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CLUSTERING STATES TO IMPROVE THE STRATEGIC HIGHWAY SAFETY PLAN

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CLUSTERING STATES TO IMPROVE THE STRATEGIC HIGHWAY SAFETY PLAN

THESIS

A thesis submitted in partial fulfillment of the
requirements for the degree of Master of Science in the
College of Engineering
at the University of Kentucky

By

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ABSTRACT OF THESIS

CLUSTERING STATES TO IMPROVE THE STRATEGIC HIGHWAY SAFETY PLAN

Each update to a Strategic Highway Safety Plan (SHSP) can require a large amount of time, resources, and funding. From the requirements in U.S.C.148(a)(13)(E-F), in the SHSP update process states must consider the results of other transportation planning processes and develop a list of strategies to reduce or eliminate fatal and serious injury crashes (United States , 2023). To fulfil these requirements more efficiently and to gain the largest amount of benefit from said research, this thesis asks the question: how do we select other state transportation plans to study for ideas on improving our own SHSP? In this thesis, a k-means clustering method is proposed to group states based on a variety of factors. These include state demographics, roadway attributes, highway safety performance, and SHSP characteristics. Specific clusters of states can then be selected based on other states that share characteristics most like our own, or based on other states that have the best safety performance. Then, in future studies, the smaller group of states selected can be studied for successful safety improvement programs that have been implemented to gain ideas for improving our own state's next SHSP. As a case study, the methodology and resulting conclusions are applied to Kentucky in this thesis.

KEYWORDS: Strategic Highway Safety Plan, Highway Safety, K-Means Clustering, Emphasis Areas, Traffic Safety Planning

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11/06/2023
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CHAPTER 1. INTRODUCTION

1.1 Introduction

Space exploration in the United States has been known to push the limits of science, engineering, technology, and human abilities. With these complex and powerful technologies, space exploration involving human crew members comes with serious risks. NASA Administrator Aaron Cohen once said "Let's face it, space is a risky business. I always considered every launch a barely controlled explosion" (Cohen). As of 2022, there have been 23 astronaut fatalities, which have been a result of fatal incidents during preparations for the flight or during the actual flight (Orbital Today, 2022). Despite these tragic losses, there have been fewer astronauts that have died in the history of space exploration than the amount of people who are killed from car crashes each week in some larger states within the United States. Part of this is because space exploration has included redundant systems to increase safety to counteract the dangers of space travel. Astronauts are also safe users of space travel equipment. According to the book Safety Design for Space Systems, there are detailed and redundant safety systems set in place for the space environment, life support systems, emergency systems, collision avoidance systems, robotic systems, materials, oxygen systems, software systems, mechanical components, crew safety training, and more (Musgrave, Larsen, & Sgobba, 2009). While there are a variety of factors that must be avoided with space travel but are not a concern with highway travel (such as loss of oxygen), more extensive safety systems should be included in roadway safety to increase the factor of safety and reduce the serious injuries and fatalities.

Highway transportation has been the most popular form of transportation within the United States since the early 1900's. In the 1960's highway fatalities increased by 47.1% along with vehicle-miles traveled, which increased by 47.8% (Bureau of Transportation Statistics, 2016). As a result of these rising numbers, the first major efforts toward improving highway safety came with the creation of the Department of Transportation in 1966 (Weingrof, 2021) and again in 1970 with the formation of the National Highway Traffic Safety Administration (NHTSA) (National Highway Traffic Safety Administration, 2015). The 1970's also saw a rise in highway fatalities, with 1972 having the highest number of fatalities ever recorded in one year at 54,589 fatalities. However, the end of the decade began to see results with the national fatality rate dropping from 4.7 to 3.3 (fatalities per 100 million vehicle-miles traveled). In the 1980's there was a continued drop in the national fatality rate, from 3.4 to 2.2 fatalities per 100 million vehicle-miles traveled (VMT); in the 1990's, the national fatality rate was reduced from 2.1 to 1.6 per 100 million VMT (Bureau of Transportation Statistics, 2016). The national average has continued to fall to 1.33 fatalities per 100 million VMT as of 2021 (National Highway Traffic Safety Administration, 2022). These reductions in highway fatalities are the result of safer vehicle designs, new safety technology within vehicles, safer roads and infrastructure, the implementation of behavioral safety programs, and more standardized emergency medical services (Bureau of Transportation Statistics, 2016). However, there is still work to be done to reduce this number to zero.

Recently, a Safe Systems Approach has been adopted by the U.S. Department of Transportation Federal Highway Administration (FHWA) with a goal to eliminate all traffic related fatal and serious injuries. This approach includes five key element – safe road users, safe vehicles, safe speeds, safe roads, and post-crash care (Federal Highway Administration, 2023) – which should be integrated in a holistic manner (Doctor & Ngo, 2022). According to the FHWA Safe System mentality, it is understood that humans will make mistakes; however, these mistakes should never lead to death. Therefore, risks for the error occurring must first be reduced (Federal Highway Administration, 2023). Then, when crashes do occur, collision forces on the human body must be kept within tolerable limits to reduce injury severity from the crash (Doctor & Ngo, 2022). The graphic below from the FHWA illustrates the connection between each component of the Safe System Approach (U.S. Department of Transportation, 2022).

Figure 1: Safe Systems Approach, Image from FHWA

1.2 Strategic Highway Safety Plan Background

The Strategic Highway Safety Plan (SHSP) is the highest-level, coordinating safety plan that "identifies and analyzes highway safety problems and opportunities" within the state (Federal Highway Administration, 2020). The SHSP is a performance-based approach to highway safety. It also takes a systems-based approach, pointing back to the Safe System Approach defined above in Section 1.1. The SHSP should analyze crash data, roadway data, and traffic data to identify critical highway safety problems and corresponding safety improvement opportunities. SHSP multi-year performance goals are then established along with emphasis areas and countermeasure strategies (Federal Highway Administration, 2016). They are meant to be measurable and ambitious, such as "striving towards zero deaths" (Federal Highway Administration, 2020). After this, the SHSP is used to provide "strategic direction" for the state plans listed above by incorporating the safety performance goals, emphasis areas, and countermeasure strategies included in the SHSP where appropriate.

Since 2005, each state has been required to submit an updated SHSP document every five years to be eligible for Highway Safety Improvement Program (HSIP) funding (23 U.S.C. 148(c)) (Federal Highway Administration, 2016). The HSIP program is one of the largest transportation safety funding sources from the federal government, so it is essential for states to fulfill this requirement. The main components that must be included in each SHSP update are codified in 23 U.S.C. 148(a)(13)(A-E) These were extracted and included in Table 1.1 below (United States , 2023). This thesis will focus on improving the process to fulfill requirements (E) and (F), which will be discussed further in Section 1.3.

Table 1: SHSP Requirements, as listed in 23 U.S.C. 148(a)(13)(A-E)

A	Is developed after consultation with - i. a highway safety representative of the Governor of the State; ii. regional transportation planning organizations and metropolitan planning organizations, if any; iii. representatives of major modes of transportation; iv. State and local traffic enforcement officials; v. a highway-rail grade crossing safety representative of the Governor of the State; vi. representatives conducting a motor carrier safety program under section 31102, 31106, or 31309 of title 49; vii. motor vehicle administration agencies; viii. county transportation officials; ix. State representatives of nonmotorized users; and x. other major Federal, State, tribal, and local safety stakeholders;
B	Analyzes and makes effective use of State, regional, local, or tribal safety data;
C	Addresses engineering, management, operation, education, enforcement, and emergency services elements (including integrated, interoperable emergency communications) of highway safety as key factors in evaluating highway projects;
D	Considers safety needs of, and high-fatality segments of, all public roads, including non-State-owned public roads and roads on tribal land;
E	Considers the results of State, regional, or local transportation and highway safety planning processes;
F	Describes a program of strategies to reduce or eliminate safety hazards;
G	Includes a vulnerable road user safety assessment;
H	Is approved by the Governor of the State or a responsible State agency;
I	Is consistent with section 135(g); and
J	Is updated and submitted to the Secretary for approval as required under subsection (d)(2)

Kentucky’s most recent SHSP update is for the years 2020-2024. Therefore, Kentucky’s next SHSP update is due December 31, 2024. The current SHSP identifies six emphasis areas:

- Aggressive Driving
- Distracted Driving
- Impaired Driving
- Occupant Protection
- Roadway Departure
- Vulnerable Road Users

The SHSP also provides strategic direction for other transportation safety plans created by the state. Some examples of the plans that must coordinate with the state’s most recent SHSP and any corresponding legislation include:

- HSIP Annual Report and Annual Investment Plan
- Triennial Highway Safety Plan (3HSP) (Title 23 U.S.C. 402(b)(1)(F)(v))
- Commercial Vehicle Safety Plan (CVSP) (49 CFR 350.201 and 205)
- VRU Assessment (Title 23 U.S.C. 148(a)(13)(H))
- Local safety plans

As mentioned above, HSIP is a “core Federal-aid program” that provides funding to states for projects aimed at reducing roadway fatalities and serious injuries. According to FHWA, the HSIP has three main components: the SHSP, the State HSIP or program of highway safety improvement projects, and the Railway-Highway Crossing Program (Federal Highway Administration, 2022) The HSIP report is submitted by each state to FHWA each year, which details the specific projects being implemented that have received HSIP funding for the year. The state also internally produces an HSIP Investment Plan annually, which must coordinate with the goals, emphasis areas, and strategies spelled out in the most recent SHSP. The HSIP report is focused more on engineering countermeasures to reduce roadway related fatalities and injuries.

As of February 2023, the 3HSP is prepared by each State and submitted to NHTSA every three years. There are three different submissions included in the triennial framework: the 3HSP, the annual grant application, and the annual HSP report (National Highway Traffic Safety Administration, 2023). These three documents build upon each other by providing program information collected at different stages along the program timeline. The 3HSP plan creates the long-term highway safety plan, which focuses more on education and enforcement programs to reduce roadway related fatalities and injuries. It also includes triennial safety performance reporting. The annual grant application allows for annual implementation of the 3HSP plan. Finally, the HSP Annual Report includes the progress towards achieving the performance targets set in the 3HSP planning document. If the performance targets are not on track to be met, the HSP Annual Report will include adjustments for the next 3HSP to better meet these targets. It also includes a list of projects and activities that have been federally funded over the prior fiscal year (National Highway Traffic Safety Administration, 2023). NHTSA has created a set of performance measures, as seen in Table 1.2 below (Federal Highway Administration, 2020) of which the states must submit in their Annual Report. Performance measures that begin with "C-" are core measures that measures overall safety progress. Performance measures that begin with "A-" are activity measures that track program implementation In addition to core and activity measures, behavioral measures begin with "B-" and assess driver behavior based on safety programs that are being implemented.

Table 2: NHTSA Safety Performance Measures for 3HSP

C-1	Number of traffic fatalities (three-year or five-year moving average)
C-2	Number of serious injuries in traffic crashes
C-3	Fatalities/VMT (including rural, urban, and total fatalities)
C-4	Number of unrestrained passenger vehicle occupant fatalities, all seat positions
C-5	Number of fatalities in crashes involving a driver or motorcycle operator with a blood alcohol concentration of 0.08 g/dL or higher
C-6	Number of speeding-related fatalities
C-7	Number of motorcycle fatalities
C-8	Number of un-helmeted motorcycle fatalities
C-9	Number of drivers 20 of younger involved in fatal crashes
C-10	Number of pedestrian fatalities
B-1	Observed seat belt use for passenger vehicles, front seat outboard occupants
A-1	Number of seat belt citations issued during grant-funded enforcement activities
A-2	Number of impaired-driving arrests made during grant-funded enforcement activities
A-3	Number of speed citations issued during grant-funded activities

The Motor Carrier Safety Assistance Program (MCSAP) Grant is a federal funding program that focuses on reducing the "number and severity of crashes and hazardous materials incidents involving commercial motor vehicles (CMVs)" (Federal Motor Carrier

Safety Administrateion, 2021). To be eligible to receive this funding, states must submit a commercial vehicle safety plan (CVSP).

As of October 2022, states will be required to submit a Vulnerable Road Users (VRU) Assessment to the FHWA. They will first be required to submit this document by November 2023; after this, the updated VRU Assessment will be included with SHSP updates as an appendix. In this assessment, data will be analyzed to determine safety risks to VRU in areas that have been identified using high-risk and subsequently develop projects and strategies to reduce these risks (Federal Highway Administration, 2022).

To recap, all the planning documents mentioned above are connected to the SHSP and all can play a part in improving overall highway safety. Some focus more heavily on certain categories of the safe systems approach than others. Figure 2 below is a graphic that shows the relationship between potential emphasis areas identified from the SHSP, other highway safety planning documents, and the safe systems approach. Data quality and management makes up the foundation of the relationship graphic because quality data is necessary to plan and implement any aspect of highway safety.

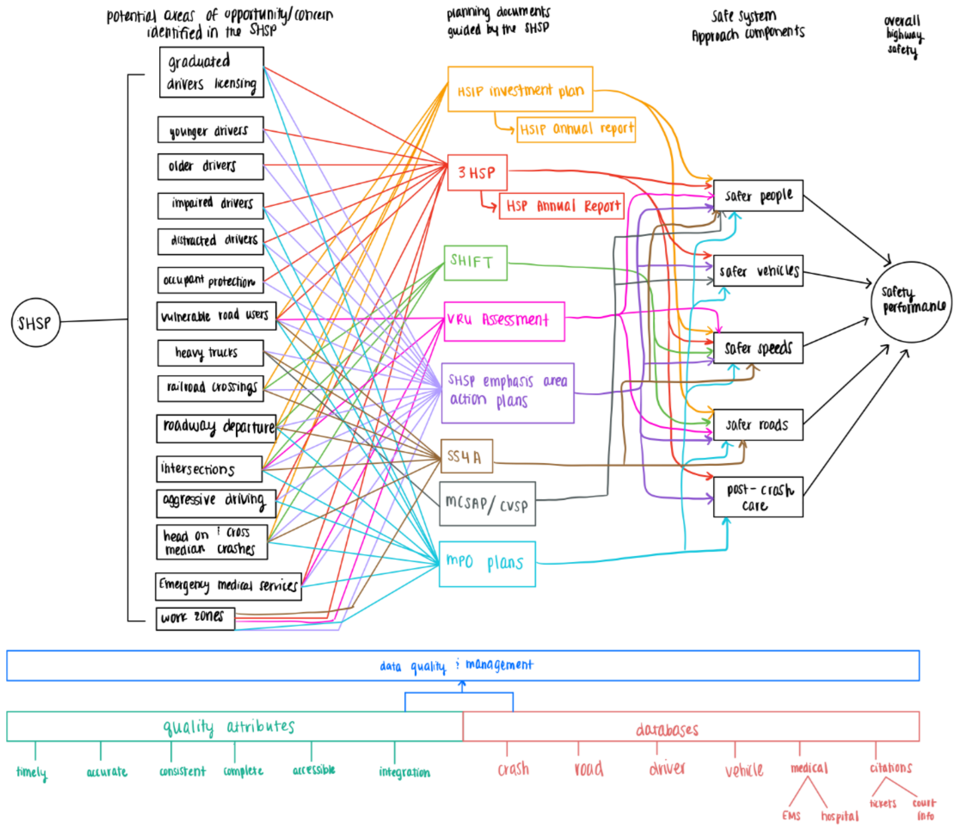

Figure 2: Highway Safety Planning Relationship with Highway Safety

1.3 Problem Statement

Each update to a SHSP requires a large amount of time, resources, and funding. To fulfil the requirement of U.S.C. 148(a)(13)(E) more efficiently and to gain the largest amount of benefit from said research, this thesis will ask the question: how do we select other state transportation plans to study for ideas on improving our own SHSP? Researching all fifty states would take too much time, so how does Kentucky effectively pick the “best” state safety programs to look at? Ultimately, how can the states be grouped so that Kentucky can compare our safety performance and current SHSP to other state safety programs and improve our next SHSP?

CHAPTER 2. LITERATURE REVIEW

2.1 Using highway safety performance data

Before beginning analysis using highway safety performance data in this thesis, it is important to understand the uses and misuses of this data. A study by O'Neill and Kyrychenko discusses just this: uses and misuses of motor-vehicle crash death rates when assessing highway-safety performance (O'Neill & Kyrychenko, 2006). In their analysis, they recognize that motor vehicle fatality rates are commonly used to measure a jurisdiction's progress in highway safety over time. They are also often used to analyze the success or "failure" of a particular countermeasure. Crash fatality rates have been a popular safety performance measure because the numerator (the number of deaths) is known with decent accuracy and the denominator (such as vehicle miles traveled, number of registered drivers, population) attempts to control for variance in driving risk exposure between locations. However, after the analysis they note that many factors outside of highway-safety policy influence the mileage death rates. For example, O'Neill and Kyrychenko note that almost 60% of the variability of crash rate differences between states can be explained by urbanization (O'Neill & Kyrychenko, 2006). Therefore, the denominators in crash fatality rates do not account for all or even most of the variations in exposure over time and across jurisdictions. While these crash fatality rates do reflect the general status of highway safety within an area, they recommend researchers should use caution when comparing highway-safety performance with this performance measure and not assume that all the variation in crash fatality rates are due to particular highway policy or countermeasure. Additionally, the authors of the same study highlighted that outcome measures directed related to the countermeasure are better for evaluation than overall crash fatality rates. For example, if the impact of motorcycle helmet laws is being studied, motorcyclist deaths should be used rather than the total number of vehicle crash fatalities (O'Neill & Kyrychenko, 2006).

2.2 Impact of COVID-19 on highway safety

Beginning in March 2020, the World Health Organization announced that the spread of the COVID-19 virus was a global pandemic (World Health Organization, 2020). In an attempt to reduce the spread of the disease, governing jurisdictions introduced unprecedented public health measures to limit people's in-person contact with one another. These included temporarily closing schools, businesses, entertainment venues, and leisure activities, to name a few. As a result of this, transportation patterns were also largely impacted. The FHWA's annual Highway Statistics Series reports the annual vehicle-miles travelled for the United States. From this data shown in Table 2.2 below, there was a drastic drop in VMT during 2020 when COVID-19 restrictions were the strictest (U.S. Federal Highway Administration, 2021). The VMT data was adapted from the Highway Statistics Series table VM-202; percent change added.

Table 3: Percent change of annual VMT before and during COVID-19 pandemic

Annual Vehicle-Miles of Travel, Total for the United States		
Year	VMT (millions)	Percent Change (%)
2014	3,025,656	
2015	3,095,373	2.3
2016	3,174,408	2.6
2017	3,212,347	1.2
2018	3,240,327	0.9
2019	3,261,772	0.7
2020	2,903,622	-11.0
2021	3,132,411	7.9

From these changes in travel during the COVID-19 pandemic, it must also be considered if and how changes in driving patterns and driving behavior affected roadway safety and the highway safety performance measures each state records and submits to the United States Federal Highway Administration (FHWA). A study published in 2020 by Vingilis et al. focuses on just this: identifying research questions to consider on driver behavior and situation factors associated with COVID-19 that could affect road safety during and after the pandemic (Vingilis, et al., 2020). The areas highlighted in this study included economic downturn having an impact on road travel and hence on road safety. Human factors such as increased stress, more "free" time, and increased alcohol and drug consumption were potential aspects that could negatively affect highway safety. Furthermore, changing public policy restrictions could change patterns of driver behavior, such as daily commuting verses working from home. While this study was written in 2020 during the beginning stages of the pandemic, multiple studies have been conducted since then that focus on one or more aspects mentioned above and quantified the impact they had on road safety.

In a study on the impact of COVID-19 on road safety in Canada and the United States, authors Vanlaar et al. compared self-reported changes in risky driving behaviors before and during the pandemic between Canada and the United States. Risky driving behaviors considered in this study included speeding, distracted driving, drinking and driving, and drugged driving. The authors hypothesized that decreases in traffic volume led to an increase in risky driving behaviors, especially speeding. Initial data showed an average decrease in all traffic crashes in the U.S. during 2020 of 41%-76%; however, research also indicated that while overall crashes decreased, there was an average increase in severe crashes by 25% (Vanlaar, et al., 2021). Survey results from the U.S. showed that while most of the respondents reported their driving behavior did not change during the pandemic, and a small proportion reported they were less likely to partake in risky driving behaviors, there was a notable portion that reported they *were* more likely to partake in risky driving behaviors during the pandemic as compared to before. In the U.S. this included 7.6% of respondents saying they were more likely to speed, 6.8% were more likely to be distracted while driving, 6.2% were more likely to drive after using drugs, and 7.6% were more likely to drink and drive. A following analysis concluded that the respondent's country and age had a significant impact on if they were more likely to engage in risky driving behaviors (Vanlaar, et al., 2021).

Yet another study looked at a case study in Salt Lake County, Utah to identify the impact of COVID-19 on traffic safety in the later stages of the pandemic (Gong, Lu, & Xianfeng, 2023). Using statistical models, crash severity and crash frequency were studied while factoring in exposure, environmental, and human factors. Results showed that crash frequency dropped significantly when lockdown restrictions were in place. As restrictions were relaxed, crash frequency steadily increased until the later stages of the pandemic, where crash frequency was slightly less but similar to pre-pandemic levels. The varying vehicle miles traveled (VMT) throughout the pandemic was identified as a contributing factor to the trends found in crash frequencies. In contrast to the crash frequency, crash severity increased substantially during the earlier stages of the pandemic, then steadily reduced to pre-pandemic levels during later stages. Characteristics of the vehicles involved in the crashes and driver behavior (especially speeding and drinking while driving) were identified as contributing factors for this trend in crash severity (Gong, Lu, & Xianfeng, 2023). One other case study from California compared crash severity and frequency before, during, and after the COVID-19 pandemic travel restrictions to determine the effects that changing VMT and average vehicle speeds had on crashes (Hughes, Kaffine, & Kaffine, 2023). Results from this study also found that VMT and crash frequency decreased significantly during the pandemic, while the frequency of severe crashes increased during this same time period. Authors acknowledged that while their case studies may not be consistent with all other areas in the United States, it is likely generally consistent to pandemic crash frequency and severity trends in other urban areas because these other areas saw similar drops in VMT as well (Hughes, Kaffine, & Kaffine, 2023).

The studies above that analyzed the impact COVID-19 had on highway safety will be important to consider in this thesis because some of the most recent highway safety performance data submitted to the FHWA by the states are from the pandemic time period. Based on the literature researched above, in this thesis the data should be compared to pre-pandemic levels so that short-term changes in highway travel and safety do not lead to incorrect analyses or conclusions. The selection of data years is discussed further in Section 3.2.

2.3 Literature on Strategic Highway Safety Plans

Since this thesis focuses on SHSPs of all the states, a literature review of current research on SHSPs must first be conducted. A study in Missouri from 2014 evaluated the change in Missouri's motor vehicle crashes after their first SHSP was developed and implemented between 2004 and 2007 (Mohammadi, Samaranayake, & Bham, 2014). Mohammadi et al. used models for different crash types to estimate the anticipated number of crashes in 2008 based on the implementation or no implementation of the Missouri SHSP safety improvements (Mohammadi, Samaranayake, & Bham, 2014). They predicted that fatal crashes could be reduced by 30% from implementing crash countermeasures included in the SHSP. However, this analysis only evaluated Missouri's change in highway safety performance internally, it was not compared to other states, and not over multiple time periods. The results were theoretical and did not compare theoretical values with the actual number of fatal crashes that occurred in Missouri in 2008. The authors also mentioned that further analysis of effectiveness for specific emphasis areas identified in the SHSP would be helpful (Mohammadi, Samaranayake, & Bham, 2014). Additionally, as mentioned in Section 2.1 by researchers O'Neill and Kyrychenko, this report did not mention other factors that could have resulted in this reduction of fatal crashes.

Two other journal articles were found on topics meant to help states develop a better SHSP document. One study by Ogle et al. identifies successful safety programs implemented in other states based on emphasis areas South Carolina had identified in their SHSP document (Ogle, Islam, Brown, Davis, & Sarasua, 2018). After the authors identified successful safety programs in other states, they then estimated the safety improvement potential in South Carolina based on several factors, including but not limited to: magnitude of the problem in the state, demographic trends, and current legislation (Ogle, Islam, Brown, Davis, & Sarasua, 2018). This study could be helpful to provide a list of potential resources to use when finding other states' successful safety programs. It also highlights factors that may change the effectiveness of a safety strategy when implemented in one state as compared to another. However, there are several limitations to this study. First, the study was unique to South Carolina. Second, it does not mention how the other programs were selected. Did this study conduct a nationwide search, or did it search the other states at random? Conducting a nationwide search would take much longer, and the strategies may not be near as effective when implemented in South Carolina if the example state has very different demographics, culture, geography, legislation, etc. This thesis will essentially turn this process around, where similar states are first grouped. Then, researchers would be able to narrow down the safety program search to the states in the same grouping.

Another study by Park and Young in 2011 focused on a supplementary method for states to select and prioritize emphasis areas in their SHSP updates. This is meant to enhance the analysis done with high-level crash statistics and expert opinion from SHSP stakeholders to provide more insight in the areas where highway safety has the greatest potential and need for improvement. According to their research, the federal government through the American Association of State Highway and Transportation Officials (AASHTO) has recommended 22 emphasis areas. The study compiled data on the emphasis areas each state picked for the SHSP documents at the time and then provided some summary statistics on the data. See an excerpt of a table from Park & Young's study in Figure 3 below. The authors found that many states selected a large number of emphasis areas and that certain emphasis areas were picked frequently among many states (Park & Young, 2012).

In this thesis analysis of characteristics of different state SHSPs it will be helpful to compare trends among emphasis areas that were chosen in the most recent SHSP updates as of 2023. When grouping similar emphasis areas together, inspiration could be taken from the "elements" or categories listed in Park and Young's study, as seen below in Figure

3. This thesis will also compare trends for the most current selected emphasis areas. Park and Young mention in their conclusion that some states may be targeting too many emphasis areas, which can make coordination between different stakeholder groups in the SHSP more difficult and therefore implementation of countermeasures for each of the emphasis areas even more challenging within the set period of time (Park & Young, 2012). This should be studied even further in this thesis to determine if there is an amount of emphasis areas that is most beneficial for state roadway safety.

P.Y. Park, J. Young / Accident Analysis and Prevention 45 (2012) 392–405 395

Table 1
Number of emphasis areas selected by individual states/provinces from AASHTO's 22 emphasis areas.

No. of emphasis areas selected	No. of states/provinces	Percentage (%)	Cumulative no. of states/provinces	Cumulative percentage (%)
1–3	0	0	0	0
4–6	7	13	7	13
7–9	14	26	21	40
10–12	14	26	35	66
13–15	10	19	45	85
16–18	6	11	51	96
19–22	2	4	53	100

Table 2
Number of states/provinces per emphasis area.

Elements	ID no.	Emphasis areas	No. of states/provinces	Percentage (%)
1. Drivers	**1**	**Instituting graduated licensing for young drivers (graduated drivers licensing)**	**40**	**75**
	2	Ensuring drivers are fully licensed and competent (licensed, competent drivers)	9	17
	3	**Sustaining proficiency in older drivers (older drivers)**	**31**	**58**
	4	**Curbing aggressive driving (aggressive driving)**	**45**	**85**
	5	**Reducing impaired driving (impaired drivers)**	**49**	**92**
	6	Keeping drivers alert (keeping drivers alert)	20	38
	7	Increasing driver safety awareness (driver safety awareness)	12	23
	8	**Increasing seatbelt usage and improving airbag awareness (seatbelts and air bags)**	**50**	**94**
2. Special users	**9**	**Making walking and street crossing safer (pedestrians)**	**33**	**62**
	10	**Ensuring safer bicycle travel (bicyclists)**	**27**	**51**
3. Vehicles	**11**	**Improving motorcycle safety and increasing motorcycle awareness (motorcyclists)**	**31**	**58**
	12	**Making truck travel safer (heavy trucks)**	**28**	**53**
	13	Increasing safety enhancements in vehicles (in-vehicle enhancements)	2	4
4. Highways	14	Reducing vehicle–train collisions (vehicle–train collisions)	11	21
	15	**Keeping vehicles on the roadway (keeping vehicles on the road)**	**45**	**85**
	16	Minimizing the consequences of leaving the road (minimizing consequences of leaving the road)	18	34
	17	**Improving the design and operation of highway intersections (intersections)**	**42**	**79**
	18	Reducing head-on and across-median collisions (head-on collisions)	17	32
	19	Designing safer work zones (work zones)	19	36
5. Emergency medical services	20	Enhancing emergency medical capabilities to increase survivability (EMS)	19	36
6. Management	**21**	**Improving information and decision support systems (decision support systems)**	**33**	**62**
	22	Creating more effective processes and safety management systems (safety management systems)	3	6

Note: Bolded emphasis areas indicate that the emphasis area that has been chosen by more than half of the investigated states/provinces (i.e., more than 27 states/provinces in North America).

