Center for
National Truck Statistics

REVIEW OF NATIONAL TRUCK ACCIDENT DATABASES

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A Review of Out-of-Service Criteria: Relationship between Accidents and Vehicle Defects

Review of National Truck Accident Databases

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16. Abstract

This report reviews several national truck and bus accident databases in order to assess the availability of data elements related to Commercial Vehicle Safety Alliance out-of-service critieria. After describing the coverage and data collection procedures for each database, tabulations of vehicle involvements according to relevant data elements are presented. The emphasis is on vehicle defects associated with accidents.

One obstacle in assessing the role of vehicle defects in accidents is the lack of systematic, postcollision vehicle inspections, especially in nonfatal accidents. The incidence of vehicle defects reported in the national files is generally low, but it is difficult to determine if this is due to the rarity of defects themselves or to underreporting. Specific shortcomings in the national files are noted, including problems with accurately identifying vehicle types, absence of data elements related to certain out-of-service criteria, sampling error, and underreporting of accidents.

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1. INTRODUCTION

The purpose of this report is to document the frequency of coding in existing national truck and bus accident databases of CVSA out-of-service items as associated factors in accidents. The report focuses on the CVSA vehicle and hazardous materials out-of-service criteria only. Section 2 describes the national databases that were reviewed. Section 3 contains a series of tabulations that illustrate the availability of data elements related to out-of-service criteria and their incidence of coding. Section 4 summarizes the shortcomings of the accident data with respect to out-of-service criteria.

2. DATA SOURCES

Several national truck and bus accident databases were reviewed to assess the availability of data elements related to CVSA out-of-service criteria. Table 1 summarizes the CVSA vehicle out-of-service criteria and lists associated data elements from each of three files. Table 2 does the same for the hazardous materials out-of-service criteria. Following are brief descriptions of the databases reviewed, including their coverage and data collection procedures.

2.1 FARS

The Fatal Accident Reporting System (FARS) was established by the National Highway Traffic Safety Administration (NHTSA) in 1975.[1] FARS contains data on a census* of fatal traffic accidents in the United States. To be included in FARS, an accident must involve a motor vehicle traveling on a public roadway and must result in the death of an occupant of a vehicle or a nonmotorist within 30 days of the accident. NHTSA has a cooperative agreement with an agency in each state's government to provide information on all qualifying fatal accidents in the state. Trained state employees, called "FARS analysts," collect, translate, and send their state's data to NHTSA's National Center for Statistics and Analysis (NCSA) in a standard format.

FARS data are obtained from states' documents including police accident reports (PARs), vehicle registration files, driver licensing files, hospital medical reports, emergency medical service reports, and others. Each analyst enters data derived from these documents into a local microcomputer data file, and daily updates are sent to NHTSA's central computer database. Data are automatically checked when entered for acceptable range values and for consistency, enabling the analyst to make corrections immediately. Several programs continually monitor and improve the completeness and accuracy of the data.

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* The objective of a *census* file is to enumerate every instance in a data source. This contrasts with a *probability sample*, where only a fraction of instances is chosen from the sampling universe. Cases in a probability sample are chosen in such a way as to be representative of the entire population.

Table 1
CVSA Vehicle Out-of-Service Criteria

Item	OOS or RS Condition	TIFA 1991-1993	GES 1993-1994	S-NET 1994
Brake system	At least 20% of the brakes are defective, cracked drums, damaged hoses, air leaks, etc.	Brake system (V)	Brake system (V)	–
Coupling devices	Problems with mounting, integrity, etc.	Trailer hitch (V)	Trailer hitch (V)	–
Exhaust system	Leaking at a point forward of or directly below the driver/sleeper compartment	Exhaust system (V)	Exhaust system (V)	–
Frame	Frame members cracked, loose, sagging, or broken; body or frame in contact with a tire	Body, doors, other (V)	Body, doors (V)	–
Fuel system	Visible leaks, fuel tank filler cap missing, insecurely attached fuel tank	–	–	–
Hubs (steering axle)		–	–	–
Lighting devices	Inoperative head lamp, rear red lamp, stop lamp, or turn signal	Headlights (V) Signal lights (V) Other lights (V) Failing to dim or to have lights on when required (D) Inadequate lighting system (D)	Headlights (V) Signal lights (V) Other lights (V) Inadequate lighting system (D)	–
Safe loading	Part of vehicle or condition of loading such that any part of load can fall onto the roadway; protection against shifting cargo as required	Overloading or improper loading of vehicle with passengers or cargo (D)	–	–
Steering mechanism	Excessive free play, auxiliary power assist	Steering system: tie-rod, kingpin, ball-joint, etc. (V)	Steering system: tie-rod, kingpin, ball-joint, etc. (V)	–
Suspension	Missing leaves; axle positioning parts cracked, broken, loose, or missing	Suspension: springs, shock absorbers, MacPherson struts, control-arms, etc. (V)	Suspension: springs, shock absorbers, MacPherson struts, control-arms, etc. (V)	–
Tires	Less than 2/32 inch tread on steering axle tire, etc.	Tires (V) Low tire pressure (D)	Tires (V)	–
Van & open-top trailer bodies		–	–	–
Wheels and rims	Rim cracks, disc wheel cracks, etc.	Wheels (V)	Wheels (V)	–
Windshield glazing	Cracks or discoloration	Broken or improperly cleaned windshield (D)	Broken or improperly cleaned windshield (D)	–
Windshield wipers	Inoperative or missing wiper	Wipers (V)	Wipers (V)	–
Vehicle defect not covered by OOS		Power train: universal joint, drive-shaft, transmission, etc. (V) Horn (V) Mirrors (V) Driver seating/control (V) Towing or pushing vehicle improperly (D) Operating without required equipment (D)	Power train: universal joint, drive-shaft, transmission, etc. (V) Mirrors (V) Driver seating/control (V)	–

TIFA 1991-1993: (V)-Data element coded under Vehicle Related Factors variable (up to 2 responses). (D)-Data element coded under Driver Related Factors (up to 3 responses).

GES 1993-1994: (V)-Data element coded under Vehicle Defects variable (just 1 response). (D)-Data element coded under Vision Obscured By variable (just 1 response).

Table 2
CVSA Hazardous Materials Out-of-Service Criteria

Item	OOS or RS Condition	TIFA 1991-1993	GES 1993-1994	SAFETYNET 1994
Shipping papers	When transporting hazmat not accompanied by shipping paper indicating hazmat being transported	–	–	–
Waste manifest	When transporting hazardous waste not accompanied by waste manifest indicating hazardous waste being transported	–	–	–
Placarding	No placards or some missing or placards misrepresent hazmat being transported	Hazardous Cargo variable indicates if hazardous material was being transported, and, if so, whether placarded. TIFA variables indicate whether hazardous cargo was being transported for each unit of a truck combination.	Hazardous Materials Placarded variable indicates whether a vehicle that was hauling hazmat was placarded. Placard number is listed when available.	Hazardous Materials Placard variable indicates whether vehicle had placard. Hazardous material name or 4-digit number, and 1-digit number also indicated.
Cargo tanks	Internal valve missing or open; cargo tank not authorized for material transported; hazmat leaking from cargo tank	Cargo Spillage variable indicates if there was any post-accident spillage of hazardous cargo.	Hazardous Materials Released variable indicates whether any hazardous cargo was released from the cargo tank or compartment	Hazardous Materials Release variable indicates whether any hazardous cargo was released from the cargo tank or compartment
Cargo tank markings	ID numbers missing; any marking misrepresents material transported	–	–	–
Posison inhalation markings		–	–	–
Markings for bulk packaging	ID numbers missing; any ID number misrepresents material transported	–	–	–
Packaging	Hazmat leaking in or from a package	–	–	–
Loading and securement	Materials not blocked or braced; transporting incompatible commodities; transporting poisons with foodstuffs; transporting material in driver compartment	"Overloading or improper loading of vehicle with passengers or cargo" coded as any of 3 possible driver-related factors.	–	–
Forbidden items (common carriers)	Transporting forbidding materials	An alpha variable lists the actual cargo being hauled	–	–
Forbidden items (all carriers)	Transporting forbidding materials	An alpha variable lists the actual cargo being hauled	–	–
Radioactive materials	Radiation level exceeds specified measurement	–	–	–
A/B explosives	Route plan or required documents not in possession	–	–	–
Flammable cryogenic liquid shipments	Special instructions not in possession	–	–	–

One of the goals of FARS is to code the accident data from the different PARs used by each state in a uniform manner. States differ in the variables and code levels they record on traffic accidents. Some state PARs have explicit variables that are similar to those coded in FARS, while others may not routinely record some data elements. Instead, such information may appear in the police officer's narrative if the officer deemed it to be significant. This is more likely for relatively rare occurrences such as vehicle defects contributing to an accident.

