# DOCUMENTING THE CHARACTERISTICS OF TRAFFIC CRASHES FOR RITI COMMUNITIES IN IDAHO

FINAL PROJECT REPORT

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**16. Abstract**

This project documents the characteristics of traffic crashes in rural, isolated, tribal, and indigenous (RITI) communities in Idaho and establishes an in-depth understanding of the baseline traffic safety conditions in RITI communities. Different sources of crash data for RITI communities in Idaho was used to conduct an in-depth ten-year crash analysis (2007-2016) to document the characteristics of traffic crashes in rural roads that serve RITI communities in Idaho. The results of analysis of fatal and severe injury crashes on unpaved roads clearly shows that ATVs and pickup trucks and the two most common vehicle types involved in crashes in these roads. The results also showed that the majority of fatal and severe injury crashes on unpaved roads involved male drivers and occupants 24 years or younger with considerable number involving occupants younger than 14 years old. A comparative safety analysis was conducted to identify and document the differences in characteristics between crashes that occurred on unpaved and paved rural roads in Idaho. The results of the analysis show that the percent of fatal and severe injury crashes where no restraining device was used is much higher in unpaved roads (50.4% and 38.3% in unpaved roads compared to 37.9 and 22.8 on paved roads). The same trend also exists in helmet use which shows the critical need for a much more aggressive seat belt and helmet use enforcement among communities who use rural unpaved roads in Idaho. The results also show a substantial difference in ATV crashes on unpaved versus paved. Teenagers or children that are 14 years or younger are more susceptible to fatal and severe injuries on unpaved roads compared to paved roads. Crash injuries for age groups from 15 to 44 are also higher on unpaved roadways. The results also clearly highlight the fact that unpaved roads have higher percentages of crashes where alcohol impairment was a major contributing circumstance. The same is true for speeding and inattention related crashes. A proportion statistical test results show that many of these results have a calculated p-value less than 0.05, indicating that these results are statistically significant at the 95% confidence level.


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## SI* (MODERN METRIC) CONVERSION FACTORS

| APPROXIMATE CONVERSIONS TO SI UNITS | | | | |
|---|---|---|---|---|
| **Symbol** | **When You Know** | **Multiply By** | **To Find** | **Symbol** |
| | | **LENGTH** | | |
| in | inches | 25.4 | millimeters | mm |
| ft | feet | 0.305 | meters | m |
| yd | yards | 0.914 | meters | m |
| mi | miles | 1.61 | kilometers | km |
| | | **AREA** | | |
| $in^2$ | square inches | 645.2 | square millimeters | $mm^2$ |
| $ft^2$ | square feet | 0.093 | square meters | $m^2$ |
| $yd^2$ | square yard | 0.836 | square meters | $m^2$ |
| ac | acres | 0.405 | hectares | ha |
| $mi^2$ | square miles | 2.59 | square kilometers | $km^2$ |
| | | **VOLUME** | | |
| fl oz | fluid ounces | 29.57 | milliliters | mL |
| gal | gallons | 3.785 | liters | L |
| $ft^3$ | cubic feet | 0.028 | cubic meters | $m^3$ |
| $yd^3$ | cubic yards | 0.765 | cubic meters | $m^3$ |
| | NOTE: volumes greater than 1000 L shall be shown in $m^3$ | | | |
| | | **MASS** | | |
| oz | ounces | 28.35 | grams | g |
| lb | pounds | 0.454 | kilograms | kg |
| T | short tons (2000 lb) | 0.907 | megagrams (or "metric ton") | Mg (or "t") |
| | | **TEMPERATURE (exact degrees)** | | |
| °F | Fahrenheit | 5 (F-32)/9 or (F-32)/1.8 | Celsius | °C |
| | | **ILLUMINATION** | | |
| fc | foot-candles | 10.76 | lux | lx |
| fl | foot-Lamberts | 3.426 | $candela/m^2$ | $cd/m^2$ |
| | | **FORCE and PRESSURE or STRESS** | | |
| lbf | poundforce | 4.45 | newtons | N |
| $lbf/in^2$ | poundforce per square inch | 6.89 | kilopascals | kPa |

| APPROXIMATE CONVERSIONS FROM SI UNITS | | | | |
|---|---|---|---|---|
| **Symbol** | **When You Know** | **Multiply By** | **To Find** | **Symbol** |
| | | **LENGTH** | | |
| mm | millimeters | 0.039 | inches | in |
| m | meters | 3.28 | feet | ft |
| m | meters | 1.09 | yards | yd |
| km | kilometers | 0.621 | miles | mi |
| | | **AREA** | | |
| $mm^2$ | square millimeters | 0.0016 | square inches | $in^2$ |
| $m^2$ | square meters | 10.764 | square feet | $ft^2$ |
| $m^2$ | square meters | 1.195 | square yards | $yd^2$ |
| ha | hectares | 2.47 | acres | ac |
| $km^2$ | square kilometers | 0.386 | square miles | $mi^2$ |
| | | **VOLUME** | | |
| mL | milliliters | 0.034 | fluid ounces | fl oz |
| L | liters | 0.264 | gallons | gal |
| $m^3$ | cubic meters | 35.314 | cubic feet | $ft^3$ |
| $m^3$ | cubic meters | 1.307 | cubic yards | $yd^3$ |
| | | **MASS** | | |
| g | grams | 0.035 | ounces | oz |
| kg | kilograms | 2.202 | pounds | lb |
| Mg (or "t") | megagrams (or "metric ton") | 1.103 | short tons (2000 lb) | T |
| | | **TEMPERATURE (exact degrees)** | | |
| °C | Celsius | 1.8C+32 | Fahrenheit | °F |
| | | **ILLUMINATION** | | |
| lx | lux | 0.0929 | foot-candles | fc |
| $cd/m^2$ | $candela/m^2$ | 0.2919 | foot-Lamberts | fl |
| | | **FORCE and PRESSURE or STRESS** | | |
| N | newtons | 0.225 | poundforce | lbf |
| kPa | kilopascals | 0.145 | poundforce per square inch | $lbf/in^2$ |

*SI is the symbol for the International System of Units. Appropriate rounding should be made to comply with Section 4 of ASTM E380. (Revised March 2003)

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## EXECUTIVE SUMMARY

This project documents the characteristics of traffic crashes in rural, isolated, tribal, and indigenous (RITI) communities in Idaho and establishes an in-depth understanding of the baseline traffic safety conditions in RITI communities. Different sources of crash data for RITI communities in Idaho was used to conduct an in-depth ten-year crash analysis (2007-2016) to document the characteristics of traffic crashes in rural roads that serve RITI communities in Idaho. Three different roadway datasets were used in the analysis including the state highway network, the local (county and city) highway networks, and the U.S. Forest service roadway network.

The results of analysis of fatal and severe injury crashes on unpaved roads clearly shows that ATVs and pickup trucks and the two most common vehicle types involved in crashes in these roads. The results also showed that the majority of fatal and severe injury crashes on unpaved roads involved male drivers and occupants 24 years or younger with considerable number involving occupants younger than 14 years old. The results also showed that the majority of these crashes happened during daylight and in clear or cloudy weather conditions. Inclement weather was not a factor that influenced crashes on unpaved roads. Alcohol impairment, inattention, and speeding seem to be the three major contributing circumstances in fatal and severe injury crashes on unpaved roads.

A comparative safety analysis was conducted to identify and document the differences in characteristics between crashes that occurred on unpaved and paved rural roads in Idaho. The results of the analysis show that the percent of fatal and severe injury crashes where no restraining device was used is much higher on unpaved roads (50.4% and 38.3% on unpaved roads compared to 37.9 and 22.8 on paved roads). The same trend also exists in helmet use which shows the critical need for a much more aggressive seat belt and helmet use enforcement among communities who use rural unpaved roads in Idaho. The results also show a substantial difference in ATV crashes on unpaved versus paved. This is not surprising considering ATV usage is largely implemented on these roads due to the environment and location. Teenagers or children that are 14 years or younger are more susceptible to fatal and severe injuries on unpaved roads compared to paved roads. Crash injuries for age groups from 15 to 44 are also higher on unpaved roadways. The results also clearly highlight the fact that unpaved roads have higher percentages of crashes where alcohol impairment was a major contributing circumstance. The same is true for speeding and inattention related crashes. A proportion statistical test results show that many of these results have a calculated p-value less than 0.05, indicating that these results are statistically significant at the 95% confidence level.

A county-based crash rate analysis was conducted to investigate the relative crash rates in rural roads for different counties in Idaho. Four different exposure measures were used to estimate the relative crash rates values. These exposure measures included number of registered drivers in the county, number of registered vehicles in the county, total county population, and total length of roadways in the county. The comparative analysis identified counties that have consistently higher rural crash rates compared to the state average (Boise County and Clark County). Other counties showed highest relative crash rates but produce less consistent results (Custer County and Lincoln County). A more formal statistical analysis that accounts for the spatial variability of these factors and exposure measures would be required to demonstrate that these results are statistically significant.

# CHAPTER 1. INTRODUCTION

## 1.1. Project Overview

This project documents the characteristics of traffic crashes in rural, isolated, tribal, and indigenous (RITI) communities in Idaho and establishes an in-depth understanding of the baseline traffic safety conditions in RITI communities. The project aims to help enhance the understanding of the impact factors that affect rural traffic crash frequencies and severities for RITI communities, and how these factors vary over time and across regions.

## 1.2. Project Goal and Objectives

The primary goal of this project is to document the characteristics of traffic crashes in RITI communities in Idaho. The long-term vision of the PIs for this project is to establish an in-depth understanding of the baseline traffic safety conditions in RITI communities as a first step towards the ultimate goal of improving safety for these underserved groups through research, education, and outreach activities. The project had the following three objectives:

1) Identify and document different sources of crash data for RITI communities in Idaho
2) Conduct an in-depth ten-year crash analysis (2007-2016) to document the characteristics of traffic crashes in RITI communities
3) Identify and document different sources for traffic exposure data that can be used to estimate crash rates for RITI communities in Idaho

The outcome of this project will help federal, state, tribal, local transportation agencies, and other entities that focus on improving safety on rural highways gain in-depth knowledge on the characteristics of traffic crashes in RITI and similar communities throughout the nation. It will also help identify gaps in crash data collection practices and policies for these communities as well as gaps in traffic exposure measures that can be used to effectively measure crash rates in rural communities. Finally, the outcome of this project will help aid and guide the state of Idaho's efforts to improve safety on Idaho's RITI roadway network through the identification of effective crash countermeasures that has the highest possible return on investment for these communities.

## 1.3. Report Organization

This report is organized in six chapters. After the introduction, chapter 2 presents the study methodology and data sources. Chapter 3 documents the characteristics of fatal and severe injury crashes on rural paved and unpaved roads followed by chapter 4 that provided the characteristics of fatal and severe injury crashes on rural paved and unpaved roads. Chapter 5 provides a synthesis covering different sources for traffic exposure data for RITI communities in Idaho. Chapter 6 includes the study findings and conclusions.

# CHAPTER 2. STUDY METHODOLOGY AND DATA SOURCES

## 2.1. Overview

Geographic Information Systems (GIS) are used to store, manage, analyze and present spatial data and provide an appropriate platform for studying the distribution and characteristics of vehicle crashes. The research conducted in this project utilized the software suite ESRI ArcGIS 10.2.2 (ESRI 2018) using both the ArcMap and ArcCatalog Products. A File Geodatabase was created to store the data layers and perform analysis, classes were created within the Geodatabase to store features for road networks, vehicle crash records, U.S. census boundary layers and demographic information from the US Census. All features in the database use a Geographic Projections System using the North American Datum of 1983 and are projected in an Idaho Transverse Mercator Projection (IDWR 2018). A projected coordinate system allowed us to measure distances in linear units instead of decimal degrees and facilitated the research's spatial analysis (Longley et al. 2011, p. 138).

## 2.2. Data Sources

### *2.2.1. Census Data*

Census TIGER files (Topologically Integrated Geographic Encoding and Referencing) provided the foundation for identifying area boundaries and incorporating demographic data into our database that is spatially explicit (US Census Bureau, 2018). These boundary layers provide the spatial framework for joining demographic data such as population to the following: blocks, block groups, census tracks, counties, and county Subdivisions.

Population estimates for Idaho in 2016 were obtained from the U.S. Census Bureau and were added to the Census Incorporated Places. This process was used to determine urban and rural areas where rural areas have a population less than 2,500 residents and urban areas have a population greater than or equal to 2,500 residents (Ratcliffe et al, 2016).

### *2.2.2. Crash Data*

Vehicle crash data was obtained from the Idaho Transportation Department (ITD) through the Office of Highway Safety Crash Analysis Reporting System for crashes that occurred between 2007 and 2016 (Webcars, 2018). Crash data were integrated with the GIS database using the latitude and longitude values associated with each crash (using the NAD 83 Geographic Coordinate System). Ten crash layers, one for each year of crash records were exported as a new feature class within the Geodatabase and projected using the NAD 83 Idaho TM projection. The ten feature classes were then merged to a single feature class representing all reported incidents in the State of Idaho between 2007 and 2016.

It is important to note that Idaho's crash data uses a vertical data structure where each row represents a vehicle involved in a crash; therefore, there is a many to one relationship between vehicles and incidents of a crash. A crash involving 4 vehicles will produce 4 rows of data and statistics such as Injury and Fatality counts are represented for the crash, not the vehicle. To simplify the data and avoid duplication, the first record was selected for each crash by excluding records that have a null value in the Accident number field. This secondary dataset was used to calculate the total number of injuries or fatalities for a given period or area. The original dataset was useful for calculating the total number of vehicles involved in crashes.

The location of a crash was geocoded using the verbal description in the crash report. The approximate distance to the nearest mile marker was often used as a secondary location system. One challenge we encountered during this research was measuring the amount of uncertainty in the location of a crash measured as latitude and longitude. Many rural and isolated roads in Idaho lack the cellular signal reception and Geographic Positioning Systems (GPS) signals to accurately measure the location of an incident.

### *2.2.3 Roadway networks*

Three road networks were used in this project. The first two were provided by ITD, including the State Highway System network and the Local Highway network which includes county and city roadways throughout the state. The third dataset was provided by the US Forest Service, and covered the forest service roadway network. A summary of the characteristics of each of the three roadway network datasets are included in Table 2.1.

**Table 2-1 Characteristics of the three roadway network datasets used in the analysis**

| Data Source | Total Data point | Length (miles) | Code | Pavement Type | Paved | Unpaved |
|---|---|---|---|---|---|---|
| Local Highway Network | 19,300 | 27,931 | C | Earth | | X |
| | | | E | Gravel | | X |
| | | | F | Asphalt < 1" or Dust Suppressant Treated Gravel | X | |
| | | | G-1 | Road or Cold Plant mixed Asphalt | X | |
| | | | G-2 | Hot mix asphalt pavement | X | |
| | | | J | Other (e.g. concrete) | X | |
| | | | B | Unimproved | | X |
| | | | AC | Asphalt | X | |
| Forest Service Roadway Network | 21,497 | 31,642 | AGG | Crushed Aggregate or Gravel | | X |
| | | | BST | Bituminous Surface Treatment | X | |
| | | | CSOIL | Compacted Soil | | X |
| | | | IMP | Improved Natural Material | | X |
| | | | Other | Other | | X |
| | | | P | Paved | X | |
| Idaho State Highway System | 2,118 | 5,742 | NA | Bituminous Overlay over Existing CRCP | X | |
| | | | NA | Overlay over Existing Jointed Concrete Pavement | X | |
| | | | NA | Asphalt Concrete Overlay over Existing AC Pavement | X | |
| | | | NA | Bituminous | X | |
| | | | NA | Bonded PCC Overlay on PCC Pavement | X | |
| | | | NA | JRCP - Jointed Plain Concrete Pavement | X | |
| | | | NA | JRCP - Jointed Reinforced Concrete Pavement | X | |
| | | | NA | Other (includes "white topping") | X | |
| | | | NA | Unpaved | | X |

# CHAPTER 3. CHARACHTERSTICS OF FATAL AND SEVERE INJURY CRASHES ON RURAL UNPAVED ROADS IN IDAHO

## 3.1. Overview

The Federal Highway Administration (FHWA) reported in 2012 that there were 1,357,430 miles of unpaved roads, which accounts for almost 35% of total road miles. Some of the unpaved roads are smooth, wide, and have a well-maintained surface with wide shoulders. However, many others have narrow or no shoulders and loose, rutted, or washboard surfaces where drivers could lose control of their vehicle due to severely muddled surfaces. These problems are often the worst where vehicles turn and brake such as on curves and at intersections. Poor quality and loose aggregate can lead to dense dust clouds resulting in low visibility. More dangers of driving on unpaved roads come from the transition from paved to unpaved. If a vehicle is approaching a gravel road without proper warnings, such as reduce speed signs, the driver could lose control of their vehicle. Additional characteristics affecting driving behavior due to physical features of unpaved roads that can impact safety include *(*FHWA-SA-14-094*)*:

- narrow lanes and/or shoulders
- sharp horizontal/vertical curves
- limited passing, stopping and horizontal sight distance, narrow bridges
- limited sight distance at intersections
- frequent roadside obstacles
- lack of clear roadside recovery area
- minimal or non-compliant signing and delineation

This chapter provides a summary of the characteristics of crashes that occurred on rural unpaved roads in Idaho. The analysis focused on fatal and severe injury ("incapacitated" or "A injury" crashes) crashes that occurred between 20007 and 20016. The analysis covered crash trends, vehicle types, geographic district, drive demographics (age and sex), light conditions, and weather conditions.

## 3.2. Analysis and Results

The characteristics of fatal and severe injury crashes in unpaved roads in Idaho are presented in Figure 3.1 through Figure 3.7 and in Table 3.1. Based on these results, the following observations can be made:

- The number of fatal crashes fluctuates from a minimum of 6 fatalities in 2016 to 19 fatalities in 2013. Severe injury crashes showed an increasing trend from 2008 to 2012, followed by a declining trend from 2012 to 2014. Fatal and severe injury crashes went significantly up in 2015, and showed a considerable decline in 2016.
- ATVs and pickup trucks were the two most common vehicle types in fatal and severe injury crashes on unpaved roads in Idaho
- District 3, the southwestern district in Idaho, experienced the highest number of fatal and severe injury crashes on unpaved roads. This is the district that has the most rural recreational attractions in Idaho.
- The majority of fatal and severe injury crashes on unpaved roads involved drivers 24 years or younger with considerable number involving occupants younger than 14 years old.

- The majority of fatal and severe injury crashes on unpaved roads involved male drivers and occupants.
- The majority of fatal and severe injury crashes on unpaved roads happened during daylight and in clear or cloudy weather conditions. Inclement weather was not a factor that influenced crashes on unpaved roads.
- Alcohol impairment, inattention, and speeding seem to be the three major contributing circumstances in fatal and severe injury crashes on unpaved roads.

