SD99-05-F

SD Department of Transportation
Office of Research

Identification of Methods for Truck Crash Reduction

Study SD99-05
Final Report

Prepared by
Business Research Bureau
University of South Dakota
414 East Clark – Patterson 132
Vermillion, SD 57069

October, 1999

DISCLAIMER

The contents of this report reflect the views of the authors who are responsible for the facts and accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the South Dakota Department of Transportation, the State Transportation Commission, or the Federal Highway Administration. This report does not constitute a standard, specification, or regulation.

ACKNOWLEDGEMENTS

This work was performed under the supervision of the SD99-05 Technical Panel:

Jon Becker ..... Office of Research
Sgt. Noel Gabriel ..... Highway Patrol
Mark Gilmore ..... FHWA
Barb Lindstrom ..... SD Trucking Association
Creighton Miller ..... Accident Records
Capt. Myron Rau ..... Highway Patrol
Dan Strand ..... Office of Research
Larry Thury ..... Midwest Coast Transport

TECHNICAL REPORT STANDARD TITLE PAGE

1. Report No. SD99-05-F	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle Identification of Methods for Truck Crash Reduction		5. Report Date October, 1999
		6. Performing Organization Code
7. Author(s) List authors' names here Kareen H. Dougherty, Ruby R. Plate, Randall M. Stuefen & Stephen L. Tracy		8. Performing Organization Report No.
9. Performing Organization Name and Address Business Research Bureau University of South Dakota 414 East Clark Street Vermillion, SD 57069-2390		10. Work Unit No. 11. Contract or Grant No.
12. Sponsoring Agency Name and Address South Dakota Department of Transportation Office of Research 700 East Broadway Avenue Pierre, SD 57501-2586		13. Type of Report and Period Covered Final Report; February 1999 to October 1999 14. Sponsoring Agency Code

15. Supplementary Notes
An Executive Summary is published as SD99-05-X.

16. Abstract

In South Dakota, trucks account for a higher percentage of fatalities than other vehicles, indicating when a truck is involved in a crash, fatalities are more likely to occur. In this study, the Business Research Bureau reviewed and linked different databases to help determine some of the underlying causes of these crashes.

The Business Research Bureau conducted an extensive literature search and review to locate existing data on truck crashes. Members of the South Dakota Highway Patrol were interviewed, panel style. The members of the Highway Patrol were questioned about crash procedures and existing and potential problems with the existing process. Individuals from the trucking industry were interviewed to determine their perspective on the crash reporting process.

The BRB linked the data from the National Governor's Associations SAFETYNET database with the Accident Records files for the final quarter of 1995 and the years 1996-1998. Statistical analysis was performed on the linked database. After a review of the linked data, the BRB decided to use only the data from 1996-1998 to assure consistency and completeness. A methodology for performing linkage was prepared and recommendations for database improvement and crash reduction was compiled.

Conclusions and recommendations were given to members of the Highway Patrol and Trucking Industry for review and discussion. Opinions and suggestions of these individuals were taken into consideration and incorporated into final recommendations.

17. Keyword Truck Crash, Truck Accident		18. Distribution Statement No restrictions. This document is available to the public from the sponsoring agency.	
19. Security Classification (of this report) Unclassified	Security Classification (of this page) Unclassified	21. No. of Pages 126 pages	22. Price

Table of Contents

List of Figures

List of Tables

Executive Summary

Introduction:

Commercial transportation is vitally important to South Dakota. Commercial trucks are responsible for approximately 90% of all goods brought into the state. For the three-year period of 1996 through 1998, commercial trucks were involved in only a small percentage of the crashes that occurred. Out of 101,092 vehicles involved in crashes, only 3,511 (about 3.5%) involved commercial trucks.

In South Dakota, commercial vehicles involved in fatal crashes represent 7.9% of all vehicles compared to 3.5% represented in all types of crashes. These statistics are consistent with national rates. This number indicates that when a commercial vehicle is involved in a crash, it is more often a fatal crash than when only smaller vehicles are involved. This study analyzed these crashes in order to determine what factors were significant when a commercial truck was involved in a collision.

This project sought to identify significant problem areas in commercial truck-related crashes. Two databases exist that document motor vehicle crashes. These are the South Dakota Accident Reporting System, which documents all reportable crashes and SAFETYNET, which documents Department of Transportation reportable events. This project uses available information to get a clearer understanding of the factors that contribute to commercial vehicle crashes in South Dakota.

Methodology:

A three-phase approach was used to identify potential problems and find areas for improvement:

The first phase of the project was to identify what has been studied on the subject. An exhaustive search for existing data was done using the internet, libraries and contact with other states. The search showed that some states had linked the crash records with SAFETYNET, with little success. A complete documentation of the response from other states is shown in Appendix C.

The next phase was to interview the people most involved in commercial vehicle crashes. Using a round table format, members of the South Dakota Highway Patrol were interviewed about their perceptions about crashes, including causes, documentation, and problems. Members of the trucking industry were identified by the technical panel and interviewed individually. The questions and responses from the Highway Patrol and Trucking Industry are shown in Appendices A and B.

The final phase of the project was to use probabilistic linkage to combine the South Dakota Accident Reporting System database and SAFETYNET. The linked data was then used to perform a statistical review in the form of frequency and regression analyses. The analysis was performed to identify areas for review and improvement.

The matched database identifies only those crashes that meet the Department of Transportation's standard for reportable. Because of this, the data used in the analysis only represent commercial vehicles that were involved in crashes resulting in a tow-away, injury or fatality.

The matched dataset consisted of the following records:

Record Type	*All Linked Records*	*Linked Records for 1996-1998*
Accident Master ("A")	872	818
Vehicle/Driver ("V")	1,326	1,244
Passenger ("R")	251	242
Other Driver ("O")	6	5
Bicycle Driver ("B")	4	4
Pedestrian ("P")	1	1

The dataset used contained data for the years 1996-1998. The fourth quarter records for 1995 were largely incomplete and were not used for this reason.

Using this dataset, frequencies, cross-tabulations, correlation and regression analyses were done to determine the factors that may be significant when commercial vehicles are involved in crashes.

Findings and Conclusions:

Using the frequencies and regression analysis, as well as the research and interviews, some general and specific conclusions were reached.

1. The number of deaths associated with accidents involving a commercial motor vehicle declined from 25 in 1996, to 21 in 1997 and 14 in 1998. Part of that decline reflects a decrease in accident severity and the remainder to a decrease in the number of accidents. The accidents per million miles traveled within the state remained fairly constant between 1996 and 1997 but the number of fatal accidents declined by two, which resulted in the number of deaths declining by four. In 1998, the accident rate decreased from 29.5 to 23.3 per million miles traveled. There were fewer accidents, fewer fatal accidents and fewer deaths in that year.

2. Alcohol involvement in commercial vehicle accidents increased in 1997 but fell below the 1996 level in 1998. There were two people killed in alcohol-related accidents in 1996, three in 1997 and one in 1998. The 1998 improvement is desirable but there are no causal relationships to explain the improvement. Further, the number of deaths each year is small and summary statistics are greatly affected by one or two events.

3. Safety restraint usage is the lowest among the younger drivers. It can not be determined from the data if lower safety restraints usage is an issue of attitude, "style" or if this group is simply uninformed. We recommend additional efforts in convincing young people that safety restraints are necessary and important to safe vehicle operation. Beyond the potential

for restraints to reduce injuries, nearly one fourth of all fatalities during the three year period involved partial or total ejection from the motor vehicle.

4. Sites where multiple accidents involving commercial motor vehicles on the Interstate Highway system have occurred are typically at or near an entry or exit point. The accident sites include points near on and off ramps and exit and entries for rest areas. It would appear that there are failure to yield issues at points of entry and exit in that the commercial motor vehicle is most likely to be going straight when the accident occurs.

5. Regression analysis shows that safety and restraint issues figure prominently as factors that are statistically significant in explaining factors that contribute to fatalities in commercial motor vehicle involved accidents. The regression model explained only 16.9 percent of the variation in the data and is considered to have weak explanatory power. The lack of systematic causes for the accidents, a limited number of locations where accidents are common and the lack of explanatory power in the regression model suggest that there is a strong random element in the occurrence of accidents involving commercial motor vehicles.

6. The regression analysis for injuries is also described as being weak in explanatory power, explaining only 16.5 percent of the variation. The factors found to be statistically significant in explaining injury accidents were conditions, type and place of collision and safety factors. As with fatal accidents there does not appear to be a systematic cause, event or issue that explains a large percentage of the accidents involving commercial motor vehicles.

7. Weight ratings of commercial motor vehicles as they relate to accidents is an interesting issue. Department of Transportation personnel told us that their estimate of trucks requiring a permit as a result of weighing more than 80,000 pounds is less than ten percent of all trucks. Some safety officials estimate from their experience that the proportion of trucks weighing more than 80,000 pounds is below five percent. Using the number of South Dakota interstate vehicles registered by South Dakota Division of Motor Vehicles (under the Interstate Registration Plan) in 1999, about 68% are weight rated at or below 80,000 lbs. The issue is that this small group of trucks with GVW ratings of 80,000 to 120,000 pounds represents nearly half of all accidents involving commercial motor vehicles. And, they are involved in fatal accidents at a rate over two and a half (2.7) times that of trucks in the 40,000 to 80,000 category. While no conclusion can be reached, a closer look is indicated.

8. The Interstate Highway system is a highly used and an extremely important route for those in the trucking industry. Because of the frequency of use, the number of crashes on an interstate highway is greater than on other roads. While the percentage per mile driven is not as high, the sheer traffic on interstate highways necessitate special concern.

9. The “non-preventable” factors, such as weather and light conditions, are not nearly as significant as the more “preventable” factors. With the exception of “Blowing Soil, Dirt and Sand” and “Fog, Smoke” the “non-preventable” conditions are not significant in the crashes in the dataset.

10. Driver error, from any of the vehicles involved, is very significant. The regression indicates that injuries and fatalities occur when driver error increases. The linked dataset is unable to recognize the vehicle involved that caused the crash, but the results point to the need for continued education in defensive driving.

11. The linked database is limited in its value. Because the dataset includes only the DOT reportable crashes (as defined in Appendix E, Glossary and Acronym List), factors that may contribute to crashes in general may be underrepresented. The current system for indicating the location of the crash is not adequate to develop meaningful geographical locations of crashes.

12. An examination of the frequencies and the rating system in SAFETYNET failed to identify any individual trucker or trucking companies that pose a statistically significant safety risk. As data from subsequent years is collected, future linkages may be able to identify carriers who pose a greater risk.

Recommendations:

Recommendations are derived from the review of literature and previous studies, input from law enforcement and members of the trucking profession and analysis of the linked databases. Recommendations are divided into sections on the databases and other areas.

Database Improvement*:*

1. Develop Crash Report Form that incorporates both the present data and the SAFETYNET fields.

   The present system requires the completion of two forms, often with similar or identical fields. This system appears to be cumbersome and provides ample opportunity for error. Using one form would allow a combination of like fields and would minimize the chances of keying errors. Additionally, a single form could improve the completeness of the "SAFETYNET" data.

2. Revise XY coordinate system to utilize real world coordinates such as latitude and longitude.

   The current XY coordinate system adequately identifies the point of the crash. Using this system however, it is difficult, if not impossible, to develop statewide statistics based on specific roadways. Using real world coordinates could facilitate the identification of patterns and trends using location. With real world coordinates, other information already collected such as weather conditions and time of day could be layered onto crash locations to develop in-depth analysis of the causes and factors of crashes.

   During this study, a method to convert XY coordinates to real world coordinates was discussed. A system of geocoding using two points in each county could be used to give approximate location. The exact location would be impossible to obtain using this method because the surveyed miles in the state do not reflect actual miles exactly. This method of

geocoding could be used to identify clusters and trends of all crashes in the state. The BRB, with the assistance of the Geological Survey, was able to accomplish this using fifty crashes in Codington County.

The most accurate way to obtain real world coordinates would be to utilize portable geocoding units. Portable units kept by law enforcement could obtain real world coordinates. The purchase of these portable units should be considered as part of the long-range plan. Hand held units vary greatly in cost (from around $120 to about $1,200 per unit). Considerable and varied options exist and specific needs would need to be assessed.

Portable GPS units could increase the safety of the officers who patrol very rural areas. Officers would be able to identify exact locations in conditions and events where visibility or other factors make it impossible.

Another option to the hand held GPS units is to purchase software that could convert current XY coordinates into real world coordinates. While the identification of the locations would still be less exact, more usable data could be developed for analysis purposes.

3. Add field to identify if carrier is a licensed commercial driver or an individual using commercial equipment for personal or commercial use.

   Presently, there is no way to identify if a carrier is a professional driver or an individual using commercial equipment for personal or commercial use. While the SAFETYNET database includes a "interstate or intrastate" field, it is inadequate to use in determining if the driver is, in fact, licensed to drive a commercial vehicle. Adding this field would enable research to be performed on the drivers involved in crashes. An alternative would be to add this as an option to an existing field such as the "driver license status" field.

4. Include speed at the time of crash on the database.

   Currently this is collected but not entered into the database. Having this field would aid in determining at what speed problems occur. Speed can be approximated using a combination of fields if exceeding the speed limit is cited. When crashes occur while drivers are driving under the posted speed limits, the actual speed could be valuable in determining if the posted limits are, in fact, appropriate. Further analysis could be done using speeds and roads, times of day, etc.

5. Consider adding an approximate weight field. The SAFETYNET database uses the Gross Vehicle Weight rating of the tractor and the trailers added together to determine the total Gross Vehicle Weight rating. As suggested earlier, a high GVW rating may indicate a heavy vehicle but it is not a reliable measure of actual vehicle weight. The GVW ratings along, with information from weigh stations, when available, and information about the load capacity could be utilized to get a reasonable approximation of vehicle weight. This approximation would be useful in determining the true impact of vehicle weight on crashes.

6. Update Accident Records System to utilize a relational database integrated with Department of Motor Vehicles and Driver Licensing.

   The current system used is a very good system but it has limitations that a relational database would not. Utilizing a relational database would enable real-time reporting, promote more consistent information and enable a cross-reference of vehicle ownership and more driver history and detail. This is a long-term recommendation that will require a substantial amount of coordination but will allow for better access to more complete data.

Resource Allocation

1. When speeding or exceeding safe speed is listed as a factor, approximately 2/3 of the time, there was some instance of road conditions being rain, snow, or ice covered, and about ½ of the time weather such as rain, snow or sleet was cited. Since speed estimates are predominantly given by driver, there is a good chance that exceeding limits are understated. More vigilant enforcement of the speed limit along with aggressive sanding of roads during hazardous weather conditions is recommended. Special concern should be at intersection and junction areas, since they account for about 25% of the speed related collisions.

2. Most crashes occur during daylight hours between 9:00 am and 5:00 pm. Resources should be allocated accordingly.

3. Interstates 90 and 29 account for the greatest number, by far, of speed related crashes (87 out of 164). Of these, Minnehaha and Lincoln counties had 28 speed related crashes and the Black Hills counties accounted for 21 crashes. Roberts county stands out as significant with 10 speed related crashes. These would be areas where additional enforcement of speed would be warranted.

4. Failure to yield is a frequently cited contributing factor (32 times). Weather and road conditions do not appear to play a part in this, as those factors are not usually indicated. The interstates represent only a small number of the failure to yield cases (5) with four of those occurring in urban areas. Most significant in the failure to yield cases is the junction where 22 of the 32 occurred. Twenty-five of the 32 crashes involving a failure to yield occurred where some sort of traffic control device was located. Signage and graded bumps prior to intersections would be useful to alert drivers of upcoming intersections.

5. Drivers who fell asleep were involved in 31 crashes. Neither weather nor roadway appears to be significant. Not surprisingly, 26 of 31 occurred after 6:00 p.m. and before 7:00 a.m. Devices used to alert drivers when their heads begin to nod might be a solution.

Other Recommendations

1. Assist law enforcement with utilizing existing and developing clearer guidelines for law enforcement to use in determining severity of injury.

   In determining injuries, using consistent criteria would enable the officers to submit reports that could be more closely used in the analysis of injury and fatality crashes. While this

information exists in the guidelines, it appears there is some disagreement on how each category is defined.

2. Continue to promote excellent working relationship between law enforcement and trucking industry.

   The industry and law enforcement have joined forces to promote safety by working together. Stressing safe vehicles, defensive driving and “share the road” philosophies have enabled greater cooperation and safer roads. This cooperative effort should be continued.

Problem Description

In South Dakota, commercial vehicles (as reported in the National Governors Association's SAFETYNET database) involved in fatal crashes represent 7.9% of all vehicles compared to 3.5% represented in all types of crashes. These statistics reflect national statistics. This number indicates that when a truck is involved in a crash, it is more often a fatal crash than when only smaller vehicles are involved. Clearly, trucks are over represented in fatal crashes.

There are many factors that may contribute to accidents. Identifying accident contributing factors may result in the ability to identify methods by which the frequency and or severity of accidents may be reduced.

In order to identify the accident contributing factors, data collection instruments must be thorough and provide for the collection of all relevant data necessary for analysis. As with most databases, the South Dakota Motor Vehicle Traffic Accident File does not provide all of the information necessary to identify some of the potentially important accident contributing factors, as they relate to truck crashes. However, additional information is maintained in a separate database called SAFETYNET. It is through the combination of these and potentially other databases that a more complete set of accident contributing factors may be assembled.

These two databases, while containing information about the same accidents, do not have a key on which they can be easily combined. The information necessary to identify accident contributing factors that may be potentially correctable may be in the combination of the two databases. Recognizing this may assist in mitigating the severity of the accident.

Computerized probabilistic record linkage methodology was first shown to be feasible in 1959 by Dr. Newcombe's research at the Atomic Energy of Canada's Chalk River Laboratories. A decade later I.P. Felligi and A.B. Sunter defined what has become a widely accepted mathematical theory of record linkage. M.A. Jaro extended the concepts of record linkage theory by developing a linear assignment approach to matching[1].

The state of South Dakota maintains an electronic database containing all reported vehicle accidents. This database, called the South Dakota Motor Vehicle Traffic Accident file, contains limited information regarding trucks. If the accident involving a truck meets certain criteria, a supplemental form with additional information is completed. This information is stored in a national database called SAFETYNET. Personnel cannot easily combine information from the two sources to detect trends or groupings of accidents. The ability to do this is necessary to correct potentially dangerous conditions.

Specifically, the linked data can identify:

- Problem areas on South Dakota roadways. Accident records combined with SAFETYNET data can identify routes with a high number of commercial vehicle crashes;
- Problem drivers by age, safety rating and experience;

[1] Statistics In Medicine, Vol. 14, 491-498 (1995).

- Accident characteristics such as time of day, weather conditions, vehicle weight and type; and
- Motor carriers that pose a greater than normal safety risk.

Objectives

- *Develop a software analysis tool to identify accident-contributing factors from data available in SAFETYNET and the South Dakota Motor Vehicle Accident file.*

In order to link the unlike files, a probabilistic linkage software tool (AUTOMATCH) was used. Once the data were received, the linkage files were established and common fields were identified. The SAFETYNET database consists of the accident event file, which contains specific accident event information, and the "census" file, which is made up of the history and record of specific commercial vehicles.

- *Use crash data from SAFETYNET and the South Dakota Motor Vehicle Traffic Accident file to identify contributing factors.*

Utilizing the linked data, contributing factors were reviewed and ranked by frequencies. Correlation and regression analysis were performed to help identify factors related to the severity of the damage to both injury and property.

- *Recommend methods for reducing the number of truck crashes in South Dakota.*

In order to recommend methods for reducing truck-related crashes, the frequency and contribution to severity, as identified in Objective 2, were rated and grouped. Utilizing work sessions with the South Dakota Highway Patrol, the South Dakota Department of Transportation and individuals in the commercial trucking industry, areas of concern were identified.

Description of the Relevant Tasks

Tasks outlined in the Request for Proposal are as follows:

1. Perform a literature search relevant to reducing truck crashes.

    - A review of literature regarding accident contributing factors and programs/strategies designed to reduce truck-related accidents will be conducted. This review may provide the Technical Panel with information on the feasibility and success of alternative methods of reducing truck related accidents.
    - A review of literature relevant to probabilistic linkage for new techniques which may be utilized to enhance the linkage of various databases.

2. Meet with the technical panel to discuss the research, scope and work plan.

- Provide Technical Panel with information on the process and procedures involved utilizing probabilistic linking.
- Discuss the use of other databases identified.

3. Conduct interviews with SD Highway Patrol, SDDOT, and South Dakota motor carriers (determined by the panel), to document existing accident databases, accident data collection forms, and procedures.

   - Interviews with selected persons to identify existing databases for potential inclusion into the linked database.
   - Interviews with selected persons to document existing databases, forms and procedures. This documentation may provide insight to changes that may lead to more accurate, timely or complete information.

4. Create a temporary electronic database that establishes a relationship between and combines information from the South Dakota Investigator's Motor Vehicle Traffic Accident File and SAFETYNET.

   - This task will require the combination of the two databases. This process involves more than just the statistical matching the databases using a probabilistic linking algorithm. The following are steps are included in the preparation of the databases:
     a) Acquire databases for matching.
     b) Prepare databases for processing. This includes the standardization of the fields in each database. Examples of fields to be standardized are name and address.
     c) Create data dictionaries for each database.
     d) Create specifications for matching. This includes identification of fields to be matched and the development of blocking strategies.
     e) Create indexing for databases to assist in the matching process.
   - Once the databases are prepared, the process of linking the databases includes:
     a) Perform frequency analysis on each database to calculate the estimated *u*-probabilities for each field.
     b) Establish initial cutoff weights.
     c) Run the matching algorithm.
     d) Review of marginal matches and duplicates for proper treatment.
     e) Repeat steps a to d in subsequent passes of the databases.

5. Analyze the combined database to identify contributing factors, accident severity and geographic locations.

   - Identify the frequency of each variable in the combined data set;
   - Cross-tabulate contributing factors by accident severity and other non-contributing factor variables;
   - Use correlation analysis to identify contributing factors that are related;
   - Use regression analysis to determine variables that have the greatest impact on accident severity; and
   - Identify geographic mapping coordinates for use in mapping locations.

6. Provide SDDOT with procedures, system, training, materials, etc. that will identify the contributing factors (high-risk areas, carriers, time of day), either by report or graphical county or state map.

    - Develop a methodology, systems and procedures to identify the contributing factors.
    - Determine the most effective method of reporting the information.

7. Based on the analysis of the database, recommend crash reduction methodologies.

    - This task will include a facilitated work session with participants from the SD Highway Patrol, SDDOT, and selected South Dakota motor carriers (determined by the technical panel). The session will include:
        a) A presentation by the researchers of the outcomes of the analysis.
        b) An open discussion on recommendations of accident reduction strategies based on identified accident contributing factors.

8. Prepare final report including methodology, findings, conclusions and recommendations.

    - Preparation of final report, executive summary and appendices. Final report will include the required number of copies, an electronic version of the reports and a camera-ready copy of the final report.

9. Recommend to the panel a method to use current resources to improve the accident data reporting and collection system.

    - Present to the panel an analysis of data issues discovered in the preparation of the databases.
    - Present potential alternatives that may prevent or limit errors in the accident data reporting and collection system.

10. Present any procedures, products and findings to the technical panel.

    - Provide a presentation to the panel regarding procedures, products and findings.

11. Make an executive presentation to the Research Review Board.

Task Performance

This project was divided into three distinct phases. The three phases are 1) the linkage of the two data sets; 2) the statistical analysis of the linked data set; and 3) the identification of contributing factors and recommendations. Individual tasks were necessary to accomplish each phase.

Task 1. Perform a literature search relevant to reducing truck crashes.

A review of literature regarding accident contributing factors and programs and strategies designed to reduce truck-related accidents was conducted. The literature review was done using the internet and library initially.

The internet and library search helped to locate and identify several organization and agencies that are actively involved in reducing the number of truck crashes and fatalities. Some of these organizations are:

- Great Lake Center for Truck and Transit Research – This site maintains an alphabetical listing of research that has been done for trucking and transit.

- Organization for Truck Safety – This site was established to provide a means of communicating with people across the nation regarding heavy truck safety and related matters.

- Advocates for Highway and Auto Safety – This group is an alliance of consumer, health and safety groups and insurance companies and agents working together to identify ways to make roads safer.

- Bureau of Transportation Statistics – This site contains a considerable amount of statistical information on all types of transportation and does a breakdown by vehicle type.

- Technical Services Truck Safety Information – Provides information on avoiding dangerous situations like fires, rollovers, downhill braking and jackknifing.

- Underride Network - A coalition of volunteers working to educate government officials, law enforcement, trucking companies, and the motoring public to the costs of unsafe practices and equipment by the trucking industry.

- Inspector-on-Line Service – Site provides vehicle inspection professionals with information and support.

- Insurance Institute for Highway Safety – The Insurance Institute for Highway Safety is dedicated to reducing highway crash deaths, injuries, and property damage losses. It is an independent, nonprofit, research and communications organization wholly supported by automobile insurers.

Additionally, many trucking companies have websites that describe their company's safety policies and how they are working to minimize crashes and fatalities. Appendix F lists websites related to truck safety.

The internet and library search did not indicate that probabilistic linkage was used to link unlike files. A review of literature relevant to probabilistic linkage was completed to ensure that the methodology for linking the data was the most current technique utilized to enhance the linkage of various databases. Currently, this software used in this project, AUTOMATCH, is the most widely used in probabilistic linkage.

Next a request for information and research was sent to Highway Safety and Accident Records personnel throughout the United States. The response received was helpful in identifying potential problems with linking the data and specific factors to examine. A matrix of the individuals and agencies contacted and the response received is shown in Appendix C. Some of the responses include:

- Truck Size and Weight Report – Illinois Department of Transportation – Identified the impact of increased weight on roads, bridges, and safety. The report makes assessments of the ongoing impacts of large trucks in general.

