Longer Combination Vehicle Safety Data Collection

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Foreword

This study was funded by the AAA Foundation for Traffic Safety. Founded in 1947 by the American Automobile Association (AAA), the AAA Foundation is an independent, publicly supported, charitable research and educational organization dedicated to saving lives and reducing injuries by preventing traffic crashes.

This peer-reviewed report examines the methods used for large-truck crash data collection and analysis in five states: Florida, Idaho, Nevada, Oregon and Utah. These states were chosen because they permit the operation of so-called Longer Combination Vehicles (LCVs) on portions of their road networks.

LCV safety is a contentious issue, with many conflicting claims being made about how safe or unsafe these vehicles are. The purpose of this research was to put these safety claims in their proper perspective by attempting to better understand the crash data collection and analysis procedures used by some of the states that permit LCV operations.

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EXECUTIVE SUMMARY

In 1999 and 2000, the AAA Foundation for Traffic Safety conducted a research program to identify barriers to analysis of large truck safety experience in the United States. The primary focus was on so-called Longer Combination Vehicles (LCVs) - the "doubles" and "triples" running on major highways throughout the country. Five states (Florida, Idaho, Nevada, Oregon, and Utah) participated in a review and evaluation of their data collection and analysis practices. Two of the states (Oregon and Utah) also participated in an audit of completed crash reports for crashes involving large trucks and specifically doubles and triples.

The results show that none of the five states has a crash reporting system that adequately supports the analysis of LCV safety. In general, there is a lack of reliable data on the exact configuration of vehicles involved in crashes, as well as a lack of specific measures of exposure for LCVs. Without good data on configuration and good measures of exposure, the main question about LCV safety (i.e., are they more or less safe than other large commercial motor vehicles?) cannot be answered empirically. The report concludes with a series of recommendations for improving the quality of data on crashes involving large trucks and for improving the states' ability to analyze LCV crashes specifically.

I. INTRODUCTION

Background

Longer combination vehicles (LCVs, a.k.a. large combination vehicles), are among the largest vehicles on our nation's highways. They are also increasing, both in terms of the proportion of vehicles on the road and in terms of the number of miles they are driven each year. Typically an LCV is large truck with two or more cargo spaces (e.g., a tractor with two or more trailers or a straight truck with additional trailing units). Sharing the road with these long vehicles can be intimidating for drivers of smaller, lighter passenger vehicles. But the question remains: Are these vehicles safe, or unsafe? Do they get into more crashes than other commercial vehicles? What is their relative crash risk compared to more familiar large truck configurations, such as a straight truck or a tractor-trailer combination?

LCVs, as a specific sub-class of commercial vehicles, have proven particularly difficult to study using the data sets and methodologies typically applied to commercial motor vehicle safety; such as the Fatality Analysis Reporting System (FARS) and the National Automotive Sampling System/ General Estimates System (NASS/GES). The primary reason for difficulty in any study of LCVs is the relatively small number of LCVs in operation and the relatively small number of crashes involving these vehicles. The national data sets are inadequate for performing statistical data analysis on infrequent vehicle types or crash types, especially if one is examining crashes at all levels of severity. Using individual state data also imposes the same limitation of relatively small numbers of vehicles, resulting in a small sample. As a consequence there are no truly definitive answers to questions about LCV safety performance. It is not known, for example, whether these vehicles have a better or worse safety record than other types of commercial vehicles using the same roadways.

There are standard data sets for recording basic, minimal information on crashes involving commercial motor vehicles or CMVs (usually used to include both trucks and buses). Chief among these is the minimum data set recommended by the National Governors' Association (NGA) in 1989 and later adopted as the required minimum data set for reporting to the Federal Motor Carrier Safety Administration (FMCSA, formerly the Office of Motor Carriers and Highway Safety, OMCHS). The NGA data elements are presented in Appendix A. This is a limited set of data which is currently being reviewed and expanded so that states will be required to provide more details for large-truck crashes. The NGA data elements are entered into a Motor Carrier Management Information System (MCMIS) through a dedicated dial-in network (SafetyNet). These data can answer some questions about CMV safety, but, as with the other nationwide data sets, the level of detail is not sufficient to answer questions about LCV safety.

A second barrier to reliable analysis of LCV safety is uncertainty regarding the accuracy of data recorded about commercial vehicles in general and classification of large trucks in particular. States do not restrict reporting of commercial vehicle crashes only to enforcement officers trained to recognize and accurately report commercial vehicle information. As a consequence, crucial data elements are of unknown quality. This includes such factors as vehicle configuration, vehicle and driver contributing factors, and other factors specific to commercial vehicles and drivers.

Research Goals and Objectives

The AAA Foundation for Traffic Safety (AAAFTS) is interested in the issue of LCV safety as part of its mission to prevent traffic crashes. The AAAFTS and the AAA members and clubs that support it would like to know if LCVs are a ***real*** traffic safety problem and, if so, what the scope of the problem may be. The first step is to describe the data and analysis necessary for conducting research regarding LCV safety. The goal of this study was to investigate data collection practices in selected states to see if sufficient data of sufficient quality exist to support detailed research.

The primary issues to be addressed were:

1) Quality and completeness of crash and travel data regarding commercial trucking vehicles in general, and LCVs in particular.

2) Quality of the analyses currently performed by selected government agencies regarding LCV safety performance.

3) Adequacy of data collection and analysis procedures for evaluating the safety performance of LCVs in selected states.

The objective of this study was to address each of these issues in five states (Florida, Idaho, Nevada, Oregon, and Utah) and to generate recommendations for improved collection and analysis of LCV safety data. The study performed four main tasks:

Task 1: Review data collection and analysis. This involved telephone and face-to-face interviews with state agency staff to gather information about current state practices related to LCV-involved crashes.

Task 2: Evaluation of data collection and analysis. This involved an expert-level review of current state practices, compared with an ideal system that would support the desired analyses of LCV safety performance.

Task 3: Data audit. This involved an expert-level evaluation of the data collected on actual crashes during 1998. The audit focussed on LCV-involved crashes, but included a sample of non-LCV large-truck crashes as well.

Task 4: Final report. The final report documents the study methodology and results and provides recommendations for State and National consideration.

This document is the result of Task 4. It describes all previous tasks and incorporates the results and recommendations from those efforts. The methodology section presents the techniques used in Tasks 1-3. The results section gives the findings from the review and evaluation conducted in all five states and from the data audit conducted in two states (Oregon and Utah). The conclusions and recommendations section includes specific recommendations for data improvement in each state, along with general recommendations for state and national data. The "Next Steps" Section proposes further activities that could improve the quality and accessibility of commercial motor vehicle (CMV) and LCV crash data. Acronyms and references used in the report are presented in the final two sections. Appendix A presents the recommended data elements as developed by the National Governors' Association (NGA) and subsequently adopted as a standard for use throughout the United States.

Technical Notes

What is an LCV? LCVs are usually defined relative to a standard configuration of vehicle – that is, a vehicle that is within a state's size and weight limits and is therefore allowed to travel the state's roads. Usually, LCVs are required to operate under an oversize-overweight permit. Historically, each state has set its own size and weight limits, which were subsequently "frozen" under the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA).

In addition, each state has defined permitted configurations of vehicles within the standard size and weight categories. These definitions are sometimes based on the length of cargo spaces, sometimes on the distance between axles, and sometimes on a combination of criteria. For the five states in the study, a synopsis of the current size and weight regulations was presented in the Task 1 report. (The information is not repeated in this report.)

For the purpose of this study, LCVs are defined as any combination vehicle with two or more cargo spaces in which at least one of the cargo spaces is longer than 28 feet and that is operating at a greater than 80,000 pounds Gross Vehicle Weight Rating (GVWR). This definition is designed to exclude what are commonly called "freeway doubles" (a tractor pulling two 28' trailers), since by Federal law these vehicles can legally travel most highways in the United States without a permit. Any configuration larger than a freeway double is included in the definition of an LCV. The following types of configurations are typical of what "LCV" is used to mean in this study: a tractor pulling two long trailers or a long and a short trailer; a tractor pulling three trailers; and a large truck with a cargo body pulling one or more trailers.

This definition of LCV is nearly the same as that used by the Federal Motor Carrier Safety Administration (FMCSA) and is a combination of the ISTEA criteria and the criteria passed into law as part of the Surface Transportation Assistance Act (STAA) of 1982. The only difference is that most of the states define a "freeway double" as a tractor pulling two 28' trailers, whereas the STAA used two 28.5' trailers. The precision of the data collected on trailer length in crashes is such that this difference would not alter conclusions reached in this report. Most states, when asked, refer to a 28' trailer length, perhaps actually meaning the 28.5' defined in the STAA law. For clarity in talking with the five states involved in the study, the 28' length was adopted as the standard for a “short” trailer.

Other configurations of tractor-trailers and truck-trailer combinations are considered LCVs. The various types of “doubles” include turnpike doubles, which consist of a tractor and two trailers both longer than 28'; Rocky Mountain doubles, which consist of a tractor pulling one long trailer (greater than 28') and one short (28') trailer. Triple-trailer combinations are typically a tractor pulling three short trailers. There are other possible combinations that would be considered LCVs, including a straight truck (a single unit consisting of a power unit and integrated cargo area) pulling one or more additional short or long trailers. There are too many possible configurations to list here. For each type of double or triple, the cargo spaces can be of any number of possible styles (box, tanker, hopper, specialty, etc.).

Scope of this study It should also be noted that the choice of participating states was based on local interest in the issue of LCV safety on the part of AAA clubs. This study is not intended to be representative of the national picture of LCV (or large truck) crash data or of LCV (or large truck) safety analysis. The methods used to evaluate data quality in the five participating states could be used to study the same issues in other states. It is likely that the states all share some common data quality concerns. The reader is cautioned, however, not to infer that this study’s recommendations can be immediately applied to other states or the nation without first performing detailed reviews, as described in the methods section.

Exposure Measures This study focused on a narrow aspect of truck safety analysis – crash data availability and quality. The usefulness of this information in decisionmaking depends on the analyst’s ability to identify both absolute and relative measures of LCV safety. Crash data alone can answer questions of an absolute nature: How many crashes happened? How many people were injured? How many people were killed? In order to create a full picture of LCV safety, analysts must also look at the safety of these vehicles relative to other vehicles. Are they more or less safe than other large trucks or than passenger cars? To answer these questions requires measures of ***exposure***. Per mile driven, per registered vehicle, and per trip, which vehicles are most likely to be involved in a crash? This study includes some focus on appropriate measures of exposure when considering the capability of states to analyze their LCV-involved crashes. Measures of exposure, such as vehicle miles traveled (VMT) or number of trips involve their own unique data quality issues. VMT, for example, is estimated based on a series of automated and manual vehicle classification counts. This study did not address whether each of the states was collecting high-quality classification count data. It merely addressed whether the classification count data were sufficiently detailed to allow an analyst to estimate a VMT for different types of LCV. Could the analyst differentiate, for instance between a “freeway double” and a true LCV double-trailer configuration when estimating VMT? Assessing the quality of the underlying vehicle count data was beyond the scope of this study.

Broader issues The safety performance of LCVs is part of the broader issue of large truck safety which is also of keen interest to AAAFTS and to AAA members. This study focused on LCVs, but most of the information pertains to all large trucks since the same crash reports are used for LCV and non-LCV large-truck crashes in each State. The data are handled in the same manner. While the study did not specifically include this broader focus, it is clear from the audit in Oregon and Utah that many issues related to LCV crash data apply to all large truck crashes in these two States and probably elsewhere.

II. METHODOLOGY

The LCV study involved two major efforts: Tasks 1 and 2 comprised an evaluation of data collection and analysis in five states. Task 3 was a detailed audit of crash data in two of the states (Oregon and Utah). The methodologies for these two main efforts are presented separately below.

Tasks 1 and 2: Evaluation of Data Collection and Analysis

In tasks 1 and 2, information was gathered from five states (Florida, Idaho, Nevada, Oregon, and Utah). The methods used involved direct contact with state personnel responsible for crash data management in general and for commercial motor vehicle crash data in particular. In order to fully document the LCV crash situation, it was also necessary to make contact with motor carrier enforcement program managers in each state. The state contacts included:

* Motor Carrier Safety Assistance Program (MCSAP) managers
* Oversize/overweight permit office managers
* Crash data managers and analysts
* Commercial Motor Vehicle (CMV) crash data managers and analysts

Each of the contacts was asked to provide relevant materials describing the programs under their direction. Such materials included, but were not limited to:

* Annual crash facts publications for the state
* Truck crash facts publications (if separate from above)
* Rules and regulations governing LCV operation in the state
* Samples of data analyses using data from CMV-involved crashes

The materials were reviewed and interviews were scheduled with the key personnel in each state. Face-to-face interviews were conducted over a two-day period in each state. The purpose of the interviews was to obtain answers to any questions that arose as a result of the review of submitted materials, obtain supplemental materials as needed, and to document the following for each state:

* The procedures used in collection and storage of CMV and LCV-involved crash data
* The analytic methods used in evaluating CMV and LCV crash experience

∗ In-state expert evaluation of the sufficiency of the data and/or data analysis for use in describing and/or improving the CMV and LCV crash experience of the state

A "best practices" approach to LCV crash data collection and analysis was developed to support evaluation of each state's methods. These best practices were derived from several sources, including:

(1) NHTSA, *Traffic Records Advisory*, 1998 Revision.

(2) James O'Day, *Accident Data Quality; Synthesis of Highway Practice 192*, 1993.

(3) Theodore H. Poister, *Performance Measurement in State Departments of Transportation; Synthesis of Highway Practice 238*, 1997.

(4) Charles V. Zegeer, *Highway Accident Analysis Systems; Synthesis of Highway Practice 91,* 1982.

In addition, National Standards were adopted by reference as part of the best practices model system. These included:

∗ National Governor's Association Recommended Data Elements for Commercial Motor Vehicle Crash Reporting.

∗ Manual on Classification of Motor Vehicle Traffic Accidents, ANSI D-16.

∗ Data Element Dictionary for Traffic Records Systems, ANSI D-20.

∗ Model Minimum Uniform Crash Criteria (MMUCC).

The best practices approach was designed to describe a system that would meet the following goals for a crash records system, specifically as applied to reporting and analyzing LCV and CMV crashes:

∗ *The system supports detection of changes in LCV crash experience through year-to-year comparisons and analysis of trends across years (1, 3, 4)*. Trend analyses are the primary tool for demonstrating a change over time in traffic safety programs. Data must be comparable across years, and the analytic techniques must incorporate some method of assessing changes over time in order to demonstrate the effectiveness of state's safety programs related to LCVs.

∗ *The LCV-specific component of the state's crash experience can be clearly identified and analyzed in comparison to other components (1, 2).* In order to describe the safety performance of LCVs, analysts must be able to identify those crashes involving LCVs and to express LCV crash experience relative to other vehicle types. This requires that valid measures of exposure be collected for each specific vehicle type and configuration of interest. Lacking exposure data, decisionmakers cannot meaningfully compare the different vehicle types.

* *LCV-involved crashes can be characterized with respect to the influence of environmental, vehicle, driver/person, and other factors, and these contributing factors can be contrasted with factors implicated in crashes of other vehicle types. (1, 2)* As with any analysis of highway and traffic safety, the state's safety programs ultimately focus on contributors to the crash problem. Without detailed information, it is difficult to design and subsequently measure the effects of countermeasures.

* *Analyzing LCV-involved crashes enables decisionmakers to identify, implement, and evaluate countermeasures designed to improve LCV safety (1, 3).* Ultimately, if the information is not useful to decisionmakers the analysis was largely wasted. In highway and traffic safety programs, this means that analyses must serve one or more aspects of countermeasure design, implementation, or evaluation.

Table 1 presents a summary of the best practices approach adopted for use in this study.

Table 1: Best Practices for LCV Crash Data Systems

Overview
The best practices listed here are geared toward ensuring a state's ability to document the crash experience of LCVs and to characterize that experience relative to other vehicle configurations. The practices listed here are not all-inclusive, however. It is recommended, for example, that states follow the guidelines put forth by the National Highway Traffic Safety Administration (NHTSA) in its Traffic Records Advisory (1). The advisory is a comprehensive guideline dealing with all aspects of traffic and highway safety records, including crashes, vehicles, roadways, and people, and includes data files to support crash analysis. The best practices guidelines presented here are restricted to the collection and use of crash data, along with selected additional data sources such as traffic volume, and roadway usage data that can help develop measures of exposure. The guidelines specifically address the ability to characterize LCV-involved crashes. Best practices are presented in four sections: crash data collection, exposure measures data collection, data management, and analysis. For each item the best practice is described in boldface and a rationale is presented in italics. A reference for each practice is provided where possible. Some best practices, however, resulted from either the logical extension of advice given by NHTSA, FMCSA, and others, or through observation of the procedures currently in force in states throughout the United States.