**Table 3.1 Contributing circumstances for fatal and severe injury crashes on unpaved roads in Idaho**

| Contributing Circumstances | Fatalities | Percentage (%) | Injuries | Percentage (%) |
|---|---|---|---|---|
| Alcohol Impaired | 33 | 26 | 113 | 16.3 |
| Asleep, Drowsy, Fatigued | 2 | 1.6 | 4 | 0.6 |
| Distracted IN or ON Vehicle | 4 | 3.1 | 15 | 2.2 |
| Drove Left of Center | 8 | 6.3 | 30 | 4.3 |
| Drug Impaired | 2 | 1.6 | 10 | 1.4 |
| Exceeded Posted Speed | 4 | 3.1 | 20 | 2.9 |
| Failed to Maintain Lane | 11 | 8.7 | 37 | 5.3 |
| Failed to Obey Stop Sign | 2 | 1.6 | 1 | 0.1 |
| Inattention | 19 | 15 | 98 | 14.1 |
| Other | 4 | 3.1 | 80 | 11.5 |
| Overcorrected | 5 | 3.9 | 44 | 6.3 |
| Speed Too Fast For Conditions | 20 | 15.7 | 179 | 25.8 |
| Unknown | 11 | 8.7 | 48 | 6.9 |
| Vision Obstruction | 2 | 1.6 | 15 | 2.2 |

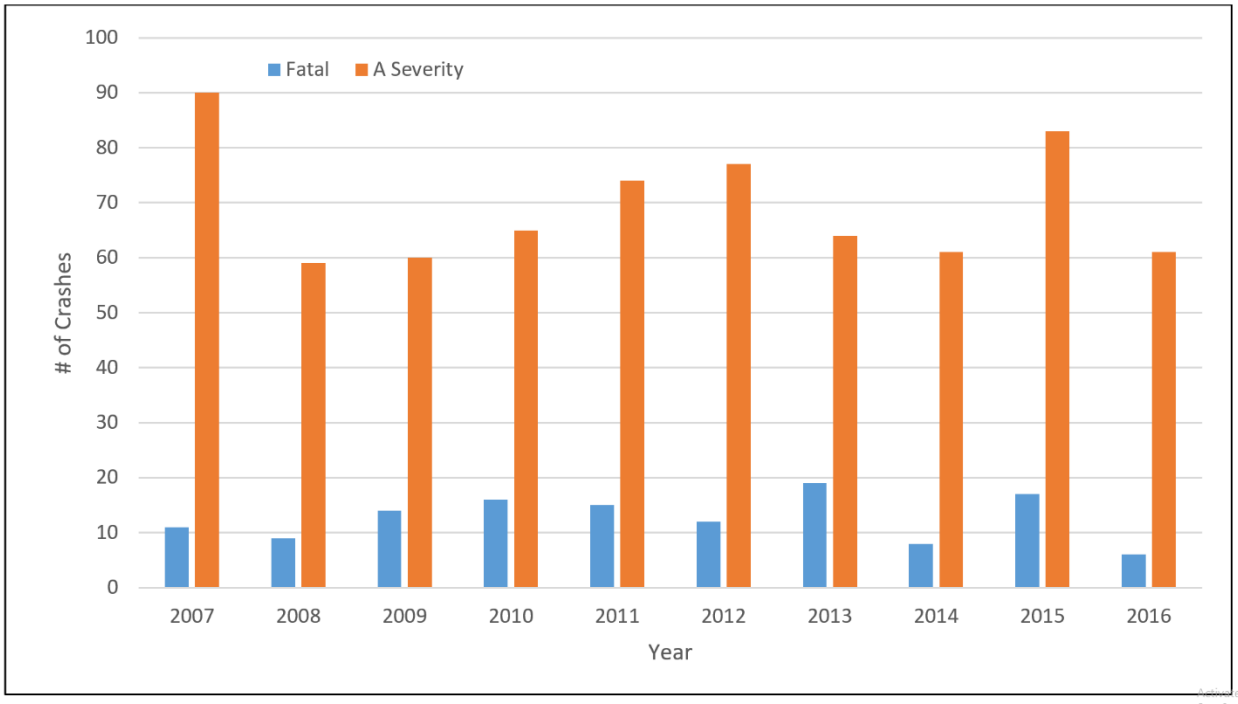



**Figure 3-1 Fatal and severe injury crashes on unpaved roads in Idaho by year**

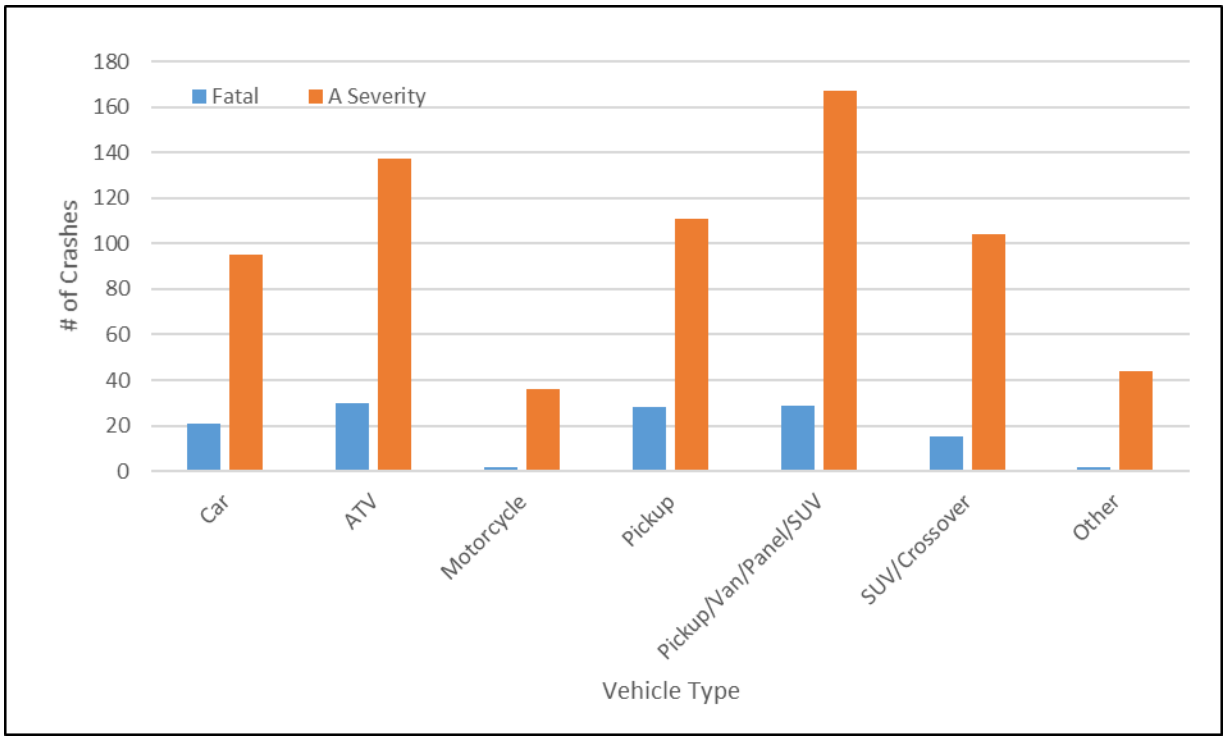



**Figure 3-2 Fatal and Severe injury crashes on unpaved roads in Idaho by vehicle type**

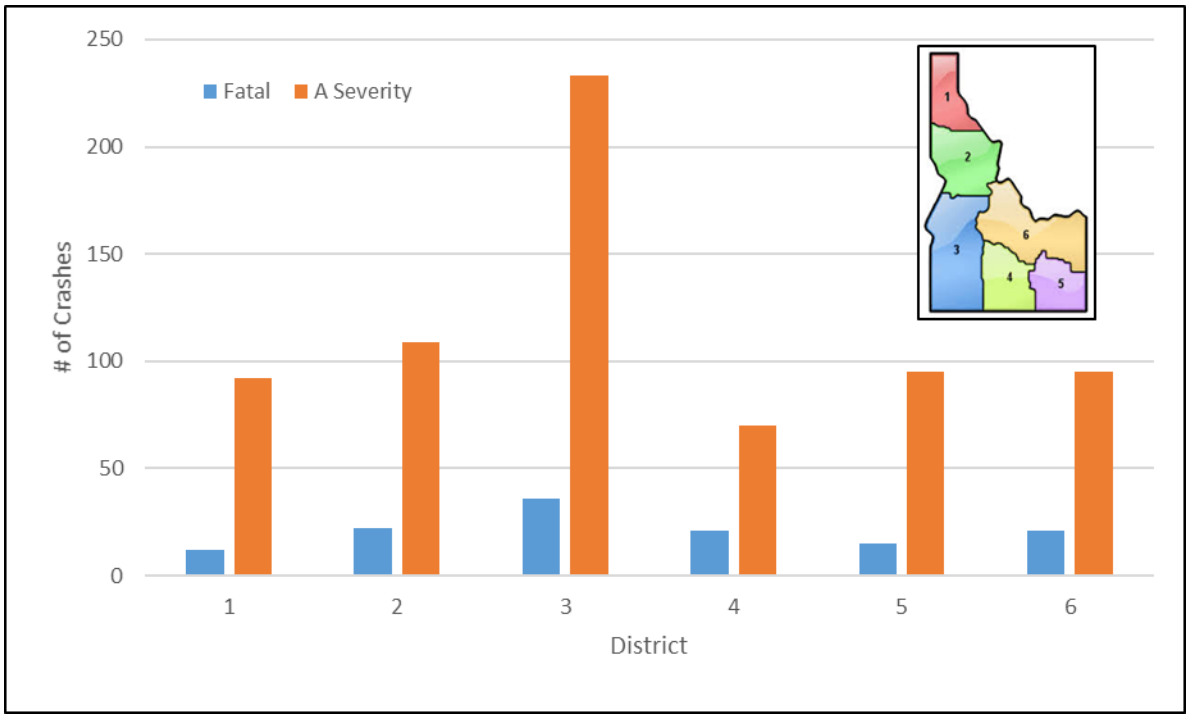



**Figure 3-3 Fatal and severe injury crashes on unpaved roads in Idaho by geographic districts**

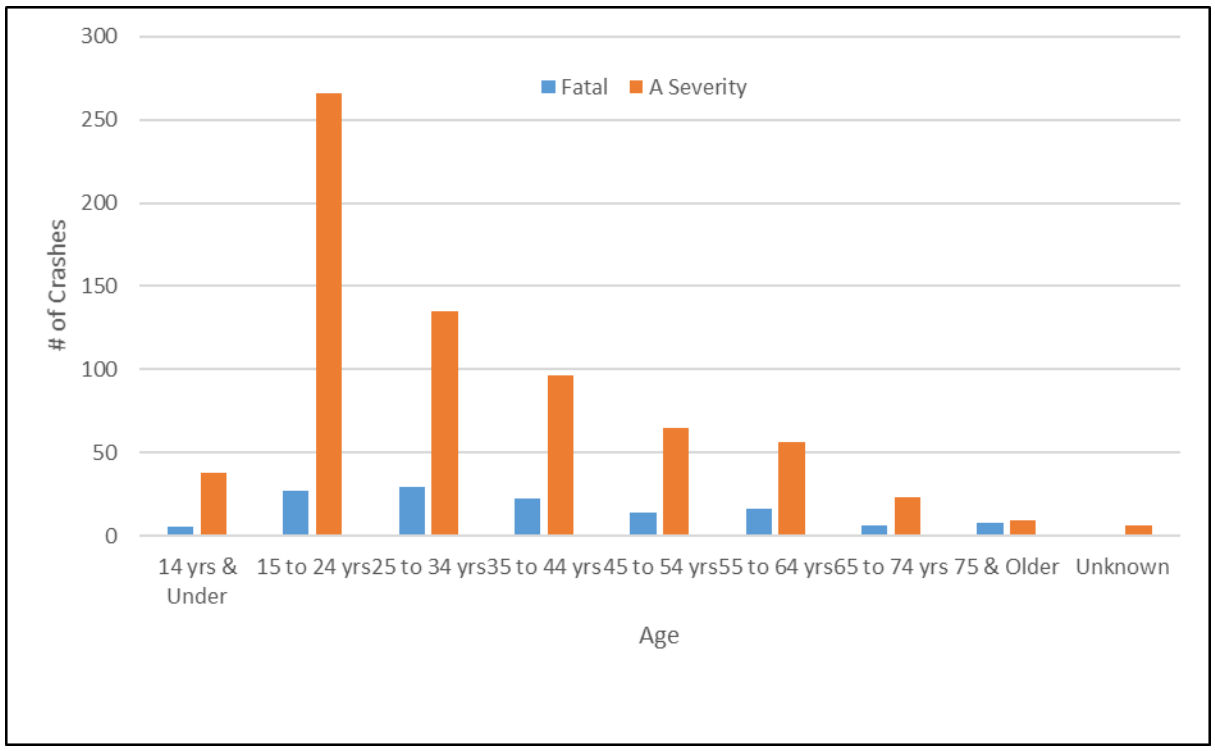



**Figure 3-4 Fatal and severe injury crashes on unpaved roads in Idaho by age**

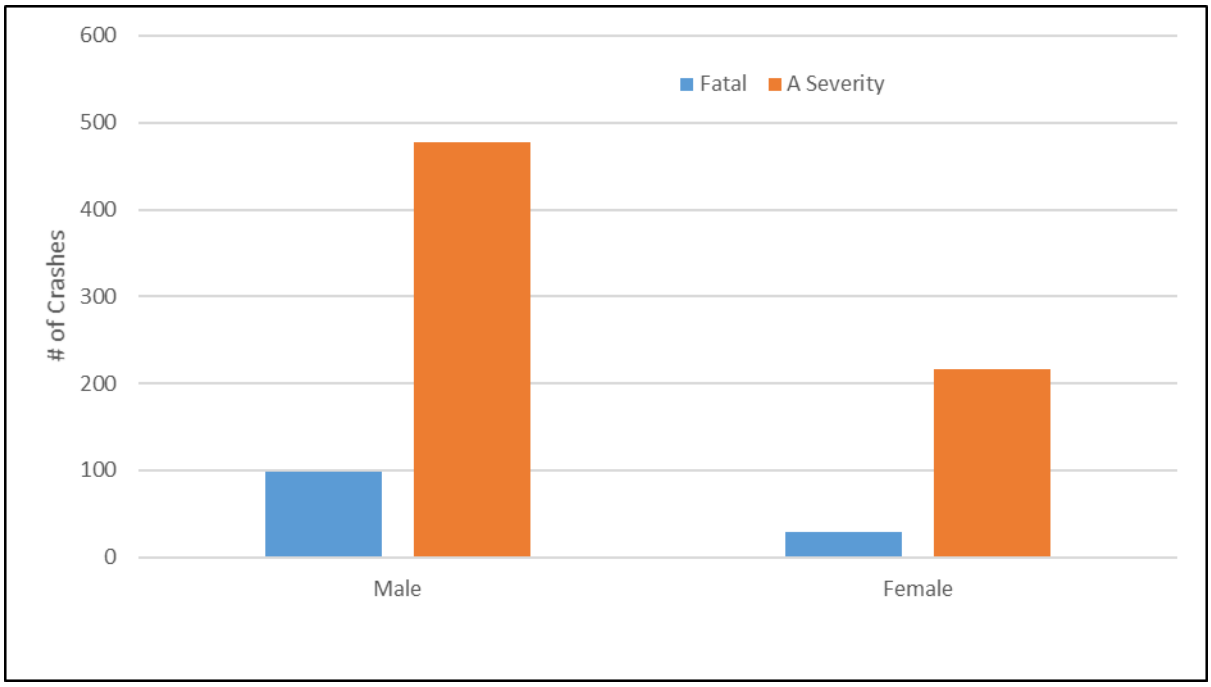



**Figure 3-5 Fatal and severe injury crashes on unpaved roads in Idaho by gender**

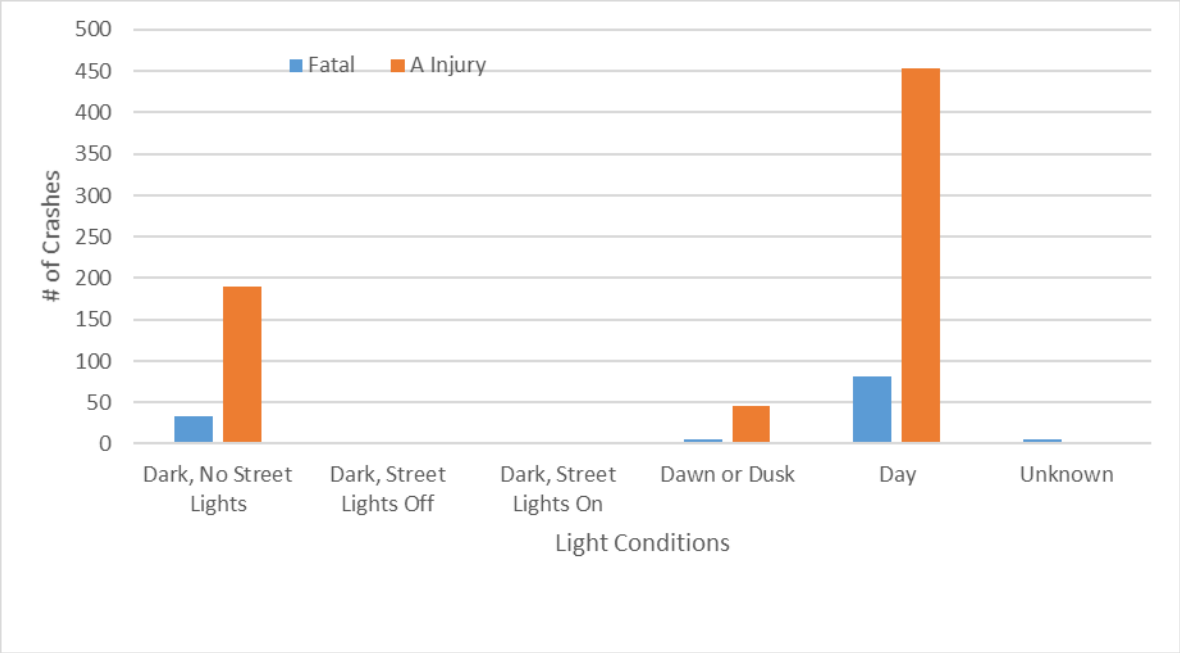



**Figure 3-6 Fatal and severe injury crashes on unpaved roads in Idaho by light conditions**

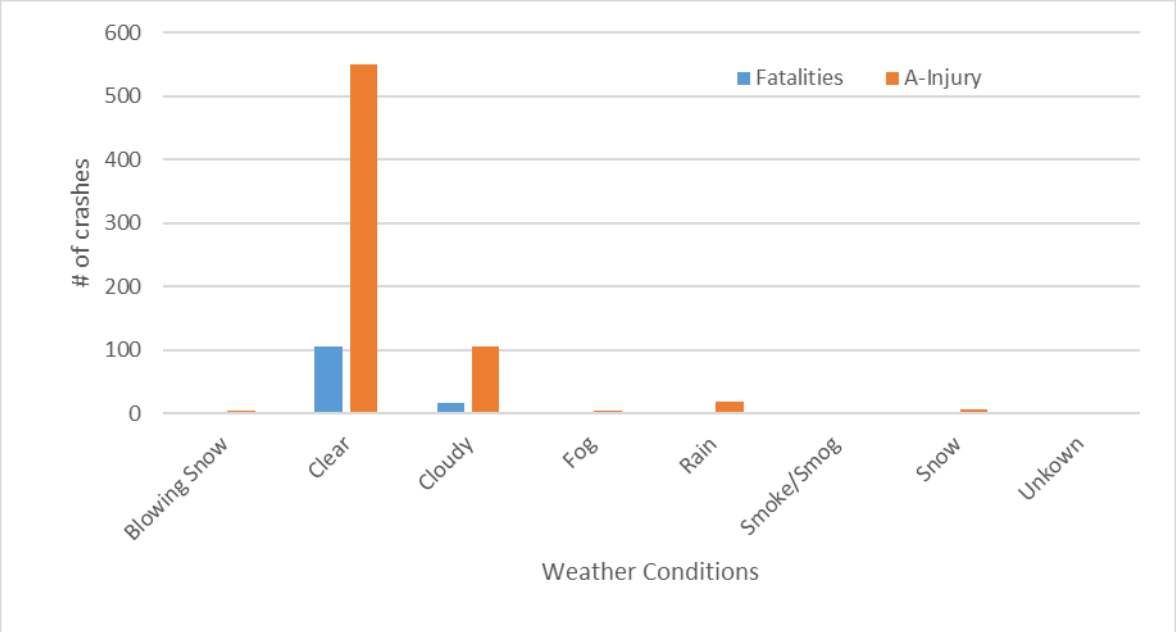



**Figure 3-7 Fatal and severe injury crashes on unpaved roads in Idaho by weather conditions**

# CHAPTER 4. FATAL AND SEVERE INJURY CRASHES ON RURAL ROADS IN IDAHO

## 4.1. Overview

This chapter documents the characteristics of fatal and severe injury crashes on rural paved roads in Idaho and presents a comparative analysis between crashes on paved and unpaved rural roads to identify major differences in crash causation and contributing circumstances between these two, relatively different, rural roadway networks that serve RITI communities.

