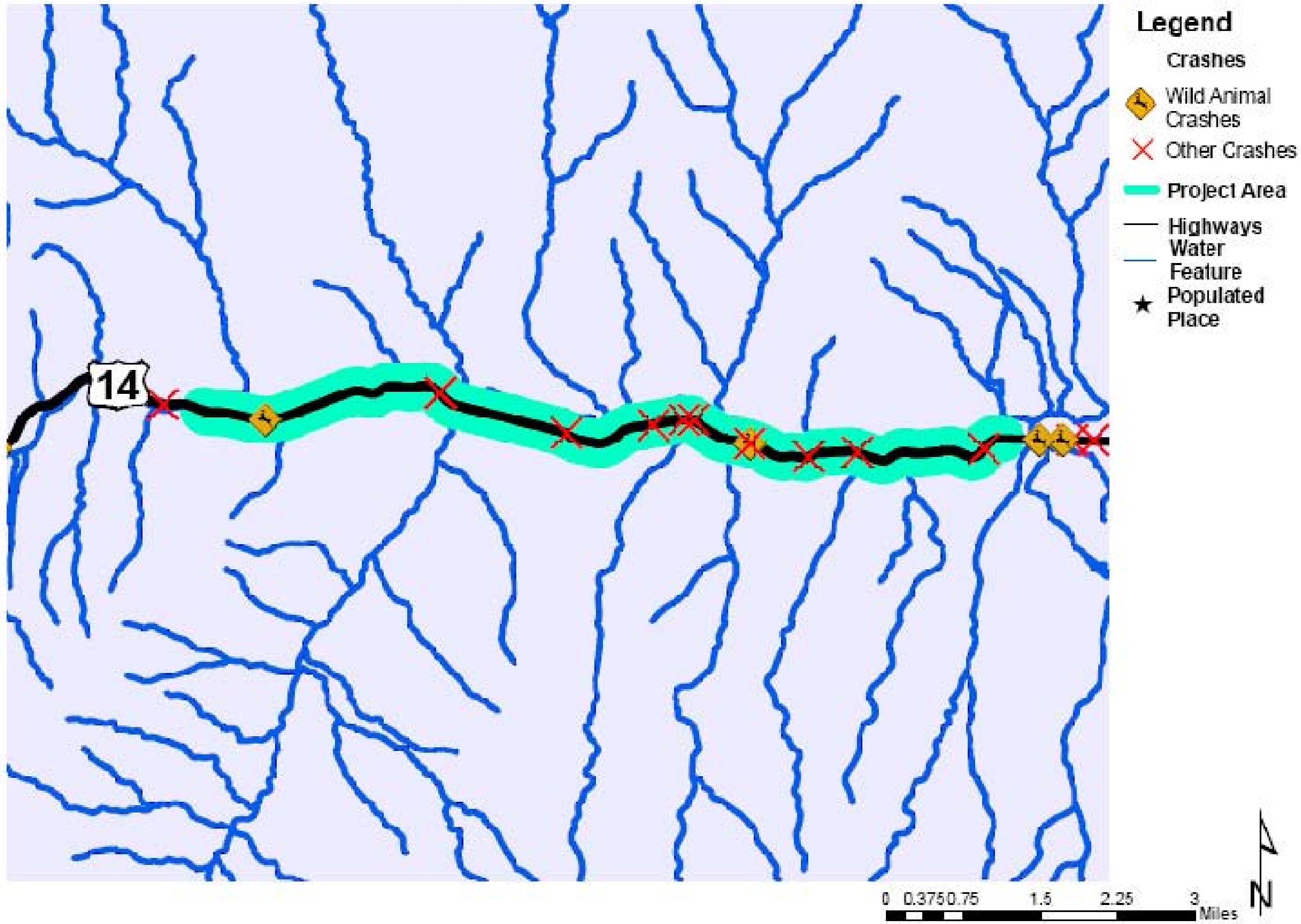
Hanging Rock Section - After Crashes

BASE_KEY	YEAR	REPORT_	HIGHWAY_SY	FED_	ROAD_SGN	MP	HIGH_ELE	DATE_	DAY	TIME	DRIVER	VEH	PER	PEDS	INJ	KILLED	HIT___RUN
0315351	03	15351	SECONDARY	S0302	US14	26.10	NONE	101103	SATURDAY	09:40	01	01	01	00	00	00	N
0303725	03	03725	SECONDARY	S0302	US14	19.90	NONE	30603	THURSDAY	13:40	02	02	02	00	00	00	N
0303721	03	03721	SECONDARY	S0302	US14	24.80	NONE	22703	THURSDAY	23:30	01	01	01	00	00	00	N
0216678	02	16678	SECONDARY	S0302	US14	21.50	NONE	102002	SUNDAY	20:15	01	01	02	00	00	00	N
0215301	02	15301	SECONDARY	S0302	US14	27.00	NONE	92102	SATURDAY	19:30	01	01	01	00	00	00	N
0213145	02	13145	SECONDARY	S0302	US14	19.60	NONE	82102	WEDNESDAY	19:15	01	01	01	00	00	00	N
0208245	02	08245	SECONDARY	S0302	US14	21.20	NONE	52902	WEDNESDAY	06:45	01	01	01	00	00	00	N
0117802	01	17802	SECONDARY	S0302	US14	27.20	NONE	111801	SUNDAY	09:00	01	01	01	00	00	00	N
0112935	01	12935	SECONDARY	S0302	US14	19.80	NONE	82201	WEDNESDAY	17:45	01	01	01	00	01	00	N
0110186	01	10186	SECONDARY	S0302	US14	25.00	NONE	70401	WEDNESDAY	21:30	01	01	01	00	00	00	N
0019741	00	19741	SECONDARY	S0302	US14	19.45	NONE	121200	TUESDAY	09:40	01	01	01	00	00	00	N
0018596	00	18596	SECONDARY	S0302	US14	26.77	NONE	112000	MONDAY	17:45	01	01	03	00	00	00	N

BASE_KEY	ROAD_SUR	LIGHTING	ROAD_CON	WEATH	RD_ALIGN	TRAFCONT	RD_JUNCT	1ST_HARM	JUNCTION	ADV_COND
0315351	BLACKTOP	DAYLIGHT	DRY	CLEAR	STRAIGHT LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	DEER	ON ROADWAY	NONE
0303725	BLACKTOP	DAYLIGHT	SNOWY	GROUN	STRAIGHT LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	MV-MV	ON ROADWAY	NONE
0303721	BLACKTOP	DARK UNLI	DRY	CLEAR	CURVE AND LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	FENCE	SHOULDER	NONE
0216678	BLACKTOP	DAYLIGHT	DRY	CLEAR	STRAIGHT LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	DEER	ON ROADWAY	NONE
0215301	BLACKTOP	DAWN OR D	DRY	CLEAR	STRAIGHT LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	DEER	-	-
0213145	BLACKTOP	DAWN OR D	WET	RAININ(	STRAIGHT UPGRADE	NONE	NON-JUNCTION	DEER	ON ROADWAY	NONE
0208245	BLACKTOP	DAYLIGHT	DRY	CLEAR	CURVE AND LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	FENCE	OFF ROADWAY	NONE
0117802	BLACKTOP	DAYLIGHT	SLUSH	SNOWII	STRAIGHT LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	FENCE	OFF ROADWAY	NONE
0112935	BLACKTOP	DAYLIGHT	DRY	CLEAR	CURVE AND LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	OVERTURN	OFF ROADWAY	UNDER REPAIR
0110186	BLACKTOP	DARK UNLI	DRY	CLEAR	STRAIGHT LEVEL	NONE	NON-JUNCTION	DEER	-	-
0019741	BLACKTOP	DAYLIGHT	SNOWY	CLEAR	CURVED DOWNGRADE	PAVEMENT MARKINGS	NON-JUNCTION	OVERTURN	OFF ROADWAY	NONE
0018596	BLACKTOP	DARK UNLI	DRY	CLEAR	STRAIGHT LEVEL	NONE	NON-JUNCTION	DEER	-	-

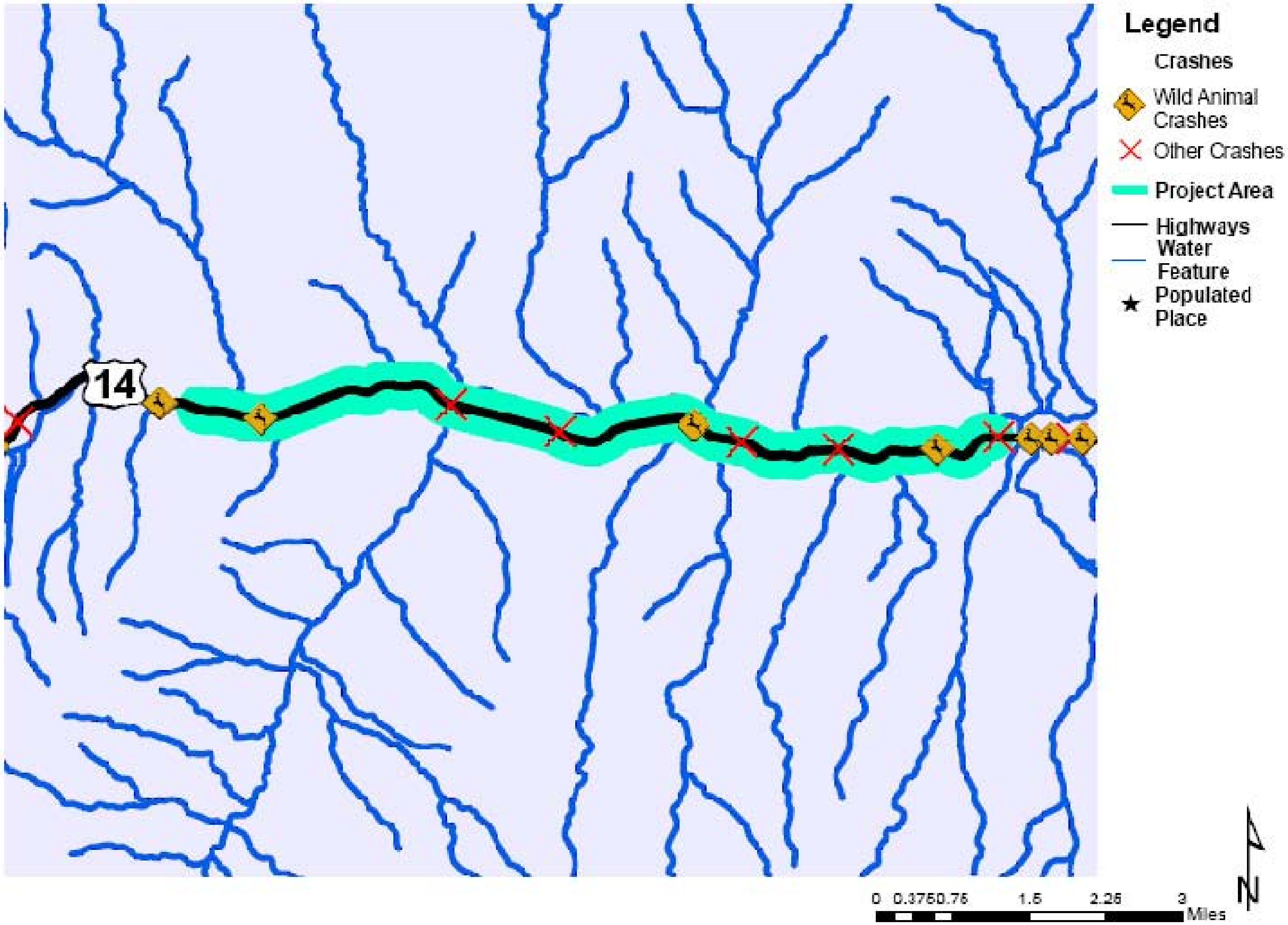
Hanging Rock Before Construction Crashes

June 8, 1995 - June 8, 1998



Hanging Rock After Construction Crashes

December 20, 1999 - December 20, 2002



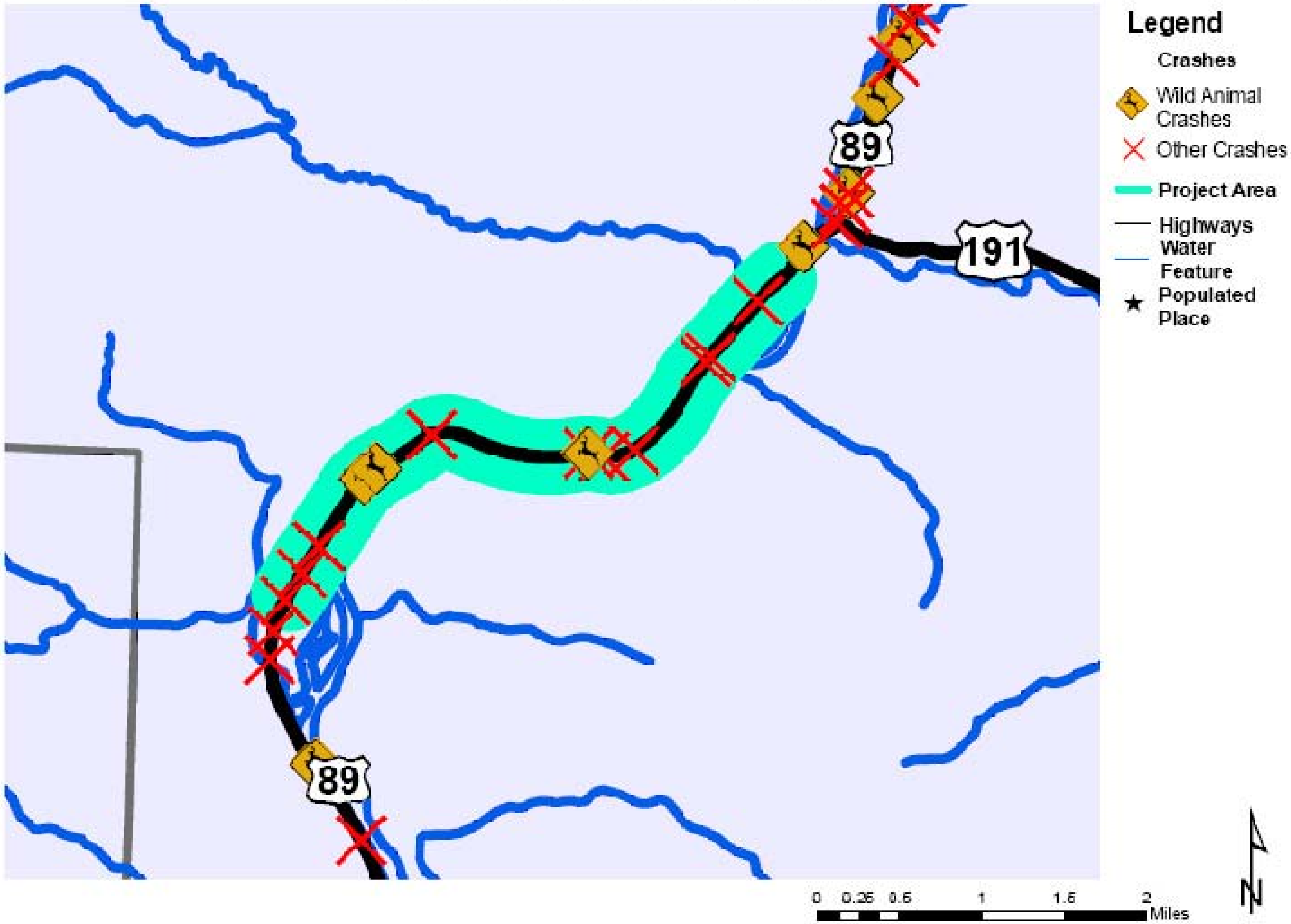
Astoria Section - Before Crashes

BASE_KEY	YEAR	REPORT_	HIGHWAY_SY	FED_	ROAD_SGN	MP	HIGH_ELE	DATE_	DAY	TIME	DRIVER	VEH	PER	PEDS	INJ	KILLED	HIT___RUN
9901383	99	01383	PRIMARY	P10	US26	138.20	NONE	11699	SATURDAY	21:15	01	01	01	00	00	00	N
9912333	99	12333	PRIMARY	P10	US26	137.02	BUSINESS ENTRANCE	80399	TUESDAY	19:00	02	02	02	00	00	00	N
9712685	97	12685	PRIMARY	P10	US26	138.20	T INTERSECTION	80297	SATURDAY	12:30	02	02	05	00	02	00	N
9917763	99	17763	PRIMARY	P10	US26	140.50	NONE	103199	SUNDAY	08:00	01	01	01	00	01	00	N
0001137	00	01137	PRIMARY	P10	US26	138.00	NONE	11800	TUESDAY	19:45	01	01	01	00	00	00	N
0004287	00	04287	PRIMARY	P10	US26	138.28	NONE	30900	THURSDAY	06:50	01	01	03	00	03	00	N
9819116	98	19116	PRIMARY	P10	US26	139.20	NONE	120198	TUESDAY	03:20	01	01	01	00	01	00	N
9814032	98	14032	PRIMARY	P10	US26	137.85	NONE	90998	WEDNESDAY	18:40	01	01	01	00	01	00	Y
9904988	99	04988	PRIMARY	P10	US26	140.85	NONE	31999	FRIDAY	14:20	01	01	01	00	01	00	N
0003577	00	03577	PRIMARY	P10	US26	140.70	NONE	30500	SUNDAY	01:15	01	01	01	00	01	00	N
9905934	99	05934	PRIMARY	P10	US26	138.10	FALLING ROCK/SLIDE	40599	MONDAY	14:30	01	01	04	00	00	00	N
9719111	97	19111	PRIMARY	P10	US26	138.30	NONE	111997	WEDNESDAY	07:10	01	01	02	00	00	00	N
9803407	98	03407	PRIMARY	P10	US26	140.60	NONE	22498	TUESDAY	13:25	01	01	01	00	00	00	N
9919688	99	19688	PRIMARY	P10	US26	140.55	NONE	120299	THURSDAY	19:55	01	01	01	00	00	00	N
9820803	98	20803	PRIMARY	P10	US26	138.06	NONE	122498	THURSDAY	07:00	01	01	01	00	01	00	N
9920172	**99**	**20172**	**PRIMARY**	**P10**	**US26**	**137.04**	**NONE**	**121799**	**FRIDAY**	**20:10**	**01**	**01**	**02**	**00**	**00**	**00**	**N**
9803406	98	03406	PRIMARY	P10	US26	137.85	NONE	22098	FRIDAY	20:15	01	01	01	00	01	00	N
9900455	**99**	**00455**	**PRIMARY**	**P10**	**US26**	**137.05**	**NONE**	**10499**	**MONDAY**	**01:50**	**01**	**01**	**03**	**00**	**00**	**00**	**N**
9719056	97	19056	PRIMARY	P10	US26	139.00	NONE	111997	WEDNESDAY	15:30	02	02	04	00	00	00	N
9918793	99	18793	PRIMARY	P10	US26	137.75	NONE	112799	SATURDAY	22:30	01	01	01	00	01	00	N
9911900	99	11900	PRIMARY	P10	US26	137.45	NONE	72799	TUESDAY	21:15	01	01	04	00	04	00	N
9706241	**97**	**06241**	**PRIMARY**	**P10**	**US26**	**136.80**	**NONE**	**40897**	**TUESDAY**	**17:30**	**01**	**01**	**01**	**00**	**00**	**00**	**N**
9815314	98	15314	PRIMARY	P10	US26	139.20	NONE	100298	FRIDAY	01:30	01	01	01	00	01	00	N
0005285	**00**	**05285**	**PRIMARY**	**P10**	**US26**	**139.00**	**NONE**	**33000**	**THURSDAY**	**19:45**	**01**	**01**	**01**	**00**	**00**	**00**	**N**
0003678	00	03678	PRIMARY	P10	US26	137.40	NONE	30900	THURSDAY	07:27	01	01	01	00	00	00	N

BASE_KEY	ROAD_SUR	LIGHTING	ROAD_CON	WEATHER	RD_ALIGN	TRAFCONT	RD_JUNCT	1ST_HARM	JUNCTION	ADV_COND
9901383	BLACKTOP	DARK UNLIGHTED	ICY	SNOWING	CURVED UPGRADED	PAVEMENT MARKINGS	NON-JUNCTION	DELINEATOR POST	OFF ROADWAY	LANE MARKING
9912333	BLACKTOP	DAYLIGHT	WET	CLEAR	STRAIGHT LEVEL	PAVEMENT MARKINGS	DRIVEWAY ACCESS	MV-MV	ON ROADWAY	NONE
9712685	BLACKTOP	DAYLIGHT	DRY	CLEAR	STRAIGHT LEVEL	PAVEMENT MARKINGS	INTERSECTION RELATED	MV-MV	ON ROADWAY	NONE
9917763	BLACKTOP	DAYLIGHT	DRY	CLEAR	STRAIGHT DOWNGRADE	PAVEMENT MARKINGS	NON-JUNCTION	BERM/DITCH	OFF ROADWAY	NONE
0001137	BLACKTOP	DARK UNLIGHTED	SLUSH	SNOWING	STRAIGHT LEVEL	NONE	NON-JUNCTION	OVERTURN	-	-
0004287	BLACKTOP	DAYLIGHT	ICY	SNOWING	STRAIGHT UPGRADE	PAVEMENT MARKINGS	NON-JUNCTION	BERM/DITCH	OFF ROADWAY	NONE
9819116	BLACKTOP	DARK UNLIGHTED	ICY	CLEAR	CURVE AND LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	SHRUB/TREE	OFF ROADWAY	NONE
9814032	BLACKTOP	DAYLIGHT	DRY	CLEAR	CURVED DOWNGRADE	PAVEMENT MARKINGS	NON-JUNCTION	CUT SLOPE	OFF ROADWAY	NONE
9904988	BLACKTOP	DAYLIGHT	DRY	CLEAR	CURVE AND LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	OVERTURN	SHOULDER	NONE
0003577	BLACKTOP	DARK UNLIGHTED	DRY	CLEAR	STRAIGHT LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	SNOW EMBANKMENT	OFF ROADWAY	NONE
9905934	BLACKTOP	DAYLIGHT	DRY	CLEAR	CURVE AND LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	BOULDER/ROCK	ON ROADWAY	DEBRIS
9719111	BLACKTOP	DAWN OR DUSK	ICY	SNOWING	CURVE AND LEVEL	NONE	NON-JUNCTION	OVERTURN	OFF ROADWAY	NONE
9803407	BLACKTOP	DAYLIGHT	SNOWY	SNOWING	STRAIGHT LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	SNOW EMBANKMENT	OFF ROADWAY	NONE
9919688	BLACKTOP	DARK UNLIGHTED	ICY	SNOWING	STRAIGHT UPGRADE	PAVEMENT MARKINGS	NON-JUNCTION	BERM/DITCH	OFF ROADWAY	NONE
9820803	BLACKTOP	DAWN OR DUSK	SNOWY	CLEAR	CURVED DOWNGRADE	NONE	NON-JUNCTION	CUT SLOPE	OFF ROADWAY	NONE
9920172	**BLACKTOP**	**DARK UNLIGHTED**	**SNOWY**	**CLEAR**	**STRAIGHT LEVEL**	**PAVEMENT MARKINGS**	**NON-JUNCTION**	**ELK**	**ON ROADWAY**	**NONE**
9803406	BLACKTOP	DARK UNLIGHTED	DRY	CLEAR	CURVED DOWNGRADE	PAVEMENT MARKINGS	NON-JUNCTION	CUT SLOPE	OFF ROADWAY	NONE
9900455	**BLACKTOP**	**DARK UNLIGHTED**	**DRY**	**CLEAR**	**STRAIGHT LEVEL**	**PAVEMENT MARKINGS**	**NON-JUNCTION**	**ELK**	**ON ROADWAY**	**NONE**
9719056	DIRT	DAYLIGHT	SNOWY	CLEAR	STRAIGHT UPGRADE	NONE	NON-JUNCTION	MV-MV	-	-
9918793	BLACKTOP	DARK UNLIGHTED	ICY	FOG	CURVE AND LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	OVERTURN	OFF ROADWAY	NONE
9911900	BLACKTOP	DARK UNLIGHTED	DRY	CLEAR	STRAIGHT LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	SHRUB/TREE	OFF ROADWAY	NONE
9706241	**BLACKTOP**	**DAWN OR DUSK**	**DRY**	**CLEAR**	**STRAIGHT LEVEL**	**PAVEMENT MARKINGS**	**NON-JUNCTION**	**ELK**	**ON ROADWAY**	**NONE**
9815314	BLACKTOP	DARK UNLIGHTED	DRY	CLEAR	CURVE AND LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	SHRUB/TREE	OFF ROADWAY	NONE
0005285	**BLACKTOP**	**DARK UNLIGHTED**	**DRY**	**CLEAR**	**STRAIGHT LEVEL**	**PAVEMENT MARKINGS**	**NON-JUNCTION**	**DEER**	**ON ROADWAY**	**NONE**
0003678	BLACKTOP	DAYLIGHT	ICY	SNOWING	STRAIGHT LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	OVERTURN	OFF ROADWAY	NONE

Astoria Before Construction Crashes

March 28, 1997 - March 28, 2000



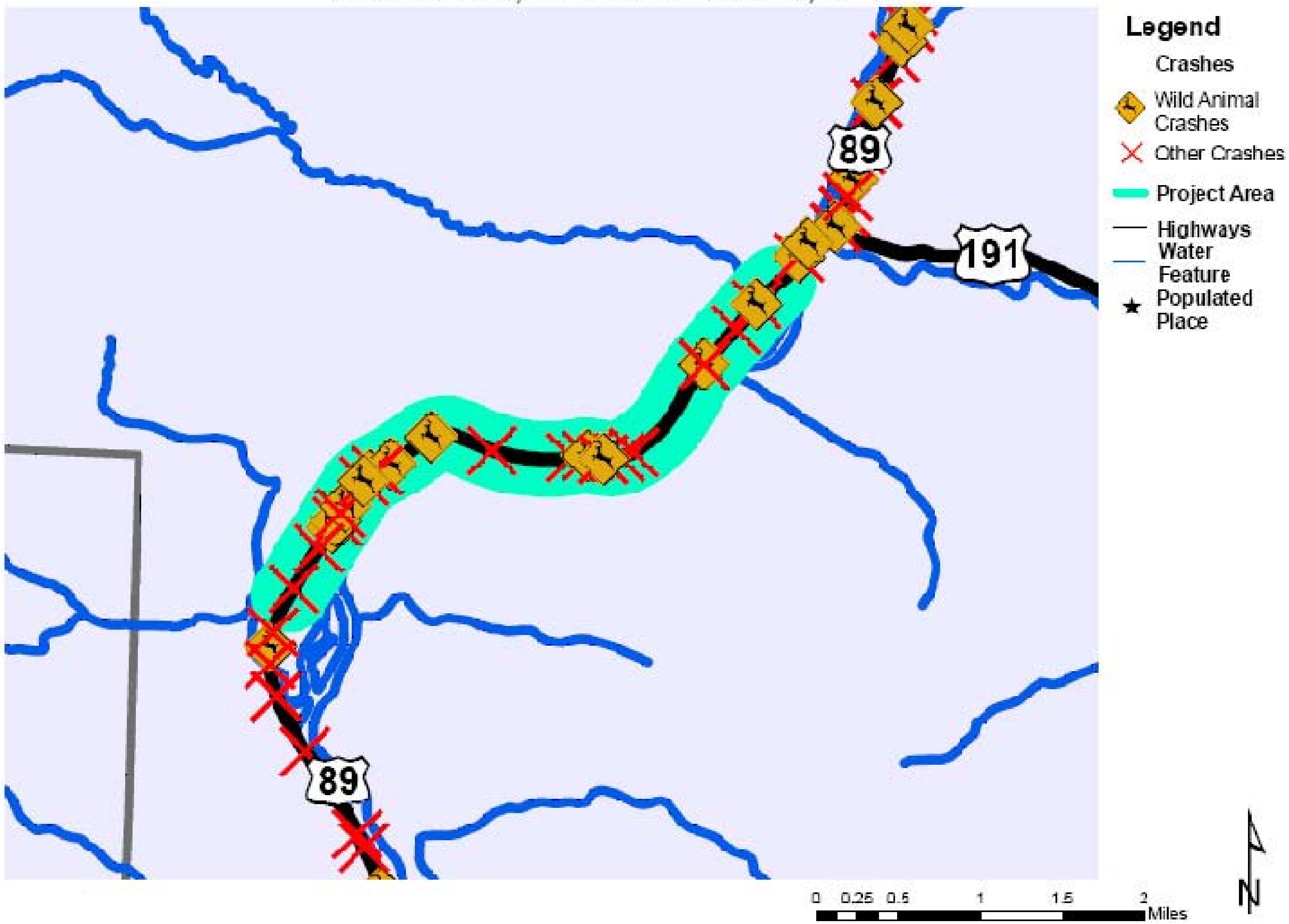
Astoria Section - After Crashes

BASE_KEY	YEAR	REPORT_	HIGHWAY_SY	FED_	ROAD_SGN	MP	HIGH_ELE	DATE_	DAY	TIME	DRIVER	VEH	PER	PEDS	INJ	KILLED	HIT__RUN
0210257	02	10257	PRIMARY	P10	US26	138.00	NONE	70502	FRIDAY	10:25	01	01	04	00	00	00	N
0208724	02	08724	PRIMARY	P10	US26	138.00	NONE	60302	MONDAY	23:30	01	01	01	00	00	00	N
0208099	02	08099	PRIMARY	P10	US26	140.00	NONE	52302	THURSDAY	22:15	01	01	04	00	00	00	N
0204078	02	04078	PRIMARY	P10	US26	138.90	NONE	30502	TUESDAY	02:45	01	01	01	00	01	00	N
0202677	02	02677	PRIMARY	P10	US26	140.30	NONE	12202	TUESDAY	14:00	01	01	01	00	01	00	N
0120216	01	20216	PRIMARY	P10	US26	138.40	NONE	121701	MONDAY	13:10	02	02	03	00	02	00	N
0119943	01	19943	PRIMARY	P10	US26	140.50	NONE	120701	FRIDAY	09:54	02	02	05	00	00	00	N
0118914	01	18914	PRIMARY	P10	US26	137.55	NONE	112501	SUNDAY	22:20	01	01	03	00	00	00	N
0118915	01	18915	PRIMARY	P10	US26	137.70	NONE	112801	WEDNESDAY	23:00	01	01	01	00	00	00	N
0311695	03	11695	PRIMARY	P10	US26	138.00	NONE	63003	MONDAY	09:10	01	01	04	00	00	00	N
0318664	03	18664	PRIMARY	P10	US26	137.15	NONE	111503	SATURDAY	19:00	01	01	01	00	00	00	Y
0301424	03	01424	PRIMARY	P10	US26	137.20	NONE	13003	THURSDAY	10:10	02	02	03	00	00	00	N
0220301	02	20301	PRIMARY	P10	US26	137.70	NONE	121402	SATURDAY	21:15	01	01	01	00	00	00	N
0220298	02	20298	PRIMARY	P10	US26	137.20	NONE	121202	THURSDAY	06:10	01	01	01	00	00	00	N
0307806	03	07806	PRIMARY	P10	US26	137.30	NONE	60303	TUESDAY	09:00	01	01	01	00	00	00	N
0414134	04	14134	PRIMARY	P10	US26	140.50	NONE	91104	SATURDAY	18:55	01	01	02	00	00	00	N
0221051	02	21051	PRIMARY	P10	US26	139.00	NONE	122302	MONDAY	X :	01	02	01	00	00	00	Y
0220304	02	20304	PRIMARY	P10	US26	139.10	NONE	111802	MONDAY	16:20	01	01	03	00	01	00	N
0217885	02	17885	PRIMARY	P10	US26	140.00	NONE	110802	FRIDAY	19:16	02	02	02	00	00	00	N
0314147	03	14147	PRIMARY	P10	US26	137.00	NONE	92003	SATURDAY	11:30	02	02	07	00	00	00	N
0212347	02	12347	PRIMARY	P10	US26	139.30	NONE	72802	SUNDAY	15:05	02	02	08	00	08	00	N
0310765	03	10765	PRIMARY	P10	US26	137.60	NONE	71603	WEDNESDAY	12:15	02	02	04	00	00	00	N
0404247	04	04247	PRIMARY	P10	US26	140.00	NONE	30904	TUESDAY	19:00	01	01	03	00	00	00	N
0212920	02	12920	PRIMARY	P10	US26	137.50	NONE	80902	FRIDAY	23:00	01	01	02	00	02	00	N
0303820	03	03820	PRIMARY	P10	US26	139.20	NONE	30503	WEDNESDAY	16:45	01	01	03	00	00	00	N
0310774	03	10774	PRIMARY	P10	US26	140.00	NONE	71803	FRIDAY	22:30	01	01	02	00	00	00	N
0419377	04	19377	PRIMARY	P10	US26	139.00	NONE	102404	SUNDAY	06:50	01	01	02	00	00	00	N
0414810	04	14810	PRIMARY	P10	US26	140.00	NONE	92304	THURSDAY	15:30	01	02	01	00	00	00	N
0315719	03	15719	PRIMARY	P10	US26	136.70	NONE	102203	WEDNESDAY	07:50	02	02	03	00	00	00	N
0415278	04	15278	PRIMARY	P10	US26	139.10	NONE	92604	SUNDAY	16:30	01	01	01	00	00	00	N
0412954	04	12954	PRIMARY	P10	US26	139.10	NONE	73104	SATURDAY	10:50	01	01	02	00	00	00	N
0311712	03	11712	PRIMARY	P10	US26	137.25	NONE	80203	SATURDAY	16:04	02	02	02	00	01	00	N
0406021	04	06021	PRIMARY	P10	US26	137.50	NONE	42404	SATURDAY	00:45	01	01	01	00	00	00	N

