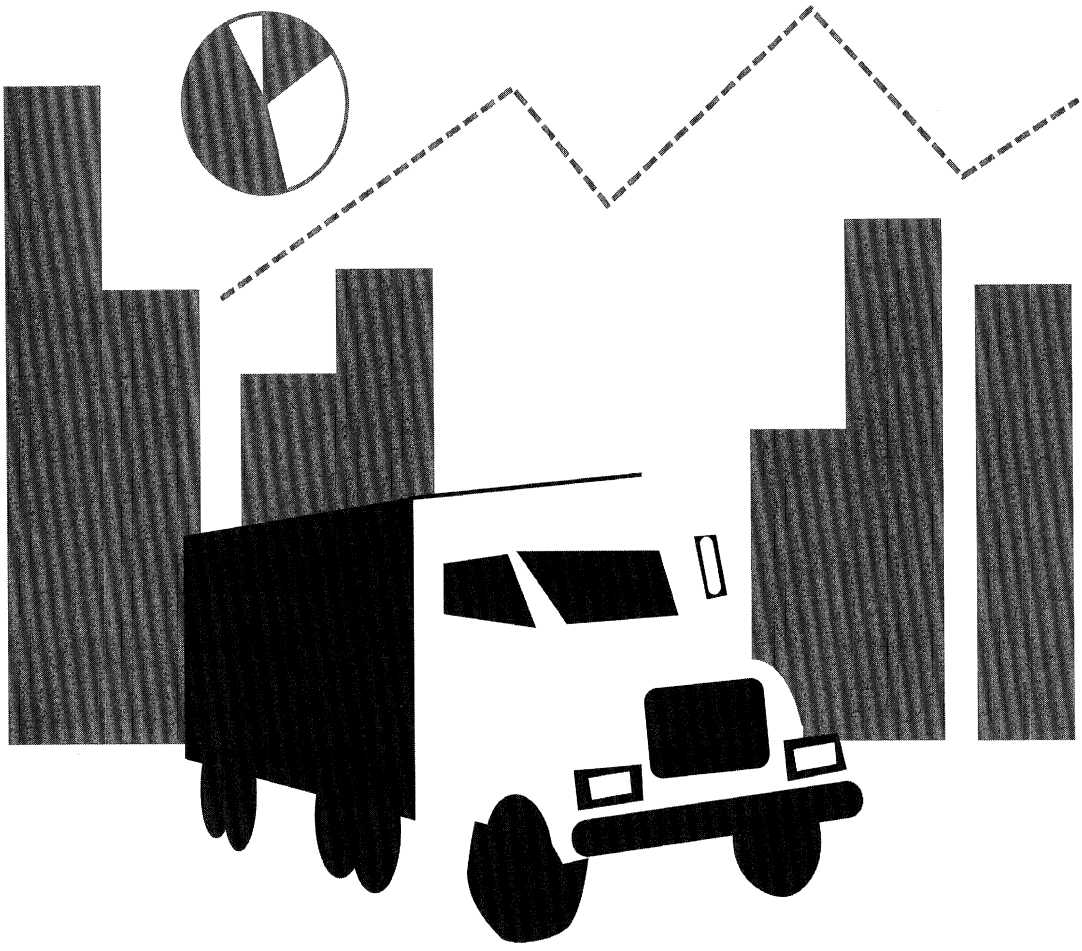
Office of Motor Carriers
Federal Highway Administration
U.S. Department of Transportation

prepared by
The Center for National Truck Statistics
University of Michigan Transportation Research Institute



Truck and Bus
Accident Factbook 1994

UMTRI-96-40

Truck and Bus Accident Factbook, 1994

October 1996

Prepared By
The Center for National Truck Statistics
University of Michigan Transportation Research Institute

for
The Office of Motor Carriers
Federal Highway Administration

The opinions, findings, and conclusions expressed in this publication are those of the Center for National Truck Statistics and not necessarily those of the Michigan Office of Highway Safety Planning or the U.S. Department of Transportation, Federal Highway Administration. This report was prepared in cooperation with the Michigan Office of Highway Safety Planning and U.S. Department of Transportation, Federal Highway Administration.

Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
UMTRI-96-40		

4. Title and Subtitle	5. Report Date
Truck and Bus Accident Factbook 1994	October 1996
	6. Performing Organization Code: UMTRI-96-40
7. Author(s): Center for National Truck Statistics	8. Performing Organization Report No.
9. Performing Organization Name and Address: The University of Michigan, Transportation Research Institute, 2901 Baxter Road, Ann Arbor, Michigan 48109-2150	10. Work Unit No.
	11. Contract or Grant No.: TR-96-03
12. Sponsoring Agency Name and Address: Office of Highway Safety Planning, Department of State Police, Lansing, Michigan 48913	13. Type of Report and Period Covered: Special Report, 1994
	14. Sponsoring Agency Code

15. Supplementary Notes

Funds provided by : Office of Motor Carriers
Federal Highway Administration
Washington DC 20590

16. Abstract

This document presents aggregate statistics on trucks and buses involved in traffic accidents in 1994. These statistics are derived from four sources: accident statistics reported through the SafetyNet data system operated by the Federal Highway Administration's Office of Motor Carriers; the General Estimates System file maintained by the National Highway Traffic Safety Administration (NHTSA); the Fatal Accident Reporting System, also maintained by NHTSA; and the Trucks Involved Fatal Accidents file compiled by the University of Michigan Transportation Research Institute. All accidents reported on herein meet the SafetyNet severity threshold of either a fatality, an injured person transported from the scene for medical attention, or at least one vehicle towed from the scene as a result of disabling damage sustained in the accident.

An estimated 151,000 trucks and 16,000 buses were involved in traffic accidents in 1994. There were 5,501 fatalities and 110,000 nonfatal injuries in accidents involving trucks. 289 persons were killed in bus accidents and 24,000 were injured. 584 truck drivers received fatal injuries as a result of traffic accidents.

17. Key Words	18. Distribution Statement
Medium trucks, heavy trucks, buses, accident statistics, SafetyNet	Unlimited

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
None	None	118	

SI* (MODERN METRIC) CONVERSION FACTORS

APPROXIMATE CONVERSIONS TO SI UNITS

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

APPROXIMATE CONVERSIONS FROM SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
	LENGTH			
mm	millimeters	0.039	inches	in
m	meters	3.28	feet	ft
m	meters	1.09	yards	yd
km	kilometers	0.621	miles	mi
	AREA			
mm^2	square millimeters	0.0016	square inches	in^2
m^2	square meters	10.764	square feet	ft^2
m^2	square meters	1.195	square yards	ac
ha	hectares	2.47	acres	mi^2
km^2	square kilometers	0.386	square miles	
	VOLUME			
ml	milliliters	0.034	fluid ounces	fl oz
l	liters	0.264	gallons	gal
m^3	cubic meters	35.71	cubic feet	ft^3
m^3	cubic meters	1.307	cubic yards	yd^3
	MASS			
g	grams	0.035	ounces	oz
kg	kilograms	2.202	pounds	lb
Mg	megagrams	1.103	short tons (2000 lb)	T
	TEMPERATURE (exact)			
°C	Celcius temperature	1.8C + 32	Fahrenheit temperature	°F
	ILLUMINATION			
lx	lux	0.0929	foot-candles	fc
cd/m^2	candela/m^2	0.2919	foot-Lamberts	fl
	FORCE and PRESSURE or STRESS			
N	newtons	0.225	poundforce	lbf
kPa	kilopascals	0.145	poundforce per square inch	psi

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

(Revised August 1992)

Summary Truck and Bus Accident Statistics

Accidents:

- 151,000 trucks were involved in traffic accidents in 1994
- 4,795 trucks were involved in fatal accidents; 56,000 trucks were involved in an accident with a nonfatal injury; and 90,000 trucks were involved in an accident in which no one was injured but at least one vehicle was towed
- There were 5,501 fatalities and 110,000 nonfatal injuries in accidents involving a truck

Truck drivers:

- 584 truck drivers died in traffic accidents; of those, 403 (69%) died in single-vehicle accidents
- 3.1% of truck drivers involved in all accidents had been using alcohol, compared with 8.5% of accident-involved passenger car drivers

Truck configuration:

- About 37% of the trucks involved in all traffic accidents were single-unit (no trailers), 58% pulled one trailer, and 2% pulled two or more trailers; truck configuration could not be determined in 4% of the cases
- 32% of trucks involved in fatal accidents were single-unit, 63% pulled one trailer, and 4% pulled at least two trailers
- There were 43 "longer combination vehicles" (LCVs) involved in fatal accidents, including two triples

Buses:

- 16,000 buses were involved in traffic accidents in 1994
- 266 buses were involved in fatal accidents
- 289 people were killed in bus accidents and 24,000 were injured

Hazardous materials:

- There were 212 trucks carrying hazardous materials involved in fatal accidents in 1994, up from 175 in 1993
- There were spills of hazardous materials from 62 of the 4,795 trucks involved in fatal accidents in 1994 (1.3%), up from 53 spills in 1993

Contents

Tables

Trends and Overview: Trucks

Truck Accidents

Vehicles: Trucks

Drivers: Trucks

Special Focus: Longer Combination Vehicles

Bus Accidents

Accident Type and Related Factors

A Look at Preliminary SafetyNet Data

Figures

Trends and Overview: Trucks

Truck Accidents

Vehicles: Trucks

Drivers: Trucks

Special Focus: Longer Combination Vehicles

Bus Accidents

A Look at Preliminary SafetyNet Data

I. Introduction

This document presents aggregate statistics on trucks and buses involved in traffic accidents that occurred in the United States in 1994. These statistics are derived from four sources: accident statistics reported through the SafetyNet data system operated by the Federal Highway Administration's Office of Motor Carriers (OMC); the General Estimates System (GES) file maintained by the National Highway Traffic Safety Administration (NHTSA); the Fatal Accident Reporting System (FARS) file, also maintained by the NHTSA; and the Trucks Involved in Fatal Accidents (TIFA) file compiled by the University of Michigan Transportation Research Institute.

The *Truck and Bus Accident Factbook* is a comprehensive overview of truck and bus accidents in the United States. All truck and bus involvements meeting a uniform severity threshold are included, regardless of whether the carriers operate in interstate commerce. Data reported here are collected from police accident reports and telephone interviews with involved parties. The data sources are described in more detail below.

What this factbook covers

In this report, an **accident** is a traffic accident meeting the SafetyNet reporting criteria. SafetyNet reporting criteria consist of two parts: one defining the types of vehicles involved in the crash, the other defining a reportable accident.

1. Vehicles

- Truck—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—a vehicle designed to carry at least sixteen people including the driver

2. Accidents

A reportable accident involves one or more trucks or buses and results in at least one of the following:

- A fatality (one or more persons killed as a result of the accident)

- An injury (one or more persons transported from the scene for immediate medical attention to injuries resulting from the accident)

- A towaway (one or more vehicles towed from the accident as a result of disabling damage sustained in the accident)

All accident statistics in this report conform to these criteria.

What this factbook does not cover

The *Truck and Bus Accident Factbook* replaces three older annual reports: OMC's *Accidents Reported by Motor Carriers of Property* and *Accidents Reported by Motor Carriers of Passengers*, and NHTSA's *Summary of Medium & Heavy Truck Crashes*. However, because the accident reporting threshold for this *Factbook* is different from either the OMC or the NHTSA report, accident and involvement frequencies reported herein are not comparable to those in either the OMC or the NHTSA reports.

The OMC reports were based on data provided by motor carriers that were required to submit reports on traffic accidents involving either a fatality, injury, or property damage above a certain value. Only carriers operating in interstate commerce were required to file such accident reports. Since SafetyNet also includes accidents of intrastate carriers, frequencies reported in this factbook are higher than those in the older OMC reports.

In contrast, NHTSA's *Summary of Medium & Heavy Truck Crashes* reported frequencies for all police-reported accidents, not just those meeting the SafetyNet reporting criteria of a fatality, injured person transported for treatment, or towaway. Accordingly, the *Summary* included a large number of relatively minor accidents (though of considerable cumulative economic importance) that are not considered here. To give an idea of the magnitude of the difference, there were an estimated 461,000 trucks involved in traffic accidents of all severities in 1994, according to the General Estimates System file. However, only an estimated 151,000 truck involvements met the SafetyNet reporting criteria. Truck involvement totals reported in this *Factbook* reflect only those 151,000 SafetyNet involvements.

The use of multiple data sources

This factbook is based on multiple sources of data. Each source has strengths and weaknesses, but when used together, they provide the best available description of truck and bus accidents that occurred in the United States.

The GES file:

- National estimates for accidents of all severities
- Extensive list of variables describing the accident and the vehicles involved
- Sample file
- Estimates from small subsets of the data, such as fatal involvements, have relatively large sampling errors associated with them

The TIFA file:

- Virtual census file of trucks involved in traffic accidents in which a fatality occurred, with sampling limited to major truck types
- Extensive list of variables providing a detailed description of the trucks involved
- Limited to fatal truck accidents only

The FARS file:

- Census file, with data on each fatal accident, including bus accidents, occurring in the United States and possessions
- Extensive list of variables describing the accident
- Limited detail about vehicles

The SafetyNet file:

- Census file, with one record for each truck and bus in a reportable accident
- Twenty-two variables describing the accident and vehicle

The SafetyNet accident system was not fully implemented for the 1994 calendar year. For the 1994 calendar year, 49 States and the District of Columbia reported some data, though, in many cases, the data appear to be incomplete. Consequently, this factbook will be based primarily on data from the GES and TIFA files, with some data from the FARS file. Section IX, "A Preliminary Look at SafetyNet Data," presents some initial findings from the SafetyNet file. Factbooks in future years will incorporate more data from SafetyNet.

Data sources

SafetyNet: SafetyNet is a data management system administered by the Federal Highway Administration (FHWA) in support of Federal and State motor carrier safety programs. Taken as a whole, SafetyNet is an automated system to collect carrier, driver, and vehicle inspection data as well as accident information. The accident information in SafetyNet incorporates a uniform set of data elements and definitions for truck and bus accidents meeting a uniform threshold. These data are coded from standard State police accident reports or from supplemental data forms developed to comply with SafetyNet reporting requirements. The data are electronically submitted through the SafetyNet system and combined into an analysis file. Data elements provide driver and carrier information, vehicle configuration and cargo body style, accident time and location, the number of fatalities and injuries transported for treatment, and whether any vehicles were towed. When all States are fully reporting, SafetyNet will provide a census of all truck and bus accidents meeting the reporting criteria.

GENERAL ESTIMATES SYSTEM: GES is compiled by the National Center for Statistics and Analysis (NCSA) within the National Highway Traffic Safety Administration (NHTSA). The file incorporates data from a probability-based, nationally-representative sample of police-reported accidents. It covers all motor vehicle types, including medium and heavy trucks. All police-reportable accidents are included. Approximately 56,000 accidents are sampled each year. The police accident report (PAR) is the sole source of data. Frequencies based on the GES file reported in the tables in this report are national estimates, calculated using an appropriate weighting variable. Since GES is a sample file, estimates are subject to sampling error. The Technical Appendix herein includes information on confidence intervals for population estimates made from GES data.

FATAL ACCIDENT REPORTING SYSTEM: FARS is compiled by the National Center for Statistics and Analysis within NHTSA. The file contains data on a census of fatal traffic accidents within the 50 States, the District of Columbia, and Puerto Rico. FARS includes records for all accidents involving a motor vehicle on a trafficway that resulted in the death of a vehicle occupant or nonmotorist within 30 days of the accident. Trained employees within each State code over 100 data elements from a variety of State documentary sources. These data are then transmitted to a central computerized database and compiled into the FARS file by NHTSA.

TRUCKS INVOLVED IN FATAL ACCIDENTS: The University of Michigan Transportation Research Institute (UMTRI) produces the TIFA file. TIFA contains detailed information on all medium and heavy trucks involved in fatal accidents in the United States, including Alaska and Hawaii. TIFA consists of a random sample of straight trucks with no trailers and tractor-semitrailers (as recorded in FARS) and all remaining medium and heavy trucks involved in a fatal accident. The file combines information from the Fatal Accident Reporting System (FARS), police accident reports, and comprehensive telephone interviews conducted by UMTRI research staff. TIFA includes most FARS variables, supplemented with a detailed description of each involved truck collected by the TIFA interview process. Telephone interviews are conducted with involved parties, most often the driver or operator of the truck. All interview responses are carefully reviewed by editors.

Note on the towaway criterion and GES

The GES file includes data for every vehicle in a sampled accident whether it was towed due to damage or towed for some other reason. A review of the variable showed that most of the cases coded as "towed not due to damage" should have been coded "towed due to damage." The GES data are coded entirely from police reports and few, if any, indicate the reason for towing. Police reports in many States simply permit the reporting officer to indicate whether the vehicle was towed and the location to which it was removed. Since the "towed not due to damage" code does not appear to be reliable, all truck or bus cases where at least one vehicle was towed, whether coded as due to damage or not, are included in the estimates derived from GES. This may result in an overestimation of towaway cases, but the amount of overestimation is probably small.

Note on data rounding and missing data

The GES file is a sample file, with associated sampling errors. The Technical Appendix discusses the GES sampling procedure and includes a table of sampling errors for different size estimates. Estimates from the GES file in this report are rounded to the nearest thousand. Percentages shown were calculated before the rounding was done. All figures for fatal accidents or fatalities in accidents are taken from the TIFA file or in some instances from the FARS file. Both TIFA and FARS are census files. Figures from TIFA or FARS are regarded as true population totals and are not rounded.

Cases with missing data in the TIFA or FARS files are reported in the tables. The GES file includes variables for which missing data have been removed through complex statistical procedures. These "imputed" variables are used in this report. A description of the statistical procedures for imputing data in the GES file is provided by T.S.T. Shelton in *Imputation in the General Estimates System*, National Highway Traffic Safety Administration, National Center for Statistics and Analysis, 1993, (DOT HS 807 985).

II. Trends and Overview: Trucks

In 1994, over 6.3 million trucks were registered to operate on U.S. roads (table II-1). Together, these trucks traveled an estimated 170 billion miles, averaging over 27,000 miles per truck. Combination trucks, primarily tractors pulling a single semitrailer, averaged 67,000 miles per year, while single-unit trucks, primarily straight trucks, averaged 13,000 miles. There were 142,000 accidents involving at least one truck, with a total of 151,000 trucks involved. Almost 4,800 trucks were involved in accidents in which at least one person was killed (**fatal** accident). An additional 56,000 trucks were involved in accidents in which at least one person was injured severely enough to be transported for immediate medical attention, though no one was killed (**injury** accident). Finally, an estimated 90,000 trucks were involved in accidents with no fatalities or injuries transported for treatment, but with at least one vehicle damaged severely enough to be towed (**towaway** accident).

Table II-1 Truck Statistics, 1994

	Single-Unit	Combination	Unknown	Total
Vehicles				
Registrations	4,678,197	1,625,117	0	6,303,314
Miles traveled (millions)	61,350	109,065	0	170,415
Average travel	13,114	67,112	0	27,036
Accidents				
Number	54,000	84,000	6,000	142,000
Number of trucks involved	55,000	89,000	6,000	151,000
Vehicles by accident severity				
Fatal	1,522	3,183	90	4,795
Injury	21,000	33,000	2,000	56,000
Towaway	32,000	53,000	4,000	90,000
Total	55,000	89,000	6,000	151,000
Involvement rate per million VMT				
Fatal	0.025	0.029	n/a	0.028
Injury	0.342	0.303	n/a	0.329
Towaway	0.522	0.486	n/a	0.528
Total	0.896	0.816	n/a	0.886

Sources: *Highway Statistics 1994*;
1994 TIFA; 1994 GES

Five-year trends of vehicles and injuries

The number of fatal involvements increased in 1994 for the second year in a row after three years of declining fatal involvements (table II-2). In 1990, 5,013 trucks were involved in an accident in which at least one fatality occurred. That number had declined to 4,185 by 1992, but increased over 6% to 4,451 in 1993 and again by almost 8% to 4,795 in 1994.

Some apparent year-to-year changes reported in the tables for injury and towaway involvements may not be statistically significant. Estimates of injury and towaway involvements are made using GES files. Since GES files are the product of sampling, each estimate has an associated sampling error. Tests of significance have been calculated for the differences between the yearly totals, and where those differences are statistically significant, they will be identified in the text. The number of fatal involvements is taken from the TIFA file. Because TIFA is a census file, the number of fatal involvements and fatalities is known with confidence.

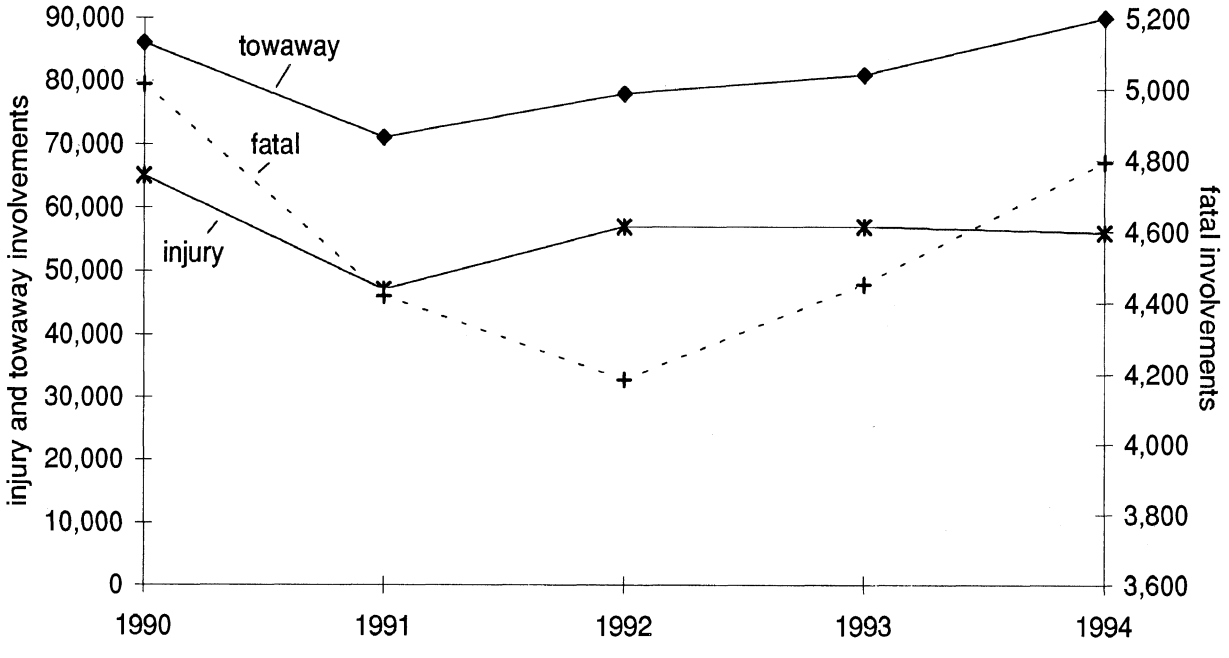
Figure II-1 shows annual estimates of fatal, injury, and towaway in-

Table II-2 Truck Involvements by Accident Severity, 1990-1994

	Fatal		Injury		Towaway		Total	
Year	N	%	N	%	N	%	N	%
1990	5,013	3.2	65,000	41.7	86,000	55.1	156,000	100.0
1991	4,420	3.6	47,000	38.2	71,000	58.2	123,000	100.0
1992	4,185	3.0	57,000	41.0	78,000	56.0	139,000	100.0
1993	4,451	3.1	57,000	39.7	81,000	57.1	142,000	100.0
1994	4,795	3.2	56,000	37.4	90,000	59.4	151,000	100.0

Sources: 1990-1994 TIFA, 1990-1994 GES

Figure II-1 Fatal, Injury, and Towaway Involvements, 1990-1994



Sources: 1990-1994 TIFA, 1990-1994 GES

volvements for 1990-1994. Generally the year-to-year differences in total involvements are not statistically significant (except for 1990-1991). The increase in involvements in 1994 is also not statistically significant, though it is likely real since it parallels the increase in fatal involvements in 1994.