- State of Maine Truck Accident History 1990-1996 – Provides a statistical review of crashes that involve commercial vehicles in Maine for a seven-year period. The report uses raw, unmodified data.

- State of Louisiana Online Reporting – State of Louisiana has put all data into a relational database and has developed an on-line crash reporting system that implements SAFETYNET elements. Crash information is entered into a computer screen that closely resembles the hard copy and is sent via the internet. Data are extracted according to needs and distributions policy. For example, all data that are required for the SAFETYNET database are automatically pulled from the data and sent to the appropriate office. This system has not been in place for an entire year, so results are not yet available.

- 1995 Iowa Crash Facts – This document provides statistical information on crashes in Iowa, including a section on truck-related crashes. In addition to the 1995 statistics, ten and twenty year statistics are included.

- A Study of Large Trucks – The Montana Department of Transportation, Engineering Division prepared this study to document the history of large trucks that traveled through the Rural Interstate and Primary Highway System in Montana. The results were used as a reference tool in design planning and specific highway construction.

Task 2. Meet with technical panel to discuss the research, scope and work plan.

The meeting with the technical panel provided them with information on the process and procedures involved utilizing probabilistic linking. The probabilistic linkage process as well as potential limitations of the SAFETYNET database were discussed.

Other databases that could be used and what they could add were identified and discussed. Members of the technical panel agreed to provide the names of individuals who could be interviewed from the Highway Patrol and the trucking industry.

Task 3. Conduct interviews with South Dakota Highway Patrol, SDDOT, and South Dakota Motor Carriers (determined by the panel, to document existing accidint databases, accident data collection forms and procedures.

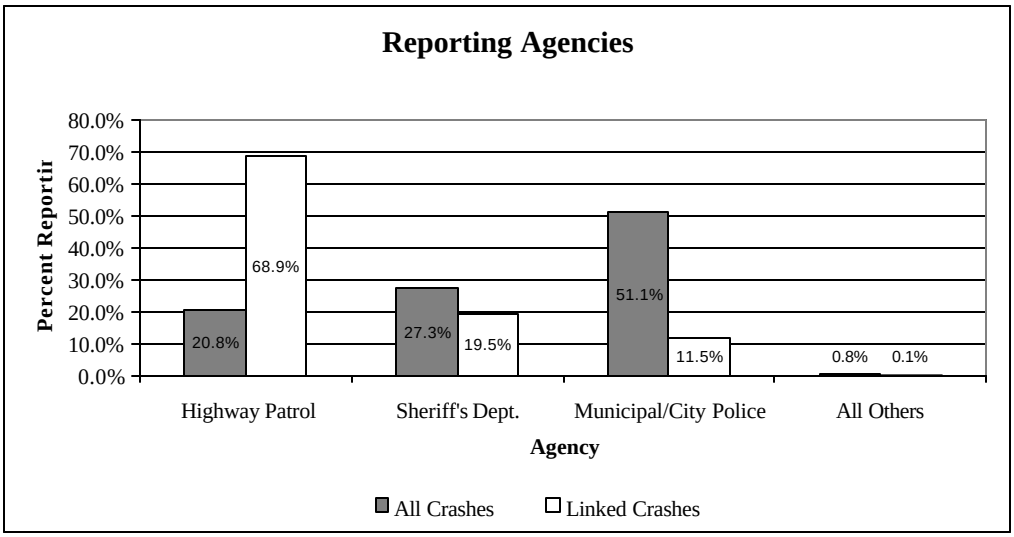
In order to accomplish this task, members of the technical panel identified individuals from the South Dakota Highway Patrol and the trucking industry who would be willing to participate in panel discussions and interviews. These individuals would help to determine areas of concern, where duplications and redundancies exist and any problems they have encountered. The discussions were also used to get an overall impression of the procedures and policies used by the trucking industry and by law enforcement, and to help identify areas that are perceived to be especially problematic.

Sample questions were developed and forwarded to DOT personnel for comment and review. A list of questions and comments by Highway Patrol staff are shown in Appendix A. Questions and responses from trucking industry personnel are shown in Appendix B.

Highway Patrol Panel Discussions

The interviews with the Highway Patrol took place on April 27 and August 31, 1999, in Sioux Falls. A panel discussion was the format used to encourage participation and generate ideas and discussion. At both sessions, the format was kept open and informal in order to make it as interactive as possible. The frequencies show that, when a commercial vehicle is involved in a crash, the Highway Patrol is the reporting agency nearly 70% of the time.

Figure 1



The April 27, 1999, discussion with the Highway Patrol was helpful in determining the procedures followed when a commercial vehicle is involved in a crash. In general, the procedure followed is very consistent among those interviewed. Officers did indicate that the use of the Vehicle Examination Report (VER) was very common. The VER is used by law enforcement to help identify safety and other violations by commercial carriers. This form contains many of the same elements that are on the supplemental crash form used to report to the SAFETYNET database.

While the participants in this discussion did not feel that completing the forms was an unreasonable or overly time-consuming task, several noted that the same thing is completed a number of times. Officers estimated the time spent dealing with all aspects of a motor vehicle crash accounts for approximately 1½ to 5% of total time. Of this time, an even smaller amount of time is spent responding to crashes involving commercial vehicles.

Officers' responses on how they determine the seriousness of a crash were somewhat varied, indicating that clearer guidelines may be necessary in order for data collected to be consistent. Officers also indicated some differences in procedures followed when determining the seriousness of an injury. Again, most officers felt some clearer guidelines could be helpful.

Generally, panel participants believed all of the elements of the forms they complete are important and document the event accurately. They pointed out a few redundancies but felt they were minor.

According to the group, the supplemental form used on the DOT reportable crashes also contained important data. Many felt there was some duplication with this form and the VER. A few officers pointed out a lack of knowledge about the specific use of this form by local and county law enforcement. Because of this, they believe the data collected from this form may be under-representing commercial vehicle crashes in the state.

When asked what they felt was the most significant factor in truck-related crashes, most felt that driver error (by either the trucker or other vehicle) was involved in almost every case. For the trucker, fatigue and stress were cited as factors that contributed to this driver error. Many Highway Patrol Officers felt that the actions of the "other driver" were very often a big factor.

Most officers did not think additional information needed to be collected, especially if all the forms (crash report, supplemental form and VER) were completed. There was some discussion about adding non-injured passenger information to the form and opinions about the necessity and usefulness of this was debated. While this data could be useful, many felt the burden of collecting and recording it might be excessive.

In general, the members of the Highway Patrol indicated that the forms used, including the accident report form, the supplemental form for DOT reportable crashes and the VER, were effective in clearly documenting a truck-related crash.

Prior to the August 31, 1999, session, the officers were sent a copy of preliminary statistical results and recommendations. This session was used to get feedback and additional input to include in the final report. At this session, the officers were asked to express their opinions on areas of the preliminary findings that they felt were valid, those they did not feel have merit, and any area of concern or confusion.

General questions arose about the recommendation to include speed at the time of crash in the database. Officers reported that an estimated speed is indicated on the crash report form. When informed that only the estimated miles over the speed limit is included, most of the officers were surprised.

One officer, responding to the recommendation that the forms used should identify the commercial license status of the driver, suggested that an existing field could be used to make this determination. Most of the troopers felt it was important to be able to make the distinction between a commercial driver, who has experience and training driving a commercial vehicle and an individual using a commercial vehicle.

Most of the troopers would like to see the narrative section included in the electronic file, if at all possible. The officers indicated this section is where they are able to more precisely identify the events and factors in a crash.

Trucking Industry Interviews

Individuals from the trucking industry were interviewed individually, at the suggestion of Larry Thury, a member of the technical panel and the trucking industry, which felt confidentiality would be important. Interviews were held at the convenience of the participant in order to get full cooperation and attention.

When questioned about procedures followed when one of their vehicles is involved in a crash, responses varied. The first step, in most cases, was to secure the crash area. For most

companies, the next step was to contact insurance or the appropriate individual at their company. Companies varied on the type of crash they reported. There is also a substantial difference in reporting an "incident" that did not result in injury or significant damage and the DOT reportable crashes.

Most of the truckers interviewed were very familiar with the accident report form. Several companies try to order a copy of this form for their files and insurance purposes after every crash. Those interviewed had a difficult time trying to pinpoint which factors were the most important in assessing a crash, since all factors can be important in different circumstances. Specifically mentioned were the narrative portions, the time of the crash, and the road conditions.

Almost all those interviewed did not feel the form contained unnecessary fields or redundancies. For most, the more information they could get, the better their insurance companies could handle the claim.

When asked what they thought was important in the supplemental form, several responded they did not usually see the form. After reviewing it, most thought some information may be a bit redundant but for them, the additional information helped to document the crash. Most were not able to identify any part of the form they believed to be unimportant since all crashes are different.

Responses varied greatly when asked about the most significant factor in crashes. Many did cite driver error as almost always a factor. Many stated the need for drivers to always be aware and drive defensively. Many also mentioned the general public was unaware of the hazards of driving a truck and put themselves at risk.

The truckers interviewed were interested in seeing additional data, like citations issued, and more information, such as photographs, collected at the scene. All felt the "other driver" should be subject to the same drug and alcohol testing requirements of the truck driver.

Truckers questioned about the most preventable factor in crashes responded in a number of ways. Several mentioned speed, and how speed can and should be controlled. Others cited fatigue. All responded that driver error should be a preventable factor. When asked about the least preventable factors, comments and responses were different from person to person. A number of those interviewed looked at the other driver as an unknown. Most mentioned that training drivers to respond to circumstances appropriately is very important in minimizing the severity of crashes.

Most carriers were fairly satisfied with the way truck-related crashes were reported. Most did indicate they would like more feedback in a timely manner. This feedback would help them identify problem drivers, take disciplinary action or provide the appropriate training to alleviate the problem.

The truckers expressed general satisfaction with the type of response they receive in a crash. Most cited law enforcement as generally very helpful and quick to respond. Most were very

satisfied with the way their insurance companies respond. When a driver is injured, most thought the company should be notified as soon as possible to make certain that all incidentals to the crash could be addressed.

The responses from the trucking industry were useful in determining specific factors to examine and areas of greatest concern. The responses were used in determining specific statistical research to perform.

Truckers were also asked to review initial findings and make suggestions. The individuals who responded were concerned that the findings, as presented, indicate that commercial vehicles are a big factor in vehicle crashes but, in reality, commercial vehicles make up only about 3.5% of the crashes. The findings were modified to establish that the study examined only a small percentage of the total number of vehicle crashes.

Task 4: Create a temporary electornic database that establishes a relationship between and combines information from the South Dakota Investigator's Motor Vehicle Traffic Accident File and SAFETYNET

In order to create a database that could be used for statistical analysis purposes, information from SAFETYNET and the South Dakota Accident Records databases were linked. Prior to linking the databases, the following steps were performed:

- Databases for matching were acquired – The Office of Accident Records promptly sent the crash records from 1997 and 1998. The years of 1995 and 1996 were already on hand at the BRB for a different project.

  The SAFETYNET database was ordered from the Computing Technologies, a data processing company tasked with disseminating SAFETYNET data, in February and received in late May. Due to the incomplete data from 1995 and 1999 these years were not used in analysis.

- Databases were prepared for processing. This includes the standardization of the fields in each database. Examples of fields to be standardized are date and time of accident.

- Databases were linked using procedure outlined in Appendix D.

- The linked database was analyzed to identify contributing factors, accident severity and geographic locations.

Data Analysis

Task 5: Analyze the combined database to identify contributing facors, accident severity and geographic locations.

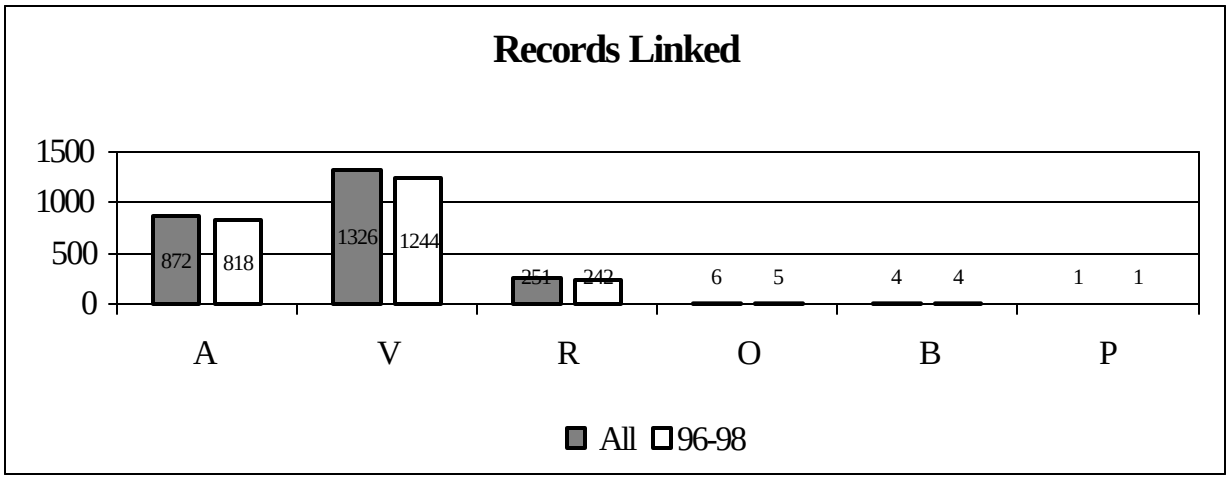
The combined dataset used contained the files that matched in both the Accident Record File and the SAFETYNET file. The years used for analysis were 1996-1998 since these were complete and represent meaningful events. Analysis based on specific events used the Accident Master (or "A") records only. Analysis identifying individual vehicle data required use of the Vehicle (or "V") records.

The matched database identifies only those crashes that meet the Department of Transportation's standard for reportable. Because of this, the data used in the analysis does not represent commercial vehicles that were involved in crashes that did not result in a tow-away, injury or fatality.

The matched dataset consisted of the following records:

Record Type	*All Linked Records*	*Linked Records for 1996-1998*
Accident Master ("A")	872	818
Vehicle/Driver ("V")	1,326	1,244
Passenger ("R")	251	242
Other Driver ("O")	6	5
Bicycle Driver ("B")	4	4
Pedestrian ("P")	1	1

Figure 2



The dataset used contained data for the years 1996-1998. The fourth quarter records for 1995 were largely incomplete and were not used.

Using this dataset, frequencies, cross-tabulations, correlation and regression analyses were done to determine the factors that may be significant when commercial vehicles are involved in crashes.

Frequencies and Cross-tabulations

The data analyzed pertains to only those crashes taking place in South Dakota that involve at least one commercial motor vehicle (CMV). The information is for calendar years 1996, 1997 and 1998.

The CMVs are predominantly trucks (823) but include buses (23) as well. Eighteen (18) of the twenty-three (23) were school buses.

Table 1
Frequencies of Vehicle Type
For the Years of 1996-1998

Vehicle Type/Body Style	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
2 Wheel Drive Passenger Car	222	17.8888	17.8888	17.8888
4 Wheel Drive Passenger Car	3	0.24174	0.24174	18.1305
2 Wheel Drive All Purpose Vehicle(Bronco, Blazer, Scout, etc	2	0.16116	0.16116	18.2917
4 Wheel Drive All Purpose Vehicle(Bronco, Blazer, Scout, Jeep	19	1.53102	1.53102	19.8227
2 Wheel Drive Truck Based Station Wagon	4	0.32232	0.32232	20.145
4 Wheel Drive Truck Based Station Wagon	5	0.4029	0.4029	20.5479
2 Wheel Drive Pickup	32	2.57857	2.57857	23.1265
4 Wheel Drive Pickup	53	4.27075	4.27075	27.3973
4 Wheel Drive Pickup with Camper	3	0.24174	0.24174	27.639
Van	26	2.09508	2.09508	29.7341
Bus	22	1.77276	1.77276	31.5068
Straight Truck	155	12.4899	12.4899	43.9968
Straight Truck with Trailer	40	3.22321	3.22321	47.22
Truck Tractor Only	12	0.96696	0.96696	48.1869
Truck Tractor with Single Semi-trailer	581	46.8171	46.8171	95.004
Truck Tractor with Two or More Trailers	34	2.73973	2.73973	97.7438
Motor Home	2	0.16116	0.16116	97.9049
Motorcycle	3	0.24174	0.24174	98.1467
Farm Machinery	7	0.56406	0.56406	98.7107
Heavy Equipment	2	0.16116	0.16116	98.8719
Other	14	1.12812	1.12812	100
Total	1,241	100	100	

Most do not take place in the cities. Eighty-three percent (83%) took place in unincorporated places.

Eighty-three percent (83%) of these accidents took place on a state road.

Eighty percent (80%) of the vehicles involved were moving straight ahead and not maneuvering. Eighty-four percent (84%) of the time, the CMV was moving straight ahead.

Table 2
Vehicle Maneuver
Commercial Vehicles Only
1996-1998

Vehicle Maneuver	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
Straight Ahead	713	84.4787	84.4787	84.4787
Turning Right	19	2.25118	2.25118	86.7299
Turning Left	49	5.80569	5.80569	92.5355
Backing	5	0.59242	0.59242	93.128
Passing	27	3.19905	3.19905	96.327
Immobile from Previous Accident	1	0.11848	0.11848	96.4455
Stopped in Traffic	30	3.5545	3.5545	100
Total	844	100	100	

The maneuver with the highest percentage of vehicles involved was that group making left hand turns (7.7%) which is a distant second to eighty percent (see Table V25, Appendix G). For CMV's this percentage is about 6%.

Exceeding the speed limit was indicated for only 4% of the vehicles (CMVs were cited about 3%). Exceeding safe speed was cited as a contributing factor about sixteen percent of the time (16%) with CMVs exceeding safe speeds about 17% of the time.

Table 3
Exceeding Speed Limit
Commercial Vehicles Only
1996-1998

Exceeding Speed Limit	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
Not Exceeding Speed Limit or Parked	760	90.0474	90.0474	90.0474
1 to 5 MPH over Speed Limit	13	1.54028	1.54028	91.5877
6 to 10 MPH Over Speed Limit	7	0.82938	0.82938	92.4171
11 to 15 MPH Over Speed Limit	2	0.23697	0.23697	92.654
16 to 20 MPH Over Speed Limit	2	0.23697	0.23697	92.891
21 to 30 MPH Over Speed Limit	2	0.23697	0.23697	93.128
Not Stated	23	2.72512	2.72512	95.8531
Unknown	35	4.14692	4.14692	100
Total	844	100	100	

The majority of vehicles were traveling on dry surfaces (61%) with all but a few on either concrete (49%) or blacktop (45%).

Table 4
Surface Conditions
Commercial Vehicles Only
1996-1998

Surface Conditions	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
Dry	498	60.8802	60.8802	60.8802
Wet	80	9.77995	9.77995	70.6601
Ice	133	16.2592	16.2592	86.9193
Frost	12	1.46699	1.46699	88.3863
Slush	25	3.05623	3.05623	91.4425
Snow	66	8.06846	8.06846	99.511
Other	4	0.489	0.489	100
Total	818	100	100	

Most took place on the roadway (74%).

No special location (90%) such as a railroad crossing or a bridge is commonly involved.

It isn't likely that a traffic control was ignored, most accidents took place where no control was present (76%).

The most common type of commercial vehicle to be involved in the accident is the semi-trailer truck (with one or more trailers). This type of vehicle accounted for about 73% of the commercial vehicles involved in these crashes.

Females are involved as CMV drivers about four percent (4%) of the time.

For all CMV-involved crashes, a collision with a motor vehicle in transport (not parked) was cited as the first harmful event in sixty-three percent (63%) of the cases. For CMVs only, the percentage is about fifty (50%). The second most cited factor for all vehicles in a CVM-involved crash were non-collision overturning accidents, accounting for about twenty percent (20%) of the crashes. For CMVs only, overturning accidents were about twenty-eight percent of the crashes (28%).

Table 5
Driver Contributing Circumstances
Most Frequently Cited
Commercial Vehicles Only
1996-1998

Driver Contributing Circumstances	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
Exceeded Safe Speed but Not Limit	145	17.1801	17.3031	17.3031
Other	35	4.14692	4.17661	21.4797
Failed to Yield to Vehicle	31	3.67299	3.69928	25.179
Fell Asleep	31	3.67299	3.69928	28.8783
Following Too Closely	25	2.96209	2.98329	31.8616
Distracted by Object, Person(s) Inside Car	21	2.48815	2.50597	34.3675
Exceeded Speed Limit	19	2.25118	2.2673	36.6348
Improper Passing	15	1.77725	1.78998	38.4248
Failed to Stop for Stop Sign or Flashing Red	12	1.4218	1.43198	39.8568
Wrong Side of road	9	1.06635	1.07399	40.9308

Weather is listed as a factor about half the time (48%) and snow plays a role about thirteen percent (13%) of the time. About fifty-two percent (52%) took place under clear skies.

Table 6
Weather Conditions
At Time of Accident
1996-1998

Weather Conditions	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
Clear	425	51.956	51.956	51.956
Cloudy	169	20.6601	20.6601	72.6161
Raining	61	7.45721	7.45721	80.0733
Sleet, Hail, Freezing Rain	22	2.68949	2.68949	82.7628
Snowing	105	12.8362	12.8362	95.599
Fog, Smoke	24	2.93399	2.93399	98.533
Dust Storm	2	0.2445	0.2445	98.7775
Other	10	1.22249	1.22249	100
Total	818	100	100	

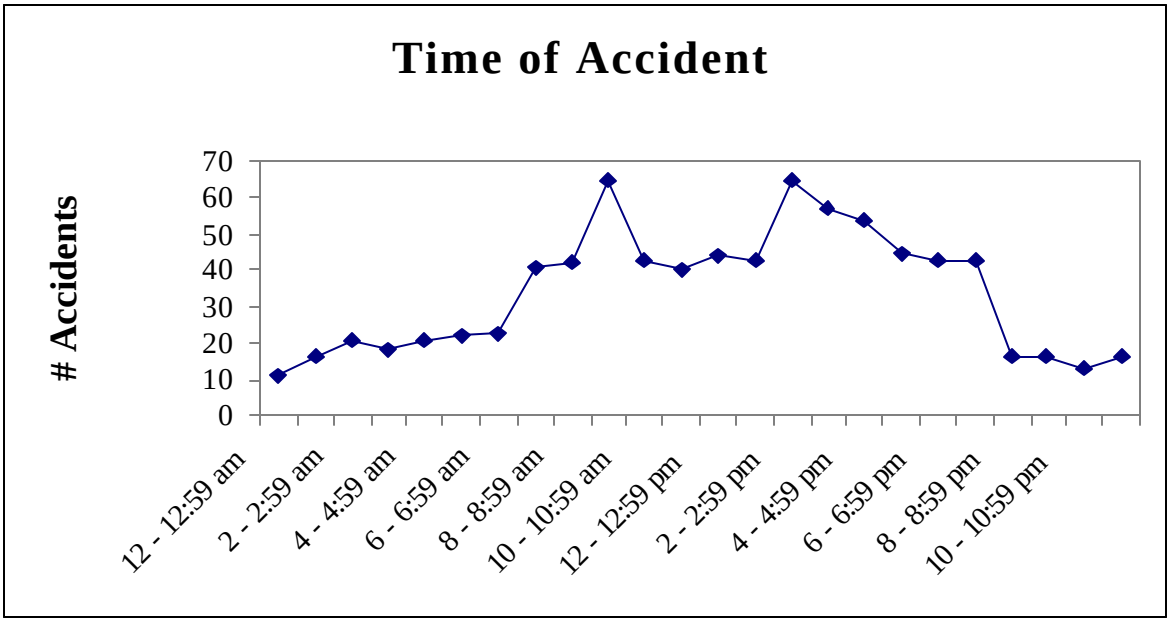
Table 7
Accident Month
1996-1998

Accident Month Code	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
January	99	12.1027	12.1027	12.1027
February	59	7.21271	7.21271	19.3154
March	65	7.94621	7.94621	27.2616
April	60	7.33496	7.33496	34.5966
May	43	5.25672	5.25672	39.8533
June	47	5.74572	5.74572	45.599
July	50	6.11247	6.11247	51.7115
August	67	8.19071	8.19071	59.9022
September	77	9.4132	9.4132	69.3154
October	72	8.80196	8.80196	78.1174
November	93	11.3692	11.3692	89.4866
December	86	10.5134	10.5134	100
Total	818	100	100	

While the crashes occurred throughout the year, the winter months represent the greatest number of events.

Additionally, most crashes occurred during the day with peaks at 9:00 to 9:59 am and 2:00 to 2:59 pm as shown in Figure 3.

Figure 3



Most individuals involved in a truck-related crash used lap and shoulder belts (59%) while an additional ten (10%) percent used lap belts only. Sixty-one percent (61%) of the truckers used lap and shoulder belts and thirteen percent (13%) used lap belts only.

Table 8
Safety Equipment Used
By Vehicle Type
1996-1998

Vehicle Type/Body Style	*None*	*Lap, Shoulder or Both*	*Helmet or Eye protection*	*Other*	*Unknown*	*Total*
Passenger Vehicles	107	211	0	3	11	332
Van	10	14	0	0	2	26
Bus	1	20	0	0	1	22
Straight Truck	63	84	0	0	8	155
Straight Truck with Trailer	17	23	0	0	0	40
Truck Tractor Only	3	9	0	0	0	12

Vehicle Type/Body Style	*None*	*Lap, Shoulder or Both*	*Helmet or Eye protection*	*Other*	*Unknown*	*Total*
Truck Tractor with Single Semi-trailer	84	464	1	1	25	575
Truck Tractor with Two or More Trailers	4	29	0	0	1	34
Motor Home	0	1	0	0	0	1
Motorcycle	2	0	1	0	0	3
Farm Machinery	5	1	0	0	1	7
Heavy Equipment	2	0	0	0	0	2
Other	1	13	0	0	0	14
Total	299	869	2	4	49	1223

The vehicles are most likely to be from South Dakota (55%) and surrounding states to the north, south and east: Minnesota (7%), North Dakota (5%), Iowa (5%), Nebraska (4%).