## 4.2. Comparative Safety Analysis: Unpaved and Paved Rural Roads in Idaho

Table 4-1, Table 4-2, and Table 4-3, and Figure 4-1 through Figure 4-12 show a comparison between the characteristics of fatal and severe injury crashes on rural unpaved and paved roads in Idaho. Based on the results shown in these Tables and Figures, the following observations can be made from the data presented in the Tables and Figures:

- The percent of fatal and severe injury crashes where no restraining device was used is much higher on unpaved roads (50.4% and 38.3% on unpaved roads compared to 37.9 and 22.8 on paved roads). The same trend also exists in helmet use as can be shown in Table 4-2 and Figure 4-8. This shows the need for much more aggressive seat belt and helmet use enforcement in rural unpaved roads.
- There is a substantial difference in ATV crashes on unpaved versus paved. This is not surprising considering ATV usage is largely implemented on these roads due to the environment and location.
- The proportion of male drivers fatal and severe injury crashes are slightly higher on unpaved roads.
- The categorical age groups for fatal and incapacitating injuries for paved and unpaved roads are presented in Figure 4-7 and Figure 4-8. Ages are divided into 10-year groups starting at the age of 14 or younger and ending at 75 and older. In Idaho teenagers can get their driver's license at 15 years old with restrictions on number of passengers allowed in their vehicle and time of day they're allowed to drive. This type of driver's license is an underage license designed for anyone 17 years or younger and once the licensee becomes 18 years old they're eligible for a regular driver's license. The data presented in the Figure4-7 and Figure 4-8 clearly shows that teenagers or children that are 14 years or younger are more susceptible to fatal and severe injuries on unpaved roads versus paved roads. Crash injuries for age groups from 15 to 44 are also higher on unpaved roadways, but for the following groups it levels out and then older individuals are more involved in paved crashes.
- The light conditions comparison data presented in Figure 4-9 and Figure 4-10 shows, when compared with paved roads, higher percentage of fatal crashes occur at night with no street lights.
- The data shown in Figure 4-11 and Figure 4-12 shows, again, that inclement weather is not a major factor in fatal and severe injury crashes that occur on unpaved roads. However, when compared to paved roads, a higher percentage of crashes on unpaved roads occur during daylight.

- The data presented in Table 4-3 clearly highlight the fact that unpaved roads have higher percentages of crashes where alcohol impairment was a major contributing circumstance. The same is true for speeding and inattention.

**Table 4-1 Protective device use for paved and unpaved roads in Idaho**

| Paved | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Protection Device | Units | % | Fatalities | % | 'A" Severity | % | Total Injuries | % |
| Air Bag Activated- Belts In Use | 419 | 7.2 | 93 | 8.2 | 555 | 8.6 | 648 | 8.5 |
| Air Bag Activated- No Belts In Use | 132 | 2.3 | 44 | 3.9 | 133 | 2.1 | 177 | 2.3 |
| Helmet Used | 459 | 7.9 | 64 | 5.7 | 405 | 6.3 | 469 | 6.2 |
| No Helmet | 221 | 3.8 | 47 | 4.2 | 189 | 2.9 | 236 | 3.1 |
| Non-Activated Air Bag- Belts In Use | 435 | 7.5 | 53 | 4.7 | 562 | 8.7 | 615 | 8.1 |
| Non-Activated Air Bag- No Belts In Use | 116 | 2.0 | 34 | 3.0 | 161 | 2.5 | 195 | 2.6 |
| None | 1425 | 24.5 | 428 | 37.9 | 1474 | 22.8 | 1902 | 25.1 |
| Shoulder and Lap | 2152 | 37.0 | 300 | 26.5 | 2492 | 38.6 | 2792 | 36.8 |
| Shoulder Belt Only | 34 | 0.6 | 7 | 0.6 | 56 | 0.9 | 63 | 0.8 |
| Unknown/Other | 423 | 7.3 | 60 | 5.3 | 427 | 6.6 | 487 | 6.4 |

| Unpaved | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Protection Device | Units | % | Fatalities | % | 'A" Severity | % | Total Injuries | % |
| Air Bag Activated- Belts In Use | 9 | 1.7 | 2 | 1.6 | 8 | 1.2 | 10 | 1.2 |
| Air Bag Activated- No Belts In Use | 9 | 1.7 | 5 | 3.9 | 15 | 2.2 | 20 | 2.4 |
| Helmet Used | 56 | 10.6 | 8 | 6.3 | 59 | 8.5 | 67 | 8.2 |
| No Helmet | 68 | 12.8 | 13 | 10.2 | 71 | 10.2 | 84 | 10.2 |
| Non-Activated Air Bag- Belts In Use | 20 | 3.8 | 0 | 0.0 | 28 | 4.0 | 28 | 3.4 |
| Non-Activated Air Bag- No Belts In Use | 20 | 3.8 | 8 | 6.3 | 28 | 4.0 | 36 | 4.4 |
| None | 203 | 38.3 | 64 | 50.4 | 266 | 38.3 | 330 | 40.2 |
| Shoulder and Lap | 92 | 17.4 | 13 | 10.2 | 141 | 20.3 | 154 | 18.8 |
| Shoulder Belt Only | 3 | 0.6 | 1 | 0.8 | 3 | 0.4 | 4 | 0.5 |
| Unknown/Other | 50 | 9.4 | 13 | 10.2 | 75 | 10.8 | 88 | 10.7 |

**Table 4-2 Vehicle type for fatal and severe injury crashes on paved and unpaved Idaho roads**

| Vehicle Type | Unpaved | | | | | Paved | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Fatal | % | A Severity | % | Total | Fatal | % | A Severity | % | Total |
| Car | 21 | 16.5 | 95 | 13.7 | 116 | 1992 | 34.3 | 370 | 32.7 | 2280 |
| ATV | 30 | 23.6 | 137 | 19.7 | 167 | 128 | 2.2 | 23 | 2.0 | 125 |
| Motorcycle | 2 | 1.6 | 36 | 5.2 | 38 | 719 | 12.4 | 118 | 10.4 | 629 |
| Pickup | 28 | 22.0 | 111 | 16.0 | 139 | 740 | 12.7 | 157 | 13.9 | 768 |
| Pickup/Van/Panel/SUV | 29 | 22.8 | 167 | 24.1 | 196 | 1058 | 18.2 | 228 | 20.2 | 1334 |
| SUV/Crossover | 15 | 11.8 | 104 | 15.0 | 119 | 577 | 9.9 | 133 | 11.8 | 742 |
| Other | 2 | 1.6 | 44 | 6.3 | 46 | 602 | 10.4 | 101 | 8.9 | 576 |
| Total | 127 | 100 | 694 | 100 | 821 | 5816 | 100 | 1130 | 100 | 6454 |

**Table 4-3 Contributing circumstances for fatal and severe injury crashes on paved and unpaved roads**

| Contributing Circumstances | Unpaved | | | | Paved | | | |
|---|---|---|---|---|---|---|---|---|
| | Fatalities | % | Injuries | % | Fatalities | % | Injuries | % |
| Alcohol Impaired | 33 | 26.0 | 113 | 16.3 | 170 | 15.0 | 751 | 11.6 |
| Animal(s) in Roadway | 0 | 0.0 | 4 | 0.6 | 10 | 0.9 | 128 | 2.0 |
| Asleep, Drowsy, Fatigued | 2 | 1.6 | 4 | 0.6 | 49 | 4.3 | 395 | 6.1 |
| Distracted IN or ON Vehicle | 4 | 3.1 | 15 | 2.2 | 13 | 1.2 | 146 | 2.3 |
| Drove Left of Center | 8 | 6.3 | 30 | 4.3 | 105 | 9.3 | 292 | 4.5 |
| Drug Impaired | 2 | 1.6 | 10 | 1.4 | 14 | 1.2 | 72 | 1.1 |
| Depressed, Angry, Disturbed | 1 | 0.8 | 1 | 0.1 | 2 | 0.2 | 17 | 0.3 |
| Exceeded Posted Speed | 4 | 3.1 | 20 | 2.9 | 32 | 2.8 | 115 | 1.8 |
| Failed to Maintain Lane | 11 | 8.7 | 37 | 5.3 | 123 | 10.9 | 393 | 6.1 |
| Failed to Obey Stop Sign | 2 | 1.6 | 1 | 0.1 | 21 | 1.9 | 107 | 1.7 |
| Failed to Yield | 0 | 0.0 | 7 | 1.0 | 37 | 3.3 | 306 | 4.7 |
| Following Too Close | 0 | 0.0 | 3 | 0.4 | 5 | 0.4 | 99 | 1.5 |
| Foot Slipped Off or Caught On Pedal | 0 | 0.0 | 1 | 0.1 | 0 | 0.0 | 2 | 0.0 |
| Improper Backing | 0 | 0.0 | 3 | 0.4 | 2 | 0.2 | 18 | 0.3 |
| Improper Overtaking | 0 | 0.0 | 1 | 0.1 | 17 | 1.5 | 70 | 1.1 |
| Improper Turn | 1 | 0.8 | 6 | 0.9 | 3 | 0.3 | 44 | 0.7 |
| Improperly Parked | 0 | 0.0 | 3 | 0.4 | 1 | 0.1 | 1 | 0.0 |
| Inattention | 19 | 15.0 | 98 | 14.1 | 138 | 12.2 | 1005 | 15.6 |
| Other | 2 | 1.6 | 29 | 4.2 | 82 | 7.3 | 429 | 6.6 |
| Other Vehicle Defect | 0 | 0.0 | 15 | 2.2 | 1 | 0.1 | 47 | 0.7 |
| Overcorrected | 5 | 3.9 | 44 | 6.3 | 81 | 7.2 | 300 | 4.6 |
| Physical Impairment | 0 | 0.0 | 2 | 0.3 | 5 | 0.4 | 17 | 0.3 |
| Sick | 0 | 0.0 | 1 | 0.1 | 4 | 0.4 | 35 | 0.5 |
| Speed Too Fast For Conditions | 20 | 15.7 | 179 | 25.8 | 125 | 11.1 | 945 | 14.6 |
| Steering | 0 | 0.0 | 2 | 0.3 | 0 | 0.0 | 6 | 0.1 |
| Unknown | 11 | 8.7 | 48 | 6.9 | 82 | 7.3 | 640 | 9.9 |
| Vision Obstruction | 2 | 1.6 | 15 | 2.2 | 3 | 0.3 | 59 | 0.9 |
| Wrong Side or Wrong Way | 0 | 0.0 | 2 | 0.3 | 5 | 0.4 | 15 | 0.2 |