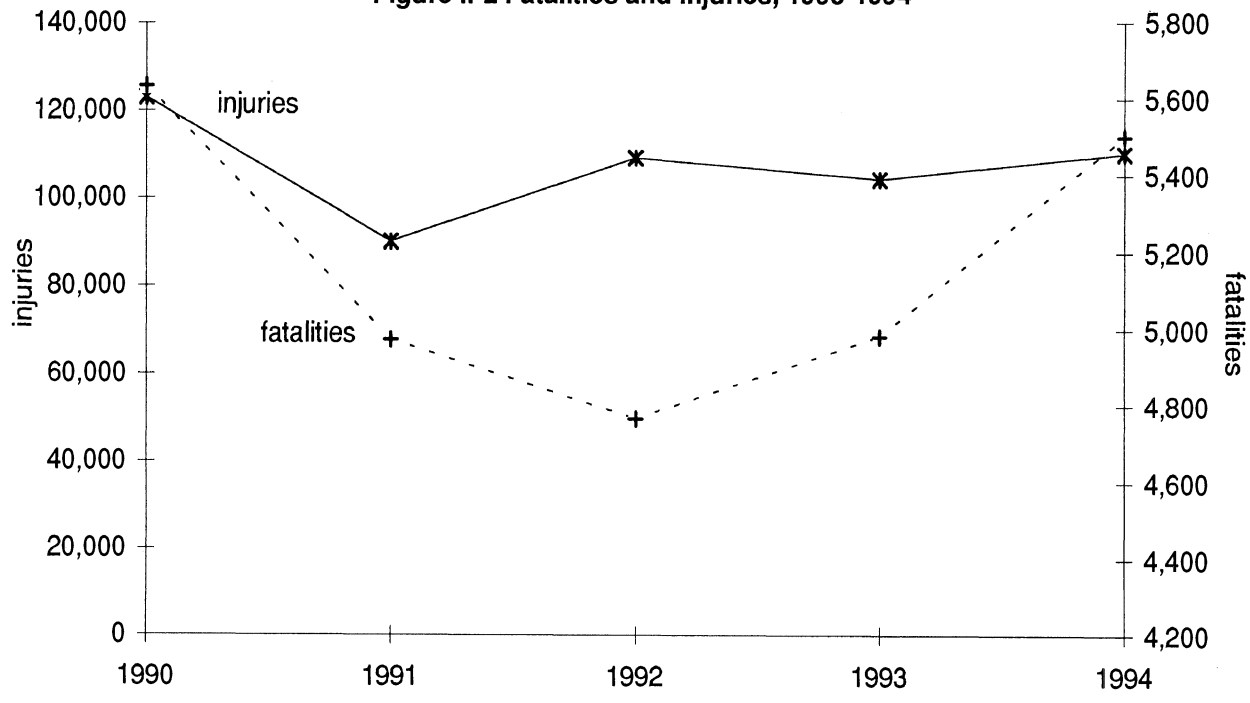
Table II-3 shows the number of persons killed and estimated number of persons injured in truck accidents, 1990-1994. The fatality column is from the TIFA files. The increase in fatalities in each of the two most recent years has brought the total number killed in truck accidents almost back to the level of 1990. The estimated number of injuries in 1994 also shows a substantial increase, though not statistically significant, from 1993. The only difference in the number of injuries in the table that is statistically significant is that between 1990 and 1991. Figure II-2 shows the estimated number of fatalities and injuries.

Table II-3 Total Fatalities and Injuries in Truck Accidents 1990-1994

	Fatalities		Injuries		Total	
Year	N	% change	N	% change	N	% change
1990	5,635		123,000		128,000	
1991	4,974	-13.3	90,000	-35.8	95,000	-34.7
1992	4,767	-4.3	109,000	17.2	114,000	16.3
1993	4,981	4.3	104,000	-4.5	109,000	-4.1
1994	5,501	9.5	110,000	4.8	115,000	5.0

Sources: 1990-1994 TIFA, 1990-1994 GES

Figure II-2 Fatalities and Injuries, 1990-1994



Sources: 1990-1994 TIFA, 1990-1994 GES

Fatal involvements by configuration

The distribution of trucks involved in fatal accidents by combination type has been quite stable over time (table II-4). In each year between 1990 and 1994, about 30% of the trucks were single-unit, about 64% pulled one trailer, and fewer than 5% were multitrailer. The multitrailer category includes straight trucks with more than one trailer and tractors pulling three trailers, but the large majority of that category is the tractor-semitrailer, full-trailer combination. Despite an increasing reliance on tractors pulling two trailers ("doubles") in hauling freight, the annual proportion of fatal multitrailer involvements has remained steady, and the number of their involvements has actually declined, from 203 in 1990 to 172 in 1994.

Table II-4 Combination Type for Fatal Involvements, 1990-1994

	Single-Unit		One-Trailer		Multitrailer		Unknown		Total	
Year	N	%	N	%	N	%	N	%	N	%
1990	1,477	29.5	3,241	64.7	203	4.0	92	1.8	5,013	100.0
1991	1,314	29.7	2,857	64.6	175	4.0	74	1.7	4,420	100.0
1992	1,257	30.0	2,660	63.6	189	4.5	79	1.9	4,185	100.0
1993	1,375	30.9	2,811	63.2	178	4.0	87	2.0	4,451	100.0
1994	1,522	31.7	3,011	62.8	172	3.6	90	1.9	4,795	100.0

Sources: 1990-1994 TIFA, 1990-1992 FARS

Table II-5 shows the number of involvements for each truck combination in each State in 1994. The table is restricted to fatal involvements, since data on the state in which the accident occurred are available only for fatal accidents. (Once the SafetyNet accident system is fully implemented, State data will be available for all accident severities.) Three States, California, Texas, and Florida, accounted for 1,019 involvements, or 21% of total fatal truck involvements. (Those three States also account for 25% of the population of the United States.) Alaska, Hawaii, Rhode Island, and the District of Columbia had the fewest fatal involvements, with a total of just 18 among them. One-trailer combinations had more fatal involvements than any other configuration in all but five States (Massachusetts, New York, Rhode Island, South Dakota, and Washington). The first three are located in the densely populated Northeast. Multitrailer involvements were found more often in the western States. California recorded 60 multitrailer fatal involvements, by far the largest number and 34.9% of all multitrailer involvements. The next highest count was 14 in Michigan. Arizona and Ohio had seven each; Texas and Oregon each accounted for six.

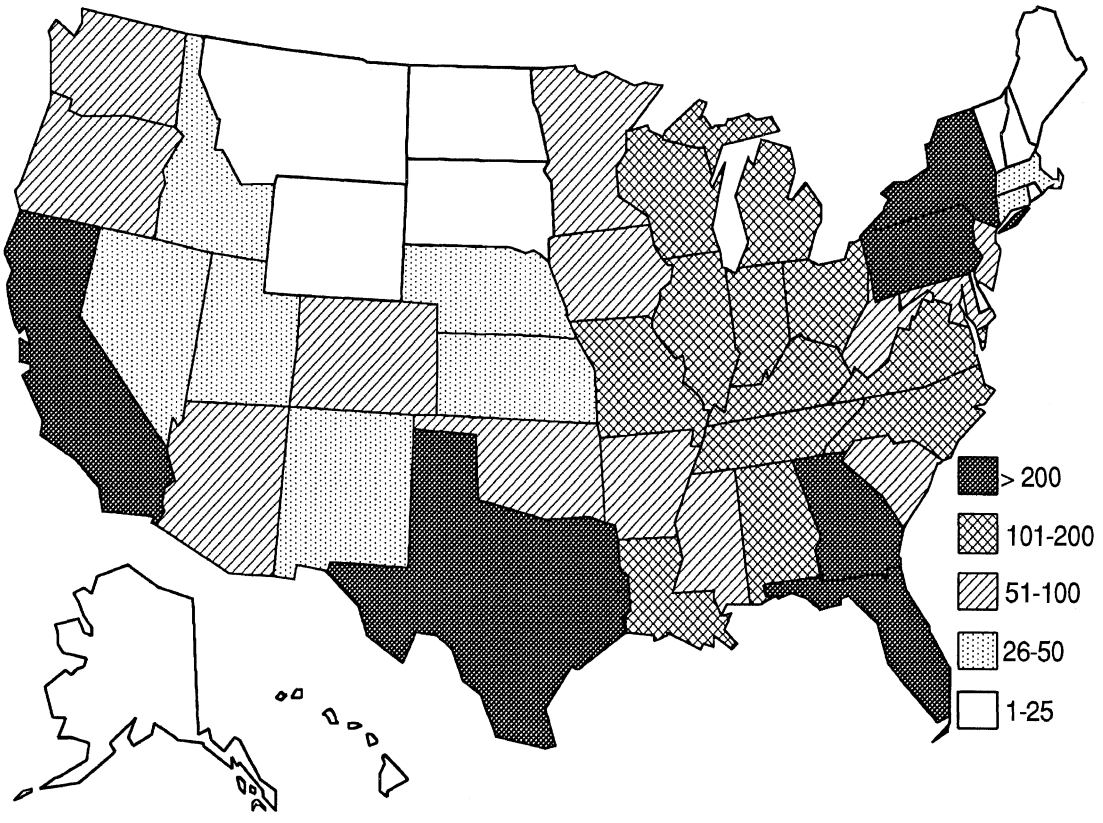
Table II-5 Fatal Involvements by State and Combination Type, 1994

State	Single-Unit		One-Trailer		Multitrailer		Unknown		Total	
	N	%	N	%	N	%	N	%	N	%
Alabama	40	2.6	112	3.7	3	1.7	0	0.0	155	3.2
Alaska	0	0.0	5	0.2	1	0.6	0	0.0	6	0.1
Arizona	22	1.4	50	1.7	7	4.1	0	0.0	79	1.6
Arkansas	17	1.1	70	2.3	1	0.6	0	0.0	88	1.8
California	119	7.8	197	6.5	60	34.9	1	1.1	377	7.9
Colorado	16	1.1	41	1.4	2	1.2	0	0.0	59	1.2
Connecticut	13	0.9	14	0.5	0	0.0	0	0.0	27	0.6
Delaware	0	0.0	13	0.4	0	0.0	0	0.0	13	0.3
D.C.	0	0.0	2	0.1	0	0.0	0	0.0	2	0.0
Florida	104	6.8	183	6.1	3	1.7	0	0.0	290	6.0
Georgia	61	4.0	139	4.6	3	1.7	0	0.0	203	4.2
Hawaii	2	0.1	2	0.1	0	0.0	0	0.0	4	0.1
Idaho	15	1.0	23	0.8	4	2.3	0	0.0	42	0.9
Illinois	56	3.7	113	3.8	3	1.7	0	0.0	172	3.6
Indiana	39	2.6	93	3.1	3	1.7	0	0.0	135	2.8
Iowa	14	0.9	60	2.0	3	1.7	0	0.0	77	1.6
Kansas	12	0.8	35	1.2	3	1.7	0	0.0	50	1.0
Kentucky	39	2.6	61	2.0	1	0.6	0	0.0	101	2.1
Louisiana	30	2.0	78	2.6	2	1.2	0	0.0	110	2.3
Maine	5	0.3	16	0.5	0	0.0	0	0.0	21	0.4
Maryland	33	2.2	43	1.4	0	0.0	1	1.1	77	1.6
Massachusetts	27	1.8	18	0.6	0	0.0	0	0.0	45	0.9
Michigan	61	4.0	103	3.4	14	8.1	0	0.0	178	3.7
Minnesota	24	1.6	54	1.8	0	0.0	0	0.0	78	1.6
Mississippi *	0	0.0	0	0.0	0	0.0	87	96.7	87	1.8
Missouri	45	3.0	86	2.9	2	1.2	0	0.0	133	2.8
Montana	2	0.1	14	0.5	2	1.2	0	0.0	18	0.4
Nebraska	12	0.8	29	1.0	3	1.7	0	0.0	44	0.9
Nevada	5	0.3	19	0.6	5	2.9	0	0.0	29	0.6
New Hampshire	2	0.1	6	0.2	0	0.0	0	0.0	8	0.2
New Jersey	29	1.9	43	1.4	2	1.2	0	0.0	74	1.5
New Mexico	6	0.4	29	1.0	1	0.6	0	0.0	36	0.8
New York	107	7.0	101	3.4	1	0.6	1	1.1	210	4.4
N.Carolina	61	4.0	136	4.5	2	1.2	0	0.0	199	4.2
N.Dakota	4	0.3	3	0.1	1	0.6	0	0.0	8	0.2
Ohio	51	3.4	138	4.6	7	4.1	0	0.0	196	4.1
Oklahoma	19	1.2	54	1.8	2	1.2	0	0.0	75	1.6
Oregon	18	1.2	40	1.3	6	3.5	0	0.0	64	1.3
Pennsylvania	86	5.7	123	4.1	1	4.4	0	0.0	210	4.4
Rhode Island	4	0.3	2	0.1	0	0.0	0	0.0	6	0.1
S.Carolina	21	1.4	69	2.3	2	1.2	0	0.0	92	1.9
S.Dakota	12	0.8	4	0.1	0	0.0	0	0.0	16	0.3
Tennessee	40	2.6	94	3.1	1	0.6	0	0.0	135	2.8
Texas	91	6.0	255	8.5	6	3.5	0	0.0	352	7.3
Utah	12	0.8	13	0.4	3	1.7	0	0.0	28	0.6
Vermont	4	0.3	6	0.2	0	0.0	0	0.0	10	0.2
Virginia	57	3.7	76	2.5	1	0.6	0	0.0	134	2.8
Washington	28	1.8	25	0.8	4	2.3	0	0.0	57	1.2
W.Virginia	22	1.4	38	1.3	0	0.0	0	0.0	60	1.3
Wisconsin	33	2.2	69	2.3	3	1.7	0	0.0	105	2.2
Wyoming	2	0.1	14	0.5	4	2.3	0	0.0	20	0.4
Total	1,522	100.0	3,011	100.0	172	100.0	90	100.0	4,795	100.0

* Truck configuration is unavailable for Mississippi because Mississippi does not release police reports to the TIFA project.
Source: 1994 TIFA

Figure II-3 shows the distribution of all fatal truck involvements in the United States in 1994. The distribution reflects both population size and truck usage. California, Texas, and Florida had the greatest number of fatal truck involvements, while the New England States and the States of the upper Far West had the fewest. The States of the upper Midwest also had large numbers of involvements, reflecting both population size and industrial concentration.

Figure II-3 Fatal Truck Involvements, 1994

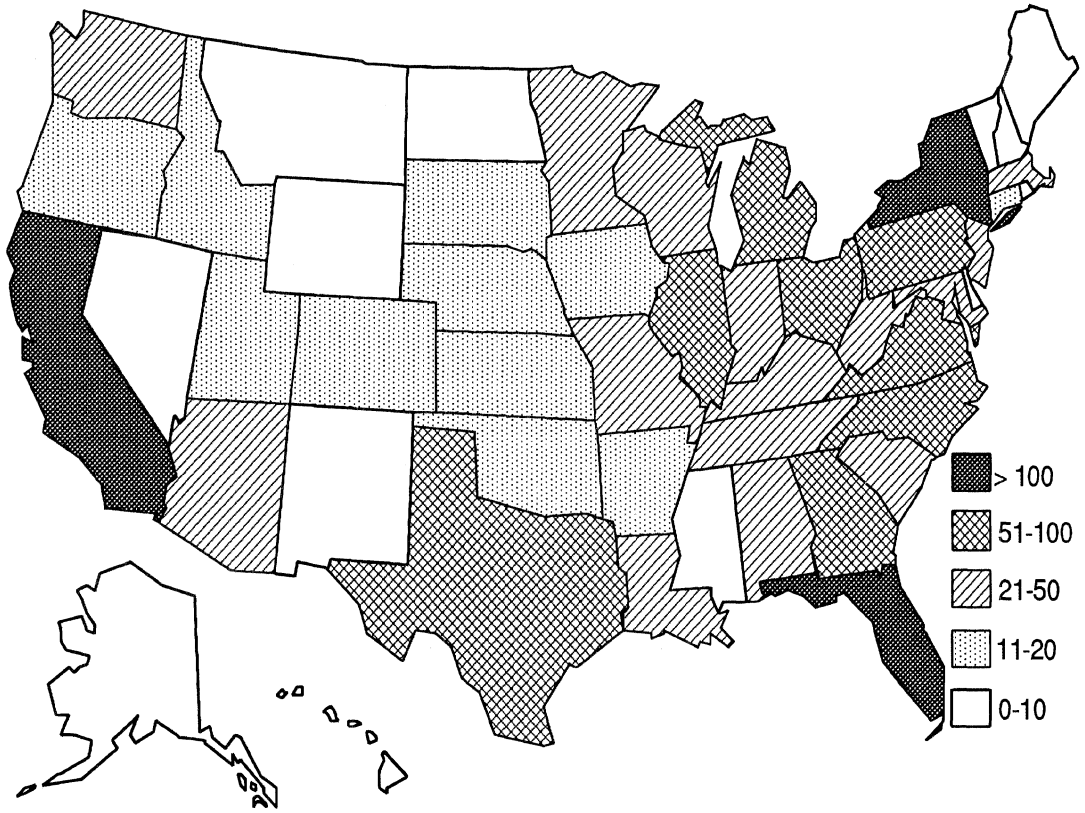


Source: 1994 TIFA

The geographical distribution of single-unit trucks involved in fatal accidents is shown in figure II-4. Of the total of 4,795 trucks involved in a fatal accident, 1,522 were single-unit trucks.

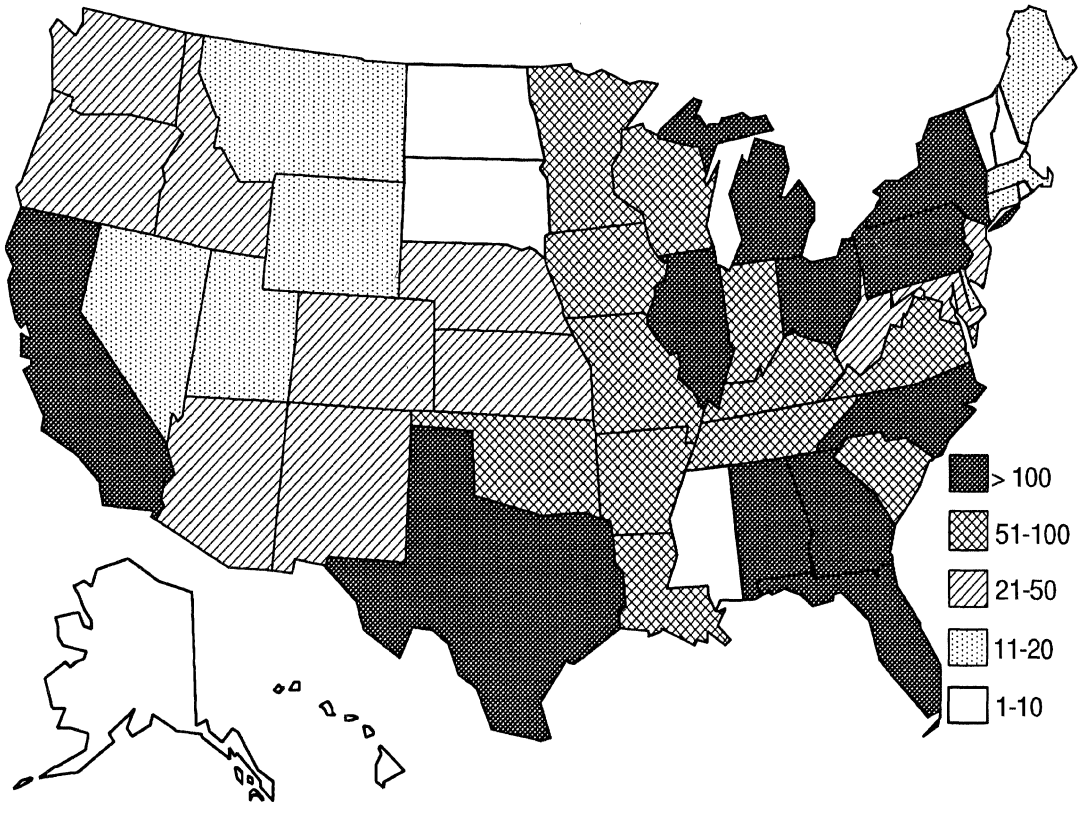
One-trailer combinations make up the majority of all truck fatal involvements, so figure II-5 is similar to figure II-3. Texas, California and Florida had the largest number of one-trailer fatal involvements in 1994; one-trailer fatal involvements were also concentrated in the industrial States of the Midwest.

Figure II-4 Single-Unit Fatal Truck Involvements, 1994



Source: 1994 TIFA

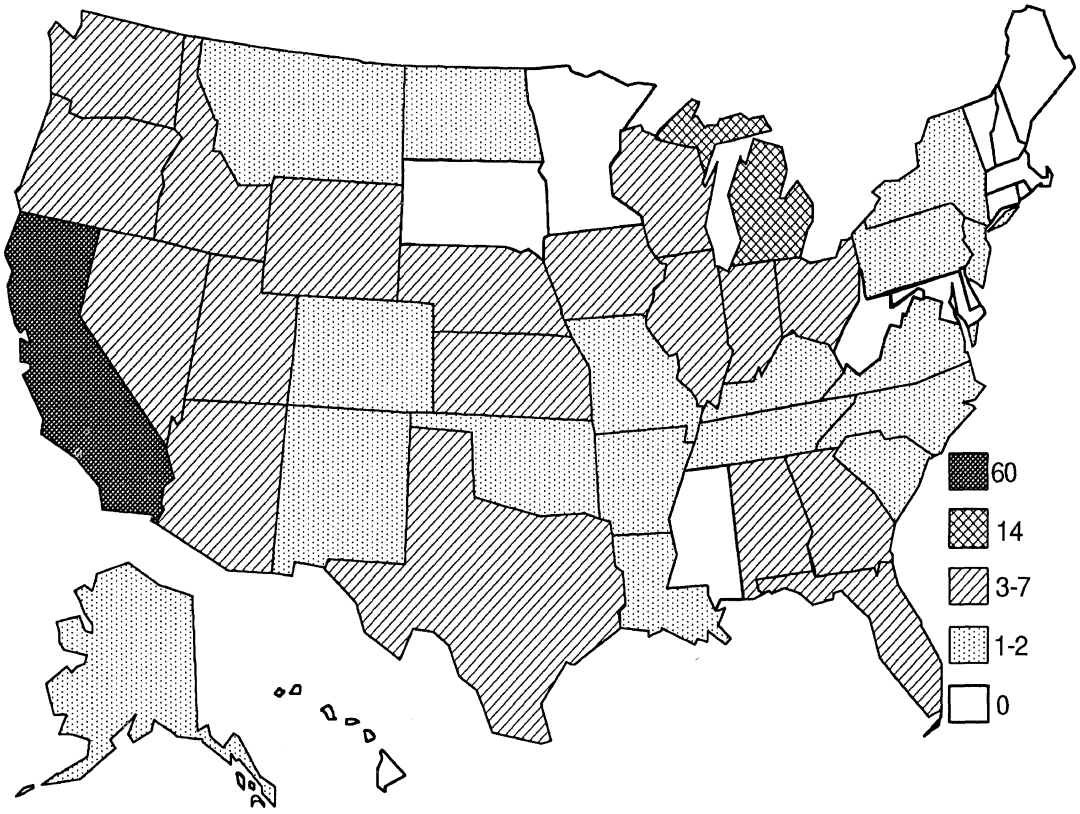
Figure II-5 One-Trailer Fatal Truck Involvements, 1994



Source: 1994 TIFA

The pattern of multitrailer fatal involvements across the U.S. differs signficantly from either all fatal involvements or any of the other combination types. Multitrailer involvements were heavily concentrated in the West and especially in California. California had 60 fatal involvements of multitrailer trucks in 1994, while Michigan, Arizona, and Ohio were the next highest States with fourteen, seven, and seven, respectively. Twelve States and the District of Columbia recorded no multitrailer fatal involvements, nine states counted only one, and eight had only two.