Most CMV involved accidents (69%) take place on roads not physically divided.

A complete table of frequencies is shown in Appendix G.

The amount of information available on commercial motor vehicle involved accidents is considerable but the patterns within the data are not easily discerned. The findings presented in the paragraph above do not all fit the notion of situations that will foster mishaps. The phrases sun shining, not speeding, going straight down the road, wearing safety equipment, dry pavement, black top and concrete surfaces with no special situation noted do not conjure peril. The question to be asked relates to systematic occurrence. Do the circumstances that resulted in the occurrence of these accidents appear to be random or are there systematic events and occurrences that explain what led to the event? That is not to suggest that accidents do not have causes. Indeed, every accident has a cause. The question to be answered beyond frequency and trends is whether or not there are systemic causes of these events.

Motor Vehicle Accidents

The death rates associated with commercial vehicle accidents per 100 miles traveled have declined in the two years subsequent to 1996. The reduction is primarily the result of fewer deaths associated with this motoring group. The number of miles traveled each year has held relatively constant over the three year period analyzed.

Table 9
South Dakota Yearly Comparison of Commercial Motor Vehicle Traffic Fatalities, Injuries, Accidents and Miles Traveled

Year	Deaths	Death Rate[1]	Injuries	Total Accidents	Total Accident Rate[2]	Fatal Accident	Injury Accidents	Miles Traveled +(000,000)
1996	25	2.5	344	295	29.8	18	141	990
1997	21	2.1	332	298	29.5	16	154	1,009
1998	14	1.5	239	225	23.3	13	107	964

1 Number of deaths per 100 million vehicle miles traveled.
2 Number of accidents per 100 million vehicle miles traveled.

Source: SD Department of Transportation: Accident Records

The total accident rate for commercial vehicles is a fraction (approximately 11%) of the rate for all vehicles but the death rate per 100 million miles traveled is higher for accidents associated with commercial vehicles than for all motor vehicles. Based upon miles traveled, the likelihood that a commercial motor vehicle will be involved in an accident is much less than for all vehicles. The inverse is true with respect to deaths per mile traveled. A death is more likely when a commercial vehicle is involved. In 1996, the comparison is 8.5 percent of commercial vehicles compared to 0.8 percent for all vehicles. The end result is death rates per 100 million miles that do not differ that greatly.

Table 9a
South Dakota Yearly Comparison of Motor Vehicle Traffic Fatalities, Injuries, Accidents and Miles Traveled

Year	Deaths	Death Rate[1]	Injuries	Total Accidents	Total Accident Rate[2]	Fatal Accidents	Injury Accidents	Miles Traveled +(000,000)
1996	175	2.24	8,490	21,653	277.57	142	5,653	7,801
1997	148	1.88	8,161	20,899	264.81	128	5,478	7,892
1998	165	2.05	7,723	19,735	245.49	149	5,112	8,039

1 Number of deaths per 100 million vehicle miles traveled.
2 Number of accidents per 100 million vehicle miles traveled.

Source: SD Department of Transportation: Accident Records

Alcohol Involvement

Table 10
Alcohol Involved Accidents as Percent of All Accidents
Involving Commercial Vehicles 1996-98

	1996	*1997*	*1998*
Total Accidents	3.4%	5.4%	3.6%
	10	16	8
Fatal Accidents	11.1%	18.8%	7.7%
	2	3	1
Injury Accidents	5.7%	5.8%	4.7%
	8	8	5
Fatalities	8.0%	14.3%	7.1%
	2	3	1
Injuries	5.2%	3.9%	3.3%
	18	13	8

Alcohol involvement frequencies pertain only to drivers of the vehicles. No pedestrians or bicycle drivers involved in an accident were noted as having consumed alcohol. There were no accidents that involved two drivers that had consumed alcohol.

Table 10a
Persons Killed in Alcohol Involved Accidents by Age
1996 - 1998

Age Group	*1996*	*1997*	*1998*
21 - 29	0	2	1
30 - 39	0	1	0
40 - 49	0	0	0
50 - 59	0	0	0
60+	2	0	0
Total	2	3	1

The data that follows monitors alcohol related accidents that involved injuries and fatalities. Accidents in 1998 show a considerable improvement over the preceding years in accidents involving fatalities and injuries. Fatal accidents in 1998 involving alcohol decreased by two-thirds while those not involving alcohol decreased eight percent. Similarly, injury accidents in 1998 involving alcohol decreased forty-four percent and those not involving alcohol decreased thirty percent.

Table 11
Commercial Vehicle Accident Activity
1996 – 1998

	Fatal Accidents		*Injury Accidents*	
Year	Alcohol Related	Non-alcohol Related	Alcohol Related	Non-alcohol Related
1996	2	16	8	133
1997	3	13	9	145
1998	1	12	5	102

Table 12 presents the counts of blood alcohol tests administered as a result of a commercial vehicle accident. Of those tested, the vast majority tested as not having alcohol in their systems. The number of drivers refusing to be tested obscures the percentage of drivers that were or were potentially under the influence of alcohol while driving.

Table 12
Commercial Accident
Blood Alcohol Tests

Year	*Tested Zero (.00)*	*Tested Less Than .01*	*Tested .01 or Higher*	*Refused Test*	*No Test Given*
1996	34	1	1	1	419
1997	23	2	4	3	411
1998	22	1	2	1	289

Safety Equipment

On January 1, 1995 a law took effect requiring front seat occupants to be fastened by a safety belt system. The following table reports use of safety equipment for all drivers in the vehicles including other drivers. During 1998, 74.8 percent of drivers involved in a commercial motor vehicle accident were reported to be wearing some form of safety restraint. In 1997, 80.6 percent of all drivers of motor vehicles involved in accidents were reported to have been wearing seat belts compared to 69.5 percent of all drivers in this group. The youngest drivers are the least likely to wear seatbelts (see Table 13).

Table 13
Safety Restraint Usage
Accident-Involved Drivers
1996 - 1997

Age	*1996*	*1997*	*1998*
14 - 15	25.0%	50.0%	33.3%
16 - 17	33.3%	50.0%	50.0%
18 - 20	57.9%	42.9%	45.5%
21 - 24	61.4%	71.1%	60.9%
25 - 34	74.2%	73.8%	76.5%
35 - 44	72.1%	76.5%	82.3%
45 - 54	84.5%	70.7%	75.9%
55 - 64	68.8%	69.7%	83.0%
65+	51.4%	59.9%	66.7%
Total	69.7%	69.5%	74.8%
	(315)	(312)	(243)

Twenty-four percent of the 42 vehicle occupants killed in an accident involving a commercial vehicle were either partially or totally ejected from the motor vehicle.

Table 13a
Fatalities by Ejection Status for Motor Vehicle Occupants
Commercial Motor Vehicle Accidents
(Excludes Motorcycles, Mopeds, and Snowmobiles)

Ejection Status	*Number Ejected*
Not Ejected	32
Partial Ejection	3
Total Ejection	7
Total	42

Crash Location

The interstates are the most likely place for a commercial motor vehicle to be involved in a motor vehicle accident. The east and west highways of 12, 212 and 14 follow with approximately five percent of the CMV involved accidents. Highway 12 serves Aberdeen and Mobridge. Highway 212 serves Watertown and Gettysburg while Highway 14 traverses Brookings, Huron, Pierre, Philip and Spearfish.

Table 14
Accident Frequency by Highway Number
1996 – 1998

Highway Number	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
90	168	20.5	20.5	20.5
29	107	13.1	13.1	40.5
12	37	4.5	4.5	46.0
212	33	4.0	4.0	50.8
14	32	3.9	3.9	55.5
18	29	3.5	3.5	59.8
281	28	3.4	3.4	63.9
34	24	2.9	2.9	67.5
16	23	2.8	2.8	70.8
79	18	2.2	2.2	73.5

Percentage Differences: There were 679 records with highway number identified and 139 where highway id was missing.

The fatal accidents on Highway 14 took place in Beadle, Brookings and Hughes counties. These counties are the location of the largest communities on that highway: Huron, Brookings and Pierre. Hughes county had four deaths from two accidents, Brookings had four and Beadle county had two single loss fatal accidents.

The fatal accidents on Highway 12 were in Day, Edmund and Roberts counties. The accidents were equally spread among the counties at two fatalities each. Brown county, home to Aberdeen, was not the site of a fatal accident.

Clark county on Highway 212 had two CMV accidents in which four people were killed (8). Butte, Codington and Dewey counties each had two accidents with one fatality per incident.

Pennington and Minnehaha, the largest counties in the state, had the largest number of accidents and the greatest number of the state's accidents which resulted in fatalities between 1996 and 1998 (see Table 16). This finding seems reasonable given these counties are the most populous in the state and are home to the state's largest centers of commerce. Commercial motor vehicle traffic should reflect increased consumption and the need for trucks to support the population and industry in these counties.

Table 15
Accident Frequency by County
Highest Ten
1996 - 1998

County	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
Pennington	81	9.9	9.9	9.9
Minnehaha	74	9.0	9.0	18.9
Jackson	31	3.8	3.8	22.7
Union	30	3.7	3.7	26.4
Brown	29	3.5	3.5	30.0
Codington	26	3.2	3.2	33.1
Lincoln	26	3.2	3.2	36.3
Lawrence	25	3.1	3.1	39.4
Lyman	24	2.9	2.9	42.3
Meade	21	2.6	2.6	44.9

Table 16
Fatal Accident Frequency by County
Highest Ten
1996 – 1998

County	*Frequency*	*Percent*	*ValidPercent*	*Cumulative Percent*
Minnehaha	4	8.51	8.51	8.51
Pennington	4	8.51	8.51	17.02
Roberts	3	6.38	6.38	23.40
Beadle	2	4.26	4.26	27.66
Brookings	2	4.26	4.26	31.91
Butte	2	4.26	4.26	36.17
Clark	2	4.26	4.26	40.43
Codington	2	4.26	4.26	44.68
Davison	2	4.26	4.26	48.94
Douglas	2	4.26	4.26	53.19

Miles Traveled

Another meaningful measure of accident rates is the number of miles traveled per CMV accident. The greater the number of miles traveled per accident the better. There are three counties with no accidents involving commercial motor vehicles during the three years studied: Hyde, Mellette and Shannon counties. The miles per accident for these counties in Table 8 are the number of CMV accident free miles per county. For the rest of the counties, those on the left had more CMV miles traveled per accident than those on the right.

Table 16a
CMV Miles Traveled Urban and Rural by County
Per CMV Involved Accident
1996 – 1998

	County	Miles / Accident		County	Miles / Accident
1	Hyde*	10,103,071	34	Turner	3,574,089
2	Mellette*	10,324,780	35	Faulk	3,572,160
3	Shannon*	25,068,111	36	Mc Pherson	3,517,364
4	Bon Homme	22,025,684	37	Davison	3,413,485
5	Dewey	8,813,079	38	Fall River	3,407,871
6	Hutchinson	8,163,530	39	Roberts	3,375,904
7	Edmunds	7,998,813	40	Lyman	3,367,581
8	Brule	7,899,898	41	Brown	3,189,920
9	Mc Cook	7,610,723	42	Lake	3,122,167
10	Ziebach	5,699,597	43	Day	2,993,341
11	Todd	5,196,458	44	Sanborn	2,975,601
12	Lincoln	5,071,611	45	Tripp	2,963,047
13	Hand	4,977,780	46	Codington	2,949,106
14	Jerauld	4,968,974	47	Jones	2,902,039
15	Campbell	4,926,748	48	Hughes	2,859,314
16	Meade	4,877,552	49	Harding	2,857,026
17	Moody	4,765,162	50	Haakon	2,811,558
18	Beadle	4,729,681	51	Aurora	2,763,556
19	Charles Mix	4,502,146	52	Hamlin	2,576,739
20	Minnehaha	4,332,366	53	Bennett	2,523,497
21	Miner	4,292,375	54	Kingsbury	2,442,836
22	Clay	4,142,624	55	Butte	2,423,835
23	Grant	4,089,078	56	Gregory	2,330,572
24	Yankton	4,040,531	57	Spink	2,319,792
25	Lawrence	3,953,195	58	Jackson	2,269,997
26	Hanson	3,893,444	59	Walworth	2,225,272
27	Clark	3,847,379	60	Deuel	2,166,765
28	Brookings	3,811,643	61	Potter	2,109,324
29	Custer	3,788,967	62	Corson	2,107,727
30	Union	3,715,679	63	Stanley	2,026,023
31	Pennington	3,631,096	64	Sully	1,886,937
32	Marshall	3,598,843	65	Douglas	1,763,095
33	Buffalo	3,584,394	66	Perkins	885,148

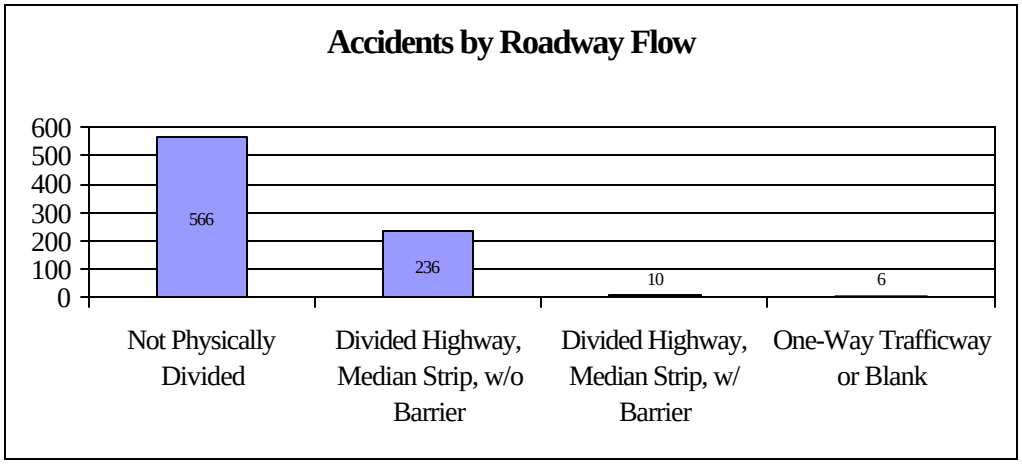
*Hyde, Mellete and Shannon counties had no accidents involving CMVs during the time period analyzed.

The five counties with the most accidents can be compared with the measure in Table 16. Minnehaha and Pennington had the most accidents in the state but rank in the top half in miles per accident at 20 and 31, respectively. Likewise Union county is in the top half ranked at number 30. Brown county falls just below the half way measure at 41 and Jackson county placed 58th out of the 66 counties nearing the bottom.

Table 17
Accident Frequency by Type of Roadway Flow
1996 – 1998

	Frequency	*Percent*	*Valid Percent*	*Cumulative Percent*
Not Physically Divided (Two Way Traffic)	566	69.2	69.2	69.2
Divided Highway, Median Strip, w/o Traffic Barrier	236	28.9	28.9	98
Divided Highway, Median Strip, w/ Traffic Barrier	10	1.2	1.2	99.3
One-Way Trafficway or Blank	6	0.7	0.7	100
Total	818	100	100	

Figure 4



There are locations on the interstate system where more than one accident occurred during the three-year period. These locations are predominantly at or near some access point on the road system. Access points include interchanges, exits either on or off and rest stops.

Table 18
Locations of Multiple Accident Sites on Interstate System
1996 - 1998

County	Near Match		Mile Marker	I29	I90	I229
Aurora		Near Intersection Hwy 281	310.49		2	
Brule		Near Chamberlain Rest Area	267.00		2	
Deuel		Near Castlewood Rest Area	159.00	3		
Grant		Near Milbank Exit	199.00	2		
	Hanson		344.02		1	
Hanson		Near Alexandria Exit	345.00		2	
	Jackson		130.00		1	
Jackson		Cactus Flat	131.27		4	
Jackson		East of Cactus Flats	136.35		2	
	Jackson		156.00		1	
Jackson		East of Kadoka	157.00		2	
Jackson		Near Kadoka Rest Area	168.00		2	
	Jackson		169.00		1	
Jones		Murdo Exit	190.00		2	
Jones		Murdo Exit	193.00		3	
Jones		East of Murdo	195.00		2	
Lawrence		Near Intersection Hwy 14a	12.32		2	
Lawrence		Near Intersection Hwy 34	26.14		2	
Lincoln		Near Rest Area	53.32	2		
Lincoln		Near Lenox Exit	68.35	2		
	Lyman		258.37		1	
	Lyman		259.88		1	
Lyman		Near Oacoma Exit	260.49		2	
Meade			34.32		2	
Meade			50.00		4	
Minnehaha		Near Minnesota Avenue Exit	3.12			2
	Minnehaha		77.26	1		
Minnehaha		Near 41st Street Exit	77.89	2		
	Minnehaha		78.00	1		
Minnehaha		Near 12th Street Exit	79.26	4		
	Minnehaha		79.54	1		
Minnehaha		Between Renner and Baltic Exits	91.00	2		
Minnehaha		Near Baltic Exit	95.00	2		
	Minnehaha		395.00		1	
Minnehaha		Near I29 and I90 Interchange	396.55		4	
	Minnehaha		400.57		1	
Minnehaha		Near I229 Interchange	400.58		4	
	Minnehaha		402.00		1	
Minnehaha		Near Corson Exit	405.00		2	
	Minnehaha		406.12		1	
	Minnehaha		406.99		1	
	Moody		113.00	1		
Moody		Near Flandreau Exit	114.00	2		
	Moody		114.83	1		
Pennington		Near Hwy 190 Exit	57.00		2	
	Pennington		57.79		1	
	Pennington		58.00		1	
Pennington		Near Lacross Street Exit	59.19		2	
Pennington		Near Hwy 161 Exit	61.84		2	
	Pennington		85.00		1	
Pennington		Between New Underwood and Wasta	86.00		2	
	Pennington		86.23		1	
	Pennington		87.00		1	
	Pennington		110.55		1	
Pennington		Near Hwy 240 Exit Near Wall	111.00		3	
Pennington		Near Exit	121.00		2	
	Pennington		206.08	1		
Roberts		Near Hwy 12 Exit	207.30	2		
Roberts		Near Hwy 109 Exit	212.00	2		
Roberts		Near Hwy 109 Exit	213.00	2		
	Roberts		213.88	1		
Union		Near Elk Point Exit	18.49	2		
Union		Near Elk Point Exit	19.00	2		
	Union		20.00	1		
	Union		26.00	1		
Union		Near Hwy 50 Exit	27.00	2		
Union		Near Rest Area	33.00	2		

Regression Analysis

Regression analysis can be used to determine what contributes to CMV accidents beyond reviewing frequencies and trends. Regression analysis is employed to determine that portion of the variance in the dependent variables "number of injuries" and "number of fatalities" that can be explained using other variables from the combined records describing commercial motor vehicle accidents. The independent variables considered in the regression equations are presented in the variable dictionary presented in Table 19. Many of the variables in the database were dummy coded and included in the regression model while other data were included in binomial or interval measures.

Table 19
Commercial Motor Vehicle Accident Record
Multiple Regression Data Dictionary

Codings	Variables	Labels	Category
Duma	H_class	Highway Class	Location
Dumb	Fhe	First Harmful Event	Event
Dumc	Crlight	Light Condition	Conditions
Dumd	Sur_type	Surface Type	Surface
Dume	Sur_cond	Surface Condition	Surface
Dumf	Jct	Intersection Related	Location
Dumg	Time_q	Time of Day Quarterly	Time
Dumi	Seq_one	Sequence of Events First	Event
Dumj	Month_q	Months Quarterly	Time
Dumk	Cc_ot1	Contributing Circumstance	Conditions
Duml	Obj_h1	Object Hit First	Collision
Dumm	Crlight	Light Condition	Conditions
Dumn	Crweather	Weather Conditions	Conditions
Dumo	Traf_con	Traffic Controls	Safety
Dump	Cc_v1	Blowing Soil, Dirt & Sand	Conditions
Dumq	S_eq	Shoulder Harness Only Used	Safety
Dumr	V_typ	Vehicle Type/Body Style	Vehicle
Dums	V_sev	Vehicle Damage Severity	Vehicle
Dumt	Fhe	First Harmful Event	Event
Dumu	C_dbp1	Driver Contributing Circumstances	Safety
Dumv	Mhe	Most Harmful Event	Event
Dumw	Eject	Ejection	Restraint
Dumx	Alc	Alcohol / Drug Involvement	Driver Status
Weekend	Weekend	Saturday or Sunday (Yes or No)	Time
I_road	I_road	Interstate Highway (Yes or No)	Safety
Age	Age	Age	Driver Status
Sex	Sex	Sex (Male or Female)	Driver Status
Month_q	Month_q	Month Quarterly	Time

Number Killed

The dependent variable "number killed" was regressed upon using the independent variables described in the data dictionary using the stepwise-forward regression technique. There were 1,225 vehicle operator records included in the analysis. The final regression model associated with commercial motor vehicle "fatal accidents" is presented below with a brief explanation of the variables provided in Table 20.

Number Killed = -0.005 + 0.592DUMU14 + 1.896DUMQ5 + 0.293DUMU6 + 0.109DUMI9 + 0.454DUMW3 + .896DUMP13 - 0.106DUMO3 + 0.309DUMU10 + 0.147DUMP1 + 0.338DUML17 + 0.211DUML8 + 0.505DUMI8

Table 20
Commercial Motor Vehicle Fatality Multiple Regression
Data Dictionary and Assigned Categories

Fatality	(+/-) Variable	Label	Category
Dumu14	+ C_dbp1	Wrong Side of Road	Safety
Dumq5	+ S_eq	Eye Protection Only	Safety
Dumu6	+ C_dbp1	Failed to Stop for Stop Sign or Flashing Red	Safety
Dumi9	+ Seq_one	Collision Involving Motor Vehicle in Transport	Event
Dumw3	+ Eject	Total Ejection	Restraint
Dump13	+ Cc_v1	Signs, Billboard, etc	Conditions
Dumu10	+ C_dbp1	Turning from Wrong Lane	Safety
Dump1	+ Cc_v1	Fog, Smoke	Conditions
Duml17	+ Obj_h1	Bridge-Veh Traveling Under	Event
Dumi8	+ Seq_one	Collision Involving Pedestrian	Event
Duml8	+ Obj_h1	Approach (Object Hit)	Collision
Dumo3	- Traf_con	Traffic Control Signal	Safety

The regression model is significant at the F-test .01 level. The explanatory power of the regression model is limited. Most of the variability is not explained as represented by the adjusted R^2 statistic.

F-statistic = 19.5
Adjusted R^2 = .154
Standard Error of the Estimate = .34

Although the model does not have a great deal of explanatory power, it does show that there are variables that are systematically related to the dependent variable and the relationship is in the direction that one would expect. A plus sign preceding the variable indicates that an increase in the variable will result in an increase in the number of fatalities associated with commercial motor vehicles while a negative sign indicates that an increase in the variable will result in a decrease in the number of fatalities. For example, an increase in the number of commercial

trucks driving on the wrong side of the road will result in an increase in the number of fatalities. An increase in the number of motorcycle riders using eye protection *only* (with no protective helmet used) will result in a higher number of fatalities. Conversely, an increase in the number of "yield" signs will result in fewer fatalities associated with the drivers of commercial motor vehicles. The collision involving a commercial vehicle and a pedestrian would appear to have an incorrect sign. The idea that such a collision results in fatalities at an average rate less than that for other accidents is not intuitive but in fact there was no fatality that resulted from such an accident over the three year period.

Number Injured

The dependent variable "number injured" was regressed upon using the independent variables in the data dictionary previously presented. The technique used is stepwise-forward regression. There were 1,225 vehicle operator records included in the analysis. The final regression model associated with commercial motor vehicle "injury accidents" is presented below with a brief explanation of the variables provided in Table 21.

Number Killed = -0.069 + 2.199DUMP2 + 0.785DUMB4 + 1.351DUMI10 + 1.140DUML8 + 0.628DUML9 + 0.536DUMK1 + 0.667DUMU1 + 3.367DUMV36 + 0.593DUMF2 + 0.400DUMI1 + 0.227DUMC1 + 0.274DUMA1 – 0.184DUMQ3 – 0.329DUMF3 – 0.198DUMJ1 – 0.633DUMP5

The regression model is significant at the F-test .01 level. The explanatory power of the regression model is not great. Most of the variability is not explained as represented by the adjusted R^2 statistic.

F-statistic = 16.5
Adjusted R^2 = .168
Standard Error of the Estimate = 1.37

Again the model does not have strong explanatory power but it does show that there are variables that are systematically related to the dependent variable and the relationship is in the direction that one would expect. Items involving the collisions listed in Table 21 result in increased injuries as do increases in speeding and the number of junctions. On the other hand, increases in the use of "lap and shoulder harnesses" does result in a decrease in the number of injuries just as one might expect. An increase in the glare and reflection will lead to a decrease in the number of injuries. This finding is counter intuitive but only one accident out of thirty-five involving glare and reflection involved a motor vehicle that was speeding. It is possible that drivers do adjust speed when vision is obscured.