Figure 3: Summary and analysis of state emphasis areas, image from Park & Young

2.4 Clustering States based on highway safety performance

The United States is made up of a unique group of states that can vary greatly in their geography, economy, population demographics, traffic growth, highway system size, and more (U.S. Federal Highway Administration, 2021). A study by Henderson & Niemeier used variables from categories similar to above to delineate peer states with similar attributes to better account for the jurisdiction variation in the planning and maintenance of state transportation systems (Hendren & Niemeier, 2008). The FHWA Highway Statistics Series recommends using the approach laid out in this study to compare state highway safety performance effectively and unbiasedly. Henderson & Niemeier took data for 42 variables (extracted from table PS-1 in the FHWA's Highway Statistics Series) that impacted transportation investment and policy was collected for two time periods: 1985-

1990 and 1995-2000. These variables focus on three main themes of general features, degree of urbanization, and growth characteristics. From a agglomerative clustering hierarchical method analysis, 10-, 9-, 8-, and 7- cluster solutions were created for the first time period (1985-1990). For the second time period analysis (1995-2000), cluster options for 12, 11, 10, 9, and 8 groups were presented. An image of the resulting cluster solutions created by Hendren & Niemeier for the years 1985-1990 can be seen below in Figure 4 (Hendren & Niemeier, 2008). Additionally, Hendren & Niemeier created a map where states have been color-coded by clusters, as seen in Figure 5 below (Hendren & Niemeier, 2008). This visual can be used in this thesis to highlight any geographic trends from cluster analysis results. While the data used to conduct the analysis is now out of data, the process and the fundamental findings are still relevant and can be applied to more recent data collected from each of the states for this thesis. Moreso, in the methods used for this thesis, it could be beneficial to cluster states based on their SHSP characteristics to expand on the cluster groups that were created from Hendren & Niemeier's study.

	10 Clusters	9 Clusters	8 Clusters	7 Clusters
Agglomeration Step:	40	41	42	43
Fusion Coefficient	31.9	39.3	39.7	44.8
Coefficient Increase:	2.1	7.4	0.4	5.1
Dendrogram Distance:	6	7	> 7	> 7
Cluster #1	KS NE OK MO AL KY AR GA WA IL PA OH MI MN TX	KS NE OK MO AL KY AR GA WA IL PA OH MI MN TX	KS NE OK MO AL KY AR GA WA IL PA OH MI MN TX	KS NE OK MO AL KY AR GA WA IL PA OH MI MN TX
Cluster #2	LA	LA	LA	LA
Cluster #3	IN TN OR WI IA MS NC VA DE SC WV	IN TN OR WI IA MS NC VA DE SC WV	IN TN OR WI IA MS NC VA DE SC WV	IN TN OR WI IA MS NC VA DE SC WV
Cluster #4	FL MD HI NV	FL MD HI NV	FL MD HI NV	FL MD HI NV
Cluster #5	ID SD ND CO NM UT MT WY	ID SD ND CO NM UT MT WY	ID SD ND CO NM UT MT WY	ID SD ND CO NM UT MT WY
Cluster #6	ME VT NH	ME VT NH	ME VT NH	ME VT NH
Cluster #7	AK	AK	AK	AK
Cluster #8	MA NJ CT RI	MA NJ CT RI	MA NJ CT RI	MA NJ CT RI
Cluster #9	CA NY	CA NY	CA NY	CA NY
Cluster #10	AZ	AZ	AZ	AZ

Figure 4: 1985-1990 Comparison of Cluster Results, Image from Hendren & Niemeier

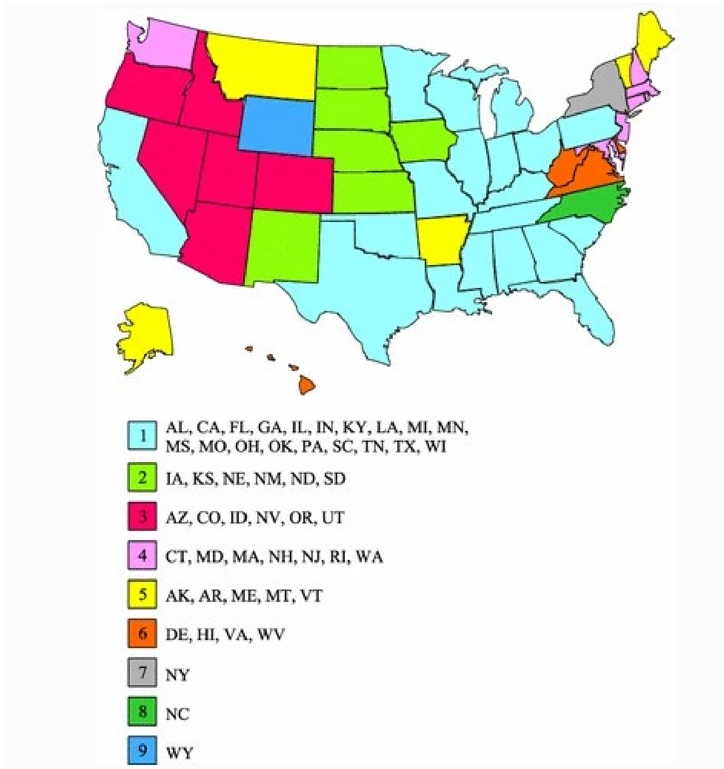

Figure 5: 1995-2000 9-Cluster Solution, Image from Hendren & Neimeier

2.5 Demographic and socioeconomic effect on highway safety

Much research is available on the relationship between independent variables and their effect on highway safety. While the studies listed below are not directly used in this thesis analysis, it is still helpful to have a general understanding of the different factors that can affect roadway safety. Potential demographic and socioeconomic factors that affect highway safety identified in this study include household income, educational attainment, GDP per capita, gender, age, seat belt usage, alcohol consumption, and urbanization of an area.

From existing literature, researchers Stamatiadis et al. analyzed why there are higher fatality crash rates in the southeastern portion of the U.S. as compared to other parts of the country. They found that the southeast region has a lower educational attainment and economic standing, and there are more drivers in groups that have been identified as more likely to participate in risky driving behaviors. The analysis confirmed that lower educational attainment and economic standing, and the younger and older ages groups were correlated with single-vehicle crashes (Stamatiadis & Puccini, 1999). Another study by Lyon et al. focused specifically on younger and older drivers and their crash risk, which is higher than other driver age groups. Through self-reported data, the authors found that young drivers (18-21 years old) had the highest proportion of drivers who engaged in distracted driving or fatigued driving, while older drivers (65 years and older) had the lowest proportion of drivers who reported this driving behavior (Lyon, et al., 2020). In yet another analysis of traffic crashes among the younger and older drivers, McGwin & Brown confirmed again that young drivers were more likely and older drivers were less likely to partake in risky driving behaviors. They continued to conclude that for young drivers, this higher level of risk taking combined with less driving experience led to this age group having a higher risk of being involved in a crash. Even though older drivers were less likely to partake in distracted or risky driving behaviors, the age group is overrepresented in crashes as well, due to perceptual problems and slower response times (McGwin & Brown, 1999).

A study by Lee et al. determined that using proper restraints (i.e. seat belts) could decrease the fatal crash risk of vehicle occupants up to 54%. They also found that young drivers were overrepresented in unrestrained crash fatalities (Lee & Schofer, 2003). Another study from Norway shows consistent results with Lee et al. and concludes that using a seat belt reduces fatal and serious injuries by 60% for front seat occupants and 44% for rear seat occupants (Hoye, 2016). Hoye also estimated that unbelted drivers had an 8.3 times higher fatal crash risk and 5.2 times higher serious injury crash risk as compared to belted drivers (Hoye, 2016).

In another study by Ye et al. identified other socioeconomic factors related to distracted driving that are associated with crash risk. These include texting and age, where younger drivers are more likely to text, annual miles driven, which was also correlated with a higher likelihood of texting, as were gender (women were more likely to text) and marital status (married persons were more likely to text) (Ye, Osman, & Ishak, 2017).

In a survey to Americans to analyze the relationship between crash histories, risky driving behavior, demographic characteristics, and driver opinions on traffic safety countermeasures, Chen et al. determined that women were more likely to text and drive while men were more likely to drink and drive. Drivers who were married were more likely to speed. Drivers who regularly text while driving increased the likelihood of a crash. Single men drivers had a higher driver’s license revocation rate, received more traffic citations, and were less likely to wear a seat belt. Impaired driving countermeasures received the most support from respondents (Chen & Kockelman, 2013).

It is also known that fatality rates and severity of rural crashes are worse than those in urban areas. This must be kept in mind when comparing different regions. The Kentucky SHSP identifies four factors that contribute to this trend: human behavior (such as lower seat belt usage rates in rural areas), vehicle size (there are often more fatal crashes in rural areas involving large trucks, SUVs, and pickup trucks), roadway environment (rural roads often have narrow shoulders and only a painted centerline between opposing traffic, which allows less room for error in roadway departure crashes), and a higher emergency response time to reach the crash or hospitals in rural areas (Kentucky Transportation Cabinet, 2020).

2.6 Public policy effect on highway safety

There is also a large amount of literature that focuses on public policy's effects on highway safety. This section serves to provide a general overview of how policy can also affect highway safety. Most of these public policies are focused on the "safe drivers" and "safe speeds" elements of the Safe Systems approach by regulating risky driving behavior through laws such as speed limits, seatbelt laws, laws against drinking and driving, and laws against cell phone use.

McCarthy analyzed the effect of highway speed limits, seat belt use laws, availability of alcohol, restrictions on common site sale of gasoline and alcohol, and traffic enforcement on fatal crashes in urban areas (McCarthy, 1999). Results did not provide significant support for the hypothesis that relaxed speed limits increased fatality crashes or that stricter seat belt laws reduced fatal crashes. Results supported the hypothesis that police enforcement is beneficial for drivers to adhere to traffic regulations. There was also support that increased alcohol availability reduces highway safety; however, this result was based on the number of alcohol licenses in the urban area and does not solely reflect the amount of alcohol consumed (McCarthy, 1999). Bans on common gasoline and alcohol sites had a slight increase in fatal crashes right outside of the urban areas, but the hypothesis that the ban had no effect could not be rejected for other areas in the study. The author proposes that this could increase traffic exposure because the average distance travelled to reach common site sales for gasoline and alcohol are increased. However, there was not enough data to test this hypothesis in the study. McCarthy concludes that despite the positive trend of alcohol licenses on fatal accidents, the results should not support limiting the number of alcohol licenses since alcohol consumption or traffic exposure cannot be explicitly controlled (McCarthy, 1999).

Another study by Dong et al. also looked at the effects of highway safety laws and sociocultural characteristics on fatal crashes. In this study, the researchers found that states that allow speed camera enforcement are associated with a lower amount of fatal crashes (Dong, Nambisan, & Clarke, 2017). The long-term effect that distracted driving laws have on driving behavior and subsequently crash frequencies still need to be studied further before supporting or opposing legislation, findings in this study indicated that limited or no handheld cell phone enforcement could increase the likelihood of fatal crashes by 25 percent (Dong, Nambisan, & Clarke, 2017).

CHAPTER 3. METHODOLOGY

3.1 Motivation for clustering states

This study will focus on clustering states to compare and improve their highway safety performance. In roadway safety, learning from other states can be extremely beneficial in improving road safety planning, strategies, and implementation. Moreso, this is a requirement for each SHSP update (see U.S.C. 148(a)(13)(E-F)) (United States , 2023). However, in the United States, researching fifty states for each road safety projects would be very time consuming. To use roadway safety researchers' time more efficiently, this thesis creates a methodology to identify a group of states that would be most relevant to learn from based on the roadway safety topic. This thesis considers a variety of different ways to cluster states: by demographic characteristics of the state, by state highway safety performance, and by state SHSP document characteristics. Then, this thesis will consider how the results from these cluster analyses could help improve Kentucky's next SHSP update.

3.2 COVID-19 Comments and Data Years Selection

As mentioned in the literature review, the COVID-19 pandemic had a major impact on transportation patterns. The FHWA reported a large decrease in vehicle miles traveled during 2020 when COVID-19 restrictions were the strictest (see Section 2.2) (U.S. Federal Highway Administration, 2021). The precise impact that this change in transportation had on highway safety is still being researched. This study focuses on clustering states to compare and improve their highway safety performance under typical travel conditions. Therefore, variables regarding highway safety performance or highway travel are not used from the years 2020-2021 to avoid short-term fluctuations in travel risk exposure (and therefore safety performance) caused by the COVID-19 pandemic.

2020 Demographic data from the U.S. Census Bureau are used because these variables are much slower to change and are therefore more resistant to being impacted by the COVID-19 pandemic. Also, because the U.S. Census Bureau only conducts a census once a decade, the 2020 census has the most recent information on demographic or socioeconomic statistics from the states.

3.3 State Highway Performance Data, Demographic Information, and SHSP Characteristics

To support the cluster analysis included in following sections of this thesis, data must be compiled from multiple sources. As mentioned in the introduction, states are required to submit reports to be eligible for various federal transportation funding programs. The FHWA and NHTSA have multiple databases that store the information reported by states. These databases include state highway information on safety performance, safety performance targets and goals, and reports (such as for the SHSP or HSIP report) for each state. While this list is not exhaustive of the state highway data available on the FHWA's and NHTSA's websites, the information gathered and included in this thesis supports the analysis explained in following sections.

The data collected was available for all 50 states but was not aggregated. In some cases, the data was available by state for multiple years. Or, if the data was presented with all 50 states listed, they were available for one year only. This study created tables of safety performance data for all 50 states over multiple years. The years included were typically from the ten-year period 2012-2021. The compiled data is then used to support the analysis in this thesis.

The list below summarizes the sources of data used in this study or data compiled for ready reference for future studies. It also lists the appendix where the raw data tables are included in this thesis.

- FHWA Highway Statistics Series
  - Appendix A: Annual vehicle miles travelled by state
  - Appendix B: Public road length (total, rural, and urban)
- Appendix C: NHTSA State Highway Safety Plans and Annual Reports
  - Annual number of roadway fatalities by state
  - Annual fatality rate by state (fatalities per 100 MVMT)
  - Annual rural fatality rate by state (fatalities per 100 MVMT)
  - Annual urban fatality rate by state (fatalities per 100 MVMT)
  - Annual passenger vehicle occupant fatalities (total, restrained, unrestrained, unknown)
  - Annual alcohol-impaired driving fatalities
  - Annual speeding-related driving fatalities
  - Annual motorcyclist fatalities
  - Annual pedestrian fatalities
  - Annual bicyclist and other cyclist fatalities
  - Annual observed seat belt use
- US Census Bureau
  - Appendix D: Percent of the state population that lives in urban areas
- FHWA SHSP Report Database
  - Appendix E: SHSP emphasis areas by state
  - Appendix F: SHSP safety performance goals by state

Note that in Appendix C, the safety performance measures from the state Highway Safety Plan annual reports highlights several performance measures labelled with a (C-#). These coincide with the core safety performance measures identified by NHTSA, which are listed in Chapter 1. While not all these safety performance measures were used in this thesis, they were still included for completeness.

3.4 Clustering states based on demographic information

Section 2.1 mentions a study by O'Neill and Kyrychenko that discusses the uses and misuses of motor-vehicle crash death rates when assessing highway-safety performance. In their analysis, they found that urbanization can explain almost 60% of the variability of crash rate differences between states. Therefore, this section focuses on clustering states by their urbanization using a k-means clustering technique. Three different cluster analyses regarding the urbanization of each state are conducted:

- The percent of the state's population that lives in urban areas and the 2019 five-year rolling average of the state's urban fatality crash rate
- The percent of the state's total road length that are urban and the 2019 five-year rolling average of the state's urban fatality crash rate
- The percent of the state's total road length that are rural and the 2019 five-year rolling average of the state's rural fatality crash rate

The 2019 five-year rolling average was used for the crash rates to help smooth out the natural fluctuations that happen with crash statistics from year to year.

The k-means cluster analyses were conducted using R Studio. First, the "elbow" method was used to determine the optimal number of clusters. This method creates a plot that shows the proposed number of clusters (k) on the x-axis and the total within sum of square for each corresponding number of clusters on the y-axis. The "elbow", or inflection point, on this plot is where the improved reduction of total within sum of squares begins diminishing at a much lower rate, making the benefit of adding more clusters much less after this point. Therefore, the optimal number of clusters is at this inflection point in the graph. An example optimal number of clusters plot is shown below in Figure 6. The optimal number of k clusters in the example plot is k=3.

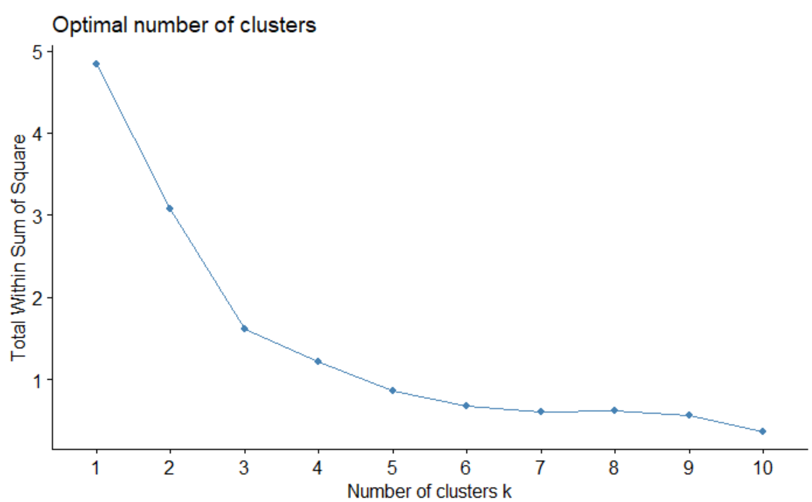

Figure 6: Optimal number of clusters plot example

Then, the clusters of states are created using k-means clustering. The example code for the state's urban population and the state's urban fatality rate can be seen below in Figure 7. The same code was used for the other k-means analyses in this study. The only change is the input spreadsheet with the unique variable data for each cluster analysis. Appendix A, B, C, and D are used to create these inputs for the k-means analyses mentioned in this chapter, as seen in Appendix E Appendix F shows the resulting outputs from the k-means cluster analyses conducted in chapter 4.

From this code, an optimal number of clusters plot and a cluster plot showing the resulting clustering groups is produced. The cluster assigned to each state is then exported to Microsoft Excel to produce a spatial map that color codes the state by their cluster number from the k-means analysis.

```
---
title: "clustering percent pop urban"
output: word_document
---
```{r}
library(factoextra)
library(cluster)
library(ClusterR)
```

```{r}
dataset_percent_pop_urban=read.csv("C:/Users/toric/Documents/r studio shsp thesis stuff/percent_pop_urban.csv",
                    row.names="State")

#remove any missing values
dataset_percent_pop_urban <- na.omit(dataset_percent_pop_urban)

#scale df so the variables have a mean zero and standard deviation one
#dataset <- scale(dataset)

#elbow method to determine optimal number of k
set.seed(123)

#function to compute total within-cluster sum of square
fviz_nbclust(dataset_percent_pop_urban, kmeans, method="wss")
```
```{r}
#perform k means with optimal number of k clusters and extract info
set.seed(123)
final <- kmeans(dataset_percent_pop_urban, centers=5, nstart=25)
print(final)

#create cluster plot with optimal number of clusters
kfinal <- kmeans(dataset_percent_pop_urban, centers=5, nstart=25)
fviz_cluster(final, data=dataset_percent_pop_urban,
             stand=FALSE,
             repel=TRUE,
             labelsize=10,
             xlab="2020 Percent of State Population Living in Urban Areas",
             ylab="2019 5-year Rolling Average of Urban Fatality Rate"
               )
```
```

Figure 7: Example R Studio Code for K-Means Cluster Analysis

3.5 Clustering states based on core safety performance measures

While there are many potential safety performance measures to cluster the states by, just one was selected for this study to serve as an example of how the safety performance measure being studied by the state can be used to cluster and evaluate where they are compared to other states. This study will cluster the 2019 five-year rolling average percent of total passenger vehicle occupant fatalities where occupants were unrestrained and the 2019 five-year rolling average of observed seat belt use. Then, depending on what area of safety a state is focusing on, they can customize the variables and conduct the cluster analysis to best fit their safety analysis and planning.

R studio is used to determine the optimal number of clusters for these variables and then to conduct the k-means cluster analysis. Similar code can be found in Figure 7 in Section 3.4. The only change is the input spreadsheet that was used, which contained the unique data for these two variables. The raw spreadsheet data is found in Appendix E.

3.6 Clustering states based on SHSP characteristics

In this section, the states are sorted and grouped based on two characteristics of their SHSP documents: the emphasis areas identified, and the safety performance goals set.

3.6.1 SHSP Emphasis Areas

The state emphasis areas are grouped in two different ways. First, as mentioned in Section 3.3, the emphasis areas the states identified in their most recent and available SHSP update were compiled and aggregated. In this section, the method for sorting and grouping the emphasis areas into a matrix format is described. Such output creates a helpful visual for state safety professionals to use when comparing the emphasis areas their state has identified to other states. To create the emphasis area matrix (as seen in Appendix G), the states comprise rows and the emphasis areas comprise columns. Each cell reports all the emphasis areas identified for the state on that row.

Next, the emphasis areas are sorted into groups. Twelve different groups of similar emphasis areas are created by engineering judgement. Two other emphasis areas did not fit into groups, so they comprise stand-alone "groups." These twelve groups are:

- Driver behavior
- Roadway design
- Vulnerable road users
- Younger & older users
- Other vehicle groups
- Reports
- Post-crash
- Technology
- Education
- Local Safety
- Licensing
- Changing road conditions

Some of these groups were created because they included emphasis areas that were of the same type (for example, the VRU group includes emphasis areas pedestrians, bicycles, and bicycles & pedestrians). Other groups were created using the Safe Systems Approach attributes, as defined in Section 1.1. For example, the group of emphasis areas "driver behavior" included emphasis areas such as aggressive driving, speed management, distracted driving, safe road users, etc.

Next, matrix rows and columns are totaled. For the columns, the sum of the total number of emphasis areas for each state and the sum of the total number of groups for each state are included. Finally, the rows of the matrix are sorted from greatest to least by the total number of emphasis areas for each state.

The second way the states' emphasis areas are clustered is by using a k-means clustering method for two variables: the total number of emphasis areas identified in the SHSP and 2019 five-year rolling average for the total fatality rate. R studio is used to determine the optimal number of clusters for these variables and then to conduct the k-means cluster analysis. Similar code can be found in Figure 7 in Section 3.4. The only change is the spreadsheet that was used, which contained the unique data for these two variables. The raw spreadsheet data can be found in Appendix E.

3.6.2 SHSP Goals

Appendix H includes a table of all the safety performance goals extracted from each state's SHSP document. This is used to group SH2ySP goals in two different ways: by the type of performance measure(s) included in the goal and by aggressiveness of the goal. In Appendix H, the SHSP update year and goals are the only information taken direction from SHSP documents. A good/fair/poor rating was also given to each state to roughly indicate how prominent the goal was in the SHSP document. A "good" rating was given if the goal was clearly labelled, highlighted, or bolded to stand out from the rest of the text, and given in a heading in the table of contents. A "fair" rating was given if the goal included some but not all of the criteria listed above. A "poor" rating was given if the goal was not clearly stated, labelled, or if there was no effort to make it stand out from the surrounding text.

In Appendix H, column with the "type" of goal indicates what safety performance target(s) the goal is based on. The type of goal for each state is used in this study as both an organizational and a clustering method. If the type of goal is listed as a "%" this means the goal is listed as a percent reduction in the performance measure(s). If the type of goal is listed as a "number" this means the goal is listed as a specific performance measure number the state would like to achieve (e.g. Prevent serious crashes on Kentucky's highways such that the annual number of deaths falls at or below 500 by the year 2024). For states that have "5 safety performance measures" listed as the goal type, this refers to the five core safety measures identified by the FHWA in their HSIP methodology. The type of goal labelled "TZD" refers to the Towards Zero Deaths goal identified in the Safe Systems approach. If the type of goal is labelled "No Date" this means that the state has a goal Towards Zero Deaths but did not identify the timeline by which they would like to achieve this goal. The states are clustered into 11, 7, and 5 clusters based on type.

Finally, in Appendix H the "aggressiveness" of each SHSP goal is reported in terms of the percent reduction of fatalities over the life of the SHSP plan (5 years). This column in Appendix H is calculated in this thesis. Each state's goal aggressiveness is based on percent reductions of fatalities, even if the state included more than one safety performance measure goal. The only exception to this is Kansas, which only included a goal that combined fatal and serious injury crash rate reductions. The calculated "aggressiveness" of the Kansas goal assumes this reduction is the same for fatal crashes.

States categorized with the goal type "TZD" (Towards Zero Deaths) means the state has a goal to reach zero roadway fatalities by a target year. To calculate the aggressiveness of the SHSP goal in terms of percent reduction of fatalities over just the five-year life of the life of the SHSP document, a 100% reduction is assumed from the first listed SHSP year in the most recent update to the target date the state set for reaching zero deaths. The percent annual reduction that would be needed to achieve this goal by the target year was computed. Then, the percent annual reductions were summed over the life of the SHSP document, which is five years.

If states have identified a goal to reach zero roadway fatalities but did not specify a target year for when they want to achieve this, they were categorized with a "No Dates" goal type. These states were assigned the percent reduction from the least aggressive goal of the "TZD" category. This was determined to be California, which set a goal for 16.7% reduction of fatalities over the five-year life of their SHSP document. This assumption was made because most of the states in the "No Date" category had a goal of reaching zero roadway deaths but did not have a year listed for when they wanted to achieve this, keeping actual numerical calculations from being made.

To calculate the aggressiveness of the SHSP goal for states with a "Number of Fatalities" type, the equation below was used. For the inputs to this equation, the goal listed in each SHSP document is assumed to be the final five-year rolling average number of fatalities. The initial five-year rolling average number of fatalities is calculated from the actual annual number of fatalities reported in the HSP reports. This value is the five year rolling average from the year before the SHSP document began, then back five years prior. For example, the initial five-year average number of fatalities for Kentucky's most recent SHSP document (2020-2024) is the 2019 five year rolling average, which averages the number of fatalities for the years 2015-2019.

$$\%\,reduction = \frac{(final\ 5\ yr\ avg.number\ of\ fatalities) - (initial\ 5\ yr\ avg.of\ fatalities)}{(initial\ 5\ yr\ avg.of\ fatalities)}$$

To calculate the aggressiveness of the SHSP goal for states with a "Number of Fatality Rate" type, the percent reduction equation above was used, even though in reality fatality rates may be more challenging to decrease if the annual VMT increases in that state.

Finally, the states were clustered using a k-means clustering method for two variables: the aggressiveness of their SHSP goal and the actual net percent change in fatalities for the years 2015-2019. This five-year data was chosen because it was the most recent data available that also excluded 2020, where the numbers could have been affected by the COVID-19 pandemic. R studio was used to determine the optimal number of clusters for these variables and then to conduct the k-means cluster analysis. Similar code can be found in Figure 7 in Section 3.4. The only change is the spreadsheet that was used, which contained the unique data for these two variables. The raw spreadsheet data can be found in Appendix E.

4.1 Clustering states based on demographic information

From the methodology explained in Section 3.4, the following analyses are conducted:

4.1.1 Population living in urban areas and urban fatality rate

The two variables used to cluster the states in this analysis are the percent of the state population living in an urban area and the 2019 five-year rolling average urban fatality rate. Figure 8 shows an optimal number of clusters plot. From this plot, the inflection point is at k=5, which is the optimal number of clusters.

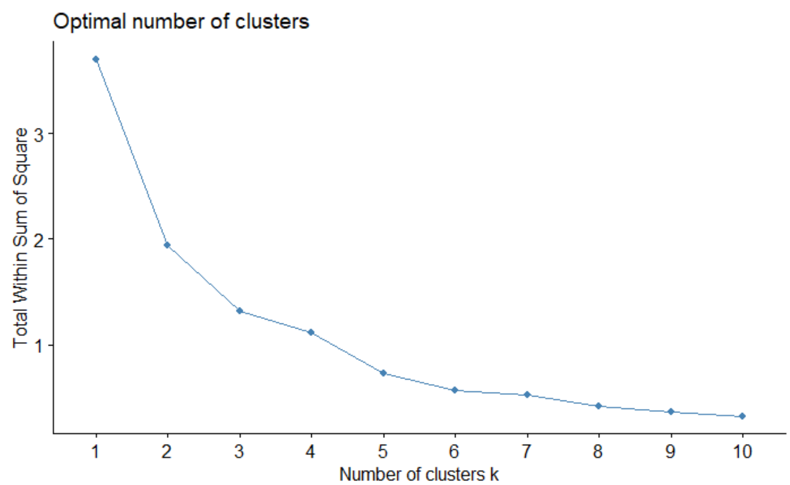

Figure 8: Urban population and urban fatality rate elbow test for k number of clusters

Using the number of clusters k=5, a k-means cluster analysis is performed. A cluster plot is created, as shown in Figure 9. In this cluster plot, clusters 3, 4, and 5 have a higher percentage of their total state population living in urban areas. Clusters 1 and 2 have a lower percentage of the total state population living in urban areas. Additionally, cluster 1 has the best safety performance when looking at urban crash fatality rates, followed by cluster 4. Kentucky is in cluster 2, which has similar percentages of the state population living in urban areas as cluster 1, but higher urban crash fatality rates. Differences could be due to culture, demographics, safe strategies being implemented, or other factors. Figure 10 shows the states color coded by the cluster assignment from the k-means test. Cluster 1 is mostly northern, midwestern states. Cluster 2 (Kentucky's cluster) are typically geographically close to Kentucky and mostly comprise of southeastern states (except for Alaska).