Figure II-6 Multitrailer Fatal Truck Involvements, 1994



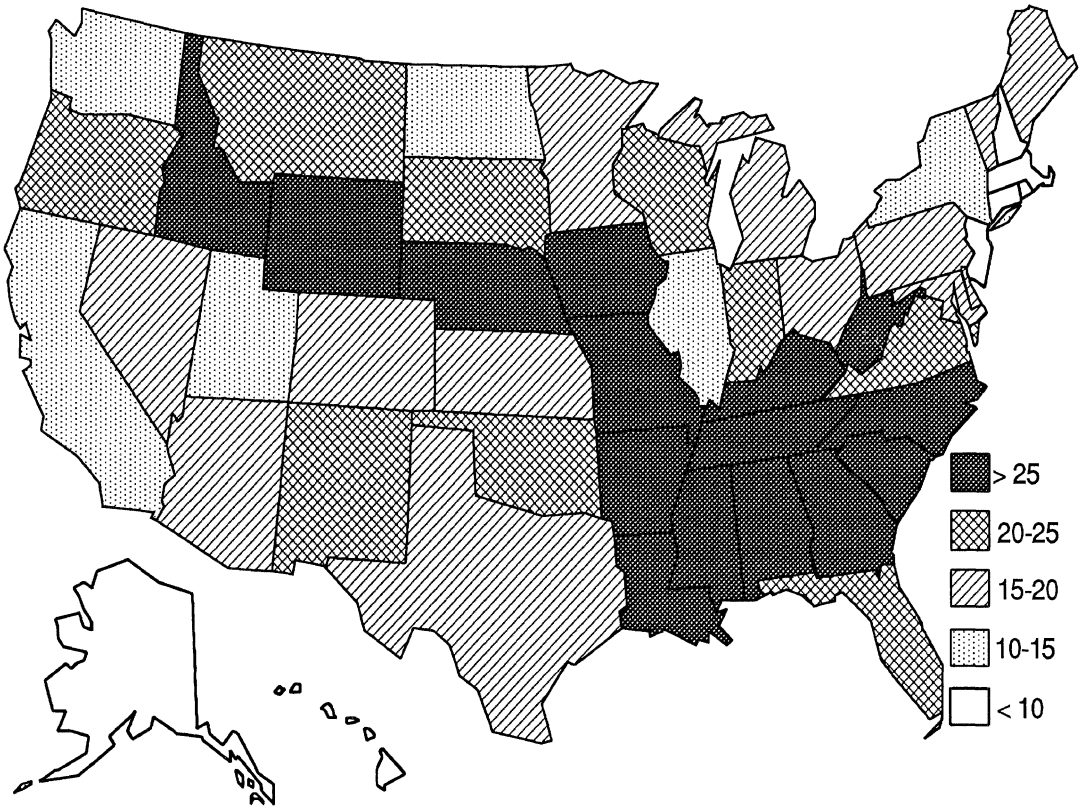
Source: 1994 TIFA

Fatal involvements per capita

Finally, figure II-7 provides a context for interpreting the previous maps. It shows the rate of fatal truck involvements per million population in each State. Note that the States with the greatest number of fatal involvements, (i.e., California, Texas, and Florida) have low or average involvements per million population. In contrast, some States with relatively few fatal involvements have among the highest rates of involvement per million population.

There are many methods of measuring "exposure" to traffic accidents. Truck involvements per million population is just one of them. The purpose of figure II-7 is not to measure "traffic safety" in the States, but instead to "correct" the previous figures for the population sizes of the States. The total number of fatal truck involvements in a State is related to population size as well as to many other factors.

Figure II-7 Fatal Truck Involvements per Million Population, 1994



Sources: 1994 TIFA; *Statistical Abstract 1994*

III. Truck Accidents

This section presents statistics describing the environment in which truck traffic accidents occurred in 1994. All tables in this section show counts and proportions of vehicles by features of the accident environment.

Highlights of this section:

- Almost 88% of truck accident involvements occurred during the work week
- 79.6% of truck involvements occurred with no adverse weather conditions; 84.6% of fatal involvements occurred with no adverse weather conditions
- 72.1% of all truck involvements and 79.7% of fatal involvements occurred on dry roads
- 23.8% of fatal involvements occurred in the dark compared with 12.0% of nonfatal involvements
- 26.2% of the fatal involvements of one-trailer trucks and 31.4% of multitrailer trucks occurred on Interstate highways
- Head-on collision was identified in 23.4% of fatal involvements compared with only 2.2% of all truck accident involvements
- A collision with a pedestrian or bicyclist was identified in 9.1% of fatal involvements, but only 1.7% of all involvements

Month, day of week, and time of day

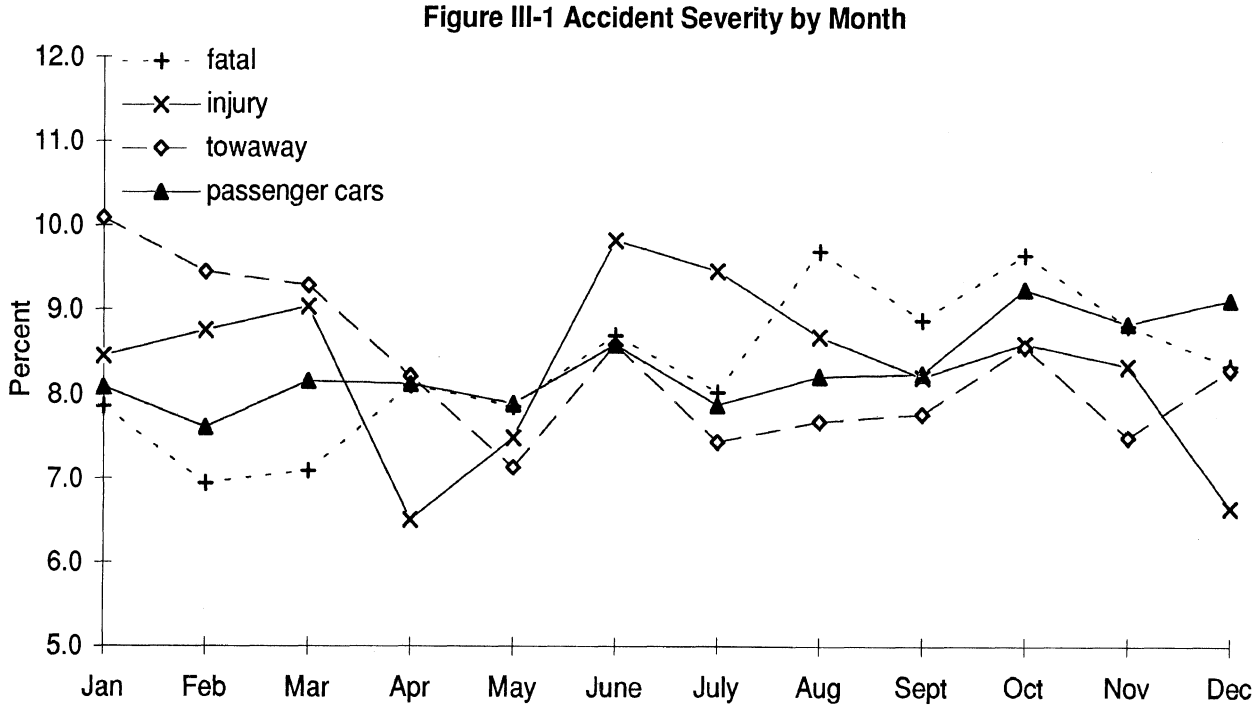
Fatal truck involvements appear to follow a seasonal pattern, with fewer involvements in the winter months and more in July and August. In 1994, February had the fewest fatal truck involvements with 333, while August had the greatest number, 465, a difference of 40%. The pattern of injury and towaway involvements is not as clear, though the lack of clarity may be due to relatively small sample sizes in GES. The monthly distribution of passenger car involvements is included in figure III-1 for comparison.

Table III-1 Accident Severity by Month

	Fatal		Injury		Towaway		All	
Month	N	%	N	%	N	%	N	%
January	377	7.9	5,000	8.4	9,000	10.1	14,000	9.4
February	333	6.9	5,000	8.8	8,000	9.4	14,000	9.1
March	340	7.1	5,000	9.0	8,000	9.3	14,000	9.1
April	389	8.1	4,000	6.5	7,000	8.2	11,000	7.6
May	377	7.9	4,000	7.5	6,000	7.1	11,000	7.3
June	417	8.7	6,000	9.8	8,000	8.6	14,000	9.1
July	385	8.0	5,000	9.5	7,000	7.4	12,000	8.2
August	465	9.7	5,000	8.7	7,000	7.7	12,000	8.1
September	426	8.9	5,000	8.2	7,000	7.8	12,000	8.0
October	463	9.7	5,000	8.6	8,000	8.6	13,000	8.6
November	423	8.8	5,000	8.3	7,000	7.5	12,000	7.9
December	400	8.3	4,000	6.7	7,000	8.3	12,000	7.7
Total	4,795	100.0	56,000	100.0	90,000	100.0	151,000	100.0

Sources: 1994 TIFA, 1994 GES

Figure III-1 Accident Severity by Month



Sources: 1994 TIFA, 1994 GES, 1994 FARS

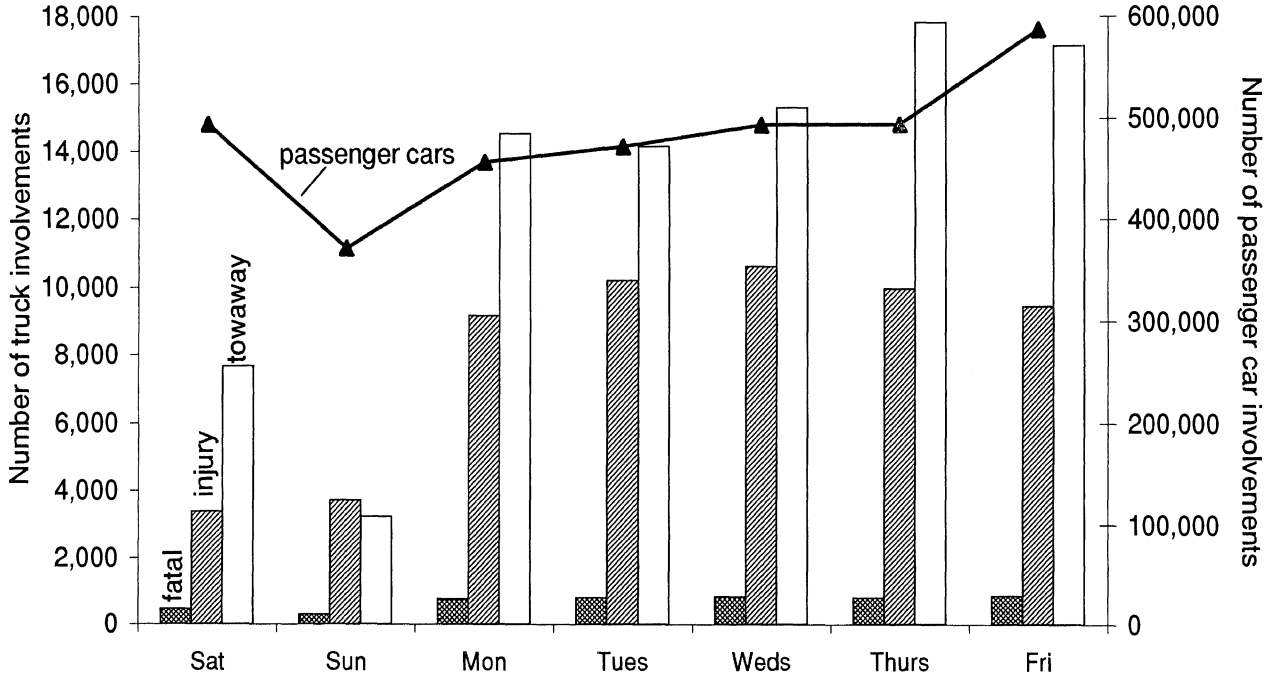
Most truck involvements in traffic accidents occurred during the work week. Almost 88% of truck involvements took place from Monday to Friday in 1994 (table III-2). The number of trucks involved in traffic accidents declined steeply on the weekend, though note that Saturday had about 50% more involvements than Sunday. The weekend proportion was slightly higher for fatal truck involvements than for nonfatal, with 15.5% of fatal truck involvements occurring on Saturday or Sunday, compared with 12.4% of all truck involvements. On weekends, many businesses are closed, though trucks used for long-distance freight haulage continue to operate. These trucks use roads with higher travel speeds, where traffic accidents are more likely to include a fatality. Figure III-2 includes passenger car involvements by day of week for comparison. Passenger cars are often used for recreational driving and so have a higher proportion of accidents on weekends.

Table III-2 Day of Week by Accident Severity

	Fatal		Injury		Towaway		All	
Day	N	%	N	%	N	%	N	%
Saturday	454	9.5	3,000	6.0	8,000	8.5	11,000	7.6
Sunday	291	6.1	4,000	6.6	3,000	3.6	7,000	4.8
Monday	766	16.0	9,000	16.2	15,000	16.2	24,000	16.2
Tuesday	803	16.7	10,000	18.0	14,000	15.7	25,000	16.6
Wednesday	828	17.3	11,000	18.8	15,000	17.0	27,000	17.7
Thursday	797	16.6	10,000	17.6	18,000	19.8	29,000	18.9
Friday	856	17.9	9,000	16.7	17,000	19.1	27,000	18.1
Total	4,795	100.0	56,000	100.0	90,000	100.0	151,000	100.0

Sources: 1994 TIFA, 1994 GES

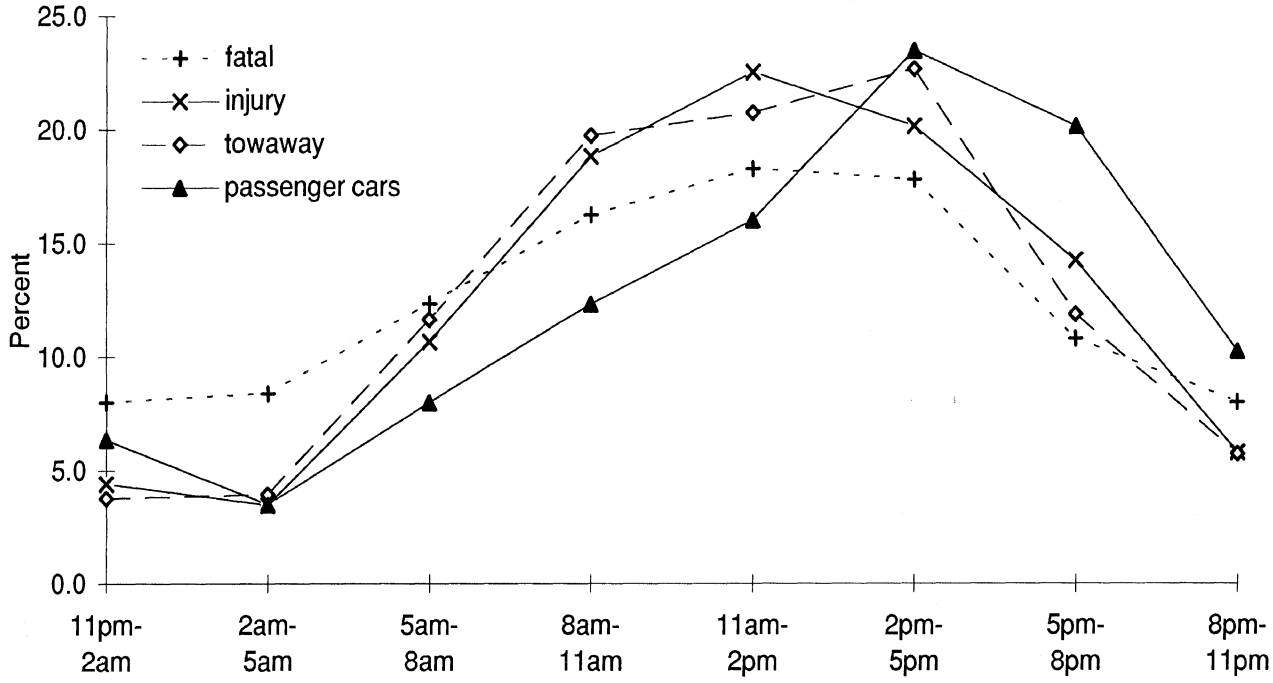
Figure III-2 Day of Week by Accident Severity



Sources: 1994 TIFA, 1994 GES, and 1994 FARS

The distribution of truck involvements over the course of a day also varies greatly. Figure III-3 shows the distribution of each accident severity in 1994 by time of day. Passenger car involvements are also included for comparison. Injury and towaway involvements rose gradually from about 4% for the three-hour period from 2 a.m. to 5 a.m. to about 20% to 23% for the periods between 11 a.m. and 2 p.m. and between 2 p.m. and 5 p.m. The percentage of injury and towaway involvements then declined sharply overnight. The distribution of fatal involvements followed the same general trend, although it fluctuated within a more narrow range—the increase was not as great during normal working hours and fatal involvements declined less overnight compared with the other accident severities. The proportion of fatal involvements was about twice as high as nonfatal involvements between 11 p.m. and 5 a.m. Why is the proportion of fatal involvements higher at night? During the day, a substantial amount of travel is related to pickup and delivery operations. At night, more travel is on high-speed roads, carrying freight between cities. Driver fatigue and shortened sight distances due to darkness are also a problem. In such circumstances, if an accident occurs, it is more likely to be serious.

Figure III-3 Time of Day by Accident Severity



Sources: 1994 TIFA, 1994 GES, 1994 FARS

Weather, road, and light condition

Almost 80% of all U.S. truck involvements in 1994 occurred with no adverse weather conditions (table III-3). Rain was the most common type of adverse weather, accounting for 13.9% of all truck accident involvements. Snow fell in only 4.7% of the involvements and was somewhat more likely for towaway (5.5%) than for injury (3.6%) or fatal (2.9%) involvements. For fatal involvements, the proportion of weather problems was actually lower than for injury and towaway involvements. There were no adverse conditions in 84.6% of all fatal involvements and rain was coded for only 9.6%. This may indicate that drivers generally operate their vehicles more carefully and slowly in bad weather, so that if an accident occurs, it is less likely to be serious.

Table III-3 Weather Condition by Accident Severity

	Fatal		Injury		Towaway		All	
Weather	N	%	N	%	N	%	N	%
No adverse	4,055	84.6	45,000	79.9	71,000	79.1	120,000	79.6
Rain	461	9.6	9,000	15.4	12,000	13.2	21,000	13.9
Snow	141	2.9	2,000	3.6	5,000	5.5	7,000	4.7
Fog	102	2.1	*	0.7	1,000	0.8	1,000	0.8
Other	20	0.4	*	0.4	1,000	1.4	2,000	1.0
Total	4,795	100.0	56,000	100.0	90,000	100.0	151,000	100.0

Note: Includes 16 fatal involvements with unknown weather conditions.
* GES estimate less than 500
Sources: 1994 TIFA, 1994 GES

Table III-4 shows road conditions by accident severity for truck accident involvements in 1994. Naturally, the distribution of road conditions is quite similar to that of weather conditions. Most truck accident involvements occurred on dry roads. The proportion of fatal involvements on dry roads was higher than for injury or towaway involvements. Though it was snowing or sleeting in less than 5% of all involvements, roads were snowy or icy in 8.7% of all involvements.

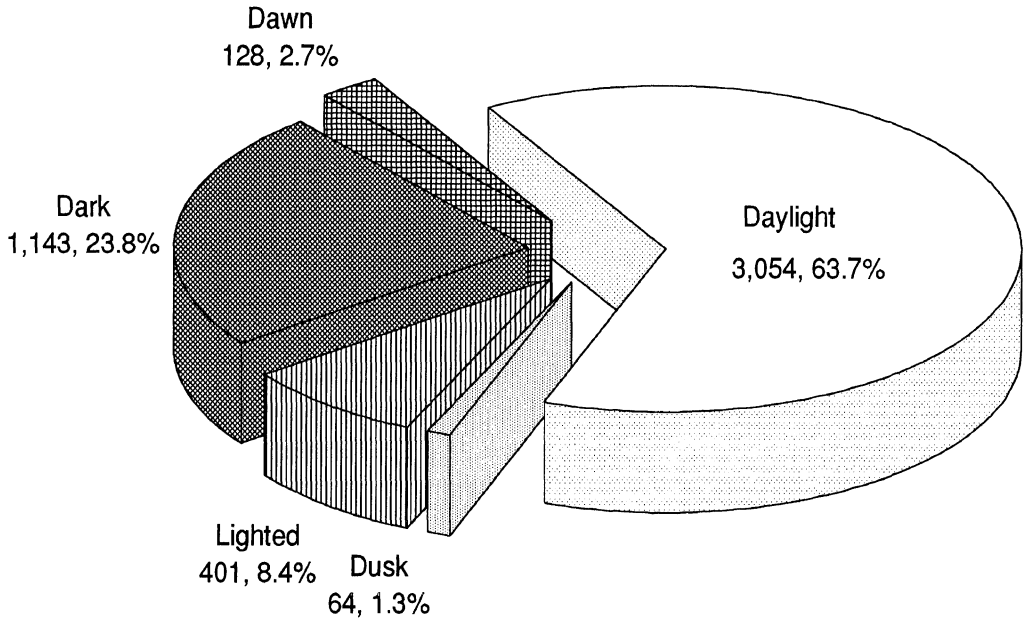
Table III-4 Road Condition by Accident Severity

Road	Fatal		Injury		Towaway		All	
condition	N	%	N	%	N	%	N	%
Dry	3,820	79.7	41,000	73.4	64,000	71.0	109,000	72.1
Wet	718	15.0	11,000	20.3	16,000	18.4	29,000	19.0
Snow/slush	109	2.3	1,000	1.2	3,000	3.7	4,000	2.7
Ice	116	2.4	3,000	4.8	6,000	6.9	9,000	6.0
Total	4,795	100.0	56,000	100.0	90,000	100.0	151,000	100.0

Note: Includes fewer than 1000 cases with other or unknown road conditions.
Sources: 1994 TIFA, 1994 GES

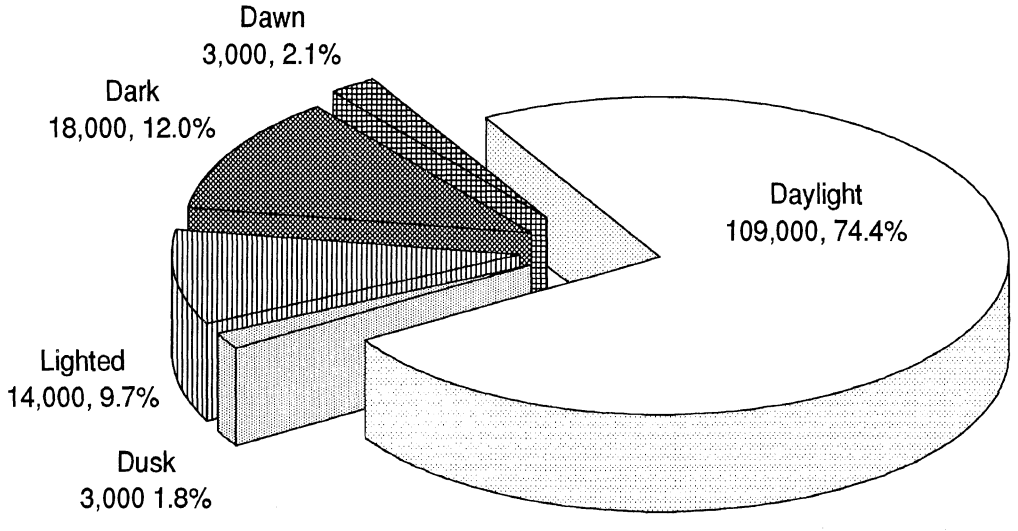
Figures III-4 and III-5 show light condition for fatal and nonfatal (injury and towaway) involvements in 1994. Most involvements, both fatal and nonfatal, occurred either during daylight or on lighted roads. However, fatal involvements had a higher proportion of "dark" and "dawn," while nonfatal involvements were much more likely to occur in daylight. In fact, 23.8% of truck involvements in a fatal accident occurred in the dark, compared with only 12% of truck involvements in a nonfatal accident. This is consistent with the time of day distribution shown in figure III-3. Truck travel at night is more likely to consist of long-haul trips on roads where travel speeds are high.