Crash Data Collection

1. **Data should be collected on all crashes, regardless of severity (1, 2, 4).** *Only with a complete set of data can a state hope to understand the true crash experience of LCVs. Typically lacking are data on property damage only (PDO) crashes below the state's reporting threshold. This is a practical limitation of all U.S. crash records systems given the high costs of collecting data. While an ideal system would collect data on crashes below the threshold, the cost would be prohibitive. At a minimum, however, there should be no missing data for crashes above the state threshold.*

2. **Data collection should be performed by trained professionals wherever possible and at a minimum for all crashes above the state reporting threshold (1, 2, 4).** *Some states use data from drivers' reports of crashes and in some cases these self reports may be the only information a state has about a crash. Ideally, data would be derived only from reports completed by trained personnel such as law enforcement officers or designated report writers, who would gather nearly identical information. Data consistency is a key to the ultimate reliability of any analysis, and data reported by drivers is suspect simply because crashes affect drivers' records and insurance.*

3. **There should be one form for all crash data collection, or at least some verified method of ensuring that commercial vehicle supplemental forms are completed. (1, 2, 4).** *Several states implemented commercial motor vehicle (CMV) supplemental forms that are not integrated into the state's primary crash form. The result has been that in several states the level of compliance with CMV crash reporting requirements is much lower than for all other crash data. Officers simply fail to complete and submit the supplemental form. One solution is to incorporate the CMV crash information into the primary crash report form, which increases wasted paper because most crash reports do not include CMV information. States could also find ways to help ensure full reporting. Automated field data collection software, with user prompts for completing of all required data fields, is one way to improve reporting. Rapid feedback to the enforcement agencies when data are discovered missing and training in reporting methods can also be effective.*

4. **Data elements recommended by the National Governor's Association (NGA) should be collected on all CMV crashes (1).** *These data elements are required by FMCSA and must be entered into the MCMIS data system via SafetyNet. It is expected that all states comply with this requirement. The primary benefit in complying with the NGA data element requirement is that, at the national level, it is now possible to combine data from all states with some assurance of comparability. Without such comparable data from the states, especially in the area of CMV safety, monitoring truck safety becomes much more difficult and less reliable. (5)*

5. **For each commercial vehicle, information on the precise configuration of the vehicle (number of trailers, length of trailers, axles per trailer, power unit type, etc.) should be collected in a manner that relates to the state's overdimensional permit regulations as well as covering standard vehicle configurations (freeway double, turnpike double, Rocky Mountain double, triple, etc.).** *States regulate the configurations of CMVs that may travel selected roadways through permit programs, posted restrictions, and other methods. In an ideal system, the data describing a CMV involved in a crash would relate directly to the regulated or permitted truck configurations in the state. The advantage of matching configurations recorded in crash data with those tracked in the permit program is that the permits become a potential source of exposure data. In addition, without such a match, the state has no reasonable way to evaluate whether its permit program is in line with safety goals. That is, the state would not be able to determine if the current size and weight restrictions are helping to improve LCV safety.*

6. **Data collection fields and field definitions should meet or exceed national standards (MMUCC, ANSI D-16, ANSI D-20) (1, 2).** *At the present time, no states use crash data collection forms that exactly match the MMUCC guidelines. It is anticipated that this will change over time; best practices dictate that all states use a common standard. Currently ANSI-D16 is the best source for data definitions while MMUCC is the guideline for a minimum data set. All states should collect at least the data elements in MMUCC. As with the NGA data elements, use of other standards is most important for comparative and aggregate analysis at the national level. With greater compliance will come a greater ability to analyze the national LCV crash problem and improved assessment of each state's contribution to the national picture.*

7. **Correct carrier identification should be collected for all CMVs involved in a crash. All carriers should have obtained or be assigned unique DOT identification numbers.** *Several states have initiated programs to ensure that intrastate motor carriers obtain DOT ID numbers. This makes it easier to audit crash records to ensure that the numbers reported at the federal level (by FMCSA) are correct; i.e., that only interstate carriers are included. Since all carriers are not required to have a DOT number, and since there is no corresponding requirement to collect that number after a crash, states have a hard time determining whether CMVs in crashes are intrastate or are interstate but lack a number on the form. Most importantly, without the carrier ID number on the crash report it is far more difficult to track interstate carrier safety performance.*

Exposure Measure Data Collection

1. **States should collect information on several measures of exposure in addition to having high quality VMT data. Additional potential measures include: fleet makeup, permits issued, and tolls, among others. (1, 2)** *Typically, exposure is measured by vehicle miles traveled. (VMT). This measure is widely used and generally accepted as meaningful. Unfortunately, VMT measures are often not specific, and data collection errors can make use of the numbers problematic. In an ideal system, VMT estimates would be available and reliable for each vehicle configuration of interest. In some cases, non-traditional methods of generating VMT estimates, such as toll collection data, can provide the necessary specificity (6,7). In addition, VMT is not the only possible measure of exposure and, in fact, may be less meaningful than other measures depending on what is needed. Ideally, a state will be able to generate other measures of exposure and produce crash rates per registered driver, per permit issued, per trip taken, and so forth. Having multiple measures supports a more thorough analysis of the data and can lead to fresh insights into the state's crash experience. It is explicitly recognized that the cost of generating valid VMTs for specific vehicle configurations can be high and that other measures of exposure may also suffer from a high cost of data collection and poor data quality. These issues need to be addressed no matter what exposure measures are used by the state.*

2. **The exposure measures should be available for various configurations of CMVs, including distinct estimates for each of the major types of tractor/trailer configurations (singles, freeway double, turnpike double, Rocky Mountain double, triple, etc.).** *Without estimated VMT for each possible configuration of CMV, it is impossible for states to compare the crash rates of the various vehicle types. As a consequence, all comparisons must be done on raw crash counts only, a situation that only reveals part of the story. The relative safety performance of different vehicle types, for example, could not be compared if only the absolute numbers of crashes, injuries, and fatalities are available. Other measures in addition to VMT should also be available for specific configurations of vehicles.*

Data Management

1. **Data should be entered into an automated system as close to the collection source as possible. For example, field data entry of crashes by enforcement officers into an automated system is preferable to data entry by clerks in a central location. (1, 2)** *Field data entry by trained professionals at the crash scene eliminates data handling steps. Every time data are handled (e.g., each time the report is entered into a system or coded for later entry) represents another opportunity for error. If data are entered once in the field, all subsequent error opportunities can be eliminated.*

2. **Reports from different sources (enforcement officer, driver, other) should be clearly delineated and the data from the various sources should not be "mixed" to form one official record of the crash without retaining the ability to review the original reports. That is, conflicting data sources should not be resolved by data management staff in order to create one single record of the crash. (Ideally this point would be moot because all reports are produced by trained professionals and no driver information is used to report the crash.) (1, 2)** *In states where driver reports or other sources of information about the crash are used, sources should be maintained separately. Failure to do so means that the final crash record used by the state is composed of mixed data from sources that may be more or less reliable. Since such a merged file must involve the judgement of the individuals responsible for "blending" the various data sources, the other obvious problem with the resulting file is that it does not consist of uniform records. Some records would contain only driver self-reported information, others would contain a mixture of police and driver-reported data, and so forth. Unless the sources are retained separately (preferably in an automated format to facilitate retrieval and comparison) there is no way to distinguish among records of various types and quality of the data cannot be determined.*

3. **Missing and incomplete reports are researched with the official reporting and/or enforcement agency and resolved. (1, 2)** Any *crash records system should ensure data quality for completeness and accuracy. There must be a meaningful way to identify when data are missing (e.g., the report never arrived from the enforcement agency) and must also be some practical method for obtaining the missing reports in a timely fashion. In many states, this is currently not feasible since data entry lag times are so long that there is no reasonable way to follow up missing reports in a timely fashion. Without timely feedback, there is no expectation that the enforcement personnel can accurately complete the necessary reports. Timely feedback is also a very effective training tool that can improve data quality over time.*

4. **Quality control checks are performed on all data prior to adding it to the official database. Errors are resolved with the officer who submitted the report or with his/her supervisor(s). (1, 2)** *Along with data completeness, accuracy is the main goal of a crash records system. In an ideal system, if errors are found they are corrected by the person who submitted the original report. This works best when errors are identified in a timely fashion. If there is a long data entry lag, errors cannot be addressed while the information is still fresh, and if errors are not addressed with the person who wrote the report, an important training and quality improvement opportunity is lost.*

5. **Data entered in to SafetyNet are a subset of the data stored on the state's full crash report database and are transferred to SafetyNet electronically rather than requiring separate data entry.** *Double data entry, or handling CMV crash records in a separate process from the primary crash report data, means that the main crash file and the MCMIS data will not match. The practice of not using the main file to generate, as a subset, the data going into SafetyNet translates to more data entry time, less useful data sets, and a significant barrier to data quality audits. Many states have this dual system because the lag for data entry into the main crash report systems is too long so that states enter truck crash data sooner, but into a separate system that does not share data with the main crash file.*

6. **All crash data are available in one records system, including all standard and CMV-related information in one database. (1, 2, 4)** *Since states already automatically enter crash data into the crash record system, the ideal system is one that does not require double data entry for crash reports involving CMVs. More importantly, if a state integrates the CMV crash information into its primary crash records system, a complete record of the crash is available for analysis.*

7. **The data in the system is auditable through checks against original reports or checks against other data systems. The results of audits are used to generate improvements in data collection and management. (1, 2)** *If the state has multiple systems, it is imperative that audits are conducted to ensure that the systems show the same crash counts (assuming the same reporting thresholds for the multiple systems). In an ideal system, regular audits result in meaningful feedback to the people who collect the data in the field and to those who enter it or manage it in the state's system.*

Analysis

1. **The state has its own data analysis system capable of accessing integrated data, including the main crash report plus supplemental data, on all CMV-involved crashes. That is, SafetyNet is not the only (or primary) source of CMV crash data analysis. (1, 2, 3, 4)** *To have value, the data must be useful in decisionmaking. In an ideal system, state personnel in a variety of jobs would be able to request or conduct analyses of crash data to meet their specific needs. This means that the state must either have easy-to-use analytical software or a method for ensuring that data users' needs are met through some analytic support staff function.*

2. **The analysis system supports standard tabular reports for any field or combination of fields in the crash records system.** *For most purposes, a simple analytic system is sufficient. Users should be able to obtain a crash report, but one that helps them characterize crashes and make decisions.*

3. **The analysis system is capable of using the state's location coding scheme so that it produces location-based counts of crashes involving CMVs. The system should be capable of doing this analysis individually for each type of CMV. (1, 3, 4)** *States typically create a master list of unique location codes that are assigned to locations on roadways. These codes are the primary link to other data sources, such as pavement files and roadway files. To best support decisionmaking, the crash information should be easily tied to the information in roadway files. The primary uses for location-based analyses, especially as they relate to LCV safety, is in designing enforcement and engineering countermeasures. Combined with analysis of contributing factors, location-based analyses can give safety program personnel detailed information to help decide which locations to target for which type(s) of treatment.*

4. **Analysis of CMV crash experience in the state is updated annually. (1, 3, 4)** *Just as most states prepare an annual crash facts report, states should be capable of analyzing and reporting on CMV crash facts each year. This can be done as part of the overall crash facts, or it can be a completely separate effort. The annual updates are necessary to facilitate analysis of trends, i.e., how the crash experience of LCVs is changing over time and how those changes relate to specific countermeasures the state has implemented.*

5. **The analysis supports reporting of crash characteristics and counts for each key type of LCV and, for comparison purposes, non-LCV tractor/trailer combinations. (1)** *The database should contain the appropriate data and be able to access and summarize it. If the data aren't specific enough, there is no hope of analyzing LCV types. Assuming the data are specific enough, the system should support access to and reporting of the data. In the case of LCVs, this may actually mean that the system must also support combining data over multiple years because LCV crashes are relatively rare events.*

6. **The system uses available measures of exposure to produce crash rates and comparisons among vehicle configurations, including individual LCV types. (1)** *Assuming appropriate measures of exposure are available, it is important that they be used to help decisionmakers understand the state's experience with LCV crashes. Measures of exposure should be used to calculate crash rates per VMT, per licensed driver, per registered vehicle, per permitted load, and so forth. These measures should supplement the presentation of crash counts to give decisionmakers an added perspective.*

The comparison of state procedures to these best practices in Tasks 1 and 2 was based on the submitted materials and information gathered during site visits to each state.

Task 3: Data Audit

The goal of Task 3 was to conduct a form-level audit of crash reports in two states, Oregon and Utah. The primary focus was to determine the quality and consistency of reports on crashes involving LCVs, but also to compare that to the quality of reports from crashes involving non-LCV large trucks. The objective was to develop a set of recommendations that would address the major issues found in the audit. The form-level audit was not designed to be exhaustive or to go beyond the readily available data, that which ultimately would be used to analyze LCV and large truck crashes in these two states. Put another way, the audit was a means of identifying the most prevalent and most important data quality problems rather than of documenting every problem and its frequency.

The approach was to develop a representative sample of LCV and non-LCV large truck crashes in both states and to have two experts jointly evaluate the reports to reach agreement on data quality problems.

The sample of crashes was selected to meet the following criteria:

- The sample must represent all large-truck involved crashes in the state.
- The sample must also represent all LCV crashes in the state.
- The sample should be large enough so expert evaluators can judge the magnitude of problems associated with data collection and make recommendations for improvement.
- The sampling strategy should be similar for the two states (Oregon and Utah) so that any differences between them do not result from different research procedures.

This last criterion was implemented with a view toward potential expansion of this project and/or later use of the results for research. As noted in the introduction, the study was not designed to be immediately generalized to the national level. Similar evaluations and audits should be conducted in other states before reliable judgements can be made about the nationwide status of LCV and large truck crash reports. However, it is also recognized (and reflected in the sampling plan) that such generalizations are difficult to avoid. This was the primary reason for adopting the same sampling plan in both states. Replication of this methodology in other states should give comparable results.

In order to develop a single sampling plan that would work for both Oregon and Utah, an outside expert in sampling strategy and statistical methodology was enlisted. The person selected has conducted numerous studies over several decades in transportation safety research and has participated in dozens of data audits sponsored by NHTSA and state government agencies.

The sampling expert was provided with previous reports from this project (Tasks 1 and 2) along with supplementary information provided by the states. This information included tables of crash frequency for identifiable large truck configurations captured in the state's data. This was important because, for the LCV vehicle configurations of most interest, the data are included as part of the count for crashes involving specific types of CMVs in the state data.

The codes for vehicle configuration differ markedly between states and this affected how the sample was designed. The goal of making the two states' samples comparable meant that the vehicle configuration coding differences had to be considered when deciding how many of each type of crash to ask for from the state. In particular, Oregon does not distinguish among the various types of double-trailer combination vehicles whereas Utah has several different vehicle configuration codes depending on the length of *both* the front and rear trailer in a tractor-plus-two-trailer combination. Some of these double-trailer combinations ("doubles") are not LCVs and some are. Using coded data in the crash database Utah can, in theory, distinguish between types of doubles that are and are not LCVs whereas Oregon cannot.

In both states all triple-trailer combinations ("triples") consist of a tractor plus three towed trailers, each a maximum of 28 feet long. There are no differences in what constitutes a triple in the states' coding, but the Utah vehicle-type codes can (in theory) also distinguish between vehicles with three cargo spaces – that is, a straight truck towing two trailers is distinguishable from a tractor towing three trailers.

The sampling strategy was developed with the preceding facts in mind, along with the overall counts of crashes involving large trucks and the sub-counts of crashes involving various large-truck configurations for both states. The following decisions were made based on these counts and the state's ability to distinguish truck configurations:

* All 1998 truck crashes coded as triples by the state would be added to the sample. This amounts to a census of the eligible crashes. If the state data file showed at least one triple in the crash, the crash report was copied and added to the sample.

* A 20% sample was taken for all 1998 crashes involving doubles in both states. This meant that in Oregon the list of crashes coded as involving at least one double was used. In Utah, the sample was based on a list of crashes within the several configurations of doubles. For each list every fifth crash was selected. For configurations of doubles in Utah that showed up rarely, (i.e., fewer than five crashes were coded) at least one crash was selected for the sample.

* A 10% sample was taken for all 1998 crashes involving at least one truck with a GVWR greater than 26,000 pounds. This ensured that the sample would only reflect large truck crashes. This 10% sample was selected without regard to the samples already selected

for triples and doubles. That is, every crash with at least one truck over 26,000 pounds GVWR was eligible for inclusion. An ordered list was produced of all such crashes, and every 10th crash was added to the sample.

In order to ensure that the sample would be representative, it was necessary to be reasonably certain that selecting every 5th (for doubles) and every 10th (for large trucks) crash would approximate randomness. This assurance was arrived at by interviewing the persons responsible for data management in the two states to determine if crashes selected in such a manner would not represent all the state's recorded crashes. The primary questions asked were:

In 1998, were there any crash numbering conventions other than a general date order? In other words, does the number assigned to a crash report indicate only the order in which it was received by the state and not the place of origin, the type of vehicles involved, or the crash severity?