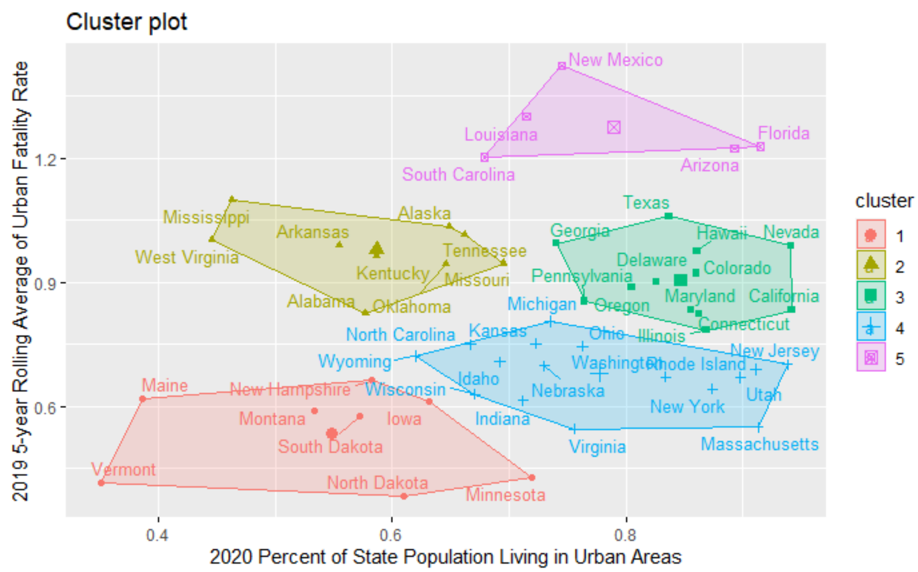

Figure 9: Urban population and urban fatality rate cluster plot

From observing the different clusters for the urban fatality rate and urban population, R can identify states that have a similar spread of the population living in urban areas but have a better safety performance when it comes to urban fatality rates. For example, Virginia, North Carolina, Ohio, and Indiana from Cluster 4 are geographically close to Kentucky, but consistently record a lower urban fatality rate than Kentucky.

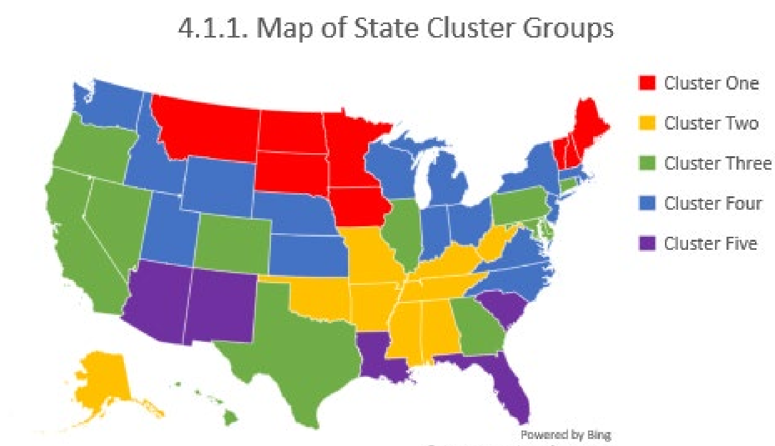

Figure 10: Urban population and urban fatality rate map of state cluster groups

4.1.2 Percent of total road length that is urban and urban fatality rate

The two variables used to cluster the states in this analysis are the 2020 percent of total road length in the state that is classified as urban and the 2019 five-year rolling average urban fatality rate. This groups states by how "urban" their transportation systems are and by their actual urban fatality rate safety performance. Figure 11 shows the optimal number of clusters plot. From this plot, the inflection point can be identified as k=3, which is the optimal number of clusters.

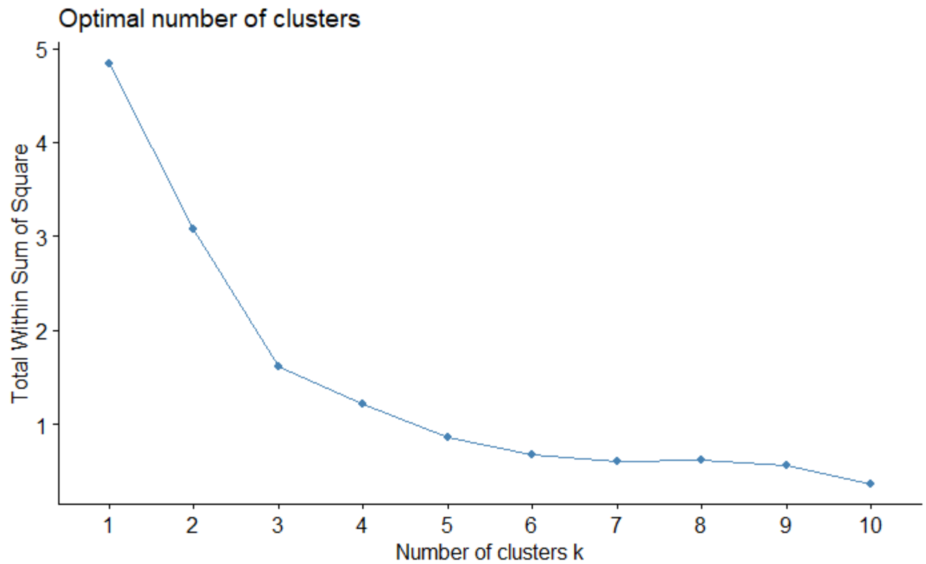

Figure 11: Percent of total road length classified as urban and urban fatality rate elbow test for k number of clusters

A plot displaying the 3 clusters is shown in Figure 12. In this plot, cluster 2 has the lowest average urban crash fatality rate (i.e. the best safety performance for this safety performance measure). States in cluster 1 and cluster 2 have similar percentages of total road length classified as urban roads. Cluster 3 has a much higher percentage of roads classified as urban. Kentucky falls in in cluster 1, which means the state is in the group with higher (and therefore "worse") actual safety performance when looking at urban fatality rates.

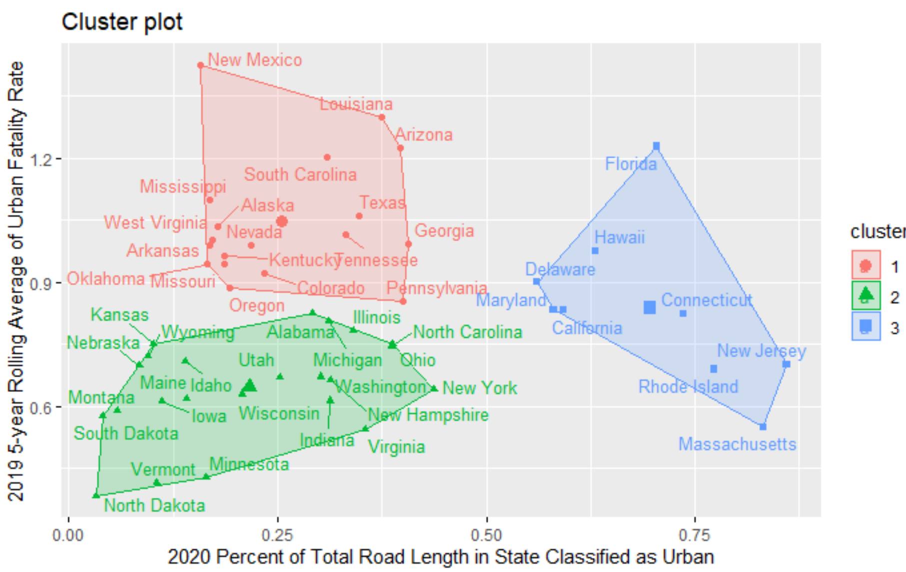

Figure 12: Percent of total road length classified as urban and urban fatality rate cluster plot

Figure 13 shows a map where states are color coded by the cluster assignment from the k-means test. It is interesting to note that cluster 1 is predominantly southern states, while cluster 2 is predominantly northern states.

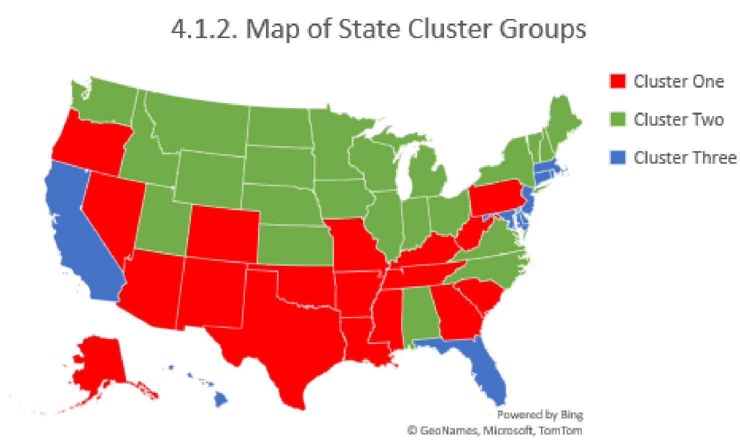

Figure 13: Percent of total road length classified as urban and urban fatality rate map of state cluster groups

4.1.3 Percent of total road length that is rural and rural fatality rate

This k-means cluster analysis is similar to the analysis conducted in section 4.1.2. The two variables used to cluster the states in this analysis are the 2020 percent of total road length in the state that is classified as rural and the 2019 five-year rolling average rural fatality rate. This is not necessarily the inverse of the variables used in Section 4.1.2. because this analysis uses rural fatality rates as the highway safety performance measure. The inflection point on the optimal number of clusters graph can be seen in Figure 14, which is k=4.

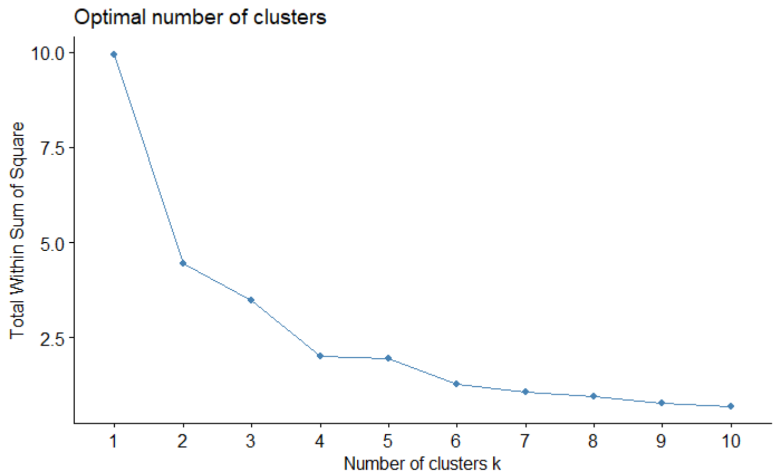

Figure 14: Percent of total road length classified as rural and rural fatality rate elbow test for k number of clusters

A cluster plot is shown in Figure 15. In this plot, cluster 1 states have a very small percentage of their roads that are classified as rural. They also have a very low rural fatality rate, which makes sense because they do not have many rural roads. Cluster 2 and 3 have the highest percentage of rural roads in their states, while cluster 2 has better safety performance with lower rural crash fatality rates. Cluster 3 has slightly higher rural fatality rates. Finally, cluster 4 has roughly the same amount of rural and urban roads in each of its states, but states in this cluster consistently have the highest rural fatality rates.

Since Kentucky is in cluster 3, it is in the middle of the pack when looking at rural fatality rate performance. When looking at just cluster 2 and 3 (which have similar roadway characteristics distributions), it is in the more under-performing group. This means that our rural roads are not as safe when it comes to preventing fatal crashes in rural locations as compared to other states that have approximately the same distribution of rural vs. urban roads in their state.

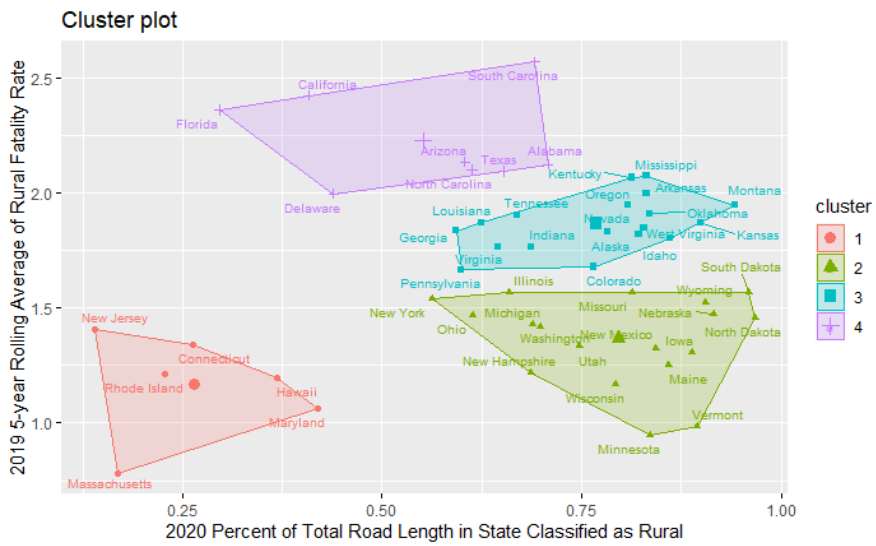

Figure 15: Percent of total road length classified as rural and rural fatality rate cluster plot

Figure 16 shows a map where states are color coded by the cluster assignment from the k-means test. The clusters and geographical locations follow the same general trend as the map in Figure 13, where the northern states typically had better safety performance for both rural and urban fatality rates.

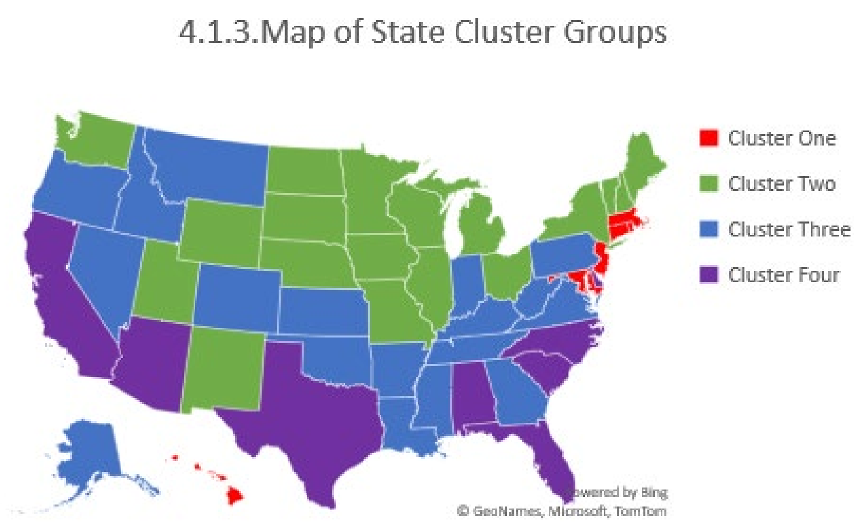

Figure 16: Percent of total road length classified as rural and rural fatality rate map of state cluster groups

4.2 Clustering states based on core safety performance measures

From the methodology explained in Section 3.5, the following analysis in 4.2.1. is conducted. Two related safety performance measures are selected to conduct a k-means cluster analysis to demonstrate how clustering states solely by their safety performance can be used to help compare state highway safety to each other. States that are performing well for the selected performance measures could be studied more closely to determine other factors or safety planning strategies that are being used to help them achieve better roadway safety performance. There are many safety performance measures that could be used to cluster states. Section 4.2.1. highlights one k-means clustering analysis based on two selected safety performance measures. States can then use this model to adapt the safety performance measures selection to assist in understanding data related to their specific safety goals or SHSP emphasis areas.

4.2.1 Percent of total passenger vehicle occupant fatalities were occupants were unrestrained and observed seat belt use

The two variables used to cluster the states in this analysis are the percent of unrestrained passenger vehicle fatalities and percent of observed seat belt usage. The percent of passenger vehicle fatalities that were unrestrained is the 2019 five-year rolling average of the number of total passenger vehicle fatalities, and the 2019 five-year rolling average of the number of unrestrained passenger vehicle fatalities, from the Highway Safety Plan reports. Then, the two averages were made into a proportion to calculate the percentage of total passenger vehicle fatalities that were unrestrained. The observed seat belt use was also the 2019 five-year average of observed seat belt use, recorded as percentages. The inflection point that determines the optimal number of clusters can be seen in Figure 17 , which is determined to be k=3.

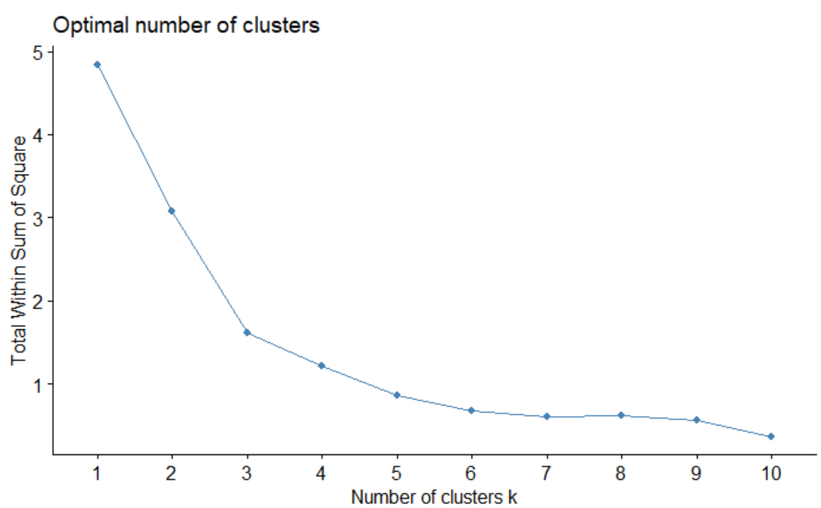

Figure 17: Percent of unrestrained passenger vehicle fatalities and percent of seat belt usage elbow test for k number of clusters

Using the number of clusters k=3, a k-means cluster analysis is performed. A cluster plot is created, as shown in Figure 18. In this cluster plot, there is a loose linear relationship between the percent of passenger vehicle fatalities that were unrestrained and the observed seat belt usage in a state. States that have high percentages of unrestrained passenger vehicle fatalities are also more likely to observe lower percentages of seat belt usage (cluster 1). These are the lowest performing states for these two safety performance measures. Kentucky is in the middle of the safety performance range, located in cluster 2. States in cluster 3 observed high percentages of seat belt usage in their states and also recorded lower percentages of unrestrained passenger vehicle fatalities.

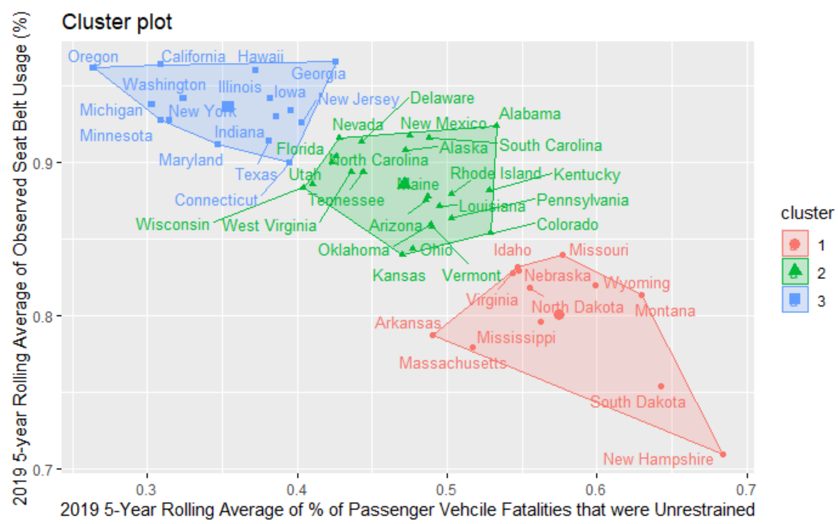

Figure 18: Percent of unrestrained passenger vehicle fatalities and percent of seat belt usage

Figure 19 shows a map where states are color coded by the cluster assignment from the k-means test. Cross referencing the map in Section 4.1.1. (Figure 10), the states with higher percentages of their population living in urban areas also typically saw higher seat belt use percentages.

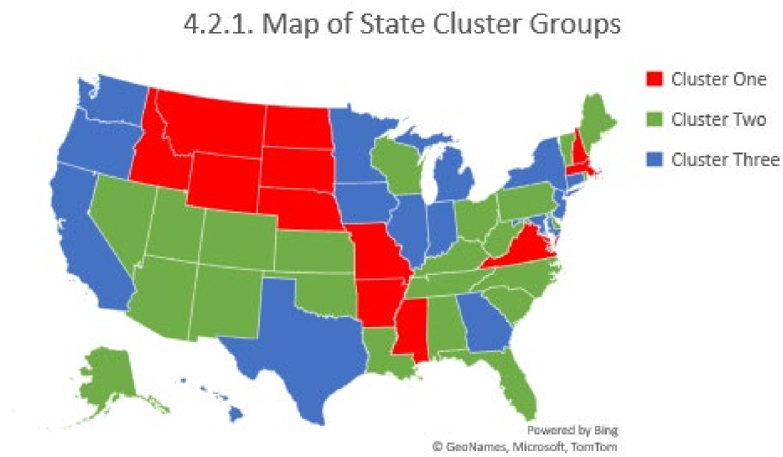

Figure 19: Percent of unrestrained passenger vehicle fatalities and percent of seat belt usage map of state cluster groups

4.3 Clustering states based on SHSP characteristics

From the methodology explained in Section 3.6, the following analyses are conducted:

4.3.1 SHSP Emphasis Areas

The first way the states can be clustered is simply by analyzing the matrix of emphasis areas identified by each state in Appendix G. Most states included at least one emphasis area in their SHSP from the driver behavior, roadway design, and vulnerable road users (VRU) category groups of emphasis areas. Minnesota included the largest number of emphasis areas in their most recent SHSP, which was 20. The smallest total number of emphasis areas identified by a state was 3, and these states were Alaska, Pennsylvania, and South Carolina. The average number of total emphasis areas identified by a state was 8 emphasis areas. Kentucky is right under this average, with 6 emphasis areas included in their most recent SHSP update. This comprehensive list of emphasis areas for each state could provide a beneficial visual for state roadway safety planners when updating their SHSP document to see popular emphasis areas that other states have identified. This can also be helpful for states to think about emerging emphasis areas that come with new technology in transportation or changing travel behavior.

The second way the states can be clustered is by the k-means analysis, clustering states by the total number of emphasis areas they identified and by the actual fatality rate performance. The two variables used to cluster the states in this analysis are the total number of emphasis areas the state identified in their most recent SHSP document and the actual 2019 five year rolling average fatality rate. Because each state is on a different rotation schedule for the SHSP update, and because data for the years of their most recent SHSP update may not be available yet, the actual fatality rate from the years 2015-2019 are used for all states to calculate the 2019 five year rolling average. The inflection point that determines the optimal number of clusters can be seen in Figure 20, which is k=4.

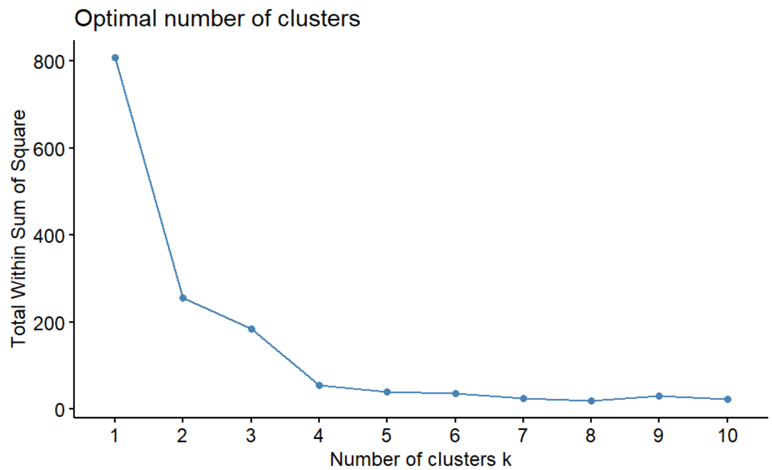

Figure 20: SHSP number of emphasis areas and fatality rate elbow test for k number of clusters

Using the number of clusters k=4, a k-means cluster analysis is performed. A cluster plot is created, as shown in Figure 22. Cluster 3 has the lowest number of emphasis areas included in these states' SHSP. Cluster 1 has the second lowest number of emphasis areas. Kentucky is included in this cluster. Cluster 2 has the second highest number of emphasis areas, and Cluster 4 has the highest number of emphasis areas. According to this plot, there is not much correlation between the number of emphasis areas a state has in their SHSP and the fatality rate of the state. Therefore, according to this plot, roadway safety performance is not really affected whether a greater number of emphasis (that are more specific) or a fewer number of emphasis areas (that encompass a larger range of roadway safety concerns) are used in the SHSP.

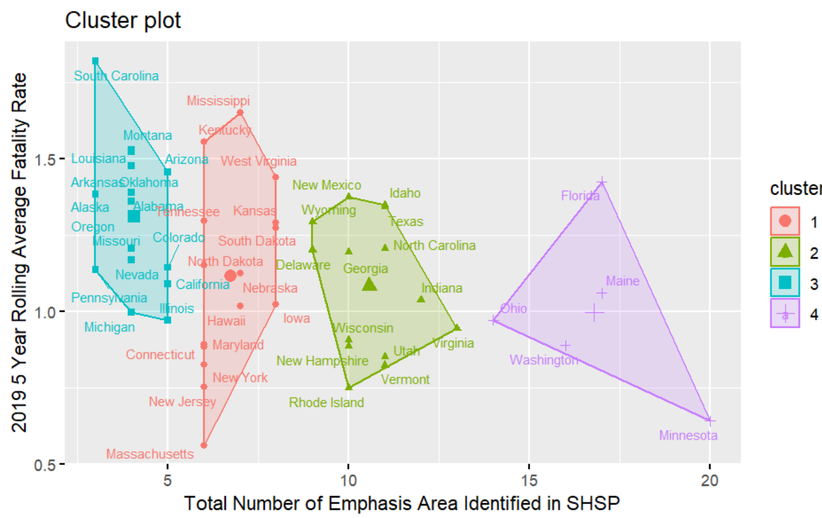

Figure 21: SHSP emphasis areas and actual fatality rate cluster plot

Figure 22 shows a map where states are color coded by the cluster assignment from the k-means test. There are not any strong geographic patterns when it comes to the cluster the states have been assigned from the k-means analysis.

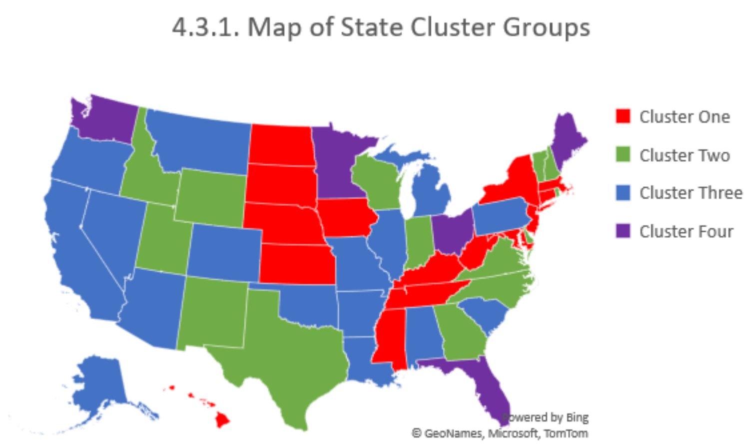

Figure 22: SHSP emphasis areas map of state cluster groups

4.3.2 SHSP Goals

The states are clustered by their SHSP goals two ways in this thesis. The first way states were clustered by their SHSP goals is by the type of safety performance measure(s). The list of the SHSP goal for each state can be found in Appendix H. Eleven unique types of safety performance measures (or combinations of safety performance measures) were used in the state goals. As mentioned in Section 3.6.2, clustering by 11 groups, 7 groups, and 5 groups are created from engineering judgement to combine the types of goals that were most similar. The resulting groupings are seen below in Figure 23. From this list, states can identify other states that have goals like theirs in terms of safety performance measures used. The most common type of safety performance measures included in state SHSP goals were both fatalities and serious injuries, in the form of a percent reduction or a numerical reduction. Kentucky is included in the cluster for SHSP goals focusing just on reducing fatalities.