BASE_KEY	ROAD_SUR	LIGHTING	ROAD_CON	WEATHER	RD_ALIGN	TRAFCONT	RD_JUNCT	1ST_HAI	JUNCTION	ADV_COND
0210257	BLACKTOP	DAYLIGHT	DRY	CLEAR	CURVE AND I	PAVEMENT MARKINGS	NON-JUNCTION	DEER	ON ROADWAY	NONE
0208724	BLACKTOP	DARK UNLIGHTED	DRY	CLEAR	CURVE AND I	PAVEMENT MARKINGS	NON-JUNCTION	MOOSE	ON ROADWAY	NONE
0208099	BLACKTOP	DARK UNLIGHTED	DRY	CLEAR	CURVE AND I	PAVEMENT MARKINGS	NON-JUNCTION	DEER	ON ROADWAY	NONE
0204078	BLACKTOP	DARK UNLIGHTED	DRY	CLEAR	STRAIGHT LE	PAVEMENT MARKINGS	NON-JUNCTION	OVERTU	OFF ROADWAY	NONE
0202677	BLACKTOP	DAYLIGHT	ICY	STRONG WIND	CURVED DOV	NONE	NON-JUNCTION	SNOW E	-	-
0120216	BLACKTOP	DAYLIGHT	ICY	SNOWING	CURVE AND I	PAVEMENT MARKINGS	NON-JUNCTION	MV-MV	ON ROADWAY	NONE
0119943	BLACKTOP	DAYLIGHT	SNOWY	CLEAR	STRAIGHT DO	PAVEMENT MARKINGS	NON-JUNCTION	MV-MV	ON ROADWAY	NONE
0118914	CONCRETE	DARK UNLIGHTED	DRY	CLEAR	STRAIGHT LE	WARNING SIGN	NON-JUNCTION	ELK	ON ROADWAY	NONE
0118915	BLACKTOP	DARK UNLIGHTED	SNOWY	SNOWING	CURVE AND I	WARNING SIGN	NON-JUNCTION	ELK	ON ROADWAY	NONE
0311695	BLACKTOP	DAYLIGHT	DRY	CLEAR	STRAIGHT LE	PAVEMENT MARKINGS	NON-JUNCTION	DEER	ON ROADWAY	NONE
0318664	BLACKTOP	DARK UNLIGHTED	DRY	CLEAR	STRAIGHT LE	WARNING SIGN	NON-JUNCTION	ELK	ON ROADWAY	NONE
0301424	BLACKTOP	DAYLIGHT	SLUSH	RAINING	STRAIGHT LE	PAVEMENT MARKINGS	NON-JUNCTION	MV-MV	ON ROADWAY	NONE
0220301	BLACKTOP	DARK UNLIGHTED	DRY	CLEAR	STRAIGHT LE	PAVEMENT MARKINGS	NON-JUNCTION	ELK	ON ROADWAY	NONE
0220298	BLACKTOP	DAYLIGHT	ICY	CLEAR	CURVE AND I	PAVEMENT MARKINGS	NON-JUNCTION	ELK	ON ROADWAY	NONE
0307806	BLACKTOP	DAYLIGHT	DRY	CLEAR	STRAIGHT LE	PAVEMENT MARKINGS	NON-JUNCTION	DEER	ON ROADWAY	NONE
0414134	BLACKTOP	DAYLIGHT	DRY	CLEAR	STRAIGHT DO	PAVEMENT MARKINGS	NON-JUNCTION	DEER	ON ROADWAY	NONE
0221051	BLACKTOP	DARK UNLIGHTED	DRY	UNKNOWN	STRAIGHT LE	PAVEMENT MARKINGS	NON-JUNCTION	PARKED	SHOULDER	NONE
0220304	BLACKTOP	DAYLIGHT	ICY	CLEAR	CURVE AND I	PAVEMENT MARKINGS	NON-JUNCTION	OVERTU	OFF ROADWAY	NONE
0217885	BLACKTOP	DARK UNLIGHTED	SLUSH	SNOWING	STRAIGHT LE	PAVEMENT MARKINGS	NON-JUNCTION	MV-MV	ON ROADWAY	OTHER
0314147	CONCRETE	DAYLIGHT	DRY	CLEAR	STRAIGHT LE	NONE	NON-JUNCTION	MV-MV	-	-
0212347	BLACKTOP	DAYLIGHT	DRY	CLEAR	CURVE AND I	PAVEMENT MARKINGS	NON-JUNCTION	MV-MV	ON ROADWAY	NONE
0310765	BLACKTOP	DAYLIGHT	DRY	CLEAR	STRAIGHT LE	PAVEMENT MARKINGS	NON-JUNCTION	MV-MV	ON ROADWAY	NONE
0404247	BLACKTOP	DARK UNLIGHTED	DRY	CLEAR	CURVED UPG	PAVEMENT MARKINGS	NON-JUNCTION	DEER	ON ROADWAY	NONE
0212920	BLACKTOP	DARK UNLIGHTED	DRY	CLEAR	CURVE AND I	PAVEMENT MARKINGS	NON-JUNCTION	SHRUB/	OFF ROADWAY	NONE
0303820	BLACKTOP	DAYLIGHT	ICY	SNOWING	CURVE AND I	PAVEMENT MARKINGS	NON-JUNCTION	SHRUB/	OFF ROADWAY	NONE
0310774	BLACKTOP	DARK UNLIGHTED	DRY	CLEAR	STRAIGHT UI	PAVEMENT MARKINGS	NON-JUNCTION	DEER	ON ROADWAY	NONE
0419377	BLACKTOP	DAYLIGHT	UNKNOWN	UNKNOWN	UNKNOWN	PAVEMENT MARKINGS	NON-JUNCTION	DEER	ON ROADWAY	NONE
0414810	BLACKTOP	DAYLIGHT	DRY	CLEAR	STRAIGHT LE	NONE	NON-JUNCTION	PARKED	-	-
0315719	BLACKTOP	DAYLIGHT	DRY	CLEAR	STRAIGHT LE	BARRELS / CONES	NON-JUNCTION	MV-MV	ON ROADWAY	UNDER REPAIR
0415278	BLACKTOP	DAYLIGHT	DRY	CLEAR	STRAIGHT LE	PAVEMENT MARKINGS	NON-JUNCTION	DELINEA	OFF ROADWAY	NONE
0412954	BLACKTOP	DAYLIGHT	UNKNOWN	UNKNOWN	UNKNOWN	PAVEMENT MARKINGS	NON-JUNCTION	DEER	ON ROADWAY	NONE
0311712	BLACKTOP	DAYLIGHT	DRY	CLEAR	STRAIGHT LE	PAVEMENT MARKINGS	NON-JUNCTION	PEDACY	SHOULDER	NONE
0406021	BLACKTOP	DARK UNLIGHTED	DRY	CLEAR	STRAIGHT LE	PAVEMENT MARKINGS	NON-JUNCTION	ELK	ON ROADWAY	NONE

Astoria After Construction Crashes

November 21, 2001 - November 21, 2004



Round Mountain Reconstruction Area - Before Crashes

BASE_KEY	YEAR	REPORT_	HIGHWAY_SY	FED_	ROAD_SGN	MP	HIGH_ELE	DATE_	DAY	TIME	DRIVER	VEH	PER	PEDS	INJ	KILLED	HIT___RUN
9900634	99	00634	PRIMARY	P11	US189	50.35	NONE	11899	MONDAY	18:58	01	01	03	01	00	01	N
9815596	98	15596	PRIMARY	P11	US189	52.00	NONE	100798	WEDNESDAY	19:55	01	01	01	00	00	00	N
9815317	98	15317	PRIMARY	P11	US189	46.25	NONE	92598	FRIDAY	14:10	01	01	04	00	02	00	N
9814442	98	14442	PRIMARY	P11	US189	49.65	NONE	91898	FRIDAY	20:40	01	01	02	00	00	00	N
9814284	98	14284	PRIMARY	P11	US189	51.80	NONE	91498	MONDAY	20:45	01	01	02	00	00	00	N
9813600	98	13600	PRIMARY	P11	US189	52.50	NONE	90498	FRIDAY	22:00	01	01	01	00	00	00	N
9812380	98	12380	PRIMARY	P11	US189	48.80	NONE	81198	TUESDAY	22:00	01	01	01	00	00	00	N
9810809	98	10809	PRIMARY	P11	US189	48.18	NONE	71898	SATURDAY	06:05	01	01	01	00	00	00	N
9809580	98	09580	PRIMARY	P11	US189	49.30	NONE	62998	MONDAY	00:05	01	01	01	00	00	00	N
9806965	98	06965	PRIMARY	P11	US189	48.10	NONE	50598	TUESDAY	06:00	01	01	01	00	01	00	N
9805654	98	05654	PRIMARY	P11	US189	49.85	NONE	40498	SATURDAY	07:55	01	01	05	00	00	00	N
9802185	98	02185	PRIMARY	P11	US189	46.52	NONE	20598	THURSDAY	13:55	01	01	01	00	01	00	N
9716923	97	16923	PRIMARY	P11	US189	49.03	NONE	101997	SUNDAY	19:55	01	01	03	00	01	00	N
9716765	97	16765	PRIMARY	P11	US189	49.00	NONE	101997	SUNDAY	19:55	01	01	02	00	00	00	N
9716763	97	16763	PRIMARY	P11	US189	49.50	NONE	101697	THURSDAY	19:15	01	01	01	00	00	00	N
9716436	97	16436	PRIMARY	P11	US189	51.50	NONE	100997	THURSDAY	20:05	01	01	03	00	00	00	N
9709843	97	09843	PRIMARY	P11	US189	48.70	NONE	61997	THURSDAY	21:50	01	01	03	00	00	00	N
9709379	97	09379	PRIMARY	P11	US189	52.95	NONE	61297	THURSDAY	21:50	01	01	02	00	00	00	N
9703466	97	03466	PRIMARY	P11	US189	49.90	NONE	21497	FRIDAY	17:55	01	01	01	00	00	00	N
9615940	96	15940	PRIMARY	P11	US189	49.00	NONE	101196	FRIDAY	22:40	01	01	01	00	00	00	N
9615938	96	15938	PRIMARY	P11	US189	48.20	NONE	101096	THURSDAY	20:25	01	01	03	00	00	00	N
9615366	96	15366	PRIMARY	P11	US189	52.90	NONE	93096	MONDAY	19:40	02	02	04	00	01	00	N
9614964	96	14964	PRIMARY	P11	US189	52.70	NONE	92596	WEDNESDAY	19:50	01	01	01	00	01	00	N
9614963	96	14963	PRIMARY	P11	US189	52.70	NONE	92596	WEDNESDAY	19:50	01	01	05	00	00	00	N
9614789	96	14789	PRIMARY	P11	US189	46.80	NONE	91996	THURSDAY	21:00	01	01	02	00	00	00	N
9613128	**96**	**13128**	**PRIMARY**	**P11**	**US189**	**49.00**	**NONE**	**81896**	**SUNDAY**	**22:18**	**01**	**01**	**02**	**00**	**00**	**00**	**N**
9613352	96	13352	PRIMARY	P11	US189	49.00	NONE	82296	THURSDAY	22:00	01	01	02	00	00	00	N
9608779	96	08779	PRIMARY	P11	US189	51.80	NONE	60696	THURSDAY	16:05	01	01	02	00	01	00	N
9609373	**96**	**09373**	**PRIMARY**	**P11**	**US189**	**53.00**	**NONE**	**62396**	**SUNDAY**	**23:30**	**01**	**01**	**04**	**00**	**00**	**00**	**N**
9610551	**96**	**10551**	**PRIMARY**	**P11**	**US189**	**47.00**	**NONE**	**70596**	**FRIDAY**	**16:30**	**01**	**01**	**04**	**00**	**00**	**00**	**N**
9611764	96	11764	PRIMARY	P11	US189	48.00	NONE	72296	MONDAY	22:40	01	01	01	00	01	00	N
9611117	96	11117	PRIMARY	P11	US189	50.20	NONE	71996	FRIDAY	23:45	01	01	02	00	00	00	N
9905941	99	05941	PRIMARY	P11	US189	46.40	NONE	40999	FRIDAY	17:12	01	01	02	00	00	00	N

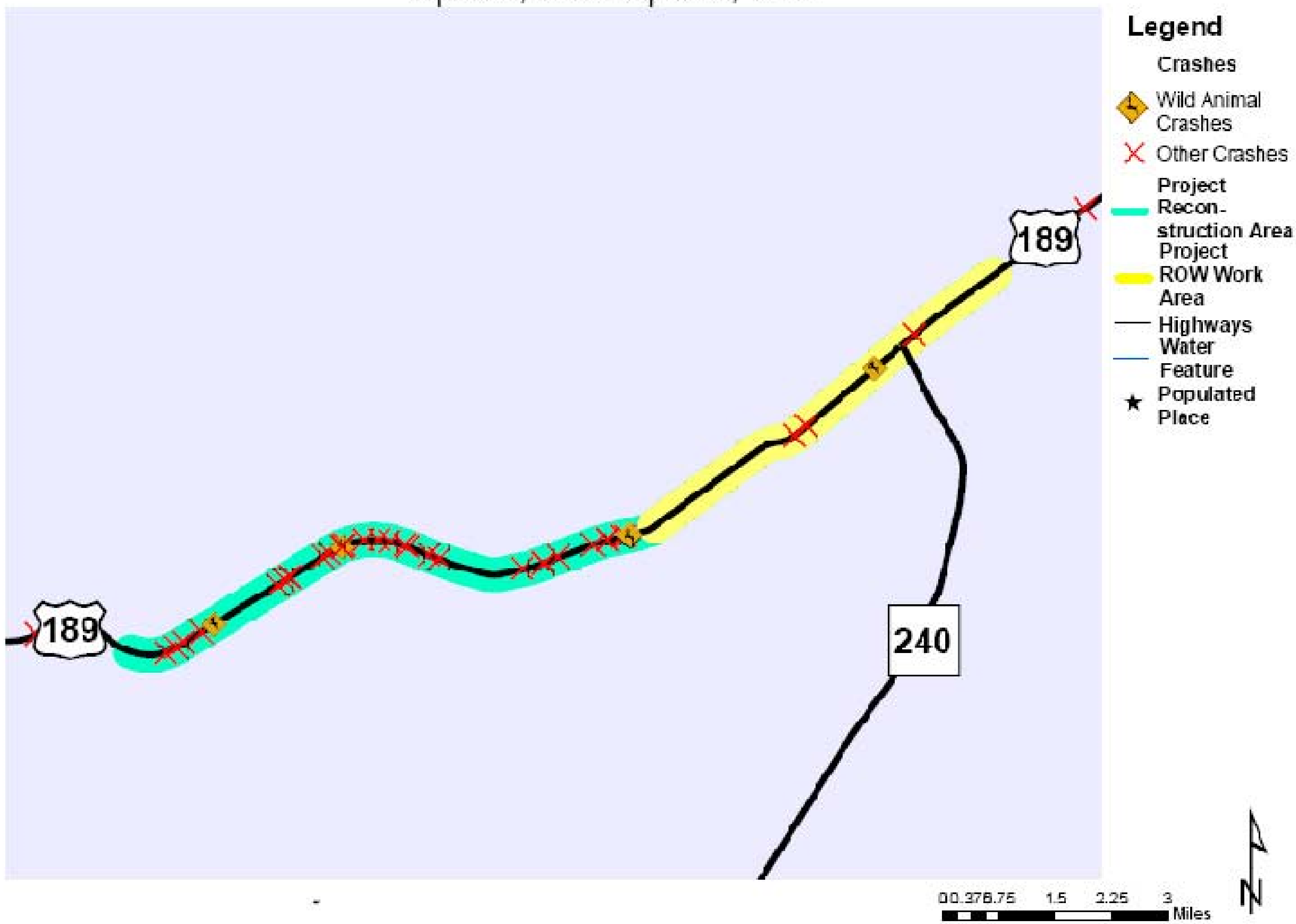
Round Mountain Right-of-Way Area - Before Crashes

BASE_KEY	YEAR	REPORT_	HIGHWAY_SY	FED_	ROAD_SGN	MP	HIGH_ELE	DATE_	DAY	TIME	DRIVER	VEH	PER	PEDS	INJ	KILLED	HIT___RUN
9815887	98	15887	PRIMARY	P11	US189	57.70	NONE	92798	SUNDAY	20:15	01	01	01	00	00	00	N
9814860	98	14860	PRIMARY	P11	US189	55.80	NONE	91998	SATURDAY	22:23	01	01	01	00	01	00	N
9812905	**98**	**12905**	**PRIMARY**	**P11**	**US189**	**57.00**	**NONE**	**82198**	**FRIDAY**	**11:30**	**01**	**01**	**03**	**00**	**00**	**00**	**N**
9717285	97	17285	PRIMARY	P11	US189	55.60	NONE	102497	FRIDAY	08:20	03	03	03	00	00	00	N

BASE_KEY	ROAD_SUR	LIGHTING	ROAD_CON	WEATHER	RD_ALIGN	TRAFCONT	RD_JUNCT	1ST_HARM	JUNCTION	ADV_COND
9815887	BLACKTOP	DAYLIGHT	DRY	CLEAR	STRAIGHT LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	COW	ON ROADWAY	NONE
9814860	BLACKTOP	DARK UNLI	DRY	CLEAR	STRAIGHT LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	COW	ON ROADWAY	NONE
9812905	**BLACKTOP**	**DAYLIGHT**	**DRY**	**CLEAR**	**STRAIGHT LEVEL**	**NONE**	**NON-JUNCTION**	**ANTELOPE**	**ON ROADWAY**	**NONE**
9717285	BLACKTOP	DAYLIGHT	SNOWY	SNOWING	STRAIGHT LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	MV-MV	ON ROADWAY	NONE

Round Mountain Before Construction Crashes

April 29, 1996 - April 29, 1999



Round Mountain Reconstruction Area - After Crashes

BASE_KEY	YEAR	REPORT_	HIGHWAY_SY	FED_	ROAD_SGN	MP	HIGH_ELE	DATE_	DAY	TIME	DRIVER	VEH	PER	PEDS	INJ	KILLED	HIT___RUN
0308316	03	08316	PRIMARY	P11	US189	47.00	NONE	60103	SUNDAY	12:45	01	01	02	00	02	00	N
0306566	03	06566	PRIMARY	P11	US189	48.50	NONE	50203	FRIDAY	20:15	01	01	01	00	00	00	N
0300056	03	00056	PRIMARY	P11	US189	50.50	NONE	10103	WEDNESDAY	19:45	01	01	01	00	00	00	N
0211998	02	11998	PRIMARY	P11	US189	52.00	NONE	73102	WEDNESDAY	12:00	02	02	03	00	00	00	N
0207314	02	07314	PRIMARY	P11	US189	47.55	NONE	50802	WEDNESDAY	12:40	01	01	02	00	02	00	N
0204891	02	04891	PRIMARY	P11	US189	48.15	NONE	33102	SUNDAY	19:15	01	01	01	00	00	00	N
0114291	01	14291	PRIMARY	P11	US189	50.00	NONE	91101	TUESDAY	04:15	01	01	01	00	00	00	N
0309801	03	09801	PRIMARY	P11	US189	53.06	NONE	70403	FRIDAY	19:00	01	01	02	00	02	00	N
0111359	01	11359	PRIMARY	P11	US189	52.00	NONE	72901	SUNDAY	21:53	01	01	03	00	00	00	N

BASE_KEY	ROAD_SUR	LIGHTING	ROAD_CON	WEATHER	RD_ALIGN	TRAFCONT	RD_JUNCT	1ST_HARM	JUNCTION	ADV_COND
0308316	DIRT	DAYLIGHT	DRY	STRONG WIND	STRAIGHT LEVEL	WARNING SIGN	NON-JUNCTION	OTHER NON-COLLISION	ON ROADWAY	UNDER REPAIR
0306566	BLACKTOP	DAWN OR D	DRY	CLEAR	STRAIGHT UPGRADE	PAVEMENT MARKINGS	NON-JUNCTION	DEER	ON ROADWAY	NONE
0300056	BLACKTOP	DARK UNLI	ICY	CLEAR	STRAIGHT UPGRADE	PAVEMENT MARKINGS	NON-JUNCTION	BERM/DITCH	OFF ROADWAY	OTHER
0211998	BLACKTOP	DAYLIGHT	DRY	CLEAR	STRAIGHT DOWNGRADE	PAVEMENT MARKINGS	NON-JUNCTION	MV-MV	ON ROADWAY	NONE
0207314	BLACKTOP	DAYLIGHT	DRY	CLEAR	STRAIGHT DOWNGRADE	PAVEMENT MARKINGS	NON-JUNCTION	OVERTURN	OFF ROADWAY	NONE
0204891	BLACKTOP	DARK UNLI	DRY	CLEAR	STRAIGHT HILLCREST	PAVEMENT MARKINGS	NON-JUNCTION	DEER	-	-
0114291	BLACKTOP	DARK UNLI	DRY	CLEAR	STRAIGHT DOWNGRADE	PAVEMENT MARKINGS	NON-JUNCTION	DEER	-	-
0309801	BLACKTOP	DAYLIGHT	DRY	CLEAR	STRAIGHT DOWNGRADE	PAVEMENT MARKINGS	NON-JUNCTION	OVERTURN	OFF ROADWAY	NONE
0111359	BLACKTOP	DARK UNLI	DRY	CLEAR	STRAIGHT LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	ANTELOPE	ON ROADWAY	NONE

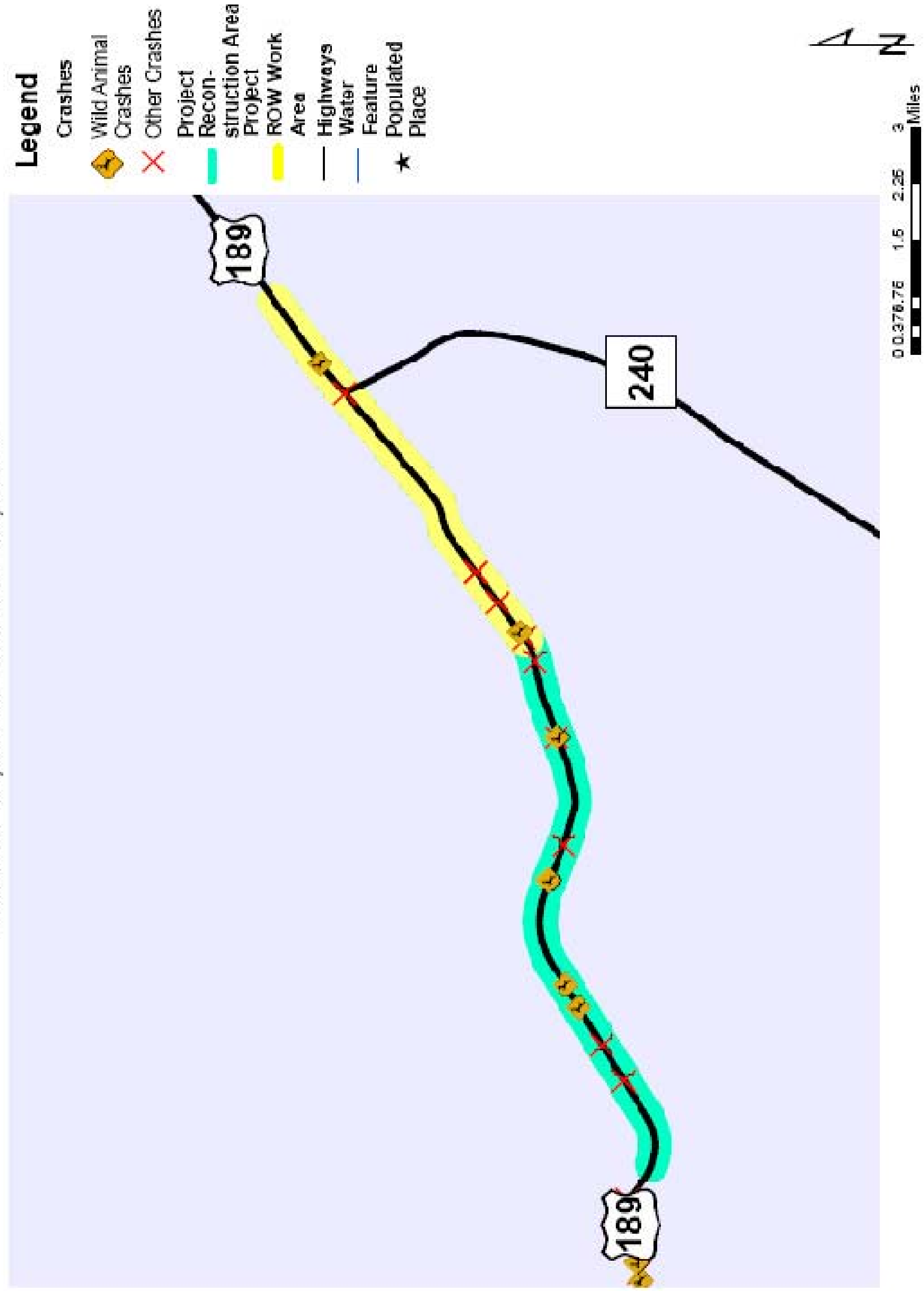
Round Mountain Right-of-Way Area - After Crashes

BASE_KEY	YEAR	REPORT_	HIGHWAY_SY	FED_	ROAD_SGN	MP	HIGH_ELE	DATE_	DAY	TIME	DRIVER	VEH	PER	PEDS	INJ	KILLED	HIT___RUN
0308677	03	08677	PRIMARY	P11	US189	58.00	NONE	61503	SUNDAY	08:10	01	01	02	00	00	00	N
0312279	03	12279	PRIMARY	P11	US189	54.50	NONE	80703	THURSDAY	03:30	01	01	01	00	00	00	N
0206466	02	06466	PRIMARY	P11	US189	53.40	NONE	41802	THURSDAY	00:10	01	01	01	00	01	00	N
0119456	01	19456	PRIMARY	P11	US189	54.00	NONE	120901	SUNDAY	16:15	01	01	01	00	00	00	N
0117821	01	17821	PRIMARY	P11	US189	54.50	NONE	111401	WEDNESDAY	02:00	01	01	01	00	01	00	N
0113796	01	13796	PRIMARY	P11	US189	53.50	NONE	90701	FRIDAY	23:45	01	01	02	00	00	00	N
0106754	01	06754	PRIMARY	P11	US189	57.49	T INTERSECTION	50201	WEDNESDAY	21:25	01	01	02	00	00	00	N

BASE_KEY	ROAD_SUR	LIGHTING	ROAD_CON	WEATHER	RD_ALIGN	TRAFCONT	RD_JUNCT	1ST_HARM	JUNCTION	ADV_COND
0308677	BLACKTOP	DAYLIGHT	DRY	CLEAR	CURVED DOWNGRADE	PAVEMENT MARKINGS	NON-JUNCTION	DEER	-	-
0312279	BLACKTOP	DARK UNLI	DRY	CLEAR	CURVED DOWNGRADE	PAVEMENT MARKINGS	NON-JUNCTION	BERM/DITCH	-	-
0206466	BLACKTOP	DARK UNLI	DRY	CLEAR	CURVE AND LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	OVERTURN	OFF ROADWAY	NONE
0119456	BLACKTOP	DAYLIGHT	ICY	CLEAR	STRAIGHT LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	DELINEATOR POST	OFF ROADWAY	NONE
0117821	BLACKTOP	DARK UNLI	DRY	GROUND BLIZZARD	STRAIGHT DOWNGRADE	PAVEMENT MARKINGS	NON-JUNCTION	OVERTURN	OFF ROADWAY	NONE
0113796	BLACKTOP	DARK UNLI	DRY	CLEAR	STRAIGHT LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	ANTELOPE	-	-
0106754	BLACKTOP	DARK UNLI	DRY	CLEAR	STRAIGHT LEVEL	STOP SIGN	INTERSECTION	BERM/DITCH	OFF ROADWAY	NONE

Round Mountain After Construction Crashes

October 12, 2000 - October 12, 2003



Torrington West Section - Before Crashes

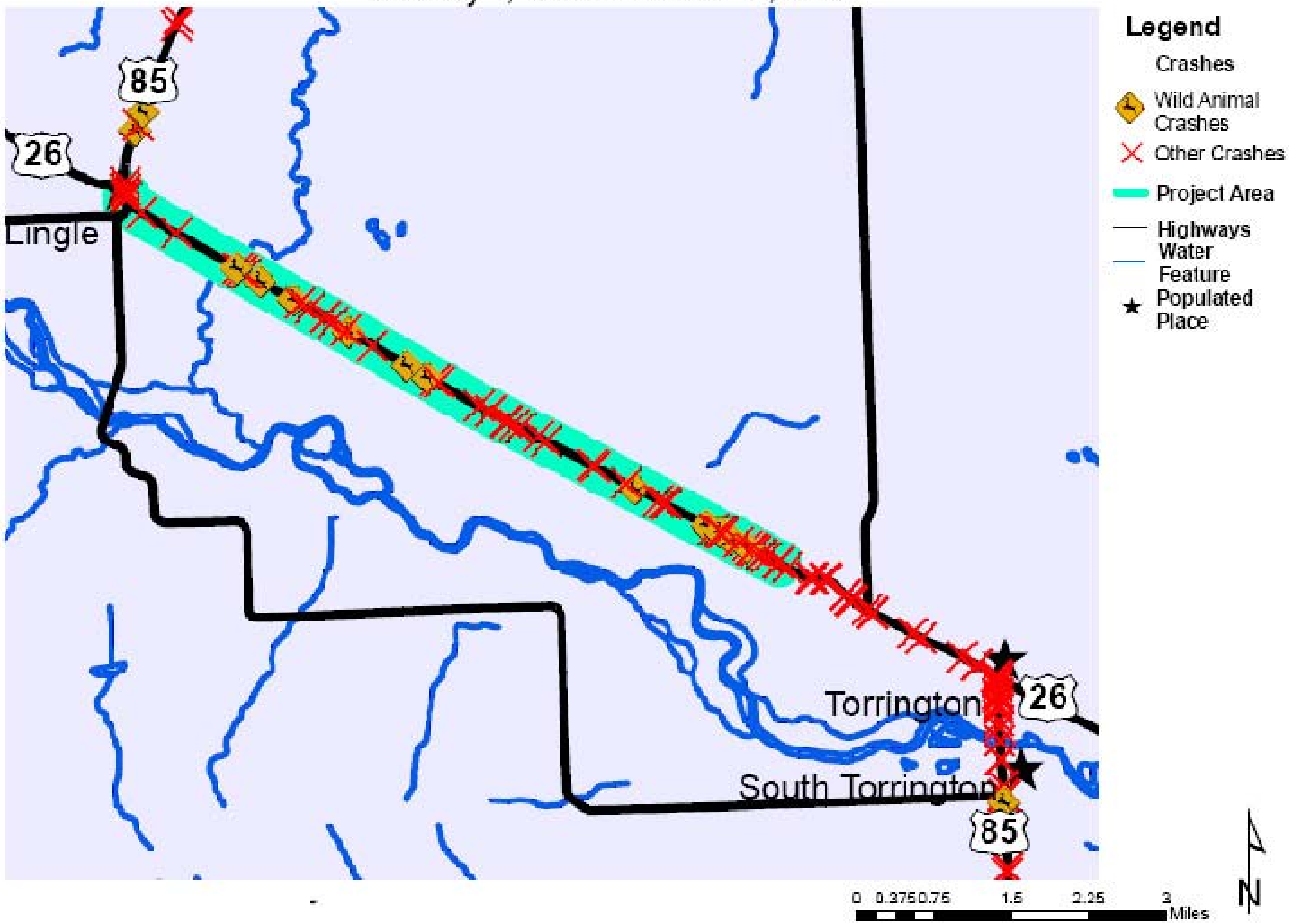
BASE_KEY	YEAR	REPORT_	HIGHWAY_SY	FED_	ROAD_SGN	MP	CITY	HIGH_ELE	DATE_	DAY	TIME	DRIVER	VEH	PER	PEDS	INJ	KILLED	HIT__RUN
9517880	95	17880	PRIMARY	P25	US85	98.00		4-WAY INTERSECTION	113095	THURSDAY	16:00	01	01	01	00	01	00	N
9703804	97	03804	PRIMARY	P25	US85	96.40		NONE	30297	SUNDAY	19:45	01	01	02	00	00	00	N
9701393	97	01393	PRIMARY	P25	US85	96.93		DRIVEWAY	12197	TUESDAY	17:35	02	02	03	00	00	00	N
9713481	97	13481	PRIMARY	P25	US85	100.70		NONE	82297	FRIDAY	01:10	01	01	01	00	00	00	N
9514876	95	14876	PRIMARY	P25	US85	102.90	LINGLE	NONE	101295	THURSDAY	10:10	02	02	02	00	00	00	N
9604520	96	04520	PRIMARY	P25	US85	96.50		NONE	30596	TUESDAY	16:20	01	01	01	00	00	00	N
9621358	96	21358	PRIMARY	P25	US85	96.00		NONE	122596	WEDNESDAY	22:30	01	01	01	00	01	00	N
9516654	95	16654	PRIMARY	P25	US85	96.00		NONE	110895	WEDNESDAY	22:20	01	01	02	00	00	00	N
9619574	96	19574	PRIMARY	P25	US85	100.62		NONE	120396	TUESDAY	17:00	01	01	01	00	00	00	N
9518600	95	18600	PRIMARY	P25	US85	94.80	TORRINGTON	T INTERSECTION	121195	MONDAY	17:05	02	02	02	00	00	00	N
9508374	95	08374	PRIMARY	P25	US85	98.00		4-WAY INTERSECTION	61995	MONDAY	12:10	02	02	02	00	00	00	N
9618650	96	18650	PRIMARY	P25	US85	96.03		T INTERSECTION	111696	SATURDAY	10:20	02	02	02	00	00	00	N
9501713	95	01713	PRIMARY	P25	US85	95.00	TORRINGTON	NONE	12395	MONDAY	22:18	01	01	01	00	00	00	N
9504010	95	04010	PRIMARY	P25	US85	101.12		NONE	30595	SUNDAY	06:45	01	01	01	00	01	00	N
9505360	95	05360	PRIMARY	P25	US85	101.35		NONE	41095	MONDAY	22:40	01	01	02	00	00	00	N
9620492	96	20492	PRIMARY	P25	US85	98.90		DRIVEWAY	121396	FRIDAY	17:00	02	02	05	00	00	00	N
9612297	96	12297	PRIMARY	P25	US85	95.50		NONE	80496	SUNDAY	19:15	01	01	01	00	00	00	N
9704423	97	04423	PRIMARY	P25	US85	94.94	TORRINGTON	BUSINESS ENTRANCE	31397	THURSDAY	16:45	02	02	05	00	00	00	N
9601436	96	01436	PRIMARY	P25	US85	94.90	TORRINGTON	NONE	13196	WEDNESDAY	07:55	01	01	01	00	00	00	N
9604756	96	04756	PRIMARY	P25	US85	96.00		NONE	31396	WEDNESDAY	18:00	01	01	02	00	00	00	N
9617290	96	17290	PRIMARY	P25	US85	98.00		4-WAY INTERSECTION	110196	FRIDAY	18:00	02	02	04	00	01	00	N
9609894	96	09894	PRIMARY	P25	US85	97.60		4-WAY INTERSECTION	62696	WEDNESDAY	11:00	02	02	03	00	00	00	N
9712591	97	12591	PRIMARY	P25	US85	95.40		NONE	81197	MONDAY	12:05	01	01	02	00	02	00	N
9513015	95	13015	PRIMARY	P25	US85	94.75	TORRINGTON	BUSINESS ENTRANCE	90995	SATURDAY	08:10	02	02	03	00	00	00	N
9618649	96	18649	PRIMARY	P25	US85	97.50		DRIVEWAY	111696	SATURDAY	09:15	02	02	05	00	00	00	N
9519130	95	19130	PRIMARY	P25	US85	94.90	TORRINGTON	NONE	122195	THURSDAY	06:30	01	01	01	00	00	00	N
9607269	96	07269	PRIMARY	P25	US85	99.00		NONE	50596	SUNDAY	04:20	01	01	02	00	00	00	N
9509108	95	09108	PRIMARY	P25	US85	102.64		T INTERSECTION	63095	FRIDAY	12:10	02	02	04	00	00	00	N
9616812	96	16812	PRIMARY	P25	US85	96.10		NONE	101796	THURSDAY	17:20	03	03	05	00	00	00	N
9620123	96	20123	PRIMARY	P25	US85	100.00		NONE	120996	MONDAY	05:45	01	01	01	00	00	00	N
9602677	96	02677	PRIMARY	P25	US85	98.85		NONE	21596	THURSDAY	06:30	01	01	01	00	00	00	N
9606061	96	06061	PRIMARY	P25	US85	98.00		T INTERSECTION	40896	MONDAY	14:50	02	02	07	00	01	00	N
9607510	96	07510	PRIMARY	P25	US85	95.33		NONE	51296	SUNDAY	02:00	02	02	03	00	01	00	N
9613974	96	13974	PRIMARY	P25	US85	94.94	TORRINGTON	BUSINESS ENTRANCE	91196	WEDNESDAY	09:45	02	02	03	00	00	00	N
9512368	95	12368	PRIMARY	P25	US85	98.20		NONE	82295	TUESDAY	07:50	02	02	03	00	03	00	N
9712188	97	12188	PRIMARY	P25	US85	98.20		NONE	73197	THURSDAY	18:05	01	01	01	00	00	00	N
9518403	95	18403	PRIMARY	P25	US85	95.20	TORRINGTON	NONE	121095	SUNDAY	21:15	01	01	01	00	00	00	N
9710991	97	10991	PRIMARY	P25	US85	96.90		NONE	70497	FRIDAY	04:30	01	01	01	00	01	00	N
9609427	96	09427	PRIMARY	P25	US85	99.26		NONE	62496	MONDAY	18:00	01	01	02	00	00	00	N
9712588	97	12588	PRIMARY	P25	US85	100.30		T INTERSECTION	80797	THURSDAY	08:45	02	02	03	00	01	00	N
9618646	96	18646	PRIMARY	P25	US85	95.33		NONE	111496	THURSDAY	03:55	01	01	02	00	00	00	N
9619564	96	19564	PRIMARY	P25	US85	99.70		NONE	112496	SUNDAY	19:38	01	01	01	00	00	00	N
9613954	96	13954	PRIMARY	P25	US85	97.99		4-WAY INTERSECTION	90496	WEDNESDAY	15:30	03	03	04	00	01	00	N
9613953	96	13953	PRIMARY	P25	US85	101.30		NONE	90396	TUESDAY	16:05	02	02	02	00	01	00	N
9704425	97	04425	PRIMARY	P25	US85	97.83		NONE	31697	SUNDAY	12:40	01	01	01	00	00	00	Y
9700035	97	00035	PRIMARY	P25	US85	98.33		NONE	10197	WEDNESDAY	01:45	01	01	02	00	00	00	Y
9707969	97	07969	PRIMARY	P25	US85	101.40		NONE	51697	FRIDAY	15:30	01	01	01	00	00	00	N
9604759	96	04759	PRIMARY	P25	US85	95.00	TORRINGTON	NONE	31696	SATURDAY	23:55	01	01	01	00	00	00	N
9514520	95	14520	PRIMARY	P25	US85	95.30		NONE	100695	FRIDAY	23:58	01	01	03	00	00	00	N
9500638	95	00638	PRIMARY	P25	US85	100.30		NONE	11695	MONDAY	17:00	01	01	02	00	00	00	N
9713798	97	13798	PRIMARY	P25	US85	100.03		NONE	82197	THURSDAY	16:15	01	01	03	00	00	00	N
9508106	95	08106	PRIMARY	P25	US85	102.20		NONE	61295	MONDAY	13:30	01	01	02	00	00	00	N
9508659	95	08659	PRIMARY	P25	US85	100.20		NONE	62495	SATURDAY	00:05	01	01	01	00	00	00	N
9608299	96	08299	PRIMARY	P25	US85	95.10	TORRINGTON	NONE	52696	SUNDAY	02:30	01	01	01	00	00	00	Y
9606062	96	06062	PRIMARY	P25	US85	94.94	TORRINGTON	BUSINESS ENTRANCE	41396	SATURDAY	12:00	02	02	02	00	00	00	N
9618643	96	18643	PRIMARY	P25	US85	101.42		NONE	111196	MONDAY	19:15	01	01	04	00	00	00	N
9621360	96	21360	PRIMARY	P25	US85	98.00		4-WAY INTERSECTION	122696	THURSDAY	16:38	02	02	02	00	00	00	N
9616428	96	16428	PRIMARY	P25	US85	95.33		PORT/REST AREA	102196	MONDAY	18:50	02	03	04	00	00	00	N
9707851	97	07851	PRIMARY	P25	US85	94.81	TORRINGTON	T INTERSECTION	50997	FRIDAY	08:10	02	02	02	00	00	00	N
9506779	95	06779	PRIMARY	P25	US85	98.00		4-WAY INTERSECTION	50595	FRIDAY	15:45	02	02	03	00	01	00	N
9703803	97	03803	PRIMARY	P25	US85	102.89	LINGLE	NONE	30197	SATURDAY	07:15	01	01	02	00	01	00	N
9714132	97	14132	PRIMARY	P25	US85	97.90		BUSINESS ENTRANCE	91397	SATURDAY	18:00	02	02	03	00	00	00	N
9709046	97	09046	PRIMARY	P25	US85	100.50		NONE	60697	FRIDAY	19:00	01	01	06	00	00	00	N

Torrington West Section - Before Crashes (Cont.)