2.2 TIFA

The Center for National Truck Statistics (CNTS) at UMTRI has annually produced the Trucks Involved in Fatal Accidents (TIFA) dataset since the 1980 data year.[2] The TIFA database provides coverage of all medium and heavy trucks recorded in the FARS file. Trucks with a gross vehicle weight rating (GVWR) of 10,000 pounds or less, primarily pickups, are not included. While the FARS file includes detail on the accident environment and events, the information on the vehicles involved, particularly for trucks, is limited. TIFA combines accident, vehicle, and driver records from FARS with information about the physical configuration and cargo of the truck collected through a telephone survey. CNTS does not alter in any way data from the FARS records that are included in TIFA. Rather, the FARS data provide the starting point for the TIFA database, and additional information is then collected for each truck.

The TIFA data collection effort begins with a case listing of truck involvements from FARS. All cases coded medium or heavy trucks by FARS are listed, as well as certain other vehicle categories where medium/heavy trucks are likely to be classified by mistake. Obvious nonsample vehicles are removed from the list by checking the Vehicle Identification Number (VIN). Police accident reports are obtained from the states for all the remaining vehicles. The PARs provide the names of individuals to contact for further information. The survey is conducted primarily by telephone interview. If a telephone interview proves impossible, then a mail questionnaire is sent. The first person or company contacted is, when possible, the owner of the truck as listed in the police report. If that fails, an attempt is made to reach the driver. If neither the owner nor the driver can be reached, as much information as possible is collected from other parties, such as the investigating police officer or the tow truck operator, if the vehicle was towed from the scene. Finally, if no knowledgeable respondent can be found, as much information as possible is coded from the police report.

Each completed interview is carefully checked by an editor. For each case the VIN is decoded to confirm that the make and model information and the power unit description conform to published model specifications. The model series information allows the editors to cross-check the manufacturer's specifications with the reported weights and dimensions. UMTRI-developed editing manuals are used to evaluate information obtained from interviews to ascertain the accuracy of the reporting, especially concerning the types of freight hauled, the necessary equipment, and the typical hardware configurations used in such conditions. Reported weights are compared with typical weight ranges for similar cargos and body styles. Extensive consistency checking is performed on all cases as well. A set of computerized algorithms checks for total accuracy of elements in each individual case. If inconsistencies are found, the case is returned to an interviewer for follow-up calls to gather direct involvement information.

The scrutiny given each case assures the accuracy and validity of the information in the resulting TIFA dataset. A prime benefit of this procedure is that the level of missing data in TIFA is on the order of 1 to 2 percent for most variables, an exceptionally low rate for this kind of data. The combination of the FARS accident level variables with the physical detail of the TIFA survey produces the most complete account of fatal truck accidents available.

2.3 GES

Like FARS, the National Accident Sampling System General Estimates System (GES) was developed and designed by NHTSA's NCSA.[3] GES began operation in 1988. GES obtains its data from a nationally representative probability sample selected from the estimated 6.1 million police-reported accidents that occur annually. These accidents include those that result in a fatality or injury and those involving major property damage. Also like FARS, GES reports on all classes of motor vehicles involved in traffic accidents.

Data are obtained by GES data collectors in 60 geographic sites across the United States. These data collectors make weekly, biweekly, or monthly visits to approximately 400 police agencies within the 60 sites. During the visits, the data collectors list all PARs not previously listed and then select a sample of the listed PARs. The collectors obtain copies of these selected PARs and send them to the NASS zone centers for quality review and processing. The zone centers forward the selected PARs to data processing contractors, who extract the required data, code it into a common format, and create an electronic file. During data coding, the data are checked for validity and consistency. After the datafile is created, quality checks are performed on the data.

Since GES data are obtained from a probability sample of police-reported traffic accidents, national estimates can be made from these data. Each case in GES has a sampling weight. This weight is used when calculating estimates of national-level accident characteristics. The national estimates produced from GES data may differ from the true values because they are based on a probability sample of accidents and not a census of all accidents. The size of these differences may vary depending on which sample of accidents was selected. Because the number of accidents involving trucks and especially buses is small in relation to the number of accidents involving passenger vehicles, estimates concerning truck and bus accidents may be expected to be more prone to sampling error.

2.4 SAFETYNET

SAFETYNET is a data management system administered through the Federal Highway Administration's (FHWA) Office of Motor Carriers (OMC) in support of federal and state motor carrier safety programs.[4] The SAFETYNET accident system replaces data obtained from the carrier self-reporting requirement forms MCS 50-T and 50-B. All accidents reported to SAFETYNET should meet the following severity threshold: the accident must have resulted in either a fatality; an injured person transported from the scene for medical attention; or at least one vehicle towed from the scene because of disabling damage. SAFETYNET reports on trucks and buses involved in accidents meeting these criteria. The definition of a truck is a motor vehicle equipped for carrying property and having at least two axles and six tires, or a vehicle displaying a hazardous materials placard. Bus is defined as a vehicle designed to carry at least sixteen people including the driver.

Data collected in SAFETYNET conform to the set of data elements for truck and bus accidents recommended by the National Governor's Association (NGA) to the states in 1990. This recommendation was written into federal law in 1991 with the Intermodal Surface Transportation Efficiency Act (ISTEA). ISTEA mandated that all states must

participate in the SAFETYNET truck and bus reporting system by January 1, 1994. SAFETYNET has been phased in gradually, so some reporting of accidents took place prior to that date. About 30% of reportable cases were actually reported in 1993, and this improved to about 50% for 1994.[5]

SAFETYNET is an automated system to collect carrier, driver, and vehicle inspection data as well as accident information. Accident data are coded from state PARs or from supplemental data forms developed to comply with SAFETYNET reporting requirements. Data are electronically submitted through the SAFETYNET system and combined into an analysis file. When all states are fully reporting, SAFETYNET will provide a census of truck and bus accidents meeting the reporting criteria. In its current stage of implementation, however, there are several problems with SAFETYNET data aside from incomplete reporting.[6] Not all states seem to be following the reporting criteria in terms of accident severity or vehicle type. Also, there are various anomalies in the data that suggest that some states are incorrectly translating data from their PARs to the coding scheme required by SAFETYNET.

2.5 MCS 50-T

Prior to the development of SAFETYNET, OMC required interstate carriers of goods to file a report, called the MCS 50-T, of all accidents resulting in a fatality, an injury treated away from the scene, or in property damage of $4,400 or more.[7] The MCS 50-T files contained detailed information on the physical characteristics of accident-involved trucks, but they had several shortcomings. Beyond the fact that the files only sought to represent interstate carriers, underreporting of accidents was a problem. Many accidents that met the reporting criteria were not reported to OMC. Also, the fact that accidents were self-reported by fleets casts doubts on the reliability of the data.

As mentioned above, with the advent of SAFETYNET, MCS 50-T forms are no longer filed with OMC. The last complete year of MCS 50-T data was 1992, although the most recent year of MCS 50-T data maintained at UMTRI is 1991.