Clustering based upon type of SHSP goal			
	11 Clusters	7 Cluster	5 Clusters
Cluster 1 (% fatalities)	Mississippi Missouri N. Carolina Pennsylvania Utah	Mississippi Missouri N. Carolina Pennsylvania Utah	Mississippi Missouri N. Carolina Pennsylvania Utah
Cluster 2 (# fatalities)	Idaho Indiana Kentucky N. Dakota Texas	Idaho Indiana Kentucky N. Dakota Texas	Idaho Indiana Kentucky N. Dakota Texas
Cluster 3 (% fatalities & serious injuries)	Montana Alabama Colorado Connecticut Delaware Illinois Louisiana New Hampshire Rhode island Virginia Vermont West Virginia	Montana Alabama Colorado Connecticut Delaware Illinois Louisiana New Hampshire Rhode island Virginia Vermont West Virginia	Montana Alabama Colorado Connecticut Delaware Illinois Louisiana New Hampshire Rhode island Virginia Vermont West Virginia
Cluster 4 (# fatalities & serious injuries)	Michigan Minnesota S. Dakota Alaska	Michigan Minnesota S. Dakota Alaska	Michigan Minnesota S. Dakota Alaska
Cluster 5 (% fatalities, serious injuries, injuries)	New Jersey	New Jersey	New Jersey
Cluster 6 (% 5 safety performance measures	Ohio	Ohio	Ohio
Cluster 7 (# 5 safety performance measures)	Nebraska Nevada New York Oklahoma Tennessee Wisconsin	Nebraska Nevada New York Oklahoma Tennessee Wisconsin	Nebraska Nevada New York Oklahoma Tennessee Wisconsin
Cluster 8 (# fatality rate)	Hawaii	Hawaii	Hawaii
Cluster 9 (# serious injury rate)	Kansas	Kansas	Kansas
Cluster 10 (TZD)	Maryland California Washington	Maryland California Washington	Maryland California Washington
Cluster 11 (no date for TZD or non-numeric goal)	Massachusetts Arkansas Florida Georgia Iowa Maine Arizona New Mexico Oregon S. Carolina Wyoming	Massachusetts Arkansas Florida Georgia Iowa Maine Arizona New Mexico Oregon S. Carolina Wyoming	Massachusetts Arkansas Florida Georgia Iowa Maine Arizona New Mexico Oregon S. Carolina Wyoming

Figure 23: Clustering states by type of SHSP goal

Next, a k-means cluster analysis is also used to cluster the states by the goals set in their SHSP documents. This analysis looks at the relative "aggressiveness" of their goals in a numerical sense instead of by the type of safety performance measures that are included in the goal. The two variables used to cluster the states in this analysis are the percent reduction in crash fatalities over the life of the SHSP document (five years) and the actual net percent change in crash fatalities over five years. Because each state is on a different rotation schedule for the SHSP update, and because data for the years of their most recent

SHSP update may not be available yet, the actual number of crash fatalities from the years 2015-2019 are used for all states. Each year's number of fatalities is a five-year rolling average. The inflection point that determines the optimal number of clusters can be seen in Figure 24, which is k=3.

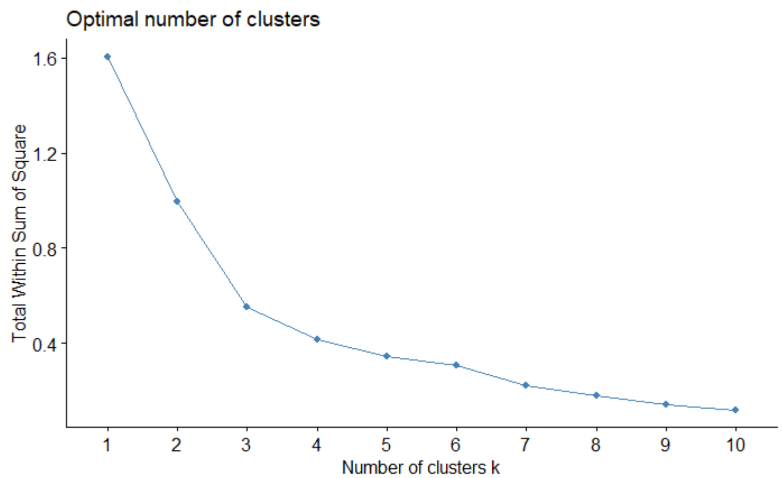

Figure 24: SHSP goals aggressiveness and actual improvement elbow test for k number of clusters

Using the number of clusters k=3, a k-means cluster analysis is performed. A cluster plot is created, as shown in Figure 25. In this cluster plot, because we are looking at fatality reductions, the states on the left side of the plot have set the most "aggressive" goals in their SHSP. These states are in cluster 3. Kentucky is in this lead group when it comes to setting ambitious goals aiming to reduce crash fatalities. However, when it comes to actual reduction in fatalities, only states in cluster 2 have seen an actual overall decrease in their fatalities for the past several years. Cluster 1 and 3 have actually seen a slight net increase in actual fatalities recorded.

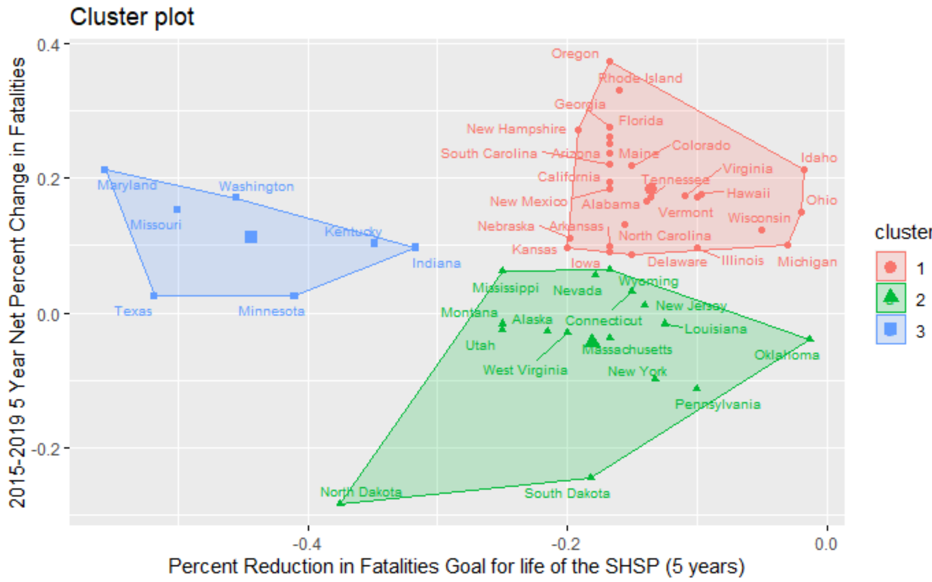

Figure 25: SHSP goals aggressiveness and actual improvement cluster plot

Figure 26 shows a map where states are color coded by the cluster assignment from the k-means test. Geographically, cluster 2, where most states in this cluster have seen a decrease in fatalities over recent years, are mostly northern states. The exception to this is Louisianna, Mississippi, and Oklahoma.

4.3.2. Map of State Cluster Groups

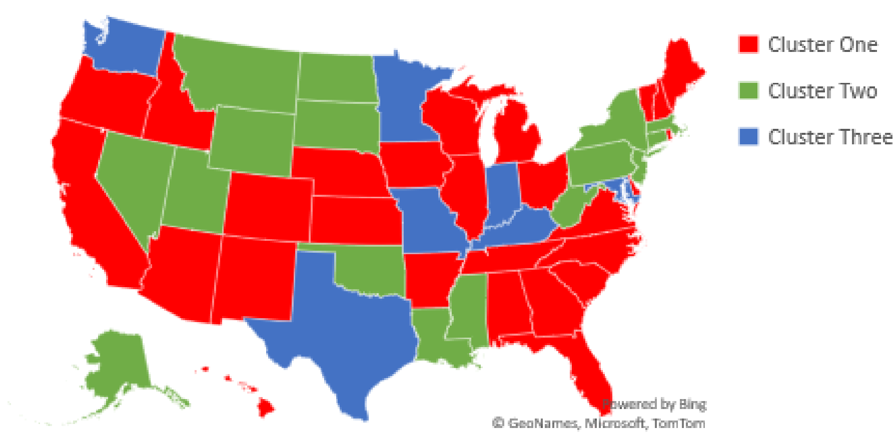

Figure 26: SHSP goal aggressiveness map of state cluster groups

CHAPTER 5. CONCLUSIONS

5.1 General Conclusions

Researching all fifty states for safety strategy ideas during the SHSP update process could be very time consuming. Additionally, the safety strategy ideas gathered in such a nationwide search may not all be useful for comparison states with very different demographic, cultural, legislation, and/or other factors that affect highway safety improvement potential. This thesis used statistical analyses to provide clusters of other states that are likely to be most useful for informing a state as to developing strategies and emphasis areas to include in SHSP revision. This is intended to narrow down the number of states to research for successful safety programs, by identifying states that have similar highway safety improvement potential or similar highway safety planning documents.

5.2 Limitations

A significant limitation to the analysis in this research is the access to the data for all 50 states. While the k-means clustering method described in this thesis can be adapted to analyze a wide variety of highway safety or SHSP related data, this information must first be available for all 50 states.

Data for the years 2020-2021 were left out of the analysis to avoid any confounding effects from the change in transportation safety patterns due to the COVID-19 pandemic. This analysis was conducted in 2023, so the data used in this thesis is already several years old and may already be outdated from actual current highway safety trends.

The k-means cluster analysis that is used in this thesis only considers two variables at a time, when in reality there are a large number of variables that affect highway safety at the same time. It is difficult to grasp and model the relationship between all the factors that affect highway safety.

5.3 Recommendations & Suggestions for Future Research

The outputs from the cluster analyses conducted in chapter 4 provide a more specified group of states to use when comparing highway safety programs. The next step for future research would be to research successful safety programs being implemented in the states from the selected cluster.

The cluster chosen to investigate further could be based on states with the same demographics as the subject state. For example, from the results in Section 4.1.1, more investigation would be needed in a future study to determine why states in Cluster 1 have similar urban population demographics as Cluster 2, but consistently have lower urban fatal crash rates than Cluster 2. It could be useful to compare urban highway safety programs that may explain different safety performance between the clusters.

Clusters could also be chosen based on groups with the best highway safety performance. For example, from the results in Section 4.2.1, states in Cluster 3 consistently recorded a lower percentage of fatalities for unrestrained vehicle occupants and observed high seat belt usage. The states in this cluster are therefore considered to have the best safety performance for occupant protection. Future research in a certain state (i.e. Kentucky) could look at states in Cluster 3 to find new safety strategy ideas to encourage and increase seat belt usage in their own state, which would hopefully result in a lower number of unrestrained passenger fatalities and a lower number of total roadway fatalities.

Finally, comparison states could be based on states' SHSP characteristics, such as emphasis areas identified. The compiled emphasis area table in Appendix G could be useful when states consider which emphasis areas, they should include in their next SHSP update. Specifically, when developing Kentucky's next SHSP update in 2024, this list can be used to compare other common emphasis areas identified by other states with the current emphasis areas in Kentucky's document. It could also be used to identify new emphasis areas other states are identifying as transportation safety research continues to evolve or as new technology is being used in transportation.

For specific highway safety performance measures or state characteristics not included in the cluster analyses of this thesis, the k-means clustering method can be modified in future studies to use the data most relevant to a state's safety planning. Ideas for other data that could be included in future state clustering analyses are: the percentage of total vehicle miles that are travelled on rural roads within a state, median or mean income of a state, and the amount of funding spent on different types of roadway safety projects (such as engineering improvements for roadways or educational campaigns). Furthermore, expanding this methodology to cluster the states based on multiple time periods could identify states that are consistently similar to each other over multiple SHSP updates and better highlight safety performance trends among states. Finally, conducting a meta-clustering analysis where more than two variables are used at one time could provide even more specialized and accurate clustering of states.

APPENDICES

APPENDIX A. ANNUAL VEHICLE MILES TRAVELLED BY STATE

Table 4: Annual Vehicle Miles Travelled by Stated (100 Million VMT), compiled from FHWA Statistics Series

	2012			2013			2014			2015			2016		
State	Rural	Urban	Total	Rural	Urban	Total	Rural	Urban	Total	Rural	Urban	Total	Rural	Urban	Total
Alabama	30,185	34,774	64,959	30,303	34,743	65,046	27,653	38,014	65,667	28,283	38,974	67,257	29,135	40,092	69,227
Alaska	2,299	2,493	4,792	2,326	2,523	4,848	2,016	2,840	4,857	2,126	2,920	5,045	2,238	3,020	5,259
Arizona	17,068	43,061	60,129	14,234	46,353	60,586	15,541	47,090	62,631	15,589	49,455	65,045	15,708	50,078	65,786
Arkansas	18,306	15,216	33,522	16,079	17,415	33,493	16,438	17,586	34,024	16,864	18,033	34,897	17,227	18,528	35,755
California	57,520	268,752	326,272	51,827	277,707	329,534	52,440	280,417	332,857	53,680	281,859	335,539	52,995	287,120	340,115
Colorado	14,943	31,826	46,769	14,844	32,124	46,968	14,417	34,569	48,985	14,707	35,730	50,437	15,277	36,874	52,152
Connecticut	3,879	27,390	31,269	3,817	27,124	30,941	3,120	28,071	31,190	3,158	28,434	31,592	3,161	28,478	31,639
Delaware	2,970	6,216	9,186	3,053	6,254	9,308	2,873	6,723	9,596	3,000	6,931	9,931	3,000	7,178	10,178
Florida	34,505	156,869	191,374	34,734	157,968	192,702	31,805	169,235	201,040	33,130	173,852	206,982	35,072	180,478	215,551
Georgia	35,111	72,378	107,488	25,593	83,762	109,355	25,816	85,719	111,535	28,590	89,517	118,107	30,044	92,758	122,802
Hawaii	2,407	7,642	10,050	1,795	8,304	10,099	1,713	8,461	10,174	1,773	8,527	10,301	1,819	8,817	10,635
Idaho	9,512	6,803	16,315	9,291	6,689	15,980	9,390	6,764	16,154	9,537	7,124	16,662	9,907	7,292	17,199
Illinois	26,391	78,187	104,578	25,359	79,938	105,297	24,704	80,202	104,906	25,030	80,193	105,223	25,544	81,770	107,314
Indiana	29,434	49,489	78,923	29,167	49,144	78,311	29,271	49,932	79,204	28,223	50,596	78,819	32,506	50,677	83,183
Iowa	19,099	12,497	31,596	18,198	13,443	31,641	18,484	12,930	31,414	19,289	13,872	33,161	19,625	13,712	33,337
Kansas	15,083	15,490	30,572	14,466	15,743	30,208	14,858	15,852	30,710	14,980	16,399	31,379	15,217	16,886	32,103
Kentucky	27,349	19,995	47,344	27,172	19,824	46,996	25,706	22,234	47,941	26,132	22,543	48,675	26,354	22,959	49,313
Louisiana	20,244	26,645	46,889	19,790	27,968	47,758	20,038	28,213	48,252	18,520	29,660	48,180	18,939	30,216	49,156
Maine	10,255	3,944	14,199	10,234	3,895	14,129	10,328	3,974	14,301	10,550	4,080	14,629	10,020	4,818	14,838
Maryland	14,249	42,226	56,476	10,556	46,131	56,688	10,165	46,267	56,432	10,369	47,146	57,516	10,671	48,467	59,137
Massachusetts	2,534	53,406	55,940	2,586	53,725	56,311	2,610	54,943	57,552	2,822	56,435	59,257	3,492	58,333	61,825
Michigan	30,164	64,384	94,548	28,058	67,074	95,132	28,321	69,063	97,384	29,116	68,727	97,843	29,913	69,520	99,433
Minnesota	24,487	32,502	56,988	23,318	33,656	56,974	23,452	33,942	57,395	23,452	33,942	57,395	24,077	34,952	59,029
Mississippi	23,245	15,422	38,667	22,051	16,707	38,758	22,463	17,036	39,499	22,160	17,730	39,890	22,874	17,881	40,755
Missouri	28,640	39,863	68,504	28,500	40,958	69,458	29,008	41,901	70,909	29,444	42,474	71,918	30,370	43,648	74,019
Montana	8,904	2,982	11,885	8,344	3,689	12,033	8,426	3,731	12,157	8,529	3,816	12,345	8,706	3,893	12,599
Nebraska	11,181	8,095	19,277	11,235	8,087	19,322	11,416	8,197	19,613	11,383	8,718	20,101	11,353	9,347	20,700
Nevada	4,838	19,310	24,148	5,015	19,635	24,649	4,832	20,470	25,302	5,011	20,915	25,925	5,233	21,555	26,788
New Hampshire	5,813	7,081	12,894	5,068	7,835	12,903	5,102	7,868	12,970	5,166	7,928	13,094	5,358	8,155	13,513
New Jersey	4,551	69,674	74,225	4,545	69,984	74,530	4,694	70,162	74,856	4,835	70,558	75,393	4,948	72,144	77,093
New Mexico	14,590	10,971	25,562	14,372	10,714	25,086	14,372	10,975	25,347	15,532	11,903	27,435	16,015	11,870	27,886
New York	26,983	95,920	122,903	26,752	97,603	124,355	25,096	98,889	123,984	24,760	96,939	121,699	24,994	24,994	122,337
North Carolina	40,983	63,967	104,950	40,610	64,602	105,213	36,564	71,448	108,012	37,633	74,246	111,879	39,294	77,455	116,749
North Dakota	7,633	2,449	10,081	7,518	2,582	10,100	7,870	2,642	10,511	7,291	2,745	10,036	6,853	2,886	9,739
Ohio	36,484	76,231	112,715	33,235	79,532	112,767	33,306	79,461	112,766	33,783	79,890	113,673	34,840	83,768	118,608
Oklahoma	21,795	26,077	47,872	20,581	27,417	47,999	20,854	26,845	47,699	21,169	26,544	47,713	21,837	27,176	49,013
Oregon	14,531	18,642	33,173	14,995	18,710	33,706	13,486	21,124	34,610	14,303	21,695	35,999	14,572	22,147	36,719
Pennsylvania	34,680	64,204	98,884	35,310	63,318	98,628	35,911	63,970	99,882	35,395	65,550	100,945	34,368	66,994	101,362
Rhode Island	841	6,965	7,807	903	6,872	7,775	876	6,801	7,677	888	6,945	7,833	905	7,022	7,927
South Carolina	23,451	25,586	49,036	23,421	25,565	48,986	22,636	27,295	49,931	23,610	28,116	51,726	24,832	29,721	54,553
South Dakota	6,478	2,635	9,113	6,426	2,696	9,122	6,433	2,792	9,225	6,512	2,813	9,324	6,641	2,866	9,507
Tennessee	28,211	42,955	71,167	27,937	43,130	71,067	25,376	46,960	72,336	25,467	51,203	76,670	24,546	52,338	76,884
Texas	70,834	167,002	237,836	75,825	168,700	244,525	67,898	175,178	243,076	68,889	189,233	258,122	71,146	200,117	271,263
Utah	8,005	18,523	26,528	7,248	19,758	27,005	7,323	20,231	27,554	8,287	21,317	29,604	8,310	23,139	31,449
Vermont	5,340	1,876	7,216	5,258	1,858	7,116	4,975	2,085	7,059	5,199	2,115	7,314	5,251	2,131	7,382
Virginia	29,716	51,243	80,959	30,100	50,667	80,767	30,197	50,787	80,985	23,602	59,023	82,625	28,708	55,755	84,463
Washington	16,947	39,815	56,762	15,627	41,584	57,211	15,893	42,167	58,060	16,514	43,138	59,653	16,983	44,035	61,018
West Virginia	11,108	8,117	19,226	11,210	8,022	19,232	11,175	7,943	19,117	9,722	10,104	19,827	9,983	9,557	19,539
Wisconsin	30,590	28,497	59,087	30,753	28,733	59,486	30,980	29,073	60,053	32,120	29,954	62,073	32,265	31,782	64,046
Wyoming	6,414	2,857	9,271	6,446	2,863	9,309	6,538	2,919	9,457	6,652	2,945	9,597	6,448	2,874	9,323

	2017			2018			2019			2020			2021		
State	Rural	Urban	Total	Rural	Urban	Total	Rural	Urban	Total	Rural	Urban	Total	Rural	Urban	Total
Alabama	28,683	41,994	70,677	28,788	42,379	71,167	29,011	42,723	71,735	27,814	40,108	67,921	29,164	42,728	71,892
Alaska	2,323	3,196	5,519	2,277	3,211	5,487	2,590	3,291	5,881	2,483	2,823	5,306	2,682	3,070	5,752
Arizona	15,999	49,071	65,070	16,343	49,802	66,145	16,690	53,591	70,281	15,768	49,990	65,758	17,620	56,140	73,760
Arkansas	17,590	18,799	36,389	17,787	18,888	36,675	17,945	19,154	37,099	16,305	17,614	33,919	19,259	19,168	38,427
California	54,702	289,160	343,862	58,432	290,364	348,796	56,480	284,356	340,836	55,381	244,431	299,812	58,381	252,442	310,823
Colorado	15,722	37,660	53,382	15,894	38,059	53,954	16,216	38,418	54,634	15,040	33,602	48,642	16,723	37,117	53,840
Connecticut	3,144	28,356	31,500	3,159	28,437	31,596	3,189	28,412	31,601	2,936	26,908	29,845	2,858	26,130	28,989
Delaware	2,613	7,854	10,467	2,470	7,710	10,179	2,527	7,718	10,245	2,021	6,324	8,345	2,835	7,317	10,152
Florida	35,912	182,914	218,826	36,742	185,074	221,816	37,531	188,983	226,514	35,241	172,835	208,076	37,741	179,826	217,566
Georgia	29,766	94,967	124,733	32,849	98,607	131,456	31,810	101,318	133,128	28,984	86,983	115,967	30,241	90,444	120,685
Hawaii	1,863	8,885	10,749	1,845	9,042	10,887	1,877	9,147	11,024	1,467	7,319	8,785	1,736	8,236	9,972
Idaho	9,957	7,344	17,300	10,180	7,529	17,709	10,109	7,949	18,058	10,018	7,389	17,406	11,225	8,084	19,308
Illinois	25,773	82,238	108,011	25,652	82,302	107,954	25,376	82,149	107,525	23,326	70,795	94,121	21,602	75,928	97,530
Indiana	29,309	52,443	81,752	29,691	51,837	81,529	30,106	52,613	82,719	27,731	48,877	76,608	29,108	49,532	78,640
Iowa	19,803	13,679	33,482	19,717	13,566	33,282	19,956	13,581	33,537	17,877	11,874	29,751	19,954	13,086	33,039
Kansas	15,229	17,029	32,258	15,345	16,846	32,190	15,230	16,612	31,843	13,697	14,156	27,854	15,402	16,291	31,693
Kentucky	26,251	22,989	49,239	26,616	22,928	49,544	26,597	22,813	49,410	25,232	21,304	46,536	26,389	21,722	48,111
Louisiana	19,017	30,204	49,221	19,534	30,511	50,045	19,798	31,562	51,360	18,971	29,404	48,374	20,958	33,770	54,728
Maine	10,034	4,704	14,738	10,178	4,605	14,784	10,251	4,620	14,871	9,104	3,982	13,086	10,057	4,503	14,560
Maryland	10,733	49,312	60,045	10,648	49,128	59,775	10,712	49,503	60,216	9,404	41,481	50,885	10,444	46,157	56,601
Massachusetts	3,098	59,563	62,660	3,069	63,703	66,772	3,052	61,837	64,890	2,693	51,434	54,127	2,895	56,220	59,115
Michigan	31,023	70,734	101,757	31,204	71,194	102,398	31,282	70,891	102,174	27,593	58,954	86,547	30,922	65,822	96,744
Minnesota	24,377	35,594	59,971	24,672	35,766	60,438	24,827	35,904	60,731	22,167	29,453	51,619	24,548	32,623	57,171
Mississippi	24,063	16,814	40,877	23,833	16,898	40,730	23,996	17,095	41,091	23,289	16,376	39,665	24,284	16,568	40,853
Missouri	32,472	43,440	75,911	33,166	43,429	76,595	34,510	44,659	79,168	32,530	40,268	72,797	36,464	43,327	79,791
Montana	8,746	3,898	12,645	8,754	3,945	12,700	8,941	3,951	12,892	8,423	3,681	12,104	9,449	4,033	13,482
Nebraska	11,501	9,501	21,002	11,617	9,358	20,975	11,663	9,579	21,242	10,836	8,596	19,432	11,869	9,341	21,210
Nevada	5,459	22,128	27,587	5,701	22,618	28,319	5,639	23,155	28,794	5,333	19,898	25,231	5,931	21,146	27,077
New Hampshire	5,432	8,249	13,681	5,484	8,292	13,776	5,554	8,274	13,828	4,937	7,019	11,956	5,429	7,701	13,130
New Jersey	4,880	72,628	77,509	4,868	72,671	77,539	4,967	73,238	78,205	4,251	62,090	66,341	4,696	68,977	73,673
New Mexico	16,810	11,026	27,836	16,179	11,109	27,288	16,423	11,349	27,772	14,211	9,546	23,756	16,054	10,770	26,823
New York	25,160	98,317	123,477	25,303	98,207	123,510	25,487	98,499	123,986	21,922	80,555	102,477	23,328	83,542	106,870
North Carolina	40,129	79,048	119,176	41,166	79,962	121,127	41,618	80,857	122,475	36,857	69,485	106,342	40,606	77,129	117,734
North Dakota	6,798	2,919	9,717	6,882	2,974	9,856	6,876	2,950	9,826	5,886	2,882	8,768	6,292	2,964	9,256
Ohio	35,342	84,256	119,598	34,637	79,837	114,474	35,022	79,672	114,694	31,182	71,933	103,115	34,033	78,890	112,923
Oklahoma	22,212	27,190	49,402	22,096	23,337	45,433	22,020	22,628	44,648	20,872	21,128	42,000	22,464	22,296	44,760
Oregon	14,547	22,206	36,753	14,589	22,259	36,848	13,608	22,200	35,808	12,376	19,922	32,298	14,871	21,971	36,842
Pennsylvania	35,003	66,611	101,614	34,318	67,792	102,109	34,505	68,359	102,864	31,099	56,884	87,982	34,232	68,454	102,686
Rhode Island	904	7,096	8,001	913	7,095	8,009	918	6,663	7,581	772	6,092	6,864	1,006	6,520	7,526
South Carolina	25,284	30,213	55,497	25,596	31,205	56,801	26,015	31,925	57,939	24,391	29,581	53,972	26,016	31,476	57,492
South Dakota	6,751	2,891	9,643	6,786	2,934	9,719	6,934	2,989	9,922	6,839	2,904	9,743	7,087	2,907	9,994
Tennessee	25,373	56,880	82,253	25,892	55,429	81,321	26,184	56,708	82,892	24,955	51,437	76,392	26,889	55,707	82,596
Texas	72,892	200,089	272,981	76,747	205,290	282,037	78,625	209,602	288,227	71,682	188,900	260,582	79,184	205,844	285,028
Utah	8,754	22,721	31,475	8,916	23,154	32,069	8,888	24,023	32,911	8,777	21,475	30,251	9,833	23,805	33,638
Vermont	5,280	2,144	7,424	5,217	2,129	7,346	5,221	2,124	7,346	4,273	1,734	6,007	4,702	1,923	6,625
Virginia	29,209	56,054	85,263	29,009	56,327	85,336	29,392	56,040	85,432	26,438	49,672	76,110	30,018	50,084	80,102
Washington	17,098	44,322	61,420	17,426	44,940	62,367	17,497	45,033	62,530	15,493	38,165	53,658	17,037	40,760	57,797
West Virginia	9,919	9,153	19,072	9,868	9,579	19,447	9,610	9,466	19,077	8,260	7,794	16,054	8,313	7,766	16,079
Wisconsin	33,200	32,124	65,324	33,357	32,528	65,885	33,386	32,962	66,348	29,253	28,347	57,600	33,250	31,734	64,983
Wyoming	6,848	2,937	9,785	7,387	3,052	10,438	7,190	3,018	10,208	7,139	2,662	9,800	8,202	2,894	11,097