∗ In 1998, did the state experience any "clumping" of crash report submissions, especially with regard to large trucks? In other words, did any law enforcement agencies submit reports in large batches at the end of the quarters or end of the year, such that by taking every 5th or 10th crash we would be over or under-sampling that agency's reports?

∗ Are the 1998 reports considered to be of similar or better quality than those from previous years? That is, is there any reason to avoid using 1998 crash reports when conducting an audit of data quality for the state? Would other recent years be more representative?

The answers to each of these questions were satisfactory. They supported the sampling strategy described and that it could be implemented by the staff at the two state data centers. This was an important consideration as the personnel in both states were asked to generate a large sample of crashes using a standardized procedure and then to order copies of those crashes for our review. If the sampling procedure was too complex, it was possible that the state agency staff would not have time to work on the project and/or that the resulting sample might not have been generated correctly.

Once the strategy was agreed on by the data center managers, they were asked to produce three separate lists of crash identification numbers: all triples; all doubles (regardless of configuration); and all crashes involving any truck with GVWR greater than 26,000 pounds. For Oregon, the staff at the data center then pulled the relevant sample by selecting all triples, every fifth double, and every tenth large truck from the appropriate list. Utah elected to forward the lists and allow the project team to select the sample. As mentioned previously, Utah actually produced separate lists for each possible configuration of double; the project team sampled each of these sub-lists so that all configurations were proportionally represented in the final list of selected crash identification numbers.

This scheme allows the possibility of some duplication. For example, if a crash coded as involving a triple is selected in the 10% sample of all large-truck crashes, it would have already been selected in the census of crashes involving triples. In such cases, the crash was taken off the 10% sample list. Similarly, if a crash involving a double was selected in both the 20% sample of doubles crashes and the 10% sample of large-truck involved crashes, it was dropped from the large-truck sample. Such crashes were not replaced, as the double or triple was already part of the more specific sample and its results would be captured and added to the overall evaluation. There were only a small number of duplications (as one would expect) and the final counts of crashes were still 10% for both states' large-truck involved crashes.

In both states, the selected crash identification numbers were forwarded to the state's archivists for truck crash reports. The archivists were instructed to copy the entire crash report for each case. The only exclusion was that in Oregon the driver reports were not copied. This was decided because the state keeps a separate truck crash report archive that does not rely on driver report data and that includes only reports generated by an enforcement officer (the Oregon Police Traffic Crash Report, and the Police Truck/Bus Supplemental) and the motor carrier companies' reports of crashes (Motor Carrier Accident Report). There is no way in Oregon to identify in advance which crashes have both a police and motor carrier report and which are missing one or more of the forms. Since it simplified the instructions, we asked for copies of every page in the truck crash archive for Oregon, knowing in advance that some crashes would only be described based on the motor carrier reports, some based only on the police traffic crash report, some based on the police traffic crash report plus the truck/bus supplemental report, and some based on all three types of reports.

The data manager in Oregon pulled the relevant sample and forwarded copies to the project team for review. In Utah, the project team listed the crash identification numbers in the three sub-samples and forwarded those to the state archivists, who then copied the relevant reports from microfilm. The copies were forwarded to the project team for review.

The project manager maintained frequent contact with personnel in the state's data management and archival storage operations. No problems were reported and the only questions were related to the mechanisms for payment and shipping of the final copies.

Table 2 shows the sample size for Oregon and Utah categorized by vehicle configuration: triples, doubles and all large trucks.

Table 2: Sample Size (number of crashes) in Oregon and Utah

	Oregon	Utah
Triples[1]	15	32
Doubles[2]	27	75
Large Trucks[3]	148	200
Total	190	307

[1] The count of triples represents a census of all crashes involving a tractor plus three trailers.
[2] The count of doubles represents 20% of all crashes involving a tractor plus two trailers.
[3] The count of large trucks represents 10% of all crashes involving any truck with a GVWR > 26,000 lbs.

In reviewing Table 2, it is immediately clear that crashes involving doubles and triples were a somewhat larger proportion of the sample in Utah, where almost 1/3 of the crashes in the sample involved doubles or triples, than they were in Oregon, where fewer than 1/4 of the crashes in the sample involved double or triples. This caused some concern because of the smaller sample size overall in Oregon. It was decided, however, that rather than change the sampling scheme, the evaluation could proceed and the results could be viewed with an eye toward determining if a larger sample size would have changed the ultimate outcome of the audit. Since the goal was to find the most salient problems rather than give a precise accounting of the relative frequency of *all* problems, it was reasoned that the sample size was probably sufficient for both Oregon and Utah. The results of the joint form review supported this conclusion.

The primary focus of the data audit was to provide AAAFTS with an expert-level review of the quality of information contained in the crash reports for large trucks in Oregon and Utah, with special attention paid to LCVs. Because LCVs are generally found mixed into the data on doubles and triples, the reports describing crashes involving doubles (whether LCV or not) and triples (always LCVs) were reviewed separately from those involving large trucks in general.

A two-person team consisting of the project manager and an external expert reviewed crash reports from both states. Both are expert in traffic records data audits and have several years of experience with large-truck crash data in particular. The external expert is a Major in the Colorado State Patrol and has decades of field and training experience with crash reporting in general and large truck crashes in particular. Both reviewers have served on transportation records audits at the state level and the external expert is a frequent participant in NHTSA-sponsored traffic records assessments. He had not participated in past audits of Oregon or Utah, but was familiar with their practices and records systems. He also was provided with copies of the Task 1 and 2 reports from this project in order to give him background information about the practices in both states.

The audit was conducted over three days. The team met face to face on all three days with time scheduled for independent reviews and note-taking, followed by joint discussion of general issues or specific crash reports. The team met briefly the first day to discuss the project goals , the procedures to follow, and to familiarize the external expert with the forms and codes used in both states. The actual review of crash reports was conducted over the course of the final two days. A scheduled break after the first hour of review was used to discuss the workings of the process and whether any changes were needed in the review procedure. None were necessary.

Because of the importance of LCVs to the overall project goals, each crash involving a double or triple was reviewed by both participants independently and then discussed. Both reviewers' notes were compared on a case-by-case basis and a consensus opinion arrived at about each crash report's strengths and weaknesses. Thus, the audit process was structured to result in a single opinion about each LCV-involved crash report.

For the sample of large truck crashes, each reviewer took roughly one-half of the crash reports and made an independent review of the reports. Each then selected candidate reports for the other participant to evaluate as a cross-check. The cross-check reports were selected specifically to include those reports which the individual reviewers thought were particularly illustrative of some problem in or feature of that state's large truck crash reports. This cross-check was performed as an independent review in that notes on the crash were not shared until after the second reviewer had finished his evaluation. This allowed the reviewers to compare each other's comments in order to determine if they found the same good and bad points in each report. The review comments generally agreed, and, more importantly, the recommendations arising from the independent reviews agreed in detail. As with the crash reports for doubles and triples, the reviewers discussed the large truck crash reports for each state and arrived at an agreement on major problem areas and on recommendations to each state.

As each participant worked through the crash reports, he kept separate lists of specific comments on a case-by-case basis as well as comments or recommendations. These were discussed at the end of the cross-check review process in order to determine if there were any particular points of disagreement. There was no substantial disagreement.

For each state, the review comments were sorted into the following categories:

∗ Configuration: Comments related to the state's ability to determine vehicle configuration accurately, especially as this relates to a review of LCV versus non-LCV configurations.

∗ Location: Comments related to the state's ability to locate crashes involving large trucks based on information contained in crash reports.

∗ Contributing factors: Comments related to the state's ability to describe the events and causes of individual crashes and to reliably aggregate that information among crashes in order to arrive at a realistic picture of its crash experience.

∗ General: Comments related to overall data quality and/or portions of the crash report not directly related to the three main categories.

III. RESULTS

This section presents the results of the evaluations performed in Tasks 1 and 2, as well as the results of the data audit conducted in Task 3 for Oregon and Utah, listed separately for each state. A summary of results and conclusions appears in Section IV of this report, along with recommendations for each state. The Task 1 and 2 evaluation results are presented in tabular form, with each row in the tables keyed to the best-practices guidelines presented in Table 1.

Table 3: Results of Evaluation in Florida

Crash Data Collection

1. Collect Data on All Crashes	Florida does not collect crashes below the state threshold at the state level. Some of this information is available locally, but there is no way to compile statewide statistics that include a count of minor crashes. There is no reason to expect that this affects CMV data more than non-CMV crash data. Florida uses a two-tiered system for reporting. Short-form crashes are those involving no injuries or fatalities and in which all the vehicles were driveable -- basically PDO crashes in which the damage was above the state reporting threshold, but minor in all other respects. Long-form crashes are those involving disabling damage to a vehicle and/or an injury or fatality.
2. Data Collection by trained professionals	Trained personnel complete all crash reports in Florida. Driver reports of crashes are not used.
3. Unified form to ensure CMV data collected	Florida has a separate commercial vehicle truck and bus supplement form for collecting CMV-specific information. The form is not integrated with the primary official crash form. The supplemental form was reported as "often missing."
4. NGA collected on all CMV crashes	Florida collects all NGA data elements. The number of reported CMV-involved crashes based on the long form does not match the number of CMV supplemental forms submitted. Officers do not always remember to fill out the supplemental as required.
5. CMV configuration captured	Florida collects adequate information on the configuration of the vehicles involved in crashes, in part because of restrictions on the types of LCVs allowed in the state.
6. Meets standards	Florida does not currently adhere to MMUCC standards, although almost all the MMUCC elements are captured on the form.

7. Carrier ID collected	Florida has launched a program to assign USDOT numbers to all inter- and intra-state carriers, but this program is not completed yet. Carrier ID is not always collected accurately.

Exposure Measures Data Collection

1. Multiple measures collected	As with most states, Florida estimates VMT overall and can estimate VMT for specific vehicle types. These estimates are used in the state's annual crash facts report. Florida has also participated in studies using toll road data in calculating estimated VMT for specific vehicle types (6, 7). The DHSMV has information on driver and vehicle registrations for the state. These could be used to create measures of exposure for CMVs or CMV drivers in general. Actual vehicle configurations as driven are not captured by these two measures.
2. Measures for each vehicle configuration	Since Florida does not issue permits for longer combination vehicles, the permit system cannot be used to develop measures of exposure for LCVs specifically. Freeway and turnpike doubles are the only multi-unit configurations allowed in Florida, neither of which requires a permit. Since turnpike doubles are restricted to the Turnpike, it is possible that data from mandatory weigh stations could be used to estimate the volume. Tolls, which are based on the number of axles, could be used to approximate the count and miles traveled by these vehicles on that one selected roadway.

Data Management

1. Data entry near source of collection	Florida's Department of Highway Safety and Motor Vehicles (DHSMV) currently enters every crash report from a paper hardcopy. Only a small minority of these reports is printed from automated field data collection systems at the local level. The DHSMV is trying to promote regional crash data entry centers in the major counties and to change the central system to allow electronic data submission.
2. Different sources segregated	Florida relies exclusively on crash data reported by trained law enforcement personnel. There is no need to segregate data from driver reports. The state does keep separate data on long-form and short-form crashes, which are not entered into the main database.
3. Missing reports follow up with reporting agency	Data entry lags in Florida are such that there is no opportunity for meaningful follow-up with reporting officers or agencies. E.g., if a CMV supplemental form is missing, the opportunity to collect the information is long past and the data are irretrievably lost.
4. Quality Control and error follow up	Florida's data entry procedures include extensive edit checks. There is no specific process for follow-up on errors in individual reports.

5. SafetyNet is a subset of main crash database	The Florida crash records system incorporates data from the primary crash report and the CMV supplemental form. A data extract is produced which is uploaded into SafetyNet. There is no duplicate entry of data into both the crash report system and SafetyNet.
6. One records system for crash data	Florida does not have one records system for all crash data. DHSMV maintains one system and the DOT maintains a separate system in which locations are coded. The DOT system is built from a passthrough of the DHSMV records, but DOT is also interested in short-form and even non-reportable crashes and adds this information to their system, when it is available.
7. Data audits are supported	Florida has performed data audits in the past. In the case of CMV crash records, the audits have uncovered problems with missing supplemental reports and inaccurate data for Carrier ID numbers.

Analysis

1. State has analysis system	Florida's DHSMV has analytic personnel on staff. For the most part, they make use of the main crash data file by loading it into SAS. This has worked well enough in the past, but DHSMV is not the MCSAP agency for the state and supporting the analytic needs of outside agencies may overtax the DHSMV staff in the future. The state has recently established a commercial motor vehicle subcommittee of the state's Safety Management System. This group will, in part, serve to address analytic needs.
2. Tabular reports supported	The DHSMV analysts are quite skilled. They are able to produce detailed tabular reports on any fields available in the database. They also are capable of performing higher-level statistical data analyses and do so upon request.
3. Uses state codes for location reports	Location coding of crash data is done by the Florida DOT, which does not share the coded data back with DHSMV. If a location-based analysis is required, the request has to be handled by FDOT if street-level accuracy is required. The analytic capabilities at FDOT are not as easy to access as those at DHSMV. For most large truck crashes, the location will be coded in the FDOT file because the roadways on which these vehicles travel are in the state's location database.
4. Annual CMV crash facts	DHSMV produces an annual crash facts book. Until recently, this document had very little information on CMV crashes and none at all regarding multi-unit CMV configurations. Beginning with the 1998 crash facts book, the annual report will have a large section devoted to CMV crashes. It remains to be seen if this will include additional vehicle configurations in the tables. In the past, DHSMV has also produced a truck crash facts book, but this has not been produced for at least 5 years and there is no plan to publish it in the near future.
5. Capable of reporting LCV-specific data	Because the data set available to the DHSMV analysts does include information about vehicle configurations, the analysts are capable of producing reports with the desired level of specificity.

6. Measures of exposure used for rates & comparisons	There are no reasonable measures of exposure for LCVs in Florida. It is possible that FDOT can estimate some measures (such as VMT) for CMVs in general, but there is no detail available to provide separate exposure measures for each of the vehicle configurations of interest.

Overall, Florida has good data collection practices. The primary problems include CMV supplemental forms that are missing and data that are inaccurate. Both of these problems are tied directly to law enforcement's inexperience or lack of training in completing crash reports involving a commercial motor vehicle.

Because of a six-month data entry lag, missing forms and inaccurate data are not readily identified. Some agencies use automated systems for crash data collection in the field, but at present the forms are still printed out for manual data entry. The state does not currently take advantage of automation to speed up feedback. There are projects underway to improve the situation by allowing the state's crash records system to accept data electronically.

Florida in essence has neither the need nor the capability to generate LCV-related measures of exposure. Except on the Florida Turnpike, the state does not allow vehicle configurations that would be classed as LCVs for the purpose of this study. The state does, however, have some large configurations of vehicles, including single trailers up to 53' and two types of doubles. If one were interested in turnpike doubles, the data could perhaps be obtained through the Turnpike Authority along with estimates of VMT (6,7). The data on freeway doubles (which are not considered LCVs because of their shorter trailer lengths) would be nearly impossible to estimate. These vehicles are allowed on practically every road in the state.

Florida's data management is close to the best practices model. While they do have more than one crash data system, the split in data systems is not critical for the concerns of analyzing CMV data. The critical aspect of the Florida systems for CMVs is that the data only need to be entered once. This eliminates a separate data entry function just to support the SafetyNet file.

Solving the problems of missing supplemental reports is critical to improving management of data in Florida. Other states have been successful in increasing the probability of collecting the NGA data elements by creating a single crash report form. Florida is considering a move to a single form the next time they modify their state crash report. For now, however, they have very little ability to obtain missing reports because of the lag time in entering data – by the time the clerks notice that a supplemental report is missing, six months may have passed. To reduce this lag time, the DHSMV and FDOT have worked together to expedite entry of CMV-involved crashes. This opens the possibility for more timely feedback to the enforcement agencies if a supplemental report is missing. Some of the automated field data collection systems in use at local law enforcement agencies have built-in prompts for completion of the CMV supplement, but this is not a universal practice, nor have automated field data collection systems penetrated the law enforcement community to the point where they can be considered an imminent solution to the problem of missing reports.

Florida's analytic capabilities are excellent, in part because of the skilled staff at DHSMV. For CMV crash data, the primary problems are that location-coded data reside elsewhere (FDOT) and the lack of exposure measures makes it difficult to do anything beyond reporting tabular counts of crashes. It is unlikely that Florida will embark on a major effort to develop new measures of exposure that are specific to the various CMV configurations. It is difficult for the MCSAP lead agency (FDOT) to launch an effort of this magnitude without outside assistance.