Figure III-4 Light Condition for Fatal Truck Accidents



Source: 1994 TIFA

Figure III-5 Light Condition for Nonfatal Truck Accidents



Source: 1994 GES

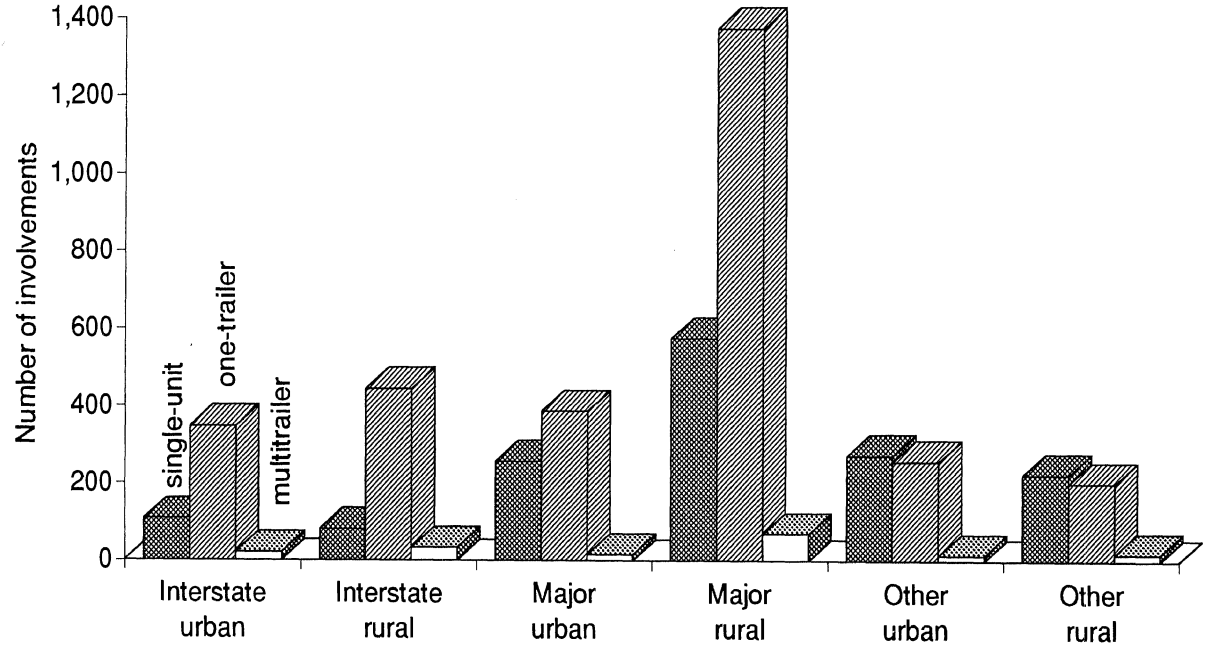
Road type and area type

Road type and area type capture important features of a truck's operating environment. Roads in urban areas typically have denser traffic and lower speeds than comparable road classes in rural areas. Interstate highways provide one-way traffic streams (which reduce the opportunity for head-on collisions), high design standards, and controlled access. Major arterials, as defined here, are U.S. and State numbered routes that are not Interstate highways, and so typically incorporate fewer safety features.

Note: Only trucks involved in fatal accidents are included in this section, since a detailed road type variable is available only in the TIFA and FARS files.

Figure III-6 shows involvement frequencies of different truck configurations in fatal accidents in 1994. Fatal involvements of one-trailer trucks were concentrated on major arterial roads in rural areas, though Interstate highways in both rural and urban areas also accounted for a substantial number. The number of one-trailer involvements on rural major arterials is striking. Travel speeds on such roads are typically high, since they are in rural areas, but they are not as safe as Interstate highways. Single-unit truck involvements, primarily straight trucks, also were relatively concentrated on rural major arterials. In addition, single-unit trucks had substantial numbers of involvements on "other" roads (i.e., not Interstate or major arterial). The involvements of multitrailer trucks occurred primarily on rural and urban limited-access roads and rural major arterials.

Figure III-6 Road and Area Type by Combination Type
Fatal Truck Involvements Only



Source: 1994 TIFA

Compared with the other combination types, single-unit fatal involvements were more uniformly distributed across the road and area types. Summing the appropriate categories in table III-5, about 32% of single-unit involvements occurred on "other" roads, including both urban and rural areas, compared with 15.1% for one-trailer combinations and 18.6% for multitrailer combinations. Fatal involvements of one-trailer combinations occurred primarily on Interstate highways and major arterials, with 26.2% on all Interstate roads and an additional 58.3% on major arterials. The fatal involvements of multitrailer combinations were concentrated on rural major arterial roads, with 40.7%, with an additional 19.2% on rural Interstate highways.

As is the case for all other tables and figures in this publication, in the absence of exposure data, causal inferences cannot be drawn from these distributions. For example, the small frequency and proportion of multitrailer fatal involvements on urban "other" roads does not indicate that multitrailer combinations operate more safely on such roads. Multitrailer combinations, primarily tractors pulling two trailers and some triples, are used mainly on Interstate highways between cities and not on smaller urban roads.

Table III-5 Fatal Involvements by Road Class/Area Type and Truck Configuration

Road class/ area type	Single-Unit		One-Trailer		Multitrailer		Unknown		Total	
	N	%	N	%	N	%	N	%	N	%
Interstate/urban	108	7.1	346	11.5	21	12.2	1	1.1	476	9.9
Interstate/rural	81	5.3	443	14.7	33	19.2	15	16.7	572	11.9
Major/urban	256	16.8	385	12.8	16	9.3	2	2.2	659	13.7
Major/rural	574	37.7	1,371	45.5	70	40.7	57	63.3	2,072	43.2
Other/urban	272	17.9	256	8.5	14	8.1	6	6.7	548	11.4
Other/rural	222	14.6	200	6.6	18	10.5	9	10.0	449	9.4
Unknown	9	0.6	10	0.3	0	0.0	0	0.0	19	0.4
Total	1,522	100.0	3,011	100.0	172	100.0	90	100.0	4,795	100.0

Source: 1994 TIFA

Manner of collision and first harmful event

A higher proportion of fatal involvements resulted from head-on collisions, compared with injury and towaway involvements (table III-6, figure III-7). Twenty-three point four percent of fatal truck involvements occurred in head-on collisions, compared with only 2.1% for injury and 1.2% for towaway accidents. In contrast, 27.8% of injury and 27.5% of towaway involvements were in rear-end collisions, compared with 17.5% of fatals. Sideswipes were also less serious, accounting for 4.5% of truck fatal involvements, but 10.1% of towaway involvements. An angle impact was the major collision type for all crash severities, coded for 30.9% of fatal involvements, 44.4% of injury involvements, and 37.2% of towaway involvements. The "single-vehicle" category includes cases where there was no collision with another vehicle.

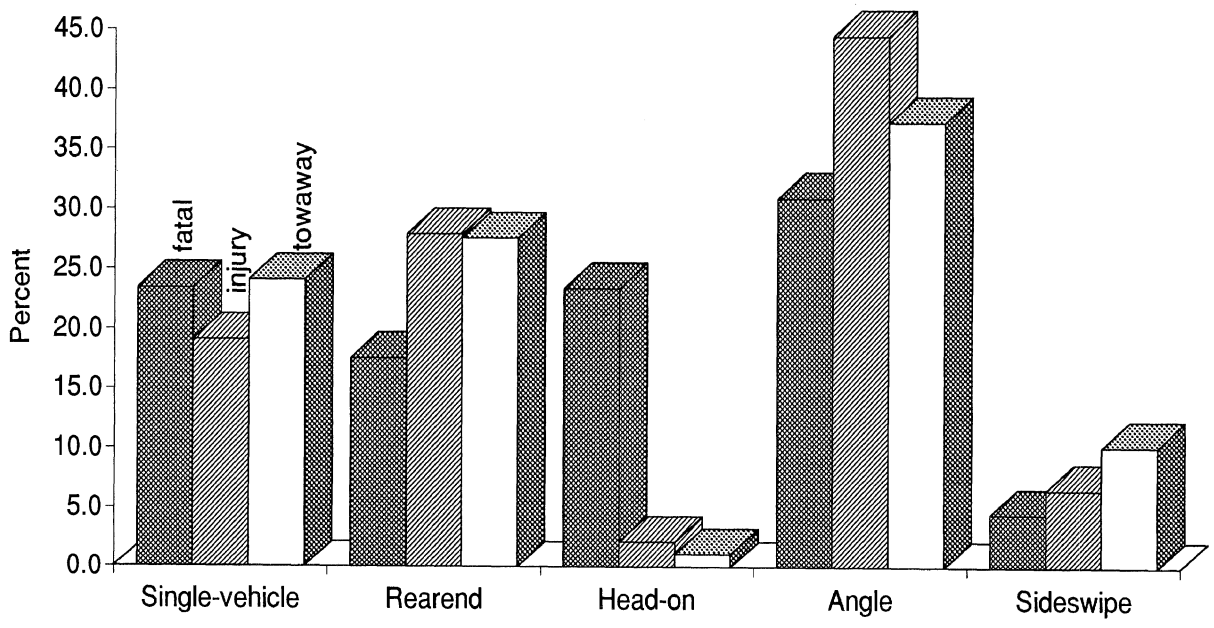
Table III-6 Manner of Collision by Accident Severity

Collision	Fatal		Injury		Towaway		All	
type	N	%	N	%	N	%	N	%
Single-vehicle	1,122	23.4	11,000	19.1	22,000	24.0	33,000	22.1
Rearend	840	17.5	16,000	27.8	25,000	27.5	41,000	27.3
Head-on	1,120	23.4	1,000	2.1	1,000	1.2	3,000	2.2
Angle	1,480	30.9	25,000	44.4	33,000	37.2	60,000	39.7
Sideswipe	215	4.5	4,000	6.5	9,000	10.1	13,000	8.6
Other	0	0.0	*	*	*	*	*	*
Unknown	18	0.4	*	*	*	*	*	*
Total	4,795	100.0	56,000	100.0	90,000	100.0	151,000	100.0

* GES estimate less than 500 or less than 0.05

Sources: 1994 TIFA, 1994 GES

Figure III-7 Manner of Collision by Accident Severity



Sources: 1994 TIFA, 1994 GES

First harmful event and accident severity

First harmful event records the first property-damaging or injury-producing event. For all accident severities, the first harmful event was a collision with another vehicle in over three-fourths of the involvements. Collisions with fixed and non-fixed objects occurred in 9.3% and 1.2% of involvements, respectively. Non-fixed objects include railroad trains, animals, and parked motor vehicles. Fixed objects include bridges, guardrails, impact attenuators, road signs, and other features of the roadway, as well as trees, ditches, embankments, and the like. Rollover was coded for 5.3% of involvements and an "other noncollision" event was coded for 4.6%. Rollover includes any number of quarter-turns, including the vehicle simply turning onto its side. Noncollision events include a fire or explosion, immersion, gas inhalation, and falling from a vehicle.

Overall, the distribution of first harmful event is similar for each accident severity, with a notable exception. Very few towaway involvements are coded "pedestrian/bicyclist," since the pedestrian or bicyclist is typically injured, and very few would require a motor vehicle to be towed.

Table III-7 First Harmful Event by Accident Severity

	Fatal		Injury		Towaway		All	
First harmful event	N	%	N	%	N	%	N	%
Collision:								
Vehicle in transport	3,664	76.4	46,000	80.9	68,000	76.1	118,000	77.9
Pedestrian/bicyclist	436	9.1	2,000	3.7	*	*	3,000	1.7
Non-fixed object	108	2.3	*	0.3	1,000	1.6	2,000	1.2
Fixed object	320	6.7	4,000	7.3	10,000	10.8	14,000	9.3
Noncollision								
Rollover	206	4.3	3,000	5.6	5,000	5.1	8,000	5.3
Other noncollision	61	1.3	1,000	2.1	6,000	6.4	7,000	4.6
Total	4,795	100.0	56,000	100.0	90,000	100.0	151,000	100.0

* GES estimate less than 500 or less than 0.05

Sources: 1994 TIFA, 1994 GES

IV. Vehicles: Trucks

This section presents statistics on the types of trucks involved in traffic accidents. The focus is primarily on **single-unit** (no trailers), **one-trailer**, and **multitrailer** (more than one trailer) trucks. **Combination** trucks are also considered in one table, where they are defined as a truck-tractor or straight truck with any number of trailers.

Most of the tables and figures in this section are limited to fatal accidents because data about weights, lengths, cargo body type, and other details are available only for trucks involved in fatal accidents. Additional detail about trucks in nonfatal accidents will become available when the SafetyNet accident system is fully implemented.

Highlights of the *Vehicles* section for 1994:

- 151,000 trucks were involved in traffic accidents
- 36.5% of trucks in traffic accidents were single-unit and 59.3% pulled at least one trailer
- 4,795 trucks were involved in an accident in which a fatality occurred
- 66.0% of trucks in fatal accidents were operated in interstate commerce
- 11.0% of single-unit trucks in fatal accidents were operated by interstate for-hire carriers, while 63.7% of one-trailer trucks and 66.3% of multitrailer trucks were interstate for-hire
- 13.5% of trucks in fatal accidents rolled over, compared with 10.3% of trucks in injury accidents, and 7.8% in towaway accidents
- There were 212 trucks carrying hazardous materials involved in fatal accidents in 1994, up from 175 in 1993, but about the same as the 202 in 1992
- There were spills of hazardous materials from 62 of the 4,795 trucks involved in fatal accidents in 1994 (1.3%)

Vehicle totals

An estimated 151,000 trucks were involved in SafetyNet-reportable traffic accidents in the U.S. in 1994, compared with 3,360,000 passenger cars in traffic accidents with a comparable reporting threshold (table IV-1). Almost 4,800 trucks were involved in an accident in which at least one fatality occurred, 56,000 where the most serious harm was a nonfatal injury transported from the scene for medical attention, and an additional 90,000 where at least one vehicle was towed.

The number of passenger cars involved in traffic accidents dwarfs the number of trucks, but truck accidents tend to be more serious. Fatal accidents accounted for 3.2% of all truck involvements, but only 0.8% of automobile accident involvements. There was one truck for every 22 passenger cars involved in an accident, but one truck for every 5 cars involved in a fatal accidents. Differences in mass help explain this disparity. Trucks can weigh up to 80,000 pounds when loaded, and more with permits or in certain States. Trucks greatly outweigh most other vehicles in an accident, increasing the probability of a fatality.

Table IV-1 Trucks and Passenger Cars by Accident Severity

Accident severity	Truck		Passenger car	
	N	%	N	%
Fatal	4,795	3.2	26,000	0.8
Injury	56,000	37.1	1,484,000	44.2
Towaway	90,000	59.6	1,850,000	55.1
Total	151,000	100.0	3,360,000	100.0

Sources: 1994 TIFA, 1994 GES

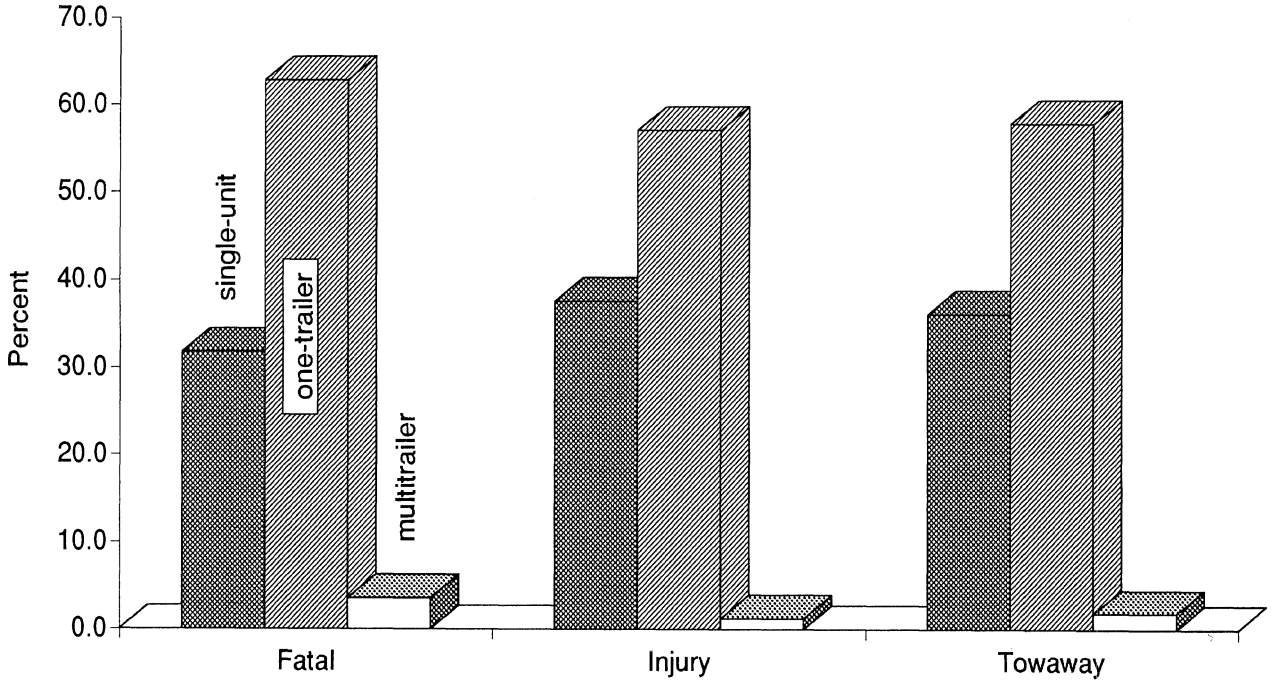
Table IV-2 shows the number of single-unit, one-trailer and multitrailer trucks involved in an accident in 1994 by accident severity. Overall, 36.5% of the trucks involved in accidents were single-unit, 57.6% were trucks with a single trailer, and an additional 1.7% were pulling multiple trailers. These proportions are about the same for injury accidents and for towaway accidents. About 63% of trucks in fatal accidents were one-trailer trucks and 3.6% were multitrailer combinations. About 32% were single-unit trucks (figure IV-1). The overrepresentation of trucks with trailers in fatal accidents could be due to the areas in which trucks operate, since single-unit trucks often work in urban areas where travel speeds are lower, while combination trucks, typically a tractor pulling a semitrailer, travel more often in rural areas at higher speeds. Combination trucks have more fatal involvements on rural major arterial roads (see table III-5), where traffic speeds are generally high.

Table IV-2 Truck Configuration by Accident Severity

Accident	Single-Unit		One-Trailer		Multitrailer		Unknown		All	
severity	N	%	N	%	N	%	N	%	N	%
Fatal	1,522	31.7	3,011	62.8	172	3.6	90	1.9	4,795	100.0
Injury	21,000	37.5	32,000	57.0	1,000	1.2	2,000	4.2	56,000	100.0
Towaway	32,000	36.1	52,000	57.7	2,000	1.8	4,000	4.4	90,000	100.0
Total	55,000	36.5	87,000	57.6	2,000	1.7	6,000	4.3	151,000	100.0

Sources: 1994 TIFA, 1994 GES

Figure IV-1 Distribution of Truck Configuration by Accident Severity



Sources: 1994 TIFA, 1994 GES

Company type

Table IV-3 tabulates fatal truck involvements by company type for single-unit, one-trailer, and multitrailer combinations. The table is limited to fatal involvements because carrier information is available only for trucks involved in fatal accidents. Company type is categorized by whether the trucks operate in interstate commerce or only within a single State; within that classification, companies are classified as either private or for-hire. Almost 46% of all trucks in fatal accidents were operated by interstate for-hire carriers. With the addition of the 20.1% of trucks operated by interstate private carriers, 66.0% of trucks in fatal accidents were operated by interstate carriers. Most of the intrastate trucks were operated by private carriers; intrastate for-hire carriers account for only 8.7% of all truck fatal involvements.