BASE_KEY	ROAD_SUR	LIGHTING	ROAD_CON	WEATHER	RD_ALIGN	TRAFCONT	RD_JUNCT	1ST_HARM	JUNCTION	ADV_COND
9517880	BLACKTOP	DAYLIGHT	DRY	CLEAR	STRAIGHT LEVEL	PAVEMENT MARKINGS	INTERSECTION	RAISED CURB	ON ROADWAY	NONE
9703804	**BLACKTOP**	**DARK UNLIGHTED**	**DRY**	**CLEAR**	**STRAIGHT LEVEL**	**PAVEMENT MARKINGS**	**NON-JUNCTION**	**DEER**	**ON ROADWAY**	**NONE**
9701393	BLACKTOP	DARK UNLIGHTED	DRY	CLEAR	STRAIGHT LEVEL	PAVEMENT MARKINGS	DRIVEWAY ACCESS	MV-MV	ON ROADWAY	NONE
9713481	**BLACKTOP**	**DARK UNLIGHTED**	**DRY**	**CLEAR**	**STRAIGHT LEVEL**	**PAVEMENT MARKINGS**	**NON-JUNCTION**	**DEER**	**ON ROADWAY**	**NONE**
9514876	BLACKTOP	DAYLIGHT	DRY	CLEAR	STRAIGHT LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	MV-MV	ON ROADWAY	NONE
9604520	BLACKTOP	DAYLIGHT	ICY	CLEAR	STRAIGHT LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	OVERTURN	OFF ROADWAY	NONE
9621358	BLACKTOP	DARK UNLIGHTED	SNOWY	SNOWING	STRAIGHT LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	POST	OFF ROADWAY	NONE
9516654	BLACKTOP	DARK UNLIGHTED	DRY	GROUND BLIZZARD	STRAIGHT LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	OTHER DOMESTIC	ON ROADWAY	NONE
9619574	BLACKTOP	DARK UNLIGHTED	DRY	CLEAR	STRAIGHT LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	OTHER OBJECT	ON ROADWAY	NONE
9518600	BLACKTOP	DARK LIGHTED	DRY	CLEAR	CURVE AND LEVEL	STOP SIGN	INTERSECTION	MV-MV	ON ROADWAY	NONE
9508374	BLACKTOP	DAYLIGHT	DRY	CLEAR	STRAIGHT LEVEL	PAVEMENT MARKINGS	INTERSECTION	MV-MV	ON ROADWAY	NONE
9618650	BLACKTOP	DAYLIGHT	SNOWY	SNOWING	STRAIGHT LEVEL	STOP SIGN	INTERSECTION	MV-MV	ON ROADWAY	NONE
9501713	BLACKTOP	DARK UNLIGHTED	DRY	CLEAR	CURVE AND LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	POST	OFF ROADWAY	NONE
9504010	**BLACKTOP**	**DAWN OR DUSK**	**DRY**	**CLEAR**	**STRAIGHT LEVEL**	**PAVEMENT MARKINGS**	**NON-JUNCTION**	**DEER**	**ON ROADWAY**	**NONE**
9505360	BLACKTOP	DARK UNLIGHTED	SNOWY	SNOWING	STRAIGHT LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	COW	ON ROADWAY	NONE
9620492	BLACKTOP	DARK UNLIGHTED	DRY	CLEAR	STRAIGHT LEVEL	PAVEMENT MARKINGS	DRIVEWAY ACCESS	MV-MV	ON ROADWAY	NONE
9612297	**BLACKTOP**	**DAYLIGHT**	**DRY**	**CLEAR**	**STRAIGHT LEVEL**	**PAVEMENT MARKINGS**	**NON-JUNCTION**	**DEER**	**ON ROADWAY**	**NONE**
9704423	BLACKTOP	DAYLIGHT	DRY	CLEAR	STRAIGHT LEVEL	PAVEMENT MARKINGS	DRIVEWAY ACCESS	MV-MV	ON ROADWAY	NONE
9601436	BLACKTOP	DAYLIGHT	ICY	CLEAR	STRAIGHT LEVEL	NONE	NON-JUNCTION	OTHER OBJECT	OFF ROADWAY	NONE
9604756	BLACKTOP	DAYLIGHT	DRY	CLEAR	STRAIGHT LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	OTHER DOMESTIC	ON ROADWAY	NONE
9617290	BLACKTOP	DARK UNLIGHTED	DRY	CLEAR	STRAIGHT LEVEL	STOP SIGN	INTERSECTION	MV-MV	ON ROADWAY	NONE
9609894	BLACKTOP	DAYLIGHT	DRY	CLEAR	STRAIGHT LEVEL	STOP SIGN	INTERSECTION	MV-MV	ON ROADWAY	NONE
9712591	BLACKTOP	DAYLIGHT	DRY	CLEAR	STRAIGHT LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	OTHER NON-COLLISION	ON ROADWAY	NONE
9513015	BLACKTOP	DAYLIGHT	DRY	CLEAR	STRAIGHT LEVEL	PAVEMENT MARKINGS	DRIVEWAY ACCESS	MV-MV	ON ROADWAY	NONE
9618649	BLACKTOP	DAYLIGHT	ICY	SNOWING	STRAIGHT LEVEL	PAVEMENT MARKINGS	DRIVEWAY ACCESS	MV-MV	ON ROADWAY	NONE
9519130	BLACKTOP	DAWN OR DUSK	ICY	SNOWING	STRAIGHT LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	OTHER SIGN	OFF ROADWAY	NONE
9607269	**BLACKTOP**	**DARK LIGHTED**	**DRY**	**CLEAR**	**STRAIGHT LEVEL**	**PAVEMENT MARKINGS**	**NON-JUNCTION**	**DEER**	**ON ROADWAY**	**NONE**
9509108	BLACKTOP	DAYLIGHT	DRY	CLEAR	STRAIGHT LEVEL	PAVEMENT MARKINGS	INTERSECTION RELATED	MV-MV	ON ROADWAY	NONE
9616812	BLACKTOP	DAYLIGHT	DRY	CLEAR	STRAIGHT LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	MV-MV	ON ROADWAY	NONE
9620123	**BLACKTOP**	**DARK UNLIGHTED**	**DRY**	**CLEAR**	**STRAIGHT LEVEL**	**PAVEMENT MARKINGS**	**NON-JUNCTION**	**DEER**	**ON ROADWAY**	**NONE**
9602677	BLACKTOP	DARK LIGHTED	DRY	CLEAR	STRAIGHT UPGRADE	PAVEMENT MARKINGS	NON-JUNCTION	HORSE	ON ROADWAY	NONE
9606061	BLACKTOP	DAYLIGHT	DRY	CLEAR	STRAIGHT LEVEL	NO PASSING ZONE	INTERSECTION	MV-MV	ON ROADWAY	NONE
9607510	BLACKTOP	DARK UNLIGHTED	DRY	CLEAR	STRAIGHT LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	MV-MV	ON ROADWAY	NONE
9613974	BLACKTOP	DAYLIGHT	DRY	CLEAR	STRAIGHT LEVEL	PAVEMENT MARKINGS	DRIVEWAY ACCESS	MV-MV	ON ROADWAY	NONE
9512368	BLACKTOP	DAYLIGHT	DRY	CLEAR	STRAIGHT LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	MV-MV	ON ROADWAY	NONE
9712188	BLACKTOP	DAYLIGHT	DRY	CLEAR	STRAIGHT LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	DELINEATOR POST	SHOULDER	NONE
9518403	**BLACKTOP**	**DARK UNLIGHTED**	**DRY**	**CLEAR**	**STRAIGHT LEVEL**	**NONE**	**NON-JUNCTION**	**DEER**	**ON ROADWAY**	**NONE**
9710991	BLACKTOP	DARK UNLIGHTED	DRY	CLEAR	STRAIGHT LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	OVERTURN	OFF ROADWAY	NONE
9609427	**BLACKTOP**	**DAYLIGHT**	**DRY**	**CLEAR**	**STRAIGHT HILLCREST**	**PAVEMENT MARKINGS**	**NON-JUNCTION**	**DEER**	**ON ROADWAY**	**NONE**
9712588	BLACKTOP	DAYLIGHT	DRY	CLEAR	STRAIGHT LEVEL	PAVEMENT MARKINGS	INTERSECTION RELATED	MV-MV	ON ROADWAY	NONE
9618646	**BLACKTOP**	**DARK UNLIGHTED**	**DRY**	**CLEAR**	**STRAIGHT LEVEL**	**PAVEMENT MARKINGS**	**NON-JUNCTION**	**DEER**	**ON ROADWAY**	**NONE**
9619564	BLACKTOP	DARK UNLIGHTED	DRY	CLEAR	STRAIGHT LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	HORSE	ON ROADWAY	NONE
9613954	CONCRETE	DAYLIGHT	DRY	CLEAR	STRAIGHT LEVEL	PAVEMENT MARKINGS	INTERSECTION RELATED	MV-MV	ON ROADWAY	NONE
9613953	BLACKTOP	DAYLIGHT	DRY	CLEAR	STRAIGHT LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	MV-MV	ON ROADWAY	NONE
9704425	BLACKTOP	DAYLIGHT	DRY	CLEAR	STRAIGHT LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	OTHER FIXED	OFF ROADWAY	NONE
9700035	BLACKTOP	DARK UNLIGHTED	DRY	CLEAR	STRAIGHT LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	FENCE	OFF ROADWAY	NONE
9707969	BLACKTOP	DAYLIGHT	DRY	CLEAR	STRAIGHT LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	OVERTURN	OFF ROADWAY	NONE
9604759	**BLACKTOP**	**DARK UNLIGHTED**	**DRY**	**STRONG WIND**	**STRAIGHT LEVEL**	**NONE**	**NON-JUNCTION**	**DEER**	**-**	**-**
9514520	BLACKTOP	DARK UNLIGHTED	DRY	CLEAR	CURVE AND LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	HORSE	ON ROADWAY	NONE
9500638	BLACKTOP	DARK UNLIGHTED	ICY	CLEAR	STRAIGHT LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	OVERTURN	OFF ROADWAY	NONE
9713798	BLACKTOP	DAYLIGHT	DRY	CLEAR	STRAIGHT LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	OVERTURN	OFF ROADWAY	NONE
9508106	CONCRETE	DAYLIGHT	DRY	CLEAR	STRAIGHT LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	OTHER SIGN	OFF ROADWAY	NONE
9508659	BLACKTOP	DARK UNLIGHTED	DRY	CLEAR	STRAIGHT LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	COW	ON ROADWAY	NONE
9608299	BLACKTOP	DARK UNLIGHTED	WET	RAINING	CURVE AND LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	ROAD APPROACH	OFF ROADWAY	NONE
9606062	BLACKTOP	DAYLIGHT	WET	CLEAR	STRAIGHT LEVEL	PAVEMENT MARKINGS	DRIVEWAY ACCESS	MV-MV	ON ROADWAY	NONE
9618643	**BLACKTOP**	**DARK UNLIGHTED**	**DRY**	**CLEAR**	**STRAIGHT LEVEL**	**PAVEMENT MARKINGS**	**NON-JUNCTION**	**DEER**	**ON ROADWAY**	**NONE**
9621360	BLACKTOP	DAWN OR DUSK	ICY	CLEAR	STRAIGHT LEVEL	STOP SIGN	INTERSECTION	MV-MV	ON ROADWAY	DEBRIS
9616428	BLACKTOP	DAYLIGHT	DRY	CLEAR	STRAIGHT LEVEL	PAVEMENT MARKINGS	DRIVEWAY ACCESS	MV-MV	ON ROADWAY	NONE
9707851	BLACKTOP	DAYLIGHT	DRY	CLEAR	CURVE AND LEVEL	STOP SIGN	INTERSECTION	MV-MV	ON ROADWAY	NONE
9506779	BLACKTOP	DAYLIGHT	DRY	CLEAR	STRAIGHT LEVEL	STOP SIGN	INTERSECTION	MV-MV	ON ROADWAY	NONE
9703803	BLACKTOP	DAYLIGHT	ICY	CLEAR	CURVE AND LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	OVERTURN	OFF ROADWAY	UNDER REPAIR
9714132	BLACKTOP	DAYLIGHT	DRY	CLEAR	STRAIGHT LEVEL	PAVEMENT MARKINGS	DRIVEWAY ACCESS	MV-MV	ON ROADWAY	NONE
9709046	BLACKTOP	DAYLIGHT	DRY	CLEAR	STRAIGHT LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	OVERTURN	OFF ROADWAY	NONE

Torrington West Before Construction Crashes

January 1, 1995 - October 13, 1997



Torrington West Section - After Crashes

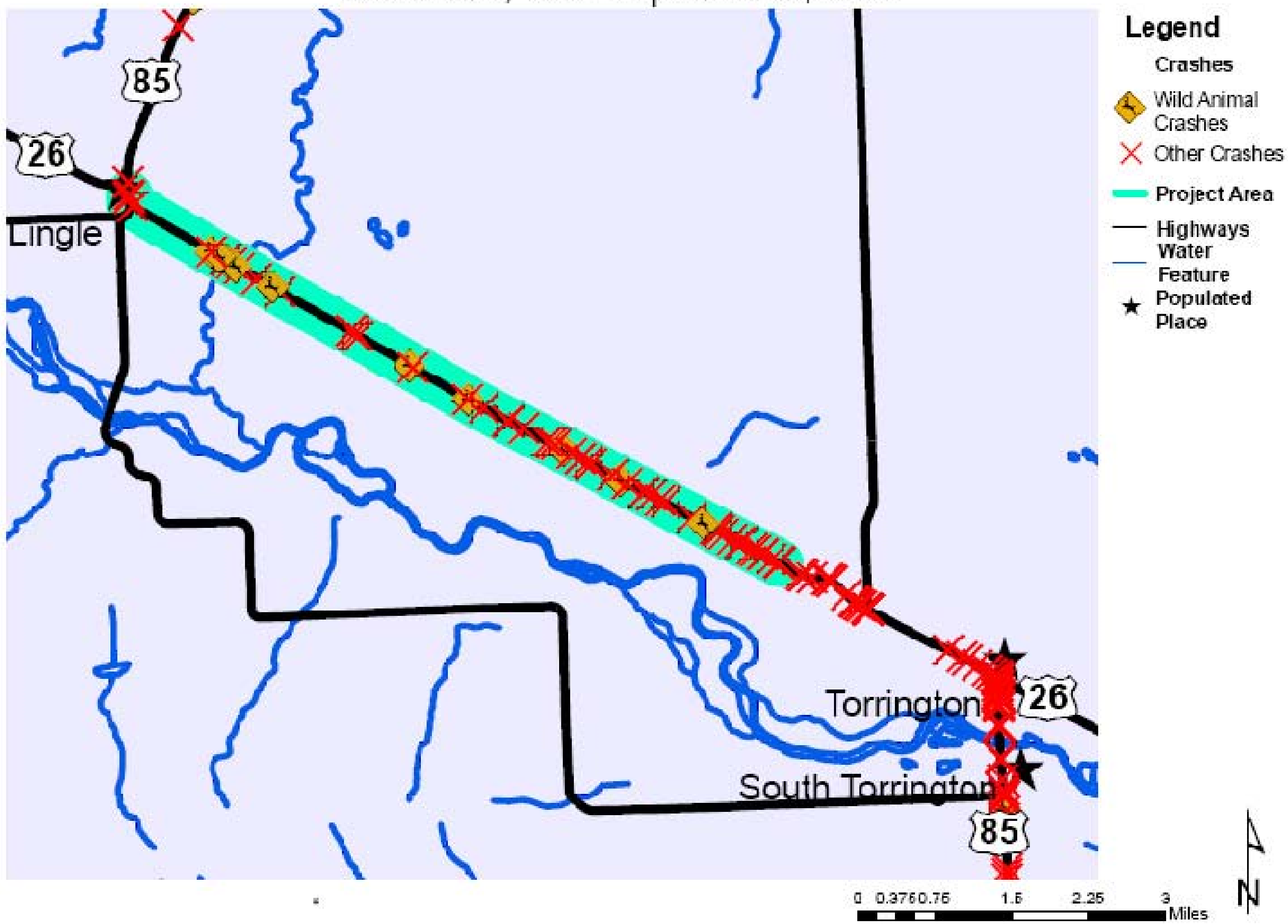
BASE_KEY	YEAR	REPORT_	HIGHWAY_SY	FED_	ROAD_SGN	MP	COTY_RD	CITY	HIGH_ELE	DATE_	DAY	TIME	DRIVER	VEH	PER	PEDS	INJ	KILLED	HIT__RUN
0112289	01	12289	PRIMARY	P25	US85	99.25	-		NONE	81301	MONDAY	06:15	01	01	01	00	00	00	N
0020593	00	20593	PRIMARY	P25	US85	97.45	-		NONE	121700	SUNDAY	00:10	01	01	01	00	01	00	N
0017000	00	17000	PRIMARY	P25	US85	100.00	-		NONE	111000	FRIDAY	20:10	02	02	03	00	02	00	N
0007654	00	07654	PRIMARY	P25	US85	95.36	-		NONE	52900	MONDAY	06:15	01	01	02	00	00	00	N
0006053	00	06053	PRIMARY	P25	US85	95.36	-		PORT/REST AREA	42500	TUESDAY	15:15	01	01	01	00	00	00	N
0000642	00	00642	PRIMARY	P25	US85	101.59	-		NONE	11600	SUNDAY	19:00	01	01	01	00	01	00	N
0204199	02	04199	PRIMARY	P25	US85	97.10	-		DRIVEWAY	31502	FRIDAY	07:05	02	02	04	00	00	00	N
9905336	99	05336	PRIMARY	P25	US85	101.52	-		APPROACH ROAD	40499	SUNDAY	04:30	01	01	01	00	00	00	Y
0114327	01	14327	PRIMARY	P25	US85	95.07	-	TORRINGTON	DRIVEWAY	92301	SUNDAY	08:00	01	01	01	00	00	00	N
9913355	99	13355	PRIMARY	P25	US85	97.30	-		NONE	81299	THURSDAY	21:00	01	01	02	00	02	00	N
9903582	99	03582	PRIMARY	P25	US85	96.03	-		NONE	22699	FRIDAY	17:35	01	01	01	00	01	00	N
0207294	02	07294	PRIMARY	P25	US85	94.81	-	TORRINGTON	4-WAY INTERSECTION	51202	SUNDAY	15:25	02	02	04	00	00	00	N
0016996	00	16996	PRIMARY	P25	US85	101.20	-		NONE	111000	FRIDAY	22:45	01	01	01	00	01	00	N
0117951	01	17951	PRIMARY	P25	US85	96.60	-		NONE	112301	FRIDAY	17:00	01	01	03	00	00	00	N
0208668	02	08668	PRIMARY	P25	US85	94.70	-	TORRINGTON	NONE	60802	SATURDAY	03:30	01	01	01	00	00	00	Y
0107870	01	07870	PRIMARY	P25	US85	95.36	-		PORT/REST AREA	53001	WEDNESDAY	10:45	01	02	01	00	00	00	N
0020597	00	20597	PRIMARY	P25	US85	95.10	-	TORRINGTON	NONE	122500	MONDAY	15:45	01	01	01	00	00	00	N
0016687	00	16687	PRIMARY	P25	US85	101.79	-		NONE	110400	SATURDAY	23:15	01	01	01	00	00	00	N
9901984	99	01984	PRIMARY	P25	US85	98.00	-		4-WAY INTERSECTION	13199	SUNDAY	12:00	02	02	02	00	01	00	N
0207114	02	07114	PRIMARY	P25	US85	95.19	-	TORRINGTON	NONE	50502	SUNDAY	06:32	01	01	02	00	02	00	N
0012618	00	12618	PRIMARY	P25	US85	102.79	-	LINGLE	T INTERSECTION	82500	FRIDAY	14:20	02	02	02	00	01	00	N
9908794	99	08794	PRIMARY	P25	US85	97.20	-		CONT LEFT TRN LANE	60499	FRIDAY	07:40	03	03	03	00	01	00	N
0200168	02	00168	PRIMARY	P25	US85	101.42	-		NONE	10202	WEDNESDAY	00:15	01	01	02	00	02	00	N
0117950	01	17950	PRIMARY	P25	US85	101.00	-		NONE	112301	FRIDAY	18:06	01	01	02	00	00	00	N
9914349	99	14349	PRIMARY	P25	US85	100.00	-		T INTERSECTION	91099	FRIDAY	13:45	02	02	18	00	03	00	N
9911507	99	11507	PRIMARY	P25	US85	94.90	-	TORRINGTON	BUSINESS ENTRANCE	72299	THURSDAY	17:23	02	02	03	00	00	00	N
0009767	00	09767	PRIMARY	P25	US85	99.95	-		NONE	70600	THURSDAY	07:10	01	01	02	00	02	00	N
0006958	00	06958	PRIMARY	P25	US85	95.40	-		DRIVEWAY	50500	FRIDAY	16:08	02	02	03	00	02	00	N
0112114	01	12114	PRIMARY	P25	US85	99.20	-		NONE	80801	WEDNESDAY	X :	01	01	01	00	01	00	N
0016586	00	16586	PRIMARY	P25	US85	101.57	-		NONE	110200	THURSDAY	17:20	01	01	02	00	00	00	N
0013286	00	13286	PRIMARY	P25	US85	101.60	-		LEFT TURN LANE	91400	THURSDAY	09:10	02	02	04	00	00	00	N
9901747	99	01747	PRIMARY	P25	US85	102.89	-	LINGLE	T INTERSECTION	13099	SATURDAY	18:30	02	02	03	00	01	00	N
0118669	01	18669	PRIMARY	P25	US85	99.90	-		NONE	113001	FRIDAY	07:35	01	01	01	00	00	00	N
0020595	00	20595	PRIMARY	P25	US85	98.50	-		NONE	121800	MONDAY	17:45	01	01	03	00	00	00	N
9918211	99	18211	PRIMARY	P25	US85	98.30	-		NONE	112099	SATURDAY	07:20	01	01	01	00	01	00	N
9916380	99	16380	PRIMARY	P25	US85	95.70	-		NONE	101199	MONDAY	18:55	01	01	01	00	00	00	N
9914193	99	14193	PRIMARY	P25	US85	96.70	-		T INTERSECTION	90399	FRIDAY	10:25	02	02	02	00	01	00	N
9909898	99	09898	PRIMARY	P25	US85	98.00	-		4-WAY INTERSECTION	62299	TUESDAY	18:00	02	02	06	00	00	00	N
9901748	99	01748	PRIMARY	P25	US85	95.10	-	TORRINGTON	NONE	20199	MONDAY	03:15	01	01	01	00	00	00	N
0117947	01	17947	PRIMARY	P25	US85	94.80	-	TORRINGTON	NONE	111701	SATURDAY	12:00	02	02	02	00	00	00	N
0111264	01	11264	PRIMARY	P25	US85	96.10	-		NONE	72201	SUNDAY	22:35	02	02	07	00	07	00	N
0215246	02	15246	PRIMARY	P25	US85	95.36	-		PORT/REST AREA	91202	THURSDAY	22:30	01	01	01	00	00	00	N
0105256	01	05256	PRIMARY	P25	US85	97.50	-		NONE	40701	SATURDAY	23:30	01	01	01	00	00	00	N
0106998	01	06998	PRIMARY	P25	US85	101.47	-		NONE	50701	MONDAY	21:00	01	01	01	00	00	00	N
0016019	00	16019	PRIMARY	P25	US85	100.90	-		NONE	101800	WEDNESDAY	08:30	01	01	01	00	00	00	N
0010575	00	10575	PRIMARY	P25	US85	96.95	-		T INTERSECTION	71900	WEDNESDAY	13:10	02	02	02	00	01	00	N
0009014	00	09014	PRIMARY	P25	US85	96.30	-		DRIVEWAY	61900	MONDAY	17:10	02	02	06	00	00	00	N
0007203	00	07203	PRIMARY	P25	US85	96.20	-		T INTERSECTION	51900	FRIDAY	15:20	02	02	02	00	01	00	N
9901473	99	01473	PRIMARY	P25	US85	97.00	-		NONE	12899	THURSDAY	11:50	02	02	02	00	00	00	N
0106287	01	06287	PRIMARY	P25	US85	95.30	-		NONE	42201	SUNDAY	15:50	01	01	02	00	01	00	N
0018410	00	18410	PRIMARY	P25	US85	96.50	-		NONE	112200	WEDNESDAY	22:50	02	02	03	00	02	00	N
9907447	99	07447	PRIMARY	P25	US85	95.40	-		PORT/REST AREA	51099	MONDAY	16:30	02	02	02	00	01	00	N
9903956	99	03956	PRIMARY	P25	US85	98.00	-		4-WAY INTERSECTION	30599	FRIDAY	15:25	02	02	06	00	06	00	N
9913804	99	13804	PRIMARY	P25	US85	98.00	-		NONE	90299	THURSDAY	12:30	01	01	01	00	00	00	N
9912649	99	12649	PRIMARY	P25	US85	98.50	-		NONE	81099	TUESDAY	10:00	01	01	01	00	00	00	N
0201191	02	01191	PRIMARY	P25	US85	95.55	-		NONE	12402	THURSDAY	22:15	01	01	02	00	00	00	N
0205082	02	05082	PRIMARY	P25	US85	97.40	-		NONE	32802	THURSDAY	21:55	01	01	01	00	00	00	N
0104636	01	04636	PRIMARY	P25	US85	97.80	-		NONE	32501	SUNDAY	14:45	01	01	01	00	00	00	N
0112468	01	12468	PRIMARY	P25	US85	94.94	-	TORRINGTON	PARALLEL PARKING	82001	MONDAY	10:55	01	02	01	00	00	00	N
0015776	00	15776	PRIMARY	P25	US85	98.00	-		4-WAY INTERSECTION	101500	SUNDAY	16:45	02	02	04	00	00	00	N
9915165	99	15165	PRIMARY	P25	US85	97.10	-		NONE	92599	SATURDAY	11:50	02	02	04	00	01	00	N
9910098	99	10098	PRIMARY	P25	US85	96.30	-		DRIVEWAY	62799	SUNDAY	16:10	02	02	03	00	01	00	N
9906932	99	06932	PRIMARY	P25	US85	101.00	-		NONE	42899	WEDNESDAY	21:00	01	01	03	00	00	00	N
0117182	01	17182	PRIMARY	P25	US85	101.67	-		NONE	111001	SATURDAY	17:30	01	01	02	00	00	00	N
0214261	02	14261	PRIMARY	P25	US85	101.78	-		NONE	90202	MONDAY	23:45	01	01	01	00	01	00	N

Torrington West Section - After Crashes (Cont.)

BASE_KEY	ROAD_SUR	LIGHTING	ROAD_CON	WEATHER	RD_ALIGN	TRAFCONT	RD_JUNCT	1ST_HARM	JUNCTION	ADV_COND
0112289	**BLACKTOP**	**DAWN OR DUSK**	**DRY**	**CLEAR**	**STRAIGHT HILLCREST**	**PAVEMENT MARKINGS**	**NON-JUNCTION**	**DEER**	**ON ROADWAY**	**NONE**
0020593	BLACKTOP	DARK UNLIGHTED	DRY	CLEAR	STRAIGHT LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	POST	OFF ROADWAY	NONE
0017000	BLACKTOP	DARK UNLIGHTED	ICY	SLEET/HAIL	STRAIGHT LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	MV-MV	ON ROADWAY	NONE
0007654	BLACKTOP	DAYLIGHT	DRY	CLEAR	STRAIGHT LEVEL	WARNING SIGN	NON-JUNCTION	EXPLOSION/FIRE	SHOULDER	NONE
0006053	CONCRETE	DAYLIGHT	DRY	CLEAR	CURVE AND LEVEL	OTHER	NON-JUNCTION	POST	OFF ROADWAY	NONE
0000642	BLACKTOP	DARK UNLIGHTED	DRY	CLEAR	STRAIGHT LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	ROAD APPROACH	OFF ROADWAY	NONE
0204199	BLACKTOP	DAYLIGHT	DRY	FOG	STRAIGHT LEVEL	SCHOOL BUS STOP LAMP	DRIVEWAY ACCESS	MV-MV	ON ROADWAY	NONE
9905336	BLACKTOP	DARK UNLIGHTED	DRY	CLEAR	STRAIGHT LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	ROAD APPROACH	OFF ROADWAY	NONE
0114327	BLACKTOP	DAYLIGHT	DRY	CLEAR	CURVE AND LEVEL	PAVEMENT MARKINGS	DRIVEWAY ACCESS	MAILBOX	OFF ROADWAY	NONE
9913355	**BLACKTOP**	**DARK UNLIGHTED**	**DRY**	**CLEAR**	**STRAIGHT LEVEL**	**PAVEMENT MARKINGS**	**NON-JUNCTION**	**DEER**	**ON ROADWAY**	**NONE**
9903582	BLACKTOP	DAWN OR DUSK	DRY	CLEAR	STRAIGHT LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	POST	OFF ROADWAY	NONE
0207294	BLACKTOP	DAYLIGHT	DRY	CLEAR	STRAIGHT LEVEL	PAVEMENT MARKINGS	INTERSECTION	MV-MV	ON ROADWAY	NONE
0016996	BLACKTOP	DARK UNLIGHTED	ICY	SNOWING	STRAIGHT LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	POST	OFF ROADWAY	NONE
0117951	**BLACKTOP**	**DARK UNLIGHTED**	**DRY**	**CLEAR**	**STRAIGHT LEVEL**	**PAVEMENT MARKINGS**	**NON-JUNCTION**	**DEER**	**ON ROADWAY**	**NONE**
0208668	BLACKTOP	DARK UNLIGHTED	DRY	CLEAR	STRAIGHT LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	POST	OFF ROADWAY	NONE
0107870	BLACKTOP	DAYLIGHT	DRY	CLEAR	STRAIGHT LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	PARKED MV	OFF ROADWAY	NONE
0020597	BLACKTOP	DAYLIGHT	ICY	CLEAR	CURVE AND LEVEL	NONE	NON-JUNCTION	BERM/DITCH	OFF ROADWAY	NONE
0016687	**BLACKTOP**	**DARK UNLIGHTED**	**DRY**	**CLEAR**	**STRAIGHT LEVEL**	**PAVEMENT MARKINGS**	**NON-JUNCTION**	**DEER**	**ON ROADWAY**	**NONE**
9901984	BLACKTOP	DAYLIGHT	DRY	CLEAR	STRAIGHT LEVEL	STOP SIGN	INTERSECTION	MV-MV	ON ROADWAY	NONE
0207114	BLACKTOP	DAWN OR DUSK	DRY	CLEAR	CURVE AND LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	OTHER SIGN	OFF ROADWAY	NONE
0012618	BLACKTOP	DAYLIGHT	DRY	CLEAR	STRAIGHT LEVEL	PAVEMENT MARKINGS	INTERSECTION	MV-MV	ON ROADWAY	NONE
9908794	BLACKTOP	DAYLIGHT	DRY	CLEAR	STRAIGHT LEVEL	PAVEMENT MARKINGS	INTERSECTION	MV-MV	ON ROADWAY	NONE
0200168	BLACKTOP	DARK UNLIGHTED	DRY	CLEAR	STRAIGHT LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	COW	ON ROADWAY	NONE
0117950	**BLACKTOP**	**DARK UNLIGHTED**	**DRY**	**CLEAR**	**STRAIGHT LEVEL**	**PAVEMENT MARKINGS**	**NON-JUNCTION**	**DEER**	**ON ROADWAY**	**NONE**
9914349	BLACKTOP	DAYLIGHT	DRY	CLEAR	STRAIGHT DOWNGRADE	PAVEMENT MARKINGS	INTERSECTION RELATED	MV-MV	ON ROADWAY	NONE
9911507	BLACKTOP	DAYLIGHT	DRY	CLEAR	STRAIGHT LEVEL	PAVEMENT MARKINGS	DRIVEWAY ACCESS	MV-MV	ON ROADWAY	NONE
0009767	BLACKTOP	DAYLIGHT	DRY	CLEAR	STRAIGHT DOWNGRADE	PAVEMENT MARKINGS	NON-JUNCTION	OVERTURN	SHOULDER	NONE
0006958	BLACKTOP	DAYLIGHT	DRY	CLEAR	STRAIGHT LEVEL	PAVEMENT MARKINGS	DRIVEWAY ACCESS	MV-MV	ON ROADWAY	NONE
0112114	BLACKTOP	DARK UNLIGHTED	DRY	CLEAR	STRAIGHT UPGRADE	PAVEMENT MARKINGS	NON-JUNCTION	OVERTURN	OFF ROADWAY	NONE
0016586	**BLACKTOP**	**DARK UNLIGHTED**	**DRY**	**CLEAR**	**STRAIGHT LEVEL**	**PAVEMENT MARKINGS**	**NON-JUNCTION**	**DEER**	**ON ROADWAY**	**NONE**
0013286	BLACKTOP	DAYLIGHT	DRY	CLEAR	STRAIGHT LEVEL	PAVEMENT MARKINGS	DRIVEWAY ACCESS	MV-MV	ON ROADWAY	NONE
9901747	BLACKTOP	DARK LIGHTED	DRY	CLEAR	CURVE AND LEVEL	STOP SIGN	INTERSECTION	MV-MV	ON ROADWAY	NONE
0118669	BLACKTOP	DAYLIGHT	ICY	CLEAR	STRAIGHT LEVEL	NONE	NON-JUNCTION	FENCE	OFF ROADWAY	NONE
0020595	**BLACKTOP**	**DARK UNLIGHTED**	**DRY**	**CLEAR**	**STRAIGHT LEVEL**	**PAVEMENT MARKINGS**	**NON-JUNCTION**	**DEER**	**ON ROADWAY**	**NONE**
9918211	BLACKTOP	DAYLIGHT	DRY	CLEAR	STRAIGHT DOWNGRADE	PAVEMENT MARKINGS	NON-JUNCTION	ROAD APPROACH	OFF ROADWAY	NONE
9916380	BLACKTOP	DAWN OR DUSK	DRY	CLEAR	STRAIGHT LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	COW	ON ROADWAY	NONE
9914193	BLACKTOP	DAYLIGHT	DRY	CLEAR	STRAIGHT LEVEL	STOP SIGN	INTERSECTION	MV-MV	ON ROADWAY	NONE
9909898	BLACKTOP	DAYLIGHT	DRY	CLEAR	STRAIGHT LEVEL	STOP SIGN	INTERSECTION	MV-MV	ON ROADWAY	NONE
9901748	BLACKTOP	DARK UNLIGHTED	DRY	CLEAR	CURVE AND LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	COW	ON ROADWAY	NONE
0117947	BLACKTOP	DAYLIGHT	DRY	CLEAR	CURVE AND LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	MV-MV	ON ROADWAY	NONE
0111264	BLACKTOP	DARK UNLIGHTED	DRY	CLEAR	STRAIGHT LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	MV-MV	ON ROADWAY	NONE
0215246	BLACKTOP	DARK LIGHTED	DRY	CLEAR	STRAIGHT LEVEL	NONE	NON-JUNCTION	BUILDING OR WALL	OFF ROADWAY	NONE
0105256	BLACKTOP	DARK UNLIGHTED	WET	RAINING	STRAIGHT LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	COW	ON ROADWAY	NONE
0106998	**BLACKTOP**	**DARK UNLIGHTED**	**DRY**	**CLEAR**	**STRAIGHT LEVEL**	**PAVEMENT MARKINGS**	**NON-JUNCTION**	**DEER**	**ON ROADWAY**	**NONE**
0016019	BLACKTOP	DAYLIGHT	DRY	CLEAR	STRAIGHT LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	COW	ON ROADWAY	NONE
0010575	BLACKTOP	DAYLIGHT	DRY	CLEAR	STRAIGHT LEVEL	PAVEMENT MARKINGS	INTERSECTION	MV-MV	ON ROADWAY	NONE
0009014	BLACKTOP	DAYLIGHT	WET	RAINING	STRAIGHT UPGRADE	PAVEMENT MARKINGS	DRIVEWAY ACCESS	MV-MV	ON ROADWAY	NONE
0007203	BLACKTOP	DAYLIGHT	DRY	CLEAR	STRAIGHT LEVEL	STOP SIGN	INTERSECTION	MV-MV	ON ROADWAY	NONE
9901473	BLACKTOP	DAYLIGHT	DRY	CLEAR	STRAIGHT LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	MV-MV	ON ROADWAY	NONE
0106287	BLACKTOP	DAYLIGHT	ICY	SNOWING	CURVE AND LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	OVERTURN	ON ROADWAY	NONE
0018410	BLACKTOP	DARK UNLIGHTED	DRY	CLEAR	STRAIGHT LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	MV-MV	ON ROADWAY	NONE
9907447	BLACKTOP	DAYLIGHT	DRY	CLEAR	STRAIGHT LEVEL	NONE	DRIVEWAY ACCESS	MV-MV	ON ROADWAY	NONE
9903956	BLACKTOP	DAYLIGHT	DRY	CLEAR	STRAIGHT LEVEL	STOP SIGN	INTERSECTION	MV-MV	ON ROADWAY	NONE
9913804	BLACKTOP	DAYLIGHT	DRY	CLEAR	STRAIGHT LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	DELINEATOR POST	OFF ROADWAY	NONE
9912649	BLACKTOP	DAYLIGHT	DRY	CLEAR	STRAIGHT LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	MAILBOX	SHOULDER	NONE
0201191	**BLACKTOP**	**DARK UNLIGHTED**	**DRY**	**CLEAR**	**STRAIGHT LEVEL**	**PAVEMENT MARKINGS**	**NON-JUNCTION**	**DEER**	**ON ROADWAY**	**NONE**
0205082	BLACKTOP	DARK UNLIGHTED	WET	SNOWING	STRAIGHT LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	COW	ON ROADWAY	NONE
0104636	BLACKTOP	DAYLIGHT	DRY	CLEAR	STRAIGHT LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	CUT SLOPE	OFF ROADWAY	NONE
0112468	BLACKTOP	DAYLIGHT	DRY	CLEAR	STRAIGHT LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	PARKED MV	SHOULDER	NONE
0015776	BLACKTOP	DAYLIGHT	DRY	CLEAR	STRAIGHT LEVEL	STOP SIGN	INTERSECTION	MV-MV	OTHER RDWAY	NONE
9915165	BLACKTOP	DAYLIGHT	DRY	CLEAR	STRAIGHT LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	MV-MV	ON ROADWAY	NONE
9910098	BLACKTOP	DAYLIGHT	WET	RAINING	STRAIGHT LEVEL	PAVEMENT MARKINGS	DRIVEWAY ACCESS	MV-MV	ON ROADWAY	NONE
9906932	**BLACKTOP**	**DAYLIGHT**	**DRY**	**CLEAR**	**STRAIGHT LEVEL**	**PAVEMENT MARKINGS**	**NON-JUNCTION**	**DEER**	**ON ROADWAY**	**NONE**
0117182	**BLACKTOP**	**DARK UNLIGHTED**	**DRY**	**CLEAR**	**STRAIGHT LEVEL**	**PAVEMENT MARKINGS**	**NON-JUNCTION**	**DEER**	**ON ROADWAY**	**NONE**
0214261	BLACKTOP	DARK UNLIGHTED	DRY	CLEAR	STRAIGHT LEVEL	PAVEMENT MARKINGS	NON-JUNCTION	GUARDRAIL END	OFF ROADWAY	NONE