Table 4: Results of Evaluation in Idaho

Crash Data Collection

1. Collect Data on All Crashes	The Idaho Transportation Department collects data on all crashes above the state threshold ($750 damage and/or injury or fatality).
2. Data Collection by trained professionals	Trained enforcement agency personnel collect all data.
3. Unified form/ensure CMV data collected	The Idaho crash report integrates the NGA data elements. There is only one form.
4. NGA collected on all CMV crashes	If a CMV is involved in a crash that meets the reporting threshold, the officer is instructed to complete the relevant sections of the official form. There have been some problems with compliance; however, the State Police (the MCSAP lead agency) funded additional training which has resulted in improved reporting by law enforcement officers.
5. CMV configuration captured	The Idaho crash report is designed to capture basic information about CMV configuration. A data audit has revealed that there is often mismatching information between configuration, number of axles, and Gross Vehicle Weight Rating (GVWR). Trailer length is not captured on the Idaho crash report form. The various types of double-trailer combinations, for example, cannot be delineated on the crash report form. All tractor/trailer/trailer combinations are given the same vehicle type code.
6. Meets standards	The Idaho crash report is not designed to be MMUCC compliant. Many of the crucial MMUCC data elements appear on the form. However, the comparison of the standard form to the MMUCC form has not been done.
7. Carrier ID collected	The carrier ID numbers are collected on the crash report form. A data audit has shown that these numbers are often reported incorrectly. The MCSAP staff researches each carrier in the FMCSA census file to ensure accuracy. When that fails to result in a correct number, the staff calls the carrier to get confirmation.

Exposure Measures Data Collection

1. Multiple measures collected	VMT is reported for all vehicles in aggregate and for CMVs as a separate class. Idaho has information on driver and vehicle registrations for the state. These could be used to create measures of exposure for CMVs or CMV drivers in general. Actual vehicle configurations as driven are not captured by these two measures.
2. Measures for each vehicle configuration	There are no measures of exposure available for specific vehicle configurations. It is possible that the permit program data could be used to develop a measure of LCV exposure, but this has not been attempted. VMT for each vehicle configuration could also be estimated based on classification counts if the data are judged to be sufficient. The quality of the state's count program was not reviewed.

Data Management

1. Data entry near source of collection	Idaho's IMPACT system allows for data entry at the scene of the crash by trained law enforcement personnel. The original electronic record of the crash is then printed out and submitted for data entry into the central database. This introduces an unnecessary step and increases the chances of data entry errors.
2. Different sources segregated	There is only one source of data in Idaho.
3. Missing reports follow up with reporting agency	Data entry lags are currently five months long. This makes it difficult to perform follow up on individual crashes.
4. Quality control and error follow up	The State Police MCSAP staff keep close watch on data quality for CMV crash records. They address quality problems through training rather than follow up on specific cases.
5. SafetyNet is a subset of main crash database	Data from the main crash reporting system are extracted and an upload file is created for SafetyNet. This increases the delay of entering data into SafetyNet but avoids the need for double data entry.
6. One records system for crash data	There is only one crash records system at the state level.
7. Data audits are supported	As evidenced by the quality control checks performed the Idaho State Police MCSAP staff, the system supports data audits quite well. The lags in data entry make it difficult to address specific cases, however the information thus gained is used in training for law enforcement agencies throughout the state.

Analysis

1. State has analysis system	Idaho has an excellent analytic support system. The Idaho Transportation Department has hired staff statisticians who primarily use SAS to produce analyses for the agency and others who make requests. The system is accessible to a wide range of users and provides a convenient and easy to use front-end to SAS.
2. Tabular reports supported	The system supports most analyses required by users without having to use the underlying SAS tools. Those tools are there, however if more in depth statistical data analysis is required.
3. Uses state codes for location reports	The analysis system is designed to incorporate the state's location codes. At present, this function of the system is not working well enough to be relied upon for analysis or planning purposes.
4. Annual CMV crash facts	The Idaho Transportation Department produces an annual crash facts book. The book has one table of information on large trucks.
5. Capable of reporting LCV-specific data	There is no method for producing LCV-specific data tables because the crash data do not include sufficient detail on vehicle configuration. Since there is a vehicle type code for triples, this specific class of LCVs could be separated for analysis, but various types of doubles cannot be distinguished.
6. Measures of exposure used for rates & comparisons	There are no measures of exposure that are specific to the vehicle configurations of interest. The only measures available are generalized to all CMVs.

Idaho supports automated field data entry, but uses paper printouts from the automated system to feed the data entry process. This is an extra step that causes delays and introduces errors into the system. Problems with accuracy are common in the CMV data. Of more importance for the study of LCVs, however, is the inability to distinguish between types of multi-unit combination vehicles. Because there is only one code for tractor/trailer/trailer combinations, the officer in the field cannot code whether a vehicle was a freeway double (two short trailers) or an LCV.

As with most states, there are no reliable measures of exposure at the level of individual vehicle configurations. The result is that it is unlikely that Idaho would be able to estimate crash rates for different vehicle configurations. Since the crash data do not include sufficient detail to distinguish among some of the configurations of interest (i.e., all double trailer combinations are coded the same way), pursuit of LCV-specific exposure measures is not likely to be worth the effort. Comparative crash rates cannot be produced if the crash counts for the various configurations can not be reported in sufficient detail.

The primary drawbacks of the Idaho crash records data management processes relate to data entry of previously automated information. Field officers have access to the IMPACT system for automated field data entry. The completed reports are then printed and submitted for data entry at the state level. This leads to a data entry backlog which in turn makes it difficult to perform any quality control or feedback in a timely or efficient manner. The fact that the system is used extensively to audit data quality means that Idaho is able to address some quality issues by altering the training given to law enforcement officers.

Idaho has excellent resources for producing high quality reports and statistical data analyses. Unfortunately, if a summary report is needed specifically for CMVs or for specific configurations of CMV, the crash data simply do not support the effort. There is no way to correct this situation without changing the crash report form to allow for additional vehicle configuration codes. Without the link to state location codes, the location analysis produced for CMV crashes is less useful or reliable than it should be.

Table 5: Results of Evaluation in Nevada

Crash Data Collection

1. Collect data on all crashes	Reports are completed on all crashes above the state threshold for damage, injury or fatality. If a CMV is involved, a supplemental form is required.
2. Data collection by trained professionals	Trained law enforcement personnel complete all reports. In the case of CMV crashes, experienced Highway Patrol officers complete most reports, except in large metro areas.
3. Unified form/ensure CMV data collected	Nevada has two crash report forms, the main form and a CMV supplement. The two forms are treated differently from the moment of completion.
4. NGA collected on all CMV crashes	The NGA data elements are captured on the CMV supplemental form. That form is required on all above-threshold CMV-involved crashes.
5. CMV configuration captured	The CMV supplemental form has 8 possible CMV configurations. There is insufficient detail in these configurations to distinguish between normal length and LCV types of vehicles in the same general category (e.g., there is only one code for tractor with double trailers).
6. Meets standards	The Nevada primary crash report form does not meet national standards. The data elements on the form (and the possible values of those data elements) are not a close match to the MMUCC guidelines. The NGA data elements are captured on the CMV supplement, which does meet the standards.
7. Carrier ID collected	Carrier ID is collected on the CMV supplemental crash form for interstate carriers. Dummy ID numbers are created for intrastate carriers so that their crashes can be stored in MCMIS.

Exposure Measures Data Collection

1. Multiple measures collected	The state has the ability to produce measures of exposure based on driver and vehicle registrations. Annual vehicle miles traveled is reported as an aggregate number. It is possible that VMT could be estimated for specific vehicle types based on classification counts. The sufficiency of the state's count program was not investigated as part of this study.
2. Measures for each vehicle configuration	There are no measures of exposure for specific vehicle configurations. Since the crash report is not used to collect information on permits, even the permit program data would be of little use.

Data Management

1. Data entry near source of collection	Data entry is centralized at the state level. There are two separate data entry paths, one for the primary state crash report and the other for CMV supplemental reports. Both involve manual data entry months after the crash event.
2. Different sources segregated	This is not an issue for Nevada with regard to the main crash report. There is only one source for crash data – the responding enforcement officer. With the exception of a brief narrative description on the state's primary crash report, all information is reported strictly by trained enforcement personnel. The form does allow for the possibility of a written driver or witness narrative, but that is the only part of the form not completed by the officer.
3. Missing reports follow up with reporting agency	There is no follow up for missing reports. In fact, the Highway Patrol staff in Nevada's MCSAP program fill out a supplemental report when one is required but it is not turned in by the reporting officer. In essence, the data in SafetyNet are a combination of police reports using the supplement and "replacement" supplements created by the supervisor of the data entry personnel.
4. Quality control and error follow up	There is only limited opportunity for quality control of CMV crash data. The two separate data sets (at DOT and NHP) do not match because of different reporting thresholds required by the state and by FMCSA. Since the primary crash report form does not contain tow-away information, the two systems will never exactly match. The staff involved in the two agencies has determined that cross-system data audits are not worth pursuing because of this mismatch. The two files are not linked.
5. SafetyNet is a subset of main crash database	In Nevada, the CMV crash supplemental form is data entered directly into SafetyNet. The supplemental reports are delivered directly to the Highway Patrol, bypassing the data entry stream for the main crash report.
6. One records system for crash data	There are two separate crash records systems in the state. The two systems do not communicate in any fashion. In theory, the files could be linked, but the DOT and NHP staff has determined that this is not feasible because of different reporting thresholds.
7. Data audits are supported	Data audits are considered a waste of effort because the main crash report system is based on different reporting thresholds from the CMV crash system. Some cross checks have been done between the FARS system and the CMV system. This allows the state to at least match on the total number of CMV-involved fatal crashes.

Analysis

1. State has analysis system	For CMV crashes, there is no state analysis system. The Highway Patrol staff use SafetyNet exclusively to obtain information.

2. Tabular reports supported	SafetyNet has limited reporting capabilities. It is the only analytic tool used by the NHP staff. Some reporting of limited CMV crash information is included by Nevada DOT in their annual crash facts report.
3. Uses state codes for location reports	Location coding in SafetyNet does not use the state location codes.
4. Annual CMV crash facts	There is a small amount of data on CMV crashes included in the state's annual crash facts book.
5. Capable of reporting LCV-specific data	There is no way to report LCV-specific data because the system does not capture sufficient detail on vehicle configuration within the main types coded on the crash report form. Since there is a vehicle type code for triples, this specific class of LCVs could be separated for analysis, but various types of doubles cannot be distinguished.
6. Measures of exposure used for rates & comparisons	There are no valid measures of exposure at the level of specific vehicle configurations. The lack of configuration-specific crash data makes it unlikely that creating such exposure measures would be worthwhile.

As in other states that use a supplemental form to capture the NGA data elements, Nevada has a problem with collecting the required CMV information. The separate form makes it easy for officers to simply forget to supply the additional information.

With respect to data collection for LCV crashes, the form has no information to adequately distinguish various configurations of double trailer combinations. If the vehicle is driven under an overdimensional permit, that information is also not captured on the crash report form.

Without efforts by Nevada DOT on behalf of the motor carrier program (housed in a separate agency, the NHP), data collection and quality problems for CMV crash data will be very difficult to solve.

Without changes in the Nevada crash report forms, there is no reason to engage in the effort of creating LCV-specific measures of exposure in Nevada. Codes for vehicle type on the CMV crash report form are not detailed enough for the state to reliably count LCV crashes. Without such counts, the measures of exposure are not worth the effort required to compile them.

For the purposes of documenting LCV crash experience, the data management practices in Nevada are far different from the outlined best practices. Primary and supplemental crash data are entered into separate and incompatible systems and missing data are "replaced" by the judgment of office staff. Data audits are nearly impossible because of the system incompatibilities. Agencies involved, in particular the Nevada DOT, are not moving in a direction that would resolve these difficulties with new system designs. The multiple entry of data also introduces opportunities for error.

Use of dummy USDOT numbers is not as reliable a tracking method as requiring each carrier to obtain an official number. The dummy numbers mean that the Nevada carrier census does not contain official carrier numbers for all inter- and intrastate carriers, but instead has a mix of official and dummy numbers.

The most problematic practice, however, is the one of replacing missing CMV supplemental forms by having office staff create them. This guarantees that many fields will be blank because the information is just not available and that data recorded into MCMIS represents a staff member's best guess rather than a direct report of what the officer saw at the scene.

Nevada is one of the few states whose MCSAP program must rely almost exclusively on the reporting capabilities of SafetyNet to obtain data analyses. Because of this, the state has no ability to link crash information from the CMV supplement to the rest of the information about that crash. Reporting of CMV safety data, in general, is limited.

Table 6: Results of Evaluation in Oregon

Crash Data Collection

1. Collect data on all crashes	Oregon's crash reporting requirements are such that the state is supposed to receive a report of every crash above the minimum threshold of $1000 damage and/or for an injury or fatality.
2. Data collection by trained professionals	A vast proportion of the data collected on crashes comes from driver self-reports – that is, the only information in the state records comes from the driver(s) involved in the crash. Enforcement officers respond to roughly 55% of crashes.
3. Unified form/ensure CMV data collected	Oregon makes use of four separate crash report forms: - The primary police crash report - A CMV supplement to be completed by law enforcement officers - A driver self-report form - A CMV carrier self-report form There is no requirement for a law enforcement officer to respond to a crash scene and fill out a report. The CMV supplemental report is also not required. Only the driver and CMV self-report forms are required by law.
4. NGA collected on all CMV crashes	The NGA data elements are captured most completely on the CMV supplemental form. Since law does not require this form, the full NGA data set is not collected on every CMV crash. With sufficient compliance, most of the data will be collected on the driver and CMV self-report forms.
5. CMV configuration captured	Both the police and self-report CMV crash forms include vehicle configuration information. The list is not sufficient to distinguish between specific types within a given configuration. For example, all doubles are given the same code.
6. Meets standards	The various reports used in Oregon do not meet the MMUCC guidelines.
7. Carrier ID collected	The carrier ID number is captured on both the Police and self-report CMV crash forms.

Exposure Measures Data Collection

1. Multiple measures collected	The state has the ability to estimate VMT for CMVs. Other measures of exposure based on driver and vehicle registrations or permits are possible.

2. Measures for each vehicle configuration	The state is able to produce estimated VMT for triple-trailer combinations. Other potential LCVs (doubles of various configurations) are not separately captured. It is possible that these could be estimated based on detailed classification counts. The sufficiency of the state's count program was not investigated as part of this study.

Data Management

1. Data entry near source of collection	Oregon has a centralized data entry operation. Paper forms are the primary source of information.
2. Different sources segregated	Oregon uses all available reports for a single crash to develop the single, most credible, description of the event. The reports are not stored separately in an automated fashion to facilitate later comparison.
3. Missing reports follow up with reporting agency	The Department of Transportation notifies carriers when their required self-report is missing. There is no follow up with enforcement agencies since there is no requirement to respond and report.
4. Quality control and error follow-up	The primary means of quality control is a cross check among the various reports describing the crash. There is generally no follow-up to correct errors, as the final record is essentially created from a mix of credible data on any of the reports submitted.
5. SafetyNet is a subset of main crash database	The data entered into SafetyNet are an extract from the motor carrier crash file maintained by the Department of Transportation.
6. One records system for crash data	There are essentially two main crash systems, the motor carrier crash file and the state file. The two are used for different purposes. The state file has a record of all reportable crashes. The motor carrier crash file records all CMV-involved crashes. From these two separate databases all other state and federal files are created. In theory, the two files could be linked to share data and reduce data entry.
7. Data audits are supported	In a sense, every report received represents an opportunity to audit the data already in the system for an individual crash. The reports are used in conjunction to arrive at the single most credible description of the event. However, there is no way to gauge the number of crashes that go unreported because drivers fail to fill out the self-report form, or how accurate and unbiased the compilation of reports is.

Analysis

1. State has analysis system	The state has good analytic capabilities in the data systems it uses for crashes in general and CMV crashes in particular.
2. Tabular reports supported	The system is capable of producing any tabular reports required.

3. Uses state codes for location reports	The system is capable of producing mapped output of crash locations based on the location coding used by Oregon DOT. This is sufficient for location of LCV crashes, as these vehicles are limited to major highways in the state.
4. Annual CMV crash facts	There are two annual reports containing information on CMV crashes: the crash rate tables and the Oregon motor vehicle traffic crash summary.
5. Capable of reporting LCV-specific data	The state tracks triple-trailer combinations separately and can report on this class of LCV specifically. Other types of LCV (the various types of doubles) are not tracked separately.
6. Measures of exposure used for rates & comparisons	Estimated VMT for triple trailer combinations is used, along with the crash counts for these vehicles, to produce estimated crash rates. Other LCV types are not reported or tracked separately. Calculation of rates for CMV crashes overall is supported.

The multiple forms and lack of a state requirement for trained law enforcement officers to respond to crash scenes means that Oregon has one of the most complex data collection strategies in the nation. In theory, the state should collect data from at least one source on every crash in excess of $1,000 and/or involving an injury or fatality. State law requires all drivers involved in above threshold crashes to submit a report to the Department of Motor Vehicles within 72 hours. The CMV operators are similarly required to submit the self-report form for motor carriers whenever the crash involves an injury, fatality, or disabling damage to a vehicle. This report must be filed in addition to the driver self-report and is due at the Department of Transportation within 30 days of the crash.