3. DATA ELEMENTS RELATED TO OUT-OF-SERVICE CRITERIA

This section presents tabulations of data related to out-of-service criteria first for trucks and then for buses. Before discussing the details of each file, some general comments pertain to all of this data. With respect to vehicle out-of-service criteria, several of the national files have a vehicle defects variable. When evaluating information coded under vehicle defects, the reader should keep in mind that police officers generally do not routinely and consistently look for vehicle defects on accident-involved vehicles. If a vehicle component very obviously failed or if a driver mentioned a vehicle defect in his statement, then the defect is likely to appear on the PAR. But without systematic postcollision vehicle inspections, more subtle vehicle problems will probably escape the officer's notice. Furthermore, if a vehicle defect is indicated, it is difficult to assess the degree to which it contributed to the accident. Accidents rarely result from a single cause. Rather, a series of events and factors typically converge to bring about a collision. For this reason, if a vehicle defect is indicated it is better to consider it an "associated factor" of the accident and not a "cause."

The approach taken with the datafiles is simply to list the frequency and percentage of vehicle involvements that had a particular data element coded. This indicates prevalence, or the proportion of accidents involving a particular factor. No assessment of risk is available with this approach, since exposure is not considered. For example, we may say that trucks with defective brakes were involved in a certain number of accidents, but this does not let us compare the number of accidents per mile traveled for trucks with defective brakes with the number of accidents per mile for trucks with brakes in good repair.

In addition, if the recording of information like vehicle defects is incomplete, any particular percentage computed cannot have much significance attached to it. For example, a low percentage of accidents involving a certain vehicle defect might be due to the defect rarely occurring or to the lack of reporting of the defect.

3.1 Trucks

3.1.1 TIFA

Tabulations of fatal truck involvements were made using the three most recent years of TIFA data, 1991-1993. The unit of analysis is a vehicle involvement in an accident. If a fatal accident involved two trucks, it represents two involvements. A total of 13,030 trucks were involved in fatal accidents in the three years examined, 4,404 in 1991, 4,175 in 1992, and 4,451 in 1993.

One advantage of using TIFA data rather than FARS data to examine vehicle defects in fatal truck accidents is to more accurately define the medium and heavy truck population. Police officers do not always receive adequate training in identifying classes of trucks. Every year FARS contains a significant number of vehicles coded as medium or heavy trucks that are actually light trucks; the reverse coding problem occurs as well. The TIFA data collection effort goes to great lengths to ensure that all cases included are trucks with a GVWR over 10,000 pounds.

TIFA data related to the CVSA vehicle out-of-service criteria are coded under Vehicle Related Factors and Driver Related Factors, both of which are FARS variables. Information coded under these variables in FARS is added to the TIFA file unchanged. FARS codes vehicle defects that were indicated in the police report, either in the narrative or elsewhere, under Vehicle Related Factors. Up to two defects may be coded for each vehicle. Tables 3 and 4 show the frequency and percentage of fatal truck involvements that had vehicle defects indicated, according to power unit type. The vast majority of fatal involvements, 90.8%, had no defect coded under the first response (Table 3). Only 718 involvements over the three years, 5.5%, had some vehicle defect indicated. The remaining 3.6% of the cases were coded either "hit-and-run vehicle" or "unknown." As Table 4 shows, only 0.7% of the involvements had a second vehicle defect coded.

Table 3
Vehicle Related Factors #1 by Power Unit Type
TIFA 1991-1993

Vehicle Related Factors #1	Power Unit Type							
	Straight		Tractor		Unknown		Total	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
None	3,598	88.5	8,014	91.8	225	95.3	11,837	90.8
Tires	62	1.5	75	0.9	2	0.8	139	1.1
Brake system	143	3.5	210	2.4	0	0.0	353	2.7
Steering system	9	0.2	8	0.1	0	0.0	17	0.1
Suspension	3	0.1	4	0.0	0	0.0	7	0.1
Power train	6	0.1	9	0.1	0	0.0	15	0.1
Exhaust system	0	0.0	1	0.0	0	0.0	1	0.0
Headlights	3	0.1	9	0.1	0	0.0	12	0.1
Signal lights	4	0.1	0	0.0	0	0.0	4	0.0
Other lights	24	0.6	26	0.3	0	0.0	50	0.4
Horn	0	0.0	0	0.0	0	0.0	0	0.0
Mirrors	1	0.0	0	0.0	0	0.0	1	0.0
Wipers	0	0.0	0	0.0	0	0.0	0	0.0
Driver seating/control	0	0.0	0	0.0	0	0.0	0	0.0
Body, doors, other	2	0.0	2	0.0	0	0.0	4	0.0
Trailer hitch	9	0.2	27	0.3	0	0.0	36	0.3
Wheels	11	0.3	3	0.0	0	0.0	14	0.1
Other vehicle defects	34	0.8	29	0.3	2	0.8	65	0.5
Hit-and-run vehicle	30	0.7	73	0.8	7	3.0	110	0.8
Unknown	128	3.1	237	2.7	0	0.0	365	2.8
Total	4,067	100.0	8,727	100.0	236	100.0	13,030	100.0

The Driver Related Factors variable has scores of code levels, grouped broadly into the categories of physical/mental conditions; vision obstructions; loss of control; in-vehicle distractions; and many miscellaneous causes which include improper vehicle maneuvers and operations. Up to three factors may be coded for each driver. There are seven levels coded under Driver Related Factors that are related to the vehicle out-of-service criteria. The frequency and percentage of fatal involvements coded under each of these seven levels are shown in Tables 5-7. All cases with some other driver related factor coded are combined in the "other" category of the tables. All seven levels are coded infrequently. Of the seven, the two most commonly coded under Driver Related Factors #1 are "overloading or improper loading of vehicle with passengers or cargo" and "operating without required equipment," with 0.6% of the cases each (Table 5). Two levels, "inadequate lighting system" and "broken or improperly cleaned windshield," were never coded in the three years of data.

Table 4
Vehicle Related Factors #2 by Power Unit Type
TIFA 1991-1993

Vehicle Related Factors #2	Power Unit Type							
	Straight		Tractor		Unknown		Total	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
None	3,897	95.8	8,436	96.7	235	99.6	12,568	96.5
Tires	3	0.1	7	0.1	0	0.0	10	0.1
Brake system	10	0.2	17	0.2	0	0.0	27	0.2
Steering system	4	0.1	4	0.0	0	0.0	8	0.1
Suspension	0	0.0	4	0.0	0	0.0	4	0.0
Power train	0	0.0	0	0.0	0	0.0	0	0.0
Exhaust system	0	0.0	0	0.0	0	0.0	0	0.0
Headlights	1	0.0	1	0.0	0	0.0	2	0.0
Signal lights	5	0.1	1	0.0	0	0.0	6	0.0
Other lights	1	0.0	3	0.0	0	0.0	4	0.0
Horn	0	0.0	0	0.0	0	0.0	0	0.0
Mirrors	0	0.0	2	0.0	0	0.0	2	0.0
Wipers	0	0.0	1	0.0	0	0.0	1	0.0
Driver seating/control	0	0.0	0	0.0	0	0.0	0	0.0
Body, doors, other	1	0.0	1	0.0	0	0.0	2	0.0
Trailer hitch	2	0.0	1	0.0	0	0.0	3	0.0
Wheels	0	0.0	1	0.0	0	0.0	1	0.0
Other vehicle defects	14	0.3	8	0.1	1	0.4	23	0.2
Hit-and-run vehicle	1	0.0	3	0.0	0	0.0	4	0.0
Unknown	128	3.1	237	2.7	0	0.0	365	2.8
Total	4,067	100.0	8,727	100.0	236	100.0	13,030	100.0