Torrington West After Construction Crashes

December 8, 1999 - September 20, 2002



APPENDIX C: TRAFFIC DATA

Centennial East Section Traffic Data

Year	Average Daily Traffic
1993	470
1994	490
1995	480
1996	480
1997	480
1998	460
1999	460
2000	460
2001	690
2002	710
2003	710
2004	730

Before ADT

Perm Counter on Wy 130 at Wy 230 (West)
Jan 2005- Nov 1996

		AADT Perm 2004	AADT project 1995		AADT project 1996	
		484	480		480	
	Average Day	Percent of AADT	Adjusted ADT proj	Monthly Vol	Adjusted ADT proj	
Jan	232	0.479338843	230.0826446	7132.561983	230.0826446	7132.561983
Feb	252	0.520661157	249.9173554	6997.68595	249.9173554	7247.603306
March	266	0.549586777	263.8016529	8177.85124	263.8016529	8177.85124
April	280	0.578512397	277.6859504	8608.264463	277.6859504	8330.578512
May	404	0.834710744	400.661157	12420.49587	400.661157	12420.49587
June	690	1.425619835	684.2975207	20528.92562	684.2975207	20528.92562
July	909	1.878099174	901.4876033	27946.1157	901.4876033	27946.1157
August	846	1.747933884	839.0082645	26009.2562	839.0082645	25170.24793
Sept	773	1.597107438	766.6115702	22998.34711	766.6115702	22998.34711
Oct	565	1.167355372	560.3305785	17370.24793	560.3305785	17370.24793
Nov	226	0.466942149	224.1322314	6723.966942	224.1322314	6723.966942
Dec	234	0.483471074	232.0661157	6961.983471		
				171875.7025		164046.9421

Total Traffic=	335922.6446
Mileage=	6.111
VMT=	2052823.281
MVMT=	2.052823281

After VMT

Perm Counter on Wy 130 at Wy 230 (West)
May, 1999-March 2001

		AADT Perm 2004	AADT project 1999		AADT project 2000		AADT project 2001	
		484	460		460		690	
	Average Day	Percent of AADT	Adjusted ADT proj	Monthly Vol	Adjusted ADT proj	Monthly Vol	Adjusted ADT proj	Monthly Vol
Jan	232	0.479338843			220.4958678	6835.371901	330.7438017	10253.0579
Feb	252	0.520661157			239.5041322	6945.619835	359.2561983	10059.1736
March	266	0.549586777			252.8099174	7837.107438	379.214876	11755.6612
April	280	0.578512397			266.1157025	7983.471074		
May	404	0.834710744	383.9669421	11902.97521	383.9669421	11902.97521		
June	690	1.425619835	655.785124	19673.55372	655.785124	19673.55372		
July	909	1.878099174	863.9256198	26781.69421	863.9256198	26781.69421		
August	846	1.747933884	804.0495868	24925.53719	804.0495868	24925.53719		
Sept	773	1.597107438	734.6694215	22040.08264	734.6694215	22774.75207		
Oct	565	1.167355372	536.9834711	16646.4876	536.9834711	16646.4876		
Nov	226	0.466942149	214.7933884	6443.801653	214.7933884	6443.801653		
Dec	234	0.483471074	222.3966942	6894.297521	222.3966942	6894.297521		
				135308.4298		165644.6694		32067.8926

Total Traffic=	333020.9917
Mileage=	6.111
VMT=	2035091.28
MVMT=	2.03509128

Morton Pass Section Traffic Data

Before Average

Year	ADT	Daily Mileage	Yearly Mileage	% of year	Total Mileage
1998	470	3217.15	1174259.75	0.79	927665.2025
1999	570	3901.65	1424102.25	1	1424102.25
2000	630	4312.35	1578320.1	1	1578320.1
2001	580	3970.1	1449086.5	0.21	304308.165
				TVMT	3306730.515
Mileage	6.845			TVMT (mill)	3.306730515

During Average

Year	ADT	Daily Mileage	Yearly Mileage	% of year	Total Mileage
2001	470	3217.15	1174259.75	0.79	927665.2025
2002	590	4038.55	1474070.75	0.75	1105553.063
				TVMT	1105553.063
Mileage	6.845			TVMT (mill)	1.105553063

After Average

Year	ADT	Daily Mileage	Yearly Mileage	% of year	Total Mileage	
2002	590	4038.55	1474070.75	0.25	368517.6875	
2003	590	4038.55	1474070.75	1	1474070.75	
2004	520	3559.4	1302740.4	1	1302740.4	
2005	570	3901.65	1424102.25	0.75	1068076.688	<----Three previous year average ADT
				TVMT	4213405.525	
Mileage	6.845			TVMT (mill)	4.213405525	

Clearmont North Traffic Data

Before Average

Year	ADT	Daily Mileage	Yearly Mileage	% of year	Total Mileage
1996	270	1984.5	726327	0.17	123475.59
1997	270	1984.5	724342.5	1	724342.5
1998	290	2131.5	777997.5	1	777997.5
1999	290	2131.5	777997.5	0.83	645737.925
				TVMT	2271553.515
Mileage	7.35			TVMT (mill)	2.271553515

During Average

Year	ADT	Daily Mileage	Yearly Mileage	% of year	Total Mileage
1999	290	2131.5	777997.5	0.17	132259.575
2000	290	2131.5	780129	0.85	663109.65
				TVMT	795369.225
Mileage	7.35			TVMT (mill)	0.795369225

After Average

Year	ADT	Daily Mileage	Yearly Mileage	% of year	Total Mileage
2000	290	2131.5	780129	0.15	117019.35
2001	580	4263	1555995	1	1555995
2002	470	3454.5	1260892.5	1	1260892.5
2003	540	3969	1448685	0.85	1231382.25
				TVMT	4165289.1
Mileage	7.35			TVMT (mill)	4.1652891

Hanging Rock Section Traffic Data

Before Mileage

Year	ADT	Daily Mileage	Yearly Mileage	% of year	Total Mileage
1995	1730	14013	5114745	0.58	2966552.1
1996	1660	13446	4921236	1	4921236
1997	1500	12150	4434750	1	4434750
1998	1650	13365	4878225	0.42	2048854.5
				TVMT	14371392.6
Mileage	8.1			TVMT (mill)	14.3713926

During Mileage

Year	ADT	Daily Mileage	Yearly Mileage	% of year	Total Mileage
1998	1650	13365	4878225	0.58	2829370.5
1999	1660	13446	4907790	0.97	4760556.3
				TVMT	7589926.8
Mileage	8.1			TVMT (mill)	7.5899268

After Mileage

Year	ADT	Daily Mileage	Yearly Mileage	% of year	Total Mileage
1999	1660	13446	4907790	0.03	147233.7
2000	1600	12960	4743360	1	4743360
2001	1700	13770	5026050	1	5026050
2002	1750	14175	5173875	0.97	5018658.75
				TVMT	14935302.45
Mileage	8.1			TVMT (mill)	14.93530245

Astoria Section Traffic Data

Year	ADT South Section	ADT North Section	Weighted Average
1997	2800	3100	2998
1998	3100	3400	3298
1999	3100	3400	3298
2000	3300	3600	3498
2001	3500	3650	3599
2002	3590	3690	3656
2003	3600	3700	3666
2004	3750	3800	3783
Percent of Section	0.34	0.66	

Before Mileage

Year	ADT	Daily Mileage	Yearly Mileage	% of year	Total Mileage
1997	2998	12111.92	4420850.8	0.75	3315638.1
1998	3298	13323.92	4863230.8	1	4863230.8
1999	3298	13323.92	4863230.8	1	4863230.8
2000	3498	14131.92	5172282.72	0.25	1293070.68
				TVMT	14335170.38
Mileage	4.04			TVMT (mill)	14.33517038

During Mileage

Year	ADT	Daily Mileage	Yearly Mileage	% of year	Total Mileage
2000	3498	14131.92	5172282.72	0.75	3879212.04
2001	3599	14539.96	5307085.4	0.89	4723306.006
				TVMT	8602518.046
Mileage	4.04			TVMT (mill)	8.602518046

After Mileage

Year	ADT	Daily Mileage	Yearly Mileage	% of year	Total Mileage
2001	3599	14539.96	5307085.4	0.11	583779.394
2002	3656	14770.24	5391137.6	1	5391137.6
2003	3666	14810.64	5405883.6	1	5405883.6
2004	3783	15283.32	5593695.12	0.89	4978388.657
				TVMT	16359189.25
Mileage	4.04			TVMT (mill)	16.35918925

Round Mountain Traffic Data

Before Mileage Reconstruction

Year	ADT	Daily Mileage	Yearly Mile:	% of year	Total Mileage
1996	510	3876	1418616	0.67	950472.72
1997	560	4256	1553440	1	1553440
1998	560	4256	1553440	1	1553440
1999	560	4256	1553440	0.33	512635.2
				TVMT	4569987.92
Mileage	7.6			TVMT (mill)	4.56998792

Before Mileage ROW

Year	ADT	Daily Mileage	Yearly Mile	% of year	Total Mileage
1996	510	2876.4	1052762	0.67	705350.8
1997	560	3158.4	1152816	1	1152816
1998	560	3158.4	1152816	1	1152816
1999	560	3158.4	1152816	0.33	380429.3
				TVMT	3391412
Mileage	5.64			TVMT (mill)	3.391412

After Mileage Reconstruction

Year	ADT	Daily Mileage	Yearly Mile:	% of year	Total Mileage
2000	560	4256	1557696	0.21	327116.16
2001	590	4484	1636660	1	1636660
2002	650	4940	1803100	1	1803100
2003	580	4408	1608920	0.79	1271046.8
				TVMT	5037922.96
Mileage	7.6			TVMT (mill)	5.03792296

After Mileage ROW

Year	ADT	Daily Mileage	Yearly Mile	% of year	Total Mileage
2000	560	3158.4	1155974	0.66	762943.1
2001	590	3327.6	1214574	1	1214574
2002	650	3666	1338090	1	1338090
2003	580	3271.2	1193988	0.33	394016
				TVMT	3709623
Mileage	5.64			TVMT (mill)	3.709623

Torrington West Section Traffic Data

Before ADT
Jan, 1995-Sept 1997
Perm Recorder E of Torrington on US 26 (mp 52.7)

		Perm 2004 AADT		Project 1995 AADT		Project 1996 AADT		Project 1997 AADT	
		3844		4580		4630		4630	
Month	Days in Mon.	Perm Monthly Traffic	% of AADT	Monthly Avg.	Monthly Traffic	Monthly Avg.	Monthly Traffic	Monthly Avg.	Monthly Traffic
Jan	31	3437	0.894120708	4095.072841	126947.2581	4139.778876	128333.1452	4139.77888	128333.1452
Feb	28/29	3504	0.911550468	4174.901145	116897.232	4220.478668	122393.8814	4220.47867	118173.4027
March	31	3618	0.941207076	4310.728408	133632.5806	4357.788762	135091.4516	4357.78876	135091.4516
April	30	3854	1.002601457	4591.914672	137757.4402	4642.044745	139261.3424	4642.04475	139261.3424
May	31	3979	1.035119667	4740.848075	146966.2903	4792.604058	148570.7258	4792.60406	148570.7258
June	30	4031	1.048647242	4802.80437	144084.1311	4855.236733	145657.102	4855.23673	145657.102
July	31	4005	1.041883455	4771.826223	147926.6129	4823.920395	149541.5323	4823.9204	149541.5323
Aug	31	4028	1.047866805	4799.229969	148776.129	4851.623309	150400.3226	4851.62331	150400.3226
Sept	30	3946	1.02653486	4701.529657	141045.8897	4752.8564	142585.692	4752.8564	142585.692
Oct	31	4026	1.047346514	4796.847034	148702.2581	4849.21436	150325.6452	4849.21436	
Nov	30	3767	0.979968783	4488.257024	134647.7107	4537.255463	136117.6639	4537.25546	
Dec	31	3945	1.026274714	4700.338189	145710.4839	4751.651925	147301.2097	4751.65193	
				Total	1673094.017	**Total**	1695579.714	**Total**	1257614.716

Total Traffic= 4626288.45
Mileage= 8.325
VMT= 38513851.3
MVMT= 38.5138513

	Average Daily Traffic			
Year	West Secti	Middle Sec	East Sectic	Weighted Average
1993	5840	4240	4030	4650
1994	5840	4240	4030	4650
1995	5770	4170	3960	4580
1996	5820	4220	4010	4630
1997	5820	4220	4010	4630
1998	5850	4250	4050	4664
1999	5950	4350	4150	4764
2000	5900	4300	4100	4714
2001	5200	4420	4100	4531
2002	6120	4650	4320	4970
2003	6330	4810	4470	5142
2004	7000	5110	4750	5548
Percent of Project	0.31	0.28	0.41	

Before ADT
December 1999-August 2002
Perm Recorder E of Torrington on US 26 (mp 52.7)

		Perm 2004 AADT		Project 1999 AADT		Project 2000 AADT		Project 2001 AADT		Project 2002 AADT	
		3844		4764		4714		4531		4970	
Month	Days in Mon.	Perm Monthly Traffic	% of AADT	Monthly Avg.	Monthly Traffic	Monthly Avg.	Monthly Traffic	Monthly Avg.	Monthly Traffic	Monthly Avg.	Monthly Traffic
Jan	31	3437	0.894120708			4214.885016	130661.4355	4051.26093	125589.0887	4443.77992	137757.1774
Feb	28/29	3504	0.911550468			4297.048907	124614.4183	4130.23517	115646.5848	4530.40583	126851.3632
March	31	3618	0.941207076			4436.850156	137542.3548	4264.60926	132202.8871	4677.79917	145011.7742
April	30	3854	1.002601457			4726.263267	141787.898	4542.7872	136283.616	4982.92924	149487.8772
May	31	3979	1.035119667			4879.55411	151266.1774	4690.12721	145393.9435	5144.54475	159480.8871
June	30	4031	1.048647242			4943.323101	148299.693	4751.42066	142542.6197	5211.7768	156353.3039
July	31	4005	1.041883455			4911.438606	152254.5968	4720.77393	146343.9919	5178.16077	160522.9839
Aug	31	4028	1.047866805			4939.644121	153128.9677	4747.8845	147184.4194	5207.89802	161444.8387
Sept	30	3946	1.02653486			4839.085328	145172.5598	4651.22945	139536.8835		
Oct	31	4026	1.047346514			4937.191467	153052.9355	4745.52706	147111.3387		
Nov	30	3767	0.979968783			4619.572841	138587.1852	4440.23855	133207.1566		
Dec	31	3945	1.026274714	4889.172737	151564.3548	4837.859001	149973.629	4650.05073	144151.5726		
				Total	151564.3548	**Total**	1726341.851	**Total**	1230724.035	**Total**	1196910.206

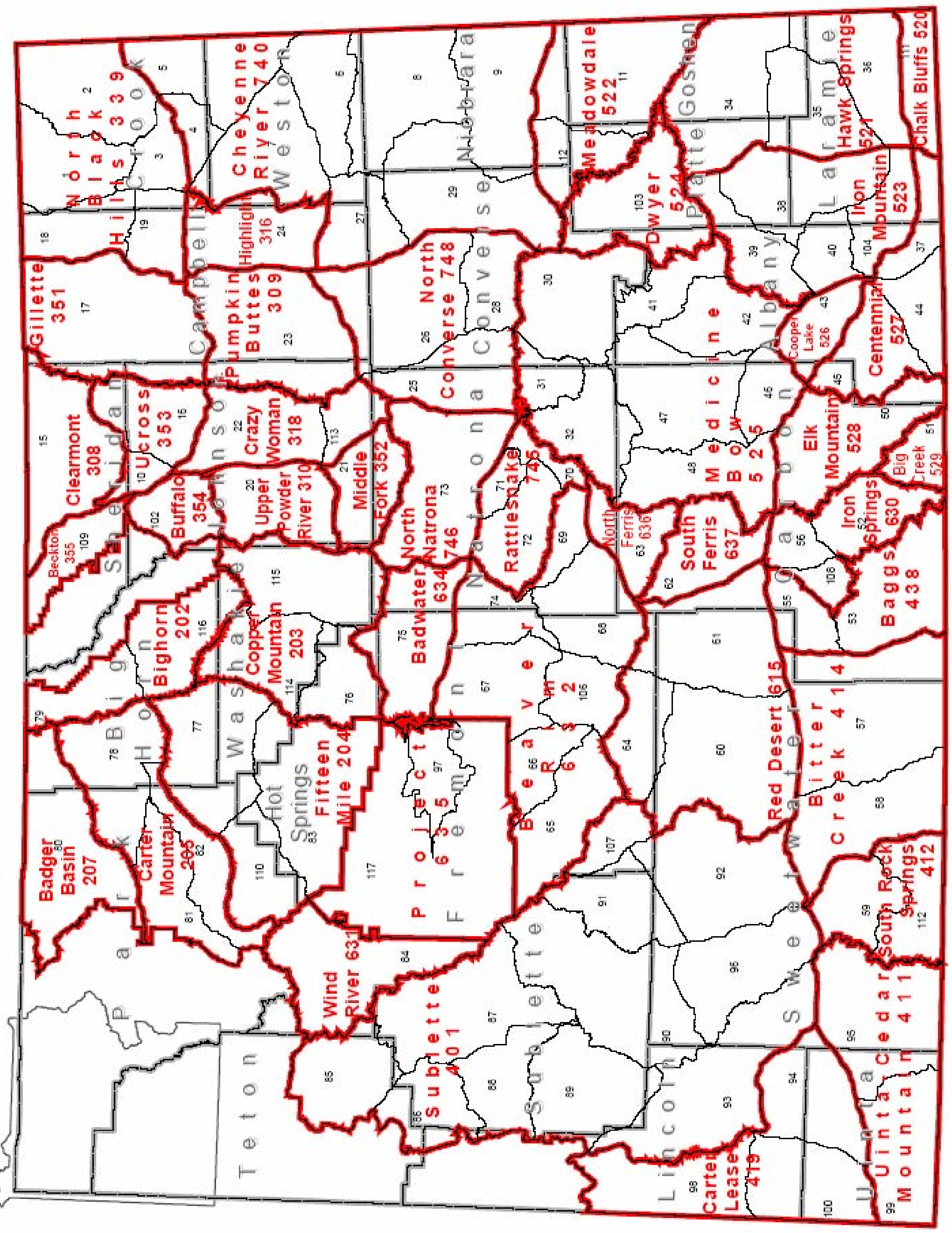
Total Traffic= 4305540.45
Mileage= 8.325
VMT= 35843624.2
MVMT= 35.8436242

APPENDIX D: WILDLIFE DATA

(Courtesy of Wyoming Game and Fish)

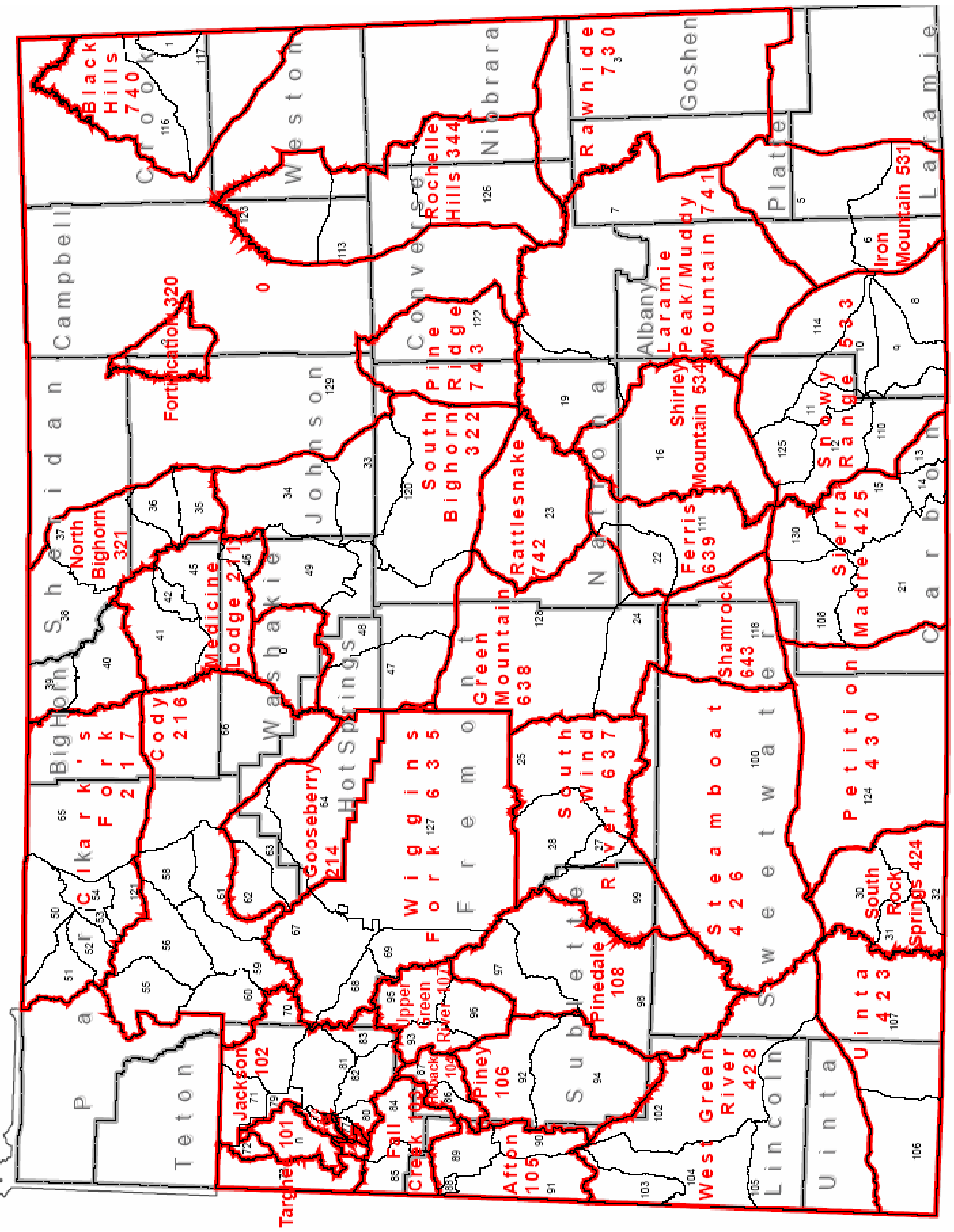
- **Herd Unit Maps**
- **Herd Population Data By Road Section**

Antelope Hunt Areas and Herdunits - 2006



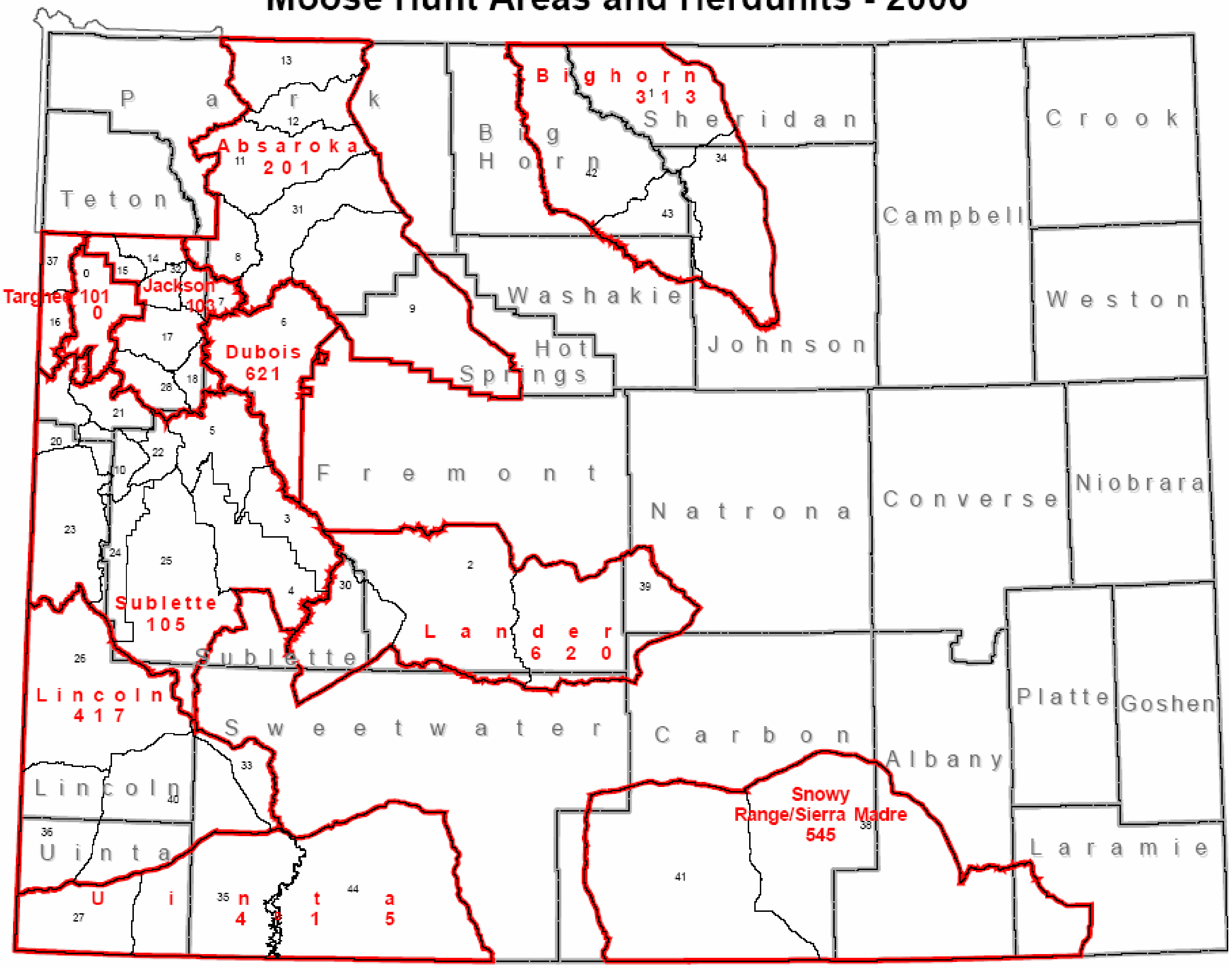
Note: Herdunits are represented by thicker lines and larger character fonts

Elk Hunt Areas and Herdunits - 2006



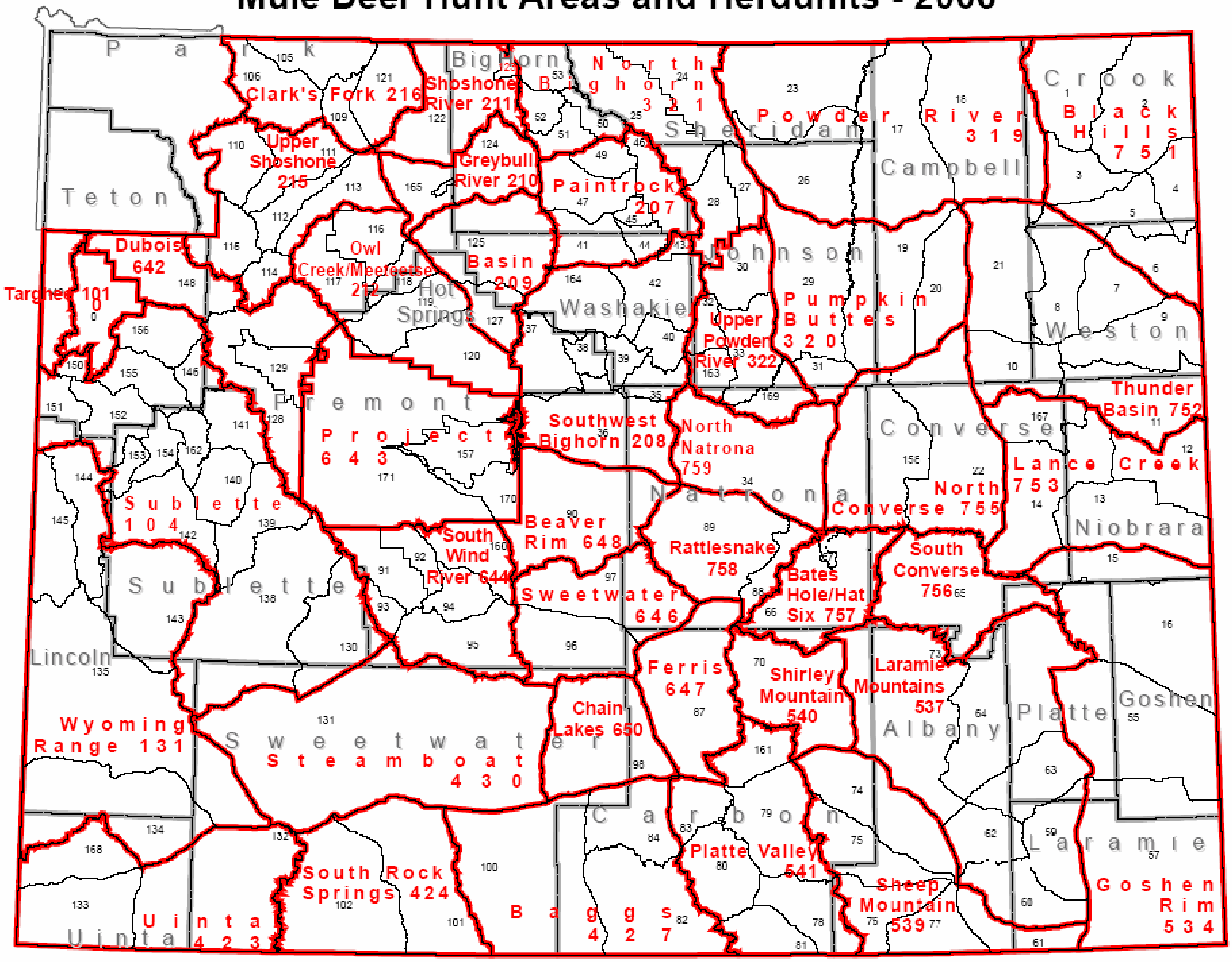
Note: Herdunits are represented by thicker lines and larger character fonts

Moose Hunt Areas and Herdunits - 2006



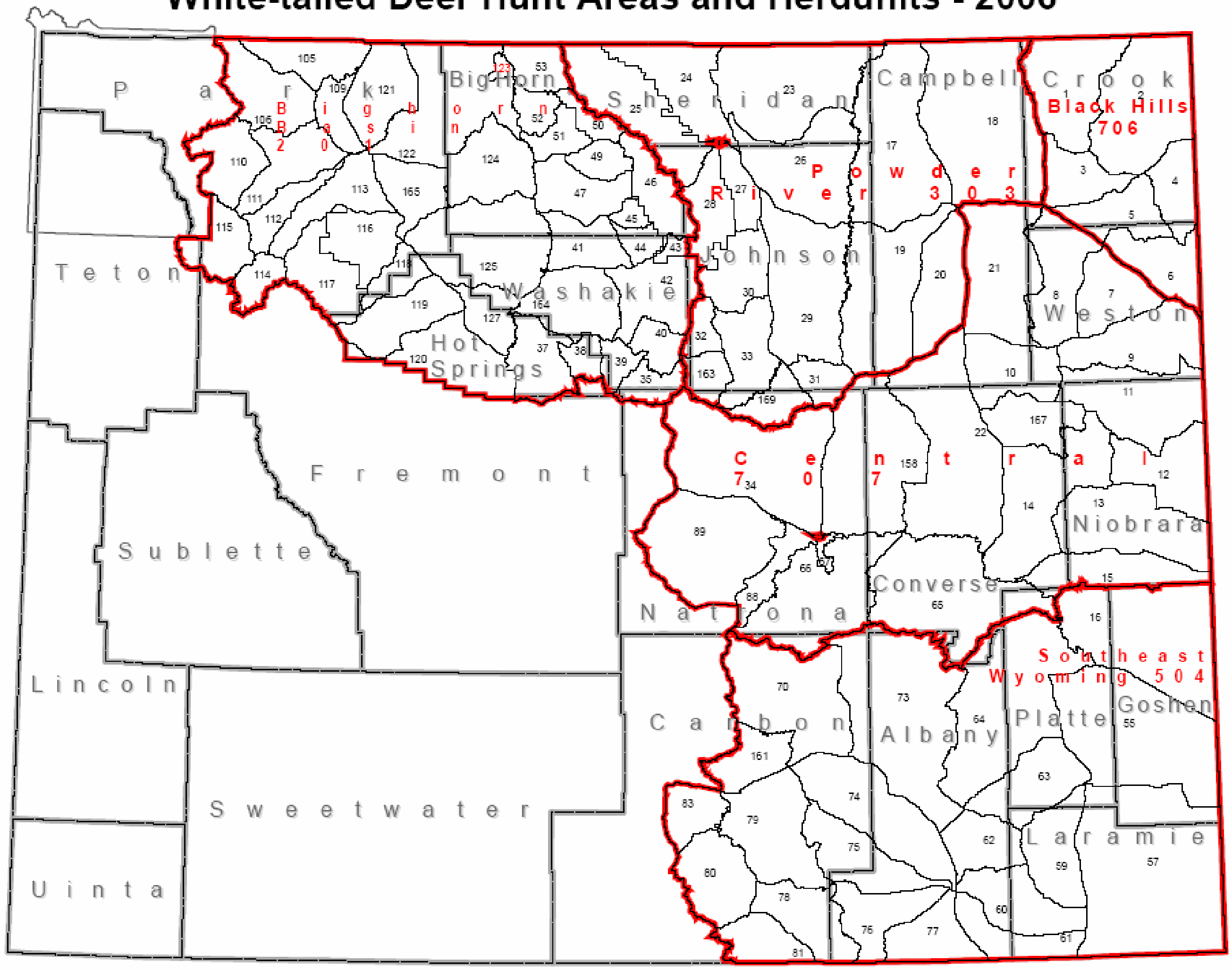
Note: Herdunits are represented by thicker lines and larger character fonts