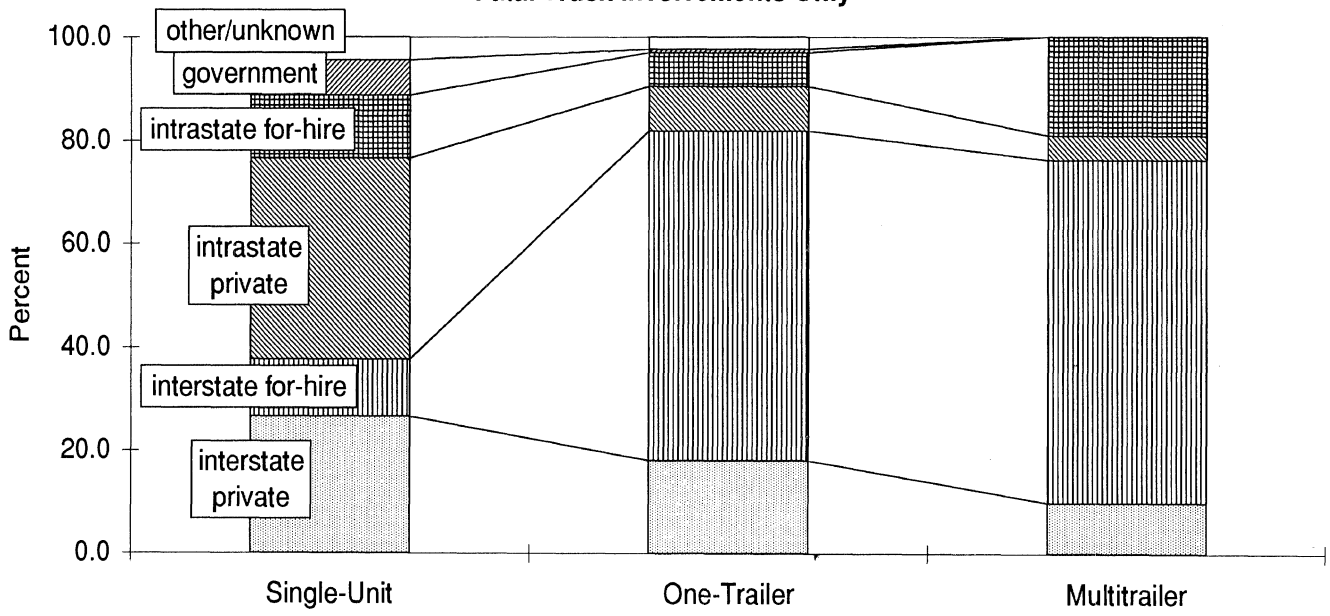
Table IV-3 Company Type by Truck Configuration
Fatal Truck Involvements Only

Company	Single-Unit		One-Trailer		Multitrailer		Unknown		All	
type	N	%	N	%	N	%	N	%	N	%
Interstate:										
Private	405	26.6	544	18.1	17	9.9	0	0.0	966	20.1
For-hire:	168	11.0	1,917	63.7	114	66.3	0	0.0	2,199	45.9
Intrastate:										
Private	592	38.9	262	8.7	8	4.7	0	0.0	862	18.0
For-hire	186	12.2	196	6.5	33	19.2	0	0.0	415	8.7
Government	103	6.8	22	0.7	0	0.0	0	0.0	125	2.6
Daily rental	34	2.2	9	0.3	0	0.0	0	0.0	43	0.9
Unknown	34	2.2	61	2.0	0	0.0	90	100.0	185	3.9
Total	1,522	100.0	3,011	100.0	172	100.0	90	100.0	4,795	100.0

Source: 1994 TIFA

Figure IV-2 illustrates the differences in the distribution of company type by truck configuration among trucks involved in fatal accidents in 1994. Single-unit trucks, which are mainly straight trucks, were predominantly operated by intrastate private carriers (e.g., farmers or construction firms). The second largest fraction of single-unit trucks was operated by interstate private carriers. Note also that almost all the government-owned trucks fell into the single-unit category. In contrast with single-unit trucks, one-trailer combinations (and even more so multitrailer combinations) involved in fatal accidents were predominantly operated by companies that haul freight for-hire across State lines. Almost 64% of one-trailer trucks in fatal accidents were interstate-for-hire; the proportion of interstate for-hire rose to 66.3% for multitrailer trucks. The proportion of intrastate for-hire trucks also was higher for multitrailer trucks than for one-trailer trucks, 19.2% to 6.5%. Some States permit certain longer combination vehicles (LCVs), which has led to the development of specialized hauling services that operate entirely within those States.

Figure IV-2 Distribution of Company Type by Truck Configuration
Fatal Truck Involvements Only

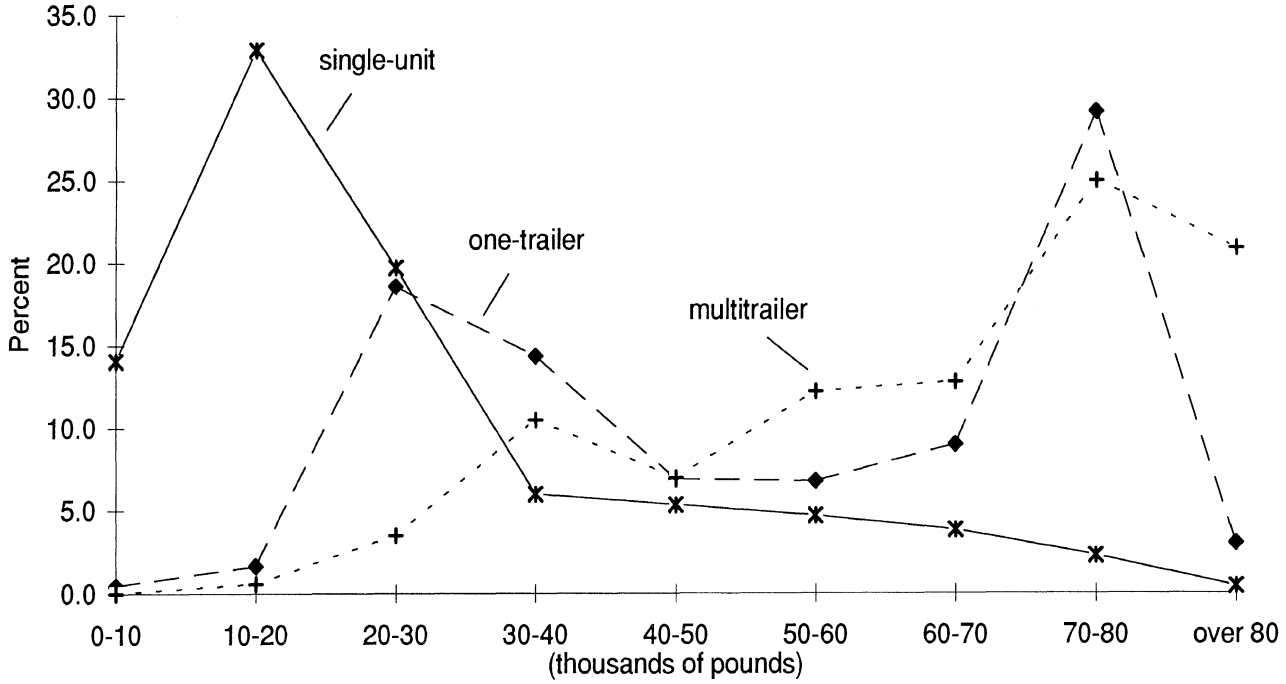


Source: 1994 TIFA

Weights and lengths

Figure IV-3 shows the distribution of the gross combination weight (GCW) of single-unit, one-trailer, and multitrailer trucks involved in fatal accidents in 1994. About 14% of single-unit trucks involved in a fatal accident weighed under 10,000 pounds. Many of these were empty—an empty single-unit truck meeting the SafetyNet reporting threshold (two axles, six tires, and equipped to carry cargo) can weigh as little as 6,000 pounds. The proportion of single-unit trucks rose to a peak at 10,000 to 20,000 pounds and then declined sharply to the 30,000-to-40,000 pound category. Almost half the single-unit trucks had GCWs less than 20,000 pounds. Only a small number of single-unit trucks in fatal accidents weighed over 50,000 pounds, though some were found with weights up to 80,000 pounds.

Figure IV-3 Gross Combination Weight by Truck Configuration
Fatal Truck Involvements Only

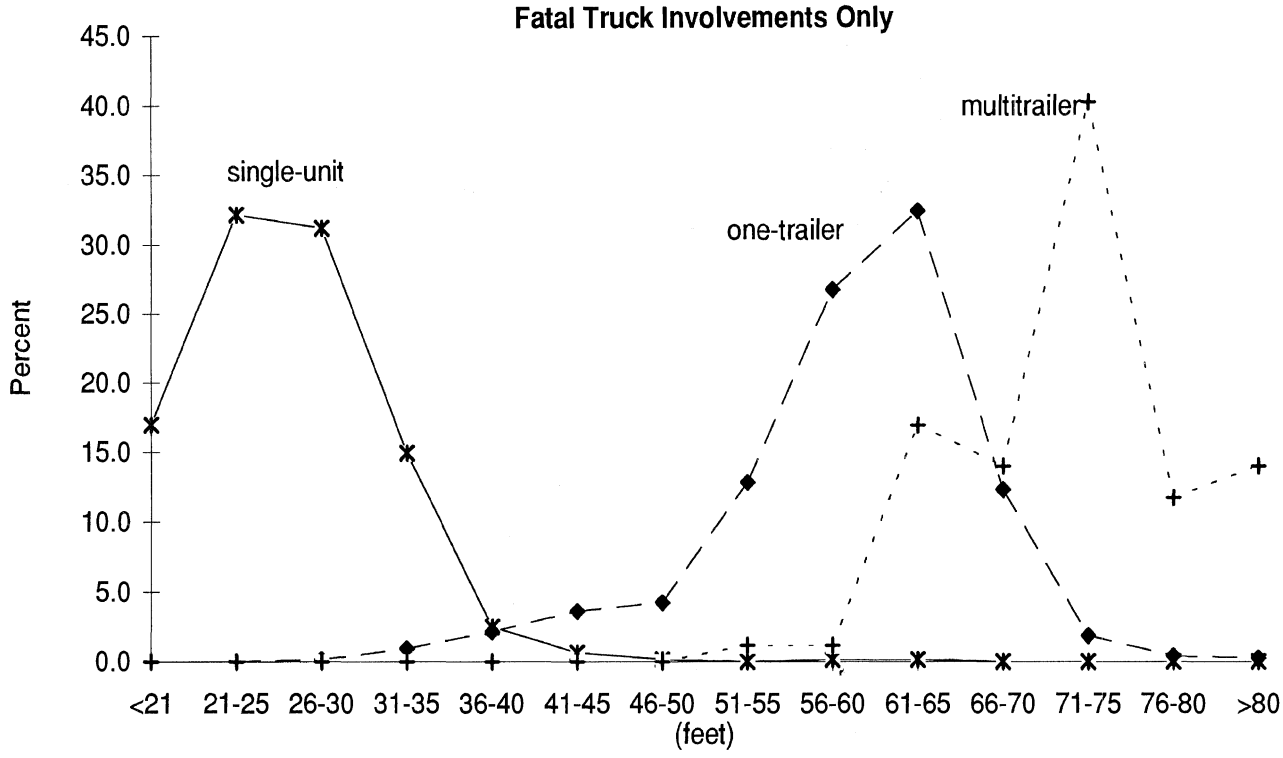


Source: 1994 TIFA

The distributions of GCW for one-trailer and multitrailer trucks involved in fatal accidents show that generally the trucks were either fully loaded or nearly empty at the time of the accident. The distribution for one-trailer trucks shows one peak in the 20,000 to 40,000 pound range; multitrailer trucks also show a peak at 20,000 to 40,000 pounds. Both distributions had a second peak at 70,000 to 80,000 pounds. The peaks at the lighter GCWs are near the empty or unloaded weight for each configuration. A typical empty weight for a tractor-semitrailer (the most common one-trailer combination) is 25,000 to 30,000 pounds. For a multitrailer combination, a typical empty weight is in the 30,000 to 35,000 pound range. Trucks in the second peak were at or near the legal GCW limit. Federal law caps GCW at 80,000 pounds, though greater weights are possible with special permits or other exemptions. Note that a much greater proportion of multitrailer combinations than one-trailer or single-unit trucks fell into the over-80,000 pound category.

Figure IV-4 shows the distribution of overall length for trucks involved in fatal accidents in 1994. Nearly all single-unit trucks in fatal accidents were shorter than 36 feet and most were shorter than the shortest one-trailer trucks. One-trailer combinations less than 46 feet long are primarily tractors pulling a short trailer. Most one-trailer combinations were in the 56 to 65 foot range, while 40.1% of multitrailer combinations were 71 to 75 feet long. Eighty-four percent of one-trailer trucks in fatal accidents were between 51 and 70 feet long. Over 87% of multitrailer trucks were between 61 and 85 feet long. The slight increase for the over-80 foot category in the multitrailer combinations reflects several cases of extreme overall lengths. These vehicles were either a triple trailer combination or some other type of longer combination vehicle (LCV). See Chapter VI, "Special Focus: Longer Combination Vehicles."

Figure IV-4 Overall Length by Truck Configuration
Fatal Truck Involvements Only



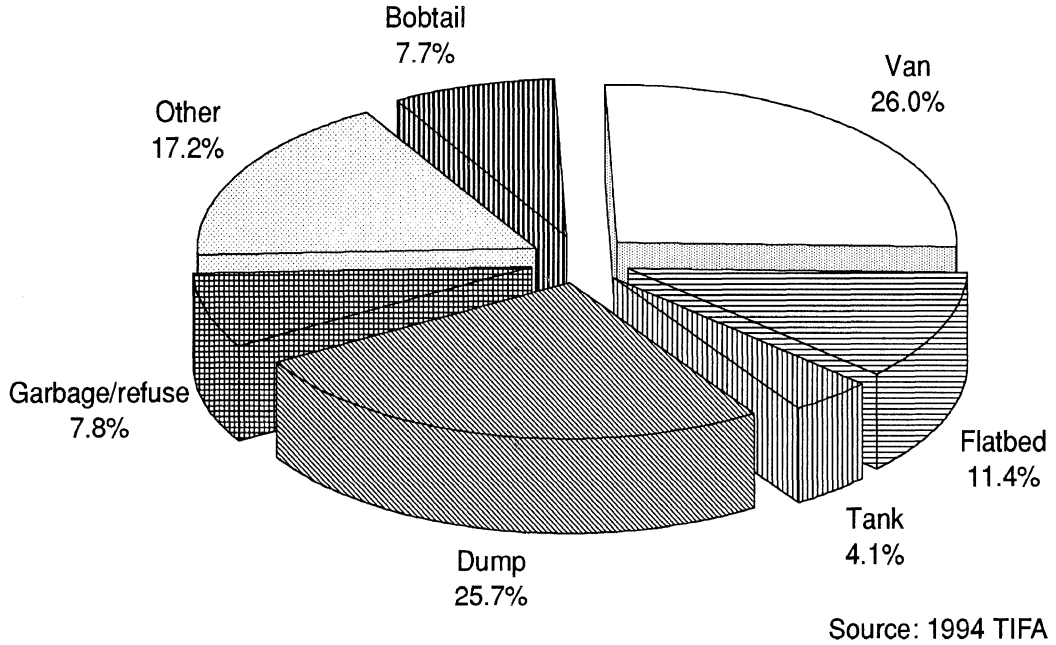
Source: 1994 TIFA

Cargo body and cargo

Figures IV-5, IV-6, and IV-7 show the distribution of cargo body type for single-unit, one-trailer, and multitrailer trucks, respectively, involved in fatal accidents in 1994. The distribution of cargo body styles was different for each truck type. Almost 8% of single-unit trucks (117 out of 1,522) were "bobtails," tractors without a trailer. The high proportion of bobtails among single-unit fatal involvements could be in part because bobtails are designed to be operated pulling a trailer, and handling properties change significantly without a trailer. Vans and dumps each accounted for about one quarter of the single-unit trucks. Seven point eight percent were refuse trucks, 4.1% were tanks, 11.4% were flatbeds, and 17.2% had some "other" cargo body style. The "other" cargo body type consisted primarily of specialized trucks, such as utility trucks or vehicles with cranes, booms, and similar equipment.

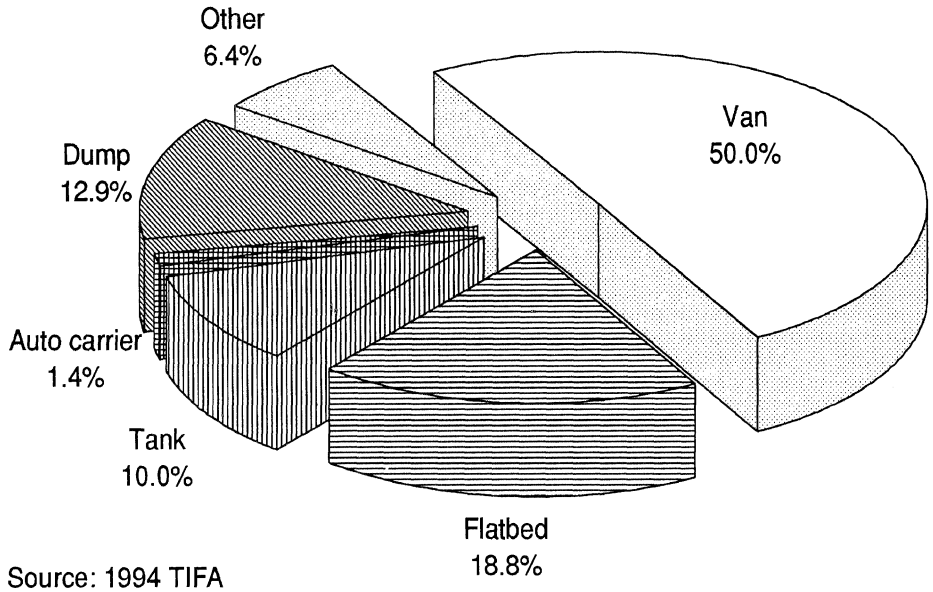
One- and multitrailer trucks had a higher proportion of van and flatbed bodies than did single-unit trucks. Fifty percent of one-trailer trucks had a van trailer, and 52.3% of multitrailer trucks were vans. Almost 19% of one-trailer trucks were flatbeds, while 18.0% of multitrailer trucks were flatbeds. Though these are distributions of trucks in fatal accidents, they clearly reflect the typical usage of each truck type. One- and multitrailer trucks are most often employed to haul large quantities of general freight long distances. Single-unit trucks are used for a variety of tasks in urban and farming communities.

Figure IV-5 Cargo Body Type for Single-Unit Trucks
Fatal Truck Involvements Only



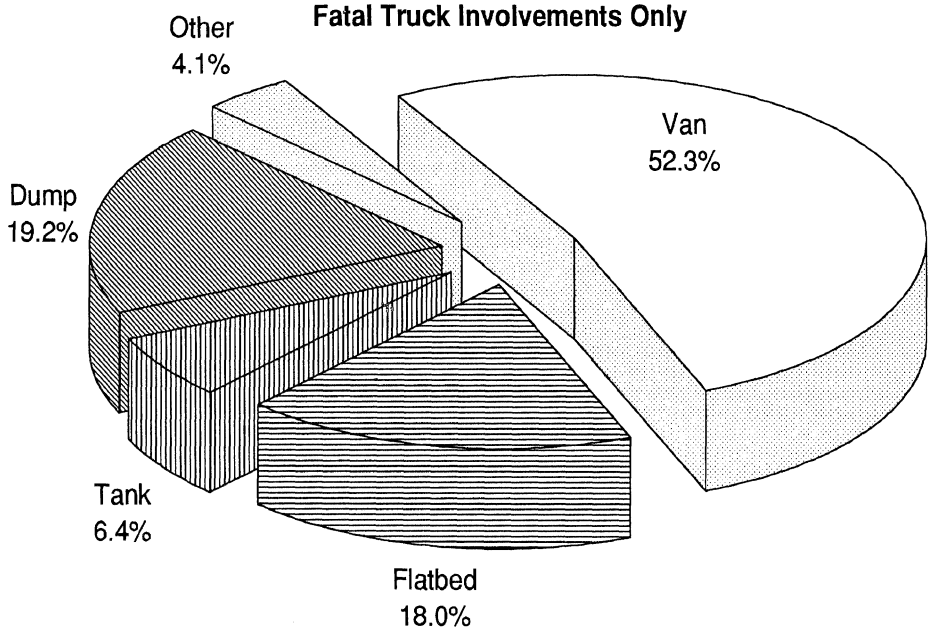
Source: 1994 TIFA

Figure IV-6 Cargo Body Type for One-Trailer Trucks
Fatal Truck Involvements Only



Source: 1994 TIFA

Figure IV-7 Cargo Body Type for Multitrailer Trucks
Fatal Truck Involvements Only



Source: 1994 TIFA

The most common cargo carried by single-unit trucks involved in a fatal accident was solids in bulk with 21.0% (table IV-4). This is consistent with their relatively high proportion of dump cargo bodies (figure IV-5). Single-unit trucks were empty 30.6% of the time and carried general freight in 11.6% of their fatal involvements. General freight was the most frequent cargo of one-trailer trucks involved in a fatal accident (25.4%), followed by solids in bulk (9.6%) and refrigerated food (7.9%). Multitrailer trucks carried general freight in 43.0% of their fatal involvements. Other common cargoes for multitrailer trucks were solids in bulk (16.9%), large objects (5.8%), and farm products (4.1%).

Table IV-4 Cargo Type by Truck Configuration
Fatal Truck Involvements Only

	Single-Unit		One-Trailer		Multitrailer		Unknown		All	
Cargo type	N	%	N	%	N	%	N	%	N	%
Empty	466	30.6	840	27.9	28	16.3	0	0.0	1,334	27.8
General freight	176	11.6	766	25.4	74	43.0	0	0.0	1,016	21.2
Household goods	30	2.0	26	0.9	0	0.0	0	0.0	56	1.2
Building materials	19	1.2	57	1.9	2	1.2	0	0.0	78	1.6
Metal	12	0.8	110	3.7	4	2.3	0	0.0	126	2.6
Heavy machinery	7	0.5	37	1.2	3	1.7	0	0.0	47	1.0
Large objects	10	0.7	70	2.3	10	5.8	0	0.0	90	1.9
Motor vehicles	12	0.8	22	0.7	0	0.0	0	0.0	34	0.7
Driveaway/towaway	35	2.3	0	0.0	0	0.0	0	0.0	35	0.7
Gases in bulk	8	0.5	9	0.3	1	0.6	0	0.0	18	0.4
Solids in bulk	320	21.0	288	9.6	29	16.9	0	0.0	637	13.3
Liquids in bulk	45	3.0	147	4.9	4	2.3	0	0.0	196	4.1
Explosives	0	0.0	2	0.1	0	0.0	0	0.0	2	0.0
Lumber	25	1.6	176	5.8	6	3.5	0	0.0	207	4.3
Refrigerated food	70	4.6	239	7.9	1	0.6	0	0.0	310	6.5
Mobile home	0	0.0	10	0.3	0	0.0	0	0.0	10	0.2
Farm products	41	2.7	97	3.2	7	4.1	0	0.0	145	3.0
Live animals	11	0.7	29	1.0	1	0.6	0	0.0	41	0.9
Other	124	8.1	31	1.0	0	0.0	0	0.0	155	3.2
N/A (bobtail)	94	6.2	0	0.0	0	0.0	0	0.0	94	2.0
Unknown	17	1.1	55	1.8	2	1.2	90	100.0	164	3.4
Total	1,522	100.0	3,011	100.0	172	100.0	90	100.0	4,795	100.0

Source: 1994 TIFA

Jackknife, rollover, and fire

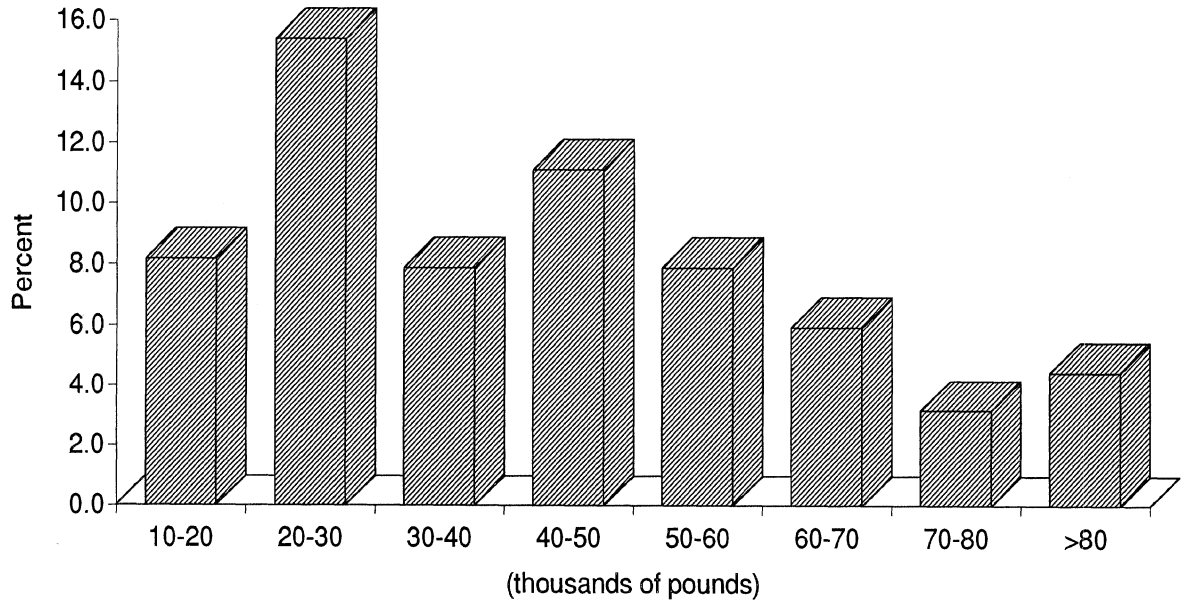
Jackknife occurs when a trailer yaws in an uncontrolled fashion with respect to the unit pulling it, often so far that the trailer and tractor make contact. Overall, jackknife occurred in an estimated 4.8% of all combination trucks involved in an accident (table IV-5). The proportion of jackknifed trucks differed by accident severity, but not as might be expected. About 7.6% of combination trucks in fatal accidents jackknifed, compared with 3.3% for injury accidents but 5.6% for towaways. Jackknife occurs most often when the brakes on the rear axles of a tractor "lock" during sudden braking. Brake lock is more likely if the trailer is unloaded or lightly loaded. Figure IV-8 illustrates that jackknife is related to GCW. Fifteen point four percent of one-trailer trucks weighing 20-30,000 pounds jackknifed, compared with about 3.2% of one-trailer trucks weighing 70-80,000 pounds.