Table 5
Driver Related Factors #1 by Power Unit Type
TIFA 1991-1993

Driver Related Factors #1	Power Unit Type							
	Straight		Tractor		Unknown		Total	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
None	2,362	58.1	5,477	62.8	152	64.4	7,991	61.3
Overloading	35	0.9	38	0.4	0	0.0	73	0.6
Improper towing	8	0.2	1	0.0	0	0.0	9	0.1
Fail to dim or have lights on	3	0.1	7	0.1	0	0.0	10	0.1
Operating w/o req. equip.	39	1.0	43	0.5	0	0.0	82	0.6
Low tire pressure	1	0.0	2	0.0	0	0.0	3	0.0
Inadequate light system	0	0.0	0	0.0	0	0.0	0	0.0
Broken/dirty windshield	0	0.0	0	0.0	0	0.0	0	0.0
Other	1,577	38.8	3,090	35.4	84	35.6	4,751	36.5
Unknown	42	1.0	69	0.8	0	0.0	111	0.9
Total	4,067	100.0	8,727	100.0	236	100.0	13,030	100.0

Table 6
Driver Related Factors #2 by Power Unit Type
TIFA 1991-1993

Driver Related Factors #2	Power Unit Type							
	Straight		Tractor		Unknown		Total	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
None	3,278	80.6	7,118	81.6	216	91.5	10,612	81.4
Overloading	7	0.2	16	0.2	1	0.4	24	0.2
Improper towing	1	0.0	2	0.0	0	0.0	3	0.0
Fail to dim or have lights on	0	0.0	5	0.1	0	0.0	5	0.0
Operating w/o req. equip.	14	0.3	20	0.2	0	0.0	34	0.3
Low tire pressure	0	0.0	0	0.0	0	0.0	0	0.0
Inadequate light system	0	0.0	0	0.0	0	0.0	0	0.0
Broken/dirty windshield	0	0.0	0	0.0	0	0.0	0	0.0
Other	725	17.8	1,497	17.2	19	8.1	2,241	17.2
Unknown	42	1.0	69	0.8	0	0.0	111	0.9
Total	4,067	100.0	8,727	100.0	236	100.0	13,030	100.0

Table 7
Driver Related Factors #3 by Power Unit Type
TIFA 1991-1993

Driver Related Factors #3	Power Unit Type							
	Straight		Tractor		Unknown		Total	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
None	3,795	93.3	8,149	93.4	235	99.6	12,179	93.5
Overloading	4	0.1	1	0.0	0	0.0	5	0.0
Improper towing	1	0.0	0	0.0	0	0.0	1	0.0
Fail to dim or have lights on	0	0.0	2	0.0	0	0.0	2	0.0
Operating w/o req. equip.	10	0.2	3	0.0	0	0.0	13	0.1
Low tire pressure	0	0.0	0	0.0	0	0.0	0	0.0
Inadequate light system	0	0.0	0	0.0	0	0.0	0	0.0
Broken/dirty windshield	0	0.0	0	0.0	0	0.0	0	0.0
Other	215	5.3	503	5.8	1	0.4	719	5.5
Unknown	42	1.0	69	0.8	0	0.0	111	0.9
Total	4,067	100.0	8,727	100.0	236	100.0	13,030	100.0

To provide further insight into the incidence of coding vehicle and driver factors in FARS, Tables 8 and 9 show Vehicle Related Factors crossed with Driver Related Factors for all the truck involvements over the three years. Cases with at least one vehicle defect coded appear as "yes" under Vehicle Related Factors in the tables. Cases with at least one response coded under Driver Related Factors appear as "yes" under that variable in the tables. The vast majority of the driver factors have nothing to do with vehicle out-of-service criteria. Most of the cases classified under "yes" are related to driving behavior, such as lanekeeping, failure to yield right-of-way, and excessive speed. Table 8 shows involvement frequencies and Table 9 shows total percentages. For 58.5% of the cases, no vehicle or driver factor was indicated. Of the cases with some vehicle factor coded, 72% also had a driver factor coded, an incidence nearly twice as high as the 37.5% of all involvements with a driver factor coded.

Table 8
Vehicle Related Factors by Driver Related Factors
Involvement Frequencies
TIFA 1991-1993

Vehicle Related Factors	Driver Related Factors				
	No	Yes	Hit&run	Unknown	Total
No	7,622	4,120	0	95	11,837
Yes	196	518	3	4	721
Hit&run	3	59	43	2	107
Unknown	170	185	0	10	365
Total	7,991	4,882	46	111	13,030

Table 9
Vehicle Related Factors by Driver Related Factors
Total Percentage of Involvements
TIFA 1991-1993

Vehicle Related Factors	Driver Related Factors				
	No	Yes	Hit&run	Unknown	Total
No	58.5	31.6	0.0	0.7	90.8
Yes	1.5	4.0	0.0	0.0	5.5
Hit&run	0.0	0.5	0.3	0.0	0.8
Unknown	1.3	1.4	0.0	0.1	2.8
Total	61.3	37.5	0.4	0.9	100.0

There are several variables in TIFA related to the CVSA hazardous materials out-of-service criteria. The FARS variable Hazardous Cargo indicates whether the vehicle was hauling any substance or material determined to be capable of posing an unreasonable risk to health, safety, and property when transported in commerce. Vehicles transporting hazardous materials should have a diamond-shaped placard affixed indicating the material carried. Levels of Hazardous Cargo also indicate whether those vehicles that were carrying hazardous material at the time of the accident had the placard affixed to the vehicle.

The TIFA survey also ascertains hazardous cargo status, separately for each unit of a truck configuration. Placard status is not determined. Table 10 compares hazardous cargo status according to the FARS variable versus the TIFA survey. There is some disagreement between the two data sources. Of the 593 trucks indicated to have been hauling hazardous cargo by FARS, TIFA agrees in 64% of the cases but indicates they were not hauling hazardous material in 35% of the cases. Similarly, for the 575 trucks shown to have been carrying hazardous cargo by TIFA, FARS agrees in 66% of the cases, but FARS indicates they were not hauling hazardous cargo in 30% of the cases.

Table 10
Hazardous Cargo in FARS versus TIFA
TIFA 1991-1993

Hazardous Cargo (FARS)	Hazardous Cargo (TIFA)			
	No	Yes	Unknown	Total
No	11,666	173	271	12,110
Yes, placarded	114	203	2	319
Yes, not placarded	14	15	0	29
Yes, unknown if placarded	81	161	3	245
Unknown	262	23	42	327
Total	12,137	575	318	13,030

Basically, the FARS and TIFA variables show very similar distributions of hazardous cargo status. The major discrepancy is which particular trucks were hauling hazardous material. In the TIFA survey, if a truck had a placard but was actually empty at the time of the accident, it will be coded "no" under Hazardous Cargo. FARS may generally code placarded trucks as hauling hazardous cargo even if they were empty. Conversely, a truck will be coded "yes" under Hazardous Cargo in TIFA based on the presence of even small amounts of hazardous material, such as a gasoline can in the cab of a truck. FARS may not consider such cases to be trucks hauling hazardous cargo.

As Table 11 shows, the FARS variable indicates 4.6% of trucks in fatal involvements were hauling hazardous material at the time of the accident. Of these trucks, 54% were coded as placarded, 5% as not placarded, and 41% as unknown if placarded. The TIFA variables indicate that 4.4% of trucks were hauling hazardous material at the time of the fatal accident (Table 12).