Mule Deer Hunt Areas and Herdunits - 2006



Note: Herdunits are represented by thicker lines and larger character fonts

White-tailed Deer Hunt Areas and Herdunits - 2006



Note: Herdunits are represented by thicker lines and larger character fonts

	Centennial East Section				
	Before		After		
	1995	1996	1999	2000	Square Mileage of Herd
Mule Deer	11,591	14,635	13,536	13,942	2,485
Density(ani/sq mile)	4.66	5.89	5.45	5.61	
Pronghorn	6,352	9,992	11,174	18,030	1,424
Density(ani/sq mile)	4.46	7.02	7.85	12.66	
Average Density	11.02			15.78	

			Population		Hunting					Harvest				Herd Ratios		% of Pop. Harvested	
Year	Herd Code	Mule Deer Herd Unit	Pop. Est.	Pop. Obj.	Active Licenses	No. Hunters	Hunter Success	Effort (days/anima	Rec. Days	Male	Female	Juvenile	Total	Sex Ratio (Males/100 Females)	Age Ratio (Juv./100 Females)	Male	Female
2005	539	Sheep Mtn.	11,000	15,000	2,231	2,231	41.0%	11.5	10,515	666	231	17	914	26	42	28.1%	3.4%
2004	539	Sheep Mtn.	9,987	15,000	2,170	2,170	45.3%	9.9	9,695	639	283	62	984	23	51	32.6%	4.7%
2003	539	Sheep Mtn.	10,885	15,000	2,342	2,342	38.5%	12.2	11,033	599	269	33	901	22	62	31.5%	4.3%
2002	539	Sheep Mtn.	11,081	15,000	2,138	2,138	31.8%	15	10,205	673	7	0	680	23	63	32.9%	0.1%
2001	539	Sheep Mtn.	13,512	15,000	1,915	1,915	30.0%	14.4	8,271	564	11	0	575	25	55	23.1%	0.1%
2000	539	Sheep Mtn.	13,942	15,000	1,999	1,999	30.8%	13	7,983	594	11	11	616	29	70	22.6%	0.2%
1999	539	Sheep Mtn.	13,536	15,000	1,782	1,782	26.8%	14.5	6,918	477	0	0	477	24	65	21.7%	0.0%
1998	539	Sheep Mtn.	15,754	15,000	NA	1,622	20.2%	23.1	7,548	327	0	0	327	27	71	13.2%	0.0%
1997	539	Sheep Mtn.	13,518	15,000	NA	1,921	15.2%	34.3	10,004	292	0	0	292	30	59	12.0%	0.0%
1996	539	Sheep Mtn.	14,635	15,000	NA	1,564	22.8%	20.1	7,154	348	8	0	356	16	60	20.7%	0.1%
1995	539	Sheep Mtn.	11,591	15,000	NA	2,030	18.4%	20.2	7,555	374	0	0	374	18	64	24.6%	0.0%
1994	539	Sheep Mtn.	11,246	15,000	NA	2,522	18.1%	22.8	10,391	450	7	0	457	18	53	27.5%	0.1%
1993	539	Sheep Mtn.	11,360	15,000	NA	3,005	34.0%	10.8	11,233	569	414	40	1,023	19	50	30.8%	5.8%
1992	539	Sheep Mtn.	16,568	15,000	NA	2,878	45.2%	7.8	10,193	758	498	45	1,301	27	61	24.2%	5.3%
1991	539	Sheep Mtn.	15,102	15,000	NA	2,561	32.6%	11.5	7,190	819	16	0	835	22	72	32.4%	0.2%
1990	539	Sheep Mtn.	12,788	15,000	NA	2,468	32.4%	9.9	7,881	698	89	13	800	22	66	31.8%	1.3%

			Population		Hunting					Harvest				Herd Ratios		% of Pop. Harvested	
Year	Herd Code	Pronghorn Herd Unit	Pop. Est.	Pop. Obj.	Active Licenses	No. Hunters	Hunter Success	Hunter Effort (days/anima l harvested)	Rec. Days	Male	Female	Juvenile	Total	Sex Ratio (Males/100 Females)	Age Ratio (Juv./100 Females)	Male	Female
2005	527	Centennial	18,000	14,000	1,942	1,857	111.6%	3.8	7,906	1,363	647	63	2,073	48	72	31.1%	7.1%
2004	527	Centennial	23,299	14,000	1,701	1,614	91.8%	3.3	4,866	989	406	87	1,482	48	84	19.3%	3.8%
2003	527	Centennial	27,437	14,000	1,710	1,555	91.8%	3.4	4,841	835	522	70	1,427	57	66	11.3%	4.0%
2002	527	Centennial	23,124	14,000	1,633	1,547	86.6%	3.4	4,602	847	470	23	1,340	51	69	14.9%	4.2%
2001	527	Centennial	21,627	14,000	1,247	1,099	89.6%	3.1	3,050	596	341	48	985	61	64	9.7%	3.4%
2000	527	Centennial	18,030	14,000	1,155	1,081	97.7%	2.3	2,456	645	367	44	1,056	59	63	12.7%	4.3%
1999	527	Centennial	11,174	14,000	1,059	921	103.4%	2.9	2,723	509	397	46	952	49	58	17.7%	6.8%
1998	527	Centennial	11,003	14,000	NA	616	123.1%	2	1,875	401	321	36	758	55	60	13.3%	5.9%
1997	527	Centennial	10,110	14,000	NA	653	95.0%	1.7	1,054	267	338	15	620	62	70	9.3%	7.3%
1996	527	Centennial	9,992	6,000	NA	464	123.1%	2.2	1,287	284	236	51	571	60	68	10.2%	5.1%
1995	527	Centennial	6,352	6,000	NA	715	106.3%	2.4	1,824	317	372	71	760	49	50	18.1%	10.4%
1994	527	Centennial	9,211	6,000	NA	953	115.0%	2.1	2,327	417	579	100	1,096	42	49	18.4%	10.7%
1993	527	Centennial	11,362	6,000	NA	1,180	132.9%	2.1	3,218	675	760	133	1,568	43	50	23.4%	11.3%
1992	527	Centennial	15,229	6,000	NA	1,589	158.7%	1.5	3,816	769	1,523	229	2,521	54	70	18.0%	19.2%
1991	527	Centennial	15,629	6,000	NA	1,067	137.5%	2.1	3,061	572	799	96	1,467	50	81	15.5%	10.8%
1990	527	Centennial	8,883	6,000	NA	1,084	117.1%	2.2	2,812	509	685	75	1,269	52	84	22.8%	15.9%

	Morton Pass Section						
	Before			After			
	1998	1999	2000	2003	2004	2005	Square Mileage of Herd
Mule Deer	32,224	33,510	32,088	23,770	27,692	27,500	4,814
Density (ani/sq mi)	6.69	6.96	6.67	4.94	5.75	5.71	
Pronghorn	16,682	19,417	19,918	14,288	23,961	15,500	2,365
Density (ani/sq mi)	7.05	8.21	8.42	6.04	10.13	6.55	
Average		14.67			13.04		

			Population		Hunting					Harvest				Herd Ratios		% of Pop. Harvested	
Year	Herd Code	Mule Deer Herd Unit	Pop. Est.	Pop. Obj.	Active Licenses	No. Hunters	Hunter Success	Hunter Effort (days/animal harvested)	Rec. Days	Male	Female	Juvenile	Total	Sex Ratio (Males/100 Females)	Age Ratio (Juv./100 Females)	Male	Female
2005	537	Laramie Mountains	27,500	29,000	2,018	1,994	58.2%	7.2	8,359	1,109	49	3	1,161	39	69	17.7%	0.4%
2004	537	Laramie Mountains	27,692	29,000	1,944	1,935	58.2%	6.6	7,467	1,010	103	13	1,126	28	64	20.0%	0.7%
2003	537	Laramie Peak - combined with Iron Mtn.	23,770	14,000	1,242	1,235	51.9%	7.9	5,040	625	16	0	641	22	74	19.0%	0.1%
2002	537	Laramie Peak	20,743	14,000	1,335	1,324	44.2%	8.8	5,152	572	13	0	585	31	56	14.3%	0.1%
2001	537	Laramie Peak	13,473	14,000	1,355	1,345	48.2%	7.5	4,860	617	31	0	648	22	57	27.1%	0.4%
2000	537	Laramie Peak	14,555	14,000	1,382	1,377	48.8%	6.9	4,662	665	5	2	672	18	65	31.7%	0.1%
1999	537	Laramie Peak	15,000	14,000	1,302	1,583	53.4%	7.3	6,196	846	0	0	846	26	68	29.6%	0.0%
1998	537	Laramie Peak	14,233	14,000	834	834	46.2%	6.9	2,663	385	0	0	385	25	67	17.2%	0.0%
1997	537	Laramie Peak	10,967	14,000	1,041	1,041	40.2%	8.5	3,567	419	0	0	419	24	87	25.1%	0.0%
1996	537	Laramie Peak	8,359	14,000	NA	1,066	40.5%	10	4,338	432	0	0	432	20	51	30.6%	0.0%
1995	537	Laramie Peak	12,534	14,000	NA	1,360	39.9%	9.2	5,007	542	0	0	542	23	76	27.2%	0.0%
1994	537	Laramie Peak	14,928	14,000	NA	1,796	38.6%	8.2	5,660	693	0	0	693	26	52	24.1%	0.0%
1993	537	Laramie Peak	14,569	14,000	NA	1,915	58.3%	5.4	6,009	697	396	24	1,117	34	50	20.6%	4.8%
1992	537	Laramie Peak	19,611	14,000	NA	2,207	66.9%	4.2	6,133	837	579	60	1,476	34	68	20.2%	5.6%
1991	537	Laramie Peak	17,701	14,000	NA	2,119	62.2%	4.9	6,068	1,089	214	14	1,317	33	61	26.6%	2.3%
1990	537	Laramie Peak	16,763	14,000	NA	2,009	56.8%	5	5,709	780	343	19	1,142	30	68	23.5%	3.9%
2003	538	Iron Mtn. - combined with Laramie Peak	19,235	15,000	638	638	61.1%	6.2	2,404	377	13	0	390	36	78	10.4%	0.1%
2002	538	Iron Mtn.	16,847	15,000	655	655	56.6%	6.7	2,471	357	14	0	371	44	55	8.7%	0.2%
2001	538	Iron Mtn.	17,536	15,000	663	663	60.6%	6.1	2,454	396	6	0	402	38	52	10.1%	0.1%
2000	538	Iron Mtn.	17,533	15,000	724	724	71.5%	5	2,579	505	13	0	518	40	51	12.1%	0.1%
1999	538	Iron Mtn.	18,510	15,000	771	771	71.6%	4.5	2,473	540	12	0	552	49	66	11.3%	0.1%
1998	538	Iron Mtn.	17,991	15,000	NA	732	71.4%	4	2,100	505	18	0	523	37	75	13.9%	0.2%
1997	538	Iron Mtn.	13,376	15,000	NA	703	46.5%	7.8	2,559	306	18	3	327	34	59	11.5%	0.3%
1996	538	Iron Mtn.	13,841	15,000	NA	783	53.5%	7.6	3,184	392	20	7	419	36	59	13.3%	0.3%
1995	538	Iron Mtn.	13,249	15,000	NA	902	51.4%	6.3	2,923	421	38	5	464	30	47	15.8%	0.5%
1994	538	Iron Mtn.	12,444	15,000	NA	1,354	50.9%	6.3	4,336	495	194	0	689	30	43	18.7%	2.6%
1993	538	Iron Mtn.	14,725	15,000	NA	1,436	71.6%	4.2	4,357	647	362	19	1,028	33	43	19.0%	4.1%
1992	538	Iron Mtn.	16,385	15,000	NA	1,773	77.6%	3.5	4,763	900	442	14	1,376	44	56	20.0%	5.1%
1991	538	Iron Mtn.	15,672	15,000	NA	1,718	73.4%	4.1	5,170	802	429	30	1,261	37	63	21.7%	5.2%
1990	538	Iron Mtn.	14,978	15,000	NA	1,774	67.6%	4.2	5,036	834	336	29	1,119	29	86	29.2%	4.6%

			Population		Hunting					Harvest				Herd Ratios		% of Pop. Harvested	
Year	Herd Code	Pronghorn Herd Unit	Pop. Est.	Pop. Obj.	Active Licenses	No. Hunters	Hunter Success	Hunter Effort (days/animal harvested)	Rec. Days	Male	Female	Juvenile	Total	Sex Ratio (Males/100 Females)	Age Ratio (Juv./100 Females)	Male	Female
2005	523	Iron Mtn.	15,500	13,000	1,793	1,580	89.7%	3.3	4,720	705	645	68	1,418	43	52	18.9%	7.4%
2004	523	Iron Mtn.	23,961	13,000	1,618	1,432	90.6%	3.3	4,274	772	459	67	1,298	34	51	16.6%	3.4%
2003	523	Iron Mtn.	14,288	13,000	1,637	1,484	82.1%	3.8	4,644	736	415	68	1,219	37	51	24.1%	5.0%
2002	523	Iron Mtn.	13,613	13,000	1,631	1,484	82.1%	3.8	4,603	779	379	60	1,218	36	42	26.0%	4.5%
2001	523	Iron Mtn.	16,650	13,000	1,966	1,751	82.1%	3.8	5,520	874	491	73	1,438	33	44	25.9%	4.8%
2000	523	Iron Mtn.	19,918	13,000	1,806	1,681	84.9%	3.4	4,902	888	455	84	1,427	40	43	19.0%	3.9%
1999	523	Iron Mtn.	19,417	13,000	1,784	1,578	97.3%	3.2	4,896	909	551	76	1,536	49	61	18.6%	5.5%
1998	523	Iron Mtn.	16,682	13,000	NA	1,088	106.8%	3	3,561	805	349	86	1,240	51	70	19.5%	4.3%
1997	523	Iron Mtn.	15,027	13,000	NA	1,189	107.0%	2.1	2,671	705	518	49	1,272	44	64	20.4%	6.6%
1996	523	Iron Mtn.	13,750	8,000	NA	860	104.4%	2.7	2,407	492	373	33	898	43	64	16.2%	5.3%
1995	523	Iron Mtn.	12,656	8,000	NA	884	93.3%	2.3	2,033	451	322	52	825	39	43	15.6%	4.3%
1994	523	Iron Mtn.	14,651	8,000	NA	1,125	102.7%	2.2	2,493	625	471	59	1,155	31	51	23.2%	5.4%
1993	523	Iron Mtn.	14,173	8,000	NA	1,282	113.8%	2.1	3,053	660	694	105	1,459	42	33	17.6%	7.8%
1992	523	Iron Mtn.	23,997	8,000	NA	1,246	124.6%	1.8	2,795	719	765	69	1,553	42	47	12.7%	5.7%
1991	523	Iron Mtn.	24,211	8,000	NA	848	116.0%	2	1,968	571	362	51	984	47	70	10.5%	3.1%
1990	523	Iron Mtn.	8,405	8,000	NA	812	112.2%	2.3	2,125	513	364	34	911	39	59	28.0%	7.7%

	Clearmont North Section						
	Before			After			
	1997	1998	1999	2001	2002	2003	Herd Square Mileage
Mule Deer	40,711	47,904	47,761	43,560	47,242	51,401	4,631
Animal Density (ani/sq mi)	8.79	10.34	10.31	9.41	10.20	11.10	
WTD	6,860	13,516	16,464	17,271	12,643	13,970	10,595
Animal Density (ani/sq mi)	0.65	1.28	1.55	1.63	1.19	1.32	
Average		10.98			11.62		

			Population		Hunting					Harvest				Herd Ratios		% of Pop. Harvested	
Year	Herd Code	Mule Deer Herd Unit	Pop. Est.	Pop. Obj.	Active Licenses	No. Hunters	Hunter Success	Hunter Effort (days/animal harvested)	Rec. Days	Male	Female	Juvenile	Total	Sex Ratio (Males/100 Females)	Age Ratio (Juv./100 Females)	Male	Female
2005	319	Powder River	54,495	52,000	4,988	4,868	69.0%	5.5	18,632	2,597	710	54	3,361	32	76	23.7%	2.6%
2004	319	Powder River	51,678	52,000	5,501	5,368	72.7%	5.1	19,969	3,241	608	51	3,900	34	56	26.0%	2.2%
2003	319	Powder River	51,401	52,000	5,482	5,365	68.9%	5.3	19,638	3,337	344	13	3,694	28	69	31.4%	1.3%
2002	319	Powder River	47,242	52,000	5,459	5,385	64.7%	5.8	20,070	3,210	267	9	3,486	29	47	29.2%	1.0%
2001	319	Powder River	43,560	52,000	5,518	5,494	64.6%	5.7	20,301	3,310	227	14	3,551	32	43	29.4%	0.9%
2000	319	Powder River	51,081	52,000	5,004	4,959	71.6%	5	17,878	3,327	218	7	3,552	27	57	30.7%	0.8%
1999	319	Powder River	47,761	52,000	4,812	4,783	65.3%	5.6	17,485	3,057	61	4	3,122	27	66	31.4%	0.2%
1998	319	Powder River	47,904	52,000	4,539	4,538	62.3%	5.5	15,596	2,815	10	0	2,825	32	65	26.6%	0.0%
1997	319	Powder River	40,711	52,000	3,902	3,819	76.9%	5.5	16,253	2,862	73	0	2,935	34	45	27.0%	0.3%
1996	319	Powder River	52,635	52,000	NA	5,824	50.5%	5.6	16,535	2,521	378	32	2,931	36	64	21.0%	1.4%
1995	319	Powder River	48,587	52,000	NA	4,958	67.9%	5.2	17,583	2,954	409	3	3,366	29	77	30.2%	1.7%
1994	319	Powder River	44,569	52,000	NA	5,366	59.8%	5.5	18,889	2,697	482	28	3,207	31	62	27.4%	2.0%
1993	319	Powder River	40,357	52,000	NA	7,124	86.1%	3.7	22,738	3,464	2,414	257	6,135	28	54	35.8%	9.8%
1992	319	Powder River	65,482	52,000	NA	7,601	95.9%	3.1	21,762	4,291	2,767	232	7,290	37	64	26.3%	7.8%
1991	319	Powder River	66,513	52,000	NA	6,450	93.9%	3.1	18,004	3,983	1,949	122	6,054	42	71	23.3%	5.9%
1990	319	Powder River	58,061	52,000	NA	5,460	82.1%	3.7	16,364	3,273	1,138	72	4,483	32	84	27.6%	4.1%

			Population		Hunting					Harvest				Herd Ratios		Harvest Percentage	
Year	Herd Code	White-tailed Deer Herd Unit	Pop. Est.	Pop. Obj.	Active Licenses	No. Hunters	unter Succe	Hunter Effort (days/animal harvested)	Rec. Days	Male	Female	Juvenile	Total	Sex Ratio (Males/100 Females)	Age Ratio (Juv./100 Females)	Male	Female
2005	303	Powder River	14,881	8,000	6,641	5,966	73.0%	6.7	29,113	1,947	1,916	495	4,358	33	80	45.8%	21.5%
2004	303	Powder River	16,264	8,000	5,877	5,340	67.0%	5.7	20,436	2,024	1,303	252	3,579	25	66	48.7%	13.3%
2003	303	Powder River	13,970	8,000	4,823	4,318	68.2%	6	17,685	1,522	1,215	208	2,945	28	91	46.0%	16.0%
2002	303	Powder River	12,643	8,000	4,770	4,420	62.3%	7.2	19,840	1,460	1,086	206	2,752	30	77	44.3%	15.1%
2001	303	Powder River	17,271	8,000	4,624	4,292	53.6%	7.8	18,041	1,392	687	220	2,299	25	80	39.8%	7.5%
2000	303	Powder River	17,078	8,000	4,702	4,555	59.5%	6.7	18,074	1,561	922	225	2,708	32	85	38.3%	10.5%
1999	303	Powder River	16,464	8,000	4,180	4,013	42.5%	9.8	16,674	911	575	219	1,705	43	88	22.9%	7.5%
1998	303	Powder River	13,516	8,000	5,082	4,915	45.7%	8	18,067	1,544	607	96	2,247	28	87	46.7%	8.8%
1997	303	Powder River	6,860	8,000	3,609	2,398	73.7%	4.1	12,483	958	626	183	1,767	32	70	46.9%	15.6%
1996	303	Powder River	9,682	8,000	NA	4,023	57.1%	7.9	18,610	1,036	1,123	138	2,297	25	74	46.0%	18.8%
1995	303	Powder River	7,906	8,000	NA	3,921	50.0%	8.2	16,137	1,028	786	147	1,961	30	88	48.6%	17.8%
1994	303	Powder River	7,874	8,000	NA	5,008	51.5%	7	18,224	1,341	1,106	171	2,618	31	74	53.0%	22.4%
1993	303	Powder River	9,734	8,000	NA	4,523	53.2%	7.8	18,365	1,153	1,062	198	2,413	27	70	46.4%	17.7%
1992	303	Powder River	10,263	8,000	NA	4,737	49.6%	4.3	10,072	1,272	979	99	2,350	35	73	42.4%	16.6%
1991	303	Powder River	10,065	8,000	NA	3,473	52.2%	3.2	5,653	854	789	169	1,812	35	85	34.8%	14.7%
1990	303	Powder River	8,418	8,000	NA	3,354	49.2%	8.1	12,106	885	533	58	1,476	33	66	38.8%	11.2%

	Hanging Rock Section						
	Before			After			
	1995	1996	1997	2000	2001	2002	Herd Square Mileage
Mule Deer	13,250	10,100	10,625	12,675	12,100	10,600	1,964
Density (ani/sq mi)	6.75	5.14	5.41	6.45	6.16	5.40	
Elk	7,350	7,925	6,975	6,525	6,500	6,100	4,145
Density (ani/sq mi)	1.77	1.91	1.68	1.57	1.57	1.47	
Average		7.56			7.54		

			Population		Hunting					Harvest				Herd Ratios		% of Pop. Harvested	
Year	Herd Code	Mule Deer Herd Unit	Pop. Est.	Pop. Obj.	Active Licenses	No. Hunters	Hunter Success	Hunter Effort (days/animal harvested)	Rec. Days	Male	Female	Juvenile	Total	Sex Ratio (Males/100 Females)	Age Ratio (Juv./100 Females)	Male	Female
2005	215	Upper Shoshone	12,860	12,000	1,976	1,957	40.9%	11.2	8,999	632	158	11	801	35	63	21.8%	2.4%
2004	215	Upper Shoshone	11,246	12,000	1,863	1,839	49.1%	9.8	8,833	728	172	3	903	31	57	28.2%	2.8%
2003	215	Upper Shoshone	10,926	12,000	1,891	1,872	37.7%	11.9	8,415	538	163	5	706	23	63	28.5%	2.7%
2002	215	Upper Shoshone	10,600	12,000	2,540	2,485	42.0%	11.8	12,354	868	171	5	1,044	24	55	37.9%	2.8%
2001	215	Upper Shoshone	12,100	12,000	2,451	2,438	51.1%	8.7	10,808	1,158	80	9	1,247	22	67	45.1%	1.2%
2000	215	Upper Shoshone	12,675	12,000	2,139	2,139	57.9%	7.9	9,727	1,154	77	7	1,238	22	80	45.5%	1.2%
1999	215	Upper Shoshone	11,575	12,000	2,199	2,199	31.2%	15.1	10,347	600	83	4	687	28	63	26.1%	1.4%
1998	215	Upper Shoshone	11,425	12,000	1,790	1,793	30.1%	16.4	8,853	368	152	20	540	29	69	18.0%	2.6%
1997	215	Upper Shoshone	10,625	12,000	2,780	2,732	25.9%	14.6	2,780	353	305	50	708	25	54	19.2%	4.9%
1996	215	Upper Shoshone	10,100	12,000	NA	2,658	66.9%	8.3	14,781	1,132	617	28	1,777	14	51	56.9%	9.2%
1995	215	Upper Shoshone	13,250	12,000	NA	2,827	56.4%	7.3	11,697	1,014	538	43	1,595	28	61	34.1%	7.1%
1994	215	Upper Shoshone	13,300	12,000	NA	2,746	61.7%	6.6	11,187	1,339	320	34	1,693	26	73	43.5%	4.6%
1993	215	Upper Shoshone - combined with Southfork Shoshone	11,200	12,000	NA	2,619	59.7%	7.2	2,619	877	624	62	1,563	26	58	35.7%	9.3%
1992	215	Upper Shoshone	4,200	3,500	NA	962	61.0%	4.7	2,776	369	194	24	587	30	63	36.1%	8.2%
1991	215	Upper Shoshone	3,159	3,500	NA	849	64.4%	5.8	3,171	303	217	27	547	29	74	40.2%	12.2%
1990	215	Upper Shoshone	3,632	2,500	NA	845	48.4%	8.8	3,612	305	93	11	409	23	80	42.6%	4.9%
1992	214	Southfork Shoshone- combined with Upper Shoshone	9,750	4,800	NA	1,963	70.8%	4.4	6,114	935	423	31	1,389	22	69	45.4%	7.7%
1991	214	Southfork Shoshone	5,710	4,800	NA	2,235	66.1%	5	7,335	919	511	47	1,477	25	74	56.2%	15.1%
1990	214	Southfork Shoshone	5,880	4,800	NA	1,865	66.3%	4.6	5,650	1,001	226	9	1,236	25	61	55.9%	6.7%

			Population		Hunting					Harvest					Herd Ratios		% of Pop. Harvested	
Year	Herd Code	Elk Herd Unit	Pop. Est.	Pop. Obj.	Active Licenses	No. Hunters	Hunter Success	Hunter Effort (days/animal harvested)	Rec. Days	Male	Yrl.Male	Female	Juvenile	Total	Sex Ratio (Males/100 Females)	Age Ratio (Juv./100 Females)	Male	Female
2005	216	Cody	6,477	5,600	2,556	2,515	48.5%	11.3	13,737	584	33	518	85	1,220	17	15	42.5%	9.5%
2004	216	Cody	6,024	5,600	2,848	2,811	45.0%	11.1	13,995	609	22	570	65	1,266	17	17	45.2%	11.3%
2003	216	Cody	5,999	5,600	2,754	2,717	47.8%	11.7	15,156	564	25	634	76	1,299	23	21	38.1%	13.2%
2002	216	Cody	6,100	5,600	3,397	3,319	46.7%	12.1	18,756	565	23	841	122	1,551	13	20	49.7%	15.5%
2001	216	Cody	6,500	5,600	3,360	3,249	52.3%	10	16,927	707	48	816	128	1,699	32	20	35.6%	16.0%
2000	216	Cody	6,525	5,600	3,001	2,938	51.3%	11.4	17,096	573	43	761	129	1,506	18	31	43.9%	14.8%
1999	216	Cody	6,950	5,600	3,346	3,277	38.6%	14.3	18,016	501	53	621	89	1,264	23	33	35.1%	12.2%
1998	216	Cody	7,975	5,600	3,419	3,305	52.9%	10.2	17,833	594	70	948	137	1,749	22	40	38.0%	16.1%
1997	216	Cody	6,975	5,600	2,808	2,713	60.4%	11.1	18,120	674	56	784	125	1,639	17	31	47.7%	14.3%
1996	216	Cody	7,925	5,600	NA	2,373	59.3%	9.4	13,278	572	78	640	118	1,408	44	28	24.3%	12.2%
1995	216	Cody	7,350	5,600	NA	2,600	41.0%	12.4	13,235	483	104	419	59	1,065	30	22	28.8%	8.0%
1994	216	Cody	7,950	5,600	NA	2,590	58.7%	8.1	12,351	703	105	629	84	1,521	26	28	37.6%	10.9%
1993	216	Cody - combined with Carter Mtn.	7,200	5,600	NA	2,264	36.0%	15.1	12,302	359	80	325	50	814	23	33	29.3%	6.6%
1992	216	Cody	3,525	3,000	NA	1,234	43.6%	10.8	5,819	238	37	236	27	538	25	36	33.4%	9.7%
1991	216	Cody	3,130	3,000	NA	1,065	54.3%	8.3	4,825	197	36	300	45	578	11	37	50.0%	12.4%
1990	216	Cody	3,209	2,400	NA	915	51.5%	10.4	4,921	191	51	207	22	471	13	29	45.2%	8.4%
1992	215	Carter Mtn. - combined with Cody	3,525	2,600	NA	1,467	52.1%	9.5	7,238	361	51	297	56	765	31	38	38.9%	12.5%
1991	215	Carter Mtn.	3,522	2,600	NA	1,279	53.0%	8.5	5,750	217	58	333	70	678	18	40	40.7%	13.0%
1990	215	Carter Mtn.	3,188	2,600	NA	1,354	46.9%	8.6	5,470	281	68	245	41	635	13	37	55.8%	10.3%

	Astoria Section						
	Before			After			
	1997	1998	1999	2002	2003	2004	Herd Square Miles
Mule Deer	24,700	26,100	31,000	32,924	34,022	26,633	6,101
Density (ani/sq mile)	4.05	4.28	5.08	5.40	5.58	4.37	
Elk	4,459	4,774	4,534	4,503	5,447	5,150	683
Density (ani/sq mile)	6.53	6.99	6.64	6.59	7.98	7.54	
Moose	5,500	5,700	5,800	3,726	4,028	4,107	5,814
Density (ani/sq mile)	0.95	0.98	1.00	0.64	0.69	0.71	
Average		12.16			13.16		

			Population		Hunting					Harvest				Herd Ratios		% of Pop. Harvested	
Year	Herd Code	Mule Deer Herd Unit	Pop. Est.	Pop. Obj.	Active Licenses	No. Hunters	Hunter Success	Hunter Effort (days/animal harvested)	Rec. Days	Male	Female	Juvenile	Total	Sex Ratio (Males/100 Females)	Age Ratio (Juv./100 Females)	Male	Female
2005	104	Sublette	28,044	32,000	5,167	5,163	35.3%	16.9	30,730	1,597	172	51	1,820	28	65	28.2%	1.2%
2004	104	Sublette	26,633	32,000	5,787	5,773	35.1%	15.8	32,063	1,689	302	38	2,029	24	68	33.7%	2.1%
2003	104	Sublette	34,022	32,000	7,232	7,216	31.7%	19.2	43,823	1,946	305	35	2,286	30	78	28.4%	1.8%
2002	104	Sublette	32,924	32,000	8,300	8,270	43.6%	13.8	49,940	2,723	813	71	3,607	29	64	35.5%	4.5%
2001	104	Sublette	34,700	32,000	7,491	7,459	43.2%	13.4	43,108	2,787	372	64	3,223	35	70	32.0%	2.2%
2000	104	Sublette	36,000	32,000	7,032	6,999	46.3%	12.3	39,831	2,991	226	22	3,239	35	82	34.0%	1.3%
1999	104	Sublette	31,000	32,000	7,393	7,383	34.0%	17.1	42,951	2,478	23	10	2,511	38	80	31.4%	0.2%
1998	104	Sublette	26,100	32,000	6,691	6,691	27.7%	21.6	39,993	1,852	0	0	1,852	33	71	30.5%	0.0%
1997	104	Sublette	24,700	32,000	0	6,425	16.4%	38.8	40,994	1,039	17	0	1,056	34	84	21.2%	0.1%
1996	104	Sublette	27,900	32,000	NA	6,324	23.0%	24.6	35,752	1,454	0	0	1,454	35	73	23.6%	0.0%
1995	104	Sublette	28,400	32,000	NA	6,081	21.1%	25.7	33,005	1,286	0	0	1,286	39	60	18.8%	0.0%
1994	104	Sublette	25,302	32,000	NA	5,616	23.6%	23.3	30,993	1,328	0	0	1,328	33	68	24.2%	0.0%
1993	104	Sublette	22,060	32,000	NA	9,446	18.8%	35.6	63,275	1,103	631	44	1,778	32	50	22.1%	4.9%
1992	104	Sublette	32,618	32,000	NA	11,763	52.6%	11.3	69,840	2,972	2,865	269	6,106	38	61	32.3%	14.9%
1991	104	Sublette	32,000	32,000	NA	11,599	76.1%	7.8	68,108	5,170	3,262	392	8,824	37	70	47.5%	17.4%
1990	104	Sublette	33,600	32,000	NA	10,079	69.3%	7.6	52,822	3,899	2,825	262	6,986	36	74	40.4%	15.0%

			Population		Hunting					Harvest				Herd Ratios		% of Pop. Harvested	
Year	Herd Code	Moose Herd Unit	Pop. Est.	Pop. Obj.	Active Licenses	No. Hunters	nter Succe	Hunter Effort (days/animal harvested)	Rec. Days	Male	Female	Juvenile	Total	Sex Ratio (Males/100 Females)	Age Ratio (Juv./100 Females)	Male	Female
2005	105	Sublette	3,926	5,500	333	333	86.8%	6.7	1,950	227	57	5	289	53	41	17.5%	2.7%
2004	105	Sublette	4,107	5,500	420	420	83.8%	6.6	2,308	258	84	10	352	51	41	19.1%	3.8%
2003	105	Sublette	4,028	5,500	603	603	85.9%	7	3,606	339	161	18	518	50	35	23.7%	6.9%
2002	105	Sublette	3,726	5,500	630	614	88.1%	7.4	4,008	362	144	35	541	53	42	26.3%	7.0%
2001	105	Sublette	5,665	5,500	615	615	89.6%	5.6	3,078	352	160	39	551	60	34	16.7%	5.2%
2000	105	Sublette	6,000	5,500	599	599	88.8%	6	3,216	332	172	28	532	69	46	14.7%	5.8%
1999	105	Sublette	5,800	5,500	542	542	91.9%	7.5	3,729	306	171	21	498	66	43	14.3%	5.8%
1998	105	Sublette	5,700	5,500	496	496	89.9%	6	2,673	279	145	22	446	66	50	13.8%	5.2%
1997	105	Sublette	5,500	5,500	483	479	95.6%	3.9	1,778	283	148	27	458	55	38	15.3%	4.9%
1996	105	Sublette	5,840	5,500	NA	480	93.8%	4.7	2,117	282	140	28	450	54	39	14.7%	4.4%
1995	105	Sublette	6,000	5,500	NA	485	91.1%	5.4	2,384	271	143	28	442	57	47	13.9%	4.6%
1994	105	Sublette	5,700	5,500	NA	495	90.7%	5.2	2,321	271	156	22	449	63	56	14.2%	5.7%
1993	105	Sublette	5,112	5,500	NA	560	88.4%	5.7	2,818	287	174	34	495	55	42	16.7%	6.3%
1992	105	Sublette	5,704	5,500	NA	614	92.3%	4.7	2,586	299	229	38	566	45	44	18.0%	7.1%
1991	105	Sublette	5,650	5,500	NA	667	87.4%	5.6	3,257	343	204	36	583	48	41	19.3%	6.4%
1990	105	Sublette	5,560	5,500	NA	821	86.7%	5.5	3,889	359	304	49	712	43	46	22.1%	9.4%