APPENDIX B. ROAD LENGTH BY STATE

Table 5: Road Length by State (miles), compiled from FHWA Statistics Series

	2012			2013			2014			2015			2016		
State	Rural	Urban	Total	Rural	Urban	Total	Rural	Urban	Total	Rural	Urban	Total	Rural	Urban	Total
Alabama	76,620	25,191	101,811	76,685	25,153	101,837	75,754	26,263	102,018	75,788	26,231	102,019	74,691	27,285	101,975
Alaska	13,878	2,423	16,301	13,248	2,432	15,680	13,089	2,640	15,728	13,296	2,833	16,129	12,710	2,818	15,528
Arizona	41,386	23,876	65,262	40,129	26,311	66,441	39,383	26,210	65,593	39,800	26,322	66,122	39,686	26,349	66,035
Arkansas	86,695	13,428	100,123	85,243	16,413	101,656	85,480	17,115	102,595	85,481	17,128	102,609	85,485	17,131	102,616
California	80,870	94,629	175,499	80,801	94,187	174,989	114,710	110,821	225,531	86,349	109,485	195,834	76,013	104,787	180,800
Colorado	68,914	19,610	88,524	68,873	19,692	88,565	68,271	20,469	88,740	68,271	20,469	88,740	68,258	20,570	88,828
Connecticut	6,229	15,202	21,431	6,261	15,213	21,474	5,694	15,815	21,508	5,683	15,829	21,512	5,689	15,842	21,531
Delaware	3,356	3,021	6,377	3,359	3,034	6,393	3,017	3,391	6,407	3,010	3,406	6,416	2,994	3,433	6,427
Florida	40,333	81,496	121,829	40,441	81,647	122,088	36,509	85,883	122,391	36,489	86,170	122,659	36,440	86,296	122,736
Georgia	85,047	40,476	125,523	77,233	51,387	128,620	77,190	50,302	127,492	77,788	50,346	128,134	75,978	52,257	128,235
Hawaii	2,052	2,364	4,416	1,864	2,566	4,430	1,668	2,772	4,439	1,668	2,788	4,455	1,666	2,803	4,469
Idaho	42,940	5,552	48,492	42,534	5,548	48,082	43,244	5,658	48,902	45,231	5,932	51,163	45,185	6,157	51,342
Illinois	98,442	45,895	144,337	98,094	47,614	145,708	96,155	49,606	145,761	96,185	49,655	145,840	96,201	49,692	145,892
Indiana	69,442	27,847	97,288	69,465	28,088	97,553	66,672	30,026	96,698	66,356	30,214	96,571	66,406	30,210	96,616
Iowa	103,013	11,425	114,438	101,775	12,654	114,429	101,769	12,404	114,173	101,969	12,473	114,442	102,145	12,596	114,741
Kansas	127,573	13,041	140,614	127,048	13,639	140,687	126,884	13,592	140,476	126,780	13,874	140,654	127,819	14,227	142,047
Kentucky	66,701	12,620	79,321	66,955	12,643	79,598	64,761	14,967	79,727	64,822	15,035	79,857	64,877	15,064	79,942
Louisiana	44,356	16,970	61,326	44,018	17,409	61,427	44,026	17,394	61,419	43,808	17,610	61,419	43,801	17,610	61,411
Maine	19,863	3,008	22,871	19,873	3,009	22,882	19,907	3,009	22,916	19,910	3,001	22,911	19,424	3,474	22,898
Maryland	14,399	17,973	32,372	13,452	18,970	32,422	13,461	18,522	31,984	13,461	18,576	32,037	13,523	18,624	32,147
Massachusetts	6,164	30,166	36,330	6,165	30,205	36,370	6,365	30,019	36,384	6,369	30,054	36,423	6,509	30,123	36,632
Michigan	86,009	36,042	122,051	84,255	37,886	122,141	84,355	37,929	122,284	84,322	37,964	122,286	84,153	37,962	122,115
Minnesota	117,931	20,902	138,832	116,560	22,208	138,767	116,624	22,144	138,767	116,624	22,144	138,767	116,670	22,125	138,794
Mississippi	64,400	10,781	75,181	63,138	11,978	75,116	63,445	12,348	75,792	63,912	12,865	76,777	64,070	12,957	77,027
Missouri	107,926	24,052	131,978	107,532	24,367	131,900	106,954	24,611	131,564	107,165	24,384	131,549	107,426	24,382	131,807
Montana	71,722	3,183	74,905	70,787	4,146	74,933	70,819	4,164	74,983	70,822	4,186	75,007	69,402	4,208	73,610
Nebraska	87,279	6,518	93,797	87,284	6,486	93,770	87,349	6,519	93,868	87,335	7,146	94,481	87,233	7,755	94,988
Nevada	30,314	8,253	38,567	31,842	8,297	40,139	33,981	8,834	42,815	34,263	9,638	43,900	32,299	10,283	42,582
New Hampshire	11,375	4,730	16,105	11,065	5,032	16,098	11,084	5,047	16,132	11,083	5,056	16,138	11,093	5,064	16,157
New Jersey	5,884	33,388	39,272	5,887	33,406	39,293	5,670	33,371	39,041	5,684	33,381	39,065	5,755	33,316	39,071
New Mexico	60,494	7,890	68,384	33,640	37,131	70,772	59,052	9,400	68,452	60,712	8,356	69,069	60,752	8,359	69,111
New York	66,201	48,508	114,709	66,206	48,522	114,728	64,738	50,069	114,807	64,398	49,967	114,365	63,794	49,706	113,499
North Carolina	68,518	37,545	106,063	68,727	37,475	106,202	65,560	40,745	106,305	65,502	40,832	106,334	65,530	40,991	106,522
North Dakota	84,929	1,922	86,851	84,925	2,153	87,078	84,962	2,125	87,088	85,003	2,125	87,128	84,531	2,866	87,397
Ohio	78,228	45,053	123,281	75,775	47,522	123,297	75,458	47,426	122,885	75,492	47,434	122,926	75,511	47,463	122,974
Oklahoma	96,675	16,146	112,821	95,213	17,728	112,940	94,789	17,883	112,673	94,790	17,922	112,711	94,824	18,164	112,988
Oregon	46,390	12,872	59,262	58,302	12,926	71,228	58,481	14,998	73,479	58,641	14,902	73,544	58,592	14,937	73,529
Pennsylvania	73,592	46,254	119,846	73,870	46,066	119,936	73,918	46,121	120,039	72,492	47,599	120,091	72,577	47,869	120,446
Rhode Island	1,224	5,256	6,480	1,364	4,742	6,106	1,358	4,668	6,027	1,361	4,686	6,046	1,365	4,688	6,052
South Carolina	49,876	16,368	66,244	49,606	16,626	66,232	57,896	18,405	76,301	57,681	18,569	76,250	56,262	19,805	76,067
South Dakota	79,462	3,074	82,536	79,312	3,246	82,558	79,212	3,364	82,576	79,193	3,383	82,576	79,155	3,402	82,557
Tennessee	70,009	25,514	95,523	70,015	25,521	95,536	66,054	29,507	95,561	64,336	31,301	95,637	64,335	31,402	95,737
Texas	213,934	99,276	313,210	212,918	100,310	313,228	205,472	108,123	313,596	205,222	108,373	313,596	205,222	108,434	313,656
Utah	35,123	10,767	45,891	35,020	11,235	46,254	34,793	11,361	46,153	35,246	11,052	46,299	35,043	11,726	46,769
Vermont	12,821	1,470	14,291	12,813	1,452	14,266	12,712	1,526	14,238	12,791	1,462	14,252	12,754	1,499	14,253
Virginia	50,179	24,413	74,591	50,279	24,469	74,748	49,414	25,487	74,901	47,273	27,789	75,061	48,632	26,463	75,096
Washington	60,136	23,742	83,878	56,906	25,542	82,448	56,473	24,944	81,417	56,305	24,033	80,338	56,295	24,097	80,392
West Virginia	33,130	5,554	38,684	33,049	5,701	38,750	33,045	5,715	38,760	31,627	7,143	38,770	32,098	6,672	38,770
Wisconsin	92,123	22,971	115,095	91,567	23,578	115,145	91,631	23,581	115,212	91,716	23,656	115,372	91,666	23,791	115,458
Wyoming	25,554	2,862	28,416	26,104	2,920	29,024	26,047	2,925	28,972	26,010	2,931	28,942	25,513	2,813	28,326

	2017			2018			2019			2020			2021		
State	Rural	Urban	Total	Rural	Urban	Total	Rural	Urban	Total	Rural	Urban	Total	Rural	Urban	Total
Alabama	72,405	28,692	101,097	71,923	29,039	100,962	71,294	29,391	100,685	70,139	30,032	100,171	70,178	29,999	100,177
Alaska	12,681	2,854	15,535	13,735	3,315	17,050	14,578	3,157	17,736	14,516	3,165	17,681	14,569	3,122	17,690
Arizona	40,200	26,358	66,558	40,400	26,381	66,782	40,391	26,510	66,901	40,390	26,578	66,968	43,160	31,623	74,783
Arkansas	85,422	17,180	102,603	85,367	17,255	102,622	85,321	17,294	102,615	82,019	17,227	99,246	82,129	17,203	99,332
California	71,549	104,665	176,214	71,275	104,315	175,589	71,526	104,029	175,555	72,969	102,593	175,562	74,942	102,358	177,300
Colorado	68,120	20,698	88,818	68,160	20,815	88,975	68,171	20,898	89,069	68,211	20,996	89,207	68,274	21,111	89,385
Connecticut	5,691	15,853	21,544	5,691	15,865	21,556	5,689	15,888	21,577	5,693	15,882	21,575	5,556	15,807	21,363
Delaware	2,804	3,648	6,452	2,835	3,626	6,461	2,852	3,647	6,499	2,862	3,663	6,526	2,885	3,659	6,544
Florida	36,481	86,368	122,848	36,580	86,519	123,099	36,395	86,710	123,104	36,457	87,030	123,488	36,424	87,228	123,652
Georgia	76,091	52,264	128,355	76,149	52,248	128,397	76,205	52,256	128,461	76,228	52,344	128,572	75,078	50,623	125,701
Hawaii	1,666	2,810	4,476	1,645	2,831	4,475	1,658	2,841	4,499	1,658	2,843	4,501	1,663	2,852	4,515
Idaho	46,215	6,222	52,437	49,959	6,388	56,347	45,198	7,321	52,519	46,217	7,064	53,281	45,395	8,636	54,031
Illinois	96,200	49,736	145,936	96,219	49,756	145,976	96,187	49,780	145,967	96,194	49,799	145,993	96,194	49,803	145,997
Indiana	66,685	30,105	96,790	66,636	30,326	96,962	66,573	30,333	96,906	66,780	30,330	97,110	66,266	31,561	97,827
Iowa	101,989	12,648	114,637	102,018	12,727	114,745	102,011	12,792	114,803	101,999	12,840	114,838	101,999	12,879	114,878
Kansas	127,820	14,235	142,054	127,815	14,385	142,200	126,204	14,168	140,372	125,979	14,133	140,112	125,456	13,725	139,181
Kentucky	64,958	15,096	80,054	65,027	15,153	80,180	65,009	14,944	79,954	65,069	14,937	80,006	64,963	14,939	79,902
Louisiana	43,801	17,610	61,411	43,801	17,615	61,416	39,961	24,006	63,967	41,521	22,225	63,746	42,575	23,343	65,918
Maine	19,454	3,406	22,860	19,599	3,216	22,815	19,601	3,218	22,819	19,614	3,237	22,851	19,601	3,237	22,838
Maryland	13,571	18,640	32,211	13,561	18,708	32,269	13,583	18,790	32,373	13,596	18,835	32,430	13,443	19,063	32,507
Massachusetts	6,193	30,529	36,723	6,190	30,573	36,763	6,191	30,600	36,791	6,188	30,627	36,815	6,187	30,643	36,830
Michigan	84,075	37,962	122,036	84,169	37,996	122,164	84,161	38,019	122,181	84,003	38,037	122,040	83,987	38,057	122,044
Minnesota	117,218	22,231	139,449	117,266	22,325	139,591	118,116	23,243	141,360	118,479	23,477	141,957	118,948	23,914	142,862
Mississippi	64,397	13,048	77,445	64,413	13,064	77,477	64,418	13,069	77,487	64,421	13,091	77,512	64,433	13,082	77,514
Missouri	107,531	24,348	131,879	107,598	24,496	132,094	107,630	24,624	132,254	107,792	24,727	132,519	107,916	24,792	132,708
Montana	69,337	4,229	73,566	69,322	4,251	73,573	69,373	4,274	73,647	69,218	4,271	73,490	69,252	4,317	73,569
Nebraska	87,284	7,879	95,163	87,239	8,023	95,262	87,255	8,036	95,290	87,261	8,070	95,331	87,317	8,081	95,397
Nevada	38,080	10,154	48,234	38,170	10,288	48,458	37,336	10,395	47,731	37,364	10,430	47,793	36,715	10,477	47,191
New Hampshire	11,092	5,064	16,156	11,105	5,065	16,171	11,111	5,074	16,185	11,116	5,077	16,193	11,129	5,098	16,228
New Jersey	5,443	33,452	38,896	5,447	33,473	38,919	5,447	33,503	38,950	5,456	33,535	38,991	5,358	33,424	38,781
New Mexico	66,106	11,099	77,205	66,428	11,177	77,605	60,538	11,289	71,827	60,798	11,294	72,092	60,907	11,272	72,179
New York	63,874	49,686	113,559	63,886	49,646	113,533	64,144	49,784	113,929	64,254	49,951	114,205	64,276	50,126	114,402
North Carolina	65,691	41,284	106,975	65,872	41,477	107,348	65,919	41,709	107,628	65,989	41,965	107,954	65,931	42,143	108,074
North Dakota	84,816	2,873	87,688	85,152	2,898	88,050	85,280	2,888	88,168	85,511	2,918	88,429	85,493	2,919	88,412
Ohio	75,498	47,489	122,987	75,519	47,495	123,014	75,489	47,542	123,031	75,475	47,517	122,992	74,718	48,069	122,788
Oklahoma	94,467	18,398	112,865	97,243	18,822	116,065	95,723	18,915	114,638	96,099	18,979	115,079	96,166	19,126	115,293
Oregon	64,221	15,054	79,275	64,055	15,211	79,266	63,846	15,199	79,045	63,857	15,134	78,991	64,291	15,126	79,417
Pennsylvania	72,759	47,762	120,521	72,320	48,270	120,590	72,354	48,360	120,714	72,336	48,510	120,845	72,375	48,522	120,897
Rhode Island	1,342	4,685	6,027	1,359	4,654	6,013	1,365	4,639	6,004	1,363	4,661	6,025	1,363	4,661	6,025
South Carolina	56,042	21,322	77,364	55,129	22,863	77,992	54,793	24,440	79,234	54,765	24,425	79,190	54,765	24,435	79,200
South Dakota	79,163	3,421	82,584	79,089	3,413	82,501	78,669	3,300	81,969	78,437	3,261	81,697	78,019	3,270	81,289
Tennessee	64,199	31,788	95,986	64,298	31,818	96,116	64,322	31,845	96,167	64,327	31,855	96,182	64,350	31,969	96,319
Texas	205,503	108,817	314,319	205,668	108,979	314,648	205,747	109,699	315,445	206,016	110,552	316,567	207,599	114,554	322,153
Utah	38,115	11,175	49,290	37,543	11,370	48,913	36,324	12,285	48,608	36,407	12,405	48,812	36,272	12,636	48,908
Vermont	12,753	1,501	14,255	12,751	1,502	14,253	12,751	1,503	14,254	12,750	1,498	14,248	12,748	1,500	14,248
Virginia	48,695	26,543	75,238	48,754	26,614	75,369	48,582	26,766	75,348	48,587	26,940	75,527	48,693	26,965	75,658
Washington	56,250	24,179	80,429	56,394	24,258	80,653	56,340	24,364	80,704	56,503	24,519	81,022	54,800	24,627	79,427
West Virginia	32,202	6,652	38,854	32,191	6,659	38,850	32,200	6,677	38,877	32,206	6,673	38,879	32,148	6,689	38,837
Wisconsin	91,695	23,852	115,547	91,701	23,907	115,609	91,711	23,963	115,673	91,712	24,039	115,751	91,577	24,117	115,694
Wyoming	27,662	2,768	30,430	26,814	2,851	29,666	27,230	2,861	30,091	27,180	2,871	30,051	27,187	2,871	30,058

APPENDIX C. 2012-2021 NHTSA STATE HSP ANNUAL REPORT DATA

Table 6: 2012 NHTSA HSP Annual Report Data

2012 NHTSA State HSP Annual Report Data

	Total Fatalities				Fatality Rate			Passenger Vehicle Occupant Fatalities				Alcohol-impaired	Speeding-Related	Motorcycle Fatalities				Pedestrian	Bicyclist and Other	Observed Seat Belt
State	Total (C-1)	Rural	Urban	Unkown	Total (C-3)	Rural	Urban	Total	Restrained	Unrestrained (C-4)	Unknown	driving fatalities (C-5)	Fatalities (C-6)	Total (C-7)	Helmeted	Unhelmeted (C-8)	Unknown	Fatalities (C-10)	Cyclist Fatalities (C-11)	Use (B-1)
Alabama	865	510	351	4	1.33	1.69	1.01	648	255	354	39	240	273	97	86	10	1	77	9	90
Alaska	59	39	20	0	1.23	1.7	0.8	39	17	19	3	15	14	9	4	5	0	8	1	88
Arizona	821	375	444	2	1.37	2.2	1.03	470	164	254	52	230	302	141	68	70	3	122	18	82
Arkansas	560	435	125	0	1.67	2.38	0.82	402	151	227	24	144	76	72	25	42	5	47	6	72
California	2966	1200	1766	0	0.91	2.09	0.66	1623	1028	496	99	829	954	447	409	32	6	653	129	96
Colorado	474	233	241	0	1.01	1.56	0.76	289	124	158	7	134	164	79	24	53	2	76	13	81
Connecticut	264	77	186	1	0.84	1.99	0.68	165	73	56	36	100	64	48	15	30	3	43	4	87
Delaware	114	57	57	0	1.24	1.92	0.92	61	29	25	7	35	46	17	13	4	0	27	4	88
Florida	2431	873	1555	3	1.27	2.53	0.99	1259	610	580	69	709	366	492	227	252	13	477	124	87
Georgia	1192	589	603	0	1.11	1.68	0.83	829	394	368	67	295	180	134	125	8	1	167	17	92
Hawaii	125	56	69	0	1.24	2.33	0.9	56	16	31	9	47	69	40	12	28	0	26	2	93
Idaho	184	152	32	0	1.13	1.6	0.47	135	59	72	4	52	61	22	12	10	0	13	2	79
Illinois	956	395	561	0	0.91	1.5	0.72	608	286	279	43	322	387	148	29	115	4	138	29	94
Indiana	781	524	257	0	0.99	1.78	0.52	518	249	214	55	230	185	152	30	116	6	59	15	94
Iowa	365	286	79	0	1.16	1.5	0.63	256	119	112	25	96	70	59	11	47	1	20	3	92
Kansas	405	326	79	0	1.32	2.16	0.51	295	117	163	15	104	114	48	12	34	2	26	7	80
Kentucky	746	582	164	0	1.58	2.13	0.82	541	231	309	1	169	151	106	38	68	0	49	6	84
Louisiana	723	345	378	0	1.54	1.7	1.42	461	191	240	30	235	211	78	71	4	3	119	24	79
Maine	164	164	0	0	1.16	1.6	0	124	49	75	0	50	78	24	10	14	0	9	1	84
Maryland	511	180	325	6	0.9	1.26	0.77	319	173	113	33	163	202	78	70	8	0	97	5	91
Massachusetts	383	50	333	0	0.68	1.97	0.62	224	76	103	45	129	114	56	44	3	9	82	16	73
Michigan	940	424	511	5	0.99	1.41	0.79	623	320	224	79	261	251	138	68	64	6	130	19	94
Minnesota	395	269	126	0	0.69	1.1	0.39	270	129	101	40	114	91	55	11	33	11	38	7	94
Mississippi	582	407	175	0	1.51	1.75	1.13	463	167	293	3	191	95	39	34	5	0	48	4	83
Missouri	826	474	350	2	1.21	1.66	0.88	600	155	394	51	283	326	104	90	9	5	84	6	79
Montana	205	191	14	0	1.72	2.15	0.47	157	42	113	2	89	88	30	9	21	0	8	1	76
Nebraska	212	161	51	0	1.1	1.44	0.63	161	43	102	16	73	44	22	20	1	1	15	0	79
Nevada	261	77	184	0	1.08	1.59	0.95	148	75	63	10	85	102	43	26	10	7	55	3	91
New Hampshire	108	60	48	0	0.84	1.03	0.68	70	20	50	0	32	39	29	10	19	0	8	0	69
New Jersey	589	71	516	2	0.79	1.56	0.74	315	153	150	12	164	157	77	66	8	3	156	14	88
New Mexico	366	259	106	1	1.43	1.78	0.97	220	98	106	16	97	122	64	22	39	3	61	7	91
New York	1180	618	562	0	0.96	2.29	0.59	629	366	206	57	340	363	170	146	15	9	303	45	90
North Carolina	1299	901	398	0	1.24	2.2	0.62	831	420	354	57	372	441	198	173	23	2	200	27	88
North Dakota	170	146	24	0	1.69	1.91	0.98	131	40	89	2	72	62	16	4	11	1	7	0	81
Ohio	1121	640	481	0	0.99	1.75	0.63	791	298	416	77	389	354	162	38	124	0	113	18	82
Oklahoma	709	468	241	0	1.48	2.15	0.92	509	199	282	28	209	219	84	19	63	2	65	5	84
Oregon	337	229	108	0	1.02	1.58	0.58	199	119	61	19	88	103	51	46	4	1	55	10	97
Pennsylvania	1310	697	613	0	1.32	2.01	0.95	876	257	498	121	407	614	210	102	102	6	163	16	84
Rhode Island	64	10	54	0	0.82	1.19	0.78	49	27	20	2	28	30	8	3	5	0	5	2	78
South Carolina	863	748	115	0	1.76	3.19	0.45	567	217	313	37	348	322	146	43	102	1	123	13	91
South Dakota	133	117	16	0	1.46	1.81	0.61	98	30	60	8	44	39	25	4	21	0	2	0	67
Tennessee	1015	576	439	0	1.43	2.04	1.02	761	307	398	56	286	197	139	127	9	3	67	8	84
Texas	3408	1696	1711	1	1.43	2.39	1.02	2228	1098	930	200	1290	1251	454	181	264	9	482	56	94
Utah	217	95	122	0	0.82	1.19	0.66	145	55	77	13	32	72	32	20	11	1	28	3	82
Vermont	77	63	14	0	1.07	1.18	0.75	52	17	34	1	24	33	11	9	2	0	10	0	84
Virginia	776	500	259	17	0.96	1.68	0.51	548	248	297	3	209	271	85	80	5	0	97	11	78
Washington	438	271	167	0	0.77	1.6	0.42	259	142	99	18	143	162	83	78	4	1	71	12	97
West Virginia	339	261	78	0	1.76	2.35	0.96	242	75	137	30	94	144	31	17	14	0	31	1	84
Wisconsin	615	389	226	0	1.04	1.27	0.79	417	177	201	39	202	209	117	27	87	3	45	11	80
Wyoming	123	101	22	0	1.33	1.57	0.77	94	41	50	3	41	41	12	2	10	0	6	0	77

Table 7: 2013 NHTSA HSP Annual Report Data

2013 NHTSA State HSP Annual Report Data

	Total Fatalities				Fatality Rate			Passenger Vehicle Occupant Fatalities				Alcohol-impaired	Speeding-Related	Motorcycle Fatalities				Pedestrian	Bicyclist and Other	Observed Seat Belt
State	Total (C-1)	Rural	Urban	Unkown	Total (C-3)	Rural	Urban	Total	Restrained	Unrestrained (C-4)	Unkown	driving fatalities (C-5)	Fatalities (C-6)	Total (C-7)	Helmeted	Unhelmeted (C-8)	Unknown	Fatalities (C-10)	Cyclist Fatalities (C-11)	Use (B-1)
Alabama	853	562	285	6	1.31	1.85	0.82	666	271	369	26	259	253	80	78	1	1	59	6	97
Alaska	51	33	18	0	1.05	1.42	0.71	27	13	12	2	16	22	9	7	2	0	6	1	86
Arizona	849	337	509	3	1.4	2.37	1.1	451	174	228	49	221	293	151	62	83	6	151	31	85
Arkansas	498	367	131	0	1.49	2.28	0.75	352	144	176	32	121	73	63	20	40	3	46	4	77
California	3107	1201	1906	0	0.94	2.32	0.69	1657	1014	516	127	880	992	463	417	35	11	734	147	97
Colorado	482	244	238	0	1.03	1.64	0.74	317	124	177	16	140	151	87	31	55	1	50	12	82
Connecticut	286	130	156	0	0.92	3.41	0.58	187	82	75	30	126	76	57	24	22	11	37	3	87
Delaware	99	51	48	0	1.06	1.67	0.77	50	26	23	1	38	37	20	13	7	0	25	1	92
Florida	2403	969	1434	0	1.25	2.79	0.91	1217	600	553	64	672	346	485	239	237	9	499	133	87
Georgia	1180	557	621	2	1.08	2.18	0.74	812	350	377	85	296	197	116	107	5	4	176	28	96
Hawaii	102	40	62	0	1.01	2.23	0.75	42	15	23	4	34	45	29	10	19	0	23	2	94
Idaho	214	175	39	0	1.34	1.88	0.58	160	54	98	8	57	50	25	12	12	1	14	3	82
Illinois	991	411	580	0	0.94	1.62	0.73	651	308	287	56	330	421	152	35	113	4	124	30	94
Indiana	784	535	249	0	1	1.83	0.51	545	279	202	64	199	218	115	19	82	14	76	14	92
Iowa	317	256	61	0	1	1.41	0.45	237	108	102	27	101	51	41	10	31	0	20	3	92
Kansas	350	271	79	0	1.16	1.87	0.5	265	103	146	16	98	111	35	15	18	2	25	6	81
Kentucky	638	494	144	0	1.36	1.82	0.73	465	220	245	0	166	125	87	28	59	0	55	3	85
Louisiana	703	342	361	0	1.47	1.73	1.29	476	197	248	31	232	193	86	66	18	2	97	14	83
Maine	144	140	4	0	1.02	1.37	0.1	111	55	55	1	41	50	14	1	13	0	11	4	83
Maryland	465	167	295	3	0.82	1.58	0.64	279	153	108	18	137	148	62	56	5	1	108	6	91
Massachusetts	351	50	300	1	0.62	1.93	0.56	218	64	100	54	125	89	42	33	5	4	79	6	75
Michigan	947	429	516	2	1	1.53	0.77	601	329	183	89	249	255	138	64	67	7	148	27	93
Minnesota	387	256	131	0	0.68	1.1	0.39	259	149	80	30	95	84	61	16	34	11	32	6	95
Mississippi	613	519	94	0	1.58	2.35	0.56	489	201	284	4	207	126	39	35	4	0	53	6	74
Missouri	757	459	298	0	1.09	1.61	0.73	559	192	325	42	244	308	74	66	7	1	73	4	80
Montana	229	224	5	0	1.9	2.68	0.14	161	50	108	3	93	76	35	12	22	1	24	1	74
Nebraska	211	170	41	0	1.09	1.51	0.51	169	44	105	20	60	39	14	12	1	1	12	0	79
Nevada	266	82	184	0	1.08	1.64	0.94	125	58	57	10	81	90	59	50	7	2	65	7	95
New Hampshire	135	87	48	0	1.05	1.72	0.61	91	35	56	0	45	66	24	7	17	0	12	4	73
New Jersey	542	79	463	0	0.73	1.74	0.66	329	174	141	14	148	118	56	51	2	3	129	14	91
New Mexico	311	215	96	0	1.24	1.5	0.9	189	72	96	21	98	122	41	13	20	8	49	4	92
New York	1202	630	572	0	0.97	2.35	0.59	616	339	186	91	369	359	170	147	16	7	336	40	91
North Carolina	1290	861	426	3	1.23	2.12	0.66	872	454	355	63	368	413	189	170	17	2	174	22	89
North Dakota	148	138	10	0	1.47	1.84	0.39	112	28	66	18	61	59	9	5	3	1	1	1	78
Ohio	989	513	471	5	0.88	1.54	0.59	699	288	352	59	266	273	132	43	87	2	85	19	85
Oklahoma	678	449	229	0	1.41	2.18	0.84	474	200	248	26	170	174	92	15	77	0	58	13	84
Oregon	313	199	114	0	0.93	1.33	0.61	216	138	54	24	103	95	34	32	2	0	48	3	98
Pennsylvania	1210	629	581	0	1.23	1.78	0.92	801	282	421	98	360	552	182	84	94	4	147	11	84
Rhode Island	65	5	60	0	0.84	0.55	0.87	37	17	19	1	23	17	11	5	6	0	14	3	86
South Carolina	767	614	153	0	1.57	2.62	0.6	488	214	242	32	339	305	149	43	106	0	100	15	92
South Dakota	135	118	17	0	1.48	1.84	0.63	100	32	61	7	41	38	22	7	15	0	9	0	69
Tennessee	995	534	461	0	1.4	1.91	1.07	719	295	349	75	284	239	138	126	12	0	80	8	85
Texas	3389	1663	1726	0	1.39	2.19	1.02	2210	1106	907	197	1327	1181	493	188	280	25	480	48	90
Utah	220	107	113	0	0.81	1.48	0.57	140	70	57	13	37	75	31	12	19	0	28	6	82
Vermont	69	58	11	0	0.97	1.1	0.59	51	28	21	2	19	18	7	5	2	0	5	0	85
Virginia	740	473	260	7	0.92	1.57	0.51	549	248	300	1	263	132	79	76	3	0	75	8	80
Washington	436	224	212	0	0.76	1.43	0.51	287	164	89	34	151	184	73	68	4	1	49	11	95
West Virginia	332	241	91	0	1.73	2.15	1.13	247	95	113	39	91	130	24	16	8	0	28	0	82
Wisconsin	543	359	181	3	0.91	1.17	0.63	376	158	186	32	177	178	85	21	62	2	37	10	82
Wyoming	87	72	15	0	0.93	1.12	0.52	66	20	41	5	25	40	9	4	5	0	4	0	82