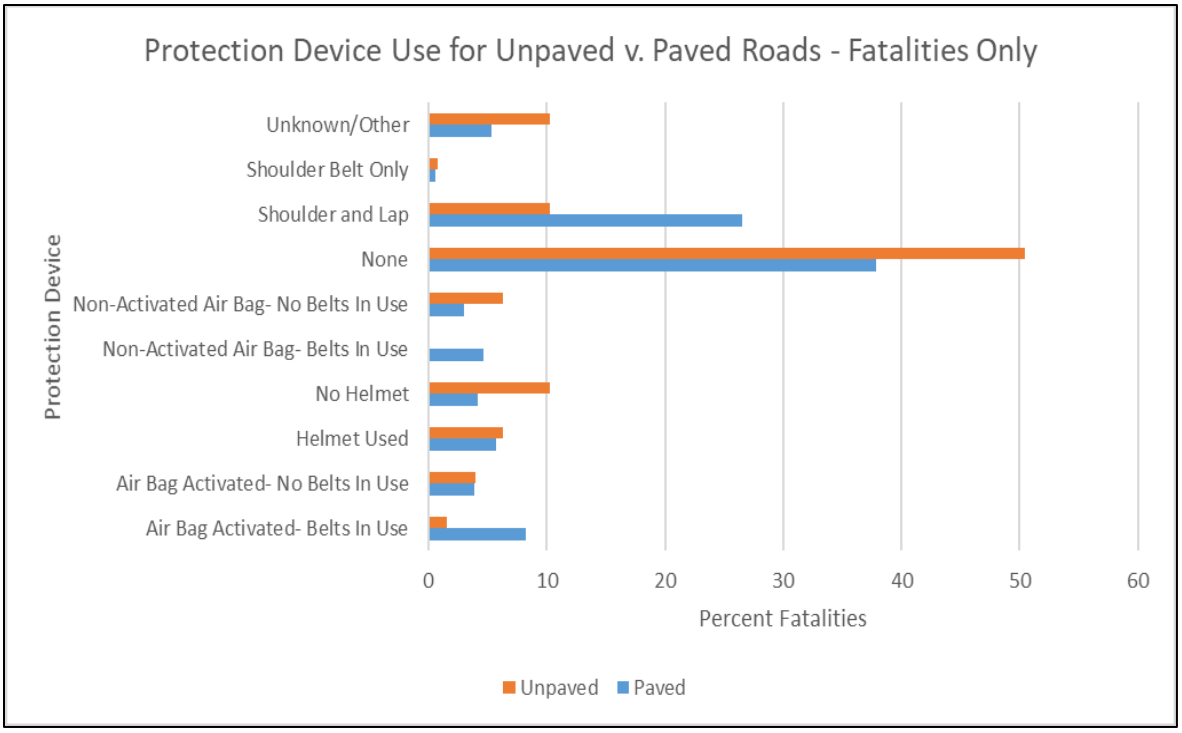



**Figure 4-1 Protective device use for fatal crashes on paved and unpaved roads in Idaho**

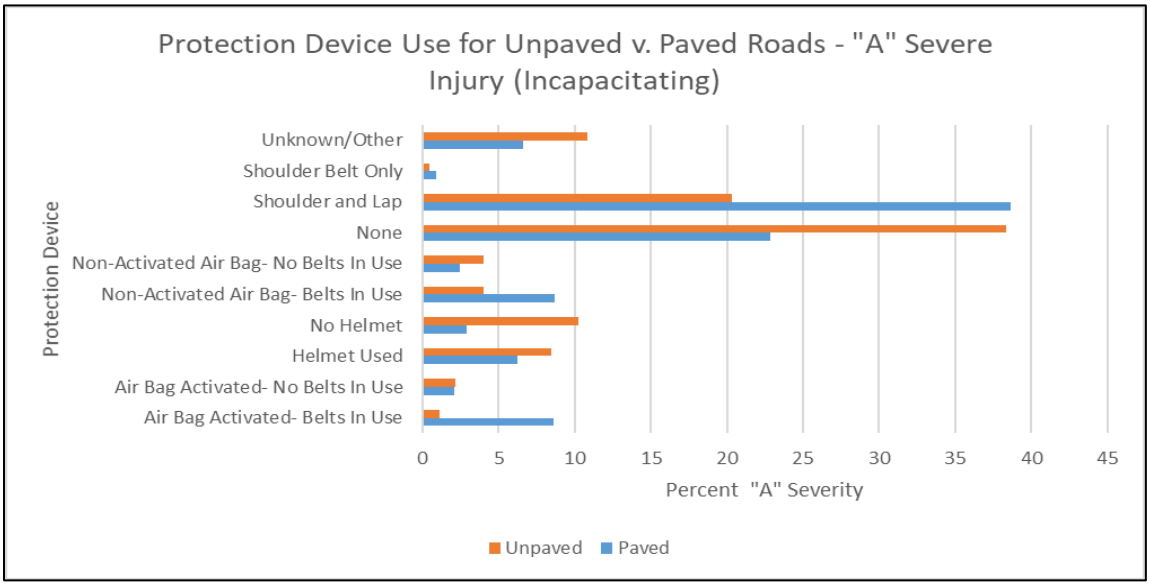



**Figure 4-2 Protective device use for fatal and severe injury crashes on paved and unpaved roads**

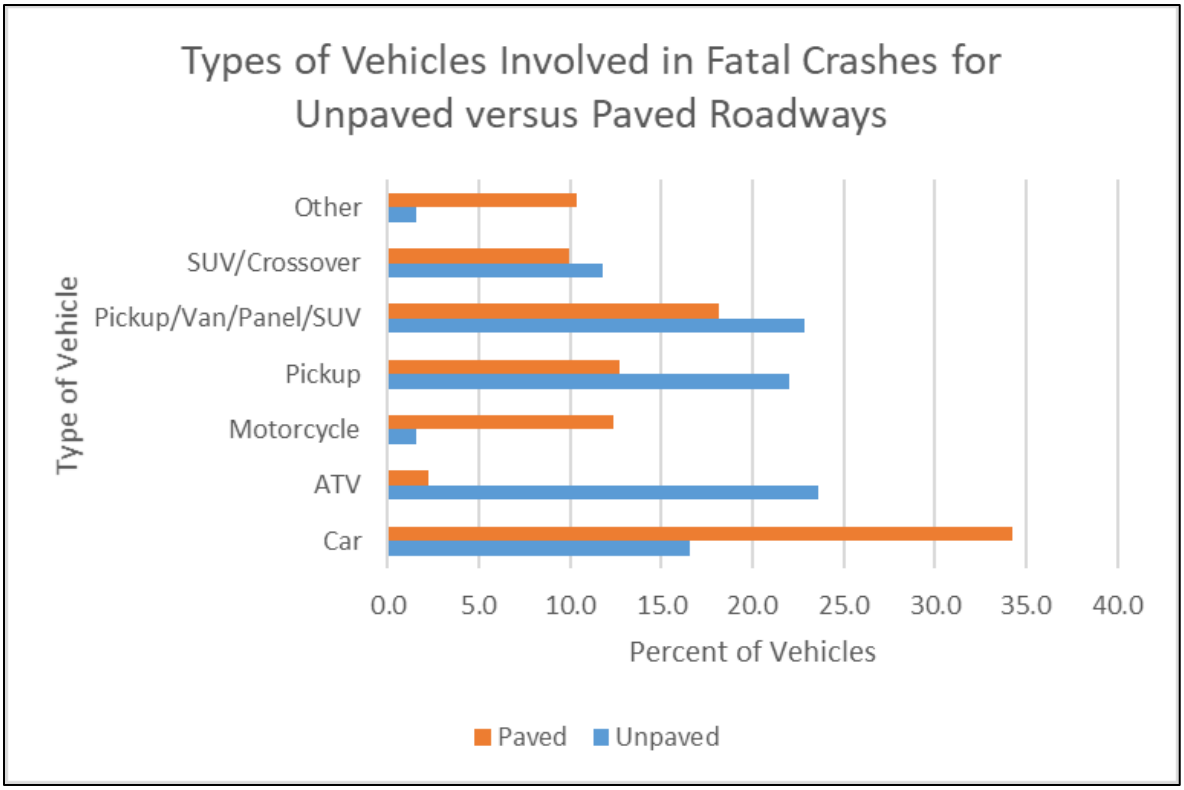



**Figure 4-3 Vehicle type for fatal crashes on paved and unpaved Idaho roads**

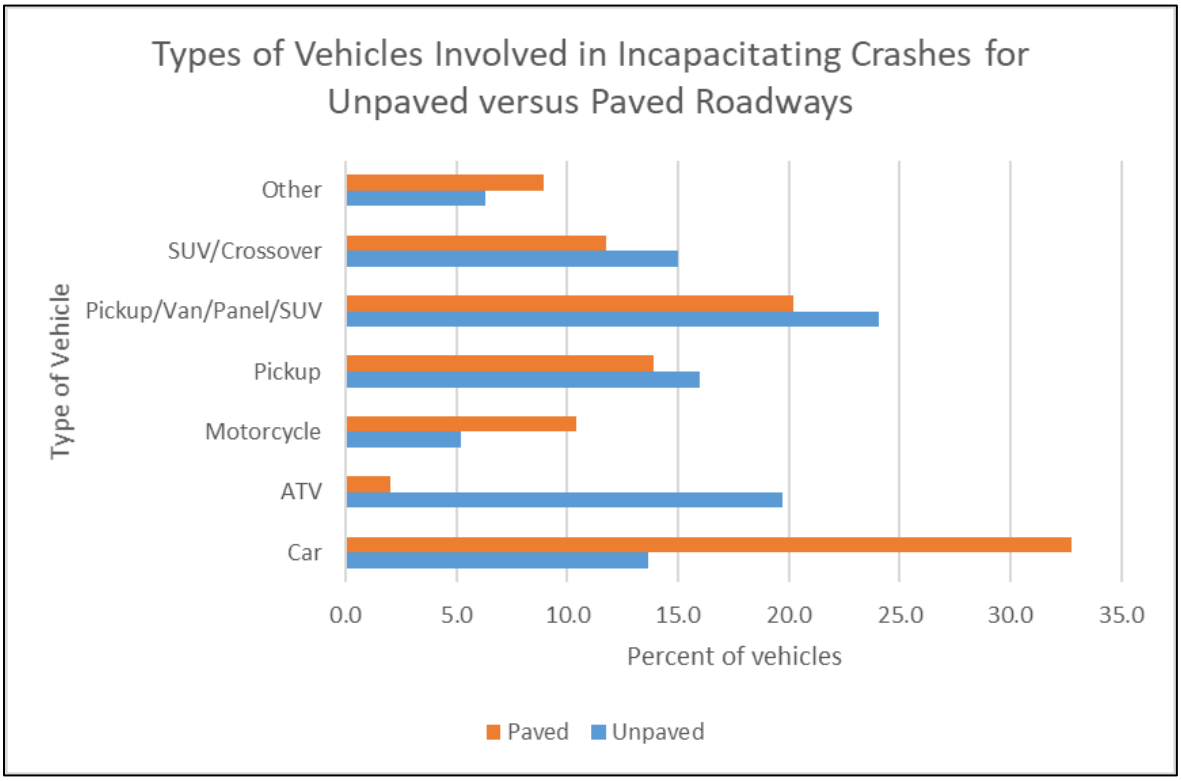



**Figure 4-4 Vehicle type for severe injury crashes on paved and unpaved roads in Idaho**

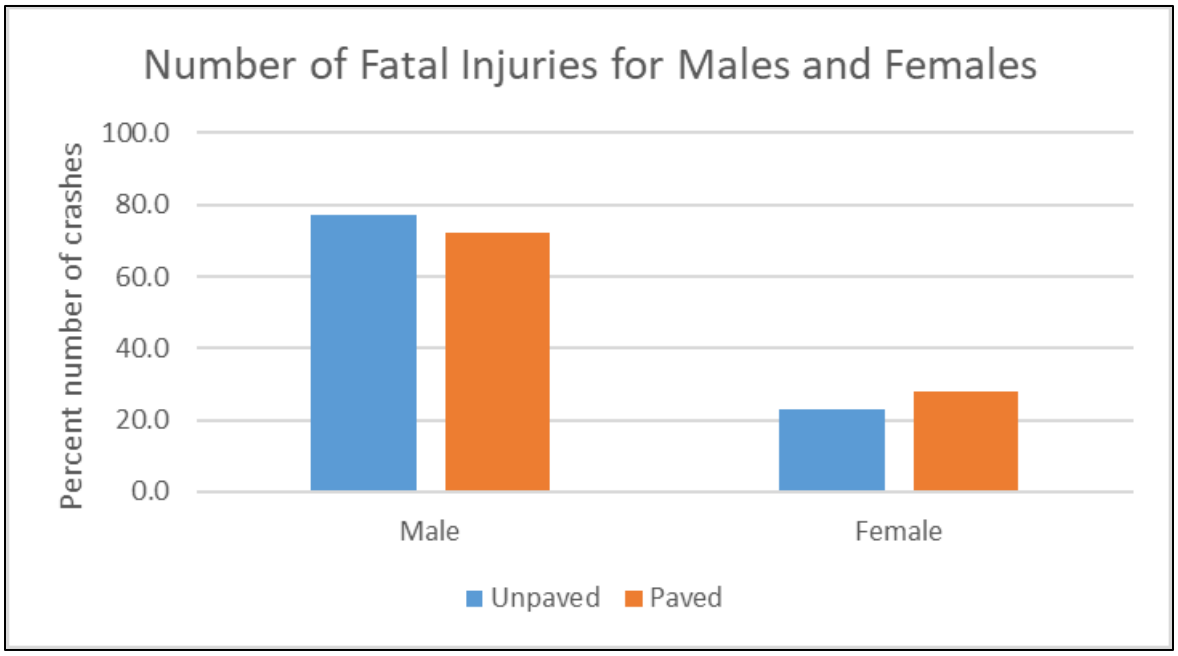



**Figure 4-5 Number of fatalities by gender on paved and unpaved roads in Idaho**

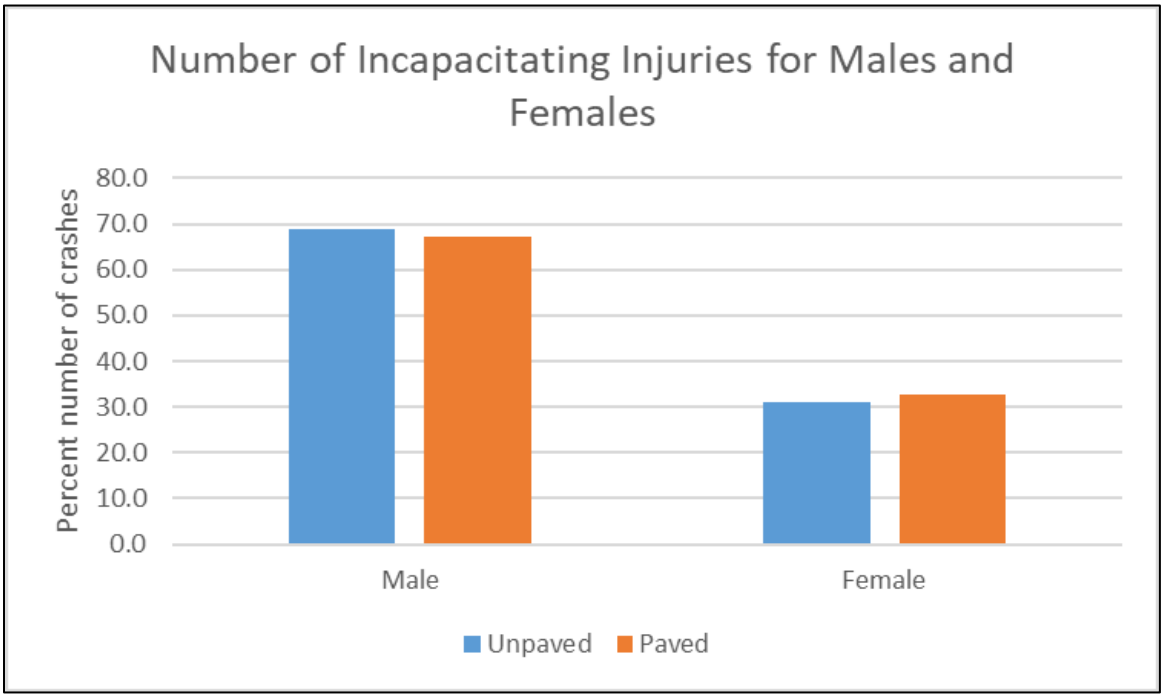



**Figure 4-6 Number of severe Injury crashes by gender on paved and unpaved roads in Idaho**

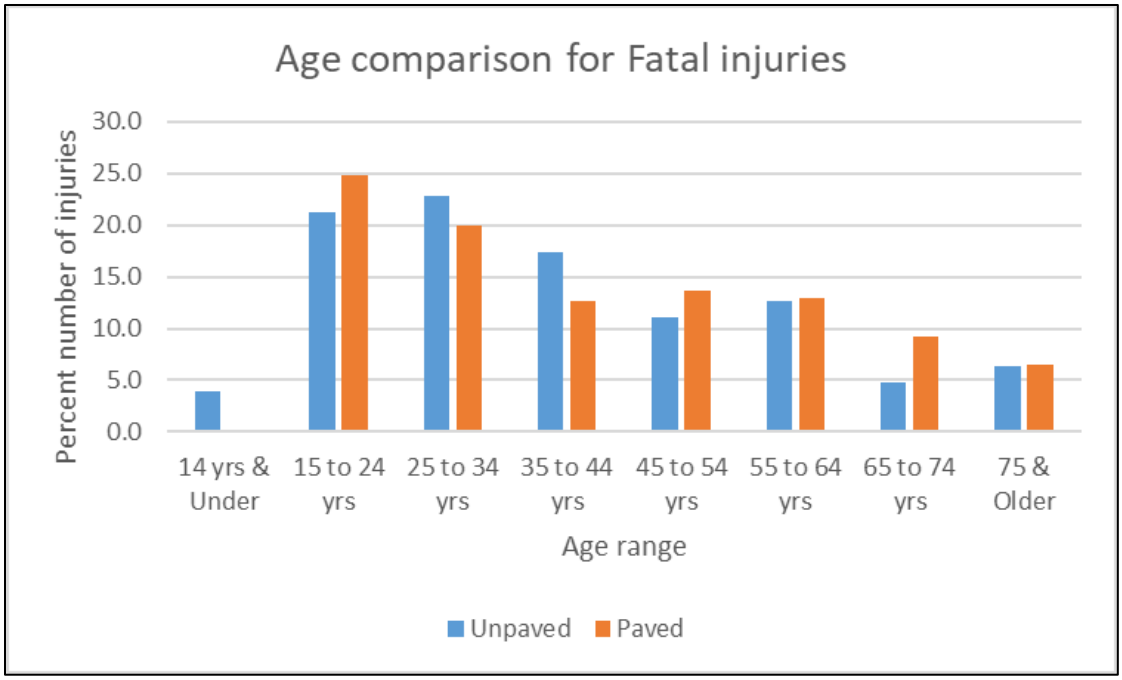



**Figure 4-7 Fatal crashes by age on paved and unpaved roads in Idaho**

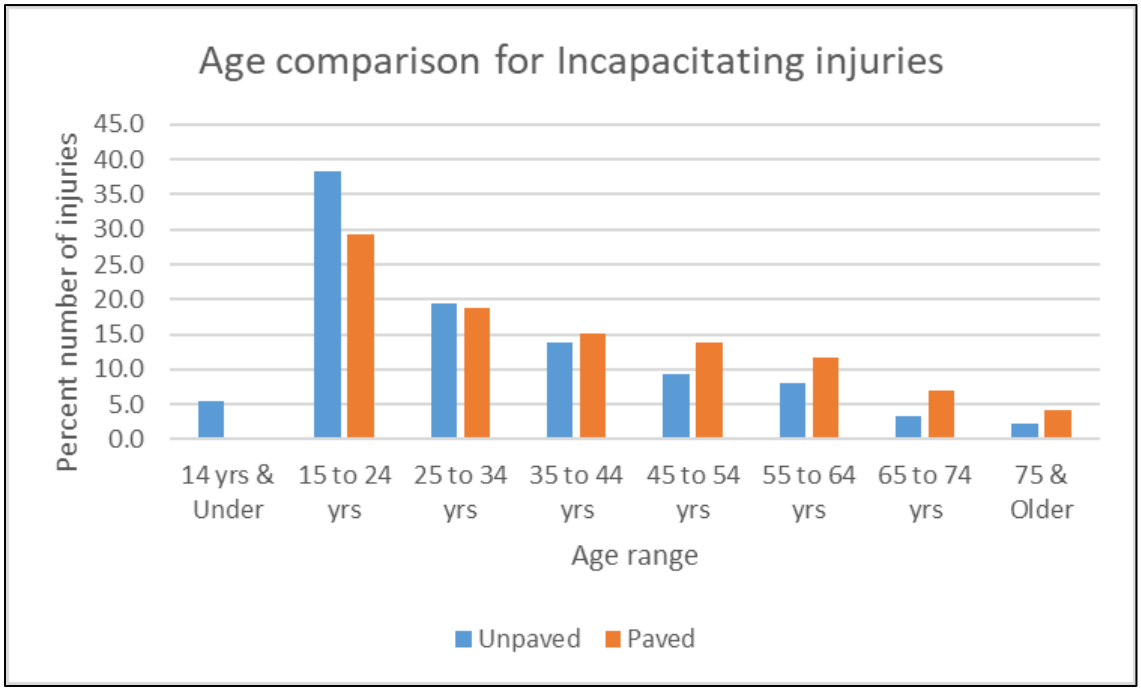



**Figure 4-8 A Sever injury crashes by age on paved and unpaved roads in Idaho**

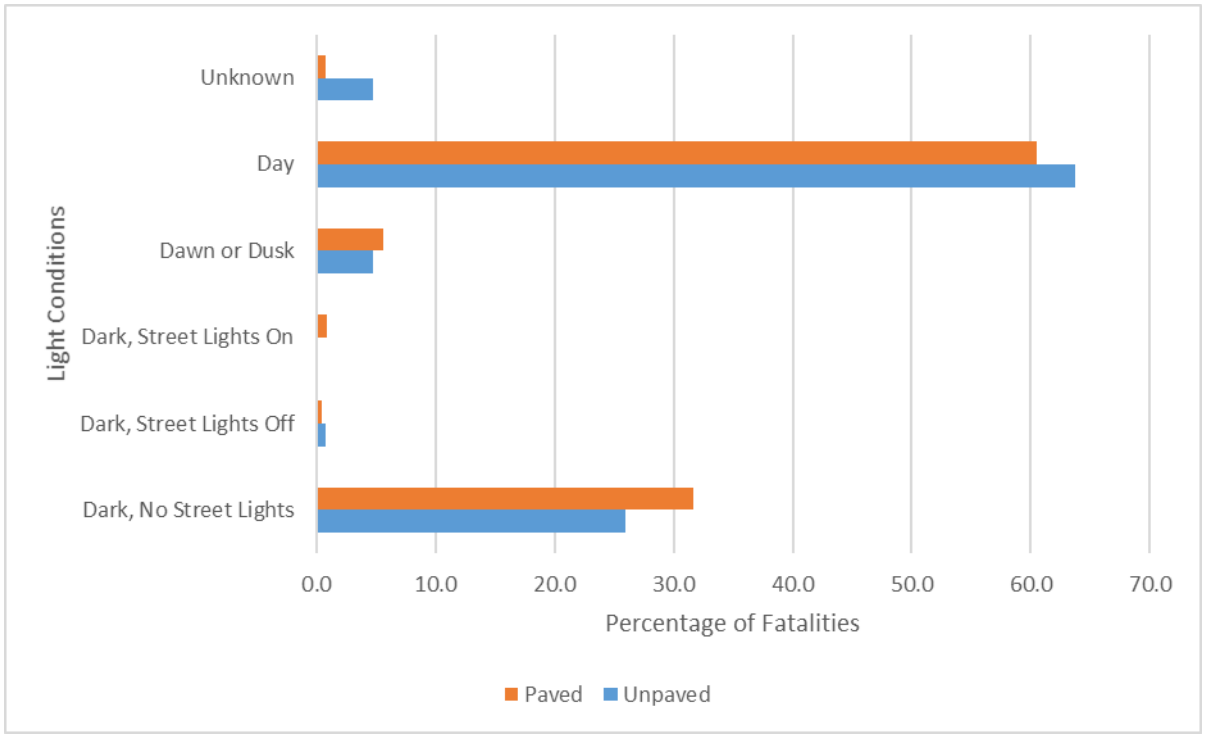



**Figure 4-9 Fatal crashes by time of day on paved and unpaved roads in Idaho**

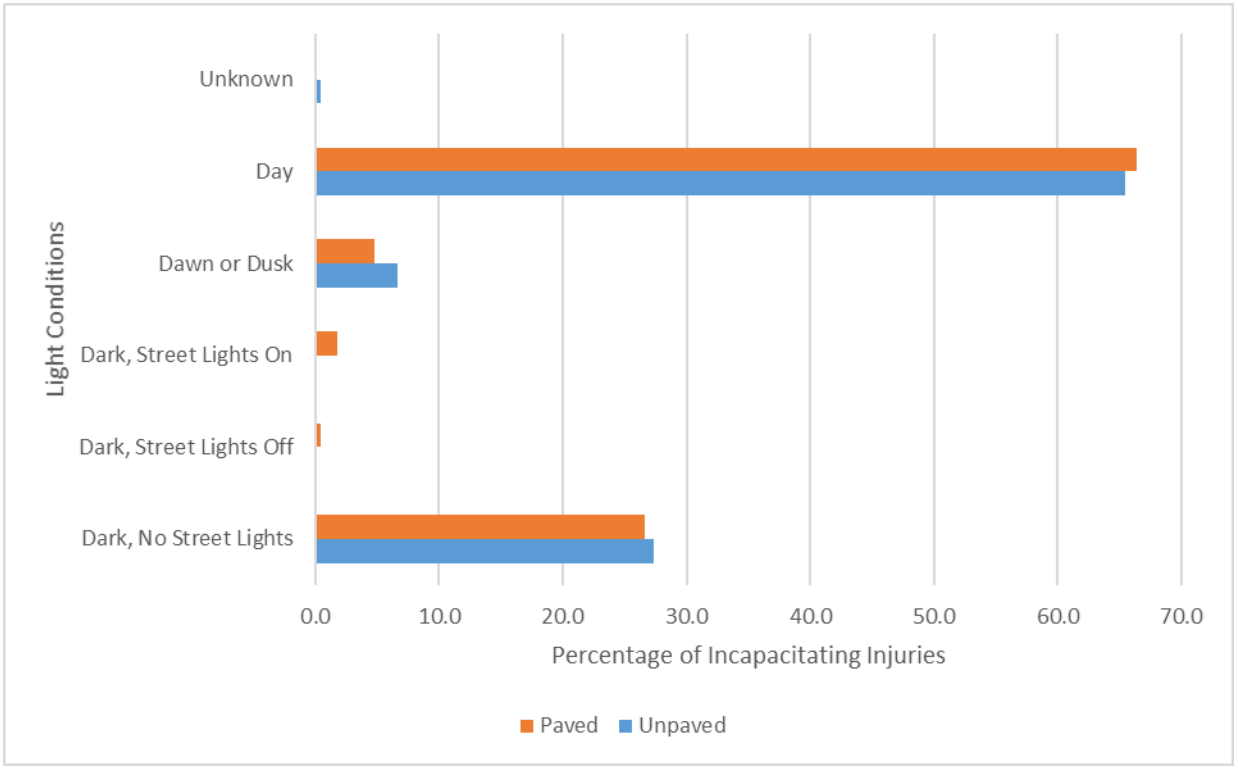



**Figure 4-10 A Severe injury crashes by time of day on paved and unpaved roads in Idaho**

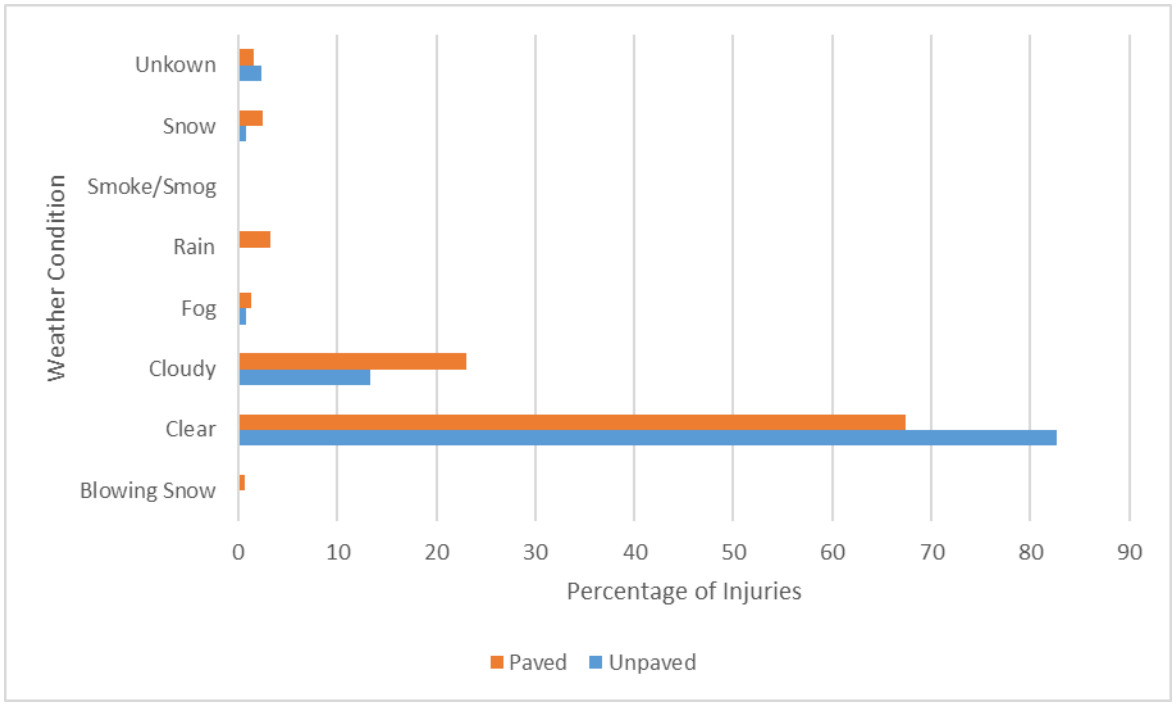



**Figure 4-11 Fatal crashes by weather conditions on paved and unpaved roads in Idaho**

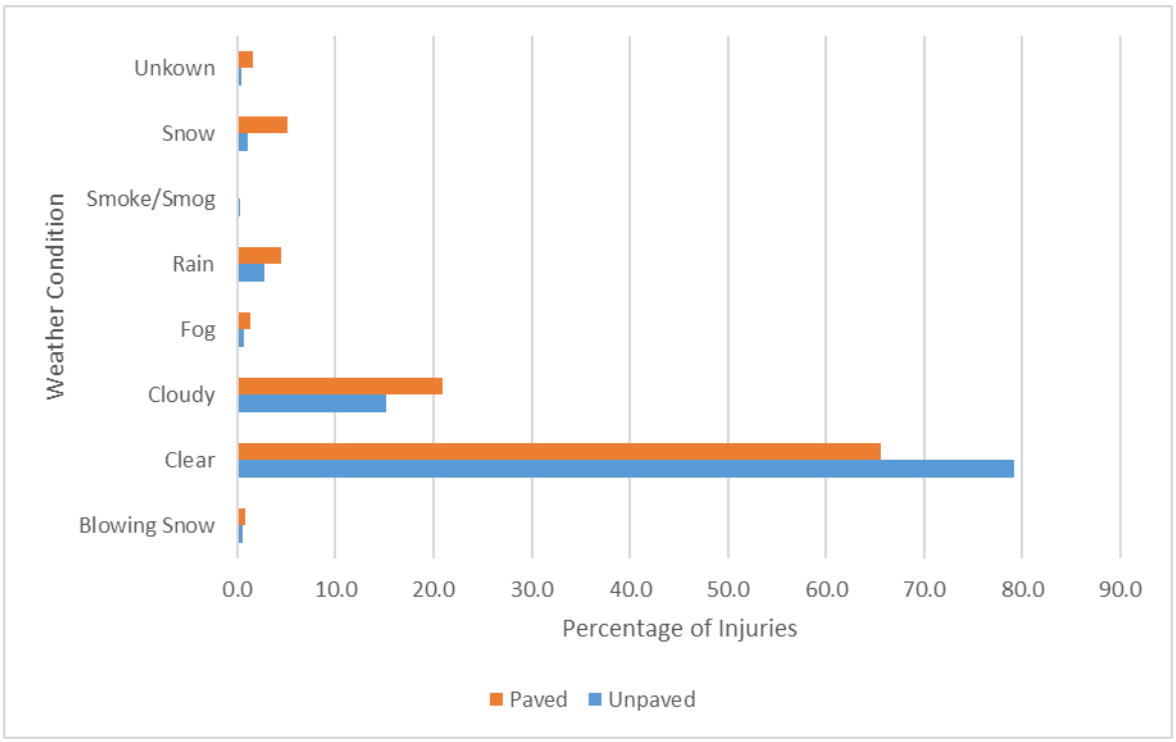



**Figure 4-12 A Severity crashes by weather conditions on paved and unpaved roads in Idaho**

## 4.3. Proportion Analysis – Paved and Unpaved Roads

In this proportion analysis, fatal and severe injury crashes on unpaved roads will be compared to paved roads for various categories. The proportion of various characteristics of crashes on roads of different crash severities, number of crashes, types of vehicles, age, and impairment were isolated for comparison. These proportions were then statistically tested to determine if differences between pairs of proportions were statistically significant. Given adequate sample sizes and assumptions of independence of the proportions, the z-statistic for a standard Normal random variable was utilized for the test. The following steps describe the analytical procedures used:

1. The null hypothesis is defined by the difference between two proportions being tested is zero. The null ($H_o$) hypothesis statement is p-value≤α and the alternative ($H_a$) hypothesis is p-value>α.
2. The confidence level is 95%, thus α (alpha) is 5% or 0.05.
3. The weighted average ($X_w$) of the two proportions was calculated. The formula used is below.
$$p = \frac{n_1 p_1 + n_2 p_2}{n_1 + n_2}$$
4. The standard error of the difference between proportions was computed by the following formula:
$$E = \sqrt{\frac{p(1-p)}{n_1} + \frac{p(1-p)}{n_2}}$$
5. The Z-statistic was computed by:
$$z = \frac{|p_1 - p_2|}{E}$$
6. The P-value is then computed.
7. Once the P-value is calculated the result can be compared to α.

Reflecting on the extensive data presented in Table 4.4, the most commonly used protection device used by Idahoans and visitors are shoulder and lap belts. Unfortunately, more people involved in fatal and incapacitating injuries on unpaved roads do not use any form of protection. The data shows an alarming trend of 40% of people not using any protection devices on unpaved roads with 50% of fatal injuries occurring because of no protection device. The shift in ATV use on unpaved roads could contribute to the large percentage of people succumbing to fatal crashes. Individuals between the ages of 25 and 34 are more susceptible to fatal injuries on unpaved roads and individuals between the ages of 15 and 24 are more susceptible to incapacitating injuries on unpaved roads. For Idaho, rural roads make up approximately 75% of total roads and 32% of total fatalities. This warrants more need for education and enforcement for these rural low volume roads. These proportion test results show that many of these results have a calculated p-value less than 0.05, indicating that these results are statistically significant at the 95% confidence level.

**Table 4-4 Proportion analysis of a variety of factors for fatal and severe injury crashes on paved and unpaved roads in Idaho**

| Crash Severity | Frequency (unpaved) | % | Frequency (Paved) | % | $X_w$ | Error | Z | P-value | % Ratio |
|---|---|---|---|---|---|---|---|---|---|
| Fatal | 127 | | 1130 | | | | | | |
| "A" - Incapacitating | 694 | | 6465 | | | | | | |
| **# of Incapacitating and Fatal Injuries by Vehicle Type** | **Frequency** | **%** | **Frequency** | **%** | $X_w$ | **Error** | **Z** | **P-value** | **% Ratio** |