Table 11
Hazardous Cargo in FARS by Power Unit Type
TIFA 1991-1993

Hazardous Cargo (FARS)	Power Unit Type							
	Straight		Tractor		Unknown		Total	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
No	3,853	94.7	8,034	92.1	223	94.5	12,110	92.9
Yes, placarded	74	1.8	243	2.8	2	0.8	319	2.4
Yes, not placarded	13	0.3	16	0.2	0	0.0	29	0.2
Yes, unknown if placarded	80	2.0	162	1.9	3	1.3	245	1.9
Unknown	47	1.2	272	3.1	8	3.4	327	2.5
Total	4,067	100.0	8,727	100.0	236	100.0	13,030	100.0

Table 12
Hazardous Cargo in TIFA by Power Unit Type
TIFA 1991-1993

Hazardous Cargo (TIFA)	Power Unit Type							
	Straight		Tractor		Unknown		Total	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
No	3,824	94.0	8,313	95.3	0	0.0	12,137	93.1
Yes	226	5.6	349	4.0	0	0.0	575	4.4
Unknown	17	0.4	65	0.7	236	100.0	318	2.4
Total	4,067	100.0	8,727	100.0	236	100.0	13,030	100.0

One of the TIFA survey variables is Cargo Spillage, which indicates if any spillage of cargo resulted from the accident. There are separate levels for spillage of hazardous and nonhazardous cargo. As Table 13 shows, 13% of the trucks in fatal involvements had spillage of nonhazardous cargo, and just 1.3% had spillage of hazardous cargo. Spillage of hazardous cargo was relatively more common among straight trucks than tractors.

Table 13
Cargo Spillage by Power Unit Type
TIFA 1991-1993

Cargo Spillage	Power Unit Type							
	Straight		Tractor		Unknown		Total	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
No spillage	3,350	82.4	7,238	82.9	5	2.1	10,593	81.3
Spillage/nonhazardous cargo	611	15.0	1,132	13.0	1	0.4	1,744	13.4
Spillage/hazardous cargo	72	1.8	98	1.1	0	0.0	170	1.3
Unknown	34	0.8	259	3.0	230	97.5	523	4.0
Total	4,067	100.0	8,727	100.0	236	100.0	13,030	100.0

3.1.2 GES

Tabulations of truck involvements in police-reported accidents were made using the two most recent years of GES data, 1993 and 1994. The weighted estimate of truck involvements for these two years is 865,788, with 404,024 in 1993 and 461,764 in 1994. These estimates are based on a total of 16,918 raw cases, 8,171 in 1993 and 8,747 in 1994.

Table 14 classifies the truck involvements in GES according to the most severe injury of all persons involved in the accident. The categories are property damage only (PDO); possible (C) injury; nonincapacitating (B) injury; incapacitating (A) injury; fatal; and injured, but severity unknown. Over three-fourths of the truck involvements in GES were PDO accidents, and less than 1% were fatal accidents.

Table 14
Vehicle Defects by Accident Severity
Truck Involvements
GES 1993-1994

Vehicle Defects	Accident Severity						
	PDO	C Injury	B Injury	A Injury	Fatal	Injured, Sev Unk	Total
None	477,934	75,846	47,769	33,295	7,036	1,961	643,840
	74.2	11.8	7.4	5.2	1.1	0.3	100.0
Tires	4,840	304	223	390	92	0	5,850
	82.7	5.2	3.8	6.7	1.6	0.0	100.0
Brake system	3,984	984	600	562	75	283	6,487
	61.4	15.2	9.2	8.7	1.2	4.4	100.0
Steering system	307	22	117	0	0	0	446
	68.8	4.9	26.3	0.0	0.0	0.0	100.0
Suspension	256	28	0	0	0	0	283
	90.2	9.8	0.0	0.0	0.0	0.0	100.0
Power train	250	4	0	55	0	0	308
	81.0	1.3	0.0	17.7	0.0	0.0	100.0
Headlights	85	0	0	30	0	0	115
	73.7	0.0	0.0	26.3	0.0	0.0	100.0
Signal lights	835	165	0	0	0	0	999
	83.5	16.5	0.0	0.0	0.0	0.0	100.0
Other lights	54	0	6	23	28	0	110
	49.1	0.0	5.0	20.7	25.2	0.0	100.0
Wipers	15	3	0	0	0	0	18
	81.9	18.1	0.0	0.0	0.0	0.0	100.0
Wheels	481	21	6	30	0	0	538
	89.4	3.9	1.1	5.6	0.0	0.0	100.0
Mirrors	13	0	0	0	0	0	13
	100.0	0.0	0.0	0.0	0.0	0.0	100.0
Trailer hitch	1,047	10	0	4	0	0	1,060
	98.7	0.9	0.0	0.4	0.0	0.0	100.0
Hit-and-run vehicle	138,206	14,723	4,559	1,884	121	988	160,481
	86.1	9.2	2.8	1.2	0.1	0.6	100.0
Defects, no details	3,046	258	272	282	6	0	3,864
	78.8	6.7	7.0	7.3	0.2	0.0	100.0
Other defects	2,173	256	383	134	82	0	3,027
	71.8	8.5	12.6	4.4	2.7	0.0	100.0
Unknown if defects	30,690	4,527	2,149	575	359	46	38,346
	80.0	11.8	5.6	1.5	0.9	0.1	100.0
Total	664,216	97,151	56,083	37,263	7,798	3,277	865,788
	76.7	11.2	6.5	4.3	0.9	0.4	100.0

The rows of Table 14 list levels of the Vehicle Defects variable, the primary variable related to the vehicle out-of-service criteria. Vehicle Defects indicates whether or not the vehicle had a defect that may have contributed to the cause of the accident. Only one defect may be coded for each vehicle. If a vehicle had multiple defects, the first defect on the list is coded. For example, if "suspension" and "trailer hitch" were both indicated on the PAR, "suspension" would be coded in GES. Table 14 does not show the levels of the Vehicle Defects variable that had no truck cases coded in 1993-1994.

Table 15 lists all the levels of Vehicle Defects, including those for which no cases were coded, by power unit type of the truck. While the Vehicle Defects variable has many levels, distributions from this variable yield only limited information. Nearly three-quarters of the cases are coded "none," and a surprising 18.5% of cases are coded "hit-and run vehicle." As it turns out, many truck cases in GES are coded "hit-and run vehicle" when really they just involve missing data and should have properly been coded under "unknown if defects."[8] Fully 97.3% of the trucks were coded either "none," "hit-and run vehicle," or "unknown if defects." This means that only 2.7% of the cases were coded with some vehicle defect. Of these vehicle defect cases, 30% were coded either "defects, no detail" or "other defects." Thus, only 1.9% of all the cases had a specific defect coded. The columns of Table 15 indicate the power unit type of the trucks. Power unit type is a weak variable in GES, since it is unknown in nearly 29% of the weighted truck cases.

Table 15
Vehicle Defects by Power Unit Type
Truck Involvements
GES 1993-1994

Vehicle Defects	Power Unit Type							
	Straight		Tractor		Unknown		Total	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
None	97,479	80.4	362,784	73.3	183,577	73.5	643,840	74.4
Tires	598	0.5	4,367	0.9	884	0.4	5,850	0.7
Brake system	1,384	1.1	2,283	0.5	2,820	1.1	6,487	0.7
Steering system	62	0.1	231	0.0	153	0.1	446	0.1
Suspension	84	0.1	91	0.0	108	0.0	283	0.0
Power train	0	0.0	241	0.0	68	0.0	308	0.0
Exhaust system	0	0.0	0	0.0	0	0.0	0	0.0
Headlights	0	0.0	115	0.0	0	0.0	115	0.0
Signal lights	0	0.0	746	0.2	253	0.1	999	0.1
Other lights	6	0.0	104	0.0	0	0.0	110	0.0
Wipers	3	0.0	15	0.0	0	0.0	18	0.0
Wheels	332	0.3	174	0.0	32	0.0	538	0.1
Mirrors	13	0.0	0	0.0	0	0.0	13	0.0
Driver seating/control	0	0.0	0	0.0	0	0.0	0	0.0
Body, doors	0	0.0	0	0.0	0	0.0	0	0.0
Trailer hitch	117	0.1	848	0.2	95	0.0	1,060	0.1
Hit-and-run vehicle	11,429	9.4	95,860	19.4	53,192	21.3	160,481	18.5
Defects, no details	694	0.6	1,936	0.4	1,234	0.5	3,864	0.4
Other defects	495	0.4	2,039	0.4	493	0.2	3,027	0.3
Unknown if defects	8,582	7.1	22,965	4.6	6,798	2.7	38,346	4.4
Total	121,280	100.0	494,801	100.0	249,707	100.0	865,788	100.0

The reader should keep in mind when reviewing all of the GES tables that the frequencies presented are weighted estimates with unknown and possibly large degrees of sampling error. For example, the 283 estimated "suspension" involvements indicated in Table 15 are based on 8 raw cases. The estimate of 999 involvements with defective signal lights derives from 9 raw cases.