Table 8: 2014 NHTSA HSP Annual Report Data

2014 NHTSA State HSP Annual Report Data

	Total Fatalities				Fatality Rate			Passenger Vehicle Occupant Fatalities				Alcohol-impaired	Speeding-Related	Motorcycle Fatalities				Pedestrian	Bicyclist and Other	Observed Seat Belt
State	Total (C-1)	Rural	Urban	Unknown	Total (C-3)	Rural	Urban	Total	Restrained	Unrestrained (C-4)	Unknown	driving fatalities (C-5)	Fatalities (C-6)	Total (C-7)	Helmeted	Unhelmeted (C-8)	Unknown	Fatalities (C-10)	Cyclist Fatalities (C-11)	Use (B-1)
Alabama	820	544	274	2	1.25	1.97	0.72	618	240	351	27	265	237	65	53	10	2	96	9	96
Alaska	73	42	31	0	1.5	2.08	1.09	42	12	21	9	22	18	8	5	3	0	14	3	88
Arizona	773	289	482	2	1.23	1.86	1.02	392	140	208	44	200	255	130	56	69	5	142	29	87
Arkansas	470	357	113	0	1.38	2.17	0.64	348	151	167	30	136	56	61	24	36	1	37	7	74
California	3102	1170	1931	1	0.93	2.23	0.69	1631	1000	479	152	876	995	522	491	24	7	709	129	97
Colorado	488	228	260	0	1	1.58	0.75	308	140	156	12	160	168	94	33	61	0	63	10	82
Connecticut	248	60	188	0	0.8	1.92	0.67	136	50	48	38	97	69	55	20	32	3	47	4	85
Delaware	124	64	60	0	1.29	2.23	0.89	73	46	25	2	52	45	15	7	7	1	26	3	92
Florida	2494	634	1860	0	1.24	1.99	1.1	1207	640	511	56	694	245	478	240	223	15	588	139	89
Georgia	1164	462	702	0	1.04	1.79	0.82	795	376	363	56	279	213	137	124	8	5	163	19	97
Hawaii	95	30	65	0	0.93	1.75	0.77	38	15	18	5	30	36	25	12	12	1	24	4	94
Idaho	186	151	35	0	1.15	1.61	0.52	130	61	68	1	53	48	25	9	15	1	13	2	80
Illinois	924	417	506	1	0.88	1.69	0.63	621	320	246	55	302	349	118	34	81	3	123	27	94
Indiana	745	472	273	0	0.94	1.61	0.55	496	235	190	71	160	204	124	26	89	9	78	12	90
Iowa	322	255	67	0	1.03	1.38	0.52	220	109	89	22	91	45	52	15	37	0	19	4	93
Kansas	385	298	87	0	1.25	2.01	0.55	296	128	150	18	108	109	48	18	28	2	23	7	86
Kentucky	672	517	155	0	1.4	2.01	0.7	498	213	285	0	171	125	86	38	48	0	57	4	86
Louisiana	740	389	351	0	1.53	1.94	1.24	503	171	284	48	247	204	83	67	10	6	105	13	84
Maine	131	118	13	0	0.92	1.14	0.33	104	63	41	0	37	39	11	7	4	0	9	2	85
Maryland	442	149	293	0	0.78	1.47	0.63	255	134	98	23	130	134	69	58	8	3	101	5	92
Massachusetts	354	37	317	0	0.62	1.42	0.58	218	67	113	38	143	85	47	39	4	4	74	8	77
Michigan	901	378	522	1	0.93	1.33	0.76	585	305	196	84	212	235	112	50	52	10	148	22	93
Minnesota	361	262	99	0	0.63	1.12	0.29	270	156	93	21	108	111	46	9	29	8	15	5	95
Mississippi	607	551	56	0	1.54	2.45	0.33	475	192	279	4	172	96	41	34	6	1	53	6	78
Missouri	766	471	295	0	1.08	1.62	0.7	556	198	312	46	205	267	91	79	7	5	65	5	79
Montana	192	178	14	0	1.58	2.11	0.38	145	40	99	6	73	52	23	10	12	1	10	2	74
Nebraska	225	177	48	0	1.15	1.55	0.59	183	57	95	31	60	49	20	18	1	1	9	2	79
Nevada	291	91	200	0	1.15	1.88	0.98	145	69	65	11	93	100	63	52	8	3	71	8	94
New Hampshire	95	48	47	0	0.73	0.94	0.6	58	13	45	0	29	47	17	3	14	0	12	3	70
New Jersey	556	78	475	3	0.74	1.66	0.68	294	157	119	18	161	99	62	52	5	5	168	11	88
New Mexico	386	248	133	5	1.52	1.73	1.21	231	106	98	27	117	132	46	9	35	2	75	5	92
New York	1041	390	651	0	0.84	1.55	0.66	540	329	155	56	312	322	148	124	21	3	264	46	91
North Carolina	1284	896	388	0	1.19	2.45	0.54	865	471	360	34	363	497	190	175	15	0	172	19	91
North Dakota	135	116	19	0	1.28	1.47	0.72	105	29	71	5	55	50	10	1	9	0	9	3	81
Ohio	1006	496	506	4	0.89	1.49	0.64	732	295	374	63	302	274	136	42	91	3	87	11	85
Oklahoma	669	468	201	0	1.4	2.24	0.75	500	209	258	33	156	152	57	13	44	0	50	4	86
Oregon	357	237	120	0	1.03	1.76	0.57	232	137	61	34	99	105	46	41	4	1	57	7	98
Pennsylvania	1195	610	585	0	1.2	1.7	0.91	768	288	371	109	349	509	185	75	100	10	161	19	84
Rhode Island	51	6	45	0	0.66	0.68	0.66	24	14	10	0	17	13	10	3	7	0	14	0	87
South Carolina	823	570	253	0	1.65	2.52	0.93	567	268	275	24	331	307	121	24	96	1	107	14	90
South Dakota	136	115	21	0	1.47	1.79	0.75	102	29	69	4	44	30	17	5	11	1	9	2	69
Tennessee	963	454	509	0	1.33	1.79	1.08	698	296	355	47	273	220	120	109	10	1	86	5	88
Texas	3536	1780	1750	6	1.45	2.62	1	2398	1224	973	201	1446	1277	451	201	234	16	479	50	91
Utah	256	125	131	0	0.93	1.71	0.65	156	80	71	5	57	90	45	19	26	0	32	9	83
Vermont	44	37	7	0	0.62	0.74	0.34	27	11	14	2	8	15	7	6	1	0	5	0	84
Virginia	703	448	247	8	0.87	1.48	0.49	476	223	250	3	216	99	90	89	1	0	88	12	77
Washington	462	214	246	2	0.8	1.35	0.58	297	169	107	21	132	162	69	69	0	0	75	7	95
West Virginia	272	205	67	0	1.42	1.83	0.84	202	71	93	38	84	66	26	17	7	2	19	2	88
Wisconsin	506	338	167	1	0.84	1.09	0.57	362	159	161	42	165	168	73	20	51	2	45	4	85
Wyoming	150	121	29	0	1.59	1.85	0.99	118	48	67	3	48	48	16	6	10	0	5	5	79

Table 9: 2015 NHTSA HSP Annual Report Data

2015 NHTSA State HSP Annual Report Data

	Total Fatalities				Fatality Rate			Passenger Vehicle Occupant Fatalities				Alcohol-impaired	Speeding-Related	Motorcycle Fatalities				Pedestrian	Bicyclist and Other	Observed Seat Belt
State	Total (C-1)	Rural	Urban	Unknown	Total (C-3)	Rural	Urban	Total	Restrained	Unrestrained (C-4)	Unknown	driving fatalities (C-5)	Fatalities (C-6)	Total (C-7)	Helmeted	Unhelmeted (C-8)	Unknown	Fatalities (C-10)	Cyclist Fatalities (C-11)	Use (B-1)
Alabama	850	590	260	0	1.26	2.09	0.67	648	252	355	41	244	236	67	57	9	1	98	9	93
Alaska	65	33	31	1	1.29	1.55	1.06	37	14	15	8	22	22	11	6	4	1	12	0	89
Arizona	897	343	550	4	1.38	2.2	1.11	495	188	256	51	267	315	137	58	74	5	155	28	87
Arkansas	550	387	163	0	1.58	2.29	0.9	389	158	196	35	159	92	80	30	48	2	44	3	78
California	3387	1404	1982	1	1.01	2.62	0.7	1849	1119	568	162	902	1032	494	464	23	7	819	136	97
Colorado	547	260	285	2	1.08	1.77	0.8	347	148	188	11	151	217	106	39	67	0	59	13	85
Connecticut	270	46	221	3	0.85	1.46	0.78	155	68	68	19	100	77	55	20	33	2	46	3	85
Delaware	131	62	69	0	1.32	2.07	1	69	33	33	3	39	35	19	13	6	0	36	3	90
Florida	2938	859	1972	107	1.42	2.59	1.13	1462	780	602	80	794	320	615	316	283	16	629	150	89
Georgia	1432	565	867	0	1.21	1.98	0.97	1008	488	411	109	358	268	152	138	10	4	194	23	97
Hawaii	93	13	80	0	0.9	0.73	0.94	37	11	15	11	37	41	26	10	16	0	25	2	93
Idaho	216	178	38	0	1.3	1.87	0.53	163	63	94	6	71	49	28	10	18	0	8	0	81
Illinois	998	419	579	0	0.95	1.67	0.72	643	303	254	86	309	377	147	41	105	1	150	26	95
Indiana	817	521	296	0	1.04	1.85	0.59	571	277	221	73	170	233	108	17	79	12	96	12	92
Iowa	320	230	90	0	0.96	1.19	0.65	236	123	101	12	78	49	41	9	31	1	25	5	93
Kansas	355	276	79	0	1.13	1.84	0.48	256	114	127	15	82	128	44	15	28	1	24	3	82
Kentucky	761	593	168	0	1.56	2.27	0.75	558	249	308	1	192	140	91	30	61	0	67	7	87
Louisiana	752	368	377	7	1.56	1.99	1.27	496	189	262	45	244	171	91	78	12	1	106	34	86
Maine	156	130	26	0	1.07	1.23	0.64	101	48	53	0	50	60	32	8	24	0	19	0	86
Maryland	520	125	378	17	0.9	1.21	0.8	317	190	87	40	159	124	75	69	6	0	97	11	93
Massachusetts	344	22	321	1	0.58	0.78	0.57	187	51	88	48	105	92	56	47	7	2	79	12	74
Michigan	967	534	428	5	0.99	1.83	0.62	588	316	190	82	266	264	141	75	57	9	166	33	93
Minnesota	411	274	135	2	0.72	1.17	0.4	280	156	85	39	115	84	61	18	38	5	39	10	94
Mississippi	677	559	118	0	1.7	2.52	0.67	546	236	309	1	171	96	37	29	8	0	63	5	80
Missouri	870	497	372	1	1.21	1.69	0.88	621	217	356	48	221	309	97	86	7	4	104	9	80
Montana	224	200	24	0	1.81	2.34	0.63	170	47	114	9	76	91	24	5	18	1	14	1	77
Nebraska	246	173	73	0	1.22	1.52	0.84	186	47	118	21	64	37	25	18	4	3	19	4	80
Nevada	326	108	214	4	1.26	2.16	1.02	177	91	72	14	99	112	55	41	11	3	66	10	92
New Hampshire	114	66	48	0	0.87	1.28	0.61	74	27	47	0	32	56	26	10	16	0	8	3	70
New Jersey	561	67	490	4	0.74	1.39	0.69	303	176	116	11	107	128	50	43	7	0	170	18	91
New Mexico	298	176	119	3	1.09	1.13	1	182	70	88	24	98	130	38	19	18	1	54	7	93
New York	1136	455	681	0	0.93	1.84	0.7	572	320	173	79	315	347	163	145	15	3	311	36	92
North Carolina	1379	910	468	1	1.23	2.42	0.63	948	501	402	45	389	547	192	176	14	2	182	23	90
North Dakota	131	122	9	0	1.31	1.67	0.33	100	29	63	8	51	43	8	5	3	0	7	1	80
Ohio	1110	492	610	8	0.98	1.46	0.76	745	291	385	69	309	207	168	55	112	1	116	25	84
Oklahoma	645	391	254	0	1.35	1.85	0.96	442	196	218	28	170	171	89	26	62	1	70	6	85
Oregon	446	282	163	1	1.24	1.97	0.75	289	169	82	38	154	119	61	57	3	1	69	8	96
Pennsylvania	1200	616	581	3	1.19	1.74	0.89	784	271	402	111	363	540	178	87	89	2	151	16	83
Rhode Island	45	7	38	0	0.57	0.79	0.55	27	10	16	1	19	20	9	5	4	0	8	0	87
South Carolina	979	555	424	0	1.89	2.35	1.51	618	280	308	30	306	366	185	54	131	0	123	16	92
South Dakota	134	114	20	0	1.44	1.75	0.71	94	27	60	7	44	31	31	9	22	0	6	1	74
Tennessee	962	482	478	2	1.25	1.89	0.93	688	306	332	50	253	189	123	109	12	2	104	10	86
Texas	3582	1622	1948	12	1.39	2.35	1.03	2369	1285	879	205	1392	1125	452	205	236	11	549	52	91
Utah	278	127	151	0	0.94	1.53	0.71	175	85	82	8	46	64	36	15	18	3	47	5	87
Vermont	57	48	9	0	0.78	0.92	0.43	34	14	17	3	15	21	11	11	0	0	5	4	85
Virginia	754	484	269	1	0.91	2.05	0.46	554	250	301	3	205	105	79	75	3	1	77	15	81
Washington	551	261	287	3	0.92	1.58	0.67	358	201	112	45	145	157	75	71	4	0	84	14	95
West Virginia	268	190	78	0	1.35	1.95	0.77	192	72	99	21	72	66	32	25	7	0	19	1	89
Wisconsin	566	360	205	1	0.91	1.12	0.68	388	176	167	45	188	167	81	15	65	1	57	15	86
Wyoming	145	119	24	2	1.51	1.79	0.81	107	26	79	2	55	46	24	7	17	0	5	0	80

Table 10: 2016 NHTSA HSP Annual Report Data

2016 NHTSA State HSP Annual Report Data

	Total Fatalities				Fatality Rate			Passenger Vehicle Occupant Fatalities				Alcohol-impaired	Speeding-Related	Motorcycle Fatalities				Pedestrian	Bicyclist and Other	Observed Seat Belt
State	Total (C-1)	Rural	Urban	Unknown	Total (C-3)	Rural	Urban	Total	Restrained	Unrestrained (C-4)	Unknown	driving fatalities (C-5)	Fatalities (C-6)	Total (C-7)	Helmeted	Unhelmeted (C-8)	Unknown	Fatalities (C-10)	Cyclist Fatalities (C-11)	Use (B-1)
Alabama	1083	803	280	0	1.56	2.76	0.7	780	296	423	61	298	329	112	101	11	0	120	3	92
Alaska	84	53	30	1	1.6	2.37	0.99	58	17	37	4	31	36	6	4	2	0	12	1	89
Arizona	952	335	612	5	1.45	2.13	1.22	511	205	246	60	244	325	146	55	86	5	186	31	88
Arkansas	561	366	195	0	1.57	2.12	1.05	398	167	196	35	130	118	82	23	59	0	49	3	75
California	3837	1593	2244	0	1.13	3.01	0.78	2030	1268	611	151	1114	1151	576	533	28	15	933	155	97
Colorado	608	266	342	0	1.17	1.74	0.93	360	166	184	10	163	211	125	42	82	1	79	16	84
Connecticut	304	37	261	6	0.96	1.17	0.92	174	73	65	36	114	82	52	14	36	2	59	6	89
Delaware	119	69	50	0	1.17	2.3	0.7	73	36	31	6	37	39	14	9	4	1	27	2	91
Florida	3176	870	2275	31	1.47	2.48	1.26	1694	889	740	65	901	310	586	288	283	15	653	139	90
Georgia	1556	603	953	0	1.27	2.01	1.03	1047	484	472	91	378	266	172	154	9	9	232	29	97
Hawaii	120	25	94	1	1.13	1.37	1.07	63	22	22	19	37	54	24	9	15	0	29	0	95
Idaho	253	194	47	12	1.47	1.96	0.64	191	67	114	10	75	54	22	7	14	1	17	6	83
Illinois	1078	437	639	2	1	1.71	0.78	702	355	268	79	336	419	154	37	116	1	147	20	93
Indiana	829	543	285	1	1	1.67	0.56	580	258	251	71	212	213	101	24	72	5	87	19	92
Iowa	402	306	96	0	1.21	1.56	0.7	290	153	109	28	108	94	60	13	47	0	22	8	94
Kansas	429	322	105	2	1.34	2.12	0.62	310	142	148	20	98	107	52	21	30	1	41	5	87
Kentucky	834	607	226	1	1.69	2.3	0.98	588	270	318	0	177	138	111	35	76	0	81	9	87
Louisiana	757	368	385	4	1.54	1.94	1.27	486	211	225	50	228	173	94	80	11	3	127	22	88
Maine	160	129	28	3	1.08	1.29	0.58	120	57	60	3	63	56	18	6	12	0	17	4	86
Maryland	522	108	408	6	0.88	1.01	0.84	290	150	112	28	143	132	76	63	12	1	108	16	91
Massachusetts	387	17	370	0	0.63	0.49	0.63	244	71	113	60	144	126	44	39	3	2	78	10	78
Michigan	1065	424	635	6	1.07	1.42	0.91	664	356	198	110	247	245	152	63	78	11	163	38	95
Minnesota	392	232	159	1	0.66	0.96	0.45	251	144	74	33	95	92	56	17	36	3	58	7	93
Mississippi	687	533	154	0	1.69	2.33	0.86	541	244	296	1	134	81	50	39	7	4	58	5	78
Missouri	947	553	394	0	1.28	1.82	0.9	666	236	383	47	248	328	128	109	15	4	96	9	81
Montana	190	170	19	1	1.51	1.95	0.49	145	47	93	5	84	61	17	5	12	0	11	3	76
Nebraska	218	166	52	0	1.05	1.46	0.56	165	61	83	21	61	36	20	9	3	8	12	1	83
Nevada	329	104	222	3	1.23	1.99	1.03	153	69	72	12	102	126	74	59	12	3	80	6	89
New Hampshire	136	75	61	0	1.01	1.4	0.75	96	25	69	2	40	77	19	11	8	0	17	2	70
New Jersey	602	86	512	4	0.78	1.74	0.71	336	178	147	11	134	132	71	64	3	4	163	18	93
New Mexico	405	229	172	4	1.45	1.43	1.45	266	117	136	13	119	146	47	25	22	0	74	4	92
New York	1041	463	578	0	0.85	1.85	0.59	518	293	151	74	296	314	136	121	9	6	307	39	92
North Carolina	1450	902	543	5	1.24	2.3	0.7	996	524	430	42	428	566	185	168	14	3	200	17	92
North Dakota	113	106	7	0	1.16	1.55	0.24	77	21	48	8	52	25	12	2	10	0	7	3	83
Ohio	1132	508	614	10	0.95	1.46	0.73	745	327	352	66	331	257	199	53	145	1	134	18	84
Oklahoma	687	426	260	1	1.4	1.95	0.96	470	201	226	43	186	185	88	25	62	1	88	5	87
Oregon	498	309	189	0	1.36	2.12	0.85	342	198	89	55	152	143	55	46	4	5	71	10	96
Pennsylvania	1188	647	541	0	1.17	1.88	0.81	756	249	400	107	342	504	191	87	97	7	170	16	85
Rhode Island	51	10	41	0	0.64	1.1	0.58	30	14	15	1	19	23	4	0	4	0	14	2	88
South Carolina	1020	613	407	0	1.87	2.47	1.37	633	285	315	33	343	393	186	52	134	0	144	25	94
South Dakota	116	103	13	0	1.22	1.55	0.45	81	20	58	3	46	37	22	6	15	1	6	0	74
Tennessee	1037	465	568	4	1.35	1.89	1.09	732	347	337	48	227	183	147	133	13	1	97	9	89
Texas	3797	1590	2205	2	1.4	2.23	1.1	2377	1234	929	214	1481	1076	495	216	267	12	675	65	92
Utah	281	121	160	0	0.89	1.46	0.69	170	82	74	14	53	72	41	18	21	2	35	5	88
Vermont	62	52	10	0	0.84	0.99	0.47	45	24	20	1	28	29	11	9	2	0	4	1	80
Virginia	760	477	281	2	0.9	1.66	0.5	513	215	296	2	223	257	79	75	4	0	122	10	79
Washington	536	240	295	1	0.88	1.41	0.67	332	175	110	47	156	154	81	77	2	2	83	17	95
West Virginia	269	169	99	1	1.38	1.69	1.04	186	73	80	33	68	60	29	19	10	0	24	1	87
Wisconsin	607	406	194	7	0.95	1.26	0.61	429	204	183	42	199	212	85	17	65	3	51	11	88
Wyoming	112	91	21	0	1.2	1.41	0.73	71	21	48	2	34	28	24	8	16	0	4	1	81

Table 11: 2017 NHTSA HSP Annual Report Data

2017 NHTSA State HSP Annual Report Data

	Total Fatalities				Fatality Rate			Passenger Vehicle Occupant Fatalities				Alcohol-impaired	Speeding-Related	Motorcycle Fatalities				Pedestrian	Bicyclist and Other	Observed Seat Belt
State	Total (C-1)	Rural	Urban	Unknown	Total (C-3)	Rural	Urban	Total	Restrained	Unrestrained (C-4)	Unknown	driving fatalities (C-5)	Fatalities (C-6)	Total (C-7)	Helmeted	Unhelmeted (C-8)	Unknown	Fatalities (C-10)	Cyclist Fatalities (C-11)	Use (B-1)
Alabama	948	585	363	0	1.34	2.04	0.86	711	265	398	48	265	257	79	72	6	1	119	7	93
Alaska	79	45	33	1	1.43	1.94	1.03	47	24	17	6	23	26	6	3	3	0	14	1	90
Arizona	998	360	637	1	1.53	2.25	1.3	491	211	243	37	270	313	162	68	86	8	213	32	86
Arkansas	525	339	186	0	1.44	1.93	0.99	374	166	180	28	146	124	69	30	36	3	47	4	81
California	3884	1423	2458	3	1.13	2.6	0.85	2093	1288	625	180	1141	1164	578	519	45	14	940	145	96
Colorado	648	277	369	2	1.21	1.76	0.98	410	175	222	13	177	230	103	31	72	0	92	16	84
Connecticut	281	44	235	2	0.89	1.4	0.83	163	81	53	29	122	90	57	22	33	2	49	3	90
Delaware	119	61	56	2	1.14	2.33	0.71	69	33	33	3	31	33	10	6	4	0	33	5	91
Florida	3116	834	2282	0	1.42	2.32	1.25	1645	923	673	49	834	307	590	291	289	10	654	125	90
Georgia	1540	594	946	0	1.23	2	1	1056	488	464	104	357	248	139	119	18	2	253	15	97
Hawaii	107	25	82	0	1	1.34	0.92	59	19	21	19	42	51	25	11	14	0	14	6	97
Idaho	245	183	62	0	1.42	1.84	0.84	177	63	95	19	64	48	27	10	17	0	15	2	81
Illinois	1090	399	688	3	1.01	1.55	0.84	713	352	265	96	357	464	160	48	108	4	147	26	94
Indiana	916	558	356	2	1.12	1.9	0.68	610	300	208	102	259	210	149	41	105	3	101	13	93
Iowa	330	254	76	0	0.99	1.28	0.56	220	97	97	26	90	70	49	14	34	1	23	5	91
Kansas	461	313	147	1	1.43	2.06	0.86	342	147	167	28	106	104	56	21	32	3	33	5	82
Kentucky	782	510	271	1	1.59	1.94	1.18	575	283	290	2	181	138	90	31	59	0	83	7	87
Louisiana	770	374	395	1	1.56	1.97	1.31	492	206	246	40	212	181	97	78	13	6	115	23	87
Maine	173	136	36	1	1.17	1.36	0.77	115	62	53	0	48	50	26	9	17	0	20	2	89
Maryland	558	127	423	8	0.93	1.18	0.86	320	163	113	44	186	163	87	70	13	4	117	11	92
Massachusetts	347	22	325	0	0.55	0.71	0.55	205	40	133	32	122	103	51	47	1	3	72	12	74
Michigan	1031	402	625	4	1.01	1.3	0.88	659	356	191	112	303	241	150	74	69	7	156	21	94
Minnesota	358	209	148	1	0.6	0.86	0.42	236	135	71	30	85	89	55	16	36	3	38	6	92
Mississippi	685	428	256	1	1.68	1.78	1.52	538	223	310	5	157	59	39	26	7	6	71	6	79
Missouri	932	467	465	0	1.23	1.44	1.07	668	230	380	58	247	347	121	100	20	1	96	9	84
Montana	186	167	19	0	1.47	1.91	0.49	142	52	86	4	56	59	22	9	13	0	14	1	78
Nebraska	228	159	69	0	1.09	1.38	0.73	166	49	99	18	67	37	27	20	0	7	20	3	86
Nevada	311	81	226	4	1.13	1.48	1.02	144	63	69	12	85	95	54	44	8	2	91	9	91
New Hampshire	102	51	51	0	0.75	0.94	0.62	70	19	51	0	26	58	15	7	8	0	11	2	68
New Jersey	624	83	536	5	0.81	1.7	0.74	331	196	119	16	121	126	83	75	3	5	183	17	94
New Mexico	380	195	180	5	1.37	1.16	1.63	222	107	105	10	113	141	53	14	35	4	75	2	92
New York	1006	474	532	0	0.81	1.88	0.54	542	307	172	63	289	310	145	131	9	5	246	46	93
North Carolina	1412	873	539	0	1.18	2.18	0.68	954	504	400	50	399	423	176	161	14	1	198	29	91
North Dakota	116	103	10	3	1.19	152	0.34	80	28	42	10	45	28	13	3	10	0	5	2	79.3
Ohio	1179	552	620	7	0.99	1.56	0.74	825	358	376	91	328	252	157	45	109	3	142	19	83
Oklahoma	657	417	240	0	1.33	1.88	0.88	435	164	233	38	161	143	93	23	68	2	79	6	87
Oregon	439	237	202	0	1.19	1.63	0.91	285	185	64	36	144	170	57	48	3	6	70	10	97
Pennsylvania	1137	607	528	2	1.12	1.73	0.79	717	248	342	127	320	469	187	97	88	2	147	22	86
Rhode Island	84	19	65	0	1.05	2.1	0.92	49	24	24	1	35	41	11	6	5	0	21	2	88
South Carolina	989	688	301	0	1.78	2.72	1	643	298	308	37	305	417	145	44	99	2	155	17	92
South Dakota	129	109	20	0	1.34	1.61	0.69	93	24	64	5	36	31	16	6	10	0	10	0	75
Tennessee	1024	494	529	1	1.24	1.95	0.93	719	358	298	63	252	170	135	123	9	3	121	8	89
Texas	3732	1505	2214	13	1.37	2.06	1.11	2375	1312	868	195	1463	1043	490	235	242	13	608	59	92
Utah	273	117	156	0	0.87	1.34	0.69	169	78	82	9	52	82	39	13	25	1	42	6	89
Vermont	69	56	13	0	0.93	1.06	0.61	45	21	20	4	18	31	13	13	0	0	8	0	85
Virginia	839	519	319	1	0.98	1.78	0.57	572	263	306	3	245	219	117	115	1	1	111	12	85
Washington	563	235	316	12	0.92	1.37	0.71	340	181	104	55	177	174	80	78	0	2	104	15	95
West Virginia	304	203	98	3	1.59	2.05	1.07	219	76	98	45	72	84	26	16	10	0	26	3	90
Wisconsin	613	397	214	2	0.94	1.2	0.67	437	210	180	47	185	180	76	30	42	4	56	7	89
Wyoming	123	95	28	0	1.26	1.39	0.95	87	28	55	4	46	37	17	4	13	0	6	0	85