Table 21
Commercial Motor Vehicle Injury Multiple Regression
Data Dictionary and Assigned Categories

Injury	(+/-) Variable	Label	Category
Dump2	+ Cc_v1	Blowing Soil, Dirt & Sand	Conditions
Dumb4	+ Fhe	Collision involving a MV in transport (Not Parked)	Event
Dumi10	+ Seq_one	Collision Involving Parked Motor Vehicle	Collision
Duml8	+ Obj_h1	Approach (Object Hit)	Collision
Duml9	+ Obj_h1	Fence (Object Hit)	Collision
Dumk1	+ Cc_ot1	Crosswind	Conditions
Dumu1	+ C_dbp1	Speeding	Safety
Dumv36	+ Mhe	Tree / Shrubbery	Event
Dumf2	+ Jct	Intersection Related	Location
Dumi1	+ Seq_one	Ran Off Road	Event
Dumc1	+ Crlight	Daylight	Conditions
Duma1	+ H_class	State Road	Location
Dumq3	- S_eq	Lap and Shoulder Harness Used	Safety
Dumf3	- Jct	Interchange Area	Location
Dumj1	- Month_q	Jan – Feb - March	Time
Dump5	- Cc_v1	Glare from Sun, Lights, Reflection	Conditions

Commercial Motor Gross Vehicle Weight Ratings

There are legal limits to the amount that a truck with a load can weigh when traveling a state's highway or interstate system without paying additional fees. In South Dakota, a vehicle traveling on the Interstate Highway system weighing more than 80,000 pounds requires a permit each time the truck travels in or passes through the state. The maximum weight limit exists for truck ratings on highways is determined by a formula that determines the maximum vehicle weight that takes into account factors that include type of vehicle, the number of axles and the distance between the axles (see Appendix E, Glossaries & Acronym Lists).

There are two interesting findings that surface from the data that pertains to heavier tractor and trailers. First, the number of "tractor/semitrailer" (category "6" in the Vehicle Configuration field in the SAFETYNET database) accidents involving trucks with gross vehicle weight (GVW) ratings exceeding 80,000 pounds (161) is nearly the same as for trucks with GVW rating of less than 80,000 pounds (174). Secondly, the trucks involved in an accident with a GVW rating of 80,000 – 120,000 pounds are more likely to involve fatalities. Ten (9.7%) percent of these truck accidents result in fatalities compared to four (3.6%) percent of trucks with GVW ratings of under 80,000. It is important to note, however, the large number of missing values.

Table 22
Accidents Involving a Tractor/Semi-trailer
1996 -1998

Number Killed	*Missing*	*0 - 40,000*	*40,001 - 80,000*	*80,001 - 120,000*	*120,001 - 160,000*	*160,001 - 200,000*	*Total*
0	146	33	135	121	26	1	462
1	10	1	4	10	0	0	25
2	1	0	0	2	0	0	3
3	0	0	1	1	0	0	2
Total	157	34	140	134	26	1	492

Figure 5

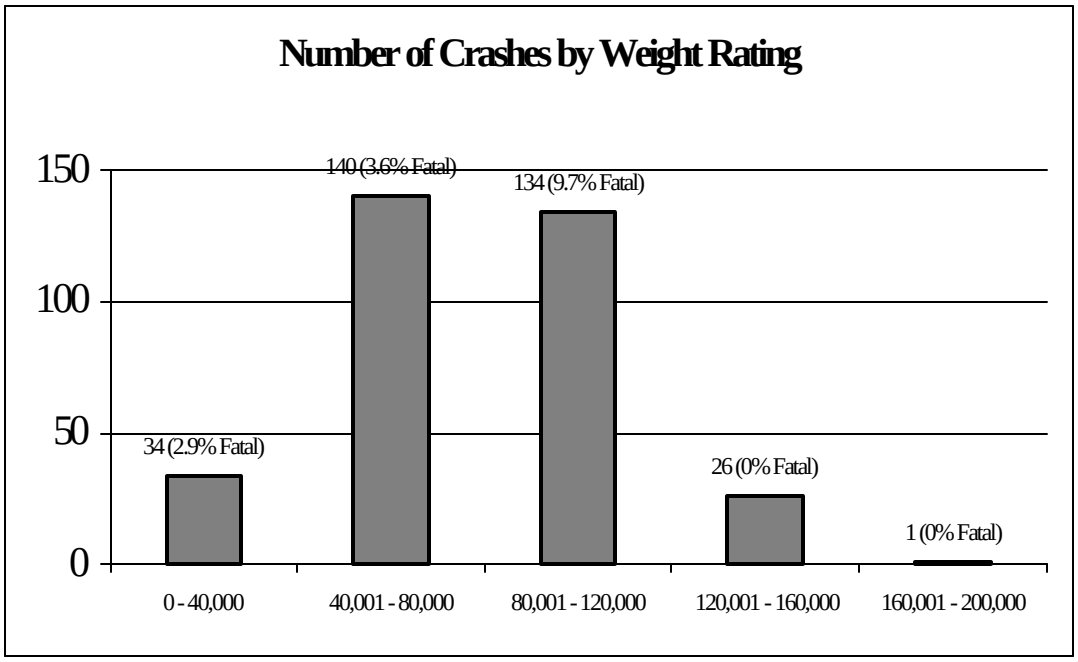


Table 23
Tractor/Semi-trailer Accidents
By Highway Number
1996 – 1998

Highway Number	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
90	127	25.8	25.8	25.8
29	80	16.3	16.3	42.1
12	21	4.3	4.3	46.3
18	20	4.1	4.1	50.4
14	18	3.7	3.7	54.1
34	16	3.3	3.3	57.3
281	16	3.3	3.3	60.6
212	14	2.8	2.8	63.4
16	12	2.4	2.4	65.9
73	12	2.4	2.4	68.3
83	12	2.4	2.4	70.7
81	11	2.2	2.2	73
44	9	1.8	1.8	74.8
37	7	1.4	1.4	76.2
79	7	1.4	1.4	77.6

*Forty-nine (49) records did not indicate a highway numbers

Table 24
Tractor/Semi-trailer Fatal Accidents
By Highway Number
1996 – 1998

Highway Number	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
14	4	13.3	16.0	16.0
90	4	13.3	16.0	32.0
16	3	10.0	12.0	44.0
12	2	6.7	8.0	52.0
83	2	6.7	8.0	60.0
281	2	6.7	8.0	68.0
10	1	3.3	4.0	72.0
19	1	3.3	4.0	76.0
20	1	3.3	4.0	80.0
29	1	3.3	4.0	84.0
37	1	3.3	4.0	88.0
46	1	3.3	4.0	92.0
65	1	3.3	4.0	9.0
212	1	3.3	4.0	100.0

*Five (5) records did not indicate a highway number.

Table 25
Tractor/Semi-trailer Accidents and Fatal Accidents
By Weather Conditions
1996 – 1998

Weather Conditions	*Accidents*	*Fatal Accidents*
Clear	238	17
Cloudy	97	7
Snowing	73	1
Raining	42	1
Fog, Smoke	17	3
Sleet, Hail, Freezing Rain	14	1
Other	9	0
Dust Storm	2	0
Total	492	30

Table 26
Tractor/Semi-trailer Accidents by Weather Conditions and
Gross Vehicle Weight Rating Groups
1996 – 1998

Weather Conditions	*Missing*	*0 - 80,000*	*Greater Than 80,000*	*Total*
Clear	80	82	76	238
Cloudy	26	30	41	97
Raining	17	12	13	42
Sleet, Hail, Freezing Rain	3	4	7	14
Snowing	22	34	17	73
Fog, Smoke	7	7	3	17
Dust Storm	0	1	1	2
Other	2	4	3	9
Total	157	174	161	492

Table 27
Fatal Accidents at Junctions
Gross Vehicle Weight Rating Groups
1996 – 1998

Number Killed	*Junction Type*	*Missing*	*0 - 80,000*	*Greater Than 80,000*	*Total*
1	Nonjunction	3	1	3	7
	Intersection	5	3	3	11
	Intersection Related	0	1	1	2
	Interchange Area	2	0	0	2
	Driveway Access	0	0	3	3
	Total	10	5	10	25
2	Intersection	0	0	2	2
	Interchange Area	1	0	0	1
	Total	1	0	2	3
3	Nonjunction	0	1	1	2
	Total	0	1	1	2

The great majority of vehicles from both weight rating groups were going straight ahead at the time of the accident. However, there is a higher likelihood that the vehicles in the heavier grouping were doing something other than going straight ahead at the time of the fatal accident. Only one of the ten lighter CMVs was doing something other than going straight ahead at impact while seven of the heavier grouping were maneuvering when the accident took place including turning left, passing and stopped in traffic.

Table 28
Tractor/Semi-trailer
Fatal Accident Vehicle Maneuvers
Selected Weight Classifications
1996 – 1998

Vehicle Maneuver	*Missing*	*0 - 80,000*	*Greater Than 80,000*	*Total*
Straight Ahead	11	6	10	27
Turning Right	0	0	0	0
Passing	0	0	2	2
Stopped in Traffic	0	0	1	1
Total	11	6	13	30

For those accidents resulting in fatalities involving the heavier rated trucks, the accidents where the truck was going straight ahead were head on, rear-end, sideswipe and angle collisions. One collision was with a pedestrian and the other occurred while the vehicle was in a turning movement.

Table 29
Tractor/Semi-trailer
Fatal Accident Manner of Collision
GVW Rating 80,001 – 120,000 lbs
1996 – 1998

Junction Type	*Not collision with motor vehicle in transport*	*Rear-end*	*Head-on*	*Angle*	*Sideswipe-same direction*	*Turning movement*	*Total*
Nonjunction	1	1	2	0	0	0	4
Intersection	0	0	0	3	1	1	5
Intersection Related	0	0	0	0	0	1	1
Driveway Access	0	1	1	0	1	0	3
Total	1	2	3	3	2	2	13

Of the 13 accidents involving a commercial motor there were two arrests and an additional two accidents in which the arrest was pending. There were nine such accidents in which no arrest was made. See Table 30. The table identifies that the fatal collisions were with two wheel drive cars, two wheel drive pickups, a four wheel drive pickup, vans and a piece of farm machinery. In addition, one of the fatal collisions was with a pedestrian. There was no instance where a vehicle other than the commercial motor vehicle was arrested in connection with the accident.

Table 30
Tractor/Semi-trailer Trailer
Fatal Accident Arrest & Vehicle Type
GVW Rating 80,001 – 120,000 lbs.
1996 – 1998

Vehicle Type/Body Style	*Arrest*			
	Yes	No	Pending	Total
2 Wheel Drive Passenger Car	0	5	0	5
2 Wheel Drive Pickup	0	2	0	2
4 Wheel Drive Pickup	0	1	0	1
Van	0	3	0	3
Truck Tractor with Single Semi-trailer	2	9	2	13
Farm Machinery	0	1	0	1
Total	2	21	2	25

The pattern of more fatal accidents with the heavier rated GVW Rated group of tractor/semi-trailers does not follow through to accidents where injuries occurred. During the three-year period, the number of accidents involving tractor/semi-trailers with heavier and lighter weight ratings is very similar.

Table 31
Tractor/Semi-trailer Trailer
Injury Accidents GVW Rate Groupings
1996 – 1998

Number Injured	*Missing*	*0-80,000*	*Greater Than 80,000*	*Total*
1	49	61	62	172
2	19	18	11	48
3	3	5	3	11
4	1	1	1	3
10	0	0	1	1
Total	72	85	78	235

The percentage of the zero to 80,000 pound GVW involved in an accident that resulted in injuries was fifty-two percent (52%) whereas the comparable percentage for the greater than 80,000 was forty-eight percent (48%). The question of heavier tractor and trailer trucks having accidents in the same proportion as those below the weight threshold for permits on the interstate system remains a point of interest. It is not known if the trucks rated at more than 80,000 pounds were loaded at this amount at the time of the accident.

Task 6: Provide SDDOT with procedures, system, training, materials, etc. that will identify the contributing factors (high-risk areas, carriers, time of day), either by report or graphical county or state map.

The procedures used to develop the linked database are outlined in Appendix E. The statistical analyses performed are subject to the content of the linked data and will need to be reevaluated as years are added to the linked database. Identification of high risk areas, carriers, etc., will also improve with additional years of information. Frequencies can help to identify areas for more in-depth regression analysis.

Findings and Conclusions

Using the frequencies and regression analysis, as well as the research and interviews, some general and specific conclusions were reached.

1. The number of deaths associated with accidents involving a commercial motor vehicle declined from 25 in 1996, to 21 in 1997 and 14 in 1998. Part of that decline reflects a decrease in accident severity and the remainder to a decrease in the number of accidents. The accidents per million miles traveled within the state remained fairly constant between 1996 and 1997 but the number of fatal accidents declined by two, which resulted in the number of deaths declining by four. In 1998, the accident rate decreased from 29.5 to 23.3 per million miles traveled. There were fewer accidents, fewer fatal accidents and fewer deaths in that year.

2. Alcohol involvement in commercial vehicle accidents increased in 1997 but fell below the 1996 level in 1998. There were two people killed in alcohol-related accidents in 1996, three in 1997 and one in 1998. The 1998 improvement is desirable but there are no causal relationships to explain the improvement. Further, the number of deaths each year is small and summary statistics are greatly affected by one or two events.

3. Safety restraint usage is the lowest among the younger drivers. It can not be determined from the data if lower safety restraints usage is an issue of attitude, "style" or if this group is simply uninformed. Nearly one fourth of all fatalities during the three year period involved partial or total ejection from the motor vehicle.

4. Sites where multiple accidents involving commercial motor vehicles on the Interstate Highway system have occurred are typically at or near an entry or exit point. The accident sites include points near on and off ramps and exit and entries for rest areas. It would appear that there are failure to yield issues at points of entry and exit in that the commercial motor vehicle is most likely to be going straight when the accident occurs.

5. Regression analysis shows that safety and restraint issues figure prominently as factors that are statistically significant in explaining factors that contribute to fatalities in commercial motor vehicle involved accidents. The regression model explained only 16.9 percent of the variation in the data and is considered to have weak explanatory power. The lack of systematic causes for the accidents, a limited number of locations where accidents are

common and the lack of explanatory power in the regression model suggest that there is a strong random element in the occurrence of accidents involving commercial motor vehicles.

6. The regression analysis for injuries is also described as being weak in explanatory power, explaining only 16.5 percent of the variation. The factors found to be statistically significant in explaining injury accidents were conditions, type and place of collision and safety factors. As with fatal accidents there does not appear to be a systematic cause, event or issue that explains a large percentage of the accidents involving commercial motor vehicles.

7. Weight ratings of commercial motor vehicles as they relate to accidents is an interesting issue. Department of Transportation personnel told us that their estimate of trucks requiring a permit as a result of weighing more than 80,000 pounds is less than ten percent of all trucks. Some safety officials estimate from their experience that the proportion of trucks weighing more than 80,000 pounds is below five percent. Using the number of South Dakota interstate vehicles registered by South Dakota Division of Motor Vehicles (under the Interstate Registration Plan) in 1999, about 68% are weight rated at or below 80,000 lbs. The issue is that this small group of trucks with GVW ratings of 80,000 to 120,000 pounds represents nearly half of all accidents involving commercial motor vehicles. And, they are involved in fatal accidents at a rate over two and a half (2.7) times that of trucks in the 40,000 to 80,000 category. While no conclusion can be reached, a closer look is indicated.

8. The Interstate Highway system is a highly used and an extremely important route for those in the trucking industry. Because of the frequency of use, the number of crashes on an interstate highway is greater than on other roads. While the percentage per mile driven is not as high, the sheer traffic on interstate highways necessitate special concern.

9. The “non-preventable” factors, such as weather and light conditions, are not nearly as significant as the more “preventable” factors. With the exception of “Blowing Soil, Dirt and Sand” and “Fog, Smoke” the “non-preventable” conditions are not significant in the crashes in the dataset.

10. Driver error, from any of the vehicles involved, is very significant. The regression indicates that injuries and fatalities occur when driver error increases. The linked dataset is unable to recognize the vehicle involved that caused the crash, but the results point to the need for continued education in defensive driving.

11. The linked database is limited in its value. Because the dataset includes only the DOT reportable crashes (as defined in Appendix E, Glossary and Acronym List), factors that may contribute to crashes in general may be underrepresented. The current system for indicating the location of the crash is not adequate to develop meaningful geographical locations of crashes.

12. An examination of the frequencies and the rating system in SAFETYNET failed to identify any individual trucker or trucking companies that pose a statistically significant safety risk. As data from subsequent years is collected, future linkages may be able to identify carriers who pose a greater risk.

Recommendations

Recommendations are derived from the review of literature and previous studies, input from law enforcement and members of the trucking profession and analysis of the linked databases. Recommendations are divided into sections on the databases and other areas.

Database Improvement:

1. Develop Crash Report Form that incorporates both the present data and the SAFETYNET fields.

   The present system requires the completion of two forms, often with similar or identical fields. This system appears to be cumbersome and provides ample opportunity for error. Using one form would allow a combination of like fields and would minimize the chances of keying errors. Additionally, a single form could improve the completeness of the "SAFETYNET" data.

2. Revise XY coordinate system to utilize real world coordinates such as latitude and longitude.

   The current XY coordinate system adequately identifies the point of the crash. Using this system however, it is difficult, if not impossible, to develop statewide statistics based on specific roadways. Using real world coordinates could facilitate the identification of patterns and trends using location. With real world coordinates, other information already collected such as weather conditions and time of day could be layered onto crash locations to develop in-depth analysis of the causes and factors of crashes.

   During this study, a method to convert XY coordinates to real world coordinates was discussed. A system of geocoding using two points in each county could be used to give approximate location. The exact location would be impossible to obtain using this method because the surveyed miles in the state do not reflect actual miles exactly. This method of geocoding could be used to identify clusters and trends of all crashes in the state. The BRB, with the assistance of the Geological Survey, was able to accomplish this using fifty crashes in Codington County.

   The most accurate way to obtain real world coordinates would be to utilize portable geocoding units. Portable units kept by law enforcement could obtain real world coordinates. The purchase of these portable units should be considered as part of the long-range plan. Hand held units vary greatly in cost (from around $120 to about $1,200 per unit). Considerable and varied options exist and specific needs would need to be assessed.

   Portable GPS units could increase the safety of the officers who patrol very rural areas. Officers would be able to identify exact locations in conditions and events where visibility or other factors make it impossible.

Another option to the hand held GPS units is to purchase software that could convert current XY coordinates into real world coordinates. While the identification of the locations would still be less exact, more usable data could be developed for analysis purposes.

3. Add field to identify if carrier is a licensed commercial driver or an individual using commercial equipment for personal or commercial use.

   Presently, there is no way to identify if a carrier is a professional driver or an individual using commercial equipment for personal or commercial use. While the SAFETYNET database includes a "interstate or intrastate" field, it is inadequate to use in determining if the driver is, in fact, licensed to drive a commercial vehicle. Adding this field would enable research to be performed on the drivers involved in crashes. An alternative would be to add this as an option to an existing field such as the "driver license status" field.

4. Include speed at the time of crash on the database.

   Currently this is collected but not entered into the database. Having this field would aid in determining at what speed problems occur. Speed can be approximated using a combination of fields if exceeding the speed limit is cited. When crashes occur while drivers are driving under the posted speed limits, the actual speed could be valuable in determining if the posted limits are, in fact, appropriate. Further analysis could be done using speeds and roads, times of day, etc.

5. Consider adding an approximate weight field. The SAFETYNET database uses the Gross Vehicle Weight rating of the tractor and the trailers added together to determine the total Gross Vehicle Weight rating. As suggested earlier, a high GVW rating may indicate a heavy vehicle but it is not a reliable measure of actual vehicle weight. The GVW ratings along, with information from weigh stations, when available, and information about the load capacity could be utilized to get a reasonable approximation of vehicle weight. This approximation would be useful in determining the true impact of vehicle weight on crashes.

6. Update Accident Records System to utilize a relational database integrated with Department of Motor Vehicles and Driver Licensing.

   The current system used is a very good system but it has limitations that a relational database would not. Utilizing a relational database would enable real-time reporting, promote more consistent information and enable a cross-reference of vehicle ownership and more driver history and detail. This is a long-term recommendation that will require a substantial amount of coordination but will allow for better access to more complete data.

<u>Resource Allocation</u>

1. When speeding or exceeding safe speed is listed as a factor, approximately 2/3 of the time, there was some instance of road conditions being rain, snow, or ice covered, and about ½ of the time weather such as rain, snow or sleet was cited. Since speed estimates are predominantly given by driver, there is a good chance that exceeding limits are understated. More vigilant enforcement of the speed limit along with aggressive sanding of roads during

hazardous weather conditions is recommended. Special concern should be at intersection and junction areas, since they account for about 25% of the speed related collisions.

2. Most crashes occur during daylight hours between 9:00 am and 5:00 pm. Resources should be allocated accordingly.

3. Interstates 90 and 29 account for the greatest number, by far, of speed related crashes (87 out of 164). Of these, Minnehaha and Lincoln counties had 28 speed related crashes and the Black Hills counties accounted for 21 crashes. Roberts county stands out as significant with 10 speed related crashes. These would be areas where additional enforcement of speed would be warranted.

4. Failure to yield is a frequently cited contributing factor (32 times). Weather and road conditions do not appear to play a part in this, as those factors are not usually indicated. The interstates represent only a small number of the failure to yield cases (5) with four of those occurring in urban areas. Most significant in the failure to yield cases is the junction where 22 of the 32 occurred. Twenty-five of the 32 crashes involving a failure to yield occurred where some sort of traffic control device was located. Signage and graded bumps prior to intersections would be useful to alert drivers of upcoming intersections.

5. Drivers who fell asleep were involved in 31 crashes. Neither weather nor roadway appears to be significant. Not surprisingly, 26 of 31 occurred after 6:00 p.m. and before 7:00 a.m. Devices used to alert drivers when their heads begin to nod might be a solution.

<u>Other Recommendations</u>

1. Assist law enforcement with utilizing existing and developing clearer guidelines for law enforcement to use in determining severity of injury.

   In determining injuries, using consistent criteria would enable the officers to submit reports that could be more closely used in the analysis of injury and fatality crashes. While this information exists in the guidelines, it appears there is some disagreement on how each category is defined.

2. Continue to promote excellent working relationship between law enforcement and trucking industry.

   The industry and law enforcement have joined forces to promote safety by working together. Stressing safe vehicles, defensive driving and “share the road” philosophies have enabled greater cooperation and safer roads. This cooperative effort should be continued.

Appendix A
Questions and Responses from Highway Patrol

Each officer was given a copy of the questions prior to the session. Officers met with BRB personnel in a focus group type of discussion. This format was chosen to enable individuals to interact with each other and generate dialog.

1. Approximately what percentage of your time is devoted to responding to crashes including completing crash-related paperwork, etc.

Responses:
- Very few, less than 5%
- About 1 ½ to 5%
- Not a substantial amount of time spent
- Depends on the year, some years not much, some years a considerable amount.

Comments:
Officers interviewed did not feel unduly burdened by the paperwork aspect of motor vehicle crashes. An accident reconstructionist may spend a considerable amount more than officers who are at the scene.

2. Of the accidents you respond to, about what percent involve commercial trucks?

Responses:
- Very few, commercial trucks do not stand out as a problem
- Fewer than 5%
- Maybe one or two a year

Comments:
In general, the officers indicated that they did not perceive commercial vehicles as involved in crashes disproportionately.

3. What is your procedure when you respond to a crash?

Responses (this was the consensus order of events):
- Call received from Communications department, closest unit is dispatched
- Secure the scene of the crash
- Determine injuries and their severity, identity non-injuries
- Determine number of vehicles involved, number of drivers/occupants
- Check for hazardous materials, and if applicable, contact the appropriate individuals for containment and clean up.

Comments:
While procedure varied slightly, general procedure was very consistent among officers. Of greatest importance was the safety of the occupants of the vehicles and the oncoming traffic.

Officers indicated it was helpful to have as much information as possible before they arrive at the scene.

4. Does the procedure differ if a commercial truck is involved?
Responses:

- Hazardous waste and the appropriate support are notified
- Varies depending on the location, type of crash and other factors

Comments:
Officers stressed the importance of understanding the cargo in order to get the appropriate support and response.

5. When determining the seriousness of the crash, what factors are considered?

Responses:
- Potential for injuries is considered
- If some sort of bodily injury has occurred, accident is considered serious
- If an ambulance needs to be called
- If an injury appears to be incapacitating

Comments:
Most officers expressed the state of the driver and the passengers as the main determining factor as to whether or not an accident is considered a serious one.

6. What criteria are used to determine if an accident is classified as an "injury accident"?

Responses:
- Any bodily injury
- Any possible injury
- Substantial vehicle damage
- Whenever the type of crash is likely to result in an injury, individuals involved are closely examined. If there is any injury at all, like a bump on forehead or a stiff neck, it is considered an injury, although not necessarily an incapacitating injury.

Comments:
What constituted an injury varied from officer to officer. While the incapacitating injuries were usually considered those transported to a hospital by ambulance, the officers used judgement to determine whether the injury was a "non-incapacitating injury" or a "possible injury" and this varied. One officer indicated that he was careful in his use of "no injury", since many non-incapacitating injuries are not apparent until later. Officers did not have any clear guidelines they followed; rather they use their best judgement. Many mentioned that clear guidelines would be helpful.

7. When do you decide to use the supplemental form for truck-related crashes?

Responses:
- Use guidelines for DOT reportable crashes
- Also will complete a Vehicle Examination Report

Comments:
Officers felt guidelines for when to use the form were fairly straightforward. Many mentioned the Vehicle Examination Report (VER) is used more often and collects a great deal of important information.

8. What elements of the accident report form do you think are most valuable in assessing the factors that may cause accidents?

Responses:
- Narrative describing what happened
- Contributing circumstances from the driver
- First harmful event
- Everything on form helps form the complete picture

Comments:
Most officers felt the narrative section was extremely valuable in determining the cause. A couple mentioned that it varied a great deal from crash to crash and because of that, all elements were important.

9. What information do you find least valuable?

Responses:
- Depending on the situation, any field could be important
- Pedestrian information is already in the narrative section
- Redundancy about trailers, is filled in two places

Comments:
The officers found it difficult to identify any element that would not be useful in some circumstance. Most felt the form did a good job of documenting the crash.

10. What elements of the supplemental truck crash report form do you think are most valuable in assessing the factors that may cause accidents?