Two more data elements related to the vehicle out-of-service criteria are listed under the Vision Obstruction variable. This variable identifies visual circumstances that may have contributed to the cause of the accident. The two elements are "inadequate lighting

system" and "broken or improperly cleaned windshield." Table 16 shows the incidence of coding for these levels, as well as the incidence of "none," "unknown," and all other vision obstructions (not related to vehicle out-of-service criteria) combined. "Inadequate lighting system" was never coded for trucks in 1993-1994, and "broken or improperly cleaned windshield" was coded in just 0.04% of the cases.

Table 16
Vision Obstruction by Power Unit Type
Truck Involvements
GES 1993-1994

Vision Obscured By	Power Unit Type							
	Straight		Tractor		Unknown		Total	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
None	98,568	81.3	370,435	74.9	190,242	76.2	659,245	76.1
Inadequate light system	0	0.0	0	0.0	0	0.0	0	0.0
Broken/dirty windshield	326	0.3	30	0.0	2	0.0	358	0.0
Other	13,418	11.1	106,039	21.4	57,361	23.0	176,818	20.4
Unknown	8,969	7.4	18,296	3.7	2,101	0.8	29,366	3.4
Total	121,280	100.0	494,801	100.0	249,707	100.0	865,788	100.0

Recent years of GES have included precrash variables designed to yield information on the circumstances leading up to the actual collision. One of these variables is Critical Event, which identifies the critical event that made the accident imminent (i.e., something happened that made the collision possible). Scores of levels are coded under this variable, two of which are of interest here. They each involve the case vehicle losing control, one because of "disabling vehicle failure (e.g. wheel fell off)" and the other due to "minor vehicle failure." As shown in Table 17, 0.7% of the truck involvements had disabling vehicle failure coded for the case truck, and an additional 0.1% had minor vehicle failure coded.

Table 17
Critical Event by Power Unit Type
Truck Involvements
GES 1993-1994

Critical Event	Power Unit Type							
	Straight		Tractor		Unknown		Total	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Disabling vehicle failure	1,489	1.2	2,178	0.4	2,473	1.0	6,141	0.7
Minor vehicle failure	398	0.3	118	0.0	119	0.0	634	0.1
Other	115,776	95.5	471,912	95.4	235,343	94.2	823,031	95.1
Unknown	3,617	3.0	20,593	4.2	11,772	4.7	35,982	4.2
Total	121,280	100.0	494,801	100.0	249,707	100.0	865,788	100.0

Two GES variables are related to the hazardous materials out-of-service criteria. The Hazardous Materials Placarded variable indicates whether a vehicle that was hauling hazardous material was placarded. As Table 18 shows, this variable was coded not applicable for 63% of the trucks in GES since they were not hauling hazardous materials. The table indicates that 0.7% of the trucks were hauling hazardous materials, 98% of which were placarded and 2% of which were not. The remaining 36% of the trucks were coded

"unknown" on this variable; "unknown" presumably was coded both if it was unknown whether the truck was hauling hazardous material or if the placard status was unknown for a truck that was hauling hazardous material.

Table 18
Hazardous Materials Placarded by Power Unit Type
Truck Involvements
GES 1993-1994

Hazardous Materials Placarded	Power Unit Type							
	Straight		Tractor		Unknown		Total	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
N/A	88,800	73.2	313,630	63.4	145,780	58.4	548,210	63.3
Yes	682	0.6	4,035	0.8	1,078	0.4	5,794	0.7
No	0	0.0	67	0.0	73	0.0	139	0.0
Unknown	31,799	26.2	177,069	35.8	102,777	41.2	311,645	36.0
Total	121,280	100.0	494,801	100.0	249,707	100.0	865,788	100.0

The Hazardous Materials Released variable indicates whether or not any hazardous cargo was released from the vehicle cargo tank or compartment. As Table 19 shows, this variable was also coded not applicable for 63% of the trucks since they were not hauling hazardous materials. Hazardous materials were released in 0.2% of the cases and not released in 0.4% of the cases, with the remaining 36% of trucks coded unknown.

Table 19
Hazardous Materials Released by Power Unit Type
Truck Involvements
GES 1993-1994

Hazardous Materials Released	Power Unit Type							
	Straight		Tractor		Unknown		Total	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
N/A	88,800	73.2	313,624	63.4	145,780	58.4	548,204	63.3
Yes	47	0.0	1,145	0.2	144	0.1	1,335	0.2
No	302	0.2	2,432	0.5	931	0.4	3,665	0.4
Unknown	32,131	26.5	177,600	35.9	102,853	41.2	312,583	36.1
Total	121,280	100.0	494,801	100.0	249,707	100.0	865,788	100.0

3.1.3 SAFETYNET

The SAFETYNET file was also reviewed for data elements related to out-of-service criteria. Unlike GES, SAFETYNET will ultimately be a census file and not a probability sample. Cases reported to SAFETYNET meet a stricter severity requirement than cases eligible for selection in GES. While GES covers all police-reported accidents, SAFETYNET cases must have resulted in a fatality, an injured person, or a vehicle towed from the scene.

Tabulations were made of SAFETYNET truck involvement data from 1994. The SAFETYNET file currently available at UMTRI is a partial file of SAFETYNET records from 1994, which is limited to interstate carriers. OMC will soon release a more complete

file of 1994 SAFETYNET records. Vehicles in SAFETYNET may be classified as various truck configurations, buses, "other vehicle type," or "unknown." For the purpose of the tables presented here, cases coded "other" or "unknown" are included with trucks; only cases specifically coded "bus" are included in the bus section.

Table 20 shows the severity of truck involvements in the 1994 SAFETYNET data by power unit type. Most of the involvements reported to SAFETYNET fell under the criterion of an injured person treated away from the scene (57% of the cases). Fatal involvements made up less than 5% of the cases, and the remaining 38% were towaways.

Table 20
Accident Severity by Power Unit Type
SAFETYNET 1994

Accident Severity	Power Unit Type: Straight		Tractor		Other		Unknown		Total	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Towaway	5,525	36.3	11,033	40.0	586	35.5	1,853	32.5	18,997	37.9
Injury	8,952	58.8	15,169	55.0	1,005	60.9	3,631	63.7	28,757	57.3
Fatal	739	4.9	1,387	5.0	59	3.6	214	3.8	2,399	4.8
Total	15,216	100.0	27,589	100.0	1,650	100.0	5,698	100.0	50,153	100.0

SAFETYNET has no data elements related to the vehicle out-of-service criteria. Two variables are related to the hazardous materials out-of-service criteria. Table 21 shows the distribution of the Hazardous Materials Placard variable for truck involvements by power unit type in SAFETYNET. This variable indicates whether the motor carrier had a hazardous materials placard. Only 2.8% of the trucks were coded "yes" on this variable; 60.5% of the cases were unknown.

Table 21
Hazardous Materials Placard by Power Unit Type
SAFETYNET 1994

Hazardous Materials Placard	Power Unit Type: Straight		Tractor		Other		Unknown		Total	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Yes	576	3.8	794	2.9	34	2.1	23	0.4	1,427	2.8
No	5,788	38.0	11,276	40.9	540	32.7	762	13.4	18,366	36.6
Unknown	8,852	58.2	15,519	56.3	1,076	65.2	4,913	86.2	30,360	60.5
Total	15,216	100.0	27,589	100.0	1,650	100.0	5,698	100.0	50,153	100.0

Table 22 shows the distribution of Hazardous Materials Release of Cargo. This variable indicates whether hazardous cargo was released from the cargo tank or compartment of the truck, if applicable. Fuel spilled from the vehicle fuel tank does not qualify as a release of hazardous material. All cases coded "no" or "unknown" under Hazardous Materials Placard are coded "not applicable" under Hazardous Materials Release. Overall, 0.5% of trucks were coded as experiencing a release of hazardous materials.