Table 12: 2018 NHTSA HSP Annual Report Data

2018 NHTSA State HSP Annual Report Data

	Total Fatalities				Fatality Rate			Passenger Vehicle Occupant Fatalities				Alcohol-impaired	Speeding-Related	Motorcycle Fatalities				Pedestrian	Bicyclist and Other	Observed Seat Belt
State	Total (C-1)	Rural	Urban	Unknown	Total (C-3)	Rural	Urban	Total	Restrained	Unrestrained (C-4)	Unknown	driving fatalities (C-5)	Fatalities (C-6)	Total (C-7)	Helmeted	Unhelmeted (C-8)	Unknown	Fatalities (C-10)	Cyclist Fatalities (C-11)	Use (B-1)
Alabama	953	541	412	0	1.34	1.88	0.97	716	299	354	63	249	262	82	72	10	0	107	9	92
Alaska	80	41	39	0	1.46	1.8	1.21	45	20	20	5	27	42	12	6	5	1	14	0	92
Arizona	1011	320	677	14	1.53	1.96	1.36	512	201	243	68	298	310	156	66	74	16	236	24	86
Arkansas	520	307	213	0	1.42	1.73	1.13	352	145	177	30	135	132	66	19	45	2	62	4	78
California	3798	1085	2712	1	1.09	1.86	0.93	2023	1223	635	165	1116	1000	523	480	34	9	978	165	96
Colorado	632	259	373	0	1.17	1.63	0.98	402	171	216	15	192	210	103	45	58	0	89	22	86
Connecticut	293	38	252	3	0.93	1.2	0.89	172	71	73	28	120	100	49	20	28	1	59	1	92
Delaware	111	34	77	0	1.09	1.38	1	62	29	32	1	28	33	17	8	9	0	23	6	92
Florida	3135	803	2332	0	1.41	2.19	1.26	1581	849	693	39	822	305	575	278	286	11	706	161	91
Georgia	1505	508	997	0	1.14	1.55	1.01	994	448	441	105	379	268	154	134	16	4	262	30	96
Hawaii	117	26	91	0	1.07	1.41	1.01	37	12	16	9	38	51	34	12	22	0	42	2	98
Idaho	234	170	64	0	1.32	1.67	0.85	152	59	80	13	56	47	38	17	21	0	17	2	85
Illinois	1035	386	649	0	0.96	1.5	0.79	668	325	252	91	325	439	119	31	87	1	166	24	95
Indiana	860	525	334	1	1.05	1.77	0.64	561	273	210	78	214	189	117	21	89	7	114	22	93
Iowa	319	255	64	0	0.96	1.29	0.47	224	121	78	25	90	62	43	14	29	0	22	7	94
Kansas	405	252	150	3	1.26	1.64	0.89	277	129	126	22	81	95	65	22	40	3	28	5	84
Kentucky	724	515	208	1	1.46	1.93	0.91	514	235	279	0	136	111	95	35	60	0	73	10	90
Louisiana	771	305	466	0	1.54	1.56	1.53	468	209	222	37	221	140	79	71	2	6	164	29	87
Maine	136	116	20	0	0.92	1.14	0.43	101	52	49	0	39	42	23	5	18	0	6	2	89
Maryland	512	90	414	8	0.86	0.85	0.84	298	162	106	30	129	128	62	48	13	1	131	6	90
Massachusetts	355	34	320	1	0.53	1.11	0.5	203	61	106	36	122	100	58	53	5	0	77	4	82
Michigan	977	410	566	1	0.95	1.31	0.8	643	355	184	104	283	248	143	79	58	6	142	21	93
Minnesota	381	218	160	3	0.63	0.88	0.45	252	123	84	45	104	114	59	17	42	0	42	7	92
Mississippi	663	440	223	0	1.63	1.85	1.32	491	205	281	5	166	48	41	35	6	0	89	6	80
Missouri	921	512	409	0	1.2	1.54	0.94	655	232	379	44	245	367	113	98	12	3	95	2	87
Montana	181	153	28	0	1.43	1.75	0.71	132	45	85	2	80	66	21	10	11	0	15	2	87
Nebraska	230	171	59	0	1.1	1.47	0.63	165	57	88	20	68	29	23	9	2	12	24	0	86
Nevada	329	89	238	2	1.16	1.56	1.05	172	89	76	7	88	93	58	46	8	4	79	8	92
New Hampshire	147	78	69	0	1.07	1.42	0.83	98	28	68	2	46	71	28	6	21	1	9	2	76
New Jersey	563	45	508	10	0.73	0.92	0.7	297	161	125	11	127	119	53	45	7	1	173	18	95
New Mexico	392	232	158	2	1.44	1.43	1.42	222	87	112	23	113	132	46	20	20	6	83	11	90
New York	964	287	677	0	0.78	1.13	0.69	477	269	154	54	325	278	152	136	7	9	268	30	93
North Carolina	1436	692	742	2	1.19	1.68	0.93	958	523	393	42	419	327	191	176	15	0	224	18	91
North Dakota	105	91	14	0	1.07	1.32	0.47	76	29	37	10	28	41	16	5	11	0	6	2	83
Ohio	1068	471	580	17	0.93	1.36	0.73	728	320	333	75	297	291	145	48	95	2	127	22	85
Oklahoma	655	429	225	1	1.44	1.94	0.96	445	205	205	35	147	147	91	26	60	5	60	16	86
Oregon	502	286	216	0	1.36	1.96	0.97	311	165	86	60	157	143	85	73	4	8	77	9	96
Pennsylvania	1190	525	660	5	1.17	1.53	0.97	748	263	384	101	339	455	165	66	92	7	197	18	89
Rhode Island	59	16	42	1	0.74	1.75	0.59	30	13	13	4	22	30	18	7	10	1	7	1	89
South Carolina	1036	679	357	0	1.82	2.65	1.14	677	314	331	32	290	450	141	41	98	2	165	23	90
South Dakota	130	117	13	0	1.34	1.72	0.44	94	29	59	6	46	52	16	4	11	1	10	0	79
Tennessee	1040	471	569	0	1.28	1.82	1.03	683	347	290	46	243	167	168	153	12	3	136	8	91
Texas	3648	1523	2113	12	1.29	1.98	1.03	2346	1221	928	197	1471	999	416	205	194	17	616	69	91
Utah	260	93	165	2	0.81	1.04	0.71	156	87	50	19	62	71	47	23	22	2	36	3	89
Vermont	68	60	7	1	0.93	1.15	0.33	52	20	30	2	15	25	7	5	1	1	6	0	90
Virginia	820	471	346	3	0.96	1.62	0.61	553	260	293	0	245	241	100	95	5	0	118	12	84
Washington	539	240	293	6	0.86	1.38	0.65	327	181	107	39	165	182	80	75	5	0	99	16	93
West Virginia	294	178	116	0	1.51	1.8	1.21	197	94	70	33	58	88	39	23	14	2	22	5	91
Wisconsin	589	387	199	3	0.89	1.16	0.61	414	203	154	57	206	186	83	30	53	0	56	4	89
Wyoming	111	96	14	1	1.06	1.3	0.46	76	33	37	6	36	38	15	6	9	0	6	0	86

Table 13: 2019 NHTSA HSP Annual Report Data

2019 NHTSA State HSP Annual Report Data

	Total Fatalities				Fatality Rate			Passenger Vehicle Occupant Fatalities				Alcohol-impaired	Speeding-Related	Motorcycle Fatalities				Pedestrian	Bicyclist and Other	Observed Seat Belt
State	Total (C-1)	Rural	Urban	Unknown	Total (C-3)	Rural	Urban	Total	Restrained	Unrestrained (C-4)	Unknown	driving fatalities (C-5)	Fatalities (C-6)	Total (C-7)	Helmeted	helmeted (	Unknown	Fatalities (C-10)	Cyclist Fatalities (C-11)	Use (B-1)
Alabama	930	535	395	0	1.3	1.84	0.92	673	268	352	53	272	216	93	78	15	0	119	6	92
Alaska	67	37	29	1	1.14	1.43	0.88	48	18	22	8	21	29	6	4	2	0	6	2	94
Arizona	979	356	604	19	1.39	2.13	1.13	476	196	220	60	259	325	175	79	86	10	210	30	91
Arkansas	511	342	169	0	1.38	1.91	0.88	353	152	166	35	131	132	66	27	34	5	62	3	82
California	3719	1141	2571	7	1.09	2.02	0.9	1944	1150	634	160	966	1108	491	452	28	11	1011	143	96
Colorado	597	242	352	3	1.09	1.49	0.92	371	160	190	21	160	239	103	48	54	1	73	20	88
Connecticut	249	47	199	3	0.79	1.47	0.7	137	58	57	22	98	64	46	15	28	3	54	3	94
Delaware	132	48	84	0	1.29	1.9	1.09	72	44	24	4	32	37	18	10	8	0	32	7	93
Florida	3185	831	2352	2	1.41	2.21	1.24	1585	898	659	28	775	303	592	280	304	8	714	161	90
Georgia	1492	520	972	0	1.12	1.63	0.96	990	514	385	91	355	260	170	151	15	4	236	21	96
Hawaii	108	21	86	1	0.98	1.12	0.94	46	22	16	8	36	52	20	5	14	1	36	4	97
Idaho	224	169	54	1	1.24	1.67	0.68	166	76	81	9	69	48	25	15	10	0	12	4	86
Illinois	1009	357	646	6	0.94	1.41	0.79	643	312	249	82	311	376	138	37	100	1	173	12	94
Indiana	810	492	315	3	0.98	1.63	0.6	555	263	220	72	200	201	127	32	89	6	73	16	95
Iowa	336	244	92	0	1	1.22	0.68	237	125	93	19	102	69	44	9	35	0	21	9	95
Kansas	410	258	151	1	1.29	1.69	0.91	315	141	137	37	87	110	41	13	28	0	16	8	85
Kentucky	732	503	229	0	1.48	1.89	1	526	264	262	0	151	114	92	24	68	0	73	5	90
Louisiana	727	375	352	0	1.42	1.89	1.12	458	179	234	45	214	94	87	69	10	8	118	22	88
Maine	157	126	31	0	1.06	1.23	0.67	103	52	48	3	49	49	27	7	20	0	16	2	89
Maryland	535	115	412	8	0.89	1.07	0.83	309	148	114	47	167	142	77	68	7	2	124	10	90
Massachusetts	336	25	311	0	0.52	0.82	0.5	200	61	97	42	112	80	46	28	0	18	77	5	82
Michigan	986	401	579	6	0.97	1.28	0.82	645	344	206	95	264	250	134	62	61	11	141	21	94
Minnesota	364	213	150	1	0.6	0.86	0.42	238	129	74	35	85	77	46	13	33	0	47	11	93
Mississippi	642	450	192	0	1.56	1.88	1.12	503	209	275	19	166	120	40	33	5	2	65	8	81
Missouri	881	463	418	0	1.11	1.34	0.94	575	181	341	53	236	328	123	106	12	5	109	14	88
Montana	184	159	25	0	1.43	1.78	0.63	117	44	67	6	66	57	23	9	14	0	16	3	89
Nebraska	248	178	70	0	1.17	1.53	0.73	191	68	90	33	60	49	25	21	1	3	20	1	80
Nevada	304	111	191	2	1.06	1.97	0.82	158	94	55	9	89	89	56	39	3	14	62	8	94
New Hampshire	101	58	42	1	0.73	1.04	0.51	61	21	38	2	38	35	30	15	14	1	10	0	71
New Jersey	558	63	488	7	0.71	1.27	0.67	260	143	109	8	129	110	85	67	15	3	174	13	90
New Mexico	425	241	184	0	1.53	1.47	1.62	248	117	101	30	125	156	55	17	32	6	83	9	92
New York	934	255	678	1	0.75	1	0.69	433	246	150	37	256	269	136	122	11	3	274	48	94
North Carolina	1457	799	655	3	1.19	1.92	0.81	961	488	428	45	386	331	210	187	20	3	221	19	88
North Dakota	100	84	16	0	1.02	1.22	0.54	69	24	33	12	42	25	11	4	7	0	5	2	84
Ohio	1153	530	617	6	1.01	1.51	0.77	780	324	379	77	362	321	162	45	116	1	124	25	86
Oklahoma	640	422	217	1	1.43	1.92	0.96	435	194	206	35	156	128	68	23	42	3	85	13	85
Oregon	493	280	213	0	1.38	2.06	0.96	318	172	87	59	171	154	57	46	8	3	82	11	96
Pennsylvania	1059	501	552	6	1.03	1.45	0.81	665	259	318	88	299	441	176	85	87	4	147	14	89
Rhode Island	57	3	54	0	0.75	0.33	0.81	35	15	18	2	24	36	13	9	3	1	8	0	88
South Carolina	1006	689	317	0	1.74	2.65	0.99	629	291	300	38	276	459	154	35	116	3	163	26	90
South Dakota	102	84	18	0	1.03	1.21	0.6	72	31	38	3	28	24	14	6	6	2	7	1	75
Tennessee	1136	514	621	1	1.37	1.96	1.1	779	385	343	51	289	180	155	130	20	5	148	7	92
Texas	3619	1453	2159	7	1.26	1.85	1.03	2282	1188	868	226	1338	1116	417	208	187	22	649	66	91
Utah	248	116	131	1	0.75	1.31	0.55	149	88	48	13	38	67	34	16	16	2	38	6	90
Vermont	47	42	5	0	0.64	0.8	0.24	32	17	15	0	9	22	8	6	1	1	3	0	89
Virginia	831	499	328	4	0.97	1.7	0.59	559	255	301	3	237	228	102	91	11	0	123	13	85
Washington	538	236	298	4	0.86	1.35	0.66	313	148	108	57	181	152	95	93	2	0	102	9	93
West Virginia	260	167	87	6	1.36	1.74	0.92	169	78	73	18	56	85	28	19	9	0	31	3	90
Wisconsin	567	369	192	6	0.85	1.11	0.58	376	180	142	54	186	173	85	31	54	0	59	14	90
Wyoming	147	124	20	3	1.44	1.72	0.66	103	53	47	3	33	49	15	6	8	1	11	0	78

Table 14: 2020 NHTSA HSP Annual Report Data

2020 NHTSA State HSP Annual Report Data

	Total Fatalities				Fatality Rate			Passenger Vehicle Occupant Fatalities				Alcohol-impaired	Speeding-Related	Motorcycle Fatalities				Pedestrian	Bicyclist and Other	Observed Seat Belt
State	Total (C-1)	Rural	Urban	Unknown	Total (C-3)	Rural	Urban	Total	Restrained	Unrestrained (C-4)	Unknown	driving fatalities (C-5)	Fatalities (C-6)	Total (C-7)	Helmeted	Unhelmeted (C-8)	Unknown	Fatalities (C-10)	Cyclist Fatalities (C-11)	Use (B-1)
Alabama	934	521	412	1	1.38	1.87	1.03	705	263	384	58	233	266	78	68	10	0	101	10	0
Alaska	64	38	26	0	1.21	1.53	0.92	39	18	14	7	15	23	4	2	2	0	13	2	0
Arizona	1053	348	654	51	1.6	2.21	1.31	516	215	237	64	295	366	161	77	79	5	222	33	0
Arkansas	651	443	208	0	1.92	2.72	1.18	435	179	209	47	166	170	81	39	39	3	82	6	0
California	3980	1193	2781	6	1.33	2.15	1.14	2135	1148	782	205	1180	1295	549	502	34	13	1013	136	0
Colorado	622	237	384	1	1.28	1.58	1.14	351	142	190	19	188	287	138	63	72	3	87	15	86
Connecticut	299	43	254	2	1	1.46	0.94	168	63	67	38	123	106	57	26	25	6	59	6	0
Delaware	116	44	72	0	1.39	2.18	1.14	73	32	34	7	30	33	14	12	2	0	25	3	0
Florida	3329	721	2606	2	1.6	2.05	1.51	1746	895	817	34	891	295	589	285	292	12	695	170	0
Georgia	1658	645	1010	3	1.43	2.23	1.16	1065	502	461	102	373	380	186	166	14	6	279	32	0
Hawaii	85	12	73	0	0.97	0.82	1	40	11	13	16	28	37	18	5	13	0	21	4	0
Idaho	214	165	49	0	1.23	1.65	0.66	156	56	85	15	61	62	26	10	15	1	14	3	0
Illinois	1193	359	831	3	1.27	1.54	1.17	777	298	297	182	380	461	151	48	101	2	175	30	0
Indiana	897	441	456	0	1.17	1.59	0.93	588	272	225	91	247	238	150	28	114	8	93	20	0
Iowa	343	233	110	0	1.15	1.3	0.93	207	92	91	24	118	63	65	20	44	1	29	10	95
Kansas	426	260	166	0	1.53	1.9	1.17	288	125	134	29	93	102	65	27	37	1	46	4	85
Kentucky	780	501	279	0	1.68	1.99	1.31	541	247	294	0	198	162	89	36	53	0	91	5	0
Louisiana	828	383	443	2	1.71	2.02	1.51	533	200	297	36	229	189	75	51	13	11	144	34	0
Maine	164	131	32	1	1.25	1.44	0.8	114	50	63	1	60	49	29	8	21	0	9	2	0
Maryland	573	87	483	3	1.13	0.93	1.16	323	135	133	55	190	170	83	70	13	0	134	15	90
Massachusetts	343	25	318	0	0.63	0.93	0.62	211	60	99	52	98	101	54	47	4	3	52	10	0
Michigan	1086	431	652	3	1.25	1.56	1.11	670	294	221	155	306	291	167	76	75	16	172	39	0
Minnesota	394	240	153	1	0.76	1.08	0.52	245	110	100	35	107	122	64	22	41	1	45	10	0
Mississippi	748	511	234	3	1.89	2.19	1.43	535	215	228	92	146	129	61	41	14	6	105	9	79
Missouri	987	490	497	0	1.36	1.51	1.23	677	196	424	57	309	421	122	99	23	0	128	8	86
Montana	213	185	27	1	1.76	2.2	0.73	150	56	93	1	95	83	25	11	14	0	17	0	90
Nebraska	233	162	71	0	1.2	1.5	0.83	158	37	100	21	71	39	33	28	5	0	18	1	81
Nevada	333	89	244	0	1.32	1.67	1.23	161	66	77	18	90	103	62	50	3	9	81	11	0
New Hampshire	104	57	45	2	0.87	1.15	0.64	56	15	36	5	38	37	25	7	16	2	16	2	72
New Jersey	586	54	519	13	0.88	1.27	0.84	303	148	127	28	153	146	74	65	7	2	174	18	0
New Mexico	398	209	186	3	1.68	1.47	1.95	239	97	131	11	129	160	44	18	24	2	79	8	0
New York	1045	286	759	0	1.02	1.3	0.94	518	284	174	60	295	383	194	164	25	5	229	47	0
North Carolina	1538	819	718	1	1.45	2.22	1.03	1034	497	501	36	448	488	190	173	15	2	230	26	87
North Dakota	100	76	24	0	1.14	1.29	0.83	61	17	38	6	35	24	17	3	14	0	8	1	84
Ohio	1230	471	727	32	1.19	1.51	1.01	790	305	393	92	461	340	207	52	152	3	159	18	0
Oklahoma	653	390	263	0	1.55	1.87	1.24	453	189	220	44	180	156	61	19	37	5	86	12	0
Oregon	507	284	223	0	1.57	2.29	1.12	306	167	98	41	183	135	67	54	5	8	71	14	95
Pennsylvania	1129	498	626	5	1.28	1.6	1.1	666	218	334	114	318	461	209	90	113	6	143	20	89
Rhode Island	67	13	54	0	0.98	1.68	0.89	34	11	17	6	28	34	12	6	5	1	17	2	0
South Carolina	1066	621	445	0	1.98	2.55	1.5	701	298	371	32	319	496	136	45	91	0	188	14	0
South Dakota	141	109	32	0	1.45	1.59	1.1	91	28	57	6	50	42	27	5	20	2	14	0	68
Tennessee	1217	512	705	0	1.59	2.05	1.37	814	351	391	72	323	189	148	134	13	1	172	13	0
Texas	3876	1504	2369	3	1.49	2.1	1.25	2430	1157	1018	255	1533	1443	477	233	229	15	688	79	0
Utah	276	114	162	0	0.91	1.3	0.75	175	84	66	25	60	72	40	17	23	0	33	8	0
Vermont	62	49	13	0	1.03	1.15	0.75	38	15	23	0	17	17	10	9	1	0	8	1	89
Virginia	850	442	408	0	1.12	1.67	0.82	582	240	340	2	283	257	100	94	6	0	111	7	0
Washington	574	247	325	2	1.07	1.59	0.85	336	170	110	56	212	173	92	88	3	1	105	13	93
West Virginia	267	171	89	7	1.66	2.07	1.14	177	64	84	29	74	60	38	17	20	1	18	3	0
Wisconsin	612	375	234	3	1.06	1.28	0.83	397	150	178	69	207	214	116	33	83	0	50	12	89
Wyoming	127	101	26	0	1.3	1.41	0.98	89	43	44	2	44	42	19	7	10	2	6	1	83

Table 15: 2021 NHTSA HSP Annual Report Data

2021 NHTSA State HSP Annual Report Data

	Total Fatalities				Fatality Rate			Passenger Vehicle Occupant Fatalities				Alcohol-impaired	Speeding-Related	Motorcycle Fatalities				Pedestrian	Bicyclist and Other	Observed Seat Belt
State	Total (C-1)	Rural	Urban	Unknown	Total (C-3)	Rural	Urban	Total	Restrained	Unrestrained (C-4)	Unknown	driving fatalities (C-5)	Fatalities (C-6)	Total (C-7)	Helmeted	Unhelmeted (C-8)	Unknown	Fatalities (C-10)	Cyclist Fatalities (C-11)	Use (B-1)
Alabama	983	520	463	0	1.24	1.41	1.08	721	316	354	51	281	274	77	62	12	3	128	7	91
Alaska	67	36	31	0	1.16	1.34	1.01	39	17	13	9	22	27	6	4	2	0	16	2	92
Arizona	1180	357	780	43	1.6	2.03	1.39	602	212	290	100	421	373	150	72	70	8	248	45	89
Arkansas	693	408	285	0	1.8	2.12	1.49	448	180	228	40	185	148	96	41	53	2	79	10	84
California	4285	1291	2992	2	1.38	2.21	1.19	2344	1245	878	221	1370	1509	565	516	37	12	1108	125	97
Colorado	691	295	394	2	1.28	1.76	1.06	429	179	222	28	216	202	135	48	84	3	92	15	87
Connecticut	298	45	253	0	1.03	1.57	0.97	169	70	74	25	112	119	65	25	35	5	53	3	92
Delaware	136	43	93	0	1.34	1.52	1.27	79	36	40	3	34	46	23	19	4	0	29	2	92
Florida	3738	778	2958	2	1.72	2.06	1.64	1930	1013	884	33	1019	391	651	314	328	9	817	197	90
Georgia	1797	598	1199	0	1.49	1.98	1.33	1182	515	555	112	391	369	185	165	14	6	306	15	95
Hawaii	94	19	73	2	0.94	1.09	0.89	30	10	19	1	28	45	33	12	21	0	25	4	94
Idaho	271	186	84	1	1.4	1.66	1.04	187	68	106	13	85	59	31	11	20	0	21	3	83
Illinois	1334	371	953	10	1.37	1.72	1.26	844	311	332	201	461	487	174	62	108	4	209	34	94
Indiana	932	425	505	2	1.19	1.46	1.02	614	258	245	111	234	252	134	42	86	6	111	21	93
Iowa	356	247	107	2	1.08	1.24	0.82	219	106	87	26	118	84	68	17	51	0	30	11	93
Kansas	424	257	164	3	1.34	1.67	1.01	300	126	134	40	109	98	47	18	26	3	43	4	86
Kentucky	806	496	309	1	1.68	1.88	1.42	553	267	286	0	190	143	105	32	73	0	75	10	90
Louisiana	972	406	564	2	1.78	1.94	1.67	628	226	334	68	299	281	83	61	19	3	184	34	86
Maine	153	111	38	4	1.05	1.1	0.84	107	52	55	0	45	26	21	8	13	0	19	2	92
Maryland	561	41	509	11	0.99	0.39	1.1	334	151	147	36	195	168	77	61	15	1	129	6	91
Massachusetts	417	27	389	1	0.71	0.93	0.69	246	91	111	44	150	114	72	66	1	5	74	5	78
Michigan	1136	412	712	12	1.17	1.33	1.08	691	321	235	135	325	321	174	77	74	23	174	29	93
Minnesota	488	262	225	1	0.85	1.07	0.69	322	164	99	59	130	167	69	24	44	1	50	9	92
Mississippi	772	459	234	79	1.89	1.89	1.41	583	258	238	87	155	122	38	35	2	1	94	16	80
Missouri	1016	503	511	2	1.27	1.38	1.18	657	207	402	48	290	404	158	71	80	7	117	7	88
Montana	239	181	56	2	1.77	1.92	1.39	173	54	109	10	104	86	26	7	19	0	18	3	92
Nebraska	221	164	57	0	1.04	1.38	0.61	165	63	76	26	65	36	21	19	0	2	15	1	81
Nevada	385	130	255	0	1.42	2.19	1.21	191	96	71	24	116	112	87	63	9	15	80	6	93
New Hampshire	118	60	57	1	0.9	1.11	0.74	78	15	48	15	45	40	26	5	19	2	8	2	76
New Jersey	699	66	618	15	0.95	1.41	0.9	337	146	160	31	178	178	99	83	12	4	212	23	94
New Mexico	481	258	220	3	1.79	1.61	2.04	278	101	165	12	154	186	51	23	27	1	102	6	90
New York	1157	255	901	1	1.08	1.09	1.08	552	314	184	54	388	418	218	181	30	7	293	33	93
North Carolina	1663	784	878	1	1.41	1.93	1.14	1117	558	515	44	466	478	230	209	18	3	248	23	90
North Dakota	101	77	24	0	1.09	1.22	0.81	68	30	31	7	33	29	8	3	5	0	10	1	82
Ohio	1354	521	821	12	1.2	1.53	1.04	854	305	440	109	531	341	223	66	154	3	168	30	84
Oklahoma	762	436	325	1	1.7	1.94	1.46	531	231	260	40	192	181	80	15	59	6	106	12	84
Oregon	599	344	255	0	1.63	2.31	1.16	370	174	116	80	215	154	84	76	5	3	87	18	95
Pennsylvania	1230	484	742	4	1.2	1.41	1.08	732	266	367	99	337	500	222	107	108	7	176	21	90
Rhode Island	63	12	50	1	0.84	1.19	0.77	41	19	18	4	24	20	13	5	8	0	7	2	89
South Carolina	1198	658	540	0	2.08	2.53	1.72	764	342	379	43	401	486	177	64	112	1	190	23	90
South Dakota	148	121	27	0	1.48	1.71	0.93	105	31	65	9	52	35	22	5	17	0	14	0	87
Tennessee	1327	524	803	0	1.61	1.95	1.44	901	416	393	92	355	231	166	144	13	9	177	7	90
Texas	4498	1744	2749	5	1.58	2.2	1.34	2818	1330	1172	316	1906	1568	515	266	232	17	817	91	90
Utah	328	140	188	0	0.98	1.42	0.79	217	114	78	25	79	109	39	23	15	1	43	6	88
Vermont	74	68	6	0	1.12	1.45	0.31	45	17	27	1	23	30	15	13	2	0	8	0	89
Virginia	973	542	428	3	1.21	1.81	0.85	681	339	336	6	281	337	111	100	9	2	123	16	82
Washington	670	267	399	4	1.16	1.57	0.98	396	198	149	49	262	206	90	85	2	3	142	14	94
West Virginia	280	174	105	1	1.74	2.09	1.35	184	77	74	33	65	64	27	14	12	1	36	0	88
Wisconsin	620	414	204	2	0.95	1.25	0.64	388	154	164	70	199	212	121	36	83	2	48	9	88
Wyoming	110	86	24	0	0.99	1.05	0.83	71	26	43	2	38	45	17	6	8	3	11	0	80

APPENDIX D. PERCENT OF STATE POPULATION LIVING IN URBAN AREAS

Table 16: 2020 Percent of State Population Living in Urban Areas

State	2020 Urban Population as % of the Total Population
California	94.2%
Nevada	94.1%
New Jersey	93.8%
Florida	91.5%
Massachusetts	91.3%
Rhode Island	91.1%
Utah	89.8%
Arizona	89.3%
New York	87.4%
Illinois	86.9%
Connecticut	86.3%
Hawaii	86.1%
Colorado	86.0%
Maryland	85.6%
Texas	83.7%
Washington	83.4%
Delaware	82.6%
Oregon	80.5%
Pennsylvania	76.5%
Ohio	76.3%
Virginia	75.6%
New Mexico	74.5%
Georgia	74.1%
Michigan	73.5%
Nebraska	73.0%
Kansas	72.3%
Minnesota	71.9%
Louisiana	71.5%
Indiana	71.2%
Missouri	69.5%
Idaho	69.2%
South Carolina	67.9%
Wisconsin	67.1%
North Carolina	66.7%
Tennessee	66.2%
Alaska	64.9%
Oklahoma	64.6%
Iowa	63.2%
Wyoming	62.0%
North Dakota	61.0%
Kentucky	58.7%
New Hampshire	58.3%
Alabama	57.7%
South Dakota	57.2%
Arkansas	55.5%
Montana	53.4%
Mississippi	46.3%
West Virginia	44.6%
Maine	38.6%
Vermont	35.1%

APPENDIX E. R STUDIO INPUT DATA FOR K-MEANS CLUSTERING

Table 17: R Studio Input Data for Section 4.1.1. Analysis

R Studio Input Data for Population Living in Urban Areas and Urban Fatality Rate		
State	2020_Percent_Urban_Population	2019_5yr_Average_Urban_Fatality_Rate
Alabama	0.577	0.824
Alaska	0.649	1.034
Arizona	0.893	1.224
Arkansas	0.555	0.99
California	0.942	0.832
Colorado	0.86	0.922
Connecticut	0.863	0.824
Delaware	0.826	0.9
Florida	0.915	1.228
Georgia	0.741	0.994
Hawaii	0.861	0.976
Idaho	0.692	0.708
Illinois	0.869	0.784
Indiana	0.712	0.614
Iowa	0.632	0.612
Kansas	0.723	0.752
Kentucky	0.587	0.964
Louisiana	0.715	1.3
Maine	0.386	0.618
Maryland	0.856	0.834
Massachusetts	0.913	0.55
Michigan	0.735	0.806
Minnesota	0.719	0.428
Mississippi	0.463	1.098
Missouri	0.695	0.946
Montana	0.534	0.59
Nebraska	0.73	0.698
Nevada	0.941	0.988
New Hampshire	0.583	0.664
New Jersey	0.938	0.702
New Mexico	0.745	1.424
New York	0.874	0.642
North Carolina	0.667	0.75
North Dakota	0.61	0.384
Ohio	0.763	0.746
Oklahoma	0.646	0.944
Oregon	0.805	0.888
Pennsylvania	0.765	0.854
Rhode Island	0.911	0.69
South Carolina	0.679	1.202
South Dakota	0.572	0.578
Tennessee	0.662	1.016
Texas	0.837	1.06
Utah	0.898	0.67
Vermont	0.351	0.416
Virginia	0.756	0.546
Washington	0.834	0.672
West Virginia	0.446	1.002
Wisconsin	0.671	0.63
Wyoming	0.62	0.722