Responses:
- Event code
- Most of the fields are just “paperwork” types of information

Comments: Most felt that the information on the supplemental form is somewhat redundant and more “paperwork” oriented.

11. What information do you find least valuable?

Responses:
- A lot of the information is already collected on the accident report or the VER
- Some local offices are unfamiliar with form or just do not complete it

Comments:
The officers expressed concern that the form is not always completed. Additionally, the officers felt that a great deal of the supplemental form was redundant.

12. In your experience, what do you consider the most significant factor in truck-related crashes?

Responses:
- The "other driver"
- Truck driver driving too hard
- Too many hours
- Fatigue and stress

Comments:
Most officers felt the greatest majority of the truck-involved crashes were not caused by the driver of the truck, but the other vehicle. When the truck driver was at fault, however, the greatest contributing factor was fatigue.

13. What, if any, additional information should be collected? Why?

Responses:
- Nothing additional necessary, everything is already on the accident report, the VER and the supplemental form.
- Possibly could add all passengers but that could get difficult if crashes involved a large number of people

Comments:
In general, the Highway Patrolmen felt the information collected currently, including the VER, Accident Report and the supplemental form documented the crash very thoroughly.

Appendix B
Questions and Responses from Trucking Industry

Trucking industry personnel were interviewed on an individual basis at the suggestion of Larry Thury, a member of the technical panel and the Director of Safety for MCT. Individuals from large, medium, small and intrastate only firms were interviewed.

1. What are your procedures when one of your vehicles is involved in a crash?

Responses:
- Secure area and contact insurance carrier
- Secure area and determine if it is DOT reportable or not. If yes, telephone company immediately. If no, use internal system.
- Contact Highway Patrol, secure area, contact company
- Depends on severity. Injuries are immediately called in, but "incidents" are reported at the end of the week.

Comments:
In general, safety (securing the scene) was the primary concern and second was getting their insurance carrier and company notified. Several carriers felt their insurance carriers were extremely helpful.

2. What elements of the accident report form do you think are most valuable in assessing the factors that may cause accidents?

Responses:
- All factors are important
- Time of day, road conditions, direction
- Time of accident
- Comments by law enforcement in narrative section
- Narrative section and illustration by law enforcement

Comments:
Those interviewed had varied responses but all felt that most fields could be important in different circumstances.

3. What information do you find least valuable?

Responses:
- Nothing, all fields were important
- Some of the contributing circumstances seem a little redundant
- None, it's a good report
- VIN might be unnecessary
- Some out-of-state forms ask for serial number and that is unnecessary

Comments:
Most felt the information collected was not excessive and effectively documented the event.

4. What elements of the supplemental truck crash report form do you think are most valuable in assessing the factors that may cause accidents?

Responses:
- We do not really see the forms
- Driver information useful
- The supplemental form does a good job of clarifying the type of vehicle involved
- The additional information makes a more complete picture

Comments:
Some truckers were not familiar with the form and did not request it. One individual thought one request should get them all the information relevant to the crash, including a copy of the VER, and the supplemental form.

5. What information do you find least valuable?

Responses:
- All information is important to somebody at some point in time.
- Depends on the type of accident
- We like to see all the elements on the form
- Don't see why interstate or intrastate is necessary

Comments:
Again, most were interested in getting all possible information and thought most of the data collected could be useful at some point.

6. In your experience, what do you consider the most significant factor in truck-related crashes?

Responses:
- Four-wheelers not understanding how to share the road
- The traveling public not "sharing the road"
- Driver error by any and all of the drivers involved in the crash
- Driver fatigue
- Weather conditions
- Road conditions
- Driver experience, how well the driver responds to an emergency

Comments:
The responses to this question varied greatly. Many did cite that driver error and response was always a factor.

7. What, if any, additional information should be collected? Why?

Responses:
- Crash site should be photographed (our drivers carry cameras)
- More should show up about the driver of the "other vehicle"
- Citations issued
- Same type of drug/alcohol tests for all vehicles involved, not just the trucks
- Whether the truck is commercial or agriculture transportation

Comments:
Most felt the truck involved in the crash was held to a higher standard than the passenger car and thought this should be changed. Some thought citations issued would help in the insurance claim.

8. What factors do you think are the most preventable? Why?

Responses:
- Lane changing crashes, small incidents from backing out
- Fatigue related crashes
- All driver related factors are preventable, the current law is outdated and dangerous
- Unsafe equipment that causes vehicle failure
- Speed
- Speed, that you can control

Comments:
Comments varied but consistent was the idea that driver error should be preventable.

9. What factors do you think are the least preventable? Why?

Responses:
- Time of day. You cannot always help the time you have to take off due to loading and unloading problems
- "Road rage" and courtesy of other drivers
- Staged accidents
- Weather related crashes
- Animals in path
- Can't control the other guy
- Rear-end collisions

Comments:

Again, there was an entire range of responses for this question. Truckers mentioned the importance of driving defensively and learning to react appropriately.

10. What would you change about the way truck-related accidents are reported? Why?

Responses:
- All forms would be together in a timely manner
- The way the media reports about truck-related crashes
- The same standards should be applied to the entire traveling public, trucks and non-commercial vehicles.
- Farmers driving big rigs need to be held to same standard

Comments:
Most carriers expressed satisfaction with their insurance carriers and the way that crashes are reported. Most would like quicker feedback and all of the relevant information as soon as possible. This feedback would help them identify problem drivers, take disciplinary action or provide the appropriate training to alleviate the problem.

11. How would you improve the type of response you receive in a crash?

Responses:
- We receive great response from everyone
- The response from law enforcement has really improved
- We need to be able to respond more quickly to our trucks that are on the road
- If the driver of the truck is injured, we need to have the highway patrol contact us immediately so we can make sure things are taken care of on our end
- We could use more follow-up. Let us know if a citation is issued
- We have had great response from the Highway Patrol and EMS

Comments:
In general, most consider the response of emergency personnel really good. Most indicated more follow-up would be helpful.

Appendix C
Responses from Other States

Name	Organization	State	Response	Truck Studies	Linked Files	Comments
Mike Selig	Highway Safety Management	AR	No			
Dave Duffy	Department of Transportation	AZ	No			
Stephanie Olson	CO DOT, Safety & Traffic Board	CO	No			
Bill Coplay	Highway Safety	CO	No			
Mary Kapp	Department of Public Health	CT	No			
Rashid Sleemi		DC	No			
Jacqueline L. Schraf	US DOT, NHTSA	DC	No			
Kathy S. English	Department of Highway Safety	DE	No			
J. Allison Butler	Highway Safety Management	FL	No			
Mark Lee Edwards, Ph.D.	Triple A	FL	Yes	No	No	
Erick J. Moran	NHTSA	GA	Yes	No	No	References other studies being done
Eric Harris	Department of Public Safety	GA	No			
Alvin Takeshite		HI	Yes			No state studies
Robert Thompson	Gov. Traffic Safety Highway Safety Management	IA	Yes	No	No	Referred to Iowa DOT
Terry Dillinger	Iowa DOT, Motor Vehicle Division	IA	Yes	No	No	Sent Crash Facts book for state
Rick Myers	Highway Safety Management	IL	Yes	Yes	No	Sent results of Truck Size & Weight Study
Karen Butt	Indiana State Police	IN	No			
William Reitinger	Highway Safety Management	KS	No			
Charles H. Miller, Jr.	Department of Hwy. Safety Committee Highway Safety Management	LA	Yes	No	Yes	Both databases are maintained together, have put all data online and integrated
Ronald D. Lipps	Office of Traffic Safety Highway Safety Management	MD	No			
Gerry Audibert	Maine DOT, Safety Management System	ME	Yes	Yes	No	Have study of truck crashes from 1990-1996
William Kennedy	Highway Safety Management	MI	No			
Colleen Auer	MI State Police, Office of Highway Safety Planning	MI	No			
Marc E. Dronen	Department of Public Safety, Highway Safety Management	MN	No			
Mike Curtie	MO DOT, Office of Management System Accident Record Systems	MO	No			
Leanna Depue, Ph.D.	Highway Safety Management	MO	Yes	No	No	
Ron Sennett	Highway Safety Management	MS				
Pierre Jomini	Montana DOT, Accident Record Systems	MT	Yes	Yes	No	Sent copy of study by engineering division

Name	Organization	State	Response	Truck Studies	Linked Files	Comments
Don Nail	DOT, Governors Hwy Safety Program	NC	No			
Kevin Lacy	NC DOT, Accident Records Systems	NC	Yes	Yes	No	Attempted linkage unsuccessfully, but will likely try again
Judy L. Froseth	Highway Safety Management	ND	No			
Bob Grant	Nebraska Department of Roads, Highway Safety Division, Accident Records	NE	No			
Sheila Young	NH State Police, Bureau of Enforcement	NH	Yes	No	No	Databases maintained separately, referred to Highway Patrol
Sgt. Wayne Peasley		NH	Yes	No	No	Databases eventually combined but no additional truck studies done
Joel Trella	Highway Safety Management	NJ	No			
J. Michael Quintana	Traffic Safety Bureau Highway Safety Management	NM	No			
Rosella Salazar	NM State Hwy & Transportation Dept	NM	No			
Isabel Lopez Encinias	Highway Safety Management	NM	No			
Greg Novak	Fed Hwy Adm, NE Division	NV	No			
Joann Keller	Office of Traffic Safety	NV	No			
Eileen M. Kremers	Highway Safety Management	NY	Yes	Yes	Yes	Provided information on linking two files & identified potential problems with comparisons
Christopher Mistron	NASSW County Traffic Safety Board, Highway Safety Management	NY	No			
Jerry Friedman	DOMV, Gov. Traffic & Safety Comm	NY	Yes	Yes	Yes	Referred to Motor Carrier Safety Bureau
Dennison P. Cottrell	State of New York, DOT	NY	Yes	Yes	No	Sent copy of Survey of Long Distance Truck Drivers from 1997 and Analysis of Truck Crashes in NY State
John Bray	Traffic & Safety Div, NYDOT	NY	No			
Walter F. Callahan, Jr.	Highway Safety Management	OH	No			
Alan Stevenson	OK DOT, Accident Records Systems	OK	Yes	No	No	Referred to Highway Patrol
Troy E. Costales	DOT, Traffic Safety Division	OR	No			
Bill Hunter	PennDOT, Bureau of Highway Safety & Traffic Eng.	PA	No			
Paul Annarummo	RIDOT, Accident Record System	RI	No			
Walt Bailey	Office of Research & Statistics	SC	No			

Name	Organization	State	Response	Truck Studies	Linked Files	Comments
Max Young	SC Department of Public Safety	SC	Yes	No	No	SAFETYNET data maintained as part of crash records
Randall G. Smith	Highway Safety Management	TN	No			
Tom Eldridge	TN DOT, Accident Record System	TN	No			
James G. Templeton	Dept. of Public Safety, Highway Safety Management	TX	No			
Marilee Gomez	Highway Safety Management	UT	No			
E. C. Letteer	Department of Motor Vehicles Highway Safety Management	VA	No			
Phil Salzberg, Ph.D.	Highway Safety Management	WA	No			
Brian Limotti	WS DOT, Accident Record System	WA	Yes	No	No	Referred to two other state offices
Martha E. Florey	Highway Safety Management	WI	No			
Dennis Hughes	WS DOT, Bureau of Transportation Safety	WI	No			
Aldeen K. West	Department of Transportation	WY	Yes	No	No	No Linkage Done

Appendix D
Steps for Matching SAFETYNET & Accident Records

1. Obtain Accident Record files from South Dakota DOT. Files received for 1995, 1996, 1997 and 1998 in fixed ASCII text file. Files to be included for DOT are crash95.txt, crash96.txt, crash97.txt, and crash98.txt.

2. Obtain SAFETYNET file from Office of Motor Carrier and Highway Safety (OMCHS). Data for all states was received. Data was received for 1995 through 1998 also in fixed ASCII text format.

   South Dakota SAFETYNET records were stripped off and are in file sdsafety.txt

3. Load SAFETYNET file to Microsoft Access and select the SAFETYNET records for accidents in South Dakota only. Only the South Dakota records will be used to match.

4. Create Automatch Data dictionary file for Accident Records, stored as crash.dic.

5. Create Automatch Data dictionary file for SAFETYNET Records, stored as safety.dic.

6. Calculate the cutoff weight. The number of records in each file to be matched is used to calculate the cutoff weight.

   The formula used based on 98.75% probability of being a match is:

   (90/(1-90))/ 1/(1/(Number of Records in SAFETYNET file *.1)/((Number of records in File A * Number of records in File B)-Number of expected matches in File A)).

7. Determine best matching variables – Accident Month, Accident Day, Accident hour, County, Vehicle Identification Number (VIN), SD Accident Record Number. The Excel spreadsheet Match Guidelines Crash SAFETYNET.xls contains the calculations for the match weights and the cutoff.
8. Calculate u probability for the matching variables where u is the probability that the field agrees given that the record pair is unmatched or probability the field agrees at random.

Accident Month	1/12 (1 chance in 12)=.083
Accident Day	1/30 (1 chance in 30)=.033
Accident Hour	1/24 (1 chance in 24)=.042
County	1/69 (1 chance in 69)=.014
VIN	1/1000 (1 chance in 1,000) =.001

(the u could be larger, but we do not want to overstate the matching of VIN.)

SD Accident Number	1/1000 (1 chance in 1,000) = .001

(could be larger but, again, we do not want to overstate the matching of a Accident Number)

9. Calculate m probability for the matching variables where m is the probability that the field agrees given the record pair is a match. This is essentially one minus the error rate of the field in matched records.

Accident Month	.90 (90 of 100 match)
Accident Day	.90 (90 of 100 match)
Accident Hour	.90 (90 of 100 match)
County	.90 (90 of 100 match)
VIN	.75 (75 of 100 match)
SD Accident Number	.90 (90 of 100 match)

10. Calculate the weight for each field using the formula Log base 2 of m/u.

Accident Month	Log Base 2 of .90/.083=3.43
Accident Day	Log Base 2 of .90/.033=4.75
Accident Hour	Log Base 2 of .90/.042=4.43
County	Log Base 2 of .90/.014=5.96
VIN	Log Base 2 of .75/.001=9.55
SD Acc No	Log Base 2 of .90/.001=9.81

11. Calculate the Composite weight, this is the sum of the weights of each matching variable. The matching algorithm calculates a composite weight for each set of two records. If the two records match on a field, a positive weight is assigned for that field; if the two records do not match on a field a negative weight is assigned. The total possible weight is the sum of the weights of all matching variables.

Possible Weight	3.43+4.75+4.43+5.96+9.55+9.81=37.94

12. Determine the blocking variables for each pass. Blocking variables are used to limit the numbers of records to be compared. Both file A and file B are blocked on the same fields and therefore must agree on these fields. For example, blocking on Month splits each file into 12 blocks.

    The blocking variables used for the first pass are:

    Month, Day, and Hour.

    The blocking variables used for the Second Pass are:

    County and Hour.

13. Determine the matching variables for each pass. The matching variables are used to calculate the composite weight of a record to record match, if the composite weight is greater than or equal to the cutoff weight, the records are considered to match.

    The matching variables for pass 1 are:

        Month, Day, Hour, County, VIN, and SD Acc No.

    The matching variables for pass 2 are:

        Month, Day, Hour, County, VIN, and SD Acc No.

    The match specifications for each year are included in the files:

        crasaf95.mat, crasaf96.mat, crasaf97.mat, and crasaf98.mat.

14. Create a batch file to run the match. This file contains all the Automatch commands needed to run a match. File crasaf95.bat, crasaf96.bat, crasaf97.bat, crasaf98.bat are all included.

15. Run the batch file. This step creates several files to be reviewed. The first is crasaf95.rpt (there is a file for each year that is run). This file contains the report of the match. It prints the match variables for matched records and indicates whether it is an exact match. Also totals are generated for the number of matches and number of residuals for each file.

    The match records are stored in crasaf95.out, crasaf96.out, crasaf97.out and crasaf98.out. These are the records that met the cutoff and are considered true matches.

    The residual records from file A are stored in crasaf95.ras, crasaf96.ras, crasaf97.ras, and crasaf98.ras.

    The residual records from file B are stored in crasaf95.rbs, crasaf96.rbs, crasaf97.rbs, and crasaf98.rbs.

16. Import the matched records to Microsoft Access. The import specifications were saved to allow this process to be easily repeated.

17. Export the matched records from Access to a DBF file.

18. Open the DBF file in SPSS and save as an SPSS type file.

19. Change all the text fields to numeric, and update the labels for all fields with code values. A syntax file has been created including all the variable labels and value labels used in SPSS.

Appendix E
Glossaries & Acronym Lists

VER	Vehicle Examination Report
FHWA	Federal Highway Administration
BRB	Business Research Bureau
DOT	Department of Transportation
NHTSA	National Highway Traffic Safety Administration
FMCSR	Federal Motor Carrier Safety Regulations
HMR	Hazardous Materials Regulations

DOT Reportable Crash A crash, reported to the Federal Highway Administration through SAFETYNET,Reportable meeting the criteria established by the National Governors Association. This Crash includes crashes that involve at least one truck or one bus and involves one of the following:

- Fatality – One or more persons killed in or outside a vehicle at the time of the crash; or
- Injury – One or more persons injured as a result of the crash and transported from the crash scene for immediate medical attention; or
- Tow away – One or more vehicles disabled as a result of the crash and transported away from the scene by a tow truck or other vehicle.

Weight Limit Criteria: The maximum gross weights contained in Bridge Weight were determined by solving of the Bridge Gross Weight Formula for the various axle groupings and axle spacings. As allowed by statute, the calculated values are rounded to the nearest 500 pounds. Use the table to determine the maximum gross weight allowed on various axle groups instead of solving the above formula.

Axle weight limitations and Bridge Gross Weight Formula exceptions:

- All Axle Weights may not exceed 500 lb. per inch width of tire with the exception of a steering axle which may carry up to 600 lb. per inch width of tire. Tire width is based on tire section width. The size printed on the tire carcass indicates the section width, i.e., a 10:00 x 22 tire would equate to a 10 inch section width;
- Single Axle may not exceed 20,000 lb. (two or more axles which are spaced 40 inches or less apart will be considered a single axle);
- Tandem Axle may not exceed 34,000 lb. (two or more axles which are spaced more than 41 inches 96 inches or less apart, will be considered a tandem axle); and
- Two Consecutive Sets of Tandems may carry a gross load of 34,000 pounds each provided the overall distance between the first and last axles of the tandems is 36 feet or more.

The gross vehicle weight of a vehicle traveling on an Interstate Highway is limited to 80,000 pounds. Permits may be purchased to allow a vehicle to exceed 80,000 pounds on Interstate Highways provided the vehicle does not exceed the axle weight limits indicated above.

Appendix F
Related Web Sites and Descriptions

WEB SITES OF INTEREST

http://www.nhtsa.dot.gov - The National Highway Traffic Safety Administration (NHTSA), under the U.S. Department of Transportation, was established by the Highway Safety Act of 1970, as the successor to the National Highway Safety Bureau, to carry out safety programs under the National Traffic and Motor Vehicle Safety Act of 1966 and the Highway Safety Act of 1966. The Vehicle Safety Act has subsequently been recodified under Title 49 of the U. S. Code in Chapter 301, Motor Vehicle Safety. NHTSA also carries out consumer programs established by the Motor Vehicle Information and Cost Savings Act of 1972, which has been recodified in various Chapters under Title 49. NHTSA is responsible for reducing deaths, injuries and economic losses resulting from motor vehicle crashes. This is accomplished by setting and enforcing safety performance standards for motor vehicles and motor vehicle equipment, and through grants to state and local governments to enable them to conduct effective local highway safety programs.

http://www.fhwa.dot.gov – Federal Highway Administration. The vision of the Federal Highway Administration (FHWA) is to create the best transportation system in the world for the American people through proactive leadership, innovation, and excellence in service. We also provide expertise, resources, and information to continually improve the quality of our nation's highway system and its intermodal connections. We undertake this mission in cooperation with all of our partners to enhance the country's economic vitality, quality of life, and the environment. The FHWA is a part of the Department of Transportation and is headquartered in Washington, D.C., with field offices across the United States. Approximately 3,400 men and women make up the FHWA's workforce across this country

http://www.fhwa.dot.gov/omc/omchome.html - The OMC is part of the Federal Highway Administration, Department of Transportation, and is located in Washington, DC. We are responsible for the issuance, administration, and enforcement of the Federal Motor Carrier Safety Regulations (FMCSRs), 49 CFR Parts 325, 350, 382-399, the Hazardous Materials Regulations, 49 CFR Parts 100-180, as well as Part 40 as it pertains to the drug and alcohol testing requirements. The overall goal of OMC is to improve the safe transportation of passengers and goods on the Nation's highways, through a coordinated effort of Federal, State, and industry organizations to reduce fatalities, injuries, property damage and Hazardous Materials incidents.

http://www.bts.gov - The Bureau of Transportation Statistics (BTS) is an operating administration of the U.S. Department of Transportation (DOT). The Bureau is headed by a Director appointed by the President and confirmed by the Senate. BTS started operations in December 1992, and is required by the Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991 to improve the knowledge base for public decision making, and to improve public awareness of the nation's transportation system and its consequences. BTS compiles, analyzes, and makes accessible information on the Nation's transportation systems; collects

information on intermodal transportation and other areas as needed; and works to enhance the quality and effectiveness of government statistics.

http://www.ntsb.gov/Surface/Highway/highway.htm - The National Transportation Safety Board is an independent Federal agency charged by Congress with investigating every civil aviation accident in the United States and significant accidents in the other modes of transportation -- railroad, highway, marine and pipeline -- and issuing safety recommendations aimed at preventing future accidents.

http://www.umtri.umich.edu - University of Michigan Transportation Research Institute, UMTRI provides a setting where its research scientists and other University faculty collaborate to accomplish multidisciplinary transportation research, generating new basic knowledge and providing research training for students. Broad areas of research include crash-data collection and traffic-safety analysis, bioengineering, human factors, mechanical engineering, psychology, economics, public policy, and marine systems.

http://www.truck.net/t-safedu.html - Truck Safety and Education

http://www.olblueusa.org –Ol' Blue, USA (United Safety Alliance, Inc), a non-profit 501 (c) (3) charitable organization, is dedicated to promoting traffic safety and improving relations between law enforcement, commercial drivers and the motoring public. During our National Safety Tour "Ol' Blue", a 1951 working truck, pulls a 53-foot "Rolling Billboard" trailer featuring our sponsor's logos and those of the California Highway Patrol, Kentucky Vehicle Enforcement, Nevada Highway Patrol, and the U.S. Department of Transportation. We conduct simulated truck inspections at trade shows and truck stops. We also take our various programs to community events and public schools in our efforts to teach safety around all large vehicles.

http://www.theautochannel.com/mania/behind/ts.html - How to Avoid Getting Killed in Your Big Rig – Information on how to handle truck fires, rollovers and other dangerous situations.

http://www.mscarita.com/truck.html - Truck Safety Products

http://www.auditor.leg.state.mn.us/pe9305.htm - Truck Safety Regulation

http://www.trucking-litigation.com/facts.htm - Trucking Information Fact Sheet

http://www.naghsr.org/policy/h.html - Highway Safety Policies & Priorities

http://www.saferoads.org/policy/truck.html – Advocates For Highway and Auto
Safety Advocates for Highway and Auto Safety is an alliance of consumer, health and safety groups and insurance companies and agents working together to make America's roads safer. Advocates encourage the adoption of federal and state laws, policies and programs that save lives and reduce injuries. By joining its resources with others, Advocates helps build coalitions to increase participation of a wide array of groups in public policy initiatives which advance highway and auto safety.

http://www.timbermen.org/truck_safety.html - Objective of the Task Force - Task Force members have identified equipment improvements, management practices, training programs, safety inspections and enforcement actions that can enhance the professional operation of log trucks in Michigan. The Task Force vision for the future is to have: All Professional Truckers of Wood Products Operate in a Safe Manner So Other Road Users Are Comfortable When Meeting Log Trucks on the Public Highways.

http://www.faculty.econ.nwu.edu/faculty/savage/truck.html - Summary of Research by Leon N. Moses and Ian Savage on Truck Safety – This research work was funded by the University Transportation Centers program from the US DOT. The FHWA-OMC made available their entire database for both Safety Review and Compliance Review (SR/CR) audits and roadside inspections. The database contains information on the characteristics and safety performances of 75,000 U.S. motor carrier firms, and is therefore considerably larger than any other that has been used in formal analyses of motor carrier accidents

http://www.mtsc.org/Default.htm - Through a joint effort between state government & the trucking industry of Michigan, the Michigan Legislature created the Michigan Truck Safety Commission with Public Act 348 in 1988. This project's goal is to increase safety on Michigan's highways through a greater understanding and cooperation between truck and automobile drivers.

http://ntl.bts.gov/ntl/DOCS/435.html - Final Report: Advanced Technologies for Improving Large-truck Safety on Two-Lane Secondary Roads

http://www.servmat.com/ServicesMaterials/trucksaf.htm - AUTO & TRUCK SAFETY Products

http://www.transportnews.com – Truck and transportation related news and articles.

http://192.41.46.227/index.htm - layover.com is a one-stop trucking resource providing information on all aspects of the trucking industry.

http://www.truckerbuddy.org - Trucker Buddy is a non-profit 501(c)(3) organization dedicated to helping educate and mentor the nation's schoolchildren via a pen-pal relationship between professional truck drivers and children in grades 2-8. Trucker Buddy matches classes of students with professional truck drivers.

http://www.loads.org - LOADS is an international support group for the families of truckers and truckers themselves. LOADS is established to give trucking families a haven of support in an atmosphere of understanding.

http://www.toyconvoy.com/homepage.htm – Organization uses toy filled 18-wheeler to educate young children on truck safety and driving around commercial vehicles.