Table IV-5 Jackknife by Accident Severity (trucks with trailers only)

Jackknife	Fatal	Injury	Towaway	All
		(frequency)		
No	2,937	32,000	51,000	86,000
Yes	242	1,000	3,000	4,000
Total	3,179	33,000	54,000	90,000
		(row percentage)		
No	3.4	37.2	59.3	100.0
Yes	5.6	25.0	69.4	100.0
Total	3.5	36.6	59.8	100.0
		(column percentage)		
No	92.4	96.7	94.4	95.2
Yes	7.6	3.3	5.6	4.8
Total	100.0	100.0	100.0	100.0

Note: Jackknife is missing for 4 fatal involvements
Sources: 1994 TIFA, 1994 GES

Figure IV-8 Percentage of One-Trailer Trucks Jackknifing by Total Weight Fatal Truck Involvements Only



Sources: 1994 TIFA, 1994 GES

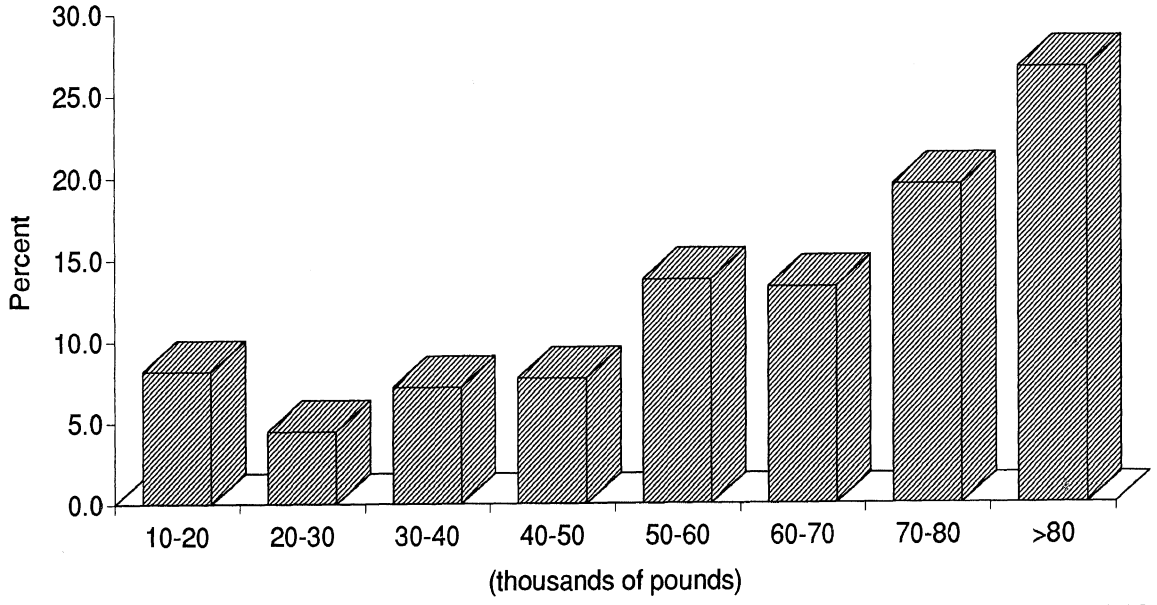
Rollover is associated with more serious accidents. Thirteen point five percent of trucks involved in a fatal accident rolled over (table IV-6). The proportion drops to 10.3% for injury accidents and 7.8% for towaways. Similarly, 4.8% of rollover involvements included a fatality, compared with only 3.0% of non-rollover involvements. Rollover is also related to GCW, though the relationship is the inverse of that in jackknife. Loaded vehicles tend to roll over more frequently than unloaded vehicles, because the center of gravity of a loaded vehicle is higher than when unloaded. Only 4.5% of one-trailer trucks weighing 20-30,000 pounds rolled over, compared with 26.7% of one-trailer trucks with a GCW of over 80,000 pounds (figure IV-9).

Table IV-6 Rollover by Accident Severity

Rollover	Fatal	Injury	Towaway	All
		(frequency)		
No	4,149	51,000	83,000	138,000
Yes	646	6,000	7,000	13,000
Total	4,795	56,000	90,000	151,000
		(row percentage)		
No	3.0	36.8	60.2	100.0
Yes	4.8	43.0	52.2	100.0
Total	3.2	37.4	59.4	100.0
		(column percentage)		
No	86.5	89.7	92.2	91.1
Yes	13.5	10.3	7.8	8.9
Total	100.0	100.0	100.0	100.0

Sources: 1994 TIFA, 1994 GES

Figure IV-9 Percentage of One-Trailer Trucks Rolling Over by Total Weight
Fatal Truck Involvements Only



Sources: 1994 TIFA, 1994 GES

Considering accidents of all severities, the occurrence of a fire on the truck is a rare event (table IV-7). An accident-involved truck experienced a fire less that one percent of the time in 1994. Fire is associated with the more serious accidents. Of the trucks that experienced a fire, 16.0% were involved in fatal accidents and 14.4% in injury accidents. Where there was no fire, 3.1% were involved in a fatal accident and 37.6% in injury accidents.

Table IV-7 Truck Fire by Accident Severity

Fire	Fatal	Injury	Towaway	All
(frequency)				
No	4,602	56,000	89,000	150,000
Yes	191	*	1,000	1,000
Total	4,793	56,000	90,000	151,000
(row percentage)				
No	3.1	37.6	59.4	100.0
Yes	16.0	14.4	69.6	100.0
Total	3.2	37.4	59.4	100.0
(column percentage)				
No	96.0	99.7	99.1	99.2
Yes	4.0	0.3	0.9	0.8
Total	100.0	100.0	100.0	100.0

* GES estimate < 500

Note: Fire is missing for 2 fatal involvements

Sources: 1994 TIFA, 1994 GES

Hazardous materials

Of the 4,795 trucks involved in a fatal accident in 1994, 212 (4.4%) were transporting hazardous commodities (table IV-8). Tanks were the most common cargo body type among these involvements, accounting for 68.4% (145) of the 212 trucks involved. Vans were the second-most common cargo body, with 43 vehicles. Hazardous commodities in vans are typically packaged goods, such as drums of paint or chemicals. In tanks, the most common hazardous material is gasoline.

Table IV-8 Trucks Transporting Hazardous Materials
Cargo Body Type by Truck Configuration
Fatal Truck Involvements Only

Cargo	Single-Unit		One-Trailer		Multitrailer		All	
body	N	%	N	%	N	%	N	%
Van	6	12.2	31	20.4	6	54.5	43	20.3
Flatbed	9	18.4	6	3.9	1	9.1	16	7.5
Tank	27	55.1	114	75.0	4	36.4	145	68.4
Dump	0	0.0	1	0.7	0	0.0	1	0.5
Other	7	14.3	0	0.0	0	0.0	7	3.3
Total	49	100.0	152	100.0	11	100.0	212	100.0

Source: 1994 TIFA

There was a total of 62 hazardous materials spills as a consequence of fatal truck accidents in 1994 (1.3% of all fatal truck involvements). Spillage of cargo was more likely from a multitrailer truck than from either a one-trailer or a single-unit truck, though there were only eleven multitrailer trucks with hazardous cargo involved in a fatal accident. Five of eleven multitrailer trucks transporting hazardous materials in a fatal accident spilled some of their cargo, compared with 40 of 152 one-trailer trucks and 17 of 49 single-unit trucks.

Table IV-9 Trucks Transporting Hazardous Materials
Cargo Spillage by Truck Configuration
Fatal Truck Involvements Only

Cargo	Single-Unit		One-Trailer		Multitrailer		All	
spillage	N	%	N	%	N	%	N	%
Yes	17	34.7	40	26.3	5	45.5	62	29.2
No	32	65.3	110	72.4	6	54.5	148	69.8
Unknown	0	0.0	2	1.3	0	0.0	2	0.9
Total	49	100.0	152	100.0	11	100.0	212	100.0

Source: 1994 TIFA

Gross vehicle weight rating

The GVWR (gross vehicle weight rating) applies only to the power unit. GVWR indicates the rated weight capacity of the axles of the truck or tractor. Classes 3 to 6 include vehicles rated between 10,001 pounds and 26,000 pounds; class 7 vehicles are rated between 26,001 and 33,000 pounds; and class 8 is over 33,000 pounds.

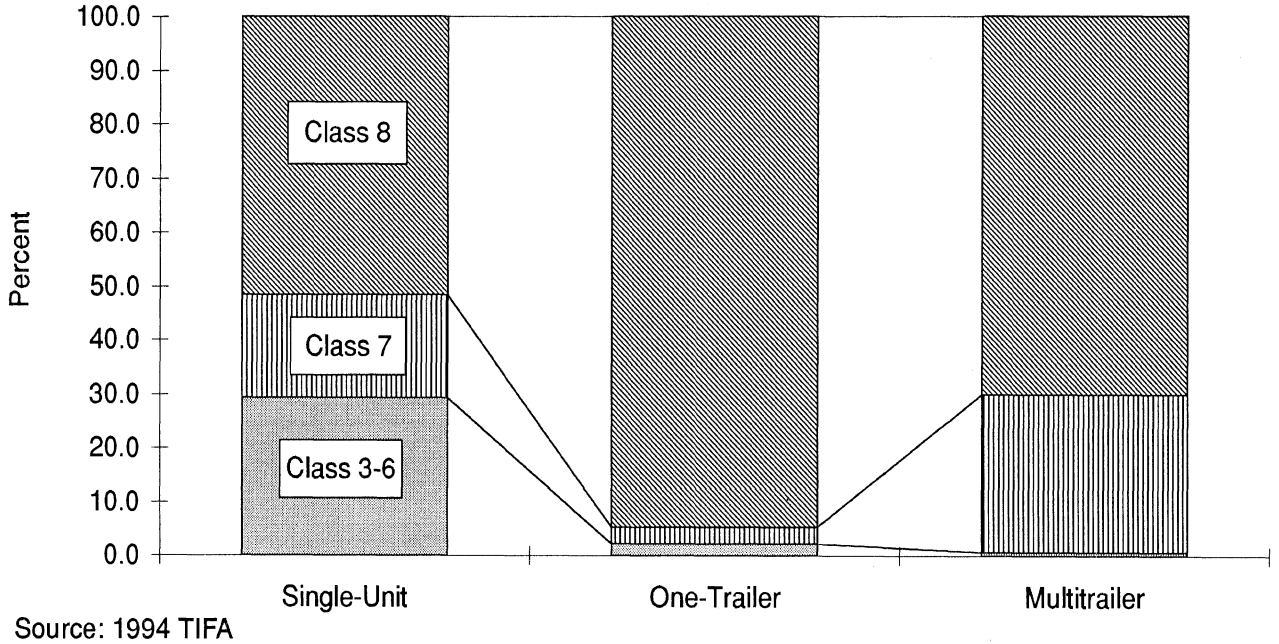
Over three-fourths of the trucks involved in fatal accidents in 1994 were class 8 (table IV-10) and almost 78% of these vehicles were pulling a single trailer. Almost 27% of the multitrailer combinations had class 7 power units (figure IV-10). The majority of these were doubles with two-axle tractors and two short trailers. Power units with a weight rating over 33,000 pounds (class 8) were the most common in all three truck configurations.

Table IV-10 Gross Vehicle Weight Rating by Truck Configuration
Fatal Involvements Only

	Single-Unit		One-Trailer		Multitrailer		Unknown		Total	
GVWR	N	%	N	%	N	%	N	%	N	%
Class 3-6	394	25.9	62	2.1	1	0.6	0	0.0	457	9.5
Class 7	256	16.8	92	3.1	46	26.7	0	0.0	394	8.2
Class 8	697	45.8	2,793	92.8	110	64.0	0	0.0	3,600	75.1
Unknown	175	11.5	64	2.1	15	8.7	90	100.0	344	7.2
Total	1,522	100.0	3,011	100.0	172	100.0	90	100.0	4,795	100.0

Source: 1994 TIFA

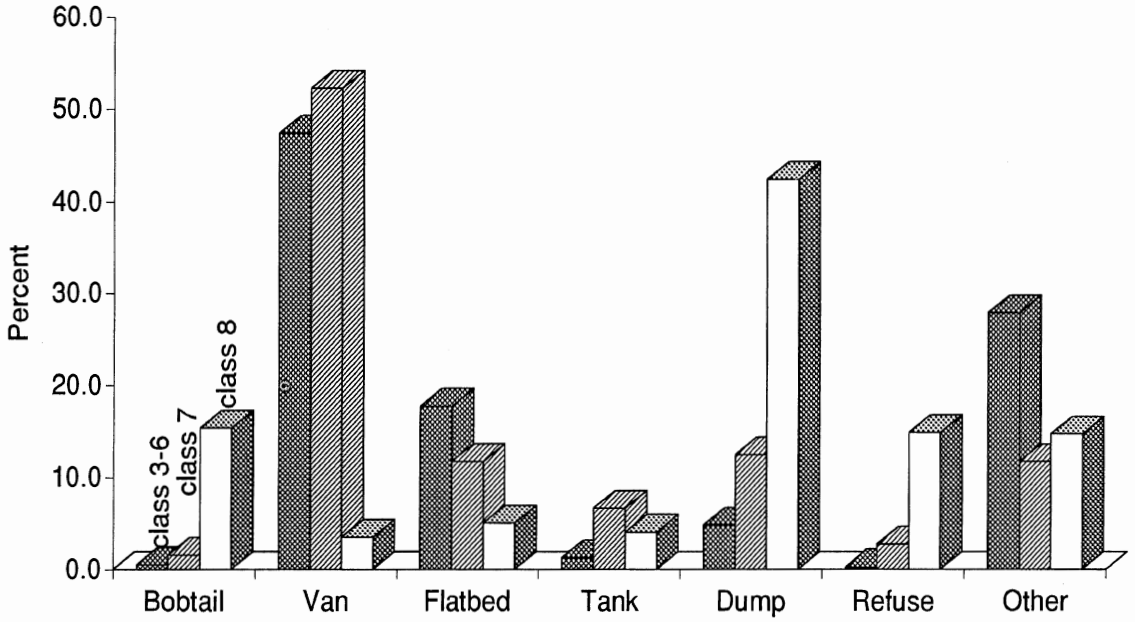
Figure IV-10 Distribution of GVWR by Truck Configuration
Fatal Truck Involvements Only



Source: 1994 TIFA

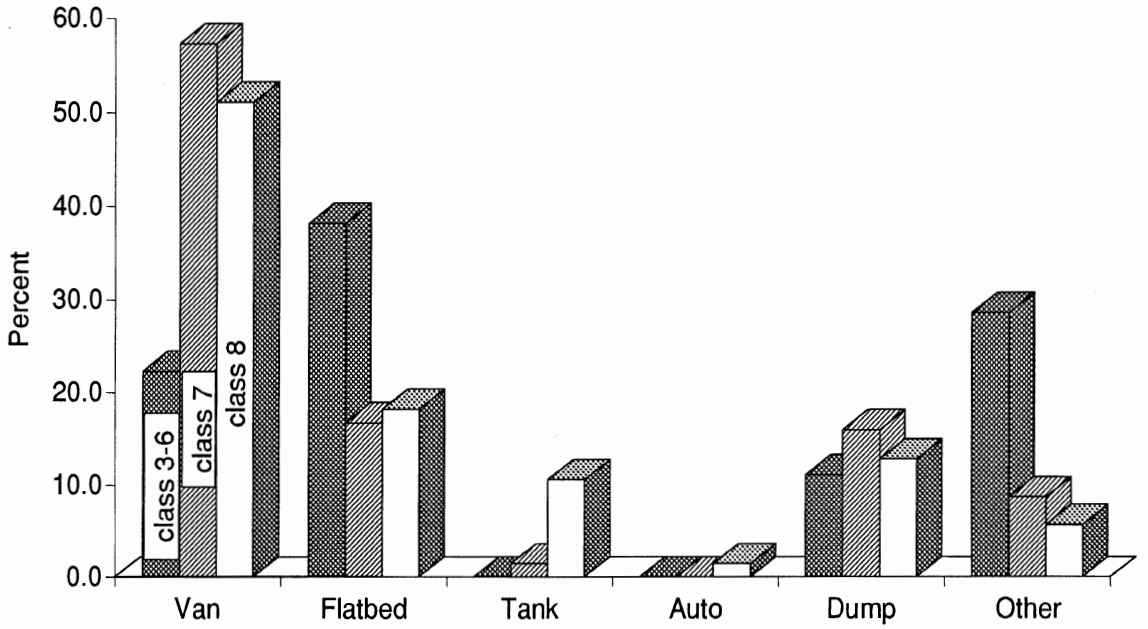
Figures IV-11 and IV-12 show cargo body by GVWR class for single-unit and combination trucks, respectively. Among single-unit trucks, van cargo bodies were the most common for class 3-6 and 7 vehicles with 47.5% and 52.3% respectively, while dumps accounted for 42.5% of class 8 single-unit trucks involved in fatal accidents in 1994. The 27.9% of "other" cargo bodies for class 3-6 trucks are primarily working bodies, like those on utility and other service trucks. The distribution is quite different for combination vehicles. Of class 3-6 trucks, 38.1% were flatbeds and 28.6% were "other" cargo bodies. These vehicles are mainly straight trucks pulling a trailer. Vans were the most common cargo bodies for class 7 and 8 combination trucks.

Figure IV-11 Single-Unit Trucks: Cargo Body Type by GVWR
Fatal Truck Involvements Only



Source: 1994 TIFA

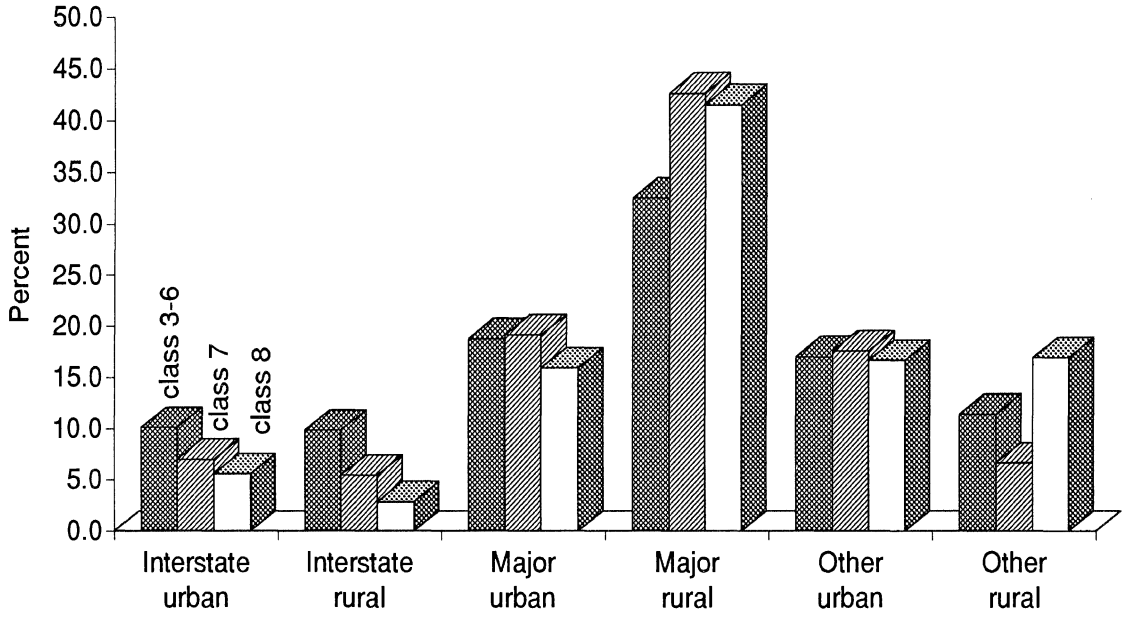
Figure IV-12 Combination Trucks: Cargo Body Type by GVWR
Fatal Truck Involvements Only



Source: 1994 TIFA

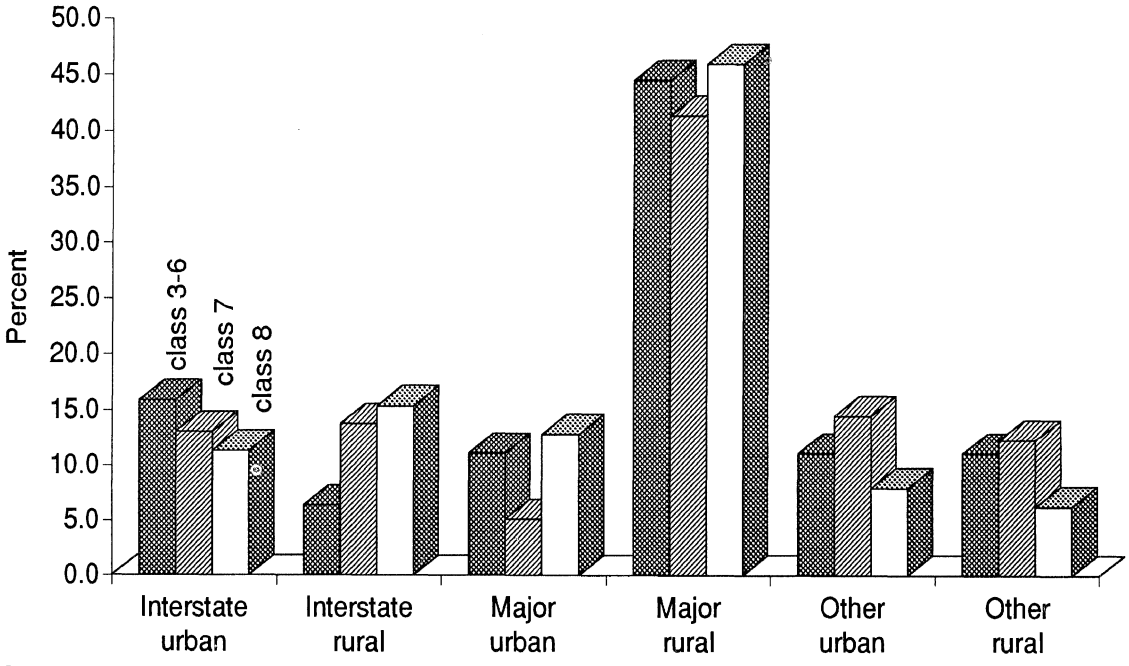
Figures IV-13 and IV-14 show road and area type of fatal accident involvements by GVWR for single-unit and combination trucks, respectively. Differences between GVWR classes across road and area type are not as striking as they were for cargo bodies, as displayed in the previous figures. Considering single-unit trucks, major arterials in rural areas were the most common sites for fatal involvements of all GVWR classes, followed by major urban and other urban. Note, though, that the proportion of the involvements of class 3-6 was lower for major rual and higher for the two categories of Interstate highways. Major arterials in rural areas also were the most common areas for combination trucks of all classes.