Table 22
Hazardous Materials Release by Power Unit Type
SAFETYNET 1994

Hazardous Materials Release	Power Unit Type									
	Straight		Tractor		Other		Unknown		Total	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
N/A	14,640	96.2	26,795	97.1	1,616	97.9	5,675	99.6	48,726	97.2
Yes	107	0.7	113	0.4	5	0.3	3	0.1	228	0.5
No	348	2.3	488	1.8	21	1.3	7	0.1	864	1.7
Unknown	121	0.8	193	0.7	8	0.5	13	0.2	335	0.7
Total	15,216	100.0	27,589	100.0	1,650	100.0	5,698	100.0	50,153	100.0

3.1.4 MCS 50-T

In 1991 34,304 accidents involving interstate motor carriers were reported to OMC. Table 23 indicates the distribution of vehicle defects among those cases. No defects were coded for over 97% of the trucks. As for the hazardous materials out-of-service criteria, 1,860 (5.4%) of the trucks were coded as hauling hazardous cargo and 411 (1.2%) of the cases resulted in spillage of hazardous cargo.

Table 23
Vehicle Defects in Truck Involvements
MCS 50-T 1991

Type of Defect or Failure	Number	Percent
Not applicable	33,353	97.2
Fuel system	76	0.2
Wheels and tires	223	0.7
Steering system	49	0.1
Suspension	33	0.1
Transmission	9	0.0
Driveline	15	0.0
Engine	27	0.1
Brakes	288	0.8
Lights	33	0.1
Coupling	26	0.1
Other	169	0.5
Missing data	3	0.0
Total	34,304	100.0

3.2 Buses

3.2.1 FARS

The FARS files were used to look at fatal bus involvements in 1993 and 1994. A total of 519 fatal bus involvements occurred in these two years, 261 in 1993 and 258 in 1994.

FARS classifies buses into five categories: school, cross-country/intercity, transit, other, and unknown.

Tables 24 and 25 show the incidence of vehicle defects by bus type in FARS. Vehicle defects were very rarely coded for buses in FARS. Of the 519 buses, 511 (98.5%) were coded either "none," "hit-and-run vehicle," or "unknown" under the Vehicle Related Factors #1 variable (Table 24).

Table 24
Vehicle Related Factors #1 by Bus Type
FARS 1993-1994

Vehicle Related Factors #1	Bus Type											
	School		Intercity		Transit		Other		Unknown		Total	
	No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.
None	208	95.4	48	94.1	175	96.2	33	91.7	31	96.9	495	95.4
Brake system	1	0.5	1	2.0	0	0.0	0	0.0	0	0.0	2	0.4
Power train	1	0.5	0	0.0	0	0.0	0	0.0	0	0.0	1	0.2
Other lights	2	0.9	0	0.0	0	0.0	0	0.0	0	0.0	2	0.4
Wipers	0	0.0	0	0.0	0	0.0	1	2.8	0	0.0	1	0.2
Body, doors, other	0	0.0	0	0.0	1	0.5	0	0.0	0	0.0	1	0.2
Other vehicle defects	0	0.0	0	0.0	1	0.5	0	0.0	0	0.0	1	0.2
Hit-and-run vehicle	3	1.4	0	0.0	3	1.6	0	0.0	1	3.1	7	1.3
Unknown	3	1.4	2	3.9	2	1.1	2	5.6	0	0.0	9	1.7
Total	218	100.0	51	100.0	182	100.0	36	100.0	32	100.0	519	100.0

Table 25
Vehicle Related Factors #2 by Bus Type
FARS 1993-1994

Vehicle Related Factors #2	Bus Type											
	School		Intercity		Transit		Other		Unknown		Total	
	No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.
None	215	98.6	49	96.1	179	98.4	33	91.7	32	100.0	508	97.9
Headlights	0	0.0	0	0.0	0	0.0	1	2.8	0	0.0	1	0.2
Other vehicle defects	0	0.0	0	0.0	1	0.5	0	0.0	0	0.0	1	0.2
Unknown	3	1.4	2	3.9	2	1.1	2	5.6	0	0.0	9	1.7
Total	218	100.0	51	100.0	182	100.0	36	100.0	32	100.0	519	100.0

The three Driver Related Factors variables were also tabulated for buses in FARS (Tables 26-28). Of the seven levels of these variables that are related to the vehicle out-of-service criteria, four were never coded for buses in 1993-1994. "Overloading or improper loading of vehicle with passengers or cargo," "operating without required equipment," and "inadequate lighting system" were each coded once.

Table 26
Driver Related Factors #1 by Bus Type
FARS 1993-1994

Driver Related Factors #1	Bus Type											
	School		Intercity		Transit		Other		Unknown		Total	
	No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.
None	153	70.2	33	64.7	138	75.8	19	52.8	21	65.6	364	70.1
Overloading	0	0.0	0	0.0	1	0.5	0	0.0	0	0.0	1	0.2
Operating w/o req. equip.	1	0.5	0	0.0	0	0.0	0	0.0	0	0.0	1	0.2
Other	62	28.4	16	31.4	41	22.5	17	47.2	11	34.4	147	28.3
Unknown	2	0.9	2	3.9	2	1.1	0	0.0	0	0.0	6	1.2
Total	218	100.0	51	100.0	182	100.0	36	100.0	32	100.0	519	100.0

Table 27
Driver Related Factors #2 by Bus Type
FARS 1993-1994

Driver Related Factors #2	Bus Type											
	School		Intercity		Transit		Other		Unknown		Total	
	No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.
None	202	92.7	45	88.2	171	94.0	29	80.6	27	84.4	474	91.3
Inadequate light system	0	0.0	0	0.0	0	0.0	0	0.0	1	3.1	1	0.2
Other	14	6.4	4	7.8	9	4.9	7	19.4	4	12.5	38	7.3
Unknown	2	0.9	2	3.9	2	1.1	0	0.0	0	0.0	6	1.2
Total	218	100.0	51	100.0	182	100.0	36	100.0	32	100.0	519	100.0

Table 28
Driver Related Factors #3 by Bus Type
FARS 1993-1994

Driver Related Factors #3	Bus Type											
	School		Intercity		Transit		Other		Unknown		Total	
	No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.
None	213	97.7	47	92.2	180	98.9	32	88.9	30	93.8	502	96.7
Other	3	1.4	2	3.9	0	0.0	4	11.1	2	6.3	11	2.1
Unknown	2	0.9	2	3.9	2	1.1	0	0.0	0	0.0	6	1.2
Total	218	100.0	51	100.0	182	100.0	36	100.0	32	100.0	519	100.0

The only variable in FARS related to the hazardous materials out-of-service criteria is Hazardous Cargo. All 519 buses in FARS were coded "no" on this variable.

3.2.2 GES

Police-reported bus accidents were analyzed using GES data. The national estimate of bus involvements during 1993-1994 is 107,799, with 51,322 in 1993 and 56,477 in 1994. These estimates are derived from 1,210 raw cases, 716 in 1993 and 494 in 1994. GES classifies three types of buses: school buses; other buses, including both transit and intercity; and unknown.

Table 29 shows accident severity for bus involvements in GES according to the levels of the Vehicle Defects variable that were coded for buses in 1993-1994. The majority of bus involvements resulted in property damage only (74%), and just 0.2% were fatal accidents.