http://deep13.ra.utk.edu/tc/ts/default.html - The Goal of the International Large Truck Safety Symposium is to bring together carriers, shippers, inspectors, law enforcement officials, highway

officials, insurers, regulators, manufacturers, and researchers to identify and discuss key issues affecting large truck safety.

http://www.ontruck.org/info/index.htm - The Ontario Trucking Association (OTA) was founded in 1926, and provides services and public policy advocacy for trucking companies hauling freight into, out of and within the Province of Ontario and the continent. OTA presently has about 1700 member companies and is the only trucking association in Ontario that represents and has members from all segments of the industry -- for-hire carriers, private carriers, owner-operators, intermodal, suppliers, etc.

http://www.odot.state.or.us/motcarr/hweb/welcome.htm - The mission of the Motor Carrier Transportation Division is to promote a safe, efficient, and responsible commercial transportation industry by simplifying compliance, reducing regulatory requirements, wherever appropriate, preserving the infrastructure, enhancing the private/ public partnership, fostering effective two-way communication, and delivering superior customer service while recognizing the vital economic interests of the commercial transportation industry.

http://www.truck.com - Welcome to Truck.Net - Your complete information source for the trucking industry.
This site is your gateway to a very large database of trucking directories and lists.

http://www.trafficsafety.org - The NETS mission is to reduce traffic crashes involving America's workers and their families by helping employers implement well-developed policies, dynamic workplace programs, and compelling community activities related to traffic safety. Government and industry leaders created the organization to address the human and economic impact of traffic crashes on the nation's workforce as well as their families and communities. NETS is the only national non-profit organization that focuses its efforts exclusively on introducing traffic to workplace safety management systems. The programs, products and services are designed to reach all employees and their families, not just fleet drivers.

http://www.nandotimes.com/politics/story/body/0,1066,52978-84946-602413-1,00.html - Outline of new truck-safety proposals

http://www.truckingsolutions.com - A Free Speech Internet Publication
Dedicated to Truck Safety Issues On America's Highways

http://www.tfhrc.gov/safety/hsis/94-022.htm - Research as part of Grants for Research Fellowships Program (GRF) study developed truck accident models for Interstates and two-lane rural roads as a function of relevant geometric features.

http://aloha.net/~dyc/truck.html - Trucking brings daily food and commodities. We love that. And yet, truckers have an image problem. People often resent sharing the road with large trucks. Truckers feel their needs are misunderstood and they're conscious of an image problem. DrDriving wants to help improve relations between 4-wheelers and 18-wheelers. Articles, surveys, links, advice, news, analyses, networking.

http://www.trucksafety.org - The trucking industry in the United States is currently plagued by numerous safety problems. Oversize and overweight trucks, truck driver fatigue, substandard vehicle maintenance, and insufficient regulatory enforcement are all obstacles to safe trucking operations. The trucking industry consistently places productivity concerns over issues of safety. But we feel that the U.S. Congress, regulatory bodies, and trucking interests have a joint responsibility to truck drivers and to the motoring public to make truck safety a top priority. Safety can be an integral part of trucking operations, and it is our goal to see that U.S. legislators work with trucking interests to set safety as their highest priority.

http://www.saferoads.com - Traffic Safety in Alberta is comprised of various stakeholders and community partners who share a common interest in traffic safety awareness. This web site centralizes their various literature and resources, and represents a united effort to promote responsible driving and safer communities.

http://www.ruhl.com - Ruhl and Associates - Forensic, Inc.'s staff of engineers, accident reconstructionists, heavy vehicle specialists and graphic artists is available to help you meet your needs. Our experts provide a continuum of service from initial on-site investigations through research, testing and reconstruction to courtroom testimony and presentation graphics and animation

http://www.pde.drivers.com/org.html - Global community for traffic safety education and driver training

http://www.mtsc.org/about.htm - The Michigan Truck Safety Commission (MTSC) is a unique organization, created through a joint venture between the trucking industry and the Michigan Legislature with P.A. 348 in 1988. MTSC is dedicated to improving highway safety through safer truck travel. MTSC provides a variety of safety training programs at either no charge or at a minimal fee to Michigan's commercial carriers.

http://www.e-z.net/~ts/ts/ts.html - Technical Services provides EXPERT OPINION for the Legal Profession and the Insurance Industry in the following areas:- Highway Accident Reconstruction: Computer Simulation, speeds, avoidability, damage analysis, vehicle handling, etc.- Automotive Products: Crashworthiness, airbags, failure analysis, rollover propensity etc.- Human Factors: Psychotropic agents (drugs) and driver performance, reaction times, visibility, conspicuity, warnings and instructions. - Failure Analysis: Fires, Brakes, Engines and other Automotive Components, Construction and Agricultural Equipment.

http://www.apneanet.org/apss98_sleepydrivers.htm - The Apnea Patient's News, Education & Awareness Network. Information on drowsy drivers and hazards.

Appendix G
Tables of Frequencies

Tables A1-A41 show frequencies from the master or "A" Records for the years of 1996 through 1998.

Table A1 - Accident Year

Accident Year	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
96	295	36.1	36.1	36.1
97	298	36.4	36.4	72.5
98	225	27.5	27.5	100.0
Total	818	100.0	100.0	

Table A2 - Accident Month

Accident Month	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
January	99	12.1	12.1	12.1
February	59	7.2	7.2	19.3
March	65	7.9	7.9	27.3
April	60	7.3	7.3	34.6
May	43	5.3	5.3	39.9
June	47	5.7	5.7	45.6
July	50	6.1	6.1	51.7
August	67	8.2	8.2	59.9
September	77	9.4	9.4	69.3
October	72	8.8	8.8	78.1
November	93	11.4	11.4	89.5
December	86	10.5	10.5	100.0
Total	818	100.0	100.0	

Table A3 - Day of Week

Day of Week	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
Sunday	50	6.1	6.1	6.1
Monday	122	14.9	14.9	21.0
Tuesday	138	16.9	16.9	37.9
Wednesday	133	16.3	16.3	54.2
Thursday	138	16.9	16.9	71.0

Day of Week	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
Friday	157	19.2	19.2	90.2
Saturday	80	9.8	9.8	100.0
Total	818	100.0	100.0	

Table A4 - Hour of Accident

Hour	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
12:00 - 12:59 am	10	1.2	1.2	1.2
1:00 - 1:59 am	16	2.0	2.0	3.2
2:00 - 2:59 am	21	2.6	2.6	5.7
3:00 - 3:59 am	18	2.2	2.2	7.9
4:00 - 4:59 am	21	2.6	2.6	10.5
5:00 - 5:59 am	22	2.7	2.7	13.2
6:00 - 6:59 am	23	2.8	2.8	16.0
7:00 - 7:59 am	41	5.0	5.0	21.0
8:00 - 8:59 am	42	5.1	5.1	26.2
9:00 - 9:59 am	65	7.9	7.9	34.1
10:00 - 10:59 am	43	5.3	5.3	39.4
11:00 - 11:59 am	40	4.9	4.9	44.3
12:00 - 12:59 pm	44	5.4	5.4	49.6
1:00 - 1:59 pm	43	5.3	5.3	54.9
2:00 - 2:59 pm	65	7.9	7.9	62.8
3:00 - 3:59 pm	57	7.0	7.0	69.8
4:00 - 4:59 pm	54	6.6	6.6	76.4
5:00 - 5:59 pm	45	5.5	5.5	81.9
6:00 - 6:59 pm	43	5.3	5.3	87.2
7:00 - 7:59 pm	43	5.3	5.3	92.4
8:00 - 8:59 pm	16	2.0	2.0	94.4
9:00 - 9:59 pm	16	2.0	2.0	96.3
10:00 - 10:59 pm	13	1.6	1.6	97.9
11:00 - 11:59 pm	16	2.0	2.0	99.9
Midnight	1	0.1	0.1	100.0
Total	818	100.0	100.0	

Table A5 - County of Accident

County	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
Aurora	15	1.8	1.8	1.8
Beadle	9	1.1	1.1	2.9
Bennett	5	0.6	0.6	3.5
Bon Homme	1	0.1	0.1	3.7
Brookings	20	2.4	2.4	6.1
Brown	29	3.5	3.5	9.7
Brule	7	0.9	0.9	10.5
Buffalo	2	0.2	0.2	10.8
Butte	15	1.8	1.8	12.6
Campbell	2	0.2	0.2	12.8
Charles Mix	7	0.9	0.9	13.7
Clark	5	0.6	0.6	14.3
Clay	8	1.0	1.0	15.3
Codington	26	3.2	3.2	18.5
Corson	9	1.1	1.1	19.6
Custer	11	1.3	1.3	20.9
Davison	15	1.8	1.8	22.7
Day	11	1.3	1.3	24.1
Deuel	18	2.2	2.2	26.3
Dewey	2	0.2	0.2	26.5
Douglas	8	1.0	1.0	27.5
Edmunds	3	0.4	0.4	27.9
Fall River	11	1.3	1.3	29.2
Faulk	4	0.5	0.5	29.7
Grant	9	1.1	1.1	30.8
Gregory	9	1.1	1.1	31.9
Haakon	3	0.4	0.4	32.3
Hamlin	11	1.3	1.3	33.6
Hand	4	0.5	0.5	34.1
Hanson	11	1.3	1.3	35.5
Harding	5	0.6	0.6	36.1
Hughes	10	1.2	1.2	37.3
Hutchinson	5	0.6	0.6	37.9
Jackson	31	3.8	3.8	41.7
Jerauld	2	0.2	0.2	41.9
Jones	16	2.0	2.0	43.9
Kingsbury	10	1.2	1.2	45.1

County	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
Lake	9	1.1	1.1	46.2
Lawrence	25	3.1	3.1	49.3
Lincoln	26	3.2	3.2	52.4
Lyman	24	2.9	2.9	55.4
Mc Cook	7	0.9	0.9	56.2
Mc Pherson	3	0.4	0.4	56.6
Marshall	5	0.6	0.6	57.2
Meade	21	2.6	2.6	59.8
Miner	3	0.4	0.4	60.1
Minnehaha	74	9.0	9.0	69.2
Moody	15	1.8	1.8	71.0
Pennington	81	9.9	9.9	80.9
Perkins	17	2.1	2.1	83.0
Potter	7	0.9	0.9	83.9
Roberts	20	2.4	2.4	86.3
Sanborn	6	0.7	0.7	87.0
Spink	17	2.1	2.1	89.1
Stanley	9	1.1	1.1	90.2
Sully	5	0.6	0.6	90.8
Todd	5	0.6	0.6	91.4
Tripp	9	1.1	1.1	92.5
Turner	8	1.0	1.0	93.5
Union	30	3.7	3.7	97.2
Walworth	10	1.2	1.2	98.4
Yankton	11	1.3	1.3	99.8
Ziebach	2	0.2	0.2	100.0
Total	818	100.0	100.0	

Table A6 - Population Group

Population Group	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
Not Incorporated	675	82.5	82.5	82.5
1-499	15	1.8	1.8	84.4
500-999	5	0.6	0.6	85.0
1,000-2,499	7	0.9	0.9	85.8
2,500-4,999	7	0.9	0.9	86.7
5,000-9,999	7	0.9	0.9	87.5
10,000-24,999	29	3.5	3.5	91.1
25,000-49,999	49	6.0	6.0	97.1
50,000-99,999	24	2.9	2.9	100.0
Total	818	100.0	100.0	

Table A7 - South Dakota Highway System

SD Highway System	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
State Trunk Highway System	679	83.0	83.0	83.0
Rural Road - (Non State Trunk)	107	13.1	13.1	96.1
City Street (Pop less than 5,000)	7	0.9	0.9	96.9
Small Urban (Pop 5,000-49,999)	14	1.7	1.7	98.7
Sioux Falls	4	0.5	0.5	99.1
Rapid City	7	0.9	0.9	100.0
Total	818	100.0	100.0	

Table A8 - Federal Highway System

Federal Highway System	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
Fed-Aid Interstate Rural	246	30.1	30.1	30.1
Fed-Aid Interstate Urban	206	25.2	25.2	55.3
Fed-Aid Primary Urban Principal Arterial	134	16.4	16.4	71.6
Fed-Aid Primary Urb Prin Art Connect Link Rural Minor	79	9.7	9.7	81.3
Fed-Aid Sec Rural Major Collector	7	0.9	0.9	82.2
Fed-Aid Urban Freeway Non-Connecting Link	37	4.5	4.5	86.7
Fed-Aid Urban Minor Arterial	35	4.3	4.3	91.0
Non Fed-Aid Rural Minor Arterial	41	5.0	5.0	96.0
Non Fed-Aid Rural Minor Collector	22	2.7	2.7	98.7
Non Fed-Aid Rural Local Roads(Not classified)	4	0.5	0.5	99.1
Non Fed-Aid Urban Principal Arterial Non-connecting Link	7	0.9	0.9	100.0
Total	818	100.0	100.0	

Table A9 - Highway Number

Highway Number	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
Not Coded	139	17.0	17.0	17.0
10	7	0.9	0.9	17.8
11	4	0.5	0.5	18.3
12	37	4.5	4.5	22.9
13	1	0.1	0.1	23.0
14	32	3.9	3.9	26.9
15	4	0.5	0.5	27.4
16	23	2.8	2.8	30.2
17	1	0.1	0.1	30.3
18	29	3.5	3.5	33.9
19	2	0.2	0.2	34.1
20	12	1.5	1.5	35.6

Highway Number	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
22	4	0.5	0.5	36.1
25	4	0.5	0.5	36.6
28	6	0.7	0.7	37.3
29	107	13.1	13.1	50.4
34	24	2.9	2.9	53.3
37	14	1.7	1.7	55.0
38	1	0.1	0.1	55.1
42	2	0.2	0.2	55.4
44	14	1.7	1.7	57.1
45	1	0.1	0.1	57.2
46	4	0.5	0.5	57.7
47	7	0.9	0.9	58.6
49	1	0.1	0.1	58.7
50	14	1.7	1.7	60.4
63	3	0.4	0.4	60.8
65	1	0.1	0.1	60.9
71	1	0.1	0.1	61.0
73	15	1.8	1.8	62.8
79	18	2.2	2.2	65.0
81	13	1.6	1.6	66.6
83	17	2.1	2.1	68.7
85	8	1.0	1.0	69.7
90	168	20.5	20.5	90.2
105	1	0.1	0.1	90.3
115	2	0.2	0.2	90.6
180	1	0.1	0.1	90.7
183	2	0.2	0.2	91.0
212	33	4.0	4.0	95.0
229	6	0.7	0.7	95.7
236	1	0.1	0.1	95.8
238	2	0.2	0.2	96.1
281	28	3.4	3.4	99.5
385	2	0.2	0.2	99.8
437	1	0.1	0.1	99.9
445	1	0.1	0.1	100.0
Total	818	100.0	100.0	

Table A10 - Highway Class

Highway Class	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
State road	679	83.0	83.0	83.0
County road	107	13.1	13.1	96.1
City road	21	2.6	2.6	98.7
Sioux Falls	4	0.5	0.5	99.1
Rapid City	7	0.9	0.9	100.0
Total	818	100.0	100.0	

Table A11 - SUF

SUF	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
	489	59.8	59.8	59.8
B	16	2.0	2.0	61.7
E	100	12.2	12.2	74.0
EB	1	0.1	0.1	74.1
EL	1	0.1	0.1	74.2
N	63	7.7	7.7	81.9
S	60	7.3	7.3	89.2
W	80	9.8	9.8	99.0
WB	1	0.1	0.1	99.1
4	1	0.1	0.1	99.3
A	6	0.7	0.7	100.0
Total	818	100.0	100.0	

Table A12 - First Harmful Event

First Harmful Event	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
Non-Collision Overturning Accident	246	30.1	30.1	30.1
Other Non-Collision accident	72	8.8	8.8	38.9
Collision Involving Pedestrian	1	0.1	0.1	39.0
Collision Involving Motor Vehicle in Transport (Not Parked)	379	46.3	46.3	85.3
Collision Involving Parked Motor Vehicle	4	0.5	0.5	85.8
Collision Involving Railway Vehicle	5	0.6	0.6	86.4
Collision Involving Bicycle	4	0.5	0.5	86.9
Collision Involving Animal	18	2.2	2.2	89.1
Collision Involving Fixed Object	72	8.8	8.8	97.9
Collision Involving Other Object	17	2.1	2.1	100.0
Total	818	100.0	100.0	

Table A13 - Manner of Collision

Manner of Collision	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
Not Collision with Motor Vehicle in Transport	439	53.7	53.7	53.7
Rear-end	135	16.5	16.5	70.2
Head-on	30	3.7	3.7	73.8
Angle	60	7.3	7.3	81.2
Sideswipe-Same Direction	61	7.5	7.5	88.6
Sideswipe-Opposite Direction	23	2.8	2.8	91.4
Turning Movement	66	8.1	8.1	99.5
Backing Movement	4	0.5	0.5	100.0
Total	818	100.0	100.0	

Table A14 - Accident Severity

Accident Severity	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
Property Damage Only	391	47.8	47.8	47.8
Fatal	47	5.7	5.7	53.5
Incapacitating Injury	159	19.4	19.4	73.0
Non-Incapacitating Injury	138	16.9	16.9	89.9
Possible Injury	83	10.1	10.1	100.0
Total	818	100.0	100.0	

Table A15 - Number Killed

Number Killed	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
0	771	94.3	94.3	94.3
1	38	4.6	4.6	98.9
2	6	0.7	0.7	99.6
3	2	0.2	0.2	99.9
4	1	0.1	0.1	100.0
Total	818	100.0	100.0	

Table A16 - Number Injured

Number Injured	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
0	416	50.9	50.9	50.9
1	286	35.0	35.0	85.8
2	74	9.0	9.0	94.9
3	26	3.2	3.2	98.0
4	8	1.0	1.0	99.0
5	4	0.5	0.5	99.5
10	1	0.1	0.1	99.6
11	2	0.2	0.2	99.9
28	1	0.1	0.1	100.0
Total	818	100.0	100.0	

Table A17 - Number of Vehicles

Number of Vehicles	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
1	428	52.3	52.3	52.3
2	364	44.5	44.5	96.8
3	18	2.2	2.2	99.0
4	4	0.5	0.5	99.5
5	3	0.4	0.4	99.9
7	1	0.1	0.1	100.0
Total	818	100.0	100.0	

Table A18 - Number of Drivers

Number of Drivers	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
0	1	0.1	0.1	0.1
1	441	53.9	53.9	54.0
2	351	42.9	42.9	96.9
3	17	2.1	2.1	99.0
4	5	0.6	0.6	99.6
5	2	0.2	0.2	99.9
7	1	0.1	0.1	100.0
Total	818	100.0	100.0	

Table A19 - Number of Passengers

Number of Passengers	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
0	686	83.9	83.9	83.9
1	90	11.0	11.0	94.9
2	25	3.1	3.1	97.9
3	4	0.5	0.5	98.4
4	9	1.1	1.1	99.5
6	1	0.1	0.1	99.6
10	2	0.2	0.2	99.9
28	1	0.1	0.1	100.0
Total	818	100.0	100.0	

Table A20 - Number of Pedestrians

Number of Pedestrians	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
0	817	99.9	99.9	99.9
1	1	0.1	0.1	100.0
Total	818	100.0	100.0	

Table A21 - Number of Other Drivers

Number of Other Drivers	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
0	813	99.4	99.4	99.4
1	5	0.6	0.6	100.0
Total	818	100.0	100.0	

Table A22 - Light Conditions

Light Conditions	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
Daylight	551	67.4	67.4	67.4
Dawn	20	2.4	2.4	69.8
Dusk	22	2.7	2.7	72.5
Dark - Lighted	24	2.9	2.9	75.4
Dark - Not Lighted	200	24.4	24.4	99.9
Unknown	1	0.1	0.1	100.0
Total	818	100.0	100.0	

Table A23 - Weather Conditions

Weather Conditions	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
Clear	425	52.0	52.0	52.0
Cloudy	169	20.7	20.7	72.6
Raining	61	7.5	7.5	80.1
Sleet, Hail, Freezing Rain	22	2.7	2.7	82.8
Snowing	105	12.8	12.8	95.6
Fog, Smoke	24	2.9	2.9	98.5
Dust Storm	2	0.2	0.2	98.8
Other	10	1.2	1.2	100.0
Total	818	100.0	100.0	

Table A24 - Surface Conditions

Surface Conditions	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
Dry	498	60.9	60.9	60.9
Wet	80	9.8	9.8	70.7
Ice	133	16.3	16.3	86.9
Frost	12	1.5	1.5	88.4
Slush	25	3.1	3.1	91.4
Snow	66	8.1	8.1	99.5
Other	4	0.5	0.5	100.0
Total	818	100.0	100.0	

Table A25 - Surface Type

Surface Type	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
Concrete	381	46.6	46.6	46.6
Blacktop	385	47.1	47.1	93.6
Gravel	47	5.7	5.7	99.4
Dirt	3	0.4	0.4	99.8
Other	2	0.2	0.2	100.0
Total	818	100.0	100.0	

Table A26 - Junction Type

Junction Type	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
Non-Junction	522	63.8	63.8	63.8
Intersection	158	19.3	19.3	83.1
Intersection Related	21	2.6	2.6	85.7
Interchange Area	67	8.2	8.2	93.9
Driveway Access	40	4.9	4.9	98.8
Rail Grade Crossing	7	0.9	0.9	99.6
Crossover Related	3	0.4	0.4	100.0
Total	818	100.0	100.0	

Table A27 - Relation to Roadway

Relation to Roadway	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
On Roadway	525	64.2	64.2	64.2
Shoulder	95	11.6	11.6	75.8
Median	48	5.9	5.9	81.7
Roadside	139	17.0	17.0	98.7
Outside of Right-of-Way	11	1.3	1.3	100.0
Total	818	100.0	100.0	

Table A28 - Character of Roadway

Character of Roadway	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
Straight Road Level	530	64.8	64.8	64.8
Straight Road Hillcrest	41	5.0	5.0	69.8
Straight Road on Grade	129	15.8	15.8	85.6
Curve Level	61	7.5	7.5	93.0
Curve Hillcrest	6	0.7	0.7	93.8
Curve on Grade	51	6.2	6.2	100.0
Total	818	100.0	100.0	

Table A29 - Highway Suffix Direction

Highway Suffix Direction	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
1	507	62.0	62.0	62.0
2	295	36.1	36.1	98.0
3	6	0.7	0.7	98.8
4	10	1.2	1.2	100.0
Total	818	100.0	100.0	

Table A30 - Traffic Controls

Traffic Controls	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
No Controls	653	79.8	79.8	79.8
Stop Sign	94	11.5	11.5	91.3
Yield Sign	10	1.2	1.2	92.5
Traffic Control Signal	41	5.0	5.0	97.6
RR Crossing Signal	1	0.1	0.1	97.7
RR Crossbucks/Pavement Markings/Signs	5	0.6	0.6	98.3
Other	13	1.6	1.6	99.9
Unknown	1	0.1	0.1	100.0
Total	818	100.0	100.0	

Table A31 - Special Location

Special Location	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
Not Special Location	734	89.7	89.7	89.7
Bridge-Vehicle Traveling Over	35	4.3	4.3	94.0
Bridge-Vehicle Traveling Under	14	1.7	1.7	95.7
Railroad Crossing	7	0.9	0.9	96.6
Entrance or Exit Ramp	28	3.4	3.4	100.0
Total	818	100.0	100.0	

Table A32 - First Object Hit

First Object Hit	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
No Objects Hit	581	71.0	71.0	71.0
Culvert	7	0.9	0.9	71.9
Mailbox	2	0.2	0.2	72.1
Curb	12	1.5	1.5	73.6
Median Divider	1	0.1	0.1	73.7
Embankment	15	1.8	1.8	75.6
Approach	13	1.6	1.6	77.1
Fence	39	4.8	4.8	81.9
Guardrail	30	3.7	3.7	85.6
Light Pole	3	0.4	0.4	85.9
Sign Post	24	2.9	2.9	88.9
Utility Pole	3	0.4	0.4	89.2
Delineator Post	39	4.8	4.8	94.0
Bridge-Veh Traveling Over	4	0.5	0.5	94.5
Bridge-Veh Traveling Under	6	0.7	0.7	95.2
Tree/Shrubbery	6	0.7	0.7	96.0
Rock	1	0.1	0.1	96.1
Barricade	3	0.4	0.4	96.5
Animal - Wild (Deer, Antelope)	5	0.6	0.6	97.1
Animal - Domestic(Cow, Horse, or Hog)	12	1.5	1.5	98.5
Other	11	1.3	1.3	99.9
Unknown	1	0.1	0.1	100.0
Total	818	100	100	

Table A33 - Second Object Hit

Second Object Hit	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
No Objects Hit	759	92.8	92.8	92.8
Culvert	1	0.1	0.1	92.9
Embankment	3	0.4	0.4	93.3
Approach	1	0.1	0.1	93.4
Fence	14	1.7	1.7	95.1
Guardrail	2	0.2	0.2	95.4
Light Pole	2	0.2	0.2	95.6
Sign Post	2	0.2	0.2	95.8
Sign Post	2	0.2	0.2	96.1
Utility Pole	17	2.1	2.1	98.2
Bridge - Veh. Traveling Over	8	1.0	1.0	99.1
Bridge - Veh Traveling Under	2	0.2	0.2	99.4
Animal – Wild (Deer, Antelope)	1	0.1	0.1	99.5
Animal - Domestic (Cow, Horse, or Hog)	1	0.1	0.1	99.6
Other	2	0.2	0.2	99.9
Unknown	1	0.1	0.1	100.0
Total	818	100.0	100.0	