			Population		Hunting					Harvest					Herd Ratios		% of Pop. Harvested	
Year	Herd Code	Elk Herd Unit	Pop. Est.	Pop. Obj.	Active Licenses	No. Hunters	nter Succe	Hunter Effort (days/animal harvested)	Rec. Days	Male	Yrl.Male	Female	Juvenile	Total	Sex Ratio (Males/100 Females)	Age Ratio (Juv./100 Females)	Male	Female
2005	103	Fall Creek	5,369	4,392	2,285	2,213	33.6%	20.1	14,929	366	79	255	43	743	23	34	36.1%	6.9%
2004	103	Fall Creek	5,150	4,392	2,465	2,423	49.0%	12.4	14,718	395	139	534	120	1,188	20	32	44.1%	13.6%
2003	103	Fall Creek	5,447	4,392	2,095	2,093	37.8%	15.7	12,436	352	78	305	56	791	22	41	36.9%	8.4%
2002	103	Fall Creek	4,503	4,392	2,294	2,290	28.1%	19.8	12,750	221	70	313	40	644	18	29	34.5%	9.3%
2001	103	Fall Creek	5,259	4,392	2,044	2,044	34.4%	17.2	12,091	227	149	244	38	703	22	37	34.1%	6.9%
2000	103	Fall Creek	4,849	4,392	1,999	1,999	35.5%	16.2	11,469	327	89	240	53	709	20	34	39.8%	7.1%
1999	103	Fall Creek	4,534	4,392	2,651	2,651	33.9%	17.8	16,064	325	142	341	92	900	22	23	40.4%	9.8%
1998	103	Fall Creek	4,774	4,392	2,520	2,520	26.2%	21.4	14,108	328	97	198	37	660	21	28	38.7%	5.8%
1997	103	Fall Creek	4,459	4,392	2,228	2,228	40.6%	15.2	13,717	348	114	383	59	904	19	29	44.7%	11.3%
1996	103	Fall Creek	4,600	4,392	NA	2,279	39.3%	16.7	14,968	288	71	416	120	895	21	31	36.1%	12.1%
1995	103	Fall Creek	4,635	4,392	NA	2,917	30.1%	17.9	15,759	305	147	388	39	879	23	27	38.9%	11.2%
1994	103	Fall Creek	5,000	4,392	NA	3,766	48.8%	10.2	18,762	485	241	948	163	1,837	22	41	51.8%	23.6%
1993	103	Fall Creek	5,109	4,392	NA	3,297	30.8%	18.1	18,360	300	147	487	81	1,015	16	23	43.2%	11.7%
1992	103	Fall Creek	6,000	4,392	NA	2,984	41.1%	12.3	15,080	406	148	554	117	1,225	19	35	42.8%	12.4%
1991	103	Fall Creek	5,955	4,392	NA	2,997	39.8%	13.7	16,389	367	192	525	110	1,194	16	37	47.3%	11.9%
1990	103	Fall Creek	4,900	4,392	NA	3,264	36.2%	14.2	16,810	306	197	588	90	1,181	12	34	55.5%	14.9%

	Round Mountain Section						
	Before			After			
	1996	1997	1998	2001	2002	2003	Herd Square Miles
Mule Deer	37,100	31,171	33,423	43,439	31,751	31,367	5,602
Density (ani/sq mile)	6.62	5.56	5.97	7.75	5.67	5.60	
Pronghorn	43,900	42,300	45,500	47,700	44,700	44,200	10,711
Density (ani/sq mile)	4.10	3.95	4.25	4.45	4.17	4.13	
Average		10.15			10.59		

			Population		Hunting					Harvest				Herd Ratios		% of Pop. Harvested	
Year	Herd Code	Mule Deer Herd Unit	Pop. Est.	Pop. Obj.	Active Licenses	No. Hunters	Hunter Success	Hunter Effort (days/animal harvested)	Rec. Days	Male	Female	Juvenile	Total	Sex Ratio (Males/100 Females)	Age Ratio (Juv./100 Females)	Male	Female
2005	131	Wyoming Range	27,169	50,000	4,935	4,935	33.7%	16.3	27,139	1,635	27	0	1,662	32	70	27.5%	0.2%
2004	131	Wyoming Range	27,590	50,000	5,835	5,835	40.0%	12.6	29,414	1,881	400	53	2,334	29	71	32.0%	2.8%
2003	131	Wyoming Range	31,367	50,000	6,637	6,637	38.3%	14.5	36,912	2,195	284	62	2,541	31	70	31.2%	1.8%
2002	131	Wyoming Range	31,751	50,000	7,158	7,158	36.9%	16.2	42,752	2,191	414	34	2,639	32	64	29.7%	2.5%
2001	131	Wyoming Range	43,439	50,000	7,250	7,250	41.4%	13.5	40,525	2,715	250	39	3,004	37	65	25.4%	1.1%
2000	131	Wyoming Range	47,808	50,000	6,777	6,777	50.3%	10.6	36,211	3,087	285	36	3,408	38	82	27.2%	1.3%
1999	131	Wyoming Range	41,579	50,000	6,681	6,681	38.9%	14.4	37,489	2,599	0	0	2,599	40	78	25.4%	0.0%
1998	131	Wyoming Range	33,423	50,000	6,905	6,905	29.1%	18.7	37,486	2,008	0	0	2,008	38	76	25.3%	0.0%
1997	131	Wyoming Range	31,171	50,000	5,642	5,642	21.1%	20.9	24,841	1,191	0	0	1,191	35	71	18.4%	0.0%
1996	131	Wyoming Range	37,100	50,000	NA	5,066	27.8%	17.1	24,020	1,408	0	0	1,408	37	78	18.1%	0.0%
1995	131	Wyoming Range	33,130	50,000	NA	5,598	27.2%	18.2	27,664	1,522	0	0	1,522	37	69	20.4%	0.0%
1994	131	Wyoming Range	28,232	50,000	NA	4,995	25.1%	17.2	21,477	1,252	0	0	1,252	30	61	22.0%	0.0%
1993	131	Wyoming Range	25,803	50,000	NA	8,431	18.6%	31.2	49,072	958	571	42	1,571	30	49	18.1%	3.8%
1992	131	Wyoming Range	34,000	38,000	NA	12,604	67.3%	8.7	74,007	3,608	4,510	369	8,487	38	54	34.9%	20.3%
1991	131	Wyoming Range - combined with Carter Lease	57,200	38,000	NA	12,187	96.7%	6.3	74,018	5,583	5,566	633	11,782	42	63	32.3%	16.6%
1990	131	Wyoming Range	52,300	38,000	NA	10,627	78.7%	6.3	52,736	4,693	3,382	293	8,368	50	87	29.8%	13.3%
1990	433	Carter Lease - combined with Wyoming Range	8,500	8,500	NA	2,246	52.8%	5.1	6,041	789	350	48	1,187	26	73	41.5%	7.6%

			Population		Hunting					Harvest				Herd Ratios		% of Pop. Harvested	
Year	Herd Code	Pronghorn Herd Unit	Pop. Est.	Pop. Obj.	Active Licenses	No. Hunters	Hunter Success	Hunter Effort (days/animal harvested)	Rec. Days	Male	Female	Juvenile	Total	Sex Ratio (Males/100 Females)	Age Ratio (Juv./100 Females)	Male	Female
2005	401	Sublette	47,900	48,000	4,746	4,314	92.1%	3.5	13,760	2,248	1,583	143	3,974	56	69	17.4%	6.9%
2004	401	Sublette	42,500	48,000	4,848	4,380	96.5%	3.4	14,358	2,444	1,544	239	4,227	47	74	24.6%	7.3%
2003	401	Sublette	44,200	48,000	4,787	4,447	94.0%	3.3	13,929	2,435	1,585	161	4,181	47	60	22.2%	6.8%
2002	401	Sublette	44,700	48,000	4,751	4,382	94.8%	3.2	13,490	2,467	1,477	212	4,156	46	62	22.8%	6.3%
2001	401	Sublette	47,700	48,000	4,102	3,732	92.0%	3.5	12,005	2,245	1,053	137	3,435	54	62	17.6%	4.4%
2000	401	Sublette	47,100	48,000	7,254	6,771	92.8%	3.3	20,711	3,447	2,492	343	6,282	52	57	26.0%	9.8%
1999	401	Sublette	49,500	48,000	6,118	5,620	96.0%	2.9	15,803	2,909	2,113	374	5,396	56	76	22.0%	8.9%
1998	401	Sublette	45,500	48,000	5,403	4,621	103.9%	3.1	15,005	2,823	1,756	220	4,799	50	72	24.9%	7.8%
1997	401	Sublette - combined with West Green River	42,300	48,000	3,664	3,375	100.4%	3	10,082	2,085	1,118	187	3,390	53	73	19.5%	5.5%
1996	401	Sublette	35,000	40,000	NA	2,308	100.8%	2.7	6,313	1,733	546	47	2,326	48	76	21.7%	3.3%
1995	401	Sublette	31,300	40,000	NA	1,590	87.6%	2.8	3,970	1,264	115	14	1,393	54	56	15.0%	0.7%
1994	401	Sublette	31,740	40,000	NA	1,308	86.2%	2.9	3,242	1,065	62	1	1,128	52	58	13.1%	0.4%
1993	401	Sublette	27,672	40,000	NA	3,258	120.4%	2.7	10,628	1,929	1,731	264	3,924	55	54	23.2%	11.5%
1992	401	Sublette	32,811	30,000	NA	4,294	146.2%	2.4	14,782	2,391	3,533	353	6,277	48	44	24.5%	17.4%
1991	401	Sublette	33,250	30,000	NA	4,178	142.8%	2.3	13,553	2,499	3,082	387	5,968	52	58	25.7%	16.5%
1990	401	Sublette	31,400	19,400	NA	4,462	138.1%	2.2	13,698	2,636	3,111	415	6,162	58	74	28.1%	19.2%
1996	417	West Green River - combined with Sublette	8,900	8,000	NA	860	119.0%	2.5	2,553	549	439	35	1,023	57	84	23.4%	10.7%
1995	417	West Green River	8,146	8,000	NA	605	97.2%	2.5	1,466	342	216	30	588	50	80	18.0%	5.7%
1994	417	West Green River	7,810	8,000	NA	536	93.1%	2.9	1,462	343	133	23	499	45	86	21.2%	3.7%
1993	417	West Green River	6,400	8,000	NA	1,296	102.4%	2.8	3,704	979	337	11	1,327	71	55	40.3%	9.9%
1992	417	West Green River	10,731	3,000	NA	1,768	151.4%	1.9	5,086	991	1,499	187	2,677	58	58	27.5%	24.1%
1991	417	West Green River	11,700	3,000	NA	1,310	152.1%	1.8	3,678	904	1,012	77	1,993	53	77	28.6%	17.0%
1990	417	West Green River	4,600	3,000	NA	893	129.1%	1.9	2,200	582	533	38	1,153	51	88	47.4%	22.1%

	Torrington West Section						
	Before			After			
	1995	1996	1997	2000	2001	2002	Herd Square Miles
Mule Deer	11,528	14,351	15,485	20,932	18,300	20,517	5,315
Density (ani/sq mi)	2.17	2.70	2.91	3.94	3.44	3.86	
WTD (objective population)	4,000	4,000	4,000	4,000	4,000	4,000	15,271
Density (ani/sq mi)	0.26	0.26	0.26	0.26	0.26	0.26	
Average		2.86			4.01		

			Population		Hunting					Harvest				Herd Ratios		% of Pop. Harvested	
Year	Herd Code	Mule Deer Herd Unit	Pop. Est.	Pop. Obj.	Active Licenses	No. Hunters	Hunter Success	Hunter Effort (days/animal harvested)	Rec. Days	Male	Female	Juvenile	Total	Sex Ratio (Males/100 Females)	Age Ratio (Juv./100 Females)	Male	Female
2005	534	Goshen Rim	19,000	25,000	1,720	1,672	50.2%	7.9	6,605	708	116	15	839	36	76	18.0%	1.3%
2004	534	Goshen Rim	23,424	25,000	1,578	1,507	57.1%	6.9	5,920	594	244	23	861	45	57	10.2%	2.1%
2003	534	Goshen Rim	20,968	25,000	1,663	1,595	52.7%	7.7	6,427	586	217	37	840	28	71	16.6%	2.0%
2002	534	Goshen Rim	20,517	25,000	1,591	1,550	48.6%	8.7	6,530	570	174	9	753	25	55	16.7%	1.5%
2001	534	Goshen Rim	18,300	25,000	2,180	2,122	49.1%	7.3	7,594	759	253	29	1,041	24	49	23.0%	2.3%
2000	534	Goshen Rim	20,932	25,000	2,279	2,250	54.6%	6.3	7,755	913	298	18	1,229	28	68	23.4%	2.7%
1999	534	Goshen Rim	20,500	25,000	2,390	2,390	50.7%	7	8,479	978	205	29	1,212	29	73	24.9%	2.0%
		Goshen Rim - combined with															
1998	534	Muskrat and Goshen Hole	18,848	14,500	1,683	1,683	53.5%	7.5	5,208	734	164	2	900	23	68	24.4%	1.6%
1997	534	Goshen Rim	4,509	14,500	629	629	41.2%	6.7	1,745	215	40	4	259	34	75	NA	NA
1996	534	Goshen Rim	4,509	4,000	NA	571	45.2%	7.7	1,997	215	43	0	258	54	65	NA	NA
1995	534	Goshen Rim	3,340	4,000	NA	567	43.0%	7.4	1,805	165	74	5	244	27	53	24.8%	3.8%
1994	534	Goshen Rim	3,120	4,000	NA	931	59.4%	4.9	2,714	254	281	18	553	41	40	26.4%	14.0%
1993	534	Goshen Rim	7,068	4,000	NA	750	74.1%	3.9	2,180	304	227	25	556	29	50	21.0%	5.4%
1992	534	Goshen Rim	6,120	4,000	NA	644	64.9%	3.9	1,615	245	155	18	418	32	78	20.8%	5.1%
1991	534	Goshen Rim	3,838	4,000	NA	596	54.5%	5.5	1,764	252	73	0	325	37	56	25.5%	3.5%
1990	534	Goshen Rim	3,868	4,000	NA	602	50.5%	6.3	1,908	231	63	10	304	28	61	28.7%	3.0%
		Muskrat - combined with															
1997	536	Goshen Rim	5,780	14,500	789	789	35.5%	9.3	2,604	235	45	0	280	22	73	26.5%	1.5%
1996	536	Muskrat	5,209	6,000	NA	780	51.9%	6.1	2,486	342	63	0	405	24	95	37.5%	2.6%
1995	536	Muskrat	4,146	6,000	NA	1,036	48.1%	6	2,971	371	116	11	498	19	79	48.3%	5.2%
1994	536	Muskrat	6,706	6,000	NA	1,069	55.3%	5.7	3,355	252	319	20	591	18	64	27.5%	8.0%
1993	536	Muskrat	6,970	6,000	NA	1,341	62.8%	4.9	4,145	606	210	26	842	24	70	41.3%	5.5%
1992	536	Muskrat	6,925	6,000	NA	1,423	81.0%	3.4	3,977	757	372	24	1,153	31	76	42.2%	10.0%
1991	536	Muskrat	6,675	6,000	NA	1,490	70.4%	4.1	4,109	792	235	22	1,049	34	81	42.9%	7.0%
1990	536	Muskrat	4,260	6,000	NA	830	60.8%	5.5	2,754	415	87	3	505	24	65	43.4%	3.7%
		Goshen Hole - combined with															
1997	535	Goshen Rim	5,196	14,500	819	819	34.1%	8	2,222	203	76	0	279	27	70	22.2%	2.8%
1996	535	Goshen Hole	4,633	4,500	NA	743	35.8%	8.5	2,260	266	0	0	266	29	62	27.4%	0.0%
1995	535	Goshen Hole	4,042	4,500	NA	1,193	56.5%	5.1	3,269	382	221	32	635	20	74	47.8%	9.6%
1994	535	Goshen Hole	3,726	4,500	NA	1,195	48.5%	6.1	3,533	301	244	34	579	21	69	42.2%	11.1%
1993	535	Goshen Hole	5,091	4,500	NA	1,549	69.5%	4.3	4,591	665	385	26	1,076	18	65	57.0%	12.2%
1992	535	Goshen Hole	9,286	4,500	NA	1,029	60.4%	4.8	2,956	361	261	0	622	20	66	26.6%	5.0%
1991	535	Goshen Hole	8,699	4,500	NA	928	58.4%	6.3	3,057	427	115	0	542	24	74	28.8%	2.6%
1990	535	Goshen Hole	6,565	4,500	NA	692	49.6%	6.5	2,228	266	77	0	343	32	75	20.8%	2.4%

			Population		Hunting					Harvest				Herd Ratios		Harvest Percentage	
Year	Herd Code	White-tailed Deer Herd Unit	Pop. Est.	Pop. Obj.	Active Licenses	No. Hunters	nter Succe	Hunter Effort (days/animal harvested)	Rec. Days	Male	Female	Juvenile	Total	Sex Ratio (Males/100 Females)	Age Ratio (Juv./100 Females)	Male	Female
2005	504	Southeast Wyoming	NA	4,000	1,663	1,645	25.3%	13.7	5,708	353	44	20	417	42	75	NA	NA
2004	504	Southeast Wyoming	NA	4,000	1,597	1,573	26.4%	11.2	4,659	311	77	27	415	40	75	NA	NA
2003	504	Southeast Wyoming	NA	4,000	1,698	1,661	22.2%	14.5	5,341	294	53	21	368	31	73	NA	NA
2002	504	Southeast Wyoming	NA	4,000	1,807	1,779	26.3%	12.7	5,928	390	60	17	467	31	48	NA	NA
2001	504	Southeast Wyoming	NA	4,000	2,024	1,992	27.6%	11	6,074	434	90	26	550	43	85	NA	NA
2000	504	Southeast Wyoming	NA	4,000	2,134	2,117	27.0%	11.1	6,344	422	128	21	571	36	68	NA	NA
1999	504	Southeast Wyoming	NA	4,000	NA	2,011	17.3%	16.5	5,752	239	90	19	348	63	79	NA	NA
		Southeast Wyoming- combined															
1998	504	with Laramie River	NA	4,000	NA	1,916	24.2%	13	6,039	358	99	6	463	42	84	NA	NA
1997	504	Southeast Wyoming	NA	3,000	NA	729	53.1%	4.6	1,769	308	64	15	387	39	56	NA	NA
1996	504	Southeast Wyoming	NA	3,000	NA	1,169	30.4%	10	3,550	324	23	8	355	46	73	NA	NA
1995	504	Southeast Wyoming	3,635	3,000	NA	2,071	23.1%	15	7,191	297	136	46	479	24	71	39.9%	6.8%
1994	504	Southeast Wyoming	3,697	3,000	NA	2,247	24.3%	13.6	7,429	390	140	17	547	22	48	44.9%	6.0%
1993	504	Southeast Wyoming	3,170	3,000	NA	2,275	23.0%	15.8	8,274	368	136	19	523	32	49	39.6%	7.2%
1992	504	Southeast Wyoming	2,079	3,000	NA	2,360	22.1%	4.2	2,283	354	179	25	558	28	69	54.5%	14.5%
1991	504	Southeast Wyoming	2,285	3,000	NA	1,743	22.6%	4.5	5,731	291	91	12	394	21	63	52.7%	6.8%
1990	504	Southeast Wyoming	2,319	3,000	NA	1,925	22.9%	4.9	2,174	232	173	35	450	39	78	35.8%	13.9%
		Laramie River -- Combined															
1997	505	with Southeast Wyoming	NA	NA	NA	358	23.7%	9.1	NA	54	31	0	85	30	88	NA	NA
1996	505	Laramie River	NA	NA	NA	327	30.9%	16.9	NA	66	35	0	101	35	72	NA	NA
1995	505	Laramie River	1,258	1,000	NA	761	10.9%	36.2	NA	60	21	2	83	29	52	22.9%	2.9%
1994	505	Laramie River	1,256	1,000	NA	1,225	13.4%	31.7	NA	101	56	7	164	35	116	36.6%	10.1%
1993	505	Laramie River	1,022	1,000	NA	1,015	20.0%	17.6	NA	109	90	4	203	36	70	37.9%	15.4%
1992	505	Laramie River	1,284	1,000	NA	943	15.8%	23.3	NA	78	71	0	149	22	57	33.1%	9.0%
1991	505	Laramie River	1,272	1,000	NA	971	11.0%	29.9	NA	34	61	12	107	57	76	9.9%	10.1%
1990	505	Laramie River	1,193	1,000	NA	1,014	11.6%	28.8	NA	67	47	4	118	41	66	22.1%	7.5%

APPENDIX E: RECORDED SPEEDS

Collected Summer 2006

Recorded Using Jamar Trax RD Counters

Centennial East Section, Eastern Counter

WY 130 Speed Summary
Augest 7-9, 2006
Page 1 is Westbound
Page 2 is Eastbound

Page 1

Site Code: 000000013840
Station ID:

Latitude: 0' 0.000 South

Report for Report From 8/7/2006 1:20:00 PM to 8/9/2006 2:07:28 PM

SPEED STATISTICS - 35 to 95+ by 5 MPH

Speed in MPH	0 - 35	36 - 40	41 - 45	46 - 50	51 - 55	56 - 60	61 - 65	66 - 70	71 - 75	76 - 80	81 - 85	86 - 90	91 - 95	96 - 999
Count	5	4	7	25	76	189	345	414	176	38	15	2	1	2
Percent	0.4	0.3	0.5	1.9	5.9	14.5	26.6	31.9	13.5	2.9	1.2	0.2	0.1	0.2

Over Speed	35	40	45	50	55	60	65	70	75	80	85	90	95	999
Count	1294	1290	1283	1258	1182	993	648	234	58	20	5	3	2	0
Percent	99.6	99.3	98.8	96.8	91.0	76.4	49.9	18.0	4.5	1.5	0.4	0.2	0.2	0.0

Percentile	5%	10%	15%	45%	50%	55%	85%	90%	95%
Speed	53	56	58	65	65	66	71	73	75

Average (Mean) 65

Pace Speed 62-71
Number in Pace 764
Percent in Pace 58.8

MISC. STATISTICS

Number of Axles	2	3	4	5	6	7	8	9	10	11	12
Avg. Wheelbase	120.4	283.8	405.7	680.0	0	0	0	0	0	0	0

Axles Per Vehicle 2.09

WY 130 Speed Summary
Augest 7-9, 2006
Page 1 is Westbound
Page 2 is Eastbound

Page 2

Site Code: 000000013840
Station ID:

Latitude: 0' 0.000 South

Report for Report From 8/7/2006 1:20:00 PM to 8/9/2006 2:07:28 PM

SPEED STATISTICS - 35 to 95+ by 5 MPH

Speed in MPH	0 - 35	36 - 40	41 - 45	46 - 50	51 - 55	56 - 60	61 - 65	66 - 70	71 - 75	76 - 80	81 - 85	86 - 90	91 - 95	96 - 999
Count	3	1	0	2	9	19	67	151	339	237	79	25	6	7
Percent	0.3	0.1	0.0	0.2	1.0	2.0	7.1	16.0	35.9	25.1	8.4	2.6	0.6	0.7

Over Speed	35	40	45	50	55	60	65	70	75	80	85	90	95	999
Count	942	941	941	939	930	911	844	693	354	117	38	13	7	0
Percent	99.7	99.6	99.6	99.4	98.4	96.4	89.3	73.3	37.5	12.4	4.0	1.4	0.7	0.0

Percentile	5%	10%	15%	45%	50%	55%	85%	90%	95%
Speed	62	65	68	73	74	75	80	81	85

Average (Mean) 74

Pace Speed 69-78
Number in Pace 587
Percent in Pace 62.1

MISC. STATISTICS

Number of Axles	2	3	4	5	6	7	8	9	10	11	12
Avg. Wheelbase	136.1	318.1	475.2	732.0	921.0	0	0	0	0	0	0

Axles Per Vehicle 2.09

WY 130 Speed Summary
Augest 7-9, 2006
Page 1 is Westbound
Page 2 is Eastbound

Site Code: 000000013840
Station ID:

COMBINED -

Latitude: 0' 0.000 South

Report for Report From 8/7/2006 1:20:00 PM to 8/9/2006 2:07:28 PM

SPEED STATISTICS - 35 to 95+ by 5 MPH

Speed in MPH	0 - 35	36 - 40	41 - 45	46 - 50	51 - 55	56 - 60	61 - 65	66 - 70	71 - 75	76 - 80	81 - 85	86 - 90	91 - 95	96 - 999
Count	8	5	7	27	85	208	412	565	515	275	94	27	7	9
Percent	0.4	0.2	0.3	1.2	3.8	9.3	18.4	25.2	23.0	12.3	4.2	1.2	0.3	0.4

Over Speed	35	40	45	50	55	60	65	70	75	80	85	90	95	999
Count	2236	2231	2224	2197	2112	1904	1492	927	412	137	43	16	9	0
Percent	99.6	99.4	99.1	97.9	94.1	84.8	66.5	41.3	18.4	6.1	1.9	0.7	0.4	0.0

Percentile	5%	10%	15%	45%	50%	55%	85%	90%	95%
Speed	55	58	60	68	69	70	76	78	81

Average (Mean)	69
Pace Speed	65-74
Number in Pace	1104
Percent in Pace	49.2

MISC. STATISTICS

Number of Axles	2	3	4	5	6	7	8	9	10	11	12
Avg. Wheelbase	127.0	301.5	425.4	706.0	921.0	0	0	0	0	0	0

Axles Per Vehicle	2.09

Centennial East, West Counter

WY 130 Speed Summary NFLL
August 7-9, 2006
Page 1 is Westbound
Page 2 is Eastbound

Page 1

Site Code: 000000013839
Station ID:

Latitude: 0' 0.000 South

Report for Report From 8/7/2006 12:28:00 PM to 8/9/2006 2:36:48 PM

SPEED STATISTICS - 35 to 95+ by 5 MPH

Speed in MPH	0 - 35	36 - 40	41 - 45	46 - 50	51 - 55	56 - 60	61 - 65	66 - 70	71 - 75	76 - 80	81 - 85	86 - 90	91 - 95	96 - 999
Count	128	65	62	125	303	298	277	139	22	3	0	0	0	0
Percent	9.0	4.6	4.4	8.8	21.3	21.0	19.5	9.8	1.5	0.2	0.0	0.0	0.0	0.0

Over Speed	35	40	45	50	55	60	65	70	75	80	85	90	95	999
Count	1294	1229	1167	1042	739	441	164	25	3	0	0	0	0	0
Percent	91.0	86.4	82.1	73.3	52.0	31.0	11.5	1.8	0.2	0.0	0.0	0.0	0.0	0.0

Percentile	5%	10%	15%	45%	50%	55%	85%	90%	95%
Speed	31	36	43	55	56	57	65	66	68

Average (Mean) 54

Pace Speed 53-62
Number in Pace 625
Percent in Pace 44.0

MISC. STATISTICS

Number of Axles	2	3	4	5	6	7	8	9	10	11	12
Avg. Wheelbase	117.4	254.5	394.7	541.0	0	0	0	0	0	0	0

Axles Per Vehicle 2.09

WY 130 Speed Summary NFLL
August 7-9, 2006
Page 1 is Westbound
Page 2 is Eastbound

Page 2

Site Code: 000000013839
Station ID:

Latitude: 0' 0.000 South

Report for Report From 8/7/2006 12:28:00 PM to 8/9/2006 2:36:48 PM

SPEED STATISTICS - 35 to 95+ by 5 MPH

Speed in MPH	0 - 35	36 - 40	41 - 45	46 - 50	51 - 55	56 - 60	61 - 65	66 - 70	71 - 75	76 - 80	81 - 85	86 - 90	91 - 95	96 - 999
Count	74	80	92	144	246	268	257	134	28	2	0	0	0	0
Percent	5.6	6.0	6.9	10.9	18.6	20.2	19.4	10.1	2.1	0.2	0.0	0.0	0.0	0.0

Over Speed	35	40	45	50	55	60	65	70	75	80	85	90	95	999
Count	1251	1171	1079	935	689	421	164	30	2	0	0	0	0	0
Percent	94.4	88.4	81.4	70.6	52.0	31.8	12.4	2.3	0.2	0.0	0.0	0.0	0.0	0.0

Percentile	5%	10%	15%	45%	50%	55%	85%	90%	95%
Speed	34	39	43	55	56	57	65	66	68

Average (Mean) 54

Pace Speed 54-63
Number in Pace 540
Percent in Pace 40.8

MISC. STATISTICS

Number of Axles	2	3	4	5	6	7	8	9	10	11	12
Avg. Wheelbase	118.5	305.1	424.4	652.3	0	0	0	0	0	0	0

Axles Per Vehicle 2.07

COMBINED -

Latitude: 0' 0.000 South

Report for Report From 8/7/2006 12:28:00 PM to 8/9/2006 2:36:48 PM

SPEED STATISTICS - 35 to 95+ by 5 MPH

Speed in MPH	0 - 35	36 - 40	41 - 45	46 - 50	51 - 55	56 - 60	61 - 65	66 - 70	71 - 75	76 - 80	81 - 85	86 - 90	91 - 95	96 - 999
Count	202	145	154	269	549	566	534	273	50	5	0	0	0	0
Percent	7.4	5.3	5.6	9.8	20.0	20.6	19.4	9.9	1.8	0.2	0.0	0.0	0.0	0.0

Over Speed	35	40	45	50	55	60	65	70	75	80	85	90	95	999
Count	2545	2400	2246	1977	1428	862	328	55	5	0	0	0	0	0
Percent	92.6	87.4	81.8	72.0	52.0	31.4	11.9	2.0	0.2	0.0	0.0	0.0	0.0	0.0

Percentile	5%	10%	15%	45%	50%	55%	85%	90%	95%
Speed	32	38	43	55	56	57	65	66	68

Average (Mean) 54

Pace Speed 53-62
Number in Pace 1161
Percent in Pace 42.3

MISC. STATISTICS

Number of Axles	2	3	4	5	6	7	8	9	10	11	12
Avg. Wheelbase	117.9	281.8	405.1	607.8	0	0	0	0	0	0	0

Axles Per Vehicle 2.08

Morton Pass Section, East Counter

WY 34 Speed Summary East
August 7-9, 2006
Page 1 is Westbound
Page 2 is Eastbound

Page 2

Site Code: 000000013842
Station ID:

Latitude: 0' 0.000 South

Report for Report From 8/7/2006 3:48:00 PM to 8/10/2006 12:21:36 AM

SPEED STATISTICS - 35 to 95+ by 5 MPH

Speed in MPH	0 - 35	36 - 40	41 - 45	46 - 50	51 - 55	56 - 60	61 - 65	66 - 70	71 - 75	76 - 80	81 - 85	86 - 90	91 - 95	96 - 999
Count	0	0	2	3	13	24	73	119	81	45	9	4	2	0
Percent	0.0	0.0	0.5	0.8	3.5	6.4	19.5	31.7	21.6	12.0	2.4	1.1	0.5	0.0

Over Speed	35	40	45	50	55	60	65	70	75	80	85	90	95	999
Count	375	375	373	370	357	333	260	141	60	15	6	2	0	0
Percent	100.0	100.0	99.5	98.7	95.2	88.8	69.3	37.6	16.0	4.0	1.6	0.5	0.0	0.0

Percentile	5%	10%	15%	45%	50%	55%	85%	90%	95%
Speed	56	60	62	67	69	69	76	77	80

Average (Mean) 68

Pace Speed 64-73
Number in Pace 209
Percent in Pace 55.7

MISC. STATISTICS

Number of Axles	2	3	4	5	6	7	8	9	10	11	12
Avg. Wheelbase	123.4	377.8	511.0	764.0	924.4	1090.0	1155.0	1136.0	0	0	0

Axles Per Vehicle 2.37

WY 34 Speed Summary East
August 7-9, 2006
Page 1 is Westbound
Page 2 is Eastbound

Page 1

Site Code: 000000013842
Station ID:

Latitude: 0' 0.000 South

Report for Report From 8/7/2006 3:48:00 PM to 8/10/2006 12:21:36 AM

SPEED STATISTICS - 35 to 95+ by 5 MPH

Speed in MPH	0 - 35	36 - 40	41 - 45	46 - 50	51 - 55	56 - 60	61 - 65	66 - 70	71 - 75	76 - 80	81 - 85	86 - 90	91 - 95	96 - 999
Count	5	7	15	25	74	121	133	96	41	13	6	2	0	1
Percent	0.9	1.3	2.8	4.6	13.7	22.4	24.7	17.8	7.6	2.4	1.1	0.4	0.0	0.2

Over Speed	35	40	45	50	55	60	65	70	75	80	85	90	95	999
Count	534	527	512	487	413	292	159	63	22	9	3	1	1	0
Percent	99.1	97.8	95.0	90.4	76.6	54.2	29.5	11.7	4.1	1.7	0.6	0.2	0.2	0.0

Percentile	5%	10%	15%	45%	50%	55%	85%	90%	95%
Speed	45	51	53	60	62	63	69	71	75

Average (Mean) 61

Pace Speed 58-67
Number in Pace 257
Percent in Pace 47.7

MISC. STATISTICS

Number of Axles	2	3	4	5	6	7	8	9	10	11	12
Avg. Wheelbase	111.8	277.3	431.8	665.4	775.0	912.5	1147.0	1125.8	1194.0	0	0

Axles Per Vehicle 2.44

WY 34 Speed Summary East
Augest 7-9, 2006
Page 1 is Westbound
Page 2 is Eastbound

Site Code: 000000013842
Station ID:

COMBINED -

Latitude: 0' 0.000 South

Report for Report From 8/7/2006 3:48:00 PM to 8/10/2006 12:21:36 AM

SPEED STATISTICS - 35 to 95+ by 5 MPH

Speed in MPH	0 - 35	36 - 40	41 - 45	46 - 50	51 - 55	56 - 60	61 - 65	66 - 70	71 - 75	76 - 80	81 - 85	86 - 90	91 - 95	96 - 999
Count	5	7	17	28	87	145	206	215	122	58	15	6	2	1
Percent	0.5	0.8	1.9	3.1	9.5	15.9	22.5	23.5	13.3	6.3	1.6	0.7	0.2	0.1

Over Speed	35	40	45	50	55	60	65	70	75	80	85	90	95	999
Count	909	902	885	857	770	625	419	204	82	24	9	3	1	0
Percent	99.5	98.7	96.8	93.8	84.2	68.4	45.8	22.3	9.0	2.6	1.0	0.3	0.1	0.0

Percentile	5%	10%	15%	45%	50%	55%	85%	90%	95%
Speed	49	53	55	63	65	66	73	75	78

Average (Mean)	64
Pace Speed	62-71
Number in Pace	424
Percent in Pace	46.4

MISC. STATISTICS

Number of Axles	2	3	4	5	6	7	8	9	10	11	12
Avg. Wheelbase	116.5	342.6	461.1	683.0	849.7	1001.3	1151.0	1127.8	1194.0	0	0

Axles Per Vehicle	2.41

Morton Pass Section, West Counter

WY 34 Speed Summary West
Augest 7-9, 2006
Page 1 is Eastbound
Page 2 is Westbound

Page 1

Site Code: 000000013841
Station ID:

Latitude: 0' 0.000 South

Report for Report From 8/7/2006 3:16:00 PM to 8/10/2006 3:29:36 PM

SPEED STATISTICS - 35 to 95+ by 5 MPH

Speed in MPH	0 - 35	36 - 40	41 - 45	46 - 50	51 - 55	56 - 60	61 - 65	66 - 70	71 - 75	76 - 80	81 - 85	86 - 90	91 - 95	96 - 999
Count	5	1	0	6	8	35	109	309	173	82	21	7	3	2
Percent	0.7	0.1	0.0	0.8	1.1	4.6	14.3	40.6	22.7	10.8	2.8	0.9	0.4	0.3

Over Speed	35	40	45	50	55	60	65	70	75	80	85	90	95	999
Count	756	755	755	749	741	706	597	288	115	33	12	5	2	0
Percent	99.3	99.2	99.2	98.4	97.4	92.8	78.4	37.8	15.1	4.3	1.6	0.7	0.3	0.0

Percentile	5%	10%	15%	45%	50%	55%	85%	90%	95%
Speed	59	62	64	69	69	70	76	77	80

Average (Mean) 69

Pace Speed 65-74
Number in Pace 497
Percent in Pace 65.3

MISC. STATISTICS

Number of Axles	2	3	4	5	6	7	8	9	10	11	12
Avg. Wheelbase	113.3	306.7	444.7	707.1	763.5	971.3	1128.3	1165.3	1216.0	0	0

Axles Per Vehicle 2.39

WY 34 Speed Summary West
Augest 7-9, 2006
Page 1 is Eastbound
Page 2 is Westbound

Page 2

Site Code: 000000013841
Station ID:

Latitude: 0' 0.000 South

Report for Report From 8/7/2006 3:16:00 PM to 8/10/2006 3:29:36 PM

SPEED STATISTICS - 35 to 95+ by 5 MPH

Speed in MPH	0 - 35	36 - 40	41 - 45	46 - 50	51 - 55	56 - 60	61 - 65	66 - 70	71 - 75	76 - 80	81 - 85	86 - 90	91 - 95	96 - 999
Count	11	0	7	12	30	68	133	195	102	38	6	4	0	0
Percent	1.8	0.0	1.2	2.0	5.0	11.2	21.9	32.2	16.8	6.3	1.0	0.7	0.0	0.0

Over Speed	35	40	45	50	55	60	65	70	75	80	85	90	95	999
Count	595	595	588	576	546	478	345	150	48	10	4	0	0	0
Percent	98.2	98.2	97.0	95.0	90.1	78.9	56.9	24.8	7.9	1.7	0.7	0.0	0.0	0.0

Percentile	5%	10%	15%	45%	50%	55%	85%	90%	95%
Speed	50	56	58	66	67	67	73	75	77

Average (Mean) 65

Pace Speed 63-72
Number in Pace 335
Percent in Pace 55.3

MISC. STATISTICS

Number of Axles	2	3	4	5	6	7	8	9	10	11	12
Avg. Wheelbase	124.2	368.4	459.8	711.4	832.8	1058.7	1159.5	1138.0	1190.0	0	0

Axles Per Vehicle 2.43

WY 34 Speed Summary West
Augest 7-9, 2006
Page 1 is Eastbound
Page 2 is Westbound

Site Code: 000000013841
Station ID:

COMBINED -

Latitude: 0' 0.000 South

Report for Report From 8/7/2006 3:16:00 PM to 8/10/2006 3:29:36 PM

SPEED STATISTICS - 35 to 95+ by 5 MPH

Speed in MPH	0 - 35	36 - 40	41 - 45	46 - 50	51 - 55	56 - 60	61 - 65	66 - 70	71 - 75	76 - 80	81 - 85	86 - 90	91 - 95	96 - 999
Count	16	1	7	18	38	103	242	504	275	120	27	11	3	2
Percent	1.2	0.1	0.5	1.3	2.8	7.5	17.7	36.9	20.1	8.8	2.0	0.8	0.2	0.1

Over Speed	35	40	45	50	55	60	65	70	75	80	85	90	95	999
Count	1351	1350	1343	1325	1287	1184	942	438	163	43	16	5	2	0
Percent	98.8	98.8	98.2	96.9	94.1	86.6	68.9	32.0	11.9	3.1	1.2	0.4	0.1	0.0

Percentile	5%	10%	15%	45%	50%	55%	85%	90%	95%
Speed	54	59	61	67	68	69	74	76	79

Average (Mean) 68

Pace Speed 65-74
Number in Pace 830
Percent in Pace 60.7

MISC. STATISTICS

Number of Axles	2	3	4	5	6	7	8	9	10	11	12
Avg. Wheelbase	118.1	337.5	450.3	709.7	798.1	1008.7	1146.1	1159.8	1203.0	0	0

Axles Per Vehicle 2.40

Clearmont North Section, South Counter

US 14 Near Clearmont Speed Summary West
Augest 15-17, 2006
Page 1 is Westbound
Page 2 is Eastbound

Page 1

Site Code: 000000013839
Station ID:

Latitude: 0' 0.000 South

Report for Report From 8/14/2006 4:08:00 PM to 8/17/2006 7:20:32 PM

SPEED STATISTICS - 35 to 95+ by 5 MPH

Speed in MPH	0 - 35	36 - 40	41 - 45	46 - 50	51 - 55	56 - 60	61 - 65	66 - 70	71 - 75	76 - 80	81 - 85	86 - 90	91 - 95	96 - 999
Count	8	3	5	14	34	68	239	474	270	145	36	13	3	2
Percent	0.6	0.2	0.4	1.1	2.6	5.2	18.2	36.1	20.5	11.0	2.7	1.0	0.2	0.2

Over Speed	35	40	45	50	55	60	65	70	75	80	85	90	95	999
Count	1306	1303	1298	1284	1250	1182	943	469	199	54	18	5	2	0
Percent	99.4	99.2	98.8	97.7	95.1	90.0	71.8	35.7	15.1	4.1	1.4	0.4	0.2	0.0

Percentile	5%	10%	15%	45%	50%	55%	85%	90%	95%
Speed	56	60	63	68	68	69	76	77	80

Average (Mean) 68

Pace Speed 65-74
Number in Pace 781
Percent in Pace 59.4

MISC. STATISTICS

Number of Axles	2	3	4	5	6	7	8	9	10	11	12
Avg. Wheelbase	197.3	289.7	411.7	680.7	844.2	0	871.0	0	0	0	0

Axles Per Vehicle 2.26

US 14 Near Clearmont Speed Summary West
Augest 15-17, 2006
Page 1 is Westbound
Page 2 is Eastbound

Page 2

Site Code: 000000013839
Station ID:

Latitude: 0' 0.000 South

Report for Report From 8/14/2006 4:08:00 PM to 8/17/2006 7:20:32 PM

SPEED STATISTICS - 35 to 95+ by 5 MPH

Speed in MPH	0 - 35	36 - 40	41 - 45	46 - 50	51 - 55	56 - 60	61 - 65	66 - 70	71 - 75	76 - 80	81 - 85	86 - 90	91 - 95	96 - 999
Count	11	6	8	11	25	67	195	412	287	117	56	22	6	2
Percent	0.9	0.5	0.7	0.9	2.0	5.5	15.9	33.6	23.4	9.6	4.6	1.8	0.5	0.2

Over Speed	35	40	45	50	55	60	65	70	75	80	85	90	95	999
Count	1214	1208	1200	1189	1164	1097	902	490	203	86	30	8	2	0
Percent	99.1	98.6	98.0	97.1	95.0	89.6	73.6	40.0	16.6	7.0	2.4	0.7	0.2	0.0

Percentile	5%	10%	15%	45%	50%	55%	85%	90%	95%
Speed	55	60	62	68	69	69	76	78	83

Average (Mean) 69

Pace Speed 65-74
Number in Pace 712
Percent in Pace 58.1

MISC. STATISTICS

Number of Axles	2	3	4	5	6	7	8	9	10	11	12
Avg. Wheelbase	203.9	357.3	453.2	706.5	858.0	990.5	0	0	0	0	0

Axles Per Vehicle 2.22

COMBINED -

Latitude: 0' 0.000 South

Report for Report From 8/14/2006 4:08:00 PM to 8/17/2006 7:20:32 PM

SPEED STATISTICS - 35 to 95+ by 5 MPH

Speed in MPH	0 - 35	36 - 40	41 - 45	46 - 50	51 - 55	56 - 60	61 - 65	66 - 70	71 - 75	76 - 80	81 - 85	86 - 90	91 - 95	96 - 999
Count	19	9	13	25	59	135	434	886	557	262	92	35	9	4
Percent	0.7	0.4	0.5	1.0	2.3	5.3	17.1	34.9	21.9	10.3	3.6	1.4	0.4	0.2

Over Speed	35	40	45	50	55	60	65	70	75	80	85	90	95	999
Count	2520	2511	2498	2473	2414	2279	1845	959	402	140	48	13	4	0
Percent	99.3	98.9	98.4	97.4	95.1	89.8	72.7	37.8	15.8	5.5	1.9	0.5	0.2	0.0

Percentile	5%	10%	15%	45%	50%	55%	85%	90%	95%
Speed	56	60	63	68	69	69	76	78	81

Average (Mean) 69

Pace Speed 65-74
Number in Pace 1493
Percent in Pace 58.8

MISC. STATISTICS

Number of Axles	2	3	4	5	6	7	8	9	10	11	12
Avg. Wheelbase	200.5	326.5	428.3	690.7	848.1	990.5	871.0	0	0	0	0

Axles Per Vehicle 2.24

Clearmont North Section, North Counter

JAMAR Technologies, Inc.
151 Keith Valley Road
Horsham, PA 19044
Change These in the Preferences Screen

Page 1

Site Code: 000000013842
Station ID:

Latitude: 0' 0.000 South

Report for Report From 8/14/2006 3:04:00 PM to 8/17/2006 7:07:12 PM

SPEED STATISTICS - 35 to 95+ by 5 MPH

Speed in MPH	0 - 35	36 - 40	41 - 45	46 - 50	51 - 55	56 - 60	61 - 65	66 - 70	71 - 75	76 - 80	81 - 85	86 - 90	91 - 95	96 - 999
Count	9	2	7	24	45	123	308	414	210	84	24	7	4	0
Percent	0.7	0.2	0.6	1.9	3.6	9.8	24.4	32.8	16.7	6.7	1.9	0.6	0.3	0.0

Over Speed	35	40	45	50	55	60	65	70	75	80	85	90	95	999
Count	1252	1250	1243	1219	1174	1051	743	329	119	35	11	4	0	0
Percent	99.3	99.1	98.6	96.7	93.1	83.3	58.9	26.1	9.4	2.8	0.9	0.3	0.0	0.0

Percentile	5%	10%	15%	45%	50%	55%	85%	90%	95%
Speed	53	57	60	66	67	68	73	75	78

Average (Mean) 66

Pace Speed 63-72
Number in Pace 761
Percent in Pace 60.3

MISC. STATISTICS

Number of Axles	2	3	4	5	6	7	8	9	10	11	12
Avg. Wheelbase	142.8	297.4	458.4	674.3	704.8	0	0	0	0	0	0

Axles Per Vehicle 2.41

JAMAR Technologies, Inc.
151 Keith Valley Road
Horsham, PA 19044
Change These in the Preferences Screen

Page 2

Site Code: 000000013842
Station ID:

Latitude: 0' 0.000 South

Report for Report From 8/14/2006 3:04:00 PM to 8/17/2006 7:07:12 PM

SPEED STATISTICS - 35 to 95+ by 5 MPH

Speed in MPH	0 - 35	36 - 40	41 - 45	46 - 50	51 - 55	56 - 60	61 - 65	66 - 70	71 - 75	76 - 80	81 - 85	86 - 90	91 - 95	96 - 999
Count	16	8	8	10	36	96	310	372	188	60	27	14	2	0
Percent	1.4	0.7	0.7	0.9	3.1	8.4	27.0	32.4	16.4	5.2	2.4	1.2	0.2	0.0

Over Speed	35	40	45	50	55	60	65	70	75	80	85	90	95	999
Count	1131	1123	1115	1105	1069	973	663	291	103	43	16	2	0	0
Percent	98.6	97.9	97.2	96.3	93.2	84.8	57.8	25.4	9.0	3.7	1.4	0.2	0.0	0.0

Percentile	5%	10%	15%	45%	50%	55%	85%	90%	95%
Speed	53	58	60	66	67	67	73	75	79

Average (Mean) 66

Pace Speed 62-71
Number in Pace 692
Percent in Pace 60.3

MISC. STATISTICS

Number of Axles	2	3	4	5	6	7	8	9	10	11	12
Avg. Wheelbase	144.7	329.7	511.5	686.6	716.4	0	0	0	1313.0	0	0

Axles Per Vehicle 2.36

JAMAR Technologies, Inc.
151 Keith Valley Road
Horsham, PA 19044
Change These in the Preferences Screen

Site Code: 000000013842
Station ID:

COMBINED -

Latitude: 0' 0.000 South

Report for Report From 8/14/2006 3:04:00 PM to 8/17/2006 7:07:12 PM

SPEED STATISTICS - 35 to 95+ by 5 MPH

Speed in MPH	0 - 35	36 - 40	41 - 45	46 - 50	51 - 55	56 - 60	61 - 65	66 - 70	71 - 75	76 - 80	81 - 85	86 - 90	91 - 95	96 - 999
Count	25	10	15	34	81	219	618	786	398	144	51	21	6	0
Percent	1.0	0.4	0.6	1.4	3.4	9.1	25.7	32.6	16.5	6.0	2.1	0.9	0.2	0.0

Over Speed	35	40	45	50	55	60	65	70	75	80	85	90	95	999
Count	2383	2373	2358	2324	2243	2024	1406	620	222	78	27	6	0	0
Percent	99.0	98.5	97.9	96.5	93.1	84.1	58.4	25.7	9.2	3.2	1.1	0.2	0.0	0.0

Percentile	5%	10%	15%	45%	50%	55%	85%	90%	95%
Speed	53	58	60	66	67	67	73	75	79

Average (Mean) 66

Pace Speed 62-71
Number in Pace 1445
Percent in Pace 60.0

MISC. STATISTICS

Number of Axles	2	3	4	5	6	7	8	9	10	11	12
Avg. Wheelbase	143.7	313.2	483.7	679.8	708.2	0	0	0	1313.0	0	0

Axles Per Vehicle 2.39

US 14 Near Cody Speed Summary East
Augest 15-17, 2006
Page 1 is Westbound
Page 2 is Eastbound

Page 1

Site Code: 000000013841
Station ID:

Latitude: 0' 0.000 South

Report for Report From 8/15/2006 3:04:00 PM to 8/17/2006 2:15:12 PM

SPEED STATISTICS - 35 to 95+ by 5 MPH

Speed in MPH	0 - 35	36 - 40	41 - 45	46 - 50	51 - 55	56 - 60	61 - 65	66 - 70	71 - 75	76 - 80	81 - 85	86 - 90	91 - 95	96 - 999
Count	48	51	71	224	608	617	386	147	26	6	1	0	0	0
Percent	2.2	2.3	3.2	10.3	27.8	28.2	17.7	6.7	1.2	0.3	0.0	0.0	0.0	0.0

Over Speed	35	40	45	50	55	60	65	70	75	80	85	90	95	999
Count	2137	2086	2015	1791	1183	566	180	33	7	1	0	0	0	0
Percent	97.8	95.5	92.2	82.0	54.1	25.9	8.2	1.5	0.3	0.0	0.0	0.0	0.0	0.0

Percentile	5%	10%	15%	45%	50%	55%	85%	90%	95%
Speed	42	47	50	55	56	57	63	65	67

Average (Mean) 56

Pace Speed 52-61
Number in Pace 1242
Percent in Pace 56.8

MISC. STATISTICS

Number of Axles	2	3	4	5	6	7	8	9	10	11	12
Avg. Wheelbase	120.3	305.1	470.0	603.2	813.6	0	0	0	0	0	0

Axles Per Vehicle 2.19

US 14 Near Cody Speed Summary East
Augest 15-17, 2006
Page 1 is Westbound
Page 2 is Eastbound

Page 2

Site Code: 000000013841
Station ID:

Latitude: 0' 0.000 South

Report for Report From 8/15/2006 3:04:00 PM to 8/17/2006 2:15:12 PM

SPEED STATISTICS - 35 to 95+ by 5 MPH

Speed in MPH	0 - 35	36 - 40	41 - 45	46 - 50	51 - 55	56 - 60	61 - 65	66 - 70	71 - 75	76 - 80	81 - 85	86 - 90	91 - 95	96 - 999
Count	99	41	136	416	718	446	115	35	4	0	0	0	0	0
Percent	4.9	2.0	6.8	20.7	35.7	22.2	5.7	1.7	0.2	0.0	0.0	0.0	0.0	0.0

Over Speed	35	40	45	50	55	60	65	70	75	80	85	90	95	999
Count	1911	1870	1734	1318	600	154	39	4	0	0	0	0	0	0
Percent	95.1	93.0	86.3	65.6	29.9	7.7	1.9	0.2	0.0	0.0	0.0	0.0	0.0	0.0

Percentile	5%	10%	15%	45%	50%	55%	85%	90%	95%
Speed	36	43	46	52	53	53	58	60	62

Average (Mean) 52

Pace Speed 48-57
Number in Pace 1247
Percent in Pace 62.0

MISC. STATISTICS

Number of Axles	2	3	4	5	6	7	8	9	10	11	12
Avg. Wheelbase	116.9	316.5	487.3	603.5	754.0	0	0	0	0	0	0

Axles Per Vehicle 2.15

COMBINED - Latitude: 0' 0.000 South

Report for Report From 8/15/2006 3:04:00 PM to 8/17/2006 2:15:12 PM

SPEED STATISTICS - 35 to 95+ by 5 MPH

Speed in MPH	0 - 35	36 - 40	41 - 45	46 - 50	51 - 55	56 - 60	61 - 65	66 - 70	71 - 75	76 - 80	81 - 85	86 - 90	91 - 95	96 - 999
Count	147	92	207	640	1326	1063	501	182	30	6	1	0	0	0
Percent	3.5	2.2	4.9	15.3	31.6	25.3	11.9	4.3	0.7	0.1	0.0	0.0	0.0	0.0

Over Speed	35	40	45	50	55	60	65	70	75	80	85	90	95	999
Count	4048	3956	3749	3109	1783	720	219	37	7	1	0	0	0	0
Percent	96.5	94.3	89.4	74.1	42.5	17.2	5.2	0.9	0.2	0.0	0.0	0.0	0.0	0.0

Percentile	5%	10%	15%	45%	50%	55%	85%	90%	95%
Speed	39	45	48	54	55	55	61	63	66

Average (Mean)	54
Pace Speed	50-59
Number in Pace	2396
Percent in Pace	57.1

MISC. STATISTICS

Number of Axles	2	3	4	5	6	7	8	9	10	11	12
Avg. Wheelbase	118.7	311.8	476.8	603.2	803.7	0	0	0	0	0	0

Axles Per Vehicle	2.17

US 14 Near Cody Speed Summary West
Augest 15-17, 2006
Page 1 is Westbound
Page 2 is Eastbound

Page 1

Site Code: 000000013840
Station ID:

Latitude: 0' 0.000 South

Report for Report From 8/15/2006 2:36:00 PM to 8/17/2006 2:02:56 PM

SPEED STATISTICS - 35 to 95+ by 5 MPH

Speed in MPH	0 - 35	36 - 40	41 - 45	46 - 50	51 - 55	56 - 60	61 - 65	66 - 70	71 - 75	76 - 80	81 - 85	86 - 90	91 - 95	96 - 999
Count	30	6	36	173	463	554	414	205	47	10	1	2	0	0
Percent	1.5	0.3	1.9	8.9	23.9	28.5	21.3	10.6	2.4	0.5	0.1	0.1	0.0	0.0

Over Speed	35	40	45	50	55	60	65	70	75	80	85	90	95	999
Count	1911	1905	1869	1696	1233	679	265	60	13	3	2	0	0	0
Percent	98.5	98.1	96.3	87.4	63.5	35.0	13.7	3.1	0.7	0.2	0.1	0.0	0.0	0.0

Percentile	5%	10%	15%	45%	50%	55%	85%	90%	95%
Speed	47	49	51	57	58	59	65	67	69

Average (Mean) 58

Pace Speed 52-61
Number in Pace 1049
Percent in Pace 54.0

MISC. STATISTICS

Number of Axles	2	3	4	5	6	7	8	9	10	11	12
Avg. Wheelbase	117.4	308.5	450.0	574.9	718.8	0	0	0	0	0	0

Axles Per Vehicle 2.21

US 14 Near Cody Speed Summary West
Augest 15-17, 2006
Page 1 is Westbound
Page 2 is Eastbound

Page 2

Site Code: 000000013840
Station ID:

Latitude: 0' 0.000 South

Report for Report From 8/15/2006 2:36:00 PM to 8/17/2006 2:02:56 PM

SPEED STATISTICS - 35 to 95+ by 5 MPH

Speed in MPH	0 - 35	36 - 40	41 - 45	46 - 50	51 - 55	56 - 60	61 - 65	66 - 70	71 - 75	76 - 80	81 - 85	86 - 90	91 - 95	96 - 999
Count	11	10	16	82	392	616	490	187	56	9	0	0	0	0
Percent	0.6	0.5	0.9	4.4	21.0	33.0	26.2	10.0	3.0	0.5	0.0	0.0	0.0	0.0

Over Speed	35	40	45	50	55	60	65	70	75	80	85	90	95	999
Count	1858	1848	1832	1750	1358	742	252	65	9	0	0	0	0	0
Percent	99.4	98.9	98.0	93.6	72.7	39.7	13.5	3.5	0.5	0.0	0.0	0.0	0.0	0.0

Percentile	5%	10%	15%	45%	50%	55%	85%	90%	95%
Speed	49	52	53	58	59	60	65	67	69

Average (Mean) 59

Pace Speed 54-63
Number in Pace 1153
Percent in Pace 61.7

MISC. STATISTICS

Number of Axles	2	3	4	5	6	7	8	9	10	11	12
Avg. Wheelbase	115.8	290.3	448.6	570.2	808.0	734.0	0	0	0	0	0

Axles Per Vehicle 2.19

COMBINED -

Latitude: 0' 0.000 South

Report for Report From 8/15/2006 2:36:00 PM to 8/17/2006 2:02:56 PM

SPEED STATISTICS - 35 to 95+ by 5 MPH

Speed in MPH	0 - 35	36 - 40	41 - 45	46 - 50	51 - 55	56 - 60	61 - 65	66 - 70	71 - 75	76 - 80	81 - 85	86 - 90	91 - 95	96 - 999
Count	41	16	52	255	855	1170	904	392	103	19	1	2	0	0
Percent	1.1	0.4	1.4	6.7	22.4	30.7	23.7	10.3	2.7	0.5	0.0	0.1	0.0	0.0

Over Speed	35	40	45	50	55	60	65	70	75	80	85	90	95	999
Count	3769	3753	3701	3446	2591	1421	517	125	22	3	2	0	0	0
Percent	98.9	98.5	97.1	90.4	68.0	37.3	13.6	3.3	0.6	0.1	0.1	0.0	0.0	0.0

Percentile	5%	10%	15%	45%	50%	55%	85%	90%	95%
Speed	48	51	52	57	58	59	65	67	69

Average (Mean) 58

Pace Speed 54-63
Number in Pace 2197
Percent in Pace 57.7

MISC. STATISTICS

Number of Axles	2	3	4	5	6	7	8	9	10	11	12
Avg. Wheelbase	116.6	297.5	449.4	573.8	736.6	734.0	0	0	0	0	0

Axles Per Vehicle 2.20

Astoria Section, East (North) Counter

US 89 Near Hoback Jct. Speed Summary East
Augest 22-24, 2006
Page 1 is Westbound
Page 2 is Eastbound

Page 1

Site Code: 000000013841
Station ID:

Latitude: 0' 0.000 South

Report for Report From 8/22/2006 9:24:00 AM to 8/24/2006 10:54:08 AM

SPEED STATISTICS - 35 to 95+ by 5 MPH

Speed in MPH	0 - 35	36 - 40	41 - 45	46 - 50	51 - 55	56 - 60	61 - 65	66 - 70	71 - 75	76 - 80	81 - 85	86 - 90	91 - 95	96 - 999
Count	29	13	28	140	865	2631	1402	265	46	15	4	1	2	1
Percent	0.5	0.2	0.5	2.6	15.9	48.3	25.8	4.9	0.8	0.3	0.1	0.0	0.0	0.0

Over Speed	35	40	45	50	55	60	65	70	75	80	85	90	95	999
Count	5413	5400	5372	5232	4367	1736	334	69	23	8	4	3	1	0
Percent	99.5	99.2	98.7	96.1	80.2	31.9	6.1	1.3	0.4	0.1	0.1	0.1	0.0	0.0

Percentile	5%	10%	15%	45%	50%	55%	85%	90%	95%
Speed	51	53	55	58	59	59	63	64	67

Average (Mean) 59

Pace Speed 54-63
Number in Pace 4277
Percent in Pace 78.6

MISC. STATISTICS

Number of Axles	2	3	4	5	6	7	8	9	10	11	12
Avg. Wheelbase	124.3	294.3	443.2	692.6	763.4	899.2	818.3	856.5	0	0	0

Axles Per Vehicle 2.33

US 89 Near Hoback Jct. Speed Summary East
Augest 22-24, 2006
Page 1 is Westbound
Page 2 is Eastbound

Page 2

Site Code: 000000013841
Station ID:

Latitude: 0' 0.000 South

Report for Report From 8/22/2006 9:24:00 AM to 8/24/2006 10:54:08 AM

SPEED STATISTICS - 35 to 95+ by 5 MPH

Speed in MPH	0 - 35	36 - 40	41 - 45	46 - 50	51 - 55	56 - 60	61 - 65	66 - 70	71 - 75	76 - 80	81 - 85	86 - 90	91 - 95	96 - 999
Count	16	8	38	139	1135	2458	1113	320	82	22	2	1	0	2
Percent	0.3	0.1	0.7	2.6	21.3	46.1	20.9	6.0	1.5	0.4	0.0	0.0	0.0	0.0

Over Speed	35	40	45	50	55	60	65	70	75	80	85	90	95	999
Count	5320	5312	5274	5135	4000	1542	429	109	27	5	3	2	2	0
Percent	99.7	99.6	98.8	96.2	75.0	28.9	8.0	2.0	0.5	0.1	0.1	0.0	0.0	0.0

Percentile	5%	10%	15%	45%	50%	55%	85%	90%	95%
Speed	51	53	54	57	58	59	63	65	67

Average (Mean) 58

Pace Speed 54-63
Number in Pace 3985
Percent in Pace 74.7

MISC. STATISTICS

Number of Axles	2	3	4	5	6	7	8	9	10	11	12
Avg. Wheelbase	124.4	333.4	507.5	703.1	788.7	882.1	843.8	750.0	0	0	0

Axles Per Vehicle 2.30

COMBINED -
Latitude: 0' 0.000 South

Report for Report From 8/22/2006 9:24:00 AM to 8/24/2006 10:54:08 AM

SPEED STATISTICS - 35 to 95+ by 5 MPH

Speed in MPH	0 - 35	36 - 40	41 - 45	46 - 50	51 - 55	56 - 60	61 - 65	66 - 70	71 - 75	76 - 80	81 - 85	86 - 90	91 - 95	96 - 999
Count	45	21	66	279	2000	5089	2515	585	128	37	6	2	2	3
Percent	0.4	0.2	0.6	2.6	18.6	47.2	23.3	5.4	1.2	0.3	0.1	0.0	0.0	0.0

Over Speed	35	40	45	50	55	60	65	70	75	80	85	90	95	999
Count	10733	10712	10646	10367	8367	3278	763	178	50	13	7	5	3	0
Percent	99.6	99.4	98.8	96.2	77.6	30.4	7.1	1.7	0.5	0.1	0.1	0.0	0.0	0.0

Percentile	5%	10%	15%	45%	50%	55%	85%	90%	95%
Speed	51	53	54	58	58	59	63	64	67

Average (Mean) 58

Pace Speed 54-63
Number in Pace 8262
Percent in Pace 76.7

MISC. STATISTICS

Number of Axles	2	3	4	5	6	7	8	9	10	11	12
Avg. Wheelbase	124.3	315.7	469.5	698.0	776.6	891.4	828.5	821.0	0	0	0

Axles Per Vehicle 2.32

JAMAR Technologies, Inc.
151 Keith Valley Road
Horsham, PA 19044
Change These in the Preferences Screen

Page 1

Site Code: 000000013840
Station ID:

Latitude: 0' 0.000 South

Report for Report From 8/22/2006 10:16:00 AM to 8/22/2006 10:30:08 PM

SPEED STATISTICS - 35 to 95+ by 5 MPH

Speed in MPH	0 - 35	36 - 40	41 - 45	46 - 50	51 - 55	56 - 60	61 - 65	66 - 70	71 - 75	76 - 80	81 - 85	86 - 90	91 - 95	96 - 999
Count	3	2	9	70	552	1219	296	23	6	0	3	1	0	0
Percent	0.1	0.1	0.4	3.2	25.3	55.8	13.6	1.1	0.3	0.0	0.1	0.0	0.0	0.0

Over Speed	35	40	45	50	55	60	65	70	75	80	85	90	95	999
Count	2181	2179	2170	2100	1548	329	33	10	4	4	1	0	0	0
Percent	99.9	99.8	99.4	96.2	70.9	15.1	1.5	0.5	0.2	0.2	0.0	0.0	0.0	0.0

Percentile	5%	10%	15%	45%	50%	55%	85%	90%	95%
Speed	51	53	54	57	57	57	61	61	63

Average (Mean) 57

Pace Speed 53-62
Number in Pace 1833
Percent in Pace 83.9

MISC. STATISTICS

Number of Axles	2	3	4	5	6	7	8	9	10	11	12
Avg. Wheelbase	123.2	304.8	440.3	673.3	746.5	918.8	751.3	842.8	0	0	0

Axles Per Vehicle 2.27

JAMAR Technologies, Inc.
151 Keith Valley Road
Horsham, PA 19044
Change These in the Preferences Screen

Page 2

Site Code: 000000013840
Station ID:

Latitude: 0' 0.000 South

Report for Report From 8/22/2006 10:16:00 AM to 8/22/2006 10:30:08 PM

SPEED STATISTICS - 35 to 95+ by 5 MPH

Speed in MPH	0 - 35	36 - 40	41 - 45	46 - 50	51 - 55	56 - 60	61 - 65	66 - 70	71 - 75	76 - 80	81 - 85	86 - 90	91 - 95	96 - 999
Count	5	4	9	25	228	559	334	100	39	7	1	0	0	0
Percent	0.4	0.3	0.7	1.9	17.4	42.6	25.5	7.6	3.0	0.5	0.1	0.0	0.0	0.0

Over Speed	35	40	45	50	55	60	65	70	75	80	85	90	95	999
Count	1306	1302	1293	1268	1040	481	147	47	8	1	0	0	0	0
Percent	99.6	99.3	98.6	96.7	79.3	36.7	11.2	3.6	0.6	0.1	0.0	0.0	0.0	0.0

Percentile	5%	10%	15%	45%	50%	55%	85%	90%	95%
Speed	52	53	55	58	59	59	64	66	69

Average (Mean) 59

Pace Speed 54-63
Number in Pace 932
Percent in Pace 71.1

MISC. STATISTICS

Number of Axles	2	3	4	5	6	7	8	9	10	11	12
Avg. Wheelbase	126.1	327.0	454.7	694.5	760.5	849.6	860.5	0	0	0	0

Axles Per Vehicle 2.41

COMBINED -

Latitude: 0' 0.000 South

Report for Report From 8/22/2006 10:16:00 AM to 8/22/2006 10:30:08 PM

SPEED STATISTICS - 35 to 95+ by 5 MPH

Speed in MPH	0 - 35	36 - 40	41 - 45	46 - 50	51 - 55	56 - 60	61 - 65	66 - 70	71 - 75	76 - 80	81 - 85	86 - 90	91 - 95	96 - 999
Count	8	6	18	95	780	1778	630	123	45	7	4	1	0	0
Percent	0.2	0.2	0.5	2.7	22.3	50.9	18.0	3.5	1.3	0.2	0.1	0.0	0.0	0.0

Over Speed	35	40	45	50	55	60	65	70	75	80	85	90	95	999
Count	3487	3481	3463	3368	2588	810	180	57	12	5	1	0	0	0
Percent	99.8	99.6	99.1	96.4	74.0	23.2	5.2	1.6	0.3	0.1	0.0	0.0	0.0	0.0

Percentile	5%	10%	15%	45%	50%	55%	85%	90%	95%
Speed	51	53	54	57	58	58	62	63	66

Average (Mean) 58

Pace Speed 53-62
Number in Pace 2761
Percent in Pace 79.0

MISC. STATISTICS

Number of Axles	2	3	4	5	6	7	8	9	10	11	12
Avg. Wheelbase	124.2	315.8	446.8	684.5	752.5	887.1	824.1	842.8	0	0	0

Axles Per Vehicle 2.32

Round Mountain Section, East Counter

JAMAR Technologies, Inc.
151 Keith Valley Road
Horsham, PA 19044
Change These in the Preferences Screen

Page 1

Site Code: 000000013839
Station ID:

Latitude: 0' 0.000 South

Report for Report From 8/21/2006 2:48:00 PM to 8/23/2006 3:49:04 PM

SPEED STATISTICS - 35 to 95+ by 5 MPH

Speed in MPH	0 - 35	36 - 40	41 - 45	46 - 50	51 - 55	56 - 60	61 - 65	66 - 70	71 - 75	76 - 80	81 - 85	86 - 90	91 - 95	96 - 999
Count	3	1	1	2	6	27	108	393	334	128	60	26	7	8
Percent	0.3	0.1	0.1	0.2	0.5	2.4	9.8	35.6	30.3	11.6	5.4	2.4	0.6	0.7

Over Speed	35	40	45	50	55	60	65	70	75	80	85	90	95	999
Count	1101	1100	1099	1097	1091	1064	956	563	229	101	41	15	8	0
Percent	99.7	99.6	99.5	99.4	98.8	96.4	86.6	51.0	20.7	9.1	3.7	1.4	0.7	0.0

Percentile	5%	10%	15%	45%	50%	55%	85%	90%	95%
Speed	62	65	66	70	71	71	78	80	84

Average (Mean) 71

Pace Speed 66-75
Number in Pace 727
Percent in Pace 65.9

MISC. STATISTICS

Number of Axles	2	3	4	5	6	7	8	9	10	11	12
Avg. Wheelbase	133.6	313.2	467.5	729.3	778.2	941.8	1053.8	1099.0	1086.0	0	0

Axles Per Vehicle 2.38

JAMAR Technologies, Inc.
151 Keith Valley Road
Horsham, PA 19044
Change These in the Preferences Screen

Page 2

Site Code: 000000013839
Station ID:

Latitude: 0' 0.000 South

Report for Report From 8/21/2006 2:48:00 PM to 8/23/2006 3:49:04 PM

SPEED STATISTICS - 35 to 95+ by 5 MPH

Speed in MPH	0 - 35	36 - 40	41 - 45	46 - 50	51 - 55	56 - 60	61 - 65	66 - 70	71 - 75	76 - 80	81 - 85	86 - 90	91 - 95	96 - 999
Count	1	0	4	9	24	58	153	380	208	64	19	8	1	1
Percent	0.1	0.0	0.4	1.0	2.6	6.2	16.5	40.9	22.4	6.9	2.0	0.9	0.1	0.1

Over Speed	35	40	45	50	55	60	65	70	75	80	85	90	95	999
Count	929	929	925	916	892	834	681	301	93	29	10	2	1	0
Percent	99.9	99.9	99.5	98.5	95.9	89.7	73.2	32.4	10.0	3.1	1.1	0.2	0.1	0.0

Percentile	5%	10%	15%	45%	50%	55%	85%	90%	95%
Speed	57	60	62	68	69	69	73	75	78

Average (Mean) 68

Pace Speed 64-73
Number in Pace 621
Percent in Pace 66.8

MISC. STATISTICS

Number of Axles	2	3	4	5	6	7	8	9	10	11	12
Avg. Wheelbase	135.7	416.6	692.7	760.0	798.3	1007.2	0	0	0	0	0

Axles Per Vehicle 2.31

COMBINED -

Latitude: 0' 0.000 South

Report for Report From 8/21/2006 2:48:00 PM to 8/23/2006 3:49:04 PM

SPEED STATISTICS - 35 to 95+ by 5 MPH

Speed in MPH	0 - 35	36 - 40	41 - 45	46 - 50	51 - 55	56 - 60	61 - 65	66 - 70	71 - 75	76 - 80	81 - 85	86 - 90	91 - 95	96 - 999
Count	4	1	5	11	30	85	261	773	542	192	79	34	8	9
Percent	0.2	0.0	0.2	0.5	1.5	4.2	12.8	38.0	26.6	9.4	3.9	1.7	0.4	0.4

Over Speed	35	40	45	50	55	60	65	70	75	80	85	90	95	999
Count	2030	2029	2024	2013	1983	1898	1637	864	322	130	51	17	9	0
Percent	99.8	99.8	99.5	99.0	97.5	93.3	80.5	42.5	15.8	6.4	2.5	0.8	0.4	0.0

Percentile	5%	10%	15%	45%	50%	55%	85%	90%	95%
Speed	59	62	64	69	70	70	76	78	81

Average (Mean) 70

Pace Speed 65-74
Number in Pace 1329
Percent in Pace 65.3

MISC. STATISTICS

Number of Axles	2	3	4	5	6	7	8	9	10	11	12
Avg. Wheelbase	134.5	378.6	547.7	743.9	785.9	963.6	1053.8	1099.0	1086.0	0	0

Axles Per Vehicle 2.35

Round Mountain Section, West Section

US 189 Near Kemmerer Speed Summary West
August 22, 2006
Page 1 is Eastbound
Page 2 is Westbound

Site Code: 000000013842
Station ID:

Latitude: 0' 0.000 South

Report for Report From 8/21/2006 2:12:00 PM to 8/23/2006 3:20:00 PM

SPEED STATISTICS - 35 to 95+ by 5 MPH

Speed in MPH	0 - 35	36 - 40	41 - 45	46 - 50	51 - 55	56 - 60	61 - 65	66 - 70	71 - 75	76 - 80	81 - 85	86 - 90	91 - 95	96 - 999
Count	1	0	1	3	8	43	177	388	236	116	88	31	8	8
Percent	0.1	0.0	0.1	0.3	0.7	3.9	16.0	35.0	21.3	10.5	7.9	2.8	0.7	0.7

Over Speed	35	40	45	50	55	60	65	70	75	80	85	90	95	999
Count	1107	1107	1106	1103	1095	1052	875	487	251	135	47	16	8	0
Percent	99.9	99.9	99.8	99.5	98.8	94.9	79.0	44.0	22.7	12.2	4.2	1.4	0.7	0.0

Percentile	5%	10%	15%	45%	50%	55%	85%	90%	95%
Speed	60	63	64	69	70	70	79	82	85

Average (Mean)	71
Pace Speed	65-74
Number in Pace	653
Percent in Pace	58.9

MISC. STATISTICS

Number of Axles	2	3	4	5	6	7	8	9	10	11	12
Avg. Wheelbase	131.4	323.6	459.8	706.5	756.4	931.8	995.0	0	1069.0	1070.0	0

Axles Per Vehicle	2.37

US 189 Near Kemmerer Speed Summary West
August 22, 2006
Page 1 is Eastbound
Page 2 is Westbound

Page 2

Site Code: 000000013842
Station ID:

Latitude: 0' 0.000 South

Report for Report From 8/21/2006 2:12:00 PM to 8/23/2006 3:20:00 PM

SPEED STATISTICS - 35 to 95+ by 5 MPH

Speed in MPH	0 - 35	36 - 40	41 - 45	46 - 50	51 - 55	56 - 60	61 - 65	66 - 70	71 - 75	76 - 80	81 - 85	86 - 90	91 - 95	96 - 999
Count	3	0	4	5	5	25	138	311	167	77	31	14	5	5
Percent	0.4	0.0	0.5	0.6	0.6	3.2	17.5	39.4	21.1	9.7	3.9	1.8	0.6	0.6

Over Speed	35	40	45	50	55	60	65	70	75	80	85	90	95	999
Count	787	787	783	778	773	748	610	299	132	55	24	10	5	0
Percent	99.6	99.6	99.1	98.5	97.8	94.7	77.2	37.8	16.7	7.0	3.0	1.3	0.6	0.0

Percentile	5%	10%	15%	45%	50%	55%	85%	90%	95%
Speed	60	63	64	68	69	69	76	79	83

Average (Mean)	70
Pace Speed	63-72
Number in Pace	513
Percent in Pace	64.9

MISC. STATISTICS

Number of Axles	2	3	4	5	6	7	8	9	10	11	12
Avg. Wheelbase	132.4	403.9	639.2	757.2	803.1	968.0	0	0	1005.0	0	0

Axles Per Vehicle	2.33

COMBINED -

Latitude: 0' 0.000 South

Report for Report From 8/21/2006 2:12:00 PM to 8/23/2006 3:20:00 PM

SPEED STATISTICS - 35 to 95+ by 5 MPH

Speed in MPH	0 - 35	36 - 40	41 - 45	46 - 50	51 - 55	56 - 60	61 - 65	66 - 70	71 - 75	76 - 80	81 - 85	86 - 90	91 - 95	96 - 999
Count	4	0	5	8	13	68	315	699	403	193	119	45	13	13
Percent	0.2	0.0	0.3	0.4	0.7	3.6	16.6	36.8	21.2	10.2	6.3	2.4	0.7	0.7

Over Speed	35	40	45	50	55	60	65	70	75	80	85	90	95	999
Count	1894	1894	1889	1881	1868	1800	1485	786	383	190	71	26	13	0
Percent	99.8	99.8	99.5	99.1	98.4	94.8	78.2	41.4	20.2	10.0	3.7	1.4	0.7	0.0

Percentile	5%	10%	15%	45%	50%	55%	85%	90%	95%
Speed	60	63	64	69	69	70	78	80	85

Average (Mean) 70

Pace Speed 65-74
Number in Pace 1162
Percent in Pace 61.2

MISC. STATISTICS

Number of Axles	2	3	4	5	6	7	8	9	10	11	12
Avg. Wheelbase	131.8	360.3	533.8	734.1	773.2	934.4	995.0	0	1037.0	1070.0	0

Axles Per Vehicle 2.36

Torrington West Section, East Counters

US 85 Near Torrington Speed Summary East
September 18-21, 2006
Eastbound Traffic only

Page 1

Site Code: 000000013839
Station ID:

Latitude: 0' 0.000 South

Report for Report From 9/18/2006 1:32:00 PM to 9/21/2006 12:01:36 PM

SPEED STATISTICS - 35 to 95+ by 5 MPH

Speed in MPH	0 - 35	36 - 40	41 - 45	46 - 50	51 - 55	56 - 60	61 - 65	66 - 70	71 - 75	76 - 80	81 - 85	86 - 90	91 - 95	96 - 999
Count	160	80	227	536	1756	3287	1093	278	57	7	2	2	0	0
Percent	2.1	1.1	3.0	7.2	23.5	43.9	14.6	3.7	0.8	0.1	0.0	0.0	0.0	0.0

Over Speed	35	40	45	50	55	60	65	70	75	80	85	90	95	999
Count	7325	7245	7018	6482	4726	1439	346	68	11	4	2	0	0	0
Percent	97.9	96.8	93.8	86.6	63.1	19.2	4.6	0.9	0.1	0.1	0.0	0.0	0.0	0.0

Percentile	5%	10%	15%	45%	50%	55%	85%	90%	95%
Speed	44	48	51	56	57	57	61	63	65

Average (Mean) 56

Pace Speed 53-62
Number in Pace 5240
Percent in Pace 70.0

MISC. STATISTICS

Number of Axles	2	3	4	5	6	7	8	9	10	11	12	13
Avg. Wheelbase	127.4	273.9	443.6	729.2	754.0	854.1	984.8	1197.1	1091.0	1024.0	1180.5	1189.7

Axles Per Vehicle 2.40

US 85 Near Torrington Speed Summary East
September 18-21, 2006
Westbound Traffic only

Page 1

Site Code: 000000013841
Station ID:

Latitude: 0' 0.000 South

Report for Report From 9/18/2006 1:40:00 PM to 9/21/2006 12:08:48 PM

SPEED STATISTICS - 35 to 95+ by 5 MPH

Speed in MPH	0 - 35	36 - 40	41 - 45	46 - 50	51 - 55	56 - 60	61 - 65	66 - 70	71 - 75	76 - 80	81 - 85	86 - 90	91 - 95	96 - 999
Count	184	88	302	856	2502	2732	607	96	19	0	2	0	0	0
Percent	2.5	1.2	4.1	11.6	33.9	37.0	8.2	1.3	0.3	0.0	0.0	0.0	0.0	0.0

Over Speed	35	40	45	50	55	60	65	70	75	80	85	90	95	999
Count	7204	7116	6814	5958	3456	724	117	21	2	2	0	0	0	0
Percent	97.5	96.3	92.2	80.6	46.8	9.8	1.6	0.3	0.0	0.0	0.0	0.0	0.0	0.0

Percentile	5%	10%	15%	45%	50%	55%	85%	90%	95%
Speed	43	47	49	55	55	56	59	60	62

Average (Mean) 54

Pace Speed 51-60
Number in Pace 5234
Percent in Pace 70.8

MISC. STATISTICS

Number of Axles	2	3	4	5	6	7	8	9	10	11	12
Avg. Wheelbase	123.8	283.0	438.0	711.5	735.6	802.2	983.2	1152.5	1138.4	1149.0	1158.5

Axles Per Vehicle 2.37

Torrington West Section, West Counters

US 85 Near Torrington Speed Summary West
September 18-21, 2006
Eastbound Traffic only

Site Code: 000000013840
Station ID:

Latitude: 0' 0.000 South

Report for Report From 9/18/2006 12:48:00 PM to 9/21/2006 11:33:52 AM

SPEED STATISTICS - 35 to 95+ by 5 MPH

Speed in MPH	0 - 35	36 - 40	41 - 45	46 - 50	51 - 55	56 - 60	61 - 65	66 - 70	71 - 75	76 - 80	81 - 85	86 - 90	91 - 95	96 - 999
Count	19	19	48	163	614	1557	2727	566	50	6	2	0	1	0
Percent	0.3	0.3	0.8	2.8	10.6	27.0	47.2	9.8	0.9	0.1	0.0	0.0	0.0	0.0

Over Speed	35	40	45	50	55	60	65	70	75	80	85	90	95	999
Count	5753	5734	5686	5523	4909	3352	625	59	9	3	1	1	0	0
Percent	99.7	99.3	98.5	95.7	85.0	58.1	10.8	1.0	0.2	0.1	0.0	0.0	0.0	0.0

Percentile	5%	10%	15%	45%	50%	55%	85%	90%	95%
Speed	51	54	56	61	61	62	65	66	67

Average (Mean) 60

Pace Speed 57-66
Number in Pace 4306
Percent in Pace 74.6

MISC. STATISTICS

Number of Axles	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Avg. Wheelbase	120.8	270.9	447.4	667.6	695.5	723.6	896.7	1052.6	0	1042.3	1206.5	1076.2	0	1161.0

Axles Per Vehicle 2.50

US 85 Near Torrington Speed Summary West
September 18-21, 2006
Westbound Traffic only

Site Code: 000000013842
Station ID:

Latitude: 0' 0.000 South

Report for Report From 9/18/2006 12:40:00 PM to 9/21/2006 11:23:28 AM

SPEED STATISTICS - 35 to 95+ by 5 MPH

Speed in MPH	0 - 35	36 - 40	41 - 45	46 - 50	51 - 55	56 - 60	61 - 65	66 - 70	71 - 75	76 - 80	81 - 85	86 - 90	91 - 95	96 - 999
Count	20	9	18	41	211	583	1970	2554	322	36	10	0	0	0
Percent	0.3	0.2	0.3	0.7	3.7	10.1	34.1	44.2	5.6	0.6	0.2	0.0	0.0	0.0

Over Speed	35	40	45	50	55	60	65	70	75	80	85	90	95	999
Count	5754	5745	5727	5686	5475	4892	2922	368	46	10	0	0	0	0
Percent	99.7	99.5	99.2	98.5	94.8	84.7	50.6	6.4	0.8	0.2	0.0	0.0	0.0	0.0

Percentile	5%	10%	15%	45%	50%	55%	85%	90%	95%
Speed	55	58	60	65	66	66	69	70	71

Average (Mean) 65

Pace Speed 61-70
Number in Pace 4524
Percent in Pace 78.4

MISC. STATISTICS

Number of Axles	2	3	4	5	6	7	8	9	10	11	12
Avg. Wheelbase	124.0	300.9	458.2	721.1	747.5	875.0	1169.0	1150.6	1144.3	1143.0	1171.7

Axles Per Vehicle 2.49

APPENDIX F: SPEED DATA PROVIDED BY WYDOT

Bosler-Wheatland Morton Pass Section (WY 34)

Actual Date of Beginning: March 15, 2001
Milepost Start: 9.69
Milepost reconstruction end: 16.53

No Data Available

Laramie - Centennial Hanging Rock Section (WY130)

Actual Date of Beginning: November 26, 1996
Milepost Start: 21.32
Milepost reconstruction end: 27.431

No Data Available

Yellowstone Park – Cody Hanging Rock Section (US 14/16/20)

Actual Date of Beginning: June 8, 1998
Kilometer post start: 44.40 (27.6 milepost)
Kilometer post reconstruction end: 31.25 (19.4 milepost)

Speed Data Collected July 6 - 9, 1992, Posted Speed 55 mph

Location	Average Speed	50th Percentile Speed	85th Percentile Speed
MP 20.0 EB	53.6	51	58
MP 20.0 WB	46.4	44	51
MP 22.5 WB	48.5	46	53
MP 24.0 EB	52.5	50	56
MP 24.0 WB	52.5	51	56
MP 26.5 EB	43.1	41	45
MP 26.5 WB	43.7	41	48

I could not find any data collected between 1996 and 2000 when the speed limit was 65 mph.

Speed Data Collected May 25 – 26, 2004, Posted Speed 50 mph

Location	Average Speed	50th Percentile Speed	85th Percentile Speed
MP 16.6 EB	59.9	59	68
MP 16.6 WB	56.8	56	62
MP 22.3 EB	57.7	57	64
MP 22.3 WB	55.5	56	60
MP 22.5 WB	48.5	46	53
MP 26.8 EB	57.4	57	61

MP 26.8 WB	54.7	54	59

Alpine Jct-Hoback Jct. Astoria Section (US 89)

Actual Date of Beginning: March 28, 2000
Milepost Start: 136.65
Milepost reconstruction end: 140.69

No Data Available

Kremmerer-La Barge Round Mountain Section (US 189)

Actual Date of Beginning: April 29, 1999
Kilometer post start: 73.68 (45.78 milepost)
Kilometer post reconstruction end: 85.91 (53.38 milepost)
Kilometer post end of fence and R/W work: 94.98 (59.02 milepost)

No Data Available

Sheridan – Gillette Clearmont North Section (US14/16)

Actual Date of Beginning: November 1, 1999
Milepost Start: 38.61
Milepost reconstruction end: 45.96

No Data Available

Torrington-Lingle (US 26)

Actual Date of Beginning: 1998?
Milepost Start: 95.01
Milepost reconstruction end: 103.41

Speed Data Collected July 6 – 7, 1993

Location	Posted Speed	Average Speed	50th Percentile Speed	85th Percentile Speed
MP 95.43 WB/NB	40	45.5	43	51
MP 95.43 EB/SB	40	43.0	40	47
MP 97.95 WB/NB	55	58.1	56	64
MP 97.95 EB/SB	55	55.4	53	60
MP 102.7 WB/NB	30	38.8	36	43
MP 102.7 EB/SB	30	36.9	35	40

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APPENDIX G: HCS LANE AND SHOULDER SPEED REDUCTIONS

Using the Highway Capacity Software HCS+

		Lane Width (ft)	Shoulder Width (ft)	HCS+ Free-Flow Speed (mph)	Difference (mph)
Centennial East	**Old**	11	0	55.3	4.7
	Reconstructed	12	6	60	
Morton Pass	**Old**	11	0	55.3	3.4
	Reconstructed	12	4	58.7	
Clearmont North	**Old**	11	0	55.3	3.4
	Reconstructed	12	4	58.7	
Hanging Rock	**Old**	11	0	55.3	4.7
	Reconstructed	12	6	60	
Astoria	**Old**	11	0	55.3	4.7
	Reconstructed	12	8	60	
Round Mountain	**Old**	11	2	57	3
	Reconstructed	12	6	60	
Torrington West	**Old**	12	2	57.4	2.6
	Reconstructed	(2x)12	6	60	

All Speeds reduced from a Base Free-Flow Speed of 60 mph

APPENDIX H:
COMBINED TABLE OF CRASH FREQUENCY AND RATE

	Centennial East			Morton Pass			Clearmont North			Hanging Rock		
	Before	During	After	Before	During	After	Before	During	After	Before	During	After
AVC Crashes	4	2	7	0	2	2	1	0	5	3	2	6
Total Crashes	12	10	10	19	5	7	6	3	7	8	8	12
AVC Frequency (crashs/mile/year)	**0.363643**	**0.125876**	**0.636375**	**0**	**0.194789**	**0.097395**	**0.04535147**	**0**	**0.226757**	**0.123457**	**0.176367**	**0.246914**
Total Frequency (crashs/mile/year)	**1.090929**	**0.629382**	**0.909107**	**0.9252496**	**0.486973**	**0.340881**	**0.27210884**	**0.408163**	**0.31746**	**0.329218**	**0.705467**	**0.493827**
Non-Animal Frequency (Crashes/MVMT)	**0.727286**	**0.503506**	**0.272732**	**0.9252496**	**0.292184**	**0.243487**	**0.22675737**	**0.408163**	**0.090703**	**0.205761**	**0.529101**	**0.246914**
AVC Rate (Crashes/MVMT)	1.948536		3.439649	0		0.474675	0.44022736		1.200397	0.208748		0.401733
Total Crash Rate (Crashes/MVMT)	5.845608		4.913785	5.7533598		1.661364	2.64136414		1.680556	0.556661		0.803465
Non-Animal Crash Rate (Crashes/MVMT)	3.897072		1.474135	5.7533598		1.186689	2.20113678		0.480159	0.347913		0.401733
	Before Yrs.	1.8		**Before Yrs.**	3		**Before Yrs.**	3		**Before Yrs.**	3	
	During Yrs.	2.6		**During Yrs.**	1.5		**During Yrs.**	1		**During Yrs.**	1.4	
	After Yrs.	1.8		**After Yrs.**	3		**After Yrs.**	3		**After Yrs.**	3	
	Mileage	6.111		**Mileage**	6.845		**Mileage**	7.35		**Mileage**	8.1	
	MVMT (B)	2.052823		**MVMT (B)**	3.302418		**MVMT (B)**	2.271554		**MVMT (B)**	14.37139	
	MVMT (A)	2.035091		**MVMT (A)**	4.213406		**MVMT (A)**	4.165289		**MVMT (A)**	14.9353	

	Astoria			Round Mountain Recon.			Round Mountain ROW			Torrington West		
	Before	During	After	Before	During	After	Before	During	After	Before	During	After
AVC Crashes	4	3	16	3	0	4	1	0	2	11	11	11
Total Crashes	25	14	33	33	2	10	4	1	6	67	54	72
AVC Frequency (crashs/mile/year)	**0.330033**	**0.436808**	**1.320132**	**0.131579**	**0**	**0.175439**	**0.059524**	**0**	**0.119048**	**0.4719**	**0.600601**	**0.4719**
Total Frequency (crashs/mile/year)	**2.062706**	**2.038439**	**2.722772**	**1.447368**	**0.175439**	**0.438596**	**0.238095**	**0.119048**	**0.357143**	**2.874303**	**2.948403**	**3.088803**
Non-Animal Frequency (Crashes/MVMT)	**1.732673**	**1.601631**	**1.40264**	**1.315789**	**0.175439**	**0.263158**	**0.178571**	**0.119048**	**0.238095**	**2.402402**	**2.347802**	**2.616903**
AVC Rate (Crashes/MVMT)	0.279034		0.978044	0.656457		0.793978	0.294862		0.539138	0.285612		0.306889
Total Crash Rate (Crashes/MVMT)	1.743963		2.017215	7.221026		1.984945	1.17945		1.617415	1.739634		2.008725
Non-Animal Crash Rate (Crashes/MVMT)	1.464929		1.039171	6.564569		1.190967	0.884587		1.078277	1.454022		1.701837
	Before Yrs.	3		**Before Yrs.**	3		**Before Yrs.**	3		**Before Yrs.**	2.8	
	During Yrs.	1.7		**During Yrs.**	1.5		**During Yrs.**	1.5		**During Yrs.**	2.2	
	After Yrs.	3		**After Yrs.**	3		**After Yrs.**	3		**After Yrs.**	2.8	
	Mileage	4.04		**Mileage**	7.6		**Mileage**	5.6		**Mileage**	8.325	
	MVMT (B)	14.33517		**MVMT (B)**	4.569988		**MVMT (B)**	3.391412		**MVMT (B)**	38.51385	
	MVMT (A)	16.35919		**MVMT (A)**	5.037923		**MVMT (A)**	3.709623		**MVMT (A)**	35.84362	

APPENDIX I:
VARIABLES USED FOR STEPWISE REGRESSION

Variables used for First Stepwise Regression

CRASH_RATE	ANIMAL_DENSITY	DESIGN_SPEED	LANE_WIDTH	SHOULDER_WIDTH	PAVEMENT_WIDTH	HCM_SPEED
1.948535968	11.00840087	65	11	0	22	60.3
0	14.66871695	40	11	0	22	35.3
0.440227357	10.9752037	60	11	0	22	55.3
0.139165358	7.555597662	30	10	0	20	25.3
0.279034005	12.16275883	55	11	0	22	50.3
0.656456877	10.14964343	65	11	2	22	62
0.28561153	2.856143646	65	12	2	28	62.4
3.439649153	17.40	65	12	6	36	65
0.474675411	13.0431419	55	12	4	32	53.7
1.20039687	11.61623752	65	12	4	32	63.7
0.267821828	7.541901186	50	12	6	36	50
0.978043579	13.16224214	55	12	8	40	55
0.793978001	10.59149558	65	12	6	36	65
0.30688861	4.009127863	65	12	6	72	65

Variables used for Second Stepwise Regression

CRASH_RATE	ANIMAL_DENSITY	RATIO	DESIGN_SPEED	LANE_WIDTH	SHOULDER_WIDTH	PAVEMENT_WIDTH	HCM_SPEED
1.948535968	11.00840087	**0.177004452**	65	11	0	22	60.3
0	14.66871695	**0**	40	11	0	22	35.3
0.440227357	10.9752037	**0.040111088**	60	11	0	22	55.3
0.139165358	7.555597662	**0.018418842**	30	10	0	20	25.3
0.279034005	12.16275883	**0.02294167**	55	11	0	22	50.3
0.656456877	10.14964343	**0.064677827**	65	11	2	22	62
0.28561153	2.856143646	**0.099999008**	65	12	2	28	62.4
3.439649153	17.40	**0.197715466**	65	12	6	36	65
0.474675411	13.0431419	**0.03639272**	55	12	4	32	53.7
1.20039687	11.61623752	**0.103337838**	65	12	4	32	63.7
0.267821828	7.541901186	**0.035511182**	50	12	6	36	50
0.978043579	13.16224214	**0.074306761**	55	12	8	40	55
0.793978001	10.59149558	**0.074963729**	65	12	6	36	65
0.30688861	4.009127863	**0.076547474**	65	12	6	72	65

APPENDIX J:
SAS OUTPUT FOR STEPWISE REGRESSION

Stepwise Selection For Animal Crash Rate
Significance for Entry = 0.05
Significance for Removal = 0.15

The SAS System
13:18 Friday, January 5, 2007 52

The REG Procedure
Model: MODEL1
Dependent Variable: y

Number of Observations Read 14
Number of Observations Used 14

Stepwise Selection: Step 1

Statistics for Entry
DF = 1,12

Variable	Tolerance	Model R-Square	F Value	Pr > F
AD	1.000000	0.2908	4.92	0.0466
DS	1.000000	0.2259	3.50	0.0859
PW	1.000000	0.0018	0.02	0.8847
LW	1.000000	0.0671	0.86	0.3713
SW	1.000000	0.0843	1.10	0.3141
HCS	1.000000	0.2133	3.25	0.0965

Variable AD Entered: R-Square = 0.2908 and C(p) = 3.1181

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	3.16252	3.16252	4.92	0.0466
Error	12	7.71137	0.64261		
Corrected Total	13	10.87388			

The SAS System
13:18 Friday, January 5, 2007 53

The REG Procedure
Model: MODEL1
Dependent Variable: y

Stepwise Selection: Step 1

Variable	Parameter Estimate	Standard Error	Type II SS	F Value	Pr > F
Intercept	-0.51352	0.62999	0.42698	0.66	0.4309
AD	0.12539	0.05652	3.16252	4.92	0.0466

Bounds on condition number: 1, 1

Stepwise Selection: Step 2

Statistics for Entry
DF = 1,11

Variable	Tolerance	Model R-Square	F Value	Pr > F
DS	0.997125	0.5458	6.17	0.0303
PW	0.897472	0.3425	0.86	0.3723
LW	0.999550	0.3640	1.27	0.2846
SW	0.998359	0.3630	1.25	0.2881
HCS	0.997108	0.5324	5.68	0.0362

Variable DS Entered: R-Square = 0.5458 and C(p) = 0.4023

The REG Procedure
Model: MODEL1
Dependent Variable: y

Stepwise Selection: Step 2

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	5.93464	2.96732	6.61	0.0130
Error	11	4.93924	0.44902		
Corrected Total	13	10.87388			

Variable	Parameter Estimate	Standard Error	Type II SS	F Value	Pr > F
Intercept	-2.72070	1.03267	3.11675	6.94	0.0232
AD	0.13169	0.04732	3.47846	7.75	0.0178
DS	0.03902	0.01570	2.77213	6.17	0.0303

Bounds on condition number: 1.0029, 4.0115

Stepwise Selection: Step 3

The REG Procedure
Model: MODEL1
Dependent Variable: y

Stepwise Selection: Step 3

Statistics for Removal
DF = 1,11

Variable	Partial R-Square	Model R-Square	F Value	Pr > F
AD	0.3199	0.2259	7.75	0.0178
DS	0.2549	0.2908	6.17	0.0303

Statistics for Entry
DF = 1,10

Variable	Tolerance	Model R-Square	F Value	Pr > F
PW	0.722725	0.5458	0.00	0.9814
LW	0.507040	0.5597	0.32	0.5866
SW	0.767621	0.5466	0.02	0.8924
HCS	0.026820	0.5474	0.04	0.8545

All variables left in the model are significant at the 0.5000 level.

No other variable met the 0.5000 significance level for entry into the model.
The REG Procedure
Model: MODEL1
Dependent Variable: y

Summary of Stepwise Selection

Step	Variable Entered	Variable Removed	Number Vars In	Partial R-Square	Model R-Square	C(p)	F Value
1	AD		1	0.2908	0.2908	3.1181	4.92
2	DS		2	0.2549	0.5458	0.4023	6.17

Step	Pr >F
1	0.0466
2	0.303

Stepwise Selection For Animal Crash Rate
Significance for Entry = 0.05
Significance for Removal = 0.15

The SAS System
13:18 Friday, January 5, 2007 47

The REG Procedure
Model: MODEL1
Dependent Variable: y

Number of Observations Read 14
Number of Observations Used 14

Stepwise Selection: Step 1

Statistics for Entry
DF = 1,12

Variable	Tolerance	Model R-Square	F Value	Pr > F
AD	1.000000	0.2908	4.92	0.0466
DS	1.000000	0.2259	3.50	0.0859
PW	1.000000	0.0018	0.02	0.8847
LW	1.000000	0.0671	0.86	0.3713
SW	1.000000	0.0843	1.10	0.3141
HCS	1.000000	0.2133	3.25	0.0965

Variable AD Entered: R-Square = 0.2908 and C(p) = 3.1181

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	3.16252	3.16252	4.92	0.0466
Error	12	7.71137	0.64261		
Corrected Total	13	10.87388			

The REG Procedure
Model: MODEL1
Dependent Variable: y

Stepwise Selection: Step 1

Variable	Parameter Estimate	Standard Error	Type II SS	F Value	Pr > F
Intercept	-0.51352	0.62999	0.42698	0.66	0.4309
AD	0.12539	0.05652	3.16252	4.92	0.0466

Bounds on condition number: 1, 1

Stepwise Selection: Step 2

Statistics for Entry
DF = 1,11

Variable	Tolerance	Model R-Square	F Value	Pr > F
DS	0.997125	0.5458	6.17	0.0303
PW	0.897472	0.3425	0.86	0.3723
LW	0.999550	0.3640	1.27	0.2846
SW	0.998359	0.3630	1.25	0.2881
HCS	0.997108	0.5324	5.68	0.0362

Variable DS Entered: R-Square = 0.5458 and C(p) = 0.4023

The SAS System
13:18 Friday, January 5, 2007 49

The REG Procedure
Model: MODEL1
Dependent Variable: y

Stepwise Selection: Step 2

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	5.93464	2.96732	6.61	0.0130
Error	11	4.93924	0.44902		
Corrected Total	13	10.87388			

Variable	Parameter Estimate	Standard Error	Type II SS	F Value	Pr > F
Intercept	-2.72070	1.03267	3.11675	6.94	0.0232
AD	0.13169	0.04732	3.47846	7.75	0.0178
DS	0.03902	0.01570	2.77213	6.17	0.0303

Bounds on condition number: 1.0029, 4.0115

Stepwise Selection: Step 3

Statistics for Removal
DF = 1,11

Variable	Partial R-Square	Model R-Square	F Value	Pr > F
AD	0.3199	0.2259	7.75	0.0178
DS	0.2549	0.2908	6.17	0.0303

Statistics for Entry
DF = 1,10

Variable	Tolerance	Model R-Square	F Value	Pr > F
PW	0.722725	0.5458	0.00	0.9814
LW	0.507040	0.5597	0.32	0.5866
SW	0.767621	0.5466	0.02	0.8924
HCS	0.026820	0.5474	0.04	0.8545

All variables left in the model are significant at the 0.1500 level.

No other variable met the 0.0500 significance level for entry into the model.

The SAS System
13:18 Friday, January 5, 2007 61

The REG Procedure
Model: MODEL1
Dependent Variable: y

Summary of Stepwise Selection

Step	Variable Entered	Variable Removed	Number Vars In	Partial R-Square	Model R-Square	C(p)	F Value
1	AD		1	0.2908	0.2908	3.1181	4.92
2	DS		2	0.2549	0.5458	0.4023	6.17

Step	Pr > F
1	0.0466
2	0.0303

Stepwise Selection For Animal Crash Rate/Animal Density
Significance for Entry = 0.5
Significance for Removal = 0.5

The SAS System
13:18 Friday, January 5, 2007 44

The REG Procedure
Model: MODEL1
Dependent Variable: y

Number of Observations Read 14
Number of Observations Used 14

Stepwise Selection: Step 1

Statistics for Entry
DF = 1,12

Variable	Tolerance	Model R-Square	F Value	Pr > F
DS	1.000000	0.4303	9.06	0.0108
LW	1.000000	0.1220	1.67	0.2208
SW	1.000000	0.0716	0.93	0.3551
PW	1.000000	0.0272	0.34	0.5734
HCS	1.000000	0.4277	8.97	0.0112

Variable DS Entered: R-Square = 0.4303 and C(p) = -1.2371

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	0.01840	0.01840	9.06	0.0108
Error	12	0.02435	0.00203		
Corrected Total	13	0.04275			

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The REG Procedure
Model: MODEL1
Dependent Variable: y

Stepwise Selection: Step 1

Variable	Parameter Estimate	Standard Error	Type II SS	F Value	Pr > F
Intercept	-0.12478	0.06678	0.00708	3.49	0.0863
DS	0.00346	0.00115	0.01840	9.06	0.0108

Bounds on condition number: 1, 1

Stepwise Selection: Step 2

Statistics for Entry
DF = 1,11

Variable	Tolerance	Model R-Square	F Value	Pr > F
LW	0.641860	0.4332	0.06	0.8164
SW	0.890686	0.4332	0.06	0.8175
PW	0.889933	0.4335	0.06	0.8097
HCS	0.026821	0.4321	0.03	0.8575

All variables left in the model are significant at the 0.5000 level.

No other variable met the 0.5000 significance level for entry into the model.

The REG Procedure
Model: MODEL1
Dependent Variable: y

Summary of Stepwise Selection

Step	Variable Entered	Variable Removed	Number Vars In	Partial R-Square	Model R-Square	C(p)	F Value
1	DS		1	0.4303	0.4303	-1.2371	9.06

Step	Pr > F
1	0,0108

Stepwise Selection For Animal Crash Rate/Animal Density
Significance for Entry = 0.05
Significance for Removal = 0.15

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The REG Procedure
Model: MODEL1
Dependent Variable: y

Number of Observations Read 14
Number of Observations Used 14

Stepwise Selection: Step 1

Statistics for Entry
DF = 1,12

Variable	Tolerance	Model R-Square	F Value	Pr > F
DS	1.000000	0.4303	9.06	0.0108
LW	1.000000	0.1220	1.67	0.2208
SW	1.000000	0.0716	0.93	0.3551
PW	1.000000	0.0272	0.34	0.5734
HCS	1.000000	0.4277	8.97	0.0112

Variable DS Entered: R-Square = 0.4303 and C(p) = -1.2371

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	0.01840	0.01840	9.06	0.0108
Error	12	0.02435	0.00203		
Corrected Total	13	0.04275			

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The REG Procedure
Model: MODEL1
Dependent Variable: y

Stepwise Selection: Step 1

Variable	Parameter Estimate	Standard Error	Type II SS	F Value	Pr > F
Intercept	-0.12478	0.06678	0.00708	3.49	0.0863
DS	0.00346	0.00115	0.01840	9.06	0.0108

Bounds on condition number: 1, 1

Stepwise Selection: Step 2

Statistics for Entry
DF = 1,11

Variable	Tolerance	Model R-Square	F Value	Pr > F
LW	0.641860	0.4332	0.06	0.8164
SW	0.890686	0.4332	0.06	0.8175
PW	0.889933	0.4335	0.06	0.8097
HCS	0.026821	0.4321	0.03	0.8575

All variables left in the model are significant at the 0.0500 level.

No other variable met the 0.0500 significance level for entry into the model.

The REG Procedure
Model: MODEL1
Dependent Variable: y

Summary of Stepwise Selection

Step	Variable Entered	Variable Removed	Number Vars In	Partial R-Square	Model R-Square	C(p)	F Value
1	DS		1	0.4303	0.4303	-1.2371	9.06

Step	Pr > F
1	0.0108

APPENDIX K:
DERIVATION OF INDIVIDUAL ANALYSIS TEST STATISTIC

$$rate = \frac{n}{mvmt}$$

$$H_0 : rate_1 = rate_2 \cong$$

Given H_0,

$$E(\frac{n_1}{MVMT_1}) \cong E(\frac{n_2}{MVMT_2}) = R$$

$$\cong \frac{n_1}{MVMT_1} - \frac{n_2}{MVMT_2} = 0$$

If H_0 true best estimator of R

would be $\hat{R} = \frac{n_1 + n_2}{MVMT_1 \;\; + MVMT_2}$

This choice is found by minimizing the variance of a weighted average estimator

$$w\frac{n_1}{MVMT_1} + (1-w)\frac{n_2}{MVMT_2}$$

$$Var(w\frac{n_1}{MVMT_1} + (1-w)\frac{n_2}{MVMT_2}) =$$

$$\frac{w^2}{MVMT_1^{\;2}}Var(n_1) + \frac{(1-w)^2}{MVMT_2^{\;2}}Var(n_2)$$

$n_1 \sim P(MVMT_1 R) \qquad \text{var}\, n_1 = MVMT_1 R$

$n_2 \sim P(MVMT_2 R) \qquad \text{var}\, n_2 = MVMT_2 R$

$$\longrightarrow \quad \frac{w^2}{MVMT_1}R + \frac{(1-w)^2}{MVMT_2}R$$

Minimize with regard to w

$$\frac{d}{dw} = \frac{2w}{MVMT_1}R - \frac{2(1-w)}{MVMT_2}R = 0$$

$\frac{w}{MVMT_1} = \frac{1-w}{MVMT_2} \longrightarrow w = \frac{MVMT_1}{MVMT_1 + MVMT_2}$, Thus, $\hat{R} = \frac{n_1 + n_2}{MVMT_1 + MVMT}$

Now using the approximations:

$$n_1 \approx P(MVMT_1 \hat{R}) \cong P(\frac{MVMT_1}{MVMT_1 + MVMT_2}(n_1 + n_2))$$

$$n_2 \approx P(MVMT_2 \hat{R}) \cong P(\frac{MVMT_2}{MVMT_1 + MVMT_2})(n_1 + n_2))$$

$$\operatorname{var} n_1 \cong \frac{MVMT_1}{MVMT_1 + MVMT_2}(n_1 + n_2)$$

$$\operatorname{var} n_2 \cong \frac{MVMT_2}{MVMT_1 + MVMT_2}(n_1 + n_2)$$

To test H_0: $rate_1 - rate_2 = 0$, we need the variance of $\hat{r}_1 - \hat{r}_2$

$$\operatorname{var}(\frac{n_1}{MVMT_1} - \frac{n_2}{MVMT_2}) = \operatorname{var}(\frac{n_1}{MVMT_1}) + \operatorname{var}(\frac{n_2}{MVMT_2})$$

$$\cong \frac{1}{MVMT_1^{\ 2}}(\frac{MVMT_1}{MVMT_1 + MVMT_2})(n_1 + n_2) + \frac{1}{MVMT_2^{\ 2}}(\frac{MVMT_2}{MVMT_1 + MVMT_2})(n_1 + n_2)$$

$$= (\frac{1}{MVMT_1} + \frac{1}{MVMT_2})\frac{(n_1 + n_2)}{MVMT_1 + MVMT_2}$$

$$\text{Test Statistic} = \frac{n_1/MVMT_1 - n_2/MVMT_2}{\sqrt{(1/MVMT_1 + 1/MVMT_2)\frac{n_1 + n_2}{MVMT_1 + MVMT_2}}}$$

For moderately large n_1 and n_2 this statistic will be approximately normally distributed because Poisson distributions are approximately normal for large means.

The observed values of n in this study are not always large, so my conclusions are approximate.