None of these forms captures data on the dimensions of trailers that would allow analysts to distinguish between LCVs and similarly configured non-LCVs.

Oregon has the ability to calculate crash rates for triple-trailer combinations because it can collect crash data and VMT specifically for this vehicle configuration. Other LCVs are not as easily identified in the crash data since the report forms do not distinguish between the various possible types within a given vehicle configuration code. This makes it not worth the effort of trying to develop corresponding exposure measures.

Data management in Oregon is complicated by the use of multiple forms. Of most concern is the practice of blending the data from the various crash reports to arrive at a single “most credible” record of the crash. This necessitates a judgment on the part of a person (the data manager) who was not at the scene of the crash. It also means that if multiple people are involved in creating this single best record, inconsistency between raters must be actively guarded against. Because the records from various sources are not stored separately in data files, there is no way to independently review the accuracy of the blended file or return to the source data to document inconsistencies in the multiple reports.

Oregon has very good analytic capabilities, but again the data are of questionable quality and are used extensively for ad hoc and standardized reporting. In the CMV analyses, the state uses standard methodologies to distinguish between avoidable and non-avoidable crashes in order to focus its efforts on those crashes which, according to the standards, could have been prevented.

Of the five states in this study, Oregon is clearly the one that stands out. Its laws do not require enforcement agencies to respond to crashes and as a result over half the data are derived solely from self-reports. Self-reported data are blended with police crash report data (when available) to produce a "most credible" picture of the crash. The decision of how to merge these various sources is based on the judgment of the person performing the task.

Oregon has good data on triple-trailer combinations and is the state in the best position to produce crash counts and rates using specific measures of exposure. Like the other states studied, Oregon does not have a reliable way of differentially describing the crash experience of the various types of double trailer combination vehicles (some LCVs and some not).

Because the driver self-report forms are clearly used for insurance purposes (the title of the driver report is *Oregon Traffic Accident and Insurance Report*), it should be noted that there is a powerful incentive for under-reporting or downplaying certain aspects of the crash. While it is difficult to know exactly what the effects will be of such heavy reliance on self-reports on data accuracy and ultimately the validity of analyses, two things are clear:

1) Blending data from various sources into a single record is not in line with a best practices approach. It is difficult to imagine a methodology by which this blending could be accomplished that would guarantee consistency across people and across years of data.

2) The data used for analysis are of suspect quality. Besides all the usual problems, the act of blending multiple reports introduces another source of inconsistency or bias.

In addition to the evaluation conducted in Tasks 1 and 2, Oregon also participated in a detailed audit of their CMV-involved crash reports in Task 3. Table 7 gives the results of that audit.

Table 7: Results of Data Audit in Oregon

1. Configuration	**a. Truck configuration on the crash report doesn't match configurations on the supplemental form.** This feature means that conflicting information is sometimes obtained because the officer has to choose among the configurations listed for the item on the form. In addition, the configurations differ to a lesser extent between the supplemental report and the motor carrier accident report. **b. Officers do not code configurations consistently.** For LCVs the most obvious example is the confusion over how to code a vehicle consisting of a straight truck plus two trailers. Some officers coded this as a double, others as a triple. The crash report lacks a code for this configuration. **c. Insufficient choices for vehicle configuration on all three report types.** The primary problem is in distinguishing among LCV and non-LCV doubles. All doubles are coded as the same vehicle configuration. Length of each of the two trailing units should be recorded, or the various types of double configurations should be available for the officer to record. **d. Cargo body type is often not recorded.** The supplemental report has the cargo body type (box, tanker, etc.) listed as one of the possible choices under vehicle configuration (double, triple, etc). There is a tendency to record one or the other because of the way the form is laid out. In contrast, the motor carrier accident report has separate items for vehicle configuration and cargo body type. There were also instances in which the body type was miscoded. Log and/or pole truck configuration is one example of a body type that is often miscoded or confused in the police reports. Mobile home "toters" are also often miscoded. **e. Gross Vehicle Weight Ratings (GVWR) are missing or entered incorrectly.** When weights are entered, the probability is that the actual weight of the load has been entered but there is no way to determine this from the form data. The number is clearly not a GVWR but it is impossible to determine what it actually represents. GVWR is used to broadly discriminate among vehicle sizes/classes. If this number is incorrect, the crash might be mis-sorted during analysis. **f. There is no consistency in the manner in which trailers are coded on the traffic crash report.** Some officers code the trailing units as separate vehicles (e.g., the power unit is vehicle 1 and the trailers are listed as 2, 3, etc.). Other officers code the trailing units as sub-vehicles of the power unit (e.g., the power unit is vehicle 1 and the trailers are listed as 1A, 1B, etc.). Still other officers fail to code the trailers at all. **g. Total number of axles is missing or coded incorrectly.** With the variety of vehicle configurations on the road, it is impossible to identify all the mistaken entries in this field. Some axle counts are clearly impossible given the vehicle configuration (e.g., 3 axles for a double) and probably reflect a mistaken understanding of what to enter in that space. **h. Diagrams do not depict the actual truck configuration.** Officers' diagrams were generally not detailed enough to determine if the vehicle had more than one trailer. Since this information was sometimes looked to as a way to "correct" the differently coded configurations on the crash report, the supplement, and the motor carrier accident report, having sufficient detail in the diagram was considered critical.

2. Location	**a. Diagrams don't match the described location in terms of number of lanes and sometimes direction of travel.** This problem is reflective of the larger problem with insufficient detail in diagrams. **b. Location coding lists two nodes, but not the distance from either node.** This problem makes it difficult to fine-tune any location analysis. When a node system is used for location coding, the distance and direction from the nearest node are key data elements.
3. Contributing factors	**a. Police reports are frequently lacking any indication of which driver is at fault.** If the officer does not cite any of the drivers, the only method available to determine fault is through the contributing cause codes or reading and interpreting the narrative. Oregon relies heavily on its ability to determine whether a crash was avoidable or not and the information that would help in this determination is missing a key component if the analyst cannot determine which driver is at fault.
4. General	**a. Out-of-date report forms are still used.** A number of jurisdictions, and even the state's highway patrol on occasion, seem to have retained copies of older forms. Some of the motor carrier companies also have older copies of the motor carrier report form. There are some data element differences between the old and new forms which make it difficult to integrate the older forms into an analysis of current data. **b. Carrier information on crash report and supplemental is missing.** This is especially true for USDOT and ICC numbers. Plate numbers asked for on the crash and supplemental forms don't match what is asked for on the motor carrier report. This makes it difficult to match up vehicles to be sure that the reports are merged correctly. **c. Hazardous materials are sometimes indicated as being present, or the truck was "placarded" but the placard number or HAZMAT ID was not recorded.** The reverse problem was also noted, that is HAZMAT placard numbers were recorded but the crash was coded as not involving hazardous materials. Analytically, these two problems make it difficult to determine which crashes actually involved vehicles carrying hazardous materials at the time of the crash. **d. Diagrams were insufficiently detailed.** This is a general problem, which affected the ability to describe locations and/or determine vehicle configurations. Often, the diagram was looked to as a way to make sense of the conflicting information in the various reports available. **e. Out-of-state carriers appear less likely to fill out the motor carrier report than are in state carriers.** The main problem here is that Oregon is almost certainly missing data on crashes despite the state's reporting requirements. Most likely missing are reports of single vehicle crashes involving trucks operated by out of state carriers.

Oregon's information on truck crashes comes from at least three source documents: the police traffic crash report, the truck/bus supplemental, and the motor carrier accident report. The first two of these are typically completed by one enforcement officer. Despite this fact, the information on the two forms does not agree, especially with regard to vehicle configuration.

This is compounded with a general low level of detail in the diagrams. The third source document comes from the motor carrier companies themselves. It is probably more reliable when vehicle configuration is in question. Other portions of the form are probably unreliable in the extreme (e.g., reviews of log book violations done by the carrier after the fact or narrative descriptions of the events). This is especially troubling if the motor carrier accident report is the only information available and the police did not respond to the scene. While police reports are generally turned in for serious (injury and fatal) crashes, this is by no means true in all cases. Especially troubling were the cases involving multiple fatalities and overturned vehicles. It is a certainty that an officer must have been dispatched to the scene, and yet in a small number of cases the only information available in the crash data file was from a motor carrier company.

Contrary to the initial results of the Task 1 and 2 evaluation in Oregon, it is clear that the motor carrier accident report has value in Oregon. Without it, there would have been several crashes in the sample where the vehicle configuration could not have been determined at all. This situation arises because of two main problems in the two police report forms:

* The choices of vehicle configuration don't match between the crash report and the supplemental

* Cargo body type is listed on the supplemental form as one of the choices for vehicle configuration. Often officers check off one of the eligible configurations and do not code the cargo body type. This results in incomplete information, but at least the configuration is captured. Less frequently however, officers check off the box for cargo body type and circle one of the types (van, dump, etc.) and then fail to code a configuration.

Old report forms are a problem in Oregon. With up to three possible forms for a single crash, maintaining the newest versions at all enforcement agencies and motor carriers is no doubt a daunting task. The problems arise, however, when the old forms are received and necessary information is simply not collected. Oregon's newest motor carrier accident report is much improved over the version in use for most of 1998. The new form asks for the carrier's USDOT and ICC number; the old version asked for the "authority number." Judging from the variety of answers, motor carrier companies did not understand what to put in this space on the form.

Table 8: Results of Evaluation in Utah

Crash Data Collection

1. Collect data on all Crashes	A crash report is required on all crashes exceeding the state's reporting threshold.
2. Data collection by trained professionals	Trained law enforcement personnel generate all crash reports entered into the system.
3. Unified form/ensure CMV data collected	Utah has a single basic crash report form that also incorporates the NGA data elements.
4. NGA collected on all CMV crashes	Most CMV crashes reports are written by specially trained personnel from the Utah Highway Patrol or local law enforcement agencies.
5. CMV configuration captured	Utah collects highly detailed information on vehicle configuration in CMV crashes. The configurations listed in the crash report match the definitions used in deciding whether or not a given vehicle requires an overdimensional permit.
6. Meets standards	The Utah crash report does not meet all MMUCC guidelines, but it does have equivalent or close matches to most of the MMUCC fields and values within fields.
7. Carrier ID collected	The carrier ID is collected at the crash scene. The state has paid close attention to the accuracy of the numbers collected. They have built an increasingly accurate census of carriers based, in part, on these efforts.

Exposure Measures Data Collection

1. Multiple measures collected	Utah has counts of drivers and vehicle registrations in the state. These are not specific to any one type of CMV and so can only be used in the aggregate. The state's permit program has extensive data on number and configuration of LCVs granted a permit.
2. Measures for each vehicle configuration	The state does not have VMT for specific CMV configurations. It can potentially estimate the number of LCVs of a given type by using the permit system information. In addition, it may be possible to estimate VMT for specific vehicle types based on classification counts. The sufficiency of the state's count program was not investigated as part of this study.

Data Management

1. Data entry near source of collection	Data entry takes two tracks in Utah. There is only one crash report form, but it is entered centrally into two different systems: the main crash reporting system and, for selected data, the MCMIS system via SafetyNet. Some agencies use automated field data collection software. For these agencies, the data are transferred to the state system without need for a hardcopy print out.
2. Different sources segregated	There is only one source of crash data in the state.
3. Missing reports follow up with reporting agency	Since the CMV data are integrated into the single crash report, there is no independent means of identifying when a report might be missing.
4. Quality control and error follow up	Data entry clerks recode the original crash report forms based on a review of the narrative and diagram. Edit checks are run immediately after data entry into the main crash records system. Rejected reports are corrected by the data entry staff and re-entered. A portion of the staff is dedicated to visual validation of every crash report form entered into the system.
5. SafetyNet is a subset of main crash database	Data are entered into MCMIS via SafetyNet on a completely separate track from the main crash report file data entry. In fact, the reports are forwarded directly to the motor carrier division where they are sorted and all CMV-related crashes are put in for data entry into MCMIS. The reason for this separate, duplicate data entry is that there is a 5-month backlog for data entry into the main crash reporting system.
6. One records system for crash data	There are essentially two crash record databases, one for CMV crashes and one for all data from all reported crashes. Because the two files result from separate data entry processes, the data in them may not match exactly. The two files are not linked.
7. Data audits are supported	There have not been any recent audits of crash reports other than the edit check and validation steps that are a normal part of data entry.

Analysis

1. State has analysis system	The state has an extensive analytic capability supported by two main resources; the crash records system and a separate analytic unit in the Traffic & Safety Division of UDOT.
2. Tabular reports supported	The basic crash records system supports user-generated reports to produce tabular reports of crash counts. The system has rudimentary subsetting capabilities, allowing users some minimal flexibility in selecting a class of records based on a criterion that they specify. This feature is only supported when the user wishes to generate a list of crashes (e.g., all crashes involving a double trailer combination). For more detailed analyses, the traffic and safety division uses SQL queries and a standard spreadsheet to generate tables of information.

3. Uses state codes for location reports	Location codes are added to the crash data before data entry in the main crash records system.
4. Annual CMV crash facts	Most reports are generated by users on an ad hoc basis. Because the CMV data are part of the main crash system, it is possible to generate a host of CMV related reports on an as needed basis.
5. Capable of reporting LCV-specific data	Utah, by virtue of the specificity of vehicle configuration information collected on the crash report form, is capable of producing analyses specifically on LCVs. Crash rates are not calculated separately for different LCV configurations, but type-specific crash counts are available.
6. Measures of exposure used for rates & comparisons	The measures of exposure available for use do not have the desired specificity for calculating rates or supporting comparisons among the various vehicle configurations.

Of the five states in the study, only Utah collects data on CMV configuration such that LCVs can be identified based on the crash data alone. The crash report is extensive and, because it integrates the CMV information with the rest of the crash data on one form, the likelihood of collecting data on commercial vehicles is improved. Unlike other states, Utah tries to have CMV crashes investigated by specifically trained personnel. Even at the local level, some departments maintain a cadre of truck-crash trained officers to handle CMV crash reporting.

Like many other states in the United States, Utah is working to ensure that it has an accurate census of intra- and inter-state trucking companies. The motor carrier division of the Utah DOT has been working with intrastate carriers to make sure that all of them have a USDOT number. These numbers are entered into the MCMIS census file. The project is not yet completed, nor is 100% accuracy in the census file expected because the file is always about three months out of date. The goal is to reach a point where only a few companies' records are absent or out of date at any given time.

Exposure measures are not well documented in Utah. VMT is reported in the aggregate for CMVs. Other measures might be available based on the data collected in the state's overdimensional permit operation. It is not clear that this analysis has been attempted.

In general, the data management practices in Utah mirror the best-practices approach. The most noticeable difference is in the duplicative data entry in the main crash file and MCMIS (except for those reports submitted electronically from agencies with automated field data collection systems). Another potentially problematic practice involves the correction of data on the crash form by the data entry personnel. This is done based on the narrative and diagram (the assumption being that the narrative and diagram require greater care on the part of the officer than do the other portions of the form). A better practice would be to provide timely feedback to the officer who wrote the original report and ask for corrections. This is not feasible because of the long data entry delays for the main crash records system.

The data entered into MCMIS are not corrected before entry. With two separate data entry processes, there are bound to be mismatches between the data in MCMIS and the data in the primary crash records system for the state. There has not been a recent audit to determine if the mismatches between files has created an actual problem for analysts or for decisionmakers.

Utah has extensive resources to support analysis of CMV crash data in general and LCV crash data specifically. The only things lacking are a CMV-oriented annual report and configuration-specific measures of exposure. It may be possible to generate estimated vehicle counts or even estimated vehicle miles traveled using data from the overdimension permit program in UDOT, but there were no analyses available to demonstrate this capability.

The motor carrier division staff within UDOT has access to a number of analytic resources. These include SafetyNet, which they use to generate location-based analyses and overall CMV crash counts for specific vehicle configurations. Should they require more detailed analyses, they can use the reporting functions of the main crash records system or ask the traffic and safety division staff for assistance.

In addition to the evaluation conducted in Tasks 1 and 2, Utah also participated in a detailed audit of their CMV-involved crash reports in Task 3. Table 9 gives the results of that audit.