| Car | 116 | 14.1 | 2650 | 34.9 | 2402.5 | 88.3 | 28.7 | 0.00 | 0.40 |
| ATV | 167 | 20.3 | 148 | 2.0 | 149.9 | 5.5 | 3.5 | 0.00 | 10.42 |
| Motorcycle | 38 | 4.6 | 747 | 9.8 | 677.7 | 24.9 | 28.5 | 0.00 | 0.47 |
| Pickup | 139 | 16.9 | 925 | 12.2 | 848.2 | 31.1 | 25.2 | 0.00 | 1.39 |
| Pickup/Van/Panel/SUV | 196 | 23.9 | 1562 | 20.6 | 1428.6 | 52.5 | 26.0 | 0.00 | 1.16 |
| SUV/Crossover | 119 | 14.5 | 875 | 11.5 | 801.2 | 29.4 | 25.7 | 0.00 | 1.26 |
| Other | 46 | 5.6 | 677 | 8.9 | 615.4 | 22.6 | 27.9 | 0.00 | 0.63 |
| **# of Fatal Injuries by Vehicle Type** | **Frequency** | **%** | **Frequency** | **%** | $X_w$ | **Error** | **Z** | **P-value** | **% Ratio** |
| Car | 21 | 16.5 | 370 | 32.7 | 334.7 | 31.3 | 11.2 | 0.00 | 0.51 |
| ATV | 30 | 23.6 | 23 | 2.0 | 23.7 | 2.2 | 3.2 | 0.0022 | 11.61 |
| Motorcycle | 2 | 1.6 | 118 | 10.4 | 106.3 | 9.9 | 11.7 | 0.00 | 0.15 |
| Pickup | 28 | 22.0 | 157 | 13.9 | 144.0 | 13.4 | 9.6 | 0.00 | 1.59 |
| Pickup/Van/Panel/SUV | 29 | 22.8 | 228 | 20.2 | 207.9 | 19.4 | 10.3 | 0.00 | 1.13 |
| SUV/Crossover | 15 | 11.8 | 133 | 11.8 | 121.1 | 11.3 | 10.5 | 0.00 | 1.00 |
| Other | 2 | 1.6 | 101 | 8.9 | 91.0 | 8.5 | 11.7 | 0.00 | 0.18 |
| **Age ("A" Severity and Fatal)** | **Frequency** | **%** | **Frequency** | **%** | $X_w$ | **Error** | **Z** | **P-value** | **% Ratio** |
| 14 yrs & Under | 43 | 5.3 | 26 | 0.3 | 27.7 | 1.0 | 17.0 | 0.00 | 15.31 |
| 15 to 24 yrs | 293 | 36.0 | 2157 | 28.6 | 1974.1 | 72.5 | 25.7 | 0.00 | 1.26 |
| 25 to 34 yrs | 164 | 20.1 | 1425 | 18.9 | 1301.3 | 47.8 | 26.4 | 0.00 | 1.07 |
| 35 to 44 yrs | 118 | 14.5 | 1114 | 14.8 | 1016.3 | 37.3 | 26.7 | 0.00 | 0.98 |
| 45 to 54 yrs | 79 | 9.7 | 1042 | 13.8 | 947.5 | 34.8 | 27.7 | 0.00 | 0.70 |
| 55 to 64 yrs | 72 | 8.8 | 891 | 11.8 | 810.6 | 29.8 | 27.5 | 0.00 | 0.75 |
| 65 to 74 yrs | 29 | 3.6 | 551 | 7.3 | 499.8 | 18.3 | 28.4 | 0.00 | 0.49 |
| 75 & Older | 17 | 2.1 | 340 | 4.5 | 308.3 | 11.3 | 28.6 | 0.00 | 0.46 |

**Table 4.4 (Cont.) Proportion analysis of a variety of factors for fatal and severe injury crashes on paved and unpaved roads in Idaho**

| Drug and Alcohol Involved | Frequency (unpaved) | % | Frequency (Paved) | % | $X_w$ | Error | Z | P-value | % Ratio |
|---|---|---|---|---|---|---|---|---|---|
| Impaired | 158 | 19.2 | 1007 | 13.3 | 924.1 | 33.9 | 25.0 | 0.00 | 1.45 |
| Unimpaired | 663 | 80.8 | 6577 | 86.7 | 5999.3 | 220.4 | 26.8 | 0.00 | 0.93 |
| **Protection Device** | **Frequency** | **%** | **Frequency** | **%** | **$X_w$** | **Error** | **Z** | **P-value** | **% Ratio** |
| Air Bag Activated- Belts In Use | 10 | 1.2 | 648 | 8.5 | 585.7 | 21.5 | 29.7 | 0.00 | 0.14 |
| Air Bag Activated- No Belts In Use | 20 | 2.4 | 177 | 2.3 | 161.7 | 5.9 | 26.5 | 0.00 | 1.04 |
| Helmet Used | 67 | 8.2 | 469 | 6.2 | 429.7 | 15.8 | 25.5 | 0.00 | 1.32 |
| No Helmet | 84 | 10.2 | 236 | 3.1 | 221.2 | 8.1 | 18.7 | 0.00 | 3.29 |
| Non-Activated Air Bag- Belts In Use | 28 | 3.4 | 615 | 8.1 | 557.7 | 20.5 | 28.7 | 0.00 | 0.42 |
| Non-Activated Air Bag- No Belts In Use | 36 | 4.4 | 195 | 2.6 | 179.5 | 6.6 | 24.2 | 0.00 | 1.71 |
| None | 330 | 40.2 | 1902 | 25.1 | 1748.4 | 64.2 | 24.5 | 0.00 | 1.60 |
| Shoulder and Lap | 154 | 18.8 | 2792 | 36.8 | 2534.3 | 93.1 | 28.3 | 0.00 | 0.51 |
| Shoulder Belt Only | 4 | 0.5 | 63 | 0.8 | 57.2 | 2.1 | 28.3 | 0.00 | 0.59 |
| Unknown/Other | 88 | 10.7 | 487 | 6.4 | 448.0 | 16.4 | 24.3 | 0.00 | 1.67 |
| **Light Conditions** | **Frequency** | **%** | **Frequency** | **%** | **$X_w$** | **Error** | **Z** | **P-value** | **% Ratio** |
| Dark, No Street Lights | 223 | 27.16 | 2077 | 27.39 | 1895.9 | 69.6 | 26.6 | 0.00 | 0.99 |
| Dark, Street Lights Off | 1 | 0.122 | 32 | 0.422 | 29.0 | 1.0 | 29.6 | 0.00 | 0.29 |
| Dark, Street Lights On | 1 | 0.122 | 126 | 1.661 | 113.8 | 4.2 | 30.0 | 0.00 | 0.07 |
| Dawn or Dusk | 52 | 6.334 | 372 | 4.905 | 340.7 | 12.5 | 25.6 | 0.00 | 1.29 |
| Day | 535 | 65.16 | 4966 | 65.48 | 4533.2 | 166.5 | 26.6 | 0.00 | 1.00 |
| Unknown | 9 | 1.096 | 11 | 0.145 | 10.8 | 0.4 | 5.3 | 0.00 | 7.56 |
| **Weather Conditions** | **Frequency** | **%** | **Frequency** | **%** | **$X_w$** | **Error** | **Z** | **P-value** | **% Ratio** |
| Blowing Snow | 4 | 0.487 | 59 | 0.778 | 53.6 | 2.0 | 28.2 | 0.00 | 0.63 |
| Clear | 654 | 79.66 | 4993 | 65.84 | 4569.2 | 167.9 | 25.8 | 0.00 | 1.21 |
| Cloudy | 122 | 14.86 | 1613 | 21.27 | 1467.4 | 53.9 | 27.7 | 0.00 | 0.70 |
| Fog | 6 | 0.731 | 104 | 1.371 | 94.4 | 3.5 | 28.4 | 0.00 | 0.53 |
| Rain | 19 | 2.314 | 325 | 4.285 | 295.1 | 10.8 | 28.3 | 0.00 | 0.54 |
| Smoke/Smog | 2 | 0.244 | 10 | 0.132 | 9.2 | 0.3 | 25.0 | 0.00 | 1.85 |
| Snow | 8 | 0.974 | 361 | 4.76 | 326.5 | 12.0 | 29.5 | 0.00 | 0.20 |