Figure IV-13 Single-Unit Trucks: Road and Area Type by GVWR
Fatal Truck Involvements Only



Source: 1994 TIFA

Figure IV-14 Combination Trucks: Road and Area Type by GVWR
Fatal Truck Involvements Only



Source: 1994 TIFA

Table IV-11 shows fatal involvements by company type for GVWR class 3-6, class 7, and class 8. A greater proportion of class 3-6 and class 7 trucks was operated by private carriers, while over half of the class 8 trucks were operated by interstate for-hire companies. Class 8 was the most common truck weight class for all company types, except daily rentals.

Table IV-11 Company Type by Gross Vehicle Weight Rating
Fatal Truck Involvements Only

Company	Class 3-6		Class 7		Class 8		Unknown		Total	
type	N	%	N	%	N	%	N	%	N	%
Interstate:										
Private	148	32.4	140	35.5	637	17.7	41	11.9	966	20.1
For-hire:	37	8.1	83	21.1	2,046	56.8	33	9.6	2,199	45.9
Intrastate:										
Private	177	38.7	100	25.4	466	12.9	119	34.6	862	18.0
For-hire	33	7.2	39	9.9	325	9.0	18	5.2	415	8.7
Government	16	3.5	27	6.9	75	2.1	7	2.0	125	2.6
Daily rental	36	7.9	2	0.5	1	0.0	4	1.2	43	0.9
Unknown	10	2.2	3	0.8	50	1.4	122	35.5	185	3.9
Total	457	100.0	394	100.0	3,600	100.0	344	100.0	4,795	100.0

Source: 1994 TIFA

Table IV-12 shows the number of fatalities in accidents by GVWR class. The total in this table is the actual number of truck accident fatalities rather than the sum of the column. (If a fatal accident involved both class 7 and class 8 trucks, for example, the number killed in that accident would be counted for both class 7 and class 8 trucks in the table below. Summing the column would overstate the number killed.) None of the weight classes was overrepresented when compared with the number of vehicles in each class that were involved in fatal accidents in 1994. Class 8 trucks comprised 75.1% of the involvements (Table IV-10) and 76.7% of the fatalities; the differences between the other two weight classes were even less.

Table IV-12
Gross Vehicle Weight Rating
by Number of Fatalities
Fatal Involvements Only

GVWR	N	%
Class 3-6	511	9.3
Class 7	448	8.1
Class 8	4,221	76.7
Unknown	383	7.0
Total	5,501	100.0

Source: 1994 TIFA

V. Drivers: Trucks

This section presents statistics on the drivers of trucks involved in traffic accidents in the United States in 1994. Highlights of this section:

- 150,000 truck drivers were involved in traffic accidents in 1994
- 584 truck drivers died in traffic accidents
- While all accident-involved truck drivers had a lower probability of nonfatal injury than all accident-involved passenger car drivers (whether involved in a collision with a truck or not), the probability of fatal injury was the same for each: 0.4%
- 3.1% of truck drivers involved in all accidents had been using alcohol, compared with 8.5% of accident-involved passenger car drivers
- 11.7% of the drivers of single-unit trucks in accidents were under 25 years old, compared with 8.1% of one-trailer truck drivers and 4.3% of multitrailer truck drivers
- The probability of injury to the truck driver was significantly higher in head-on and single-vehicle accidents than in other collision types
- Rollover and ejection are both strongly associated with fatal and other serious injuries

Note: The estimated number of drivers involved in traffic accidents is lower than the estimated number of trucks because some trucks were driverless at the time of the accident. This can occur when the truck is stopped on or partially on the road, e.g., due to mechanical problems or for some other reason, and the driver is away from the truck.

Driver injury

Of the 150,000 truck drivers involved in traffic accidents in 1994, an estimated 10,000 received C injuries, 7,000 sustained B injuries, 5,000 suffered A injuries, and 584 were killed (table V-1). A injuries are incapacitating, though not fatal; B injuries are evident (e.g., a laceration), but not incapacitating; C injuries involve a complaint of pain but are not evident to observers at the scene of the accident. (See *injury severity* in the Glossary for an explanation of injury severity classifications.) Truck drivers involved in traffic accidents were less likely to be injured than car drivers. Overall, 84.7% of the truck drivers were not injured, while 62.7% of passenger car drivers involved in traffic accidents were uninjured. Higher proportions of car drivers sustained injury for each injury severity level. Note, however, that the proportion suffering fatal injuries was the same for both passenger car and truck drivers. Given involvement in a traffic accident, 0.4% of both truck drivers and passenger car drivers were killed. (The traffic accidents reported in the table include all traffic accidents that conform to the SafetyNet severity threshold [fatality, injury transported for treatment, or at least one vehicle towed due to damage], not just truck/car collisions.)

Table V-1 Driver Injury Severity for Trucks and Passenger Cars

Injury severity	Truck drivers: truck accidents N	%	Passenger car drivers: all accidents N	%
Fatal	584	0.4	13,000	0.4
A injury	5,000	3.5	188,000	5.6
B injury	7,000	4.8	351,000	10.5
C injury	10,000	6.4	675,000	20.1
No injury	127,000	84.7	2,102,000	62.7
Severity unknown	*	0.2	21,000	0.6
Died prior	*	*	*	*
Unknown	*	*	*	*
Total	150,000	100.0	3,350,000	100.0

* GES estimate less than 500 or less than 0.05%

Sources: 1994 TIFA, 1994 GES

A total of 5,501 people were killed in truck accidents in 1994 (table V-2). A large majority of the fatalities, 4,264 (77.5%), occurred in the other, non-truck vehicles involved, primarily passenger cars. Seven hundred and thirteen (13.0%) were truck occupants, either the driver (584) or a passenger (129). Non-motorists accounted for the remaining 521 fatalities, 9.5% of the total. Most of the non-motorists were pedestrians and 89 were bicylists.

The overrepresentation of passenger car and other non-truck occupants among the fatalities is largely due to differences in mass and vehicle design. Trucks have much greater mass than almost all other motor vehicles. Accordingly, in a collision with a truck, a smaller vehicle experiences a much larger change in velocity and therefore much more damage.

Table V-2 Road User Type of Fatalities in Truck Accidents

	N	%
Trucks:		
Driver	584	10.6
Passenger	129	2.3
Truck total	713	13.0
Non-trucks		
Drivers	3,074	55.9
Passengers	1,189	21.6
Non-truck total	4,264	77.5
Non-motorists		
In parked vehicle	16	0.3
Pedestrian	396	7.2
Bicyclist	89	1.6
Other/unknown	24	0.4
Non-motorist total	525	9.5
Total	5,501	100.0

Source: 1994 TIFA, 1994 FARS

Driver age and sex

Almost 97% of truck drivers involved in traffic accidents were male (table V-3). Over 97% of all drivers of one-trailer trucks were males. Females drove 2.6% of the single-unit trucks involved in traffic accidents, 2.6% of one-trailer trucks, and 4.8% of multitrailer trucks.

Table V-3 Driver Sex by Configuration Type

	Single-Unit		One-Trailer		Multitrailer		Unknown		Total	
Driver sex	N	%	N	%	N	%	N	%	N	%
Male	53,000	97.4	84,000	97.4	2,000	95.2	5,000	81.2	145,000	96.7
Female	1,000	2.6	2,000	2.6	*	4.8	1,000	18.8	5,000	3.3
Total	54,000	100.0	87,000	100.0	2,000	100.0	6,000	100.0	150,000	100.0

* GES estimate less than 500

Note: Total includes fewer than 500 with unknown sex.

Sources: 1994 TIFA, 1994 GES

Table V-4 shows the distribution of driver age for different truck combinations in traffic accidents. The distributions for one-trailer and multitrailer trucks indicate that in 1994 drivers of accident-involved multitrailer combinations tended to be older (see figure V-1). For all configurations, over 87% of the drivers were between 25 and 64 years of age. An estimated 8.1% of one-trailer truck drivers were under 25 and only 4.3% of multitrailer truck drivers were under 25. An estimated 11.7% of single-unit drivers were under 25.

Table V-4 Driver Age by Configuration Type

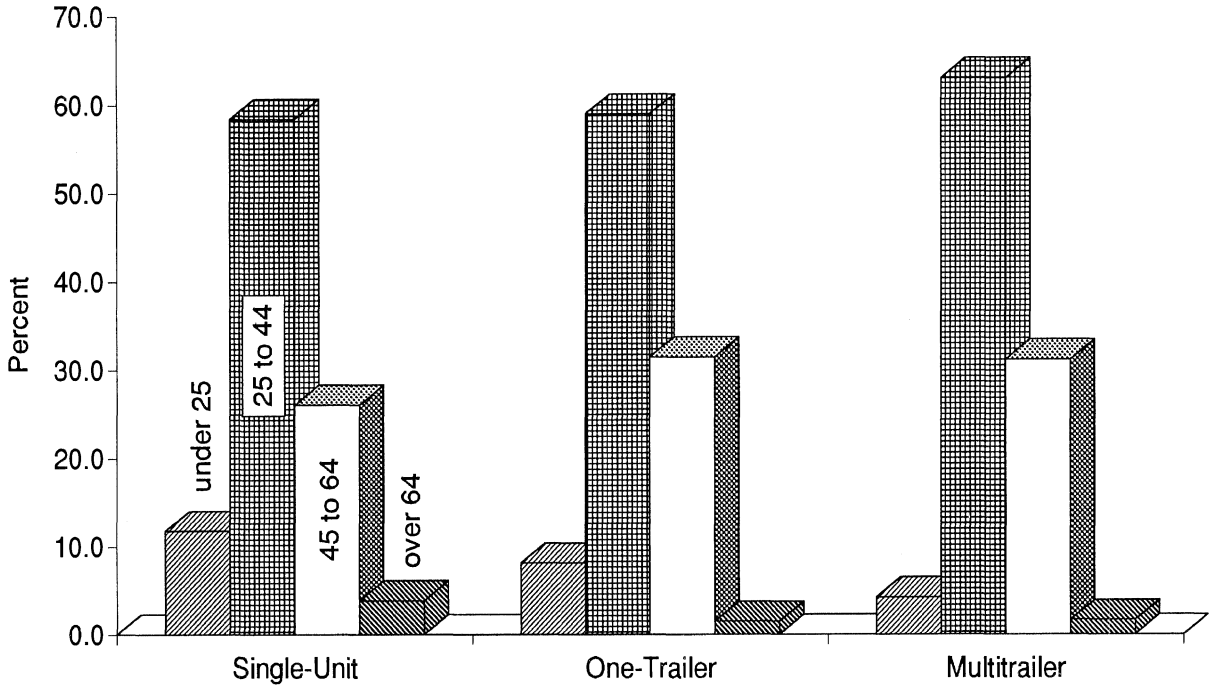
	Single-Unit		One-Trailer		Multitrailer		Unknown		Total	
Driver age	N	%	N	%	N	%	N	%	N	%
under 25	6,000	11.7	7,000	8.1	*	4.3	1,000	22.6	15,000	10.0
25 to 44	32,000	58.4	51,000	58.9	2,000	63.0	4,000	57.9	88,000	58.8
45 to 64	14,000	26.0	27,000	31.4	1,000	31.1	1,000	15.8	43,000	28.8
over 64	2,000	3.9	1,000	1.5	*	1.7	*	3.6	4,000	2.5
Total	54,000	100.0	87,000	100.0	2,000	100.0	6,000	100.0	150,000	100.0

* GES estimate less than 500

Note: Total includes fewer than 500 with unknown age.

Sources: 1994 TIFA, 1994 GES

Figure V-1 Driver Age by Configuration Type



Sources: 1994 TIFA, 1994 GES

Configuration type

Table V-5 shows the distribution of driver injuries by configuration type for drivers involved in traffic accidents in 1994. Overall, the distributions are similar, with over 80% of the drivers uninjured in each configuration type. The proportion of multitrailer drivers fatally injured is slightly higher than the other two configurations, though the number of multitrailer drivers who were killed is much smaller than for the other two. In 1994, 322 drivers of one-trailer trucks were killed in traffic accidents, compared with 216 single-unit drivers, and 27 multitrailer drivers.

Table V-5 Driver Injury Severity by Configuration Type

Injury	Single-Unit		One-Trailer		Multitrailer		Unknown		Total	
severity	N	%	N	%	N	%	N	%	N	%
Fatal	216	0.4	322	0.4	27	1.1	19	0.3	584	0.4
A injury	2,000	4.1	3,000	3.3	*	1.3	*	1.7	5,000	3.5
B injury	3,000	5.2	4,000	4.9	*	2.5	*	0.5	7,000	4.8
C injury	4,000	7.8	5,000	5.6	*	4.1	*	5.3	10,000	6.4
None	45,000	82.3	74,000	85.6	2,000	91.1	6,000	92.2	127,000	84.7
Total	54,000	100.0	87,000	100.0	2,000	100.0	6,000	100.0	150,000	100.0

* GES estimate less than 500

Note: Total includes fewer than 500 with unknown injury severity.

Sources: 1994 TIFA, 1994 GES

Alcohol use

Table V-6 shows alcohol use as reported by the police for drivers of trucks involved in traffic accidents in 1994. Overall, police-reported alcohol use was low for truck drivers, at 3.1%. The rates are low for all configurations, though higher for drivers of multitrailer combinations (9.1%). Note, however, that the estimated number of multitrailer combinations in traffic accidents is only 2,000, so the associated sampling error is relatively larger. (See the Technical Appendix for a discussion of sampling errors in the General Estimates System data.)

Reported alcohol use for drivers of passenger cars was significantly higher than for truck drivers (table V-7). Alcohol use was reported for 8.5% of passenger car drivers involved in an accident, a proportion that is almost three times higher than for truck drivers. One difference between truck and car drivers is that trucks are typically used for work and business purposes, while passenger cars are used more often for recreation, where alcohol consumption is more likely.

The reader is cautioned that the rates reported here are for alcohol use as recorded by the reporting police officer. Many researchers believe that actual rates of alcohol use are higher. However, even if true alcohol use rates are higher, the ratio between truck and passenger car driver use rates would likely remain roughly the same.

Table V-6 Driver Alcohol Use by Configuration Type

Alcohol use	Single-Unit		One-Trailer		Multitrailer		Unknown		Total	
	N	%	N	%	N	%	N	%	N	%
No	52,000	96.9	83,000	95.9	2,000	89.4	6,000	94.0	144,000	96.1
Yes	1,000	2.5	3,000	3.2	*	9.1	*	5.3	5,000	3.1
Not reported	*	0.5	1,000	0.7	*	1.0	*	0.7	1,000	0.6
Total	54,000	100.0	87,000	100.0	2,000	100.0	6,000	100.0	150,000	100.0

* GES estimate less than 500

Note: Total includes fewer than 500 drivers with unknown alcohol use.

Sources: 1994 TIFA, 1994 GES

Table V-7 Driver Alcohol Use for Passenger Cars

Alcohol use	Passenger car	
	N	%
No	3,066,000	91.5
Yes	284,000	8.5
Total	3,350,000	100.0

Source: 1994 GES

Manner of collision and first harmful event

Table V-8 and figure V-2 show the distribution of driver injury severity for different collision types. (The figure omits the "no injury" category to better show detail among injury types. Percentages sum to 100 for each collision type.) Rearend, angle, and sideswipe collisions were the least likely to result in injury to truck drivers. For each of those collision types, about 90% of involved truck drivers escaped with no injury at all. Head-on collisions and single-vehicle accidents, in contrast, produced much higher rates of driver injury. Single-vehicle accidents were clearly the most serious accident type for truck drivers. Four hundred and three drivers were killed in single-vehicle truck accidents, accounting for 69% of the 584 truck drivers killed in traffic accidents 1994. An additional estimated 2,000 drivers received A injuries and 4,000 received B injuries.

Table V-8 Driver Injury Severity by Manner of Collision

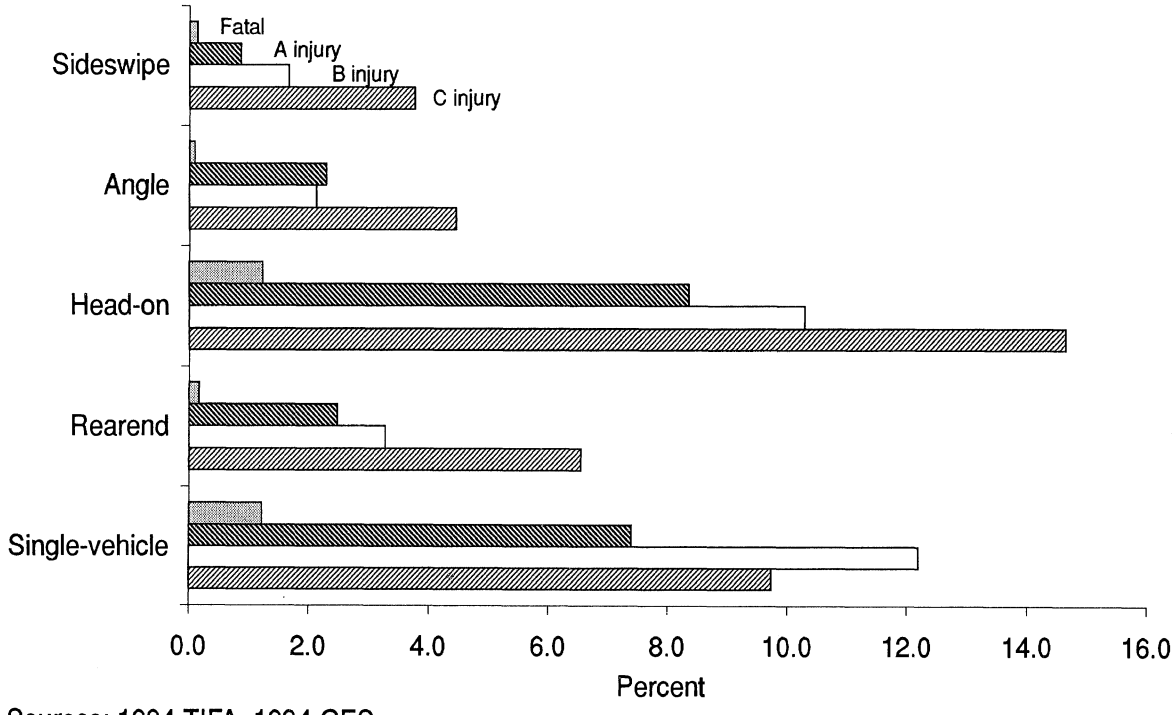
Injury	Noncollision		Collision											
	Single-vehicle		Rearend		Head-on		Angle		Sideswipe		Other/unknown		Total	
severity	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Fatal	403	1.2	67	0.2	41	1.2	53	0.1	17	0.1	3	13.3	584	0.4
A injury	2,000	7.4	1,000	2.5	*	8.4	1,000	2.3	*	0.9	*	*	5,000	3.5
B injury	4,000	12.2	1,000	3.3	*	10.3	1,000	2.1	*	1.7	*	*	7,000	4.8
C injury	3,000	9.7	3,000	6.5	*	14.7	3,000	4.5	*	3.8	*	13.3	10,000	6.4
No injury	23,000	69.1	36,000	87.4	2,000	65.1	54,000	90.9	12,000	93.6	*	73.4	127,000	84.7
Total	33,000	100.0	41,000	100.0	3,000	100.0	60,000	100.0	13,000	100.0	*	100.0	150,000	100.0

* GES estimate less than 500 or less than 0.05%

Note: Total includes fewer than 500 drivers with unknown injury severity.

Sources: 1994 TIFA, 1994 GES

Figure V-2 Driver Injury by Manner of Collision



Sources: 1994 TIFA, 1994 GES

Table V-9 and figure V-3 show the distribution of driver injury by the first harmful event in the traffic accident. (The figure omits the "no injury" category to better show detail among injury types. Percentages sum to 100 for each first harmful event.) A large majority of driver fatalities and serious injuries were associated with rollover, collisions with fixed objects, and collisions with other motor vehicles. Where the collision was with another motor vehicle, table V-8 showed that most serious driver injuries occurred in head-on, angle, and rearend collisions. Rollover and collisions with fixed and non-fixed objects, which are frequently single-vehicle accidents, were the most serious first harmful events in terms of the proportion of drivers injured or killed. Where the first harmful event was rollover, 11.7% of drivers were either killed or received A injuries. Only about 55% of such drivers were uninjured, compared with 84.7% uninjured among all accident-involved truck drivers in 1994. Where the first harmful event was a collision with a fixed object, such as a guardrail or utility pole, 11.5% received fatal or A injuries.

Table V-9 Driver Injury by First Harmful Event

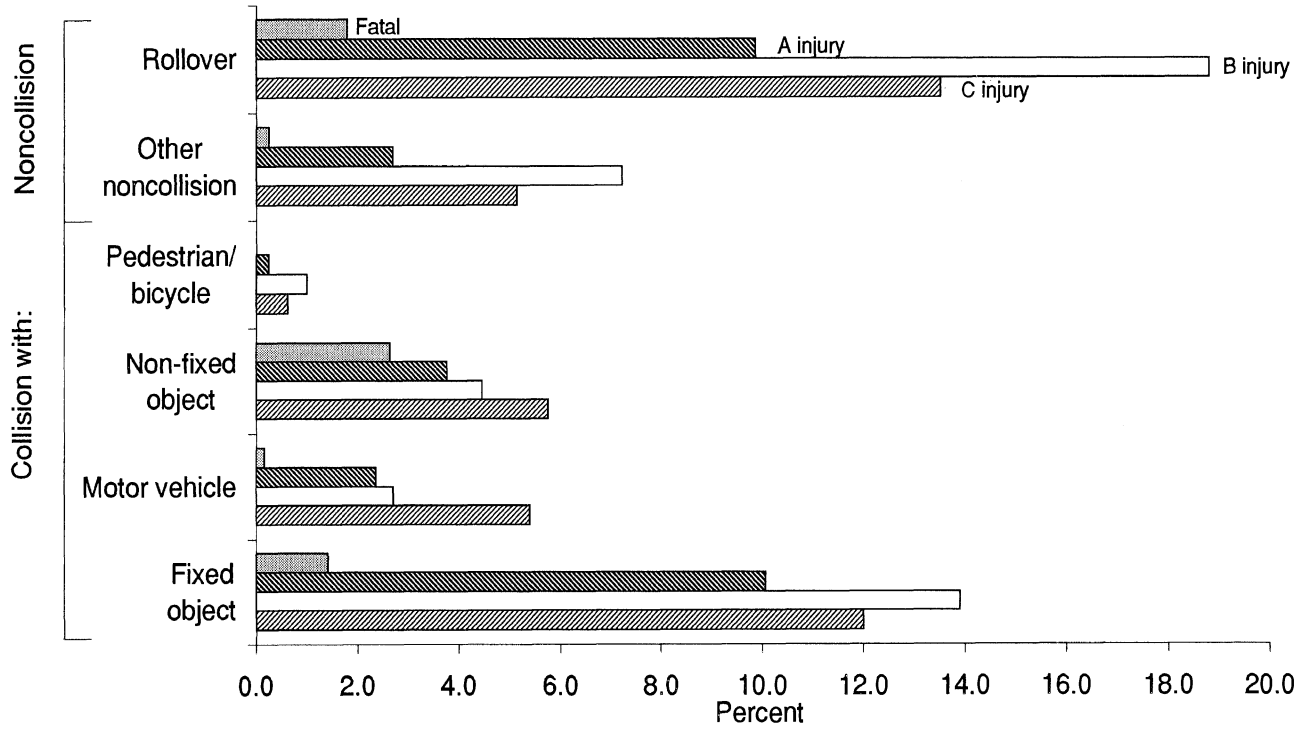
Injury	Noncollision				Collision with:								Total	
	Rollover		Other		Motor vehicle		Pedestrian/bike		Non-fixed object		Fixed object			
severity	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Fatal	143	1.8	17	0.2	180	0.2	0	0.0	46	2.6	198	1.4	584	0.4
A injury	1,000	9.9	*	2.7	3,000	2.4	*	0.2	*	3.8	1,000	10.1	5,000	3.5
B injury	1,000	18.8	1,000	7.2	3,000	2.7	*	1.0	*	4.4	2,000	13.9	7,000	4.8
C injury	1,000	13.5	*	5.1	6,000	5.4	*	0.6	*	5.8	2,000	12.0	10,000	6.4
No injury	4,000	54.9	6,000	84.7	104,000	89.2	2,000	97.9	1,000	82.8	9,000	62.4	127,000	84.7
Total	8,000	100.0	7,000	100.0	117,000	100.0	2,000	100.0	2,000	100.0	14,000	100.0	150,000	100.0

* GES estimate less than 500

Note: Total includes fewer than 500 drivers with unknown injury severity.