Table 9: Results of Data Audit in Utah

1. Configuration	**a. Officers do not code configurations consistently.** The configuration code selection and the diagram and/or data coded for individual trailers do not agree. The implication is that officers may not be familiar with the configurations as pictured on the crash report form, or that the real vehicle configuration did not directly match codes available on the form. **b. Gross Vehicle Weight Ratings (GVWR) are missing or entered incorrectly.** When ratings are entered incorrectly, the actual weight of the load probably has been entered, but there is no way to determine this from the forms. The number is clearly not a valid GVWR, but what it actually represents cannot be determined. Since GVWR is used to make broad distinctions between classes (sizes) of commercial vehicles, mis-coded GVWR data can lead to errors in the counts of crashes by vehicle type. **c. There is no consistency in the manner in which trailers are coded on the traffic crash report.** Some officers code the trailing units as separate vehicles (e.g., the power unit is vehicle 1 and the trailers are listed as 2, 3, etc.). Other officers code the trailing units as sub-vehicles of the power unit (e.g., the power unit is vehicle 1 and the trailers are listed as 1A, 1B, etc.). Other officers list some trailer information in the narrative, but usually not all the pertinent information. Still other officers failed to code the trailers at all. **d. Total number of axles is missing or coded incorrectly.** With the variety of vehicle configurations on the road, it is impossible to identify all the mistaken entries in this field. Some axle counts are clearly impossible given the vehicle configuration (e.g., 3 axles for a double) and probably reflect a mistaken understanding of what to enter in that space. When officers coded the trailers separately, there is even more confusion as to what numbers to list in this box as it is labeled "number of axles including

	trailer." Some put the total number of axles listed with the power unit, then gave the number of axles for each trailer. Others recorded the same number of axles for each of the vehicle's subunits (i.e., 8 for the power unit and 8 for unit A, B, etc. to indicate trailers). **e. Diagrams often do not depict the actual truck configuration.** Officers' diagrams were generally not detailed enough to determine if the vehicle had more than one trailer. Since this information was sometimes looked to as a way to "correct" the coded configurations on the crash report, it is critical to have sufficient detail in the diagram. **f. One of two electronic versions of the crash report does not allow officers to code trailers as separate units in the crash without throwing off the total number of vehicles count.** There are two electronically generated crash reports in use by the Utah Highway Patrol (UHP). The more automated of the two restricts the officer just to adding new vehicles to the crash, without being able to separately code a trailer as a unit (or subunit) of a combination vehicle. This means that officers using this software can only add trailer information in the narrative, where there is no guide as to what data to collect. **g. Number of trailers doesn't match vehicle configuration or diagram.** It becomes uncertain what the officer intended to show as the vehicle configuration if the configuration and count of trailers disagree. Diagrams often lacked the detail necessary to settle the question.
2. Location	**a. In some cases, the location information was missing or clearly inaccurate.** It is impossible to identify all inaccuracies of location information. Only the most obvious cases were identified in the audit. Examples include coding a crash as being both at an intersection and near it (two separately completed lines in the report). This type of mistake can cause major problems for location-based analysis, as one of its key aspects is to separately report intersection and non-intersection crashes.
3. Contributing Factors	**a. The Utah form does not allow for a full description of the sequence of events.** It appears that the form was designed to merge the sequence of events with the contributing cause, and then allow multiple codes for each vehicle. The format does not work well as it is impossible to determine the actual sequence of events from the coded values. The "type of accident" codes are insufficient to show a sequence of events for each vehicle. **b. Contributing factors in multiple vehicle crashes are confusing.** For example, box 19 on the form is used to code contributing circumstances for vehicle 1, 3, or 5, depending on which page of the overall report one is reviewing. While the forms were designed to avoid confusion, some officers clearly copied the codes they used on the first page of the report to the subsequent pages without consideration of which vehicles were being coded on the later pages.

4. General	**a. Carrier Identification incorrect or missing.** Part of the reason is that the form is set up to allow three possible entries in one space–the owner, the carrier, or the operator. Only one of these can be entered and it is up to the officer at the scene to decide which one. There is no separation of carrier and vehicle owner information, so often the vehicle owner is listed without any carrier information. Since vehicle owners of CMVs are often leasing companies, the crash is miscoded if it is not directly linkable to the actual carrier of the load. **b. Carrier ID numbers (USDOT and ICC) numbers missing.** The review only looked at this when the carrier was clearly interstate (as opposed to a Utah carrier coded by the officer as interstate). **c. Several officers confused the terms "interstate" and "intrastate."** There were several instances of clearly intrastate carriers (local construction companies, regular garbage trucks, etc.) coded as interstate. This was the main reason that the review of missing USDOT/ICC numbers consisted only of carriers with out of state addresses. **d. Hazardous material information and HAZMAT placard numbers are placed in an easily overlooked spot.** This information is called for only at the end of the narrative. Thus, this information is not easily coded and if the officer fails to note spills in the narrative the information will never be captured. **e. Contributing circumstances "speed too fast for conditions" and "other improper driving" appear to be catch-all categories.** These codes are used in a wide variety of very different crashes. The codes become less useful as these catch-all categories become more prevalent. **f. Citation information is insufficient.** Officers often used one-word descriptions of the charge and did not use statute numbers at all (the number is not asked for on the form). As a result it is hard to use citation information to determine what the officer really thought were the illegal actions that contributed to the crash.

Utah has a single crash report form. To code a multiple-vehicle crash or, more importantly for the current review, to code multiple trailers as separate subunits, multiple copies of the form are used. There seems to be a great deal of wasted effort in completing these multiple forms, as the officers typically copy a large amount of the information from the first page to all subsequent pages.

In addition, the Utah Highway Patrol has implemented some forms of automated crash report generation. These new forms are based on two different software packages, one of which has serious limitations. The simpler of the two forms is an electronic version of the official crash report and, for the most part, does a good job of replicating the fields of the original and is as easy to read as the paper original. The other form is based on a "proxy" of the official form. Items are placed in the same general location as they would be on the main form, but not quite. More importantly, some of the box labels on the form do not match those of the official form and, most seriously of all, the codes are not printed along with the labels for what the officer coded in those boxes. For the purposes of reviewing crashes involving large trucks and LCVs in particular, the form and/or software causes serious problems. Officers are not allowed to code subunits of vehicles anywhere but in the narrative. That means that information on trailing units is lost from any potential data system unless someone gleans it from the narrative. Often, the information is lacking because there are no reminders to add it to the narrative. Information from separately coded trailers was often used in the review to verify what the officer coded as the vehicle configuration.

A great deal of information about commercial vehicles and carriers is simply never gathered by officers. Most reports had at least one item missing regarding body style or type code, GVWR, number of axles, USDOT/ICC code or the name, or address and phone number of the carrier. Many reports were so incomplete as to make it impossible determine the identity of the carrier or the configuration of the vehicle from the coded information. Combined with a lack of detail in the diagrams, this created a situation where it was often impossible to tell what the vehicle configuration was with any degree of certainty. Given that there was at least one triple-trailer LCV not included in the census of triples, it is also clear that the data managers sometimes have a hard time making this determination as well.

Some of the information gathered is simply useless when looking at commercial motor vehicles, carriers, or drivers. For example, the number of years of driving experience recorded on the form and the source of the driver's education refer to the individual's original training and licensure, not to their commercial license or training. This information could prove useful for analysis of commercial drivers' crash experience, but because it records only their original license and training, it is not.

Preliminary findings from Tasks 1 and 2 had resulted in praise for Utah's crash report as being the only one in five states that had sufficiently detailed codes for vehicle configuration. It was thought that Utah would be the one state that could reliably analyze LCVs as separate classes of vehicles from other large trucks of similar configuration. Based on the review of crash data quality, and of vehicle configuration information in particular, it is clear that Utah's data do not support the desired analysis. Officers show a great deal of confusion over vehicle configuration. The result is that the crash report data on vehicle configurations are unreliable. Utah's analysts said that they rely on the narrative and diagram to "correct" miscodings in the other portions of the form. During the data audit, it became clear that this practice must be highly error-prone with respect to vehicle configuration. In many cases, it wasn't clear how to resolve discrepancies among the vehicle type code, the narrative, and the diagram because the officers often failed to provide enough information to discern which of the possible configurations was really involved.

IV. CONCLUSIONS AND RECOMMENDATIONS

This section presents the conclusions and recommendations arising from the results of Tasks 1 - 3. The conclusions and recommendations are presented separately for each state. A final, summary section gives an overall review of the conclusions from the study and a set of recommendations for AAAFTS.

Florida

The following conclusions and recommendations for Florida are based on the findings of Tasks 1 and 2.

* Add another code to the vehicle-type field so that freeway doubles and turnpike doubles may be identified separately in the crash data. These are the only types of doubles allowed in the state presently. Since turnpike doubles are restricted to one roadway in the state (Florida's Turnpike) it is usually safe to assume that doubles in crashes away from the turnpike are the smaller, non-LCV configuration. A vehicle-type code would help differentiate between vehicles for crashes on the turnpike.

* Train law enforcement personnel in the correct procedures for obtaining the USDOT carrier identification for CMVs involved in crashes. This recommendation applies to every state in the study and probably to most other states as well.

* Develop estimates of VMT and other measures of exposure for the various configurations of CMVs, especially large trucks and the two types of doubles allowed in the state. Without specific measures of exposure, it is impossible to compare the relative safety performance of different vehicle configurations.

* Create a single master file of crash data to include the location codes from Florida DOT. The present practice in Florida is not too far from the ideal presented in the "Best Practices" section of this report. The only problem with having a separate file at FDOT with located crashes is that the information is less available for analysis by potential users.

* Establish increased analytic support for the motor carrier program. FMCSA has suggested a contract with a university-based research group. This, or hiring a dedicated analyst, would help the state to focus more effectively on motor carrier safety. Whatever analytic program is put in place, it should also include training for the staff who operate the state's MCSAP program. Florida has recently added a CMV subcommittee to its safety management system in order to bring truck and bus safety to the same level of broad-based involvement as the state's other safety programs.

* Combine the current crash reports into a single form including the CMV-specific information. The DHSMV is currently considering a unified form. Moving to this type of form would tend to increase the cost of the paper forms, but would help to insure that CMV data are collected more reliably.

* Change the form to include all the MMUCC variables and codes. DHSMV is reviewing a proposal to make the crash form MMUCC compliant in the next revision.

* In general, Florida's data collection methods suffer most from a lack of timeliness. This has implications for the state's ability to manage the data effectively, including its ability to provide effective feedback to law enforcement agencies. The state's solution of establishing regional data centers is one way to improve the quality of the data while at the same time also improving timeliness. There are other methods the state may also pursue, such as outside contracting for data entry in days rather than months.

* Consider changing the state threshold so that all CMV-involved crashes are "above threshold" for reporting purposes. This is an expensive proposal, but one for which the state might be able to obtain funding through the FMCSA. A pilot program could be started to collect the data and show the costs/benefits of this more complete reporting.

Idaho

The following conclusions and recommendations for Idaho are based on the findings of Tasks 1 and 2.

* Idaho is on the verge of automating field data collection of crash information. They have provided software to law enforcement agencies, but at present have no facility for electronically transferring that information to the state's main crash records system. Solving this problem would also address many of the data collection and management problems identified, including the inability to provide feedback to enforcement agencies on missing or erroneous reports.

* Add additional vehicle configurations to the crash report form for CMVs. There should be codes available for each of the various types of doubles and truck/trailer combinations.

* mplement the MMUCC variables and codes.

* Develop more specific measures of exposure, especially for the various configurations of CMV and LCV in the state.

* Complete the system revisions required to allow use of the state's location codes in the crash database.

* Produce an annual CMV crash facts book.

Nevada

The following conclusions and recommendations for Nevada are based on the findings of Tasks 1 and 2:

* Nevada has serious problems with CMV crash data and with the systems used to store and analyze it. The Nevada DOT is moving forward with an upgrade to the main crash records system, but it is unlikely that the upgrade will improve handling of CMV crash records. Solving interagency problems is key to making any real quality improvements for CMV crash data or analysis in Nevada. Perhaps the MCSAP program managers could apply for a special grant to help pay for a portion of the new DOT system in exchange for better service.

* Combine all crash information on one form. This will only work, however, once the main crash recording system and the CMV crash recording system are integrated. Prior to accomplishing that, the forms should remain separate because combining them would undoubtedly increase data entry delays or put additional burdens on law enforcement to send copies to two state agencies.

* Add a complete set of codes for various CMV configurations to the crash form. Codes are needed so that the various types of doubles and truck/trailer configurations may be addressed separately in the crash data.

* Define and collect LCV-specific measures of exposure.

* In coordination with the Nevada DOT, find ways to increase the use of automation for field data collection once the two crash forms are integrated. This will improve timeliness and the ability to give agencies meaningful feedback.

* End the practice of replacing missing CMV supplemental reports based on forms created by the office staff.

* Produce an annual CMV crash facts book.

Oregon

The following conclusions and recommendations for Oregon are based on the findings of Tasks 1 and 2.

* The most important problem to solve in Oregon is the lack of a strict requirement for law enforcement agencies to report crashes. This has resulted in a reliance on four crash report forms (including driver and motor carrier self reports) when a single form would do the job. This will require a change in state law and so may not be feasible in the foreseeable future. Without this change, however, Oregon will remain in a situation where data quality is suspect and it will continuously face the dilemma of whether or not to merge data from various sources in order to paint a coherent picture of the events. Other alternatives to changing the law include paying for the police to complete the reports. As a perhaps more palatable change in the law, consider making it a requirement that officers respond to the scene of every crash involving a CMV and share the costs of this additional data collection with the carriers and/or insurance companies through cooperative agreements. Another means of providing an incentive to law enforcement to complete crash reports would be to pay for all or a portion of their field data collection automation. It is important to note, however, that without some method of increasing enforcement response to crash scenes, Oregon should retain its multiple forms. The data audit clearly demonstrated that only by using these multiple forms could one build a coherent understanding of the crash.

* Add a full complement of CMV configurations to the vehicle-type codes on the crash report form used by enforcement agencies.

* Change the police crash report form to include the MMUCC variables and codes.

* Develop measures of exposure for additional types of LCV other than triples.

* Keep separate automated records for driver and police reports for analytic purposes. Wherever possible, eliminate use of the driver self-reports in analyses.

* Create a single crash records system once there is a single type of crash report used for analytic purposes.

In addition to the recommendations arising from the evaluation performed in Tasks 1 and 2, Oregon’s participation in Task 3's data audit gave rise to the following recommendations:

Recommended Changes to the Forms:

* Create crash report forms for use by law enforcement officers that are easy to fill out and that capture all the data needed by the state. This should be part of a larger project designed to improve the level of response to crash scenes and of writing up the report on the part of law enforcement agencies. A cooperative effort that involves state and local law enforcement

agency personnel would, perhaps, increase law enforcement's "buy in" and lead to an increase in reporting.

* Make the truck vehicle configurations on the traffic crash report match those of the truck/bus supplemental form. As an alternative, simplify the codes on the main crash report to just say "CMV" or "truck" and rely on the codes in the supplemental form. The configurations should also match those on the motor carrier report.

* Add more specific vehicle configuration codes, especially for doubles. There are a wide variety of vehicle types being included under the single category of "doubles" and the state's ability to analyze vehicle-related factors for large trucks is hampered by a lack of specificity in this case. Add diagrams of each type.

* Move the "cargo body type" entry to its own portion of the supplemental form. As this item is placed now, officers often fail to realize that they are supposed to code both a vehicle configuration and a cargo body type. Add pictures of each type of body.

* Collect the number and length of trailers and ensure that each trailer is coded on the form as a "sub-vehicle" of the power unit. The current forms do not ask specifically for information about each trailer. The result is often confusion as to the true vehicle configuration.

* Create more space for narrative and a diagram. The current small combined space probably makes it difficult for the officer to record sufficient detail. Using an extra page is an option, but one that was not frequently used by the officers. Sufficient space to start with, or using the back of the supplemental form just for truck crashes, would encourage more detail.

* Add graphics of vehicle configurations and cargo body types to the motor carrier accident report. This may not seem to be necessary given that motor carrier companies ought to know what vehicle configurations are being discussed, but a sufficient number of crash reports were found to have incorrect vehicle configurations so as to make this recommendation worth some consideration. Pictures or graphics might be especially helpful to out-of-state carriers who are less familiar with the standard terms used in Oregon.

* Delete the driver log review and narrative from the motor carrier accident report. This information seems important, but the incentive to enter inaccurate information is just too great. It would seem implausible to suggest that this information is ever accurate in cases where the driver violated a law and the motor carrier report is the only record the state has of log book information. If the on-scene officer reviewed the log book, followed by audits conducted by the motor carrier safety officers, driver's logs would be a more reliable source of information.

* Train all officers to complete a driver log-book check. This would allow the state to obtain realistic and accurate information on driver length of service violations without relying on motor carriers' self-reports.

∗ Ensure that all enforcement agencies and motor carrier companies have the newest forms and ask them to throw away the out-of-date forms.

∗ Add a code for phantom vehicles. There were several instances where the officer noted the presence of a vehicle with a causal role in the crash, but was only able to do so in the narrative. Without a "phantom vehicle" code on the form, the crash might be attributed to some other causal factors that were less important than the actions of the phantom.

Recommended Training:

∗ Instruct officers in recognizing and recording the proper information about trucks. This includes configuration, GVWR, number of axles, cargo body types, USDOT and ICC numbers, and the indications for hazardous materials. There were too many instances were this critical information was either missing or inaccurately recorded.