**Table 4.4 (Cont.) Proportion analysis of a variety of factors for fatal and severe injury crashes on paved and unpaved roads in Idaho**

| Contributing Circumstances | Frequency (unpaved) | % | Frequency (paved) | % | $X_w$ | Error | Z | P-value | % Ratio |
|---|---|---|---|---|---|---|---|---|---|
| Alcohol Impaired | 146 | 17.78 | 921 | 12.14 | 845.3 | 31.0 | 25.0 | 0.00 | 1.46 |
| Animal(s) in Roadway | 4 | 0.487 | 138 | 1.82 | 124.9 | 4.6 | 29.3 | 0.00 | 0.27 |
| Asleep, Drowsy, Fatigued | 6 | 0.731 | 444 | 5.854 | 401.2 | 14.7 | 29.8 | 0.00 | 0.12 |
| Distracted IN or ON Vehicle | 19 | 2.314 | 159 | 2.097 | 145.3 | 5.3 | 26.3 | 0.00 | 1.10 |
| Drove Left of Center | 38 | 4.629 | 397 | 5.235 | 361.9 | 13.3 | 27.0 | 0.00 | 0.88 |
| Drug Impaired | 12 | 1.462 | 86 | 1.134 | 78.8 | 2.9 | 25.7 | 0.00 | 1.29 |
| Emotional ƒ?? Depressed, Angry, Disturbed | 2 | 0.244 | 19 | 0.251 | 17.3 | 0.6 | 27.5 | 0.00 | 0.97 |
| Exceeded Posted Speed | 24 | 2.923 | 147 | 1.938 | 135.0 | 4.9 | 24.9 | 0.00 | 1.51 |
| Failed to Maintain Lane | 48 | 5.847 | 516 | 6.804 | 470.3 | 17.3 | 27.1 | 0.00 | 0.86 |
| Failed to Obey Stop Sign | 3 | 0.365 | 128 | 1.688 | 115.8 | 4.2 | 29.5 | 0.00 | 0.22 |
| Failed to Yield | 7 | 0.853 | 343 | 4.523 | 310.2 | 11.4 | 29.5 | 0.00 | 0.19 |
| Following Too Close | 3 | 0.365 | 104 | 1.371 | 94.1 | 3.4 | 29.4 | 0.00 | 0.27 |
| Foot Slipped Off or Caught On Pedal | 1 | 0.122 | 2 | 0.026 | 1.9 | 0.0 | 20.8 | 0.00 | 4.62 |
| Improper Backing | 3 | 0.365 | 20 | 0.264 | 18.3 | 0.7 | 25.9 | 0.00 | 1.39 |
| Improper Overtaking | 1 | 0.122 | 87 | 1.147 | 78.6 | 2.9 | 30.0 | 0.00 | 0.11 |
| Improper Turn | 7 | 0.853 | 47 | 0.62 | 43.1 | 1.6 | 25.6 | 0.00 | 1.38 |
| Improperly Parked | 3 | 0.365 | 2 | 0.026 | 2.1 | 0.1 | 17.9 | 0.00 | 13.86 |
| Inattention | 117 | 14.25 | 1143 | 15.07 | 1042.8 | 38.3 | 26.8 | 0.00 | 0.95 |
| Other | 31 | 3.776 | 511 | 6.738 | 464.1 | 17.0 | 28.2 | 0.00 | 0.56 |
| Other Vehicle Defect | 15 | 1.827 | 48 | 0.633 | 44.8 | 1.6 | 20.3 | 0.00 | 2.89 |
| Overcorrected | 49 | 5.968 | 381 | 5.024 | 348.6 | 12.8 | 26.0 | 0.00 | 1.19 |
| Physical Impairment | 2 | 0.244 | 22 | 0.29 | 20.0 | 0.7 | 27.9 | 0.00 | 0.84 |
| Sick | 1 | 0.122 | 39 | 0.514 | 35.3 | 1.3 | 29.7 | 0.00 | 0.24 |
| Speed Too Fast For Conditions | 199 | 24.24 | 1070 | 14.11 | 984.9 | 36.2 | 24.1 | 0.00 | 1.72 |
| Steering | 2 | 0.244 | 6 | 0.079 | 5.6 | 0.2 | 21.4 | 0.00 | 3.08 |
| Unknown | 59 | 7.186 | 722 | 9.52 | 657.2 | 24.1 | 27.5 | 0.00 | 0.75 |
| Vision Obstruction | 17 | 2.071 | 62 | 0.818 | 57.6 | 2.1 | 21.4 | 0.00 | 2.53 |
| Wrong Side or Wrong Way | 2 | 0.244 | 20 | 0.264 | 18.2 | 0.7 | 27.6 | 0.00 | 0.92 |

# CHAPTER 5. COUNTY-BASED RELATIVE CRASH RATE ANALYSIS FOR RURAL CRASHES IN IDAHO

## 5.1. Overview

This chapter presents the results of county-based relative crash rate analysis for rural crashes in Idaho conducted using four area-based exposure measures. The four exposure measures used to estimate crash rates for each of the 44 counties in Idaho include number of registered drivers, number of registered passenger vehicles, total population based on 2010 census, and total length of roadway network. Driver's license registration and registered passenger vehicles were obtained from the Department of Motor Vehicles, 2010 Population estimates were obtained from the US Census and the total length of the roadways was calculated in ArcGIS 10.2 using the state and local roadways network datasets provided by the Idaho Transportation Department.

## 5.2. Analysis and Results

RITI communities are often located in areas that are not accessible by high volume transportation corridors such as Highways and Interstates and therefore actual vehicle counts on the roadways are in many cases unknown or not up-to-date. In this study, four area-based exposure measures were used to estimate the amount of traffic that would be expected within each of the 44 counties in Idaho including the population of the county, the total miles of roadways in the county, the total number of driver's licenses in the county and the total number of vehicles registered in the county. These area-based metrics, however, are not without their shortcomings, as the vehicle crash rates can only be applied within the boundary of each county and at the spatial scale of individual counties. They do not capture the variability of crash rates within the county or describe relationships between the traffic volumes of different counties. Nevertheless, they serve as important indicators of the overall trends of rural crash rates in Idaho.

Table 5-1 lists the four exposure measures used to estimate crash rates for each of the 44 counties in Idaho. Table 5-2 through Table 5-5 and Figure 5-1 through 5-4 present crash rates for total crashes, number of vehicles involved in crashes, fatal and severe injury crashes, and injury crashes for rural crashes in Idaho. The results in the Figures are presented as choropleth maps with values classified using the Standard Deviation of the exposure measure values. These maps show that that the distribution of crashes among counties in Idaho is uneven, with higher rates occurring in more rural areas with lower population counts. It is important to note that the number of registered vehicles and number of driver licenses issued are related to population estimates and the vehicle crash rate is likely influenced by these smaller values to normalize the rate by. The number of miles of road within a county provides a unique way of verifying which counties experience higher or lower vehicle crash rates.

The results presented in Figure 5-1 indicate that Boise County, Custer County and Clark Count as having the highest number of Fatal and A severity crashes according to population-based metrics. The road-based metric indicates that Jerome County in the southern part of the state has a significantly higher crash rate. This could be explained by the small and relatively compact size of the county which would influence the final result in a similar fashion as the low population density in Boise County. Figures 5-2 through 5-4 show a similar distribution of values with higher values concentrated in the central portion of the state and smaller values along the periphery of the State with higher population values and larger County size.

Results of the analysis show consistent results. Boise County and Clark County have consistently high rural crash rates compared to the State average. Other counties that showed highest relative crash rates but produce less consistent results include Custer County and Lincoln County. A more formal statistical analysis that accounts for the spatial variability of these factors and normalization criteria would be required to demonstrate that these results are statistically significant.

**Table 5-1 Four county-based exposure measures to estimate relative rural crash rates**

| County | Number of Registered Drivers | Number of Registered Vehicles | Total Population (2010) | Total Length of Roadway Network |
|---|---|---|---|---|
| Ada | 278,182 | 290,266 | 392,365 | 32,923 |
| Adams | 2,624 | 3,767 | 3,976 | 1,550 |
| Bannock | 54,473 | 61,571 | 82,839 | 10,701 |
| Bear Lake | 4,509 | 6,121 | 5,986 | 1,785 |
| Benewah | 7,915 | 9,390 | 9,285 | 1,489 |
| Bingham | 27,778 | 37,801 | 45,607 | 7,105 |
| Blaine | 16,993 | 21,376 | 21,376 | 9,208 |
| Boise | 5,141 | 7,297 | 7,028 | 1,428 |
| Bonner | 32,091 | 38,188 | 40,877 | 7,286 |
| Bonneville | 69,020 | 87,375 | 104,234 | 15,573 |
| Boundary | 8,214 | 10,119 | 10,972 | 1,747 |
| Butte | 2,833 | 2,570 | 2,891 | 1,624 |
| Camas | 762 | 1,168 | 1,117 | 651 |
| Canyon | 106,279 | 141,012 | 188,923 | 14,205 |
| Caribou | 5,659 | 6,723 | 6,963 | 2,304 |
| Cassia | 16,958 | 18,119 | 22,952 | 4,098 |
| Clark | 1,165 | 858 | 982 | 1,201 |
| Clearwater | 7,356 | 7,840 | 8,761 | 2,635 |
| Custer | 2,666 | 4,389 | 4,368 | 3,776 |
| Elmore | 15,766 | 21,885 | 27,038 | 6,950 |
| Franklin | 9,533 | 11,109 | 12,786 | 1,390 |
| Fremont | 8,031 | 10,679 | 13,242 | 4,673 |
| Gem | 13,787 | 15,263 | 16,719 | 1,471 |
| Gooding | 8,823 | 13,041 | 15,464 | 1,673 |
| Idaho | 11,058 | 13,767 | 16,267 | 11,478 |
| Jefferson | 15,928 | 21,180 | 26,140 | 2,652 |
| Jerome | 13,357 | 18,536 | 22,374 | 1,596 |
| Kootenai | 102,912 | 123,648 | 138,494 | 10,256 |
| Latah | 25,268 | 25,896 | 37,244 | 3,935 |
| Lemhi | 6,204 | 7,577 | 7,936 | 5,040 |
| Lewis | 2,407 | 3,839 | 3,821 | 1,486 |
| Lincoln | 3,549 | 4,336 | 5,208 | 1,099 |
| Madison | 20,776 | 19,577 | 37,536 | 1,770 |
| Minidoka | 11,471 | 17,853 | 20,069 | 2,201 |
| Nez Perce | 30,280 | 33,762 | 39,265 | 4,561 |
| Oneida | 3,840 | 4,011 | 4,286 | 1,356 |
| Owyhee | 10,557 | 10,442 | 11,526 | 4,910 |
| Payette | 17,566 | 18,958 | 22,623 | 1,437 |
| Power | 6,427 | 7,313 | 7,817 | 2,830 |
| Shoshone | 9,936 | 12,889 | 12,765 | 5,439 |
| Teton | 6,751 | 8,337 | 10,170 | 1,236 |
| Twin Falls | 53,103 | 63,090 | 77,230 | 10,296 |
| Valley | 9,071 | 10,312 | 9,862 | 6,576 |
| Washington | 6,859 | 8,707 | 10,198 | 1,809 |
| Total | 1,073,878 | 1,261,957 | 1,567,582 | 219,409 |

## Table 5-2 Rural crashes in different counties in Idaho relative to the number of registered drivers

| County | Number of Crashes | Number of Vehicles involved | Number of Fatalities | Number of Injuries | Number of Registered Drivers | Relative Crash Rate (Crash/1000 Registered Drivers) | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Number of Crashes | Number of Vehicles involved | Number of Fatalities | Number of Injuries |
| Ada | 636 | 1,142 | 65 | 1,042 | 278,182 | 2.29 | 4.11 | 0.23 | 3.75 |
| Adams | 56 | 78 | 21 | 83 | 2,624 | 21.34 | 29.73 | 8.00 | 31.63 |
| Bannock | 227 | 314 | 53 | 389 | 54,473 | 4.17 | 5.76 | 0.97 | 7.14 |
| Bear Lake | 67 | 90 | 20 | 117 | 4,509 | 14.86 | 19.96 | 4.44 | 25.95 |
| Benewah | 88 | 114 | 23 | 128 | 7,915 | 11.12 | 14.40 | 2.91 | 16.17 |
| Bingham | 330 | 495 | 89 | 529 | 27,778 | 11.88 | 17.82 | 3.20 | 19.04 |
| Blaine | 74 | 112 | 22 | 125 | 16,993 | 4.35 | 6.59 | 1.29 | 7.36 |
| Boise | 284 | 346 | 55 | 393 | 5,141 | 55.24 | 67.30 | 10.70 | 76.44 |
| Bonner | 358 | 532 | 82 | 518 | 32,091 | 11.16 | 16.58 | 2.56 | 16.14 |
| Bonneville | 314 | 510 | 57 | 564 | 69,020 | 4.55 | 7.39 | 0.83 | 8.17 |
| Boundary | 96 | 132 | 19 | 159 | 8,214 | 11.69 | 16.07 | 2.31 | 19.36 |
| Butte | 42 | 56 | 8 | 74 | 2,833 | 14.83 | 19.77 | 2.82 | 26.12 |
| Camas | 12 | 15 | 5 | 15 | 762 | 15.75 | 19.69 | 6.56 | 19.69 |
| Canyon | 757 | 1,333 | 136 | 1,346 | 106,279 | 7.12 | 12.54 | 1.28 | 12.66 |
| Caribou | 53 | 70 | 20 | 84 | 5,659 | 9.37 | 12.37 | 3.53 | 14.84 |
| Cassia | 206 | 290 | 66 | 327 | 16,958 | 12.15 | 17.10 | 3.89 | 19.28 |
| Clark | 41 | 54 | 15 | 64 | 1,165 | 35.19 | 46.35 | 12.88 | 54.94 |
| Clearwater | 65 | 82 | 15 | 91 | 7,356 | 8.84 | 11.15 | 2.04 | 12.37 |
| Custer | 97 | 110 | 29 | 110 | 2,666 | 36.38 | 41.26 | 10.88 | 41.26 |
| Elmore | 406 | 555 | 94 | 664 | 15,766 | 25.75 | 35.20 | 5.96 | 42.12 |
| Franklin | 95 | 124 | 22 | 163 | 9,533 | 9.97 | 13.01 | 2.31 | 17.10 |
| Fremont | 111 | 173 | 28 | 230 | 8,031 | 13.82 | 21.54 | 3.49 | 28.64 |
| Gem | 86 | 124 | 18 | 135 | 13,787 | 6.24 | 8.99 | 1.31 | 9.79 |
| Gooding | 158 | 211 | 45 | 238 | 8,823 | 17.91 | 23.91 | 5.10 | 26.97 |
| Idaho | 264 | 321 | 79 | 347 | 11,058 | 23.87 | 29.03 | 7.14 | 31.38 |
| Jefferson | 117 | 170 | 27 | 196 | 15,928 | 7.35 | 10.67 | 1.70 | 12.31 |
| Jerome | 266 | 424 | 82 | 491 | 13,357 | 19.91 | 31.74 | 6.14 | 36.76 |
| Kootenai | 558 | 868 | 96 | 884 | 102,912 | 5.42 | 8.43 | 0.93 | 8.59 |
| Latah | 207 | 291 | 45 | 331 | 25,268 | 8.19 | 11.52 | 1.78 | 13.10 |
| Lemhi | 104 | 122 | 27 | 141 | 6,204 | 16.76 | 19.66 | 4.35 | 22.73 |
| Lewis | 42 | 58 | 11 | 61 | 2,407 | 17.45 | 24.10 | 4.57 | 25.34 |
| Lincoln | 61 | 84 | 23 | 88 | 3,549 | 17.19 | 23.67 | 6.48 | 24.80 |
| Madison | 81 | 141 | 21 | 161 | 20,776 | 3.90 | 6.79 | 1.01 | 7.75 |
| Minidoka | 126 | 192 | 42 | 206 | 11,471 | 10.98 | 16.74 | 3.66 | 17.96 |
| Nez Perce | 198 | 284 | 50 | 305 | 30,280 | 6.54 | 9.38 | 1.65 | 10.07 |
| Oneida | 49 | 54 | 17 | 82 | 3,840 | 12.76 | 14.06 | 4.43 | 21.35 |
| Owyhee | 84 | 98 | 26 | 133 | 10,557 | 7.96 | 9.28 | 2.46 | 12.60 |
| Payette | 178 | 265 | 34 | 287 | 17,566 | 10.13 | 15.09 | 1.94 | 16.34 |
| Power | 99 | 126 | 35 | 170 | 6,427 | 15.40 | 19.60 | 5.45 | 26.45 |
| Shoshone | 119 | 155 | 36 | 155 | 9,936 | 11.98 | 15.60 | 3.62 | 15.60 |
| Teton | 39 | 59 | 7 | 52 | 6,751 | 5.78 | 8.74 | 1.04 | 7.70 |
| Twin Falls | 389 | 618 | 90 | 622 | 53,103 | 7.33 | 11.64 | 1.69 | 11.71 |
| Valley | 149 | 194 | 18 | 230 | 9,071 | 16.43 | 21.39 | 1.98 | 25.36 |
| Washington | 70 | 99 | 17 | 96 | 6,859 | 10.21 | 14.43 | 2.48 | 14.00 |
| **Average** | **178.61** | **265.57** | **40.68** | **286.95** | **24,406.32** | **13.67** | **18.41** | **3.73** | **20.88** |