Table A34 - Contributing Circumstances First Vision Obscurement 1

Vision Obscurement 1	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
None	639	78.1	78.1	78.1
Fog, Smoke	17	2.1	2.1	80.2
Blowing Soil, Dirt, Sand	8	1.0	1.0	81.2
Rain, Snow, Sleet, Hail	82	10.0	10.0	91.2
Windshield or other window obscured by Frost, Snow, or Mud	3	0.4	0.4	91.6
Glare from Sun, Lights, or Reflection	12	1.5	1.5	93.0
Trees, Crops, Bushes, Other Vegetation	6	0.7	0.7	93.8
Snow bank	6	0.7	0.7	94.5
Hill	7	0.9	0.9	95.4
Curve	10	1.2	1.2	96.6
Motor Vehicle Not Parked	7	0.9	0.9	97.4
Motor Vehicle Parked	3	0.4	0.4	97.8
Signs, Billboard, etc	1	0.1	0.1	97.9
Other	13	1.6	1.6	99.5
Unknown	4	0.5	0.5	100.0
Total	818	100.0	100.0	

Table A35 - Contributing Circumstances Second Vision Obscurement

Vision Obscurement 2	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
None	795	97.2	97.2	97.2
Rain, Snow, Sleet, Hail	1	0.1	0.1	97.3
Windshield or other window obscured by Frost, Snow, or Mud	1	0.1	0.1	97.4
Glare from Sun, Lights, Reflection	1	0.1	0.1	97.6
Snow bank	7	0.9	0.9	98.4
Hill	2	0.2	0.2	98.7
Curve	2	0.2	0.2	98.9
Motor Vehicle Not Parked	3	0.4	0.4	99.3
Signs, Billboard, etc.	1	0.1	0.1	99.4
Other	1	0.1	0.1	99.5
Unknown	4	0.5	0.5	100.0
Total	818	100.0	100.0	

Table A36 - Other Contributing Circumstances 1

Other Contributing Circumstances 1	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
None	446	54.5	54.5	54.5
Crosswind	88	10.8	10.8	65.3
Wind from Passing Vehicle	6	0.7	0.7	66.0
Slippery Surface	185	22.6	22.6	88.6
Shoulder (High, Low, Soft)	20	2.4	2.4	91.1
Debris, Objects, Animals or Vehicles in Road	27	3.3	3.3	94.4
Ruts, Holes, Bumps	3	0.4	0.4	94.7
Phantom Vehicle	5	0.6	0.6	95.4
Pedestrians, Bicycles, Other	2	0.2	0.2	95.6
Construction or Maintenance Created Conditions	9	1.1	1.1	96.7
Traffic Control Device Malfunction or Missing	1	0.1	0.1	96.8
Other	21	2.6	2.6	99.4
Unknown	5	0.6	0.6	100.0
Total	818	100.0	100.0	

Table A37 - Other Contributing Circumstances 2

Other Contributing Circumstances 2	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
None	748	91.4	91.4	91.4
Crosswind	3	0.4	0.4	91.8
Wind From Passing Vehicle	1	0.1	0.1	91.9
Slippery Surface	32	3.9	3.9	95.8
Shoulder (High, Low, Soft)	3	0.4	0.4	96.2
Debris, Objects, Animals or Vehicles in Road	10	1.2	1.2	97.4
Ruts, Holes, Bumps	2	0.2	0.2	97.7
Phantom Vehicle	4	0.5	0.5	98.2
Construction or Maintenance	3	0.4	0.4	98.5
Other	7	0.9	0.9	99.4
Unknown	5	0.6	0.6	100.0
Total	818	100.0	100.0	

Table A38 - Construction Maintenance Zone

Construction Maintenance Zone	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
None	794	97.1	97.1	97.1
Construction Zone	20	2.4	2.4	99.5
Maintenance Zone	4	0.5	0.5	100.0
Total	818	100.0	100.0	

Table A39 - Hazardous Materials Spilled

Hazardous Materials Spilled	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
No Spill	781	95.5	95.5	95.5
Material Spilled	36	4.4	4.4	99.9
Unknown	1	0.1	0.1	100.0
Total	818	100.0	100.0	

Table A40 - On Scene/Off Scene

On Scene/Off Scene	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
On Scene - One or More Accident Vehicles Present	802	98.0	98.0	98.0
On Scene - Accident Vehicles Not Present	1	0.1	0.1	98.2
Off Scene	15	1.8	1.8	100.0
Total	818	100.0	100.0	

Table A41 - Agency Filing Report

Agency Filing Report	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
Highway Patrol	564	68.9	68.9	68.9
Sheriff Department	157	19.2	19.2	88.1
Municipal/City Police	96	11.7	11.7	99.9
BIA	1	0.1	0.1	100.0
Total	818	100.0	100.0	

Tables V1-V39 show frequencies from the vehicle or "V" Records for the years of 1996 through 1998.

Table V1 - Age Groups

Age Group	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
14-15	9	0.7	0.7	0.7
16-19	67	5.4	5.5	6.2
20-24	122	9.8	10.0	16.2
25-29	127	10.2	10.4	26.5
30-34	141	11.3	11.5	38.0
35-39	153	12.3	12.5	50.5
40-44	156	12.5	12.7	63.2
45-49	138	11.1	11.3	74.5
50-54	81	6.5	6.6	81.1
55-59	74	5.9	6.0	87.1
60-64	53	4.3	4.3	91.4
65+	102	8.2	8.3	99.8
Unknown	3	0.2	0.2	100.0
Total	1226	98.6	100.0	
Missing	18	1.4		
Total	1244	100.0		

Table V2 - Gender

Gender	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
Male	1065	85.6	86.9	86.9
Female	159	12.8	13.0	99.8
Unknown	2	0.2	0.2	100.0
Total	1226	98.6	100.0	
Missing	18	1.4		
Total	1244	100.0		

Table V3 - Ejection

Ejection	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
Not Applicable, Pedestrian, Bicycle, Motorcycle	3	0.2	0.2	0.2
Not Ejected	1202	96.6	98.0	98.3
Partial Ejection	7	0.6	0.6	98.9
Total Ejection	12	1.0	1.0	99.8
Unknown	2	0.2	0.2	100.0
Total	1226	98.6	100.0	
Missing	18	1.4		
Total	1244	100.0		

Table V4 - Injury Classification

Injury Classification	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
No Injury	797	64.1	65.0	65.0
Fatal	39	3.1	3.2	68.2
Incapacitating Injury	147	11.8	12.0	80.2
Non-incapacitating Injury	142	11.4	11.6	91.8
Possible Injury	101	8.1	8.2	100.0
Total	1226	98.6	100.0	
Missing	18	1.4		
Total	1244	100.0		

Table V5 - Location Prior to Impact

Location Prior to Impact	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
Front Seat Left Side	1226	98.6	100.0	100.0
Missing	18	1.4		
Total	1244	100.0		

Table V6 - Safety Equipment

Safety Equipment	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
No Safety Equipment Used	300	24.1	24.5	24.5
Lap Belt Only Used	122	9.8	10.0	34.4
Shoulder Harness Only Used	9	0.7	0.7	35.2
Lap Belt and Shoulder Harness Used	739	59.4	60.3	95.4
Helmet Only	1	0.1	0.1	95.5
Eye Protection Only	1	0.1	0.1	95.6
Other	4	0.3	0.3	95.9
Unknown	50	4.0	4.1	100.0
Total	1226	98.6	100.0	
Missing	18	1.4		
Total	1244	100.0		

Table V7 - Alcohol/Drug Involvement

Alcohol/Drug Involvement	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
None	1166	93.7	95.1	95.1
Alcohol Only	34	2.7	2.8	97.9
Drugs Only	2	0.2	0.2	98.0
Unknown	24	1.9	2.0	100.0
Total	1226	98.6	100.0	
Missing	18	1.4		
Total	1244	100.0		

Table V8 - Blood Alcohol Content Test Results

BAC Test Results	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
0	79	6.4	6.4	6.4
2	1	0.1	0.1	6.4
3	1	0.1	0.1	6.5
4	1	0.1	0.1	6.6
5	1	0.1	0.1	6.7
14	1	0.1	0.1	6.8
16	1	0.1	0.1	6.8
18	1	0.1	0.1	6.9
19	1	0.1	0.1	7.0
22	1	0.1	0.1	7.1
28	1	0.1	0.1	7.2
34	1	0.1	0.1	7.2
Test Refused	5	0.4	0.4	7.6
No Test Given	1119	90.0	90.0	97.6
BAC Test Given but Sample Unusable	1	0.1	0.1	97.7
BAC Test Given but Results Unobtainable	17	1.4	1.4	99.0
Not Stated	11	0.9	0.9	99.9
Unknown	1	0.1	0.1	100.0
Total	1244	100.0	100.0	

Table V9 - Driver Contributing Circumstances 1

Driver Contributing Circumstances 1	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
None	614	49.4	50.1	50.1
Exceeded Speed Limit	34	2.7	2.8	52.9
Exceeded Safe Speed but Not Limit	189	15.2	15.4	68.3
Driving Under Posted Minimum Speed	10	0.8	0.8	69.1
Failed to Yield to Pedestrian	1	0.1	0.1	69.2
Failed to Yield to Vehicle	70	5.6	5.7	74.9
Failed to Stop for Stop Sign or Flashing Red	25	2.0	2.0	76.9
Disregarded Stop and Go Signal	4	0.3	0.3	77.2
Disregarded Other Traffic Control Device Sign	6	0.5	0.5	77.7
Improper Signal or Failure to Signal	10	0.8	0.8	78.5
Turning from Wrong Lane	7	0.6	0.6	79.1
Improper Turn	10	0.8	0.8	79.9
Improper Lane Change	6	0.5	0.5	80.4
Following Too Closely	34	2.7	2.8	83.2
Wrong Side of road	26	2.1	2.1	85.3
Improper Passing	21	1.7	1.7	87.0
Improper Parking	5	0.4	0.4	87.4
Improper Backing	3	0.2	0.2	87.7
Distracted by Object, Person(s) Inside Car	27	2.2	2.2	89.9
Drinking	9	0.7	0.7	90.6
Drugs - Medication	1	0.1	0.1	90.7
Fell Asleep	33	2.7	2.7	93.4
Illness (Heart Attack, Stroke, etc.)	2	0.2	0.2	93.6
Illegally in Roadway	5	0.4	0.4	94.0
Other	44	3.5	3.6	97.6
Unknown	30	2.4	2.4	100.0
Total	1226	98.6	100.0	
Missing	18	1.4		
Total	1244	100.0		

Table V10 - Driver Contributing Circumstances 2

Driver Contributing Circumstances 2	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
None	1053	84.6	85.9	85.9
Exceeded Speed Limit	4	0.3	0.3	86.2
Exceeded Safe Speed but Not Limit	5	0.4	0.4	86.6
Failed to Yield to Vehicle	15	1.2	1.2	87.8
Failed to Stop for Stop Sign or Flashing Red	6	0.5	0.5	88.3
Disregarded Other Traffic Control Device Sign	5	0.4	0.4	88.7
Improper Signal or Failure to Signal	1	0.1	0.1	88.8
Turning from Wrong Lane	2	0.2	0.2	89.0
Improper Turn	7	0.6	0.6	89.6
Improper Lane Change	12	1.0	1.0	90.5
Following Too Closely	21	1.7	1.7	92.3
Wrong Side of road	27	2.2	2.2	94.5
Improper Passing	4	0.3	0.3	94.8
Improper Parking	2	0.2	0.2	94.9
Improper Backing	1	0.1	0.1	95.0
Failure to Comply with License Restrictions	1	0.1	0.1	95.1
Distracted by Object, Person(s) Inside Car	6	0.5	0.5	95.6
Drinking	7	0.6	0.6	96.2
Drugs - Other	1	0.1	0.1	96.2
Fell Asleep	5	0.4	0.4	96.7
Physical Impairment	1	0.1	0.1	96.7
Other	10	0.8	0.8	97.6
Unknown	30	2.4	2.4	100.0
Total	1226	98.6	100.0	
Missing	18	1.4		
Total	1244	100.0		

Table V11 - Driver Contributing Circumstances 3

Driver Contributing Circumstances 3	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
None	1178	94.7	96.1	96.1
Exceeded Safe Speed but Not Limit	1	0.1	0.1	96.2
Failed to Yield to Vehicle	1	0.1	0.1	96.2
Failed to Stop for Stop Sign or Flashing Red	1	0.1	0.1	96.3
Improper Lane Change	1	0.1	0.1	96.4
Wrong Side of road	1	0.1	0.1	96.5
Improper Passing	2	0.2	0.2	96.7
Drinking	6	0.5	0.5	97.1
Fell Asleep	1	0.1	0.1	97.2
Physical Impairment	1	0.1	0.1	97.3
Other	3	0.2	0.2	97.6
Unknown	30	2.4	2.4	100.0
Total	1226	98.6	100.0	
Missing	18	1.4		
Total	1244	100.0		

Table V12 - Driver Residency

Driver Residency	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
Alabama	3	0.2	0.2	0.2
Alaska	1	0.1	0.1	0.3
Arizona	4	0.3	0.3	0.7
Arkansas	5	0.4	0.4	1.1
California	13	1.0	1.1	2.1
Colorado	15	1.2	1.2	3.3
Florida	8	0.6	0.7	4.0
Georgia	3	0.2	0.2	4.2
Idaho	5	0.4	0.4	4.6
Illinois	10	0.8	0.8	5.5
Indiana	7	0.6	0.6	6.0
Iowa	46	3.7	3.8	9.8
Kansas	11	0.9	0.9	10.7
Kentucky	1	0.1	0.1	10.8
Louisiana	3	0.2	0.2	11.0

Driver Residency	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
Maine	1	0.1	0.1	11.1
Massachusetts	1	0.1	0.1	11.2
Michigan	3	0.2	0.2	11.4
Minnesota	79	6.4	6.4	17.9
Mississippi	1	0.1	0.1	17.9
Missouri	6	0.5	0.5	18.4
Montana	21	1.7	1.7	20.1
Nebraska	48	3.9	3.9	24.1
New Hampshire	1	0.1	0.1	24.1
New Mexico	2	0.2	0.2	24.3
New York	4	0.3	0.3	24.6
North Carolina	6	0.5	0.5	25.1
North Dakota	45	3.6	3.7	28.8
Ohio	2	0.2	0.2	29.0
Oklahoma	9	0.7	0.7	29.7
Oregon	6	0.5	0.5	30.2
Pennsylvania	2	0.2	0.2	30.3
Rhode Island	1	0.1	0.1	30.4
South Carolina	2	0.2	0.2	30.6
South Dakota	747	60.0	60.9	91.5
Tennessee	2	0.2	0.2	91.7
Texas	16	1.3	1.3	93.0
Vermont	1	0.1	0.1	93.1
Virginia	5	0.4	0.4	93.5
Washington	7	0.6	0.6	94.0
Wisconsin	18	1.4	1.5	95.5
Wyoming	16	1.3	1.3	96.8
Canada	36	2.9	2.9	99.8
Unknown	3	0.2	0.2	100.0
Total	1226	98.6	100.0	
Missing	18	1.4		
Total	1244	100.0		

Table V13 - Driver License Status

Driver License Status	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
Valid License for this Type of Vehicle	1180	94.9	96.2	96.2
Restricted Permit	8	0.6	0.7	96.9
Licensed but Not for this Type of Vehicle	4	0.3	0.3	97.2
Expired License	5	0.4	0.4	97.6
Suspended/Revoked License	7	0.6	0.6	98.2
No License Required	7	0.6	0.6	98.8
No License	10	0.8	0.8	99.6
Other	1	0.1	0.1	99.7
Unknown	4	0.3	0.3	100.0
Total	1226	98.6	100.0	
Missing	18	1.4		
Total	1244	100.0		

Table V14 - Driver License Restriction Compliance

Driver License Restriction Compliance	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
No Restrictions Does Not Apply	752	60.5	61.3	61.3
All Restrictions Complied With	445	35.8	36.3	97.6
Restrictions Not Complied With	3	0.2	0.2	97.9
No Driver License	15	1.2	1.2	99.1
Unknown	11	0.9	0.9	100.0
Total	1226	98.6	100.0	
Missing	18	1.4		
Total	1244	100.0		

Table V15 - Arrest

Arrest	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
Yes	297	23.9	24.2	24.2
No	873	70.2	71.2	95.4
Pending	46	3.7	3.8	99.2
Not Stated	7	0.6	0.6	99.8
Unknown	3	0.2	0.2	100.0
Total	1226	98.6	100.0	
Missing	18	1.4		
Total	1244	100.0		

Table V16 - Hit and Run

Hit and Run	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
No Hit and Run	1223	98.3	99.8	99.8
Hit and Run	3	0.2	0.2	100.0
Total	1226	98.6	100.0	
Missing	18	1.4		
Total	1244	100.0		

Table V17 - Plate State

Plate State	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
In State-No License Plate, Plate Required	1	0.1	0.1	0.1
Alabama	2	0.2	0.2	0.2
Arizona	2	0.2	0.2	0.4
Arkansas	2	0.2	0.2	0.6
California	3	0.2	0.2	0.8
Colorado	6	0.5	0.5	1.3
Florida	4	0.3	0.3	1.6
Idaho	3	0.2	0.2	1.8
Illinois	29	2.3	2.3	4.2
Indiana	11	0.9	0.9	5.1
Iowa	47	3.8	3.8	8.8
Kansas	10	0.8	0.8	9.6
Kentucky	1	0.1	0.1	9.7
Louisiana	1	0.1	0.1	9.8

Plate State	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
Massachusetts	1	0.1	0.1	9.9
Michigan	2	0.2	0.2	10.0
Minnesota	87	7.0	7.0	17.0
Mississippi	1	0.1	0.1	17.1
Missouri	9	0.7	0.7	17.8
Montana	19	1.5	1.5	19.4
Nebraska	52	4.2	4.2	23.6
North Carolina	2	0.2	0.2	23.7
North Dakota	51	4.1	4.1	27.8
Ohio	3	0.2	0.2	28.1
Oklahoma	32	2.6	2.6	30.6
Oregon	4	0.3	0.3	30.9
Pennsylvania	2	0.2	0.2	31.1
South Carolina	2	0.2	0.2	31.3
South Dakota	739	59.4	59.4	90.7
Tennessee	3	0.2	0.2	90.9
Texas	7	0.6	0.6	91.5
Utah	5	0.4	0.4	91.9
Virginia	2	0.2	0.2	92.0
Washington	7	0.6	0.6	92.6
Wisconsin	24	1.9	1.9	94.5
Wyoming	20	1.6	1.6	96.1
Canada	35	2.8	2.8	99.0
Not Applicable (tractor, machinery, etc)	11	0.9	0.9	99.8
Unknown	2	0.2	0.2	100.0
Total	1244	100.0	100.0	

Table V18 - Number of Occupants

Number of Occupants	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
0	15	1.2	1.2	1.2
1	940	75.6	75.6	76.8
2	209	16.8	16.8	93.6
3	41	3.3	3.3	96.9
4	13	1.0	1.0	97.9
5	10	0.8	0.8	98.7
6	1	0.1	0.1	98.8
7	3	0.2	0.2	99.0
13	1	0.1	0.1	99.1
14	1	0.1	0.1	99.2
17	1	0.1	0.1	99.3
20	1	0.1	0.1	99.4
22	2	0.2	0.2	99.5
30	1	0.1	0.1	99.6
32	1	0.1	0.1	99.7
35	1	0.1	0.1	99.8
48	1	0.1	0.1	99.8
Unknown	2	0.2	0.2	100.0
Total	1244	100.0	100.0	

Table V19 - Most Harmful Event

Most Harmful Event	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
Overturn	280	22.5	22.5	22.5
Fire/Explosion	14	1.1	1.1	23.6
Fell From Vehicle	1	0.1	0.1	23.7
Other Non-Collision	60	4.8	4.8	28.5
Pedestrian	1	0.1	0.1	28.6
Bicycle	4	0.3	0.3	28.9
Railway Train	5	0.4	0.4	29.3
Animal -Wild (Deer, Antelope)	5	0.4	0.4	29.7
Animal - Domestic	13	1.0	1.0	30.8
Motor Vehicle not parked	777	62.5	62.5	93.2
Motor Vehicle in Other Roadway	8	0.6	0.6	93.9
Parked Motor Vehicle	5	0.4	0.4	94.3
Other Non-fixed Object	18	1.4	1.4	95.7
Culvert	1	0.1	0.1	95.8
Embankment	5	0.4	0.4	96.2
Approach	4	0.3	0.3	96.5
Fence	5	0.4	0.4	96.9
Guardrail	12	1.0	1.0	97.9
Light Pole	2	0.2	0.2	98.1
Sign Post	4	0.3	0.3	98.4
Utility Pole	1	0.1	0.1	98.5
Delineator Post	2	0.2	0.2	98.6
Bridge-Vehicle Traveling Over	8	0.6	0.6	99.3
Bridge-Vehicle Traveling Under	6	0.5	0.5	99.8
Tree/Shrubbery	1	0.1	0.1	99.8
Other Fixed Object	2	0.2	0.2	100.0
Total	1244	100.0	100.0	

Table V20 - Direction of Travel Before Accident

Direction	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
Not Applicable	8	0.6	0.6	0.6
North	273	21.9	21.9	22.6
South	280	22.5	22.5	45.1
East	357	28.7	28.7	73.8
West	326	26.2	26.2	100.0
Total	1244	100.0	100.0	

Table V21 - Exceeding Speed Limit

Exceeding Speed Limit	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
Not Exceeding Speed Limit or Parked	1086	87.3	87.3	87.3
1 to 5 MPH over Speed Limit	27	2.2	2.2	89.5
6 to 10 MPH over Speed Limit	11	0.9	0.9	90.4
11 to 15 MPH over Speed Limit	6	0.5	0.5	90.8
16 to 20 MPH over Speed Limit	2	0.2	0.2	91.0
21 to 30 MPH over Speed Limit	3	0.2	0.2	91.2
31 to 40 MPH over Speed Limit	1	0.1	0.1	91.3
Not Stated	38	3.1	3.1	94.4
Unknown	70	5.6	5.6	100.0
Total	1244	100.0	100.0	

Table V22 - Estimated Travel Speed - How Estimated

How Estimated	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
Officer Estimate	85	6.8	6.8	6.8
Driver Statement	976	78.5	78.5	85.3
Occupant Statement	4	0.3	0.3	85.6
Witness Statement	30	2.4	2.4	88.0
Not Stated	12	1.0	1.0	89.0
Unknown/No Estimate	137	11.0	11.0	100.0
Total	1244	100.0	100.0	

Table V23 - Vehicle Type/Body Style

Vehicle Type/Body Style	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
2 Wheel Drive Passenger Car	223	17.9	17.9	17.9
4 Wheel Drive Passenger Car	3	0.2	0.2	18.2
2 Wheel Drive All Purpose Vehicle(Bronco, Blazer, Scout, etc.)	2	0.2	0.2	18.3
4 Wheel Drive All Purpose Vehicle(Bronco, Blazer, Scout, Jeep)	19	1.5	1.5	19.9
2 Wheel Drive Truck Based Station Wagon	4	0.3	0.3	20.2
4 Wheel Drive Truck Based Station Wagon	5	0.4	0.4	20.6
2 Wheel Drive Pickup	32	2.6	2.6	23.2
4 Wheel Drive Pickup	53	4.3	4.3	27.4
4 Wheel Drive Pickup with Camper	3	0.2	0.2	27.7
Van	26	2.1	2.1	29.7
Bus	23	1.8	1.8	31.6
Straight Truck	155	12.5	12.5	44.1
Straight Truck with Trailer	40	3.2	3.2	47.3
Truck Tractor Only	12	1.0	1.0	48.2
Truck Tractor with Single Semi-trailer	582	46.8	46.8	95.0
Truck Tractor with Two or More Trailers	34	2.7	2.7	97.7
Motor Home	2	0.2	0.2	97.9
Motorcycle	3	0.2	0.2	98.2
Farm Machinery	7	0.6	0.6	98.7
Heavy Equipment	2	0.2	0.2	98.9
Other	14	1.1	1.1	100.0
Total	1244	100.0	100.0	

Table V24 - Fire Occurrence

Fire Occurrence	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
No Fire	1219	98.0	98.0	98.0
Fire Before Accident	15	1.2	1.2	99.2
Fire as a Result of Accident	10	0.8	0.8	100.0
Total	1244	100.0	100.0	

Table V25- Vehicle Maneuver

Vehicle Maneuver	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
Straight Ahead	994	79.9	79.9	79.9
Turning Right	28	2.3	2.3	82.2
Turning Left	96	7.7	7.7	89.9
Making U-turn	2	0.2	0.2	90.0
Backing	6	0.5	0.5	90.5
Passing	40	3.2	3.2	93.7
Parked Properly	8	0.6	0.6	94.4
Immobile from Previous Accident	2	0.2	0.2	94.5
Stopped in Traffic	68	5.5	5.5	100.0
Total	1244	100.0	100.0	

Table V26 - Vehicle Damage Severity

Vehicle Damage Severity	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
No Damage to Motor Vehicle	33	2.7	2.7	2.7
Disabling Damage to Motor Vehicle	876	70.4	70.4	73.1
Functional Damage to Motor Vehicle	206	16.6	16.6	89.6
Other Damage to Motor Vehicle	127	10.2	10.2	99.8
Unknown	2	0.2	0.2	100.0
Total	1244	100.0	100.0	

Table V27 - First Vehicle Contributing Circumstances

First Vehicle Contributing Circumstances	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
None	1127	90.6	90.6	90.6
Brakes	24	1.9	1.9	92.5
Steering	7	0.6	0.6	93.1
Power Train	1	0.1	0.1	93.2
Suspension	1	0.1	0.1	93.2
Tires	18	1.4	1.4	94.7
Headlights	1	0.1	0.1	94.8
Signal Lights	3	0.2	0.2	95.0
Tail lights	1	0.1	0.1	95.1
Windows, Windshield	3	0.2	0.2	95.3
Wheels	4	0.3	0.3	95.7
Truck Coupling, Trailer Hitch, Safety Chains	13	1.0	1.0	96.7
Cargo	10	0.8	0.8	97.5
Mirrors	1	0.1	0.1	97.6
Wipers	1	0.1	0.1	97.7
Other	10	0.8	0.8	98.5
Unknown	19	1.5	1.5	100.0
Total	1244	100.0	100.0	

Table V28 - Second Vehicle Contributing Circumstances

Second Vehicle Contributing Circumstances	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
None	1221	98.2	98.2	98.2
Brakes	1	0.1	0.1	98.2
Tires	1	0.1	0.1	98.3
Tail lights	1	0.1	0.1	98.4
Body, Doors, Hood	1	0.1	0.1	98.5
Unknown	19	1.5	1.5	100.0
Total	1244	100.0	100.0	

Table V29 - Trailer Type

Trailer Type	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
No Trailer Attachment	549	44.1	44.1	44.1
Semi-trailer- Single	593	47.7	47.7	91.8
Semi-trailer - Two or More	34	2.7	2.7	94.5
Mobile Home	11	0.9	0.9	95.4
Camping Trailer	3	0.2	0.2	95.7
Utility Trailer - 1 Axle	7	0.6	0.6	96.2
Utility Trailer - 2 Axles	16	1.3	1.3	97.5
Farm Trailer (Gravity Box, Hayrack, etc.)	5	0.4	0.4	97.9
Horse Trailer	4	0.3	0.3	98.2
Towed Motor Vehicle	3	0.2	0.2	98.5
Farm Equipment (Disk, Plow, etc.)	5	0.4	0.4	98.9
Other	14	1.1	1.1	100.0
Total	1244	100.0	100.0	

Tables T1-T42 show frequencies from the vehicles or "V" Records for the years of 1996 through 1998 with only the truck specific records in Table T1 selected.