∗ Give motor carrier companies training in the basics of completing the motor carrier accident report form. If this is too expensive or time consuming, consider producing a detailed manual to accompany the motor carrier accident report so that companies provide Oregon DOT with consistent information.

∗ Adopt a standard and train officers to code forms so that the #1 vehicle is the one they consider most at fault. Instruct them in the value of contributing-cause codes as well. This will help ensure that analysts have an easier job understanding the officer's meaning when reviewing crash reports, especially if they perform the kinds of analyses common in Oregon, which call for separate reviews of "avoidable" crashes.

Utah

The following conclusions and recommendations for Utah are based on the findings of Tasks 1 and 2.

∗ Utah's main problem stems from long delays in crash data entry. Delay is the reason given for handling CMV crash records on a separate track and for maintaining two separate crash recording systems. These delays inhibit the state's ability to provide meaningful feedback to enforcement agencies on missing or erroneous data. The best solution for Utah would be to promote use of automated field data collection throughout the state, or, perhaps, contract data entry for faster turnaround.

* Change the crash report form to include the MMUCC variables and codes.

∗ Develop measures of exposure for specific configurations of CMV. In particular, use the state's permit program to provide data on numbers of trips for each configuration of vehicle.

* If timeliness problems are solved as recommended, eliminate the double data entry for CMV crashes and use an extract of the main crash file instead.

* Produce a standardized annual CMV crash facts report.

In addition to the recommendations arising from the evaluation performed in Tasks 1 and 2, Utah's participation in Task 3's data audit gave rise to the following recommendations:

Recommended changes to the Crash Report Form:

* Develop a revised crash report form that is designed with the cooperation of law enforcement personnel throughout the state. In particular, the new form should encourage collection of complete, high-quality data.

* Create a format that will guide the officer through recording information on each trailer in the crash. For each trailer record the license number and other identifiers, the length, the number of axles, presence of hazardous materials, placards, spills, and the estimated damage. Code for each trailer if it tipped/rolled over.

* Reduce duplication of information by developing a standardized, simple method for recording trailer information on the crash report form.

* Add items to the sequence of events code choices (e.g., use those defined in MMUCC), to give a more detailed picture of the sequence for the crash as a whole and for individual vehicles.

* Add more codes under "contributing circumstances" to allow officers to be more specific and to cut down on overuse of "speed" and "other improper driving" as catch-all categories. At a minimum add codes for improper lane change and improper lane maintenance.

* Alter the software used by some UHP officers to provide a better printed report format that more closely matches the official report.

* Add specific coded sections to show which driver(s) received citations.

* Add separate spaces for recording vehicle owner and carrier information. Both types of information are required for commercial motor vehicles and generally only one is gathered because that's all the form allows.

Recommended Training for Officers:

* Train all enforcement officers to code trailer information as a new unit on the form, labeled in a standard manner (e.g., 1, 1A, etc.). This recommendation also requires a change to the

UHP software to allow the officers to code subunits without affecting the overall count of vehicles.

* Train officers to recognize and code **all** the information from commercial motor vehicles. Analysts need to be able to identify the carrier and the vehicle configuration with absolute certainty. They must have good USDOT/ICC numbers and good data on number of trailers, axle counts, GVWR, and whether the carrier is intra- or interstate. The carrier name, address, and phone number are also critically important.

* Make sure that the first vehicle listed is the one whose driver was judged most at fault by the officer. This standard practice makes interpretation of the rest of the form much easier for analytic purposes. As an alternative, and only with law enforcement's "buy in," establish an explicit code on the form that the officer can use to indicate the driver he/she believes to be most responsible for the crash.

* If the information is available, change the use of the driver's education and years of experience fields to reflect, for CMV drivers, the source of their commercial driver license (CDL) training and their years of experience driving commercial trucks. It is recognized that this change may not be practical for a variety of reasons, in which case the recommendation is to continue using these fields on the form as previously.

* Train officers to recognize other contributing causes and, in conjunction with the recommended form change, record those causes on the crash report. The overuse of catch-all categories makes analysis of contributing factors difficult and ultimately uninformative.

* Train officers to collect more accurate and complete location information. Without this information, it becomes difficult to reliably pinpoint crash locations and afterwards develop programs targeted to reduce crash frequency and severity at the state's "hot spots."

Summary

The following tables summarize the evaluation of the five states' data collection and analysis procedures as compared to the best practices approach developed in Task 2.

Table 10: Summary of Crash Data Collection Evaluation

	Florida	Idaho	Nevada	Oregon	Utah
1. Collect data on all crashes	all above threshold	all above threshold	all above threshold	all above threshold	all above threshold
2. Data collection by trained professionals	yes	yes	yes	no	yes
3. Unified form/ensure CMV data collected	no	yes	no	no	yes
4. NGA collected on all CMV crashes	missing reports	missing data	missing reports	yes	yes
5. CMV configuration captured	partial	partial	partial	partial	yes
6. Meets standards	partial	partial	no	no	partial
7. Carrier ID collected	yes	yes	yes	yes	yes

No state collects data on *all* crashes. Each state has a reporting threshold that in essence ensures that PDO crashes at or near the dollar threshold for damage are probably under-represented in the data. Other than this generally acknowledged problem of underreporting, four of the states (all but Oregon) have reasonable policies for report submissions. Oregon's inability to require enforcement officers to complete crash reports and the consequent reliance on driver and motor carrier self-reports makes this state's data collection practices fall clearly below the best practices outlined here. Ironically, however, it is the carrier self-report form, in particular, that was of critical value in correctly identifying vehicle configurations in Oregon when the information provided by the law enforcement officer was not clear. In other states, there is no opportunity to correct the police-provided information because there is no additional source of information for comparison.

The two states with integrated primary and CMV crash reports (Idaho and Utah) have better chances of receiving the CMV-related information simply because this information is collected as part of completing the investigation at the scene of a crash. With a separate CMV crash supplement form, two of the states (Florida and Nevada) are clearly missing data. Nevada is still counted as missing data even though the data entry staff will fill in the gaps when a supplemental report is not received. This practice can never reasonably substitute for having the correct data collected in the field by trained personnel. Oregon is listed as not missing the NGA data elements because they always do obtain data from the carrier and/or the drivers or the crash is unlikely to be in the system at all.

For the purpose of understanding the crash experience of LCVs, only Utah has a form designed to collect appropriate data. This is because Utah alone has a sufficiently detailed list of CMV configurations as choices in the crash report. An added benefit of Utah's list is that it also closely follows the state's overdimensional permit definitions. That means that data on crashes and data from permits could potentially be merged. None of the other states have an adequate list of vehicle types. Even Florida, which only allows one type of LCV anywhere in the state, has insufficient codes for vehicle configuration. There are two types of doubles allowed in the state and the codes on the crash report cannot distinguish between them. Crashes involving a double on the turnpike, for example, cannot be tied to a single configuration because that road allows turnpike doubles (an LCV) and freeway doubles (a non-LCV).

As expected, none of the states' crash reports meet the MMUCC guidelines. Florida, Idaho, and Utah could supply most of the MMUCC data elements and a fair proportion of the MMUCC-compatible codes for those data elements. Nevada and Oregon are both very far from compatibility with MMUCC.

Carrier identification, when available, is collected in the field in all five states. There were reports of data quality problems, most of which should be addressed through training of field personnel. With expansion of the programs in most of the states to require even intrastate carriers to obtain a USDOT number, the frequency of missing carrier identification on crash reports should drop. Of the five states, only Nevada has no good way of correcting the missing data problem because of the in-office assignment of dummy identifications rather than the requirement for intrastate carriers to obtain a real USDOT number.

Overall, none of the five states matches the best practices approach sufficiently to be called a model for the others. Utah is the closest, but some of the data handling methods (discussed in a later section) to some extent undermine the good data collection practices in the state. Oregon is clearly the furthest from ideal because of its reliance on driver self-reports of crashes. Nevada is nearly as far from ideal because of the nearly complete separation between the main crash reports and the CMV supplements, as well as the lack of interagency cooperation on data handling.

Table 11: Summary of Exposure Measures Evaluation

	Florida	Idaho	Nevada	Oregon	Utah
1. Multiple measures collected	partial	partial	partial	partial	partial
2. Measures for each vehicle configuration	no	no	no	partial	partial

Measures of exposure are available in all states. Unfortunately, none of the states have sufficiently detailed measures of exposure to support calculation of crash rates for specific types of vehicles, including various configurations of LCVs. This is true of every state studied, and probably also of most states in the US. Estimation of vehicle-specific VMT is possible, but is not performed on a routine basis. There are important quality issues with VMT data in general that are even more critical when attempting to estimate configuration-specific VMTs. The main problem is the cost of obtaining sufficiently detailed data on a large enough sample. States may need expert help to accomplish this.

Possible alternatives to VMT exist in all states as well. With respect to providing a means of assessing LCV safety or crash experience, however, none of the states has sufficient data. Only Oregon and Utah are able to produce exposure measures that relate to a specific segment of the LCV "fleet." Oregon can produce a measure of VMT that is specific to triples. Utah could produce an exposure measure based on the numbers of permits issued to various configurations of LCV. This measure could, in theory, be used to calculate a crash rate per trip (or even estimated VMT) for each configuration in Utah. Utah is the only state of the five that could reasonably be expected to develop meaningful crash rates for specific configurations of LCV because they are currently the only state that captures sufficiently detailed vehicle configuration information. The quality problems with this information (as discovered in Task 3) make it clear that Utah would first have to engage in data quality improvement measures before the effort to collect new measures of exposure would be useful to analysts and decisionmakers.

The importance of good exposure measures cannot be over-emphasized. Without such measures, states will not be able to calculate crash rates for specific vehicle types. Without the ability to express crash experience per mile driven, per trip taken, etc., comparisons like the ones addressed in this study are impossible. It will never be possible to compare the safety performance of different vehicle configurations without valid measures of exposure to use in the denominator of a crash rate. Of course, valid and reliable crash data are also required. Without good data in the numerator and denominator of the crash rate, there can be no valid comparison of crash experience for different vehicle types.

Table 12: Summary of Data Management Evaluation

	Florida	Idaho	Nevada	Oregon	Utah
1. Data entry near source of collection	no	yes	no	no	partial
2. Different sources segregated	N/A	N/A	N/A	no	N/A
3. Missing reports follow up with reporting agency	no	no	no	partial	no
4. Quality control and error follow up	partial	yes	no	partial	yes
5. SafetyNet is a subset of main crash database	yes	yes	no	yes	no
6. One records system for crash data	yes	yes	no	no	no
7. Data audits are supported	yes	yes	no	partial	partial

Among the five states, only Idaho and Utah are currently making much headway with respect to automated field data collection. Idaho has developed and distributed software to any enforcement agency in the state that wishes to use it. Unfortunately, the state has not obtained the full benefit of this program since it cannot accept the data electronically into the main crash records database. Data entry delays in Idaho are months longer than they ultimately could be if the system accepted electronic data transfer. Utah's system does allow for electronic data transfer, but at present only a small portion of the agencies in the state are collecting crash data using automated systems in the field. As found in Task 3, some of the software in Utah does not support detailed data collection in crashes involving LCVs because individual trailers cannot be coded as separate units. Florida is moving in the direction of automated field data collection and electronic data transfer. Nevada and Oregon are not, at least for CMV crashes.

Only Oregon accepts and uses crash data from multiple sources. The driver self-reports of crashes make up a large portion of the state's database. More troubling, however, is that the data from multiple sources is merged into a database used for analysis. This means that data collected under different methodologies is merged into a single system, and that data from different sources is also combined to create single records. Thus, the mix of data changes from record to record in the system. It is possible, but not easy, to disentangle the various sources of crash data in Oregon. A best-practices approach would avoid use of driver self-reports altogether. Barring that, the data from various sources should be maintained separately and, if desired, in a blended form as well. By relying so heavily on the merged data, Oregon is violating one of the most basic of data management best practices in this or any other field.

None of the states is currently in a position to perform effective follow up on missing or incomplete data. The data entry lag times are so long that such follow up is reasonably considered impossible. At best, the states can keep track of the most frequent problems and most frequent offenders and use that information to design or alter training for field officers. Ironically, Oregon, by virtue of its multiple data sources, is in the best position to identify missing data. Only in the case of single-vehicle crashes would the state be completely unable to perform an audit of missing data. With multiple-vehicle collisions, the legal requirement for drivers to submit a form gives the state some leverage to collect information from everyone involved (if one driver reports it, the others will be contacted if they fail to send in a report). With respect to CMV crashes, the state does follow up to collect missing reports from carriers as well as drivers.

Idaho and Utah perform quality control and follow up errors with the enforcement agencies. This would also be possible for the other states if data were entered in a more timely fashion. Florida is moving in that direction. Oregon performs a comparison of data among the various sources of information it receives. This is not precisely what was intended in the best practices outlined in this report, but the procedure does give Oregon an opportunity to review data quality in a manner that other states cannot. They have used this type of quality control check to provide feedback to carriers and commercial drivers. Nevada has no formal process of quality control leading to follow up with enforcement agencies.

Four of the states (all but Nevada) are capable of extracting their CMV-related crash information from the main crash records system for uploading into MCMIS. Of these four, all but Utah actually perform their data entry via SafetyNet in an automated fashion. Utah has decided that the delays in the main crash data entry system are too long for the MCMIS system and so they perform double data entry; once into the main crash records system and a second time into MCMIS via SafetyNet.

Only Florida and Idaho actually maintain a single crash-records system that includes all the data (primary crash data plus any from the CMV supplement). Utah is close in the sense that it does in fact enter the CMV crash data into the main system, but the data in the main system and the CMV crash data system do not necessarily match. That is because the data in the CMV system are not “corrected” before data entry, but all of the data in the main crash system are. The process of correction involves interpretation of the narrative and diagram to “fix” errors in how the officer coded the form. Since the two files are separate and the data handling procedures are different, Utah’s systems are really counted as separate and do not match the best-practices approach. Nevada’s systems are not only separate but cannot be easily matched or cross-checked in any meaningful way. Part of the problem is the differing criteria for crashes entered into the state’s system versus crashes to be entered into MCMIS. Since other states manage to solve this problem, however, it appears that the resistance in Nevada has more to do with interagency incompatibility than to the threshold differences for the two types of data or difficulties in system design.

Florida and Idaho both have good methods for auditing data and, more importantly, have performed audits in the past. Utah has some capacity for auditing data, but the fact that clerks alter (or “correct”) the data going into the main crash records system introduces a problem for later data-quality reviews since there is no longer a matching physical document against which to perform the audit. The agencies involved in Nevada’s crash reporting and CMV crash data systems have agreed that auditing the data is too difficult because of mismatching thresholds. In Oregon, a data audit is possible, but because data from various sources is "blended" in the final crash records system, there is no single matching hard copy against which to compare the data in the system.

In summary, none of the states has ideal data management practices. Some of the departures from the ideal are minor, but others, such as Oregon's blending of data; Nevada's and Utah's use of data management staff to "correct" missing or erroneous data; and the lack of interagency cooperation in Nevada raise serious concerns. With respect to an analysis of LCV crash experience, poor data management practices have sometimes unknown or unknowable implications. It is one thing, for example, to point out that Oregon's reliance on driver self-reports is affecting the quality of analysis. It is quite another to actually pin down what that effect is. Surely analyses of Oregon data would have less credibility than those derived from other states, but without an extensive audit comparing the information from the (up to) four data sources and the blended records in the state's system, there is no way to document how much less reliable the Oregon data are. Likewise, without an audit of Nevada's CMV crash data it would be difficult to determine how large a problem is caused by the practice of having the data entry staff supply "missing" supplemental reports. It is enough for the purposes of this report, however, to point out that these practices in Oregon and Nevada are far from ideal and raise serious questions about data quality.

Table 13: Summary of Analysis Evaluation

	Florida	Idaho	Nevada	Oregon	Utah
1. State has analysis system	yes	yes	no	yes	yes
2. Tabular reports supported	yes	yes	partial	yes	yes
3. Uses state codes for location reports	no	not working	no	yes	yes
4. Annual CMV crash facts	yes	no	no	yes	no
5. Capable of reporting LCV-specific data	no	for triples	for triples	for triples	yes
6. Measures of exposure used for rates & comparisons	no	no	no	for triples	no

Of the five states, only Nevada lacks a reasonable system for analysis of CMV-involved crashes. All the other states use sophisticated data analysis software and do not rely on the rudimentary reporting capabilities built into SafetyNet. Nevada, because of interagency problems and a lack of support for CMV crash data collection or analysis, has access to only the most basic analytic tools. Ironically, for the main crash data system, the state has invested heavily in both state-of-the-art database management systems and excellent analytic resources. These simply aren't open to use for analysis of **all** the information about crashes involving commercial vehicles.

All of the states can produce basic tabular reports of data. Nevada's reporting system is listed as partial because the system cannot produce reports on all variables recorded about a crash. If the data are on the main crash report, that system is used to produce reports. If the data are only on the CMV supplement, then SafetyNet is used. Analysis of information combining the two reports is not supported.