## Table 5-3 Rural crashes in different counties in Idaho relative to the number of registered vehicles

| County | Number of Crashes | Number of Vehicles involved | Number of Fatalities | Number of Injuries | Number of Registered Vehicles | Relative Crash Rate (Crash/1000 Registered Vehicles) | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Number of Crashes | Number of Vehicles involved | Number of Fatalities | Number of Injuries |
| Ada | 636 | 1,142 | 65 | 1,042 | 290,266 | 2.19 | 3.93 | 0.22 | 3.59 |
| Adams | 56 | 78 | 21 | 83 | 3,767 | 14.87 | 20.71 | 5.58 | 22.03 |
| Bannock | 227 | 314 | 53 | 389 | 61,571 | 3.69 | 5.10 | 0.86 | 6.32 |
| Bear Lake | 67 | 90 | 20 | 117 | 6,121 | 10.95 | 14.70 | 3.27 | 19.12 |
| Benewah | 88 | 114 | 23 | 128 | 9,390 | 9.37 | 12.14 | 2.45 | 13.63 |
| Bingham | 330 | 495 | 89 | 529 | 37,801 | 8.73 | 13.10 | 2.35 | 13.99 |
| Blaine | 74 | 112 | 22 | 125 | 21,376 | 3.46 | 5.24 | 1.03 | 5.85 |
| Boise | 284 | 346 | 55 | 393 | 7,297 | 38.92 | 47.42 | 7.54 | 53.86 |
| Bonner | 358 | 532 | 82 | 518 | 38,188 | 9.38 | 13.93 | 2.15 | 13.56 |
| Bonneville | 314 | 510 | 57 | 564 | 87,375 | 3.59 | 5.84 | 0.65 | 6.46 |
| Boundary | 96 | 132 | 19 | 159 | 10,119 | 9.49 | 13.05 | 1.88 | 15.71 |
| Butte | 42 | 56 | 8 | 74 | 2,570 | 16.34 | 21.79 | 3.11 | 28.79 |
| Camas | 12 | 15 | 5 | 15 | 1,168 | 10.27 | 12.84 | 4.28 | 12.84 |
| Canyon | 757 | 1,333 | 136 | 1,346 | 141,012 | 5.37 | 9.45 | 0.96 | 9.55 |
| Caribou | 53 | 70 | 20 | 84 | 6,723 | 7.88 | 10.41 | 2.98 | 12.49 |
| Cassia | 206 | 290 | 66 | 327 | 18,119 | 11.37 | 16.01 | 3.64 | 18.05 |
| Clark | 41 | 54 | 15 | 64 | 858 | 47.79 | 62.94 | 17.48 | 74.59 |
| Clearwater | 65 | 82 | 15 | 91 | 7,840 | 8.29 | 10.46 | 1.91 | 11.61 |
| Custer | 97 | 110 | 29 | 110 | 4,389 | 22.10 | 25.06 | 6.61 | 25.06 |
| Elmore | 406 | 555 | 94 | 664 | 21,885 | 18.55 | 25.36 | 4.30 | 30.34 |
| Franklin | 95 | 124 | 22 | 163 | 11,109 | 8.55 | 11.16 | 1.98 | 14.67 |
| Fremont | 111 | 173 | 28 | 230 | 10,679 | 10.39 | 16.20 | 2.62 | 21.54 |
| Gem | 86 | 124 | 18 | 135 | 15,263 | 5.64 | 8.12 | 1.18 | 8.85 |
| Gooding | 158 | 211 | 45 | 238 | 13,041 | 12.12 | 16.18 | 3.45 | 18.25 |
| Idaho | 264 | 321 | 79 | 347 | 13,767 | 19.18 | 23.32 | 5.74 | 25.21 |
| Jefferson | 117 | 170 | 27 | 196 | 21,180 | 5.52 | 8.03 | 1.28 | 9.25 |
| Jerome | 266 | 424 | 82 | 491 | 18,536 | 14.35 | 22.87 | 4.42 | 26.49 |
| Kootenai | 558 | 868 | 96 | 884 | 123,648 | 4.51 | 7.02 | 0.78 | 7.15 |
| Latah | 207 | 291 | 45 | 331 | 25,896 | 7.99 | 11.24 | 1.74 | 12.78 |
| Lemhi | 104 | 122 | 27 | 141 | 7,577 | 13.73 | 16.10 | 3.56 | 18.61 |
| Lewis | 42 | 58 | 11 | 61 | 3,839 | 10.94 | 15.11 | 2.87 | 15.89 |
| Lincoln | 61 | 84 | 23 | 88 | 4,336 | 14.07 | 19.37 | 5.30 | 20.30 |
| Madison | 81 | 141 | 21 | 161 | 19,577 | 4.14 | 7.20 | 1.07 | 8.22 |
| Minidoka | 126 | 192 | 42 | 206 | 17,853 | 7.06 | 10.75 | 2.35 | 11.54 |
| Nez Perce | 198 | 284 | 50 | 305 | 33,762 | 5.87 | 8.41 | 1.48 | 9.03 |
| Oneida | 49 | 54 | 17 | 82 | 4,011 | 12.22 | 13.46 | 4.24 | 20.44 |
| Owyhee | 84 | 98 | 26 | 133 | 10,442 | 8.04 | 9.39 | 2.49 | 12.74 |
| Payette | 178 | 265 | 34 | 287 | 18,958 | 9.39 | 13.98 | 1.79 | 15.14 |
| Power | 99 | 126 | 35 | 170 | 7,313 | 13.54 | 17.23 | 4.79 | 23.25 |
| Shoshone | 119 | 155 | 36 | 155 | 12,889 | 9.23 | 12.03 | 2.79 | 12.03 |
| Teton | 39 | 59 | 7 | 52 | 8,337 | 4.68 | 7.08 | 0.84 | 6.24 |
| Twin Falls | 389 | 618 | 90 | 622 | 63,090 | 6.17 | 9.80 | 1.43 | 9.86 |
| Valley | 149 | 194 | 18 | 230 | 10,312 | 14.45 | 18.81 | 1.75 | 22.30 |
| Washington | 70 | 99 | 17 | 96 | 8,707 | 8.04 | 11.37 | 1.95 | 11.03 |
| **Average** | **178.61** | **265.57** | **40.68** | **286.95** | **28,680.84** | **11.19** | **15.08** | **3.07** | **17.23** |

## Table 5-4 Rural crashes in different counties in Idaho relative to the county population

| County | Number of Crashes | Number of Vehicles involved | Number of Fatalities | Number of Injuries | County Population (2010 Census) | Relative Crash Rate (Crash/1000 population) | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Number of Crashes | Number of Vehicles involved | Number of Fatalities | Number of Injuries |
| Ada | 636 | 1,142 | 65 | 1,042 | 392,365 | 1.62 | 2.91 | 0.17 | 2.66 |
| Adams | 56 | 78 | 21 | 83 | 3,976 | 14.09 | 19.62 | 5.28 | 20.88 |
| Bannock | 227 | 314 | 53 | 389 | 82,839 | 2.74 | 3.79 | 0.64 | 4.70 |
| Bear Lake | 67 | 90 | 20 | 117 | 5,986 | 11.19 | 15.04 | 3.34 | 19.55 |
| Benewah | 88 | 114 | 23 | 128 | 9,285 | 9.48 | 12.28 | 2.48 | 13.79 |
| Bingham | 330 | 495 | 89 | 529 | 45,607 | 7.24 | 10.85 | 1.95 | 11.60 |
| Blaine | 74 | 112 | 22 | 125 | 21,376 | 3.46 | 5.24 | 1.03 | 5.85 |
| Boise | 284 | 346 | 55 | 393 | 7,028 | 40.41 | 49.23 | 7.83 | 55.92 |
| Bonner | 358 | 532 | 82 | 518 | 40,877 | 8.76 | 13.02 | 2.01 | 12.67 |
| Bonneville | 314 | 510 | 57 | 564 | 104,234 | 3.01 | 4.89 | 0.55 | 5.41 |
| Boundary | 96 | 132 | 19 | 159 | 10,972 | 8.75 | 12.03 | 1.73 | 14.49 |
| Butte | 42 | 56 | 8 | 74 | 2,891 | 14.53 | 19.37 | 2.77 | 25.60 |
| Camas | 12 | 15 | 5 | 15 | 1,117 | 10.74 | 13.43 | 4.48 | 13.43 |
| Canyon | 757 | 1,333 | 136 | 1,346 | 188,923 | 4.01 | 7.06 | 0.72 | 7.13 |
| Caribou | 53 | 70 | 20 | 84 | 6,963 | 7.61 | 10.05 | 2.87 | 12.06 |
| Cassia | 206 | 290 | 66 | 327 | 22,952 | 8.98 | 12.64 | 2.88 | 14.25 |
| Clark | 41 | 54 | 15 | 64 | 982 | 41.75 | 54.99 | 15.28 | 65.17 |
| Clearwater | 65 | 82 | 15 | 91 | 8,761 | 7.42 | 9.36 | 1.71 | 10.39 |
| Custer | 97 | 110 | 29 | 110 | 4,368 | 22.21 | 25.18 | 6.64 | 25.18 |
| Elmore | 406 | 555 | 94 | 664 | 27,038 | 15.02 | 20.53 | 3.48 | 24.56 |
| Franklin | 95 | 124 | 22 | 163 | 12,786 | 7.43 | 9.70 | 1.72 | 12.75 |
| Fremont | 111 | 173 | 28 | 230 | 13,242 | 8.38 | 13.06 | 2.11 | 17.37 |
| Gem | 86 | 124 | 18 | 135 | 16,719 | 5.14 | 7.42 | 1.08 | 8.08 |
| Gooding | 158 | 211 | 45 | 238 | 15,464 | 10.22 | 13.65 | 2.91 | 15.39 |
| Idaho | 264 | 321 | 79 | 347 | 16,267 | 16.23 | 19.73 | 4.86 | 21.33 |
| Jefferson | 117 | 170 | 27 | 196 | 26,140 | 4.48 | 6.50 | 1.03 | 7.50 |
| Jerome | 266 | 424 | 82 | 491 | 22,374 | 11.89 | 18.95 | 3.67 | 21.95 |
| Kootenai | 558 | 868 | 96 | 884 | 138,494 | 4.03 | 6.27 | 0.69 | 6.38 |
| Latah | 207 | 291 | 45 | 331 | 37,244 | 5.56 | 7.81 | 1.21 | 8.89 |
| Lemhi | 104 | 122 | 27 | 141 | 7,936 | 13.11 | 15.37 | 3.40 | 17.77 |
| Lewis | 42 | 58 | 11 | 61 | 3,821 | 10.99 | 15.18 | 2.88 | 15.96 |
| Lincoln | 61 | 84 | 23 | 88 | 5,208 | 11.71 | 16.13 | 4.42 | 16.90 |
| Madison | 81 | 141 | 21 | 161 | 37,536 | 2.16 | 3.76 | 0.56 | 4.29 |
| Minidoka | 126 | 192 | 42 | 206 | 20,069 | 6.28 | 9.57 | 2.09 | 10.27 |
| Nez Perce | 198 | 284 | 50 | 305 | 39,265 | 5.04 | 7.23 | 1.27 | 7.77 |
| Oneida | 49 | 54 | 17 | 82 | 4,286 | 11.43 | 12.60 | 3.97 | 19.13 |
| Owyhee | 84 | 98 | 26 | 133 | 11,526 | 7.29 | 8.50 | 2.26 | 11.54 |
| Payette | 178 | 265 | 34 | 287 | 22,623 | 7.87 | 11.71 | 1.50 | 12.69 |
| Power | 99 | 126 | 35 | 170 | 7,817 | 12.67 | 16.12 | 4.48 | 21.75 |
| Shoshone | 119 | 155 | 36 | 155 | 12,765 | 9.32 | 12.14 | 2.82 | 12.14 |
| Teton | 39 | 59 | 7 | 52 | 10,170 | 3.84 | 5.80 | 0.69 | 5.11 |
| Twin Falls | 389 | 618 | 90 | 622 | 77,230 | 5.04 | 8.00 | 1.17 | 8.05 |
| Valley | 149 | 194 | 18 | 230 | 9,862 | 15.11 | 19.67 | 1.83 | 23.32 |
| Washington | 70 | 99 | 17 | 96 | 10,198 | 6.86 | 9.71 | 1.67 | 9.41 |
| **Average** | **178.61** | **265.57** | **40.68** | **286.95** | **35,626.86** | **10.12** | **13.55** | **2.77** | **15.48** |

## Table 5-5 Rural crashes in different counties in Idaho relative to the total length of roadways

| County | Number of Crashes | Number of Vehicles involved | Number of Fatalities | Number of Injuries | Total Length of Roadways (miles) | Relative Crash Rate (Crash/1000 miles) | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Number of Crashes | Number of Vehicles involved | Number of Fatalities | Number of Injuries |
| Ada | 636 | 1,142 | 65 | 1,042 | 12,964 | 49.06 | 88.09 | 5.01 | 80.37 |
| Adams | 56 | 78 | 21 | 83 | 610 | 4.32 | 6.02 | 1.62 | 6.40 |
| Bannock | 227 | 314 | 53 | 389 | 4,214 | 17.51 | 24.22 | 4.09 | 30.01 |
| Bear Lake | 67 | 90 | 20 | 117 | 703 | 5.17 | 6.94 | 1.54 | 9.02 |
| Benewah | 88 | 114 | 23 | 128 | 586 | 6.79 | 8.79 | 1.77 | 9.87 |
| Bingham | 330 | 495 | 89 | 529 | 2,798 | 25.45 | 38.18 | 6.86 | 40.80 |
| Blaine | 74 | 112 | 22 | 125 | 3,626 | 5.71 | 8.64 | 1.70 | 9.64 |
| Boise | 284 | 346 | 55 | 393 | 562 | 21.91 | 26.69 | 4.24 | 30.31 |
| Bonner | 358 | 532 | 82 | 518 | 2,869 | 27.61 | 41.04 | 6.32 | 39.96 |
| Bonneville | 314 | 510 | 57 | 564 | 6,132 | 24.22 | 39.34 | 4.40 | 43.50 |
| Boundary | 96 | 132 | 19 | 159 | 688 | 7.40 | 10.18 | 1.47 | 12.26 |
| Butte | 42 | 56 | 8 | 74 | 639 | 3.24 | 4.32 | 0.62 | 5.71 |
| Camas | 12 | 15 | 5 | 15 | 256 | 0.93 | 1.16 | 0.39 | 1.16 |
| Canyon | 757 | 1,333 | 136 | 1,346 | 5,594 | 58.39 | 102.82 | 10.49 | 103.82 |
| Caribou | 53 | 70 | 20 | 84 | 907 | 4.09 | 5.40 | 1.54 | 6.48 |
| Cassia | 206 | 290 | 66 | 327 | 1,614 | 15.89 | 22.37 | 5.09 | 25.22 |
| Clark | 41 | 54 | 15 | 64 | 473 | 3.16 | 4.17 | 1.16 | 4.94 |
| Clearwater | 65 | 82 | 15 | 91 | 1,038 | 5.01 | 6.32 | 1.16 | 7.02 |
| Custer | 97 | 110 | 29 | 110 | 1,487 | 7.48 | 8.48 | 2.24 | 8.48 |
| Elmore | 406 | 555 | 94 | 664 | 2,737 | 31.32 | 42.81 | 7.25 | 51.22 |
| Franklin | 95 | 124 | 22 | 163 | 548 | 7.33 | 9.56 | 1.70 | 12.57 |
| Fremont | 111 | 173 | 28 | 230 | 1,840 | 8.56 | 13.34 | 2.16 | 17.74 |
| Gem | 86 | 124 | 18 | 135 | 579 | 6.63 | 9.56 | 1.39 | 10.41 |
| Gooding | 158 | 211 | 45 | 238 | 659 | 12.19 | 16.28 | 3.47 | 18.36 |
| Idaho | 264 | 321 | 79 | 347 | 4,520 | 20.36 | 24.76 | 6.09 | 26.77 |
| Jefferson | 117 | 170 | 27 | 196 | 1,044 | 9.02 | 13.11 | 2.08 | 15.12 |
| Jerome | 266 | 424 | 82 | 491 | 628 | 20.52 | 32.70 | 6.32 | 37.87 |
| Kootenai | 558 | 868 | 96 | 884 | 4,039 | 43.04 | 66.95 | 7.40 | 68.19 |
| Latah | 207 | 291 | 45 | 331 | 1,550 | 15.97 | 22.45 | 3.47 | 25.53 |
| Lemhi | 104 | 122 | 27 | 141 | 1,985 | 8.02 | 9.41 | 2.08 | 10.88 |
| Lewis | 42 | 58 | 11 | 61 | 585 | 3.24 | 4.47 | 0.85 | 4.71 |
| Lincoln | 61 | 84 | 23 | 88 | 433 | 4.71 | 6.48 | 1.77 | 6.79 |
| Madison | 81 | 141 | 21 | 161 | 697 | 6.25 | 10.88 | 1.62 | 12.42 |
| Minidoka | 126 | 192 | 42 | 206 | 867 | 9.72 | 14.81 | 3.24 | 15.89 |
| Nez Perce | 198 | 284 | 50 | 305 | 1,796 | 15.27 | 21.91 | 3.86 | 23.53 |
| Oneida | 49 | 54 | 17 | 82 | 534 | 3.78 | 4.17 | 1.31 | 6.32 |
| Owyhee | 84 | 98 | 26 | 133 | 1,933 | 6.48 | 7.56 | 2.01 | 10.26 |
| Payette | 178 | 265 | 34 | 287 | 566 | 13.73 | 20.44 | 2.62 | 22.14 |
| Power | 99 | 126 | 35 | 170 | 1,115 | 7.64 | 9.72 | 2.70 | 13.11 |
| Shoshone | 119 | 155 | 36 | 155 | 2,142 | 9.18 | 11.96 | 2.78 | 11.96 |
| Teton | 39 | 59 | 7 | 52 | 487 | 3.01 | 4.55 | 0.54 | 4.01 |
| Twin Falls | 389 | 618 | 90 | 622 | 4,054 | 30.01 | 47.67 | 6.94 | 47.98 |
| Valley | 149 | 194 | 18 | 230 | 2,589 | 11.49 | 14.96 | 1.39 | 17.74 |
| Washington | 70 | 99 | 17 | 96 | 712 | 5.40 | 7.64 | 1.31 | 7.40 |
| **Average** | **178.61** | **265.57** | **40.68** | **286.95** | **1,963.64** | **13.78** | **20.48** | **3.14** | **22.13** |