Table 29
Vehicle Defects by Accident Severity
Bus Involvements
GES 1993-1994

Vehicle Defects	Accident Severity						
	PDO	C Injury	B Injury	A Injury	Fatal	Injured, Sev Unk	Total
None	72,232	15,652	7,334	3,414	151	448	99,231
	72.8	15.8	7.4	3.4	0.2	0.5	100.0
Tires	0	62	0	0	0	0	62
	0.0	100.0	0.0	0.0	0.0	0.0	100.0
Brake system	638	19	6	0	0	0	662
	96.3	2.8	0.9	0.0	0.0	0.0	100.0
Steering system	0	0	20	0	0	0	20
	0.0	0.0	100.0	0.0	0.0	0.0	100.0
Power train	220	0	0	0	0	0	220
	100.0	0.0	0.0	0.0	0.0	0.0	100.0
Wheels	0	78	0	0	0	0	78
	0.0	100.0	0.0	0.0	0.0	0.0	100.0
Hit-and-run vehicle	2,951	262	141	106	20	0	3,480
	84.8	7.5	4.1	3.0	0.6	0.0	100.0
Defects, no details	5	318	0	10	0	0	333
	1.5	95.4	0.0	3.1	0.0	0.0	100.0
Other defects	303	0	80	0	0	0	383
	79.1	0.0	20.9	0.0	0.0	0.0	100.0
Unknown if defects	3,235	14	40	39	0	0	3,329
	97.2	0.4	1.2	1.2	0.0	0.0	100.0
Total	79,584	16,405	7,621	3,570	172	448	107,799
	73.8	15.2	7.1	3.3	0.2	0.4	100.0

Vehicle defects were rarely coded for buses, as is even more clear in Table 30, which includes a complete listing of the Vehicle Defects levels. A total of 98.4% of the buses were coded either "none," "hit-and run vehicle," or "unknown if defects" under this variable. Of the 1.6% of buses indicated to have had a defect, 41% were coded either "defects, no details" or "other defects." Again it should be remembered that GES frequencies are weighted. The estimate of 78 bus involvements with defective wheels is based on one case.

With respect to the other GES variables related to the vehicle out-of-service criteria, no buses were coded either "inadequate lighting system" or "broken or improperly cleaned windshield" on Vision Obstruction. Under Critical Event, 0.6% of the buses were coded as losing control because of disabling vehicle failure and 0.3% due to minor vehicle failure. As for the hazardous materials out-of-service criteria, all buses were coded either "not applicable" or "unknown" on both Hazardous Materials Placarded and Hazardous Materials Released. In theory GES codes these variables for both trucks and buses over 10,000 pounds GVWR.

Table 30
Vehicle Defects by Bus Type
Bus Involvements
GES 1993-1994

Vehicle Defects	Bus Type							
	School bus		Transit/intercity bus		Unknown bus type		Total	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
None	49,268	94.9	47,332	94.3	2,631	46.1	99,231	92.1
Tires	0	0.0	62	0.1	0	0.0	62	0.1
Brake system	19	0.0	643	1.3	0	0.0	662	0.6
Steering system	20	0.0	0	0.0	0	0.0	20	0.0
Suspension	0	0.0	0	0.0	0	0.0	0	0.0
Power train	220	0.4	0	0.0	0	0.0	220	0.2
Exhaust system	0	0.0	0	0.0	0	0.0	0	0.0
Headlights	0	0.0	0	0.0	0	0.0	0	0.0
Signal lights	0	0.0	0	0.0	0	0.0	0	0.0
Other lights	0	0.0	0	0.0	0	0.0	0	0.0
Wipers	0	0.0	0	0.0	0	0.0	0	0.0
Wheels	0	0.0	78	0.2	0	0.0	78	0.1
Mirrors	0	0.0	0	0.0	0	0.0	0	0.0
Driver seating/control	0	0.0	0	0.0	0	0.0	0	0.0
Body, doors	0	0.0	0	0.0	0	0.0	0	0.0
Trailer hitch	0	0.0	0	0.0	0	0.0	0	0.0
Hit-and-run vehicle	901	1.7	724	1.4	1,856	32.5	3,480	3.2
Defects, no details	10	0.0	323	0.6	0	0.0	333	0.3
Other defects	0	0.0	383	0.8	0	0.0	383	0.4
Unknown if defects	1,490	2.9	624	1.2	1,215	21.3	3,329	3.1
Total	51,928	100.0	50,169	100.0	5,701	100.0	107,799	100.0

3.2.3 SAFETYNET

A total of 3,274 bus involvements were reported to SAFETYNET in 1994. SAFETYNET does not classify buses into particular types. Towaways made up 23.6% of the bus involvements, injuries treated away from the scene accounted for 74.2%, and the remaining 2.2% of the cases were fatal involvements. On the Hazardous Materials Placard variable, 4 cases were coded "yes," 1,631 cases were coded "no," and 1,639 were unknown. Of the 4 bus cases indicated to have had a hazardous materials placard, 1 was coded "yes" under Hazardous Materials Release, 1 was coded "no," and the other 2 were unknown.

4. DATA ASSESSMENT AND DATA NEEDS

All the national accident databases reviewed here are prone to inaccuracies due to the fact that accident-involved vehicles are not systematically inspected for vehicle defects by the investigating police officer. This is especially true for nonfatal accidents. Obviously a more complete vehicle defect data collection effort would have to compete with many other priorities for time, training, and funding. However, without complete postaccident data collection, the datafiles will never be reliable enough to support serious study of the relationship between accidents and vehicle defects. No amount of consistency checking and detailed code levels in the files can compensate for data that are not comprehensively collected in the first place.

Another major need is exposure data for trucks and buses. To assess risk of accident involvement for vehicles with certain defects or for vehicles hauling hazardous materials, one needs to know the representation of these vehicles on the roads. Any kind of exposure data collection would involve a major effort, but might pay off through the ability to target high-risk factors in developing accident countermeasures.

Another weakness in several of the datafiles is the inability to accurately identify the target population of medium and heavy trucks and buses. TIFA supplies reliable data in this respect, but it is limited to fatal accidents and it excludes buses. FARS, GES, and SAFETYNET all are less reliable in the identification of trucks and buses, the latter two files especially. A large fraction of trucks in GES have unknown power unit type, and many cases in SAFETYNET are coded either "other" or "unknown" on vehicle type. Both of these files would be improved with the addition of a more detailed bus type variable. In general, all of the data addressed here is less available and less detailed for buses than for trucks.

Some of the CVSA vehicle out-of-service criteria are not represented by data elements in any of the files. Two of these are the criteria pertaining to fuel system and hubs. The MCS 50-T data had a fuel system vehicle defect level, but MCS 50-T data are no longer collected. Several of the CVSA hazardous materials out-of-service criteria have no corresponding code levels in any of the files (see Table 2).

Another concern is with sample size and the reporting of cases. TIFA and FARS are census files, but they only include fatal accidents. GES targets all police-reported accidents, but its estimates for truck and bus involvements are subject to sampling error. This could be remedied by oversampling truck and bus accidents. Also, the coding of missing data for trucks in GES under the code level "hit-and-run vehicle" needs to be addressed, and if "unknown vehicle defects" were specifically coded, the GES Vehicle Defects variable would yield more useable information. SAFETYNET currently has many problems, although these are expected to improve over time. Shortcomings in SAFETYNET at present include underreporting, not reporting cases according to the reporting criteria, states incorrectly implementing SAFETYNET code values, and the lack of any kind of vehicle defect variable.

5. REFERENCES

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Acronyms

CNTS - Center for National Truck Statistics

CVSA - Commercial Vehicle Safety Alliance

FARS - Fatal Accident Reporting System

FHWA - Federal Highway Administration

GES - General Estimates System

GVWR - gross vehicle weight rating

ISTEA - Intermodal Surface Transportation Efficiency Act

NASS - National Accident Sampling System

NCSA - National Center for Statistics and Analysis

NHTSA - National Highway Traffic Safety Administration

OMC - Office of Motor Carriers

OoS - Out of Service

PAR - police accident report

PDO - property damage only

RS - Restricted Service

TIFA - Trucks Involved in Fatal Accidents

UMTRI - University of Michigan Transportation Research Institute

VIN - Vehicle Identification Number