Table 18: R Studio Input Data for Section 4.1.2. Analysis

R Studio Input Data for Percent of Road Length Classified as Urban and Urban Fatality Rate		
State	2019_Percent_of_roads_that_are_urban	2019_5yr_Average_Urban_Fatality_Rate
Alabama	0.291908153	0.824
Alaska	0.178022493	1.034
Arizona	0.396252027	1.224
Arkansas	0.16853334	0.99
California	0.592572501	0.832
Colorado	0.234622335	0.922
Connecticut	0.736338484	0.824
Delaware	0.561126814	0.9
Florida	0.704357576	1.228
Georgia	0.406785883	0.994
Hawaii	0.631452127	0.976
Idaho	0.139388812	0.708
Illinois	0.341034213	0.784
Indiana	0.313015479	0.614
Iowa	0.11142655	0.612
Kansas	0.10093404	0.752
Kentucky	0.18691014	0.964
Louisiana	0.375285185	1.3
Maine	0.14100923	0.618
Maryland	0.580432675	0.834
Massachusetts	0.831729041	0.55
Michigan	0.311173388	0.806
Minnesota	0.164427404	0.428
Mississippi	0.168659542	1.098
Missouri	0.18618661	0.946
Montana	0.058036922	0.59
Nebraska	0.084327329	0.698
Nevada	0.217779923	0.988
New Hampshire	0.313524356	0.664
New Jersey	0.860161608	0.702
New Mexico	0.157172013	1.424
New York	0.436977831	0.642
North Carolina	0.387527984	0.75
North Dakota	0.032757415	0.384
Ohio	0.386423772	0.746
Oklahoma	0.164998623	0.944
Oregon	0.192286779	0.888
Pennsylvania	0.400615578	0.854
Rhode Island	0.772661977	0.69
South Carolina	0.308457032	1.202
South Dakota	0.040259723	0.578
Tennessee	0.331142949	1.016
Texas	0.347758511	1.06
Utah	0.25272631	0.67
Vermont	0.105422786	0.416
Virginia	0.35523691	0.546
Washington	0.301898039	0.672
West Virginia	0.17174235	1.002
Wisconsin	0.207160274	0.63
Wyoming	0.095083343	0.722

Table 19: R Studio Input Data for Section 4.1.3. Analysis

R Studio Input Data for Percent of Road Length Classified as Rural and Rural Fatality Rate		
State	2019_Percent_of_road_length_that_is_rural	2019_5yr_average_rural_fatality_rate
Alabama	0.708	2.122
Alaska	0.822	1.818
Arizona	0.604	2.134
Arkansas	0.831	1.996
California	0.407	2.422
Colorado	0.765	1.678
Connecticut	0.264	1.34
Delaware	0.439	1.996
Florida	0.296	2.358
Georgia	0.593	1.834
Hawaii	0.369	1.194
Idaho	0.861	1.802
Illinois	0.659	1.568
Indiana	0.687	1.764
Iowa	0.889	1.308
Kansas	0.899	1.87
Kentucky	0.813	2.066
Louisiana	0.625	1.87
Maine	0.859	1.25
Maryland	0.420	1.064
Massachusetts	0.168	0.782
Michigan	0.689	1.428
Minnesota	0.836	0.946
Mississippi	0.831	2.072
Missouri	0.814	1.566
Montana	0.942	1.946
Nebraska	0.916	1.472
Nevada	0.782	1.832
New Hampshire	0.686	1.216
New Jersey	0.140	1.404
New Mexico	0.843	1.324
New York	0.563	1.54
North Carolina	0.612	2.1
North Dakota	0.967	1.456
Ohio	0.614	1.47
Oklahoma	0.835	1.908
Oregon	0.808	1.948
Pennsylvania	0.599	1.666
Rhode Island	0.227	1.214
South Carolina	0.692	2.568
South Dakota	0.960	1.568
Tennessee	0.669	1.902
Texas	0.652	2.094
Utah	0.747	1.336
Vermont	0.895	0.984
Virginia	0.645	1.762
Washington	0.698	1.418
West Virginia	0.828	1.846
Wisconsin	0.793	1.17
Wyoming	0.905	1.522

Table 20: R Studio Input Data for Section 4.2.1. Analysis

R Studio Input Data 2019 percent of total fatalities that had unrestrained passenger and the 2019 observed seat belt use		
State	2019 (5 year rolling averge) percent of total passenger vehicle occupant fatalities that were unrestrained	2019 5-year rolling average observed percent of observed seatbelt use
Alabama	0.533	0.924
Alaska	0.472	0.908
Arizona	0.486	0.876
Arkansas	0.490	0.788
California	0.309	0.964
Colorado	0.529	0.854
Connecticut	0.395	0.9
Delaware	0.443	0.914
Florida	0.423	0.9
Georgia	0.426	0.966
Hawaii	0.372	0.96
Idaho	0.547	0.832
Illinois	0.382	0.942
Indiana	0.386	0.93
Iowa	0.396	0.934
Kansas	0.470	0.84
Kentucky	0.528	0.882
Louisiana	0.495	0.872
Maine	0.487	0.878
Maryland	0.347	0.912
Massachusetts	0.517	0.78
Michigan	0.303	0.938
Minnesota	0.309	0.928
Mississippi	0.562	0.796
Missouri	0.577	0.84
Montana	0.630	0.814
Nebraska	0.548	0.83
Nevada	0.428	0.916
New Hampshire	0.684	0.71
New Jersey	0.403	0.926
New Mexico	0.475	0.918
New York	0.315	0.928
North Carolina	0.426	0.904
North Dakota	0.555	0.9186
Ohio	0.477	0.844
Oklahoma	0.489	0.86
Oregon	0.264	0.962
Pennsylvania	0.503	0.864
Rhode Island	0.503	0.88
South Carolina	0.488	0.916
South Dakota	0.643	0.754
Tennessee	0.444	0.894
Texas	0.381	0.914
Utah	0.410	0.886
Vermont	0.490	0.858
Virginia	0.544	0.828
Washington	0.324	0.942
West Virginia	0.436	0.894
Wisconsin	0.404	0.884
Wyoming	0.599	0.82

Table 21: R Studio Input Data for Section 4.3.1. Analysis

R Studio Input Data Number of Emphasis Areas and Total Fatality Rate		
State	Total number of EA's for each state	2019 5 yr rolling average total fatality rate
Alabama	4	1.36
Alaska	3	1.384
Arizona	5	1.456
Arkansas	4	1.478
California	5	1.09
Colorado	5	1.144
Connecticut	6	0.884
Delaware	9	1.202
Florida	17	1.426
Georgia	10	1.194
Hawaii	7	1.016
Idaho	11	1.35
Illinois	5	0.972
Indiana	12	1.038
Iowa	8	1.024
Kansas	8	1.29
Kentucky	6	1.556
Louisiana	4	1.524
Maine	17	1.06
Maryland	6	0.892
Massachusetts	6	0.562
Michigan	4	0.998
Minnesota	20	0.642
Mississippi	7	1.652
Missouri	4	1.206
Montana	4	1.53
Nebraska	7	1.126
Nevada	4	1.168
New Hampshire	10	0.886
New Jersey	6	0.754
New Mexico	10	1.376
New York	6	0.824
North Carolina	11	1.206
North Dakota	6	1.15
Ohio	14	0.972
Oklahoma	4	1.39
Oregon	4	1.306
Pennsylvania	3	1.136
Rhode Island	10	0.75
South Carolina	3	1.82
South Dakota	8	1.274
Tennessee	6	1.298
Texas	11	1.342
Utah	11	0.852
Vermont	11	0.824
Virginia	13	0.944
Washington	16	0.888
West Virginia	8	1.438
Wisconsin	10	0.908
Wyoming	9	1.294

Table 22: R Studio Input Data for Section 4.3.2. Analysis

R Studio Input Data for SHSP Goal Aggressiveness and Actual Reduction of Fatalities		
State	Percent_reduction_in_fatalities_goal_for_SHSP	2015-2019_net_percent_change
Alabama	-0.139	0.167
Alaska	-0.215	-0.027
Arizona	-0.167	0.251
Arkansas	-0.167	0.099
California	-0.167	0.194
Colorado	-0.15	0.218
Connecticut	-0.15	0.032
Delaware	-0.15	0.087
Florida	-0.167	0.262
Georgia	-0.167	0.275
Hawaii	-0.097	0.177
Idaho	-0.017	0.213
Illinois	-0.1	0.096
Indiana	-0.317	0.097
Iowa	-0.167	0.091
Kansas	-0.2	0.096
Kentucky	-0.348	0.103
Louisiana	-0.125	-0.016
Maine	-0.167	0.238
Maryland	-0.556	0.212
Massachusetts	-0.167	-0.037
Michigan	-0.03	0.1
Minnesota	-0.41	0.025
Mississippi	-0.25	0.063
Missouri	-0.5	0.153
Montana	-0.25	-0.016
Nebraska	-0.198	0.112
Nevada	-0.178	0.057
New Hampshire	-0.192	0.271
New Jersey	-0.14	0.012
New Mexico	-0.167	0.185
New York	-0.132	-0.099
North Carolina	-0.156	0.131
North Dakota	-0.375	-0.283
Ohio	-0.02	0.15
Oklahoma	-0.013	-0.04
Oregon	-0.167	0.373
Pennsylvania	-0.1	-0.112
Rhode Island	-0.16	0.331
South Carolina	-0.167	0.22
South Dakota	-0.182	-0.245
Tennessee	-0.136	0.172
Texas	-0.518	0.025
Utah	-0.25	-0.026
Vermont	-0.1	0.173
Virginia	-0.109	0.175
Washington	-0.455	0.171
West Virginia	-0.2	-0.029
Wisconsin	-0.05	0.124
Wyoming	-0.167	0.064

APPENDIX F. R STUDIO OUTPUT DATA FROM K-MEANS CLUSTERING

Table 23: R Studio Cluster Group Output Data for All Analyses

	Cluster Group from K-Means Analysis					
State	**4.1.1.**	**4.1.2.**	**4.1.3.**	**4.2.1.**	**4.3.1.**	**4.3.2.**
Alabama	2	2	4	2	3	1
Alaska	2	1	3	2	3	2
Arizona	5	1	4	2	3	1
Arkansas	2	1	3	1	3	1
California	3	3	4	3	3	1
Colorado	3	1	3	2	3	1
Connecticut	3	3	1	3	1	2
Delaware	3	3	4	2	2	1
Florida	5	3	4	2	4	1
Georgia	3	1	3	3	2	1
Hawaii	3	3	1	3	1	1
Idaho	4	2	3	1	2	1
Illinois	3	2	2	3	3	1
Indiana	4	2	3	3	2	3
Iowa	1	2	2	3	1	1
Kansas	4	2	3	2	1	1
Kentucky	2	1	3	2	1	3
Louisiana	5	1	3	2	3	2
Maine	1	2	2	2	4	1
Maryland	3	3	1	3	1	3
Massachusetts	4	3	1	1	1	2
Michigan	4	2	2	3	3	1
Minnesota	1	2	2	3	4	3
Mississippi	2	1	3	1	1	2
Missouri	2	1	2	1	3	3
Montana	1	2	3	1	3	2
Nebraska	4	2	2	1	1	1
Nevada	3	1	3	2	3	2
New Hampshire	1	2	2	1	2	1
New Jersey	4	3	1	3	1	2
New Mexico	5	1	2	2	2	1
New York	4	2	2	3	1	2
North Carolina	4	2	4	2	2	1
North Dakota	1	2	2	1	1	2
Ohio	4	2	2	2	4	1
Oklahoma	2	1	3	2	3	2
Oregon	3	1	3	3	3	1
Pennsylvania	3	1	3	2	3	2
Rhode Island	4	3	1	2	2	1
South Carolina	5	1	4	2	3	1
South Dakota	1	2	2	1	1	2
Tennessee	2	1	3	2	1	1
Texas	3	1	4	3	2	3
Utah	4	2	2	2	2	2
Vermont	1	2	2	2	2	1
Virginia	4	2	3	1	2	1
Washington	4	2	2	3	4	3
West Virginia	2	1	3	2	1	2
Wisconsin	4	2	2	2	2	1
Wyoming	4	2	2	1	2	2

APPENDIX G. SHSP EMPHASIS AREAS BY STATE

Table 24: SHSP Emphasis Areas by State

	Driver Behavior (50)									Roadway Design (48)							VRU (40)						Young & Old (27)			Records (18)			Other Vehicle Groups (11)			Post-Crash (9)			Technology (6)			Education (3)			Local (3)			Licensing (3)		Changing Road Conditions (3)		1	1		
State	Aggressive Driving	Speed Management	Distracted Driving	Impaired Driving	Drowsy Driving	Occupant Protection	Safe Road Users	Safe Roads & Safe Speeds	Driver Behavior	Roadway Departure	Intersections	Roadway Departure and Intersections	Infrastructure	Critical Roadway Locations	High-Speed Multi-Lane Rear-End Collisions	Train (Crossings)	Vulnerable Road Users	Pedestrians	Bicyclists	Pedestrians & Bicyclists	Motorcycles	Work Zones	Young Drivers	Older Drivers	Young & Old Drivers	Traffic Records	Data Management	Management Systems	Commercial Motor Vehicles	Roadway Transit	School Buses	EMS	Post Crash Care	Traffic Incident Management	Connected Automated Vehicles	Vehicle Safety Enhancements	Research & Technology Adoption	New Approaches to Public Eduducation	Traffic Safety Education & Awareness	Decisions and Performance Improvements	Local Roads	Local Planning (MPOs, etc)	Tribal Lands	Operating After Suspension	Unlicensed Drivers	Wildlife	Icy/Snowy Roads	Equity	Double Down What Works	Total Number of EA's for Each State	Total Number of Groups for Each State
Minnesota		X	X	X		X				X	X					X		X	X		X	X	X	X			X	X	X			X				X			X						X					20	10
Florida	X		X	X	X	X				X	X					X	X			X	X	X	X	X					X	X					X															17	6
Maine		X	X	X		X				X	X									X	X		X	X		X			X			X										X		X		X	X			17	10
Washington		X	X	X	X	X				X	X					X				X	X	X	X	X					X		X															X				16	6
Ohio		X	X	X		X				X	X					X				X	X		X	X			X		X						X															14	7
Virginia		X		X		X				X	X									X	X		X	X			X		X			X			X															13	8
Indiana									X	X	X				X	X		X	X		X	X			X		X		X																					12	6
Idaho	X		X	X		X				X	X									X	X		X	X					X																					11	5
North Carolina		X	X	X		X				X	X									X	X		X	X			X																							11	5
Texas		X	X	X		X				X	X							X	X				X	X									X																	11	5
Utah	X	X	X	X		X					X	X						X			X		X	X																										11	4
Vermont	X		X	X		X				X	X									X	X		X	X			X																							11	5
Georgia			X	X		X						X						X	X		X		X	X					X																					10	5
New Hampshire	X		X	X		X				X	X									X	X		X	X																										10	4
Rhode Island	X		X	X		X						X					X						X	X			X	X																						10	5
Wisconsin	X		X	X		X				X	X									X	X				X		X																							10	5
New Mexico	X		X	X		X				X	X							X			X		X																				X							10	5
Delaware		X	X	X		X				X	X							X			X					X																								9	4
Wyoming			X								X									X	X	X		X					X																	X	X			9	6
Iowa		X	X	X		X				X	X												X	X																										8	3
South Dakota	X			X		X				X	X										X		X	X																										8	4
West Virginia	X			X		X				X	X							X						X			X																							8	5
Kansas				X		X				X	X									X			X	X																	X									8	5
Hawaii		X		X		X							X				X										X					X																		7	5
Nebraska				X		X				X	X									X			X	X																										7	4
Mississippi			X	X		X				X	X																X																		X					7	4
Connecticut									X					X						X	X		X											X																6	5
Kentucky	X		X	X		X				X							X																																	6	3
Maryland	X		X	X		X							X							X																														6	3
New York		X							X	X	X						X								X																									6	4
North Dakota	X			X		X				X	X												X																											6	3
Tennessee									X				X				X										X	X	X																					6	5
Massachusetts		X												X																						X	X	X											X	6	5
New Jersey									X	X	X						X			X																												X		6	4
Arizona									X	X	X							X									X																							5	4
California	X			X						X	X									X																														5	3
Colorado			X	X		X							X							X																														5	3
Illinois							X	X	X																			X					X																	5	3
Arkansas							X	X																									X			X														4	3
Louisiana			X	X		X							X																																					4	2
Michigan									X				X				X											X																						4	4
Missouri	X		X	X		X																																												4	1
Montana				X		X						X																				X																		4	3
Nevada				X		X							X				X																																	4	3
Oklahoma									X		X	X											X																											4	3
Oregon									X				X				X											X																						4	4
Alabama									X				X				X																							X										4	4
Alaska									X				X				X																																	3	3
Pennsylvania				X						X								X																																3	3
South Carolina	X												X				X																																	3	3
Total Number of States for Each EA	16	13	24	34	2	32	2	2	12	28	29	5	11	2	1	5	13	10	4	18	19	5	22	20	3	2	13	6	11	1	1	5	3	1	3	3	1	1	1	1	1	1	1	1	2	3	2	1	1		

APPENDIX H. SHSP SAFETY PERFORMANCE GOALS BY STATE

Table 25: SHSP Performance Measure Goals

State	SHSP Years	Easieness of goal to find	Type of Goal	Aggressiveness (% reduction of fatalities over the life of the SHSP plan)	Goal (words taken from SHSP documents)
Mississippi	2019-2023	Good	% Fatalities	25%	To reduce the number of traffic fatalities by 25% to 525 by 2023 (from 687 fatalities in 2018)
Missouri	2021-2025	Poor	% Fatalities	50%	Reduce traffic fatalities by 50% by 2025???? This is implied on this page
North Carolina	2019-2023	Good	% Fatalities	15.6%	Reduce fatalties and serious injuries by half by 2035, moving towards zero by 2050
Pennsylvania	2022-2026	Good	% Fatalities	10%	To achieve a 2% annual reduction for fatalities and maintain level for suspected serious injuries.
Utah	2020-2024	Fair	% Fatalities	25%	Reduce fatalities by 50% by 2030; Reach fewer than 200 fatalities by the end of 2021, which is a 6.8% reduction in fatalities per year since 2017; Reduce the fatality rate to 0.55 per 100MVMT by 2024.
Montana	2020-2024	Good	% Fatalities and Serious Inj	25%	Reduce fatalities and serious injuries on Montana's roads by half, from 952 in 2018 to 476 in 2030.
Alabama	2017-2021	Fair	% Fatalities and Serious Inj	13.9%	Reduce fatalities and serious injures by 50% by 2035
Colorado	2020-2023	Fair	% Fatalities and Serious Inj	15%	Establish a 15% reduction in fatalities and serious injuries as the performance target for the 2020-2023 timeframe
Connecticut	2017-2021	Good	% Fatalities and Serious Inj	15%	Reduce the number of fatalities and serious injuries on all public roads in Connecticut 15% by 2021 (this reduction will be measured between the 5-year moving average for 2010-2014 and the 5-year moving average for 2017-2021)
Delaware	2021-2025	Good	% Fatalities and Serious Inj	15%	Delaware's 2021-2025 SHSP ovjective is to reduce fatalities and serious injuries by 15% over the next 5 years to ultimately reach the goal of zero fatalities and serious injuries on Delaware's roadways
Illinois	2022-2026	Good	% Fatalities and Serious Inj	10%	The goal is a 2% annual reduction of fatalities and serious injuries based on a 5-year rolling average. Therefore, the goal for fatalities 5-year rolling average by 2026 is less than 958, and the goal for serious injuries 5-year rolling average by 2026 is less than 9,434
Louisiana	2022-2026	Good	% Fatalities and Serious Inj	12.5%	A target oal of reducing fatalties and serious injuries by 50% between 2010 and 2030
New Hampshire	2022-2026	Good	% Fatalities and Serious Inj	19.2%	Reduce the number of fatalities and serious injuries by 50% by 2035, working towards 0 by 2050.
Rhode Island	2017-2022	Fair	% Fatalities and Serious Inj	16%	Reduce fatalities and serious injuries by 3.2% annually
Virginia	2022-2026	Good	% Fatalities and Serious Inj	10.9%	To reduce deaths and severe injuries by half by 2045 (an average decline of approximately 2 to 4 % per year)
Vermont	2022-2026	Good	% Fatalities and Serious Inj	10%	Reduce fatalities and serious injuries in Vermont by 10 % during the 2022-2026 timeframe.
West Virginia	2022-2026	Good	% Fatalities and Serious Inj	20%	The objective of the 2022-2026 WV SHSP is to achieve zero fatalities by 2050 and ultimaetly zero serious injuries on our raodways, by reducing fatalities and serious injuries 4% annually over the next five years
New Jersey	2020-2024	Good	% Fatalities, Serious Inj, Injuries	14%	For each of the following categories - fatalities, serious injuries, and total injuries - reduce occurrences by 14% over the next 5 years. This amounts to a 3% per year reduction.
Ohio	2020-2024	Good	% 5 safety performance measures	2%	2% reduction goal across all five measures (number of fatalities, number of serious injuries, fatality rate, serious injury rate, number of non-motorized fatalities and serious injuries)
Massachusetts	2023-2027	Poor	No Date	16.7%	Target Zero Deaths and serious injuries on Massachusetts roadways
Arkansas	2022-2027	Poor	No Date	16.7%	The goal of the 2022-2027 SHSP is to make significant strides in achieving Arkansas' vision and goal of a fatality-free transportation system
Florida	2021-2025	Poor	No Date	16.7%	The Florida SHSP serves as a gramework of plans and activities that will improve safety and efficiency on our roadways with an ultimate goal of zero fatalities and serious injuries
Georgia	2022-2024	Fair	No Date	16.7%	Striving Towards Zero Deaths and Serious Injries for all road users in Georgia
Iowa	2019-2023	Fair	No Date	16.7%	Although Zero Fatalities is Iowa's long-term vision, the state also recognizes the need to establish shortterm goals in pursueit of this vision.
Maine	2017-2021	Good	No Date	16.7%	Maine's overall safety goal is to drive safety perofrmance toward zero deaths
Arizona	2019-2023	Good	No Date	16.7%	Reduce Traffic Fatalities on Arizona's Roadways
New Mexico	2022-2026	Good	No Date	16.7%	Reduce fatalities and serious injuries for all users on all New Mexico Roadways
Oregon	2021-2025	Good	No Date	16.7%	Improve safety culture, improve infrastructure, facilitate healthy and livable communities, use the best available tecchnologies, commute and collaborate, and invest strategically
South Carolina	2020-2024	Good	No Date	16.7%	Reduce fatalities and serious injuries on all public roadways
Wyoming	2020-2024	Good	No Date	16.7%	Reduce the frequency and severity of crashes in Wyoming
Nebraska	2022-2026	Fair	Number for 5 safety performance measures	19.8%	Goal to reduce traffic fatalities per 100 million VMT from 1.122 (2016-2020 average fatality rate) to 0.90 fatalities per 100 million VMT by 2026, reduce traffic serious injuries per 100 million VMT from 6.916 (2016-2020 average serious inj rate) to 5.5 by 2026; reduce non-motorist fatalities and serious injuries from 127 (2016-2020 average) to 110 fatalities and serious injuries by 2026
Nevada	2021-2025	Good	Number for 5 safety performance measures	17.8%	Ultimate goal of zero deaths; 2025 performance measures include target of 258.8 fatalities or less, 823.4 serious injuries or less, a fatality rate of 0.893 or less, a serious injury rate of 2.792 or less, and 233.1 non-motorized fatalities and serious injuries or less
New York	2017-2022	Good	Number for 5 safety performance measures	13.2%	Reduce roadway fatalities from the 5-year moving average of 1,143 in 2015 to 992 by 2022; Reduce the rate of roadway fatalities per 100 million VMT from the 5-year moving average of 0.89 in 2015 to 0.79 by 2022; Reduce serious inuuries from the 5-year moving average of 11,547 in 2015 to 10,024 in 2022; Reduce the rate of serious injuries from the 5-year moving average of 8.99 in 2015 to 7.81 in 2022; Reduce non-motirized fatalities and serious injuries from the 5-year moving average of 2,872 in 2015 to 2,493 in 2022
Oklahoma	2013-2014	Good	Number for 5 safety performance measures	1.3%	Fatalties held at or below 678 at the end of year 2016; fatality rate (fatalities per HMVMT) is to be held at or below 1.32 at the end of year 2016; serious injuries are to be held at or below 14, 518 at the end of year 2016; serious injury rate (serious injuries per HMVMT) is to be held at or below 30.20 at the end of year 2016; unrestrained occupant fatalities are to be held at or below 241 at the end of year 2016; fatalities involving alcohol are to be held at or below 246 at the end of the year 2016; commercial motor vehicle collisions are the be held at or below 4,341 at the end of the year 2016
Tennessee	2020-2024	Good	Number for 5 safety performance measures	13.6%	Reduce the 5-year rolling average of serious injuries to 6,205 in 2022 (14.1% reduction over 2017 value); Reduce the 5-year rolling aberage of serious injury rate to 6.16 in 2022 (35.9% reduction over 2017 value); Reduce the trend of increasing fatalities by not exceeding the 2022 5-year projected rolling average of 1,165; Reduce the 5-year rolling average of fatality rate to 1.14 in 2022 (13.6% reduction over 2017 value); Reduce the trend of increasing non-motorized fatalities and serious injuries by not exceeding the 2022 5-year projected rolling average of 716
Wisconsin	2017-2020	Good	Number for 5 safety performance measures	5%	By 2020, have a 5% reduction in number of fatalities 2% reduction each year), 5% reduction in the rate of fatalities per 100 million VMT (2% reduction each year), 10% reduction in number of serious injuries (5% reduction each year), 10% reduction in the rate of serious injuries per 100 million VMT (5% reduction each year), and a 10% reduction in number of non-motorized fatlities and non-motorized serious injuries (5% reduction each year)
Idaho	2021-2025	Good	Number of Fatalities	1.7%	Reduce the number of traffic deaths to 230 or fewer by 2025 (based on a 5-year average)
Indiana	2016-2020	Fair	Number of Fatalities	31.7%	The desired reduction in the 5-year moving average of fatality crashes over the period of this plan is a target of 544 by 2020
Kentucky	2020-2024	Good	Number of Fatalities	34.8%	Prevent serious crashes on Kentucky's highways such that the annual number of deaths falls at or below 500 by the year 2024
North Dakota	2018-2023	Good	Number of Fatalities	37.5%	To reduce annual motor vehicle crash fatalities to fewer than 75 by 2025
Texas	2022-2027	Fair	Number of Fatalities	51.8%	For the 2022 revision of the SHSP, the targets are aligned with the Road-to-Zero direction by the Texas Transportation Commission. The projections are based on the short-term target of reducing fatalities to approximately 1,800 by 2035 and the long-term target of zero fatalities by 2050.
Michigan	2019-2022	Fair	Number of Fatalities and Serious Inj	3%	Reduce fatalities from 974 in 2018 to 945 in 2022; Reduce suspected serious injures from 5,586 in 2018 to 4,994 in 2022
Minnesota	2020-2024	Good	Number of Fatalities and Serious Inj	41%	No more than 225 traffic deaths and no more than 980 serious injuries by 2025
South Dakota	2019-2024	Good	Number of Fatalities and Serious Inj	18.2%	100 or fewer traffic fatalities by 2024; 400 or fewer serious injuries by 2024
Alaska	2018-2022	Good	Number of Fatalities and Serious Inj	21.5%	Using a five-year rolling average, the goal is to reduce fatalities from 79 in 2017 to 67 in 2022 and serious injuries from 392 in 2016 to 331 in 2022
Hawaii	2019-2024	Good	Number of Fatality Rate	9.7%	Working together, we will reduce the fatality rate from 7.2 to 6.5 fatalities per 100,000 population, or less, by 2024, with the ultimate goal of zero traffic deaths
Kansas	2020-2024	Good	Number of Serious Inj Rate	20%	The overall goal of this five-year plan is to achieve a fatal and injury crash rate of less than 35 crashes per 100-million-vehicle-miles travel by 2024
Maryland	2021-2025	Fair	TZD	55.6%	Zero deaths in Maryland by 2030; my words: interim safety performance targets are set for each emphasis area to decrease the number of fatalities that are related to that emphasis area by 2025
California	2020-2024	Fair	TZD	16.7%	Establish a trend to reach zero fatalities and serious injuries by 2050
Washington	2019-2023	Fair	TZD	45.5%	To achieve zero deaths and serious injuries on our roadways by 2030

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