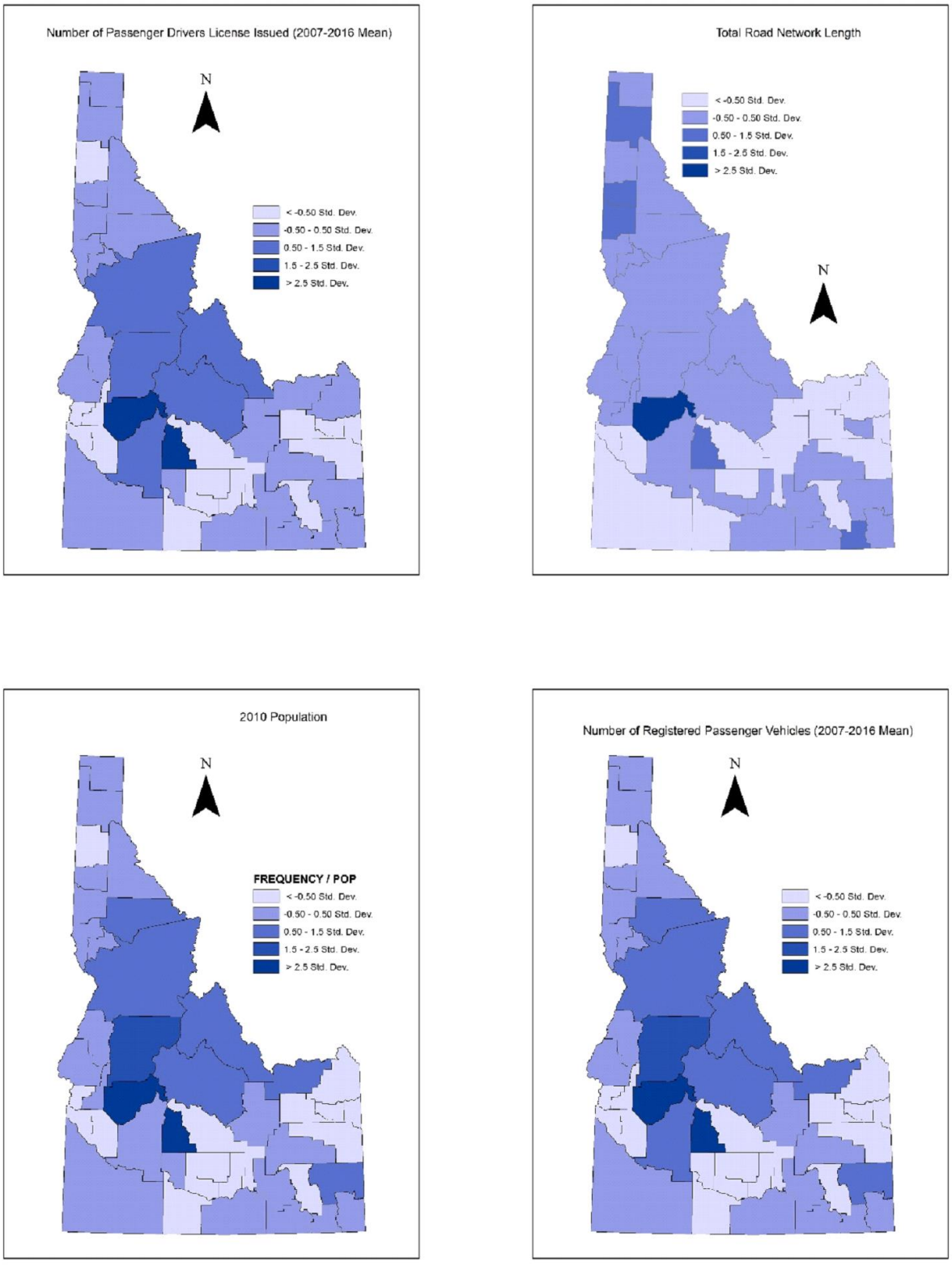
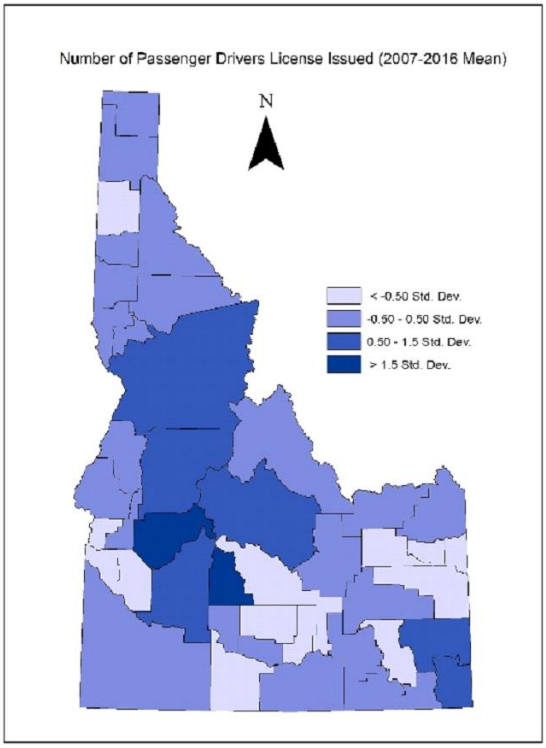
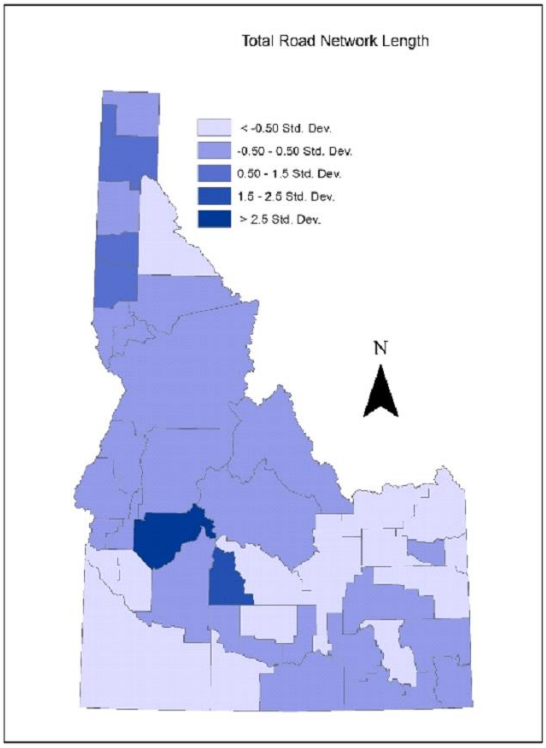
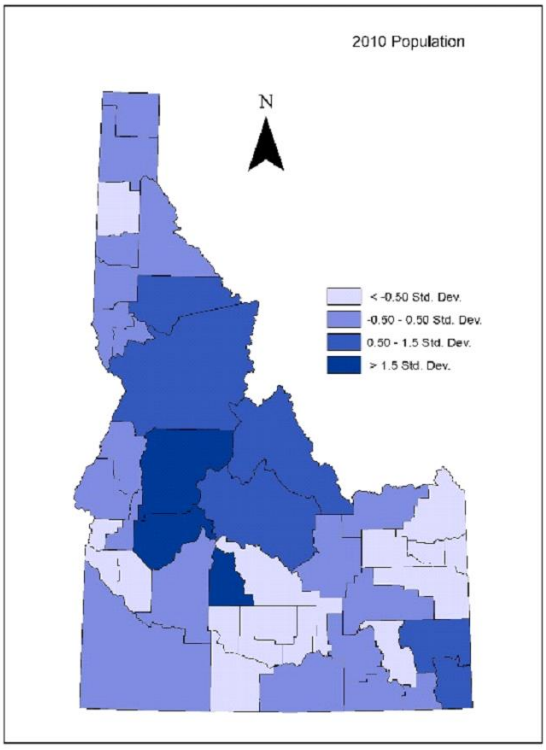



**Figure 5-1 Relative crash rates – total rural crashes in Idaho**



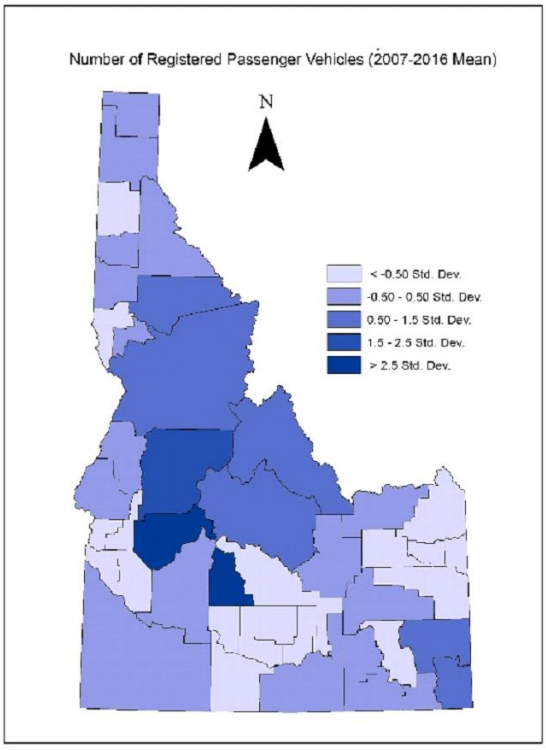




**Figure 5-2 Relative crash rates – fatal and severe injury rural crashes in Idaho**

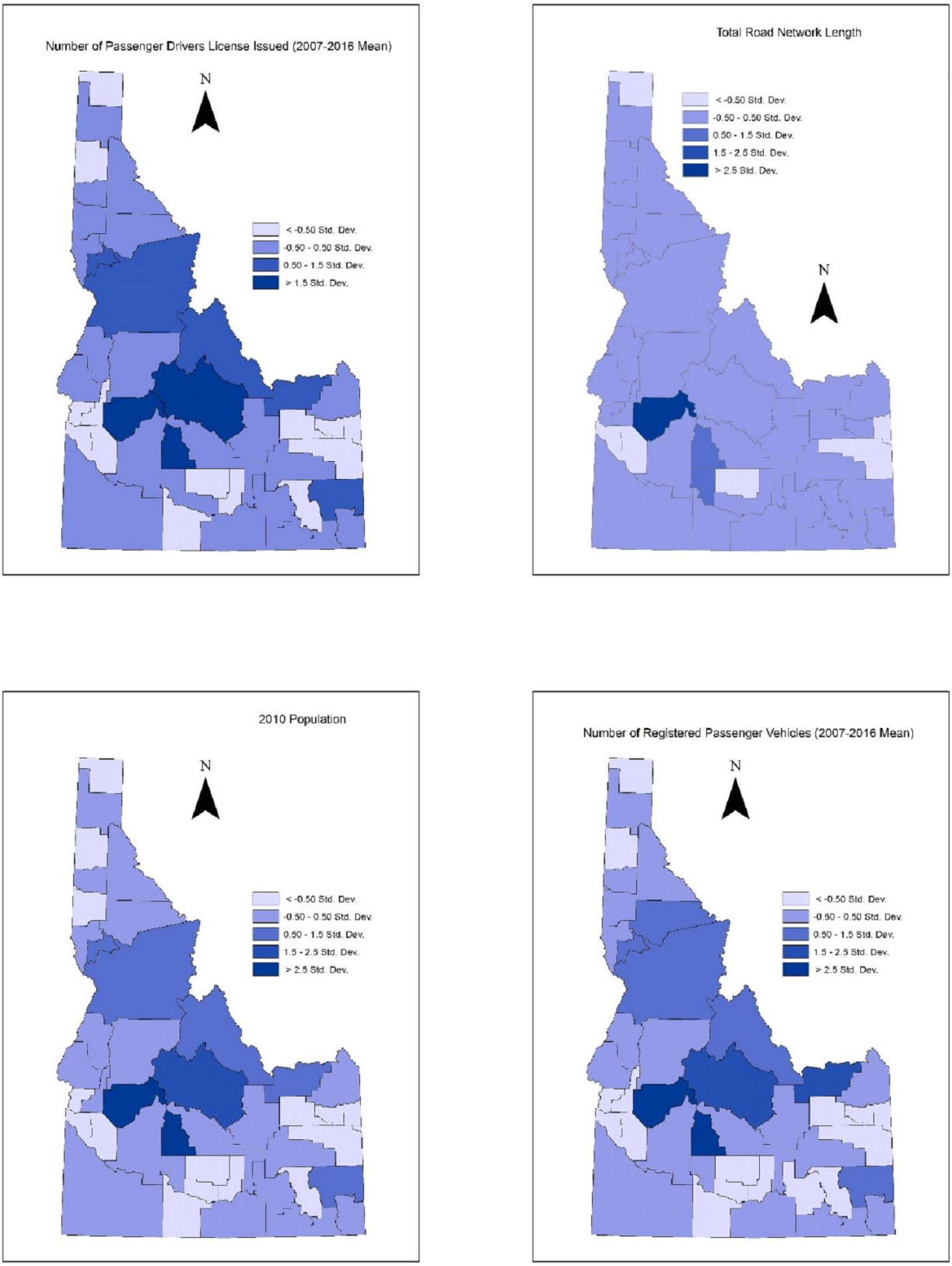
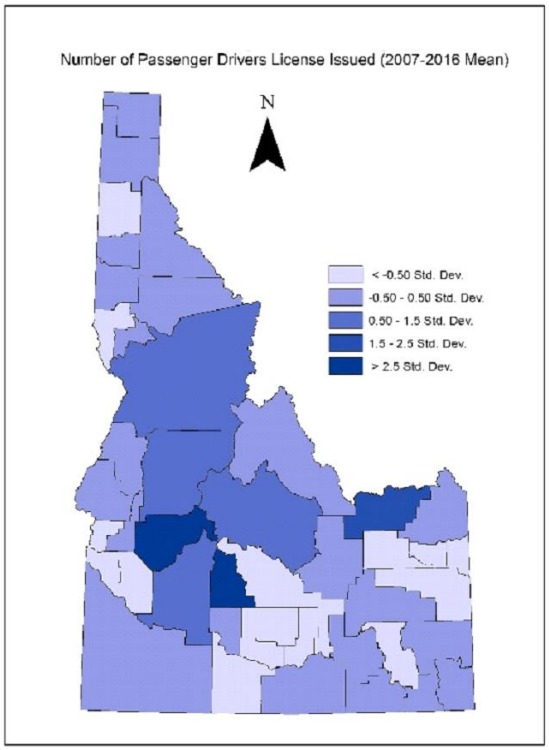
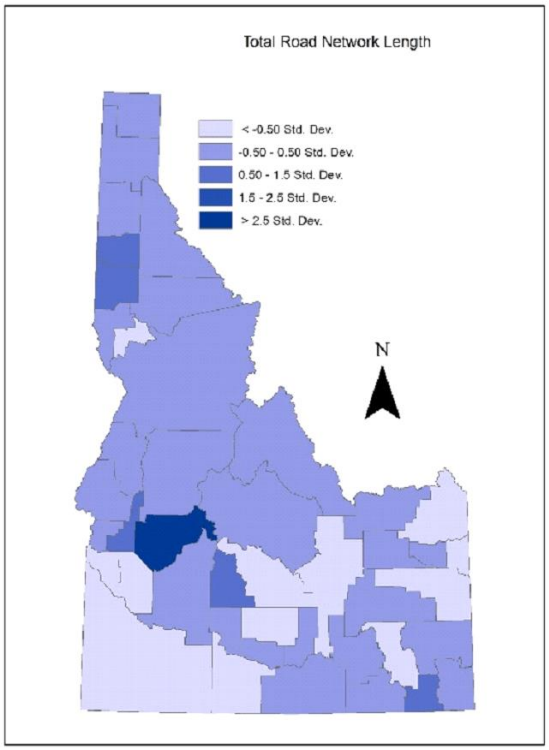
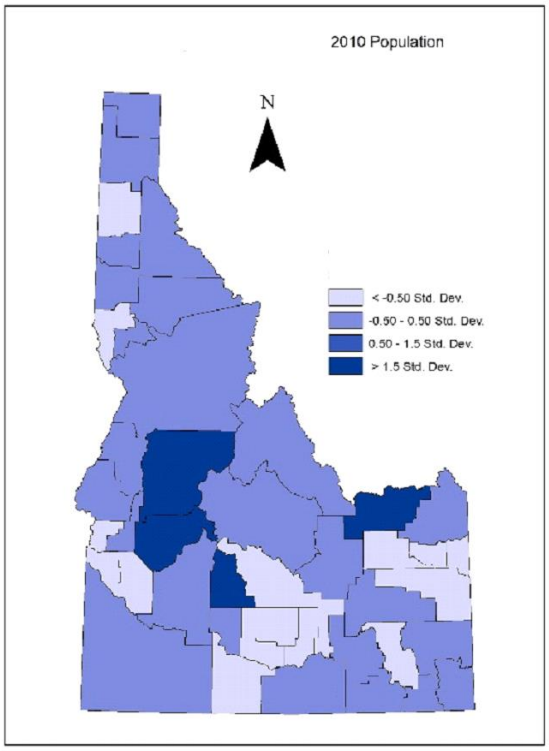



**Figure 5-3 Relative crash rates for number of vehicles involved in rural crashes in Idaho**



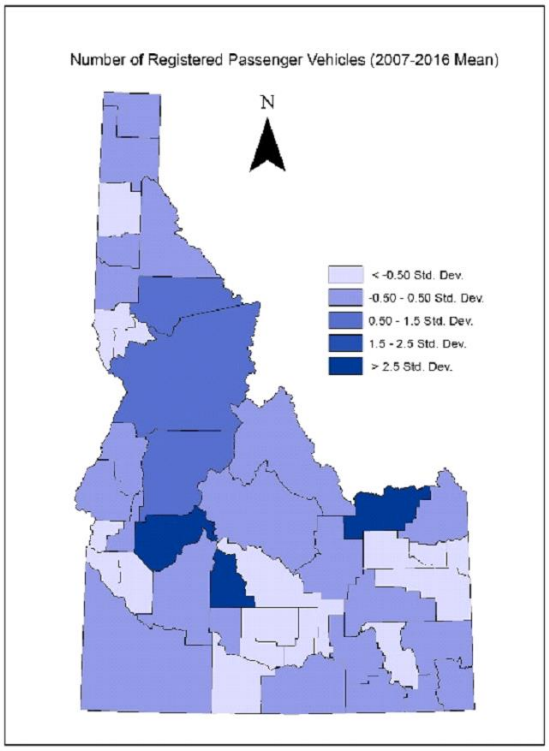




**Figure 5-4 Relative crash rates for injury rural crashes in Idaho**

# CHAPTER 6. STUDY FINDINGS AND CONCLUSIONS

This report documented the characteristics of traffic crashes for RITI communities in Idaho covering fatal and severe injury crashes on low-volume unpaved and paved roads in rural Idaho. The analysis was conducted using Idaho crash records that covered a ten-year period from 2007 to 2016. Three different roadway datasets were used in the analysis including the state highway network, the local (county and city) highway networks, and the U.S. Forest service roadway network.

The results of analysis of fatal and severe injury crashes on unpaved roads clearly shows that ATVs and pickup trucks and the two most common vehicle types involved in crashes in these roads. The results also showed that the majority of fatal and severe injury crashes on unpaved roads involved male drivers and occupants 24 years or younger with considerable number involving occupants younger than 14 years old. The results also showed that the majority of these crashes happened during daylight and in clear or cloudy weather conditions. Inclement weather was not a factor that influenced crashes on unpaved roads. Alcohol impairment, inattention, and speeding seem to be the three major contributing circumstances in fatal and severe injury crashes on unpaved roads.

A comparative safety analysis was conducted to identify and document the differences in characteristics between crashes that occurred on unpaved and paved rural roads in Idaho. The results of the analysis show that the percent of fatal and severe injury crashes where no restraining device was used is much higher on unpaved roads (50.4% and 38.3% on unpaved roads compared to 37.9 and 22.8 on paved roads). The same trend also exists in helmet use which shows the critical need for a much more aggressive seat belt and helmet use enforcement among communities who use rural unpaved roads in Idaho. The results also show a substantial difference in ATV crashes on unpaved versus paved. This is not surprising considering ATV usage is largely implemented on these roads due to the environment and location. Teenagers or children that are 14 years or younger are more susceptible to fatal and severe injuries on unpaved roads compared to paved roads. Crash injuries for age groups from 15 to 44 are also higher on unpaved roadways. The results also clearly highlight the fact that unpaved roads have a higher percentage of crashes where alcohol impairment is a major contributing circumstance. The same is true for speeding and inattention related crashes. A proportion statistical test results show that many of these results have a calculated p-value less than 0.05, indicating that these results are statistically significant at the 95% confidence level.

A county-based crash rate analysis was conducted to investigate the relative crash rates in rural roads for different counties in Idaho. Four different exposure measures were used to estimate the relative crash rates values. These exposure measures included number of registered drivers in the county, number of registered vehicles in the county, total county population, and total length of roadways in the county. The comparative analysis identified counties that have consistently higher rural crash rates compared to the state average (Boise County and Clark County). Other counties showed highest relative crash rates but produce less consistent results (Custer County and Lincoln County). A more formal statistical analysis that accounts for the spatial variability of these factors and exposure measures would be required to demonstrate that these results are statistically significant.

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