Table T1 - Vehicle Type/Body Style

Vehicle Type/Body Style	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
Bus	23	2.7	2.7	2.7
Straight Truck	155	18.3	18.3	21.0
Straight Truck with Trailer	40	4.7	4.7	25.8
Truck Tractor Only	12	1.4	1.4	27.2
Truck Tractor with Single Semi-trailer	582	68.8	68.8	96.0
Truck Tractor with Two or More Trailers	34	4.0	4.0	100.0
Total	846	100.0	100.0	

Table T2 - Alcohol/Drug Involvement

Alcohol/Drug Involvement	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
None	816	96.5	97.1	97.1
Alcohol Only	11	1.3	1.3	98.5
Drugs Only	1	0.1	0.1	98.6
Unknown	12	1.4	1.4	100.0
Total	840	99.3	100.0	
Missing	6	0.7		
Total	846	100.0		

Table T3 - Arrest

Arrest	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
Yes	189	22.3	22.5	22.5
No	619	73.2	73.7	96.2
Pending	24	2.8	2.9	99.0
Not Stated	7	0.8	0.8	99.9
Unknown	1	0.1	0.1	100.0
Total	840	99.3	100.0	
Missing	6	0.7		
Total	846	100.0		

Table T4 - Blood Alcohol Content Test Results

BAC Test Results	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
0	43	5.1	5.1	5.1
2	1	0.1	0.1	5.2
5	1	0.1	0.1	5.3
Test Refused	2	0.2	0.2	5.6
No Test Given	781	92.3	92.3	97.9
BAC Test Given but Sample Unusable	1	0.1	0.1	98.0
BAC Test Given but Results Unobtainable	9	1.1	1.1	99.1
Not Stated	8	0.9	0.9	100.0
Total	846	100.0	100.0	

Table T5 - Cargo Body Type

Cargo Body Type	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
Bus (Seats more than 15 People, Including Driver)	23	2.7	2.8	2.8
Van/Enclosed Box	378	44.7	45.9	48.7
Cargo Tank	59	7.0	7.2	55.8
Flatbed	116	13.7	14.1	69.9
Dump	106	12.5	12.9	82.8
Concrete Mixer	5	0.6	0.6	83.4
Auto Transporter	3	0.4	0.4	83.7
Garbage/Refuse	6	0.7	0.7	84.5
Other or Blank	128	15.1	15.5	100.0
Total	824	97.4	100.0	
Missing	22	2.6		
Total	846	100.0		

Table T6 - Direction of Travel Before Accident

Direction	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
North	187	22.1	22.1	22.1
South	190	22.5	22.5	44.6
East	243	28.7	28.7	73.3
West	226	26.7	26.7	100.0
Total	846	100.0	100.0	

Table T7 - Driver Contributing Circumstances 1

Driver Contributing Circumstances 1	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
None	447	52.8	53.2	53.2
Exceeded Speed Limit	19	2.2	2.3	55.5
Exceeded Safe Speed but not Limit	145	17.1	17.3	72.7
Driving Under Posted Minimum Speed	6	0.7	0.7	73.5
Failed to Yield to Pedestrian	1	0.1	0.1	73.6
Failed to Yield to Vehicle	32	3.8	3.8	77.4
Failed to Stop for Stop Sign or Flashing Red	12	1.4	1.4	78.8
Disregarded Stop and Go Signal	2	0.2	0.2	79.0
Disregarded Other Traffic Control Device Sign	3	0.4	0.4	79.4
Improper Signal or Failure to Signal	2	0.2	0.2	79.6
Improper Turn	3	0.4	0.4	80.0
Improper Lane Change	2	0.2	0.2	80.2
Following too Closely	25	3.0	3.0	83.2
Wrong Side of Road	9	1.1	1.1	84.3
Improper Passing	15	1.8	1.8	86.1
Improper Parking	2	0.2	0.2	86.3
Improper Backing	2	0.2	0.2	86.5
Distracted by Object, Person(s) Inside Car	21	2.5	2.5	89.0
Drinking	3	0.4	0.4	89.4
Drugs – Medication	1	0.1	0.1	89.5
Fell Asleep	31	3.7	3.7	93.2
Illness (Heart Attack, Stroke, etc.)	2	0.2	0.2	93.5
Illegally in Roadway	2	0.2	0.2	93.7
Other	35	4.1	4.2	97.9
Unknown	18	2.1	2.1	100.0
Total	840	99.3	100.0	
Missing	6	0.7		
Total	846	100.0		

Table T8 - Driver Contributing Circumstances 2

Driver Contributing Circumstances 2	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
None	748	88.4	89.0	89.0
Exceeded Speed Limit	2	0.2	0.2	89.3
Exceeded Safe Speed but not Limit	3	0.4	0.4	89.6
Failed to Yield to Vehicle	8	0.9	1.0	90.6
Failed to Stop for Stop Sign or Flashing Red	4	0.5	0.5	91.1
Disregarded Other Traffic Control Device Sign	5	0.6	0.6	91.7
Improper Turn	2	0.2	0.2	91.9
Improper Lane Change	3	0.4	0.4	92.3
Following Too Closely	15	1.8	1.8	94.0
Wrong Side of road	16	1.9	1.9	96.0
Improper Passing	2	0.2	0.2	96.2
Improper Parking	1	0.1	0.1	96.3
Improper Backing	1	0.1	0.1	96.4
Failure to Comply with License Restrictions	1	0.1	0.1	96.5
Distracted by Object, Person(s) Inside Car	3	0.4	0.4	96.9
Fell Asleep	3	0.4	0.4	97.3
Other	5	0.6	0.6	97.9
Unknown	18	2.1	2.1	100.0
Total	840	99.3	100.0	
Missing	6	0.7		
Total	846	100.0		

Table T9 - Driver Contributing Circumstances 3

Driver Contributing Circumstances 3	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
None	817	96.6	97.3	97.3
Failed to Stop for Stop Sign or Flashing Red	1	0.1	0.1	97.4
Improper Passing	1	0.1	0.1	97.5
Drinking	2	0.2	0.2	97.7
Other	1	0.1	0.1	97.9
Unknown	18	2.1	2.1	100.0
Total	840	99.3	100.0	
Missing	6	0.7		
Total	846	100.0		

Table T10 - Driver License Restriction Compliance

Driver License Restriction Compliance	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
No Restrictions Does not Apply	533	63.0	63.5	63.5
All Restrictions Complied With	296	35.0	35.2	98.7
Restrictions Not Complied With	2	0.2	0.2	98.9
No Driver License	4	0.5	0.5	99.4
Unknown	5	0.6	0.6	100.0
Total	840	99.3	100.0	
Missing	6	0.7		
Total	846	100.0		

Table T11 - Driver License Status

Driver License Status	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
Valid License for this Type of Vehicle	826	97.6	98.3	98.3
Restricted Permit	1	0.1	0.1	98.5
Licensed but not for this Type of Vehicle	3	0.4	0.4	98.8
Expired License	2	0.2	0.2	99.0
Suspended/Revoked License	5	0.6	0.6	99.6
No License	2	0.2	0.2	99.9
Unknown	1	0.1	0.1	100.0
Total	840	99.3	100.0	
Missing	6	0.7		
Total	846	100.0		

Table T12 - Ejection

Ejection	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
Not Ejected	828	97.9	98.6	98.6
Partial Ejection	3	0.4	0.4	98.9
Total Ejection	8	0.9	1.0	99.9
Unknown	1	0.1	0.1	100.0
Total	840	99.3	100.0	
Missing	6	0.7		
Total	846	100.0		

Table T13 - Estimated Travel Speed - How Estimated

How Estimated	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
Officer Estimate	49	5.8	5.8	5.8
Driver Statement	709	83.8	83.8	89.6
Occupant Statement	1	0.1	0.1	89.7
Witness Statement	8	0.9	0.9	90.7
Not Stated	8	0.9	0.9	91.6
Unknown/No Estimate	71	8.4	8.4	100.0
Total	846	100.0	100.0	

Table T14 - Exceeding Speed Limit

Exceeding Speed Limit	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
Not Exceeding Speed Limit or Parked	762	90.1	90.1	90.1
1 to 5 MPH over Speed Limit	13	1.5	1.5	91.6
6 to 10 MPH over Speed Limit	7	0.8	0.8	92.4
11 to 15 MPH over Speed Limit	2	0.2	0.2	92.7
16 to 20 MPH over Speed Limit	2	0.2	0.2	92.9
21 to 30 MPH over Speed Limit	2	0.2	0.2	93.1
Not Stated	23	2.7	2.7	95.9
Unknown	35	4.1	4.1	100.0
Total	846	100.0	100.0	

Table T15 - Fire Occurrence

Fire Occurrence	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
No Fire	823	97.3	97.3	97.3
Fire Before Accident	15	1.8	1.8	99.1
Fire as a Result of Accident	8	0.9	0.9	100.0
Total	846	100.0	100.0	

Table T16 - Gender

Gender	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
Male	805	95.2	95.8	95.8
Female	34	4.0	4.0	99.9
Unknown	1	0.1	0.1	100.0
Total	840	99.3	100.0	
Missing	6	0.7		
Total	846	100.0		

Table T17 - Hazardous Materials 1-Digit Number

Hazardous Materials 1-Digit Number	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
Gases-Compressed, Dissolved or Refrigerated	7	0.8	36.8	36.8
Flammable Liquids	9	1.1	47.4	84.2
Corrosives	3	0.4	15.8	100.0
Total	19	2.2	100.0	
Missing	827	97.8		
Total	846	100.0		

Table T18 - Hit and Run

Hit and Run	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
No Hit and Run	837	98.9	99.6	99.6
Hit and Run	3	0.4	0.4	100.0
Total	840	99.3	100.0	
Missing	6	0.7		
Total	846	100.0		

Table T19 - Injury Classification

Injury Classification	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
No Injury	626	74.0	74.5	74.5
Fatal	6	0.7	0.7	75.2
Incapacitating Injury	61	7.2	7.3	82.5
Non-incapacitating Injury	87	10.3	10.4	92.9
Possible Injury	60	7.1	7.1	100.0
Total	840	99.3	100.0	
Missing	6	0.7		
Total	846	100.0		

Table T20 - Interstate

Interstate	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
No	121	14.3	14.3	14.3
Yes	725	85.7	85.7	100.0
Total	846	100.0	100.0	

Table T21 - Number Injured

Number Injured	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
0	422	49.9	49.9	49.9
1	298	35.2	35.2	85.1
2	83	9.8	9.8	94.9
3	26	3.1	3.1	98.0
4	9	1.1	1.1	99.1
5	4	0.5	0.5	99.5
10	1	0.1	0.1	99.6
11	2	0.2	0.2	99.9
28	1	0.1	0.1	100.0
Total	846	100.0	100.0	

Table T22 - Number of Axles

Number of Axles	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
Not Coded	63	7.4	7.4	7.4
2	92	10.9	10.9	18.3
3	78	9.2	9.2	27.5
4	35	4.1	4.1	31.7
5	473	55.9	55.9	87.6
6	59	7.0	7.0	94.6
7	29	3.4	3.4	98.0
8	9	1.1	1.1	99.1
9	4	0.5	0.5	99.5
10	1	0.1	0.1	99.6
11	1	0.1	0.1	99.8
13	1	0.1	0.1	99.9
51	1	0.1	0.1	100.0
Total	846	100.0	100.0	

Table T23 - Number of Fatalities

Number of Fatalities	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
0	798	94.3	94.3	94.3
1	39	4.6	4.6	98.9
2	6	0.7	0.7	99.6
3	3	0.4	0.4	100.0
Total	846	100.0	100.0	

Table T24 - Number of Injuries

Number of Injuries	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
0	529	62.5	62.5	62.5
1	224	26.5	26.5	89.0
2	58	6.9	6.9	95.9
3	23	2.7	2.7	98.6
4	7	0.8	0.8	99.4
5	1	0.1	0.1	99.5
9	1	0.1	0.1	99.6
10	1	0.1	0.1	99.8
11	1	0.1	0.1	99.9
27	1	0.1	0.1	100.0
Total	846	100.0	100.0	

Table T25 - Number of Occupants

Number of Occupants	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
0	4	0.5	0.5	0.5
1	692	81.8	81.8	82.3
2	124	14.7	14.7	96.9
3	10	1.2	1.2	98.1
4	1	0.1	0.1	98.2
5	1	0.1	0.1	98.3
6	1	0.1	0.1	98.5
7	2	0.2	0.2	98.7
13	1	0.1	0.1	98.8
14	1	0.1	0.1	98.9
17	1	0.1	0.1	99.1
20	1	0.1	0.1	99.2
22	2	0.2	0.2	99.4
30	1	0.1	0.1	99.5
32	1	0.1	0.1	99.6
35	1	0.1	0.1	99.8
48	1	0.1	0.1	99.9
Unknown	1	0.1	0.1	100.0
Total	846	100.0	100.0	

Table T26 - Number of Passengers

Number of Passengers	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
0	708	83.7	83.7	83.7
1	93	11.0	11.0	94.7
2	28	3.3	3.3	98.0
3	4	0.5	0.5	98.5
4	9	1.1	1.1	99.5
6	1	0.1	0.1	99.6
10	2	0.2	0.2	99.9
28	1	0.1	0.1	100.0
Total	846	100.0	100.0	

Table T27 - Road Access Control

Road Access Control	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
No Control (Unlimited Access)	812	96.0	96.0	96.0
Full Control (Only Ramp Entry and Exit)	32	3.8	3.8	99.8
Other or Blank	2	0.2	0.2	100.0
Total	846	100.0	100.0	

Table T28 - Safety Equipment Used

Safety Equipment	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
No Safety Equipment Used	173	20.4	20.6	20.6
Lap Belt Only Used	110	13.0	13.1	33.7
Shoulder Harness Only Used	6	0.7	0.7	34.4
Lap Belt and Shoulder Harness Used	513	60.6	61.1	95.5
Helmet Only	1	0.1	0.1	95.6
Other	1	0.1	0.1	95.7
Unknown	36	4.3	4.3	100.0
Total	840	99.3	100.0	
Missing	6	0.7		
Total	846	100.0		

Table T29 - First Sequence of Events

Sequence of Events, First	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
Ran Off Road	232	27.4	27.5	27.5
Jackknife	39	4.6	4.6	32.1
Overturn(Rollover)	58	6.9	6.9	38.9
Downhill Runaway	5	0.6	0.6	39.5
Cargo Loss or Shift	7	0.8	0.8	40.4
Explosion or Fire	13	1.5	1.5	41.9
Separation of Units	15	1.8	1.8	43.7
Collision Involving Pedestrian	2	0.2	0.2	43.9
Collision Involving Motor Vehicle in Transport	395	46.7	46.7	90.7
Collision Involving Parked Motor Vehicle	21	2.5	2.5	93.1
Collision Involving Train	5	0.6	0.6	93.7
Collision Involving Pedal cycle	2	0.2	0.2	94.0
Collision Involving Animal	19	2.2	2.2	96.2
Collision Involving Fixed Object	8	0.9	0.9	97.2
Collision Involving Other Object	6	0.7	0.7	97.9
Other or Blank	18	2.1	2.1	100.0
Total	845	99.9	100.0	
Missing	1	0.1		
Total	846	100.0		

Table T30 - Second Sequence of Events

Sequence of Events, Second	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
Ran Off Road	116	13.7	26.9	26.9
Jackknife	67	7.9	15.5	42.5
Overturn(Rollover)	159	18.8	36.9	79.4
Downhill Runaway	1	0.1	0.2	79.6
Cargo Loss or Shift	27	3.2	6.3	85.8
Explosion or Fire	2	0.2	0.5	86.3
Separation of Units	5	0.6	1.2	87.5
Collision Involving Motor Vehicle in Transport	14	1.7	3.2	90.7
Collision Involving Parked Motor Vehicle	4	0.5	0.9	91.6
Collision Involving Fixed Object	27	3.2	6.3	97.9
Collision Involving Other Object	7	0.8	1.6	99.5
Other or Blank	2	0.2	0.5	100.0
Total	431	50.9	100.0	
Missing	415	49.1		
Total	846	100.0		

Table T31 - Third Sequence of Events

Sequence of Events, Third	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
Ran Off Road	20	2.4	12.0	12.0
Jackknife	13	1.5	7.8	19.9
Overturn (Rollover)	48	5.7	28.9	48.8
Cargo Loss or Shift	48	5.7	28.9	77.7
Explosion or Fire	1	0.1	0.6	78.3
Separation of Units	7	0.8	4.2	82.5
Collision Involving Motor Vehicle in Transport	6	0.7	3.6	86.1
Collision Involving Parked Motor Vehicle	3	0.4	1.8	88.0
Collision Involving Fixed Object	17	2.0	10.2	98.2
Collision Involving Other Object	1	0.1	0.6	98.8
Other or Blank	2	0.2	1.2	100.0
Total	166	19.6	100.0	
Missing	680	80.4		
Total	846	100.0		

Table T32 - Fourth Sequence of Events

Sequence of Events, Fourth	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
Ran Off Road	2	0.2	5.3	5.3
Jackknife	1	0.1	2.6	7.9
Overturn(Rollover)	9	1.1	23.7	31.6
Cargo Loss or Shift	12	1.4	31.6	63.2
Explosion or Fire	2	0.2	5.3	68.4
Separation of Units	1	0.1	2.6	71.1
Collision Involving Motor Vehicle in Transport	6	0.7	15.8	86.8
Collision Involving Parked Motor Vehicle	1	0.1	2.6	89.5
Collision Involving Fixed Object	4	0.5	10.5	100.0
Total	38	4.5	100.0	
Missing	808	95.5		
Total	846	100.0		

Table T33 - Tow Away

Tow Away	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
No	39	4.6	4.6	4.6
Yes	807	95.4	95.4	100.0
Total	846	100.0	100.0	

Table T34 - Trailer Type

Trailer Type	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
No Trailer Attachment	190	22.5	22.5	22.5
Semi-trailer-Single	593	70.1	70.1	92.6
Semi-trailer - Two or More	34	4.0	4.0	96.6
Utility Trailer - 1 Axle	3	0.4	0.4	96.9
Utility Trailer - 2 Axles	12	1.4	1.4	98.3
Farm Trailer (Gravity Box, Hayrack, etc.)	2	0.2	0.2	98.6
Towed Motor Vehicle	2	0.2	0.2	98.8
Farm Equipment (Disk, Plow, etc.)	1	0.1	0.1	98.9
Other	9	1.1	1.1	100.0
Total	846	100.0	100.0	

Table T35 - Truck/Bus

Truck/Bus	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
Bus	23	2.7	2.7	2.7
Truck	823	97.3	97.3	100.0
Total	846	100.0	100.0	

Table T36 - Vehicle Contributing Circumstances 1

Vehicle Contributing Circumstances 1	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
None	744	87.9	87.9	87.9
Brakes	22	2.6	2.6	90.5
Steering	6	0.7	0.7	91.3
Suspension	1	0.1	0.1	91.4
Tires	17	2.0	2.0	93.4
Headlights	1	0.1	0.1	93.5
Signal Lights	3	0.4	0.4	93.9
Windows, Windshield	2	0.2	0.2	94.1
Wheels	4	0.5	0.5	94.6
Truck Coupling, Trailer Hitch, Safety Chains	12	1.4	1.4	96.0
Cargo	10	1.2	1.2	97.2
Mirrors	1	0.1	0.1	97.3
Wipers	1	0.1	0.1	97.4
Other	9	1.1	1.1	98.5
Unknown	13	1.5	1.5	100.0
Total	846	100.0	100.0	

Table T37 - Vehicle Contributing Circumstances 2

Vehicle Contributing Circumstances 2	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
None	830	98.1	98.1	98.1
Tires	1	0.1	0.1	98.2
Taillights	1	0.1	0.1	98.3
Body, Doors, Hood	1	0.1	0.1	98.5
Unknown	13	1.5	1.5	100.0
Total	846	100.0	100.0	

Table T38 - Vehicle Configuration

Vehicle Configuration	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
Bus (Seats more than 15 People, Including Driver)	23	2.7	2.7	2.7
Single-Unit Truck (2-Axle, 6-Tire)	82	9.7	9.8	12.5
Single-Unit Truck (3 or more Axles)	63	7.4	7.5	20.1
Truck Trailer	102	12.1	12.2	32.3
Truck Tractor (Bobtail)	12	1.4	1.4	33.7
Tractor/Semi-trailer	519	61.3	62.0	95.7
Tractor/Double	36	4.3	4.3	100.0
Total	837	98.9	100.0	
Missing	9	1.1		
Total	846	100.0		

Table T39 - Vehicle License State

Vehicle License State	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
Other	1	0.1	0.1	0.1
Alberta	6	0.7	0.7	0.8
Alabama	2	0.2	0.2	1.1
Arkansas	1	0.1	0.1	1.2
Arizona	1	0.1	0.1	1.3
California	2	0.2	0.2	1.5
Colorado	1	0.1	0.1	1.7
Florida	2	0.2	0.2	1.9
Iowa	43	5.1	5.1	7.0
Idaho	3	0.4	0.4	7.3
Illinois	28	3.3	3.3	10.6
Indiana	7	0.8	0.8	11.5
Kansas	10	1.2	1.2	12.6
Kentucky	1	0.1	0.1	12.8
Louisiana	1	0.1	0.1	12.9
Manitoba	9	1.1	1.1	13.9
Michigan	1	0.1	0.1	14.1
Minnesota	68	8.0	8.0	22.1
Missouri	5	0.6	0.6	22.7
Mississippi	1	0.1	0.1	22.8
Montana	12	1.4	1.4	24.2

Vehicle License State	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
New Brunswick	1	0.1	0.1	24.3
North Carolina	1	0.1	0.1	24.5
North Dakota	49	5.8	5.8	30.3
Nebraska	38	4.5	4.5	34.8
Ohio	3	0.4	0.4	35.1
Oklahoma	29	3.4	3.4	38.5
Ontario	7	0.8	0.8	39.4
Oregon	4	0.5	0.5	39.8
Pennsylvania	2	0.2	0.2	40.1
Province of Quebec	1	0.1	0.1	40.2
South Carolina	2	0.2	0.2	40.4
South Dakota	436	51.5	51.5	92.0
Saskatchewan	8	0.9	0.9	92.9
Tennessee	4	0.5	0.5	93.4
Texas	7	0.8	0.8	94.2
Utah	5	0.6	0.6	94.8
Virginia	1	0.1	0.1	94.9
Washington	8	0.9	0.9	95.9
Wisconsin	23	2.7	2.7	98.6
Wyoming	12	1.4	1.4	100.0
Total	846	100.0	100.0	

Table T40 - Vehicle Damage Severity

Vehicle Damage Severity	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
No Damage to Motor Vehicle	29	3.4	3.4	3.4
Disabling Damage to Motor Vehicle	543	64.2	64.2	67.6
Functional Damage to Motor Vehicle	168	19.9	19.9	87.5
Other Damage to Motor Vehicle	104	12.3	12.3	99.8
Unknown	2	0.2	0.2	100.0
Total	846	100.0	100.0	

Table T41 - Vehicle Maneuver

Vehicle Maneuver	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
Straight Ahead	714	84.4	84.4	84.4
Turning Right	20	2.4	2.4	86.8
Turning Left	49	5.8	5.8	92.6
Backing	5	0.6	0.6	93.1
Passing	27	3.2	3.2	96.3
Immobile from Previous Accident	1	0.1	0.1	96.5
Stopped in Traffic	30	3.5	3.5	100.0
Total	846	100.0	100.0	

Table T42 - Gross Vehicle Weight Rating Groups

GVW Rating Groups	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
Missing	303	35.8	35.8	35.8
Zero - 40,000	120	14.2	14.2	50.0
40,001- 80,000	210	24.8	24.8	74.8
80,001- 120,000	173	20.4	20.4	95.3
120,001 - 160,000	37	4.4	4.4	99.6
160,001 - 200,000	2	0.2	0.2	99.9
200,001 and Up	1	0.1	0.1	100.0
Total	846	100.0	100.0	

Table T43 - Gross Vehicle Weight Rating Two Groups

GVW Rating 2 Groups	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
Missing	303	35.8	35.8	35.8
0-80,000	330	39.0	39.0	74.8
80,001 and Up	213	25.2	25.2	100.0
Total	846	100.0	100.0	