Oregon and Utah both code their crash report information using the state's roadway location scheme. Idaho's new crash records system is designed to perform that function, but the process was not working at the time of this report. Florida codes locations on crashes outside of the main crash report system at DHSMV at a later date than the file extract for MCMIS. The data files used for CMV crash analysis in Florida are derived from the data at DHSMV, not the files from the Florida DOT, where the location codes are added. However, Florida DOT has the capability of producing a CMV crash location analysis if one is requested. Nevada does not have this capability at all. The Nevada DOT could generate a location analysis for CMV-involved crashes, but the location analyses used by the state in planning its motor carrier programs come from SafetyNet and do not use the state location codes.

Only Florida and Oregon have a formal process for producing an annual report including extensive CMV crash facts. Idaho and Utah both have the capability and analytic resources to produce more than they currently do (Idaho has one table of CMV data in its annual crash facts book; Utah primarily allows users to perform ad hoc queries with the CMV data). Of the five, only Nevada is unable to do much analysis with CMV-related crash data because of the reliance on SafetyNet.

Utah is the only state among the five that could reasonably be expected to produce a table of crash counts for all types of LCVs. This is due to the fact that the official crash report form allows the officer to distinguish among the various types of combination vehicles. Idaho, Nevada and Oregon have the ability to separately report on triples involved in crashes. Only Oregon can (and does) make use of specific measures of exposure for LCVs. Again, this is only in the case of triple-trailer combinations. Utah has the potential to develop specific measures of exposure for every type of LCV based on the permit program and the fact that the crash form has sufficient vehicle type codes. This analysis has not been attempted in Utah. Florida technically does not allow LCVs in the state (with the exception of turnpike doubles on the Florida Turnpike). It has no real need to develop separate measures of exposure for LCVs. Analysis of a variety of large truck configurations, however, would be possible in Florida but would not include calculation of specific crash rates because of the lack of specific measures of exposure.

In summary, none of the states completely matches the best practices for analysis of CMV data. Utah comes close, but does not produce annual crash facts specifically for CMV involvement. In addition, Utah would need to develop configuration-specific exposure measures before it could perform analyses of crash rates for LCVs. Oregon's analytic practices are very close to those described in the best practices. Unfortunately, the data quality and data management issues resulting from the reliance on driver self-reports and the blending of self-reports and police reports makes it difficult to recommend Oregon as a model.

General Recommendations:

The following are general recommendations that apply to all or the majority of states in the study. Recommendations that apply to only one state (such as elimination of driver reports for Oregon) are presented in the first part of this section. The recommendations presented here are those that could be pursued by the AAA Foundation for Traffic Safety and others with respect to an overall program of ensuring that sufficient data and analyses are available on LCV-involved crashes nationwide.

The two most common problems among all the states are long data entry lag times that lead to an inability to provide meaningful feedback to enforcement agencies and a lack of vehicle type-specific measures of exposure. Solving the problem is of primary concern in three of the states (Florida, Idaho, and Utah) where long data entry lags contribute to missed opportunities for data quality improvement. The other two states (Nevada and Oregon) have other problems that should be solved first because the data they receive, whether timely or not, is not good enough. The second common problem – a lack of vehicle type-specific measures of exposure – is perhaps even more difficult to solve than timeliness. To create sufficiently detailed measures of exposure, each state will have to develop larger and more expensive data collection operations, most notably in their traffic-count data collection areas. It is strongly recommended that national partners like FMCSA and perhaps the FTS work with the states to help them pay for these efforts and demonstrate the usefulness of the data.

Other general recommendations are:

* Add more CMV configurations to the vehicle-type codes on the crash report forms. Only Utah has sufficient codes. The other states all need to add codes to distinguish among the various types of doubles or other configurations. Without this, data analysis of CMV crashes will always suffer from a lack of specificity. Analyzing LCV crashes specifically is out of the question for most states except in the case of triple-trailer combinations.

* Change the reporting threshold to require a police report for every crash involving a CMV. There is certainly a cost associated with this recommendation. As a companion recommendation, therefore, it is also recommend that FMCSA consider funding a pilot test of full CMV crash reporting in one state (or a small number of states) to demonstrate the usefulness of complete data. If the benefits do not outweigh the costs, then the effort could be dropped. If, however, the benefits are worth the extra cost, FMCSA could help all states find the money to perform the increased data collection. It is possible that this would be a small addition to the law enforcement agency's workload, as there aren't an overwhelming number of CMV crashes even if all PDOs are considered. If complete data were available,

states would at least have a reliable picture of all CMV-involved crashes and could use the information for making decisions. Having this data would also help states in the future when they decide to review their state reporting threshold. They would all have data to help them make the decision about whether an important cadre of crashes is being missed with the current threshold or if the proposed threshold change would result in missed opportunities to improve safety.

∗ Define, collect, and use new measures of exposure. None of the states has sufficient measures of exposure to allow calculation of crash rates for specific configurations of CMVs. With the exception of triples, this is especially true for LCVs. Utah's possible use of permit data might provide an excellent source for a new exposure measure. The other states could emulate this if they first collected sufficient vehicle type data on the crash reports. Utah should be encouraged (perhaps through a grant) to develop this idea further and, perhaps serve as a model for other states.

∗ Each state should maintain a single official crash records file for data analysis purposes. That file should include location codes and all the data collected about the crash, whether from the main form or a CMV supplement.

∗ Every state should implement an annual CMV crash facts book. Even those states that currently produce annual statistics, such as Florida and Oregon, could do more. The other three states need to develop a report and produce it every year. Ideally, the report would contain information specific to the various configurations of CMV and LCVs in particular.

In addition to the general recommendations arising from Tasks 1 and 2, Task 3's data audit identified some data quality problems common to both Oregon and Utah. Some of these are of critical importance in any effort to analyze the crash experience with large trucks in general and LCVs in particular. The most important data quality problems were:

∗ *Officers who clearly do not know how to recognize and/or code the various configurations of commercial vehicles.* This was a problem for both states, despite Utah's much more complete list of choices. A large proportion of the reports in both states had questionable information in the vehicle configuration/body type boxes of the form. In attempting to verify configurations, it was most often revealed that the code placed in the vehicle configuration box was wrong, as the remainder of the information clearly pointed to a different identification. Since the auditors had only the crash reports to look at, this check was really a test of internal consistency. There is really no way to tell from a data audit whether the codes or other information (narrative, count of trailers, diagram, etc.) were correct.

  The recommendation in both states was to give the officers more choices, ask for more information (such as trailer length), and compel the officer to code information for each trailer in any combination vehicle. Since trailer length is the primary way to distinguish among the different types of doubles, the most important recommendation here is to ask officers to record the correct length of each trailer. Some training is certainly warranted.

* *Oregon and Utah both have problem forms, but for different reasons.* Oregon has four forms (three of which were considered useful for data audit purposes in Task 3) and Utah has only one. Oregon's police crash report forms are probably easier to use than Utah's if only because the information on commercial vehicles is on a supplemental form that cuts down the amount of duplicated information that must be recorded. Utah's single form requires that the officer copy much of the information from the first page to all subsequent pages. In general, the single form approach is preferred because it reduces the proportion of missing "supplemental" data. Unfortunately, Utah's form is not the most efficient implementation of an integrated form design. It requires too much duplicated information from page to page.

  The recommendations to both states are for specific changes to their forms that would make it easier to determine who is at fault, what sequence of events took place, and what the contributing factors were in the crash. The general recommendation is to start a process whereby the forms are redesigned with strong involvement from state and local law enforcement agencies.

* Carrier information and CMV information is difficult to obtain. All states suffer to some extent from an inability to obtain accurate carrier information when crashes occur. This can only be improved through training, although some changes to the forms can help prompt officers to give complete and accurate data. The training should include specific instructions on how to recognize carrier versus owner information from the side of the power unit, and how to read information from documents carried by the driver. The forms could be changed to prompt officers for this by specifically asking for both owner and carrier information, and by labeling on the form the source for each section's information. Another possibility is to adopt the motor-carrier self-report portion of Oregon's multiple-form approach to crash data collection. This form proved to be extremely valuable in helping determine the true configuration of vehicles, and, of course, would result in more accurate carrier information as long as the companies complied with the reporting requirements.

* In both Oregon and Utah, trailers were often coded as sub-units of the power unit, but just as often the information was not coded at all or only appears in the narrative. This can be improved through changes in the form, but again, there is no substitute for training the officers and giving them guidelines built into the form. Suggested changes and training include: altering the forms to specifically allow for coding of the tractor and each trailer separately; reducing the amount of information that needs to be repeated if the new "unit" is really a trailer of a combination vehicle; instructing officers to draw the vehicle configuration as they see it; and giving the officers training in how to complete the form as it specifically relates to trailer information.

There were several more general items identified as a result of the data audit that support either a change in the forms, training, or both. Most of these are not directly related to the states' ability to identify crashes involving LCVs, but they do affect the quality of the data, and therefore the quality of any analyses using the data. The most important of these comments and recommendations were:

* It was difficult to determine an unambiguous sequence of events and/or contributing causes for crashes in both Oregon and Utah. Officers frequently did not code the crash in a manner that made it clear which driver was at fault. Some simple rules, along with minor form revisions, would help states obtain more useful data. The most important change in the forms would be to make certain that the codes for sequence of events and contributing causes were sufficiently detailed, and that there are no "catch-all" codes that should be eliminated or made more specific. The most important training issues are to instruct officers to use the codes more accurately and to make sure that the analyst can tell which driver is most at fault.

* Hazardous materials and HAZMAT placarding information is often missing or inaccurate. This information is crucial in describing a state's large truck-crash experience. The way to get better data is through training. Utah also needs to alter its form to directly ask for this information in the vehicle portion of the form rather than only in the narrative.

V. NEXT STEPS

This study was limited in scope to just five states (Florida, Idaho, Nevada, Oregon, and Utah), with only two of those (Oregon and Utah) participating in the detailed audit of crash report data. It is clear that each state has important improvements to make in order to ensure that it can adequately describe its own experience with large truck- and LCV-involved crashes.

From a national perspective, these results offer a view as to what are likely to be general problems in most states. Without actually studying the situation in each state, however, it is impossible to develop a state-by-state or nationally valid set of recommendations. In the absence of such a broad-based study, however, several courses of action suggest themselves:

* Encourage states to review their own data systems such as through a NHTSA traffic records assessment or an assessment specifically designed to look at CMV data and analyses.

* Encourage NHTSA and FMCSA to pay particular attention to truck crash records systems in the form of both the NHTSA traffic records advisory (1) and assessment, and, for more direct applicability, development of a specific truck crash records system advisory and assessment.

* Encourage states to implement regular data audits along the lines of those conducted in Task 3 for Oregon and Utah.

* Work through AAA clubs in each state to focus awareness and resources on the problems with CMV-involved and LCV-involved crash data.

* Sponsor or otherwise encourage pilot tests in states in order to demonstrate the value of adopting "best practices" approaches to data. Two suggested pilot studies in this report include one in Utah using merged crash and permit data to develop a possible measure of exposure, and another in any state willing to collect police reports on all CMV-involved crashes, regardless of whether the crash meets the current state reporting threshold. A third recommended study was specific to Oregon and would test a program to encourage police reporting of crashes involving CMVs in order to reduce the reliance on self-reports.

The recommendations for pilot tests, however, come with an important caveat: Crash data quality problems need to be solved first. It would make little sense to collect data on every CMV-involved crash if the state has trouble collecting high quality data on the serious injury and fatality-involved crashes. More data is only an improvement if the quality is sufficiently high to make the data useful for analysis. Similarly, creating new measures of exposure (as recommended in Utah) is only useful if the crash data are of sufficient quality to support analysis. The cost of new exposure measures is likely to be quite high. If the resulting analyses are viewed as flawed because the crash data (the numerator of the calculated crash rate) are of poor quality, the time and money that went into the new exposure measure were not well spent.

Training and broad-based involvement in MCSAP programs for local law enforcement are the keys to improving crash data quality. The other issues, while important, are secondary to states first taking the time to identify and correct their most serious crash data quality problems.

VI. GLOSSARY OF ACRONYMS

AAAFTS	AAA Foundation for Traffic Safety
ANSI	American National Standards Institute
CDL	Commercial Drivers License
CMV	Commercial Motor Vehicle
DHSMV	Department of Highway Safety and Motor Vehicles, FL
DOT	Department of Transportation
FARS	Fatality Analysis Reporting System
FDOT	Florida Department of Transportation
FHWA	Federal Highway Administration
FMCSA	Federal Motor Carrier Safety Administration (formerly OMCHS)
GVWR	Gross Vehicle Weight Rating
HAZMAT	Hazardous Material
ICC	Interstate Commerce Commission
LCV	Large Commercial Vehicle/ Longer Combination Vehicle (used differently in various states)
MCMIS	Motor Carrier Management Information System
MCSAP	Motor Carrier Safety Assistance Program
MMUCC	Model Minimum Uniform Crash Criteria
NASS/GES	National Automotive Sampling System / General Estimates System
NGA	National Governors' Association
NHP	Nevada Highway Patrol
NHTSA	National Highway Traffic Safety Administration
OMCHS	Office of Motor Carriers and Highway Safety (now FMCSA)
PDO	Property Damage Only
SAS	Statistical Analysis System
SQL	Structured Query Language
UDOT	Utah Department of Transportation
UHP	Utah Highway Patrol
USDOT	United States Department of Transportation
VMT	Vehicle Miles Traveled

VII. REFERENCES

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APPENDIX A
National Governors' Association Data Elements

Data Element	Description
1a	Number of trucks involved in the crash having at least 2 axles and 6 tires
1b	Number of buses involved in the crash having seats for more than 15 passengers including the driver
1c	Total number of fatalities
1d	Total number of injured persons requiring transport by EMS
1e	Total number of motor vehicles towed due to disabling damage
2	Reporting Agency
3	Agency Accident Report Number
4	Officer Badge Number
5	Date of Crash
6	Time of Crash
7	Accident location (State, County, and City/Township)
8	Total number of vehicles involved
9a	Truck or bus driver's name
9b	Driver's license number
9c	Driver's license state of issuance
9d	Driver's date of birth
10a	Carrier name
10b	Carrier address (Street, City, State, Zip)
10c	Source of carrier name: (side of veh., papers, or driver)
10d	Carrier ID numbers (USDOT, ICC, State ID, or no number)
11a	Truck/tractor VIN
11b	Truck/tractor license number and state
12	Gross Vehicle Weight Rating (GVWR)

Data Element	Description
13	Trafficway 1. not divided (2 way) 2. divided highway, median, no barrier 3. divided highway with barrier 4. One-way
14	Access control 1. No control 2. Full Control 3. Other
15	Weather condition 1. No adverse weather 2. Rain 3. Sleet, hail 4. Snow 5. Fog 6. Blowing sand, soil, dirt or snow 7. Severe crosswinds 8. Other 9. Unknown
16	Road surface condition 1. Dry 2. Wet 3. Snow or slush 4. Ice 5. Sand, mud, dirt, or oil 8. Other 9. Unknown
17	Light condition 1. Daylight 2. Dark – not lighted 3. Dark – lighted 4. Dawn 5. Dusk 9. Unknown

Data Element	Description
18	Sequence of accident events (for this vehicle) *Seq. Event* 1234 Ran off road 1234 Jackknife 1234 Overturn (rollover) 1234 Downhill runaway 1234 Cargo loss/shift 1234 Explosion/fire 1234 Separation of units 1234 Collision w/pedestrian 1234 Collision w/MV in transport 1234 Collision w/parked MV 1234 Collision w/train 1234 Collision w/pedalcycle 1234 Collision w/animal 1234 Collision w/fixed object 1234 Collision w/object, other
19	Apparent driver condition' 1. Normal 2. Had been drinking 3. Illegal drug use 4. Sick 5. Fatigue 6. Asleep 7. Medication 8. Unknown
20	Vehicle configuration 1. Bus (>15 seats including driver) 2. Single unit truck (2 axle, 6 tire) 3. Single unit truck (3 or more axles) 4. Truck/trailer 5. Truck tractor (bobtail) 6. Tractor/semi-trailer 7. Tractor/doubles 8. Tractor/triples 9. Heavy truck, unclassified
21	Total number of axles including trailers

Data Element	Description
22	Cargo body type 1. Bus (> 15 seats including driver) 2. Van/enclosed box 3. Cargo tank 4. Flatbed 5. Dump 6. Concrete mixer 7. Automobile transport 8. Garbage/refuse 9. Other
23	Hazardous materials involvement
23a	Placard Present?
23b	4 digit placard number from middle of diamond or box; 1 digit placard number from bottom of diamond
23c	Was hazardous cargo from the placarded truck released? Do not count fuel released from vehicle's own fuel tank

Appendix B

Longer Combination Vehicle Data Collection

Crash Report Forms

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