Sources: 1994 TIFA, 1994 GES

Figure V-3 Driver Injury by First Harmful Event



Sources: 1994 TIFA, 1994 GES

Restraint use

Table V-10 shows restraint use by driver injury. The top section of the table tabulates estimated frequencies, the middle section shows the distribution of restraint use for each injury severity, and the bottom section reports the injury distribution for each restraint use. Almost 59% (344 of 584) of truck drivers killed in traffic accidents used no restraints, while only 17.6% were belted. In contrast, 39.9% of drivers who sustained no injuries used 3-point safety belts, and an additional 29.7% used either a lap belt alone or a shoulder belt alone, for a total of 69.6% using some sort of safety belt. Similarly, 71.9% of truck drivers sustaining only C injuries used some sort of safety belt restraint. The reader is cautioned, however, that safety belt use for all but the most seriously injured is primarily self-reported, since the occupants are typically out of the vehicles by the time the police arrive. Consequently, the amount of safety belt use by the uninjured and lightly injured may be exaggerated. Note also the high proportion of cases, 19.7% overall, for which restraint use is unknown.

Table V-10 Driver Injury Severity by Restraint Use

Injury severity	None	3 point belt	Other	Unknown	Total
		(frequencies)			
Fatal	344	54	49	137	584
A injury	1,000	2,000	1,000	1,000	5,000
B injury	2,000	3,000	2,000	*	7,000
C injury	2,000	4,000	3,000	1,000	10,000
None	12,000	51,000	38,000	26,000	127,000
Total	17,000	59,000	43,000	29,000	150,000
		(row percentages)			
Fatal	58.9	9.2	8.4	23.5	100.0
A injury	27.9	31.6	17.5	23.1	100.0
B injury	23.1	43.5	26.8	6.6	100.0
C injury	17.7	42.1	29.8	10.4	100.0
None	9.5	39.9	29.7	20.9	100.0
Total	11.5	39.8	29.1	19.7	100.0
		(column percentages)			
Fatal	2.0	0.1	0.1	0.5	0.4
A injury	8.5	2.8	2.1	4.1	3.5
B injury	9.7	5.3	4.4	1.6	4.8
C injury	9.8	6.7	6.5	3.4	6.4
None	70.0	85.1	86.6	89.8	84.7
Total	100.0	100.0	100.0	100.0	100.0

* GES estimate less than 500

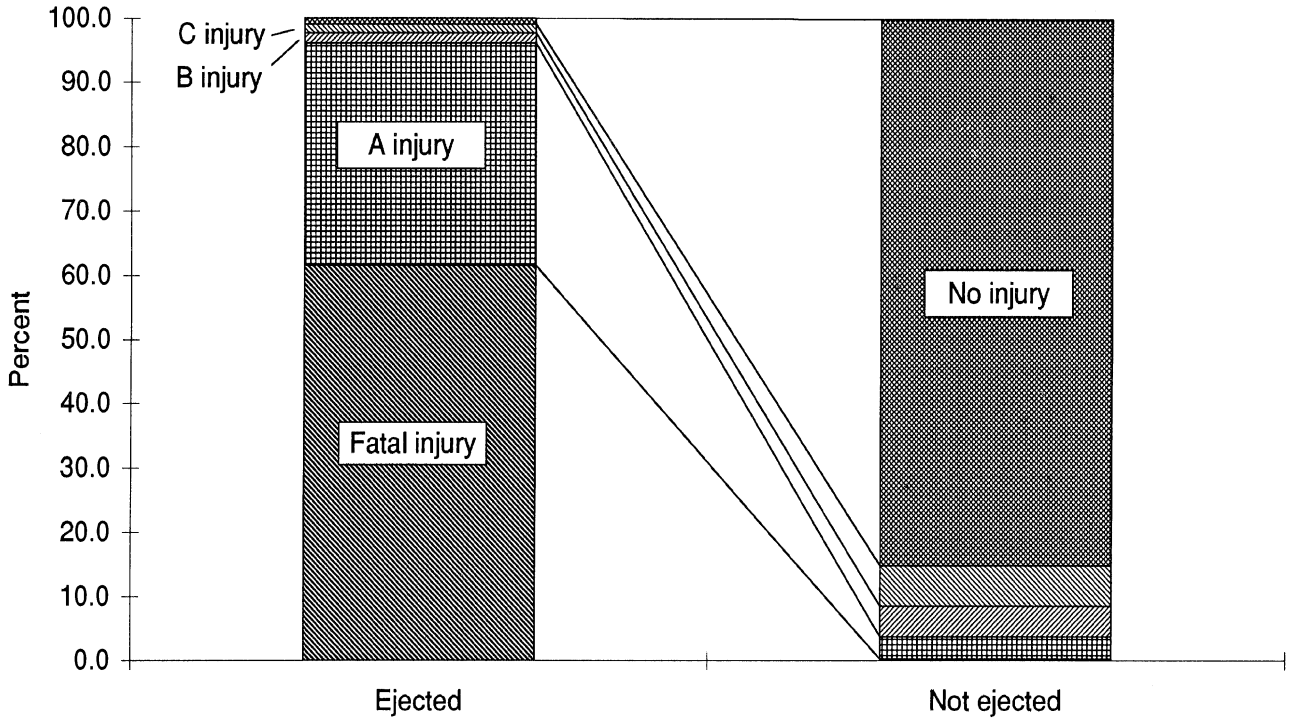
Note: Total includes fewer than 500 drivers with unknown injury severity.

Sources: 1994 TIFA, 1994 GES

Ejection and rollover

Ejection is strongly associated with serious driver injuries. There were fewer than an estimated 500 ejections of truck drivers in traffic accidents in 1994. Nevertheless, the probability of serious injury is high when ejection occurs. Figure V-4 shows the injury distribution for ejection and no ejection. Only 1.0% of ejected drivers were uninjured, over 61.5% were killed, and an additional 34.5% sustained A injuries. Among drivers who stayed in the cab, only 0.3% were killed and 3.4% sustained A injuries.

Figure V-4 Driver Injury by Ejection



Sources: 1994 TIFA, 1994 GES

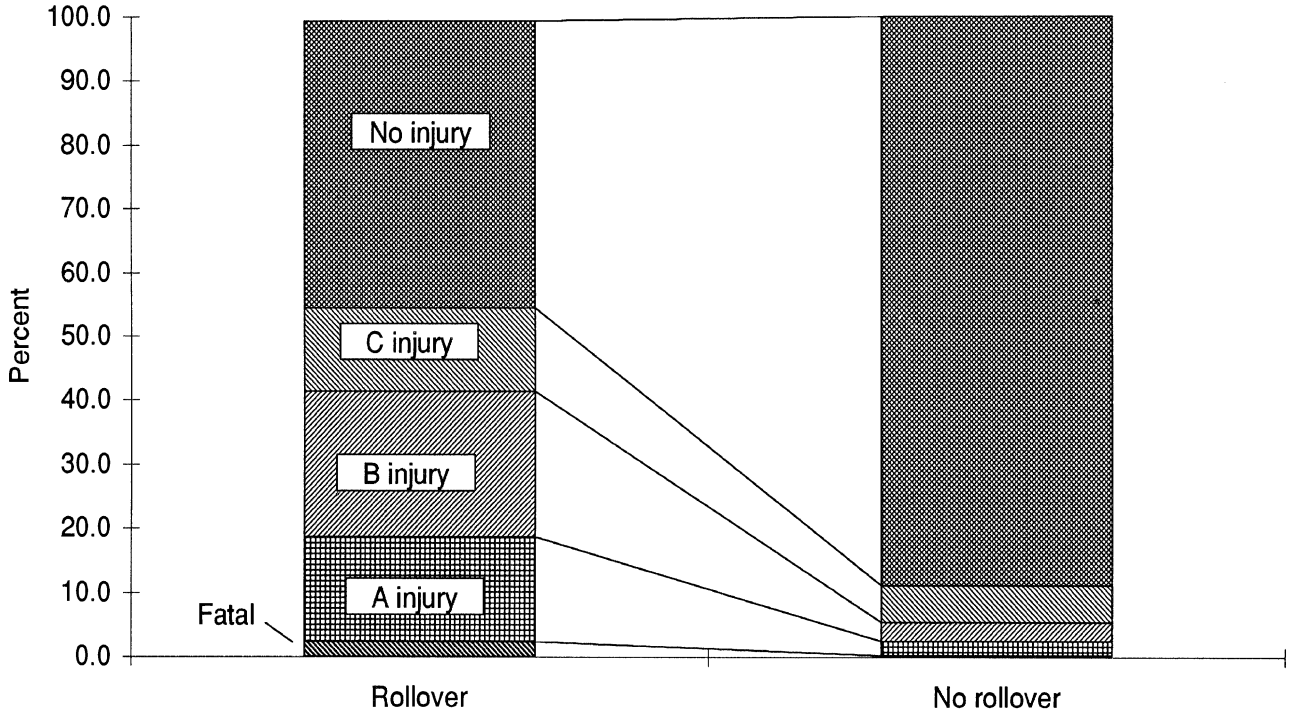
Table V-9 tabulated rollover when it was the first harmful event. Table V-11 shows all rollovers, regardless of when the rollover occurred in the accident sequence. Rollover is associated with serious driver injuries, though not as strongly as ejection. An estimated 13,000 drivers were involved in a rollover. Of these, 321 (2.4%) were killed and an estimated 2,000 (16.3%) received A injuries. Only 44.9% of the drivers were uninjured. In contrast, 88.7% of the drivers of trucks that did not roll over were uninjured. Only about 9% of all accident-involved truck drivers experienced rollover, but 55% of driver fatalities and about 42% of drivers with A injuries occurred in trucks that rolled over. Figure V-5 illustrates the injury distributions for trucks that rolled over and those that remained on their wheels.

Table V-11 Driver Injury by Rollover

Injury	Rollover		No rollover		Total	
severity	N	%	N	%	N	%
Fatal	321	2.4	263	0.2	584	0.4
A injury	2,000	16.3	3,000	2.2	5,000	3.5
B injury	3,000	22.7	4,000	3.0	7,000	4.8
C injury	2,000	13.0	8,000	5.7	10,000	6.4
None	6,000	44.9	121,000	88.7	127,000	84.7
Total	13,000	100.0	136,000	100.0	150,000	100.0

Note: Total includes fewer than 500 drivers with unknown injury severity
Sources: 1994 TIFA, 1994 GES

Figure V-5 Driver Injury by Rollover



Sources: 1994 TIFA, 1994 GES

VI. Special Focus: Longer Combination Vehicles

There is no common, uniform definition of a *longer combination vehicle.* Each State exercises primary responsibility for setting truck weight and length limits within its borders, consistent with Federal regulations. The Surface Transportation Assistance Act of 1982 (STAA) required States to permit tractors with two trailers, each up to 28.5 feet long, on Interstate highways and other routes designated by the Federal Highway Administration. In addition, the Act prohibited States from establishing a maximum gross combination weight (GCW) limit of less than 80,000 pounds. In 1991, the Intermodal Surface Transportation Efficiency Act (ISTEA) froze State weight and length limits by providing that no State could permit multitrailer trucks longer or heavier than those operating under existing State laws as of June 1, 1991. Accordingly, in this section, a longer combination vehicle is defined as a combination vehicle with more than one trailer that exceeds the minimum weight and length standards set by the STAA of 1982. An LCV, therefore, is:

- a truck-tractor with at least two trailers capable of carrying cargo;
- and at least one trailer 29 feet long or longer;

or,

- a truck-tractor with at least two trailers capable of carrying cargo;
- and a gross combination weight greater than 80,000 pounds;

or,

- a truck-tractor with three trailers capable of carrying cargo.

Overlength LCVs have at least one cargo-carrying trailer longer than 28.5 feet. **Overweight** LCVs exceed the weight standard only (i.e., both trailers are within the length standard but the gross combination weight (GCW) of the vehicle exceeds 80,000 pounds). LCVs categorized as **both** exceed both the weight and length standards. Triples are LCVs with three cargo-carrying trailers. A truck-tractor, two-trailer combination that falls within the limits established by the STAA of 1982 will be termed an **STAA double**.

Data presented in this section are drawn entirely from the Trucks Involved in Fatal Accident (TIFA) file; accordingly only LCVs involved in fatal accidents are included. Currently, only the TIFA file includes the data on individual trailer lengths and GCW necessary to identify LCVs.

Five-year trends

Table VI-1 shows the number of LCVs involved in fatal accidents, 1990-1994. Also shown for comparison is the number of "STAA doubles" and doubles combinations for which weight or trailer-length information is not available to make a classification. The grand total for the table includes all tractors with multiple trailers and the proportions calculated are of all tractors with multiple trailers (doubles and a triple).

Table VI-1 Fatal Involvements of LCVs and "STAA Doubles," 1990-1994

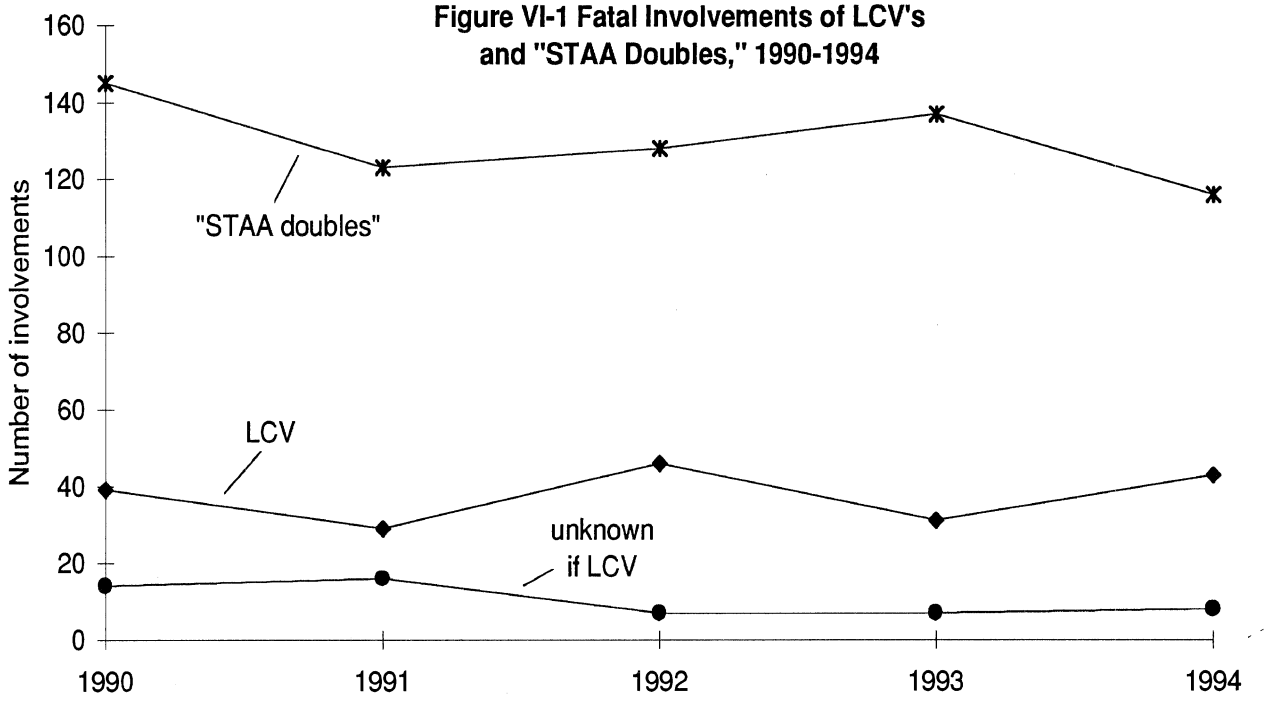
	1990		1991		1992		1993		1994	
Year	N	%	N	%	N	%	N	%	N	%
Longer Combination Vehicles										
Overlength	24	12	20	12	17	9	15	9	10	6
Overweight	10	5	2	1	12	7	6	3	18	11
Both	3	2	7	4	14	8	9	5	13	8
Triple	2	1	0	0	3	2	1	1	2	1
Subtotal	39	20	29	17	46	25	31	18	43	26
Non-LCV Tractor and Two Trailers										
"STAA double"	145	73	123	73	128	71	137	69	116	77
Unknown double	14	7	16	10	7	4	7	5	8	4
Grand total	198	100	168	100	181	100	175	100	167	100

Source: 1990-1994 TIFA

The sum of all LCV types—overlength, overweight, both overweight and overlength, and triples—varied from a low of 29 in 1991 to a high of 46 in 1992. In 1994, 43 LCVs were involved in fatal accidents. Similarly, the total of "STAA doubles" and other doubles of unknown type ranged from 159 in 1990 to 124 in 1994. The number of LCVs and non-LCV doubles has remained relatively constant over the five-year period.

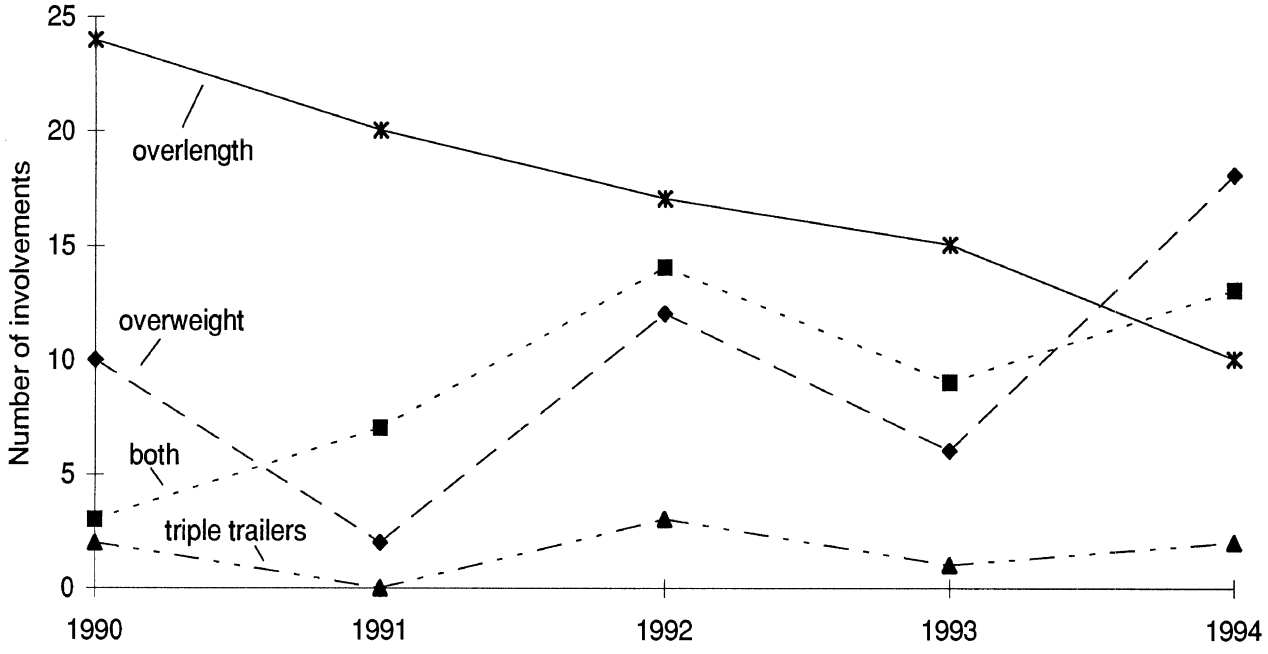
Figure VI-2 shows the detail underlying the LCV line in figure VI-1. Overweight LCVs are the most common type, triples the least common. There were two triples involved in a fatal accident in 1990, none in 1991, three in 1992, one in 1993, and two in 1994. The number of involvements is so small that there does not appear to be any meaningful trend.

Figure VI-1 Fatal Involvements of LCV's and "STAA Doubles," 1990-1994



Source: 1991-1994 TIFA

Figure VI-2 Fatal Involvements of LCV Types, 1990-1994



Source: 1991-1994 TIFA

Common LCV types

Two LCV types have common names in the trucking industry. Turnpike doubles consist of two trailers of the same length, each 40 to 48 feet long. Rocky Mountain doubles have a 40-foot first trailer and a short, typically 28-foot, second trailer. As table VI-2 shows, most LCVs do not fall into either category. The definition of "Rocky Mountain doubles" was broadened for table VI-2 to include any combination with a first trailer over 40 feet and a second trailer between 20 and 30 feet long. Even using this expanded definition, almost 42% of the LCVs involved in fatal accidents in 1994 ("other LCV" in the table) did not fall into any of the standard types. There were only two triples, five Rocky Mountain doubles, and no turnpike doubles involved in a fatal accident in 1994.

Table VI-2 Common LCV Types
Fatal Involvements Only

	N	%
Rocky Mountain double	5	12
Turnpike double	0	0
Other LCV	18	42
Overweight	18	42
Triple	2	5
Total	43	100

Source: 1994 TIFA

Table VI-3 compares the number of fatal involvements, fatalities, and deaths per involvement for LCVs, other tractors with two trailers, and tractor-semitrailers. There were almost 2,800 tractor-semitrailers involved in a fatal accident in 1994, with 3,367 deaths and a rate of 1.20 deaths per involvement. The death rate for all LCVs was lower, 1.09. The death rate for overweight LCVs was 1.00, for overlength LCVs 1.30, and for triples 1.00. The reader is cautioned that, since there are so few LCV fatal involvements, one accident with a large number of deaths can skew the results.

Table VI-3 Fatal Involvements and Deaths
for Selected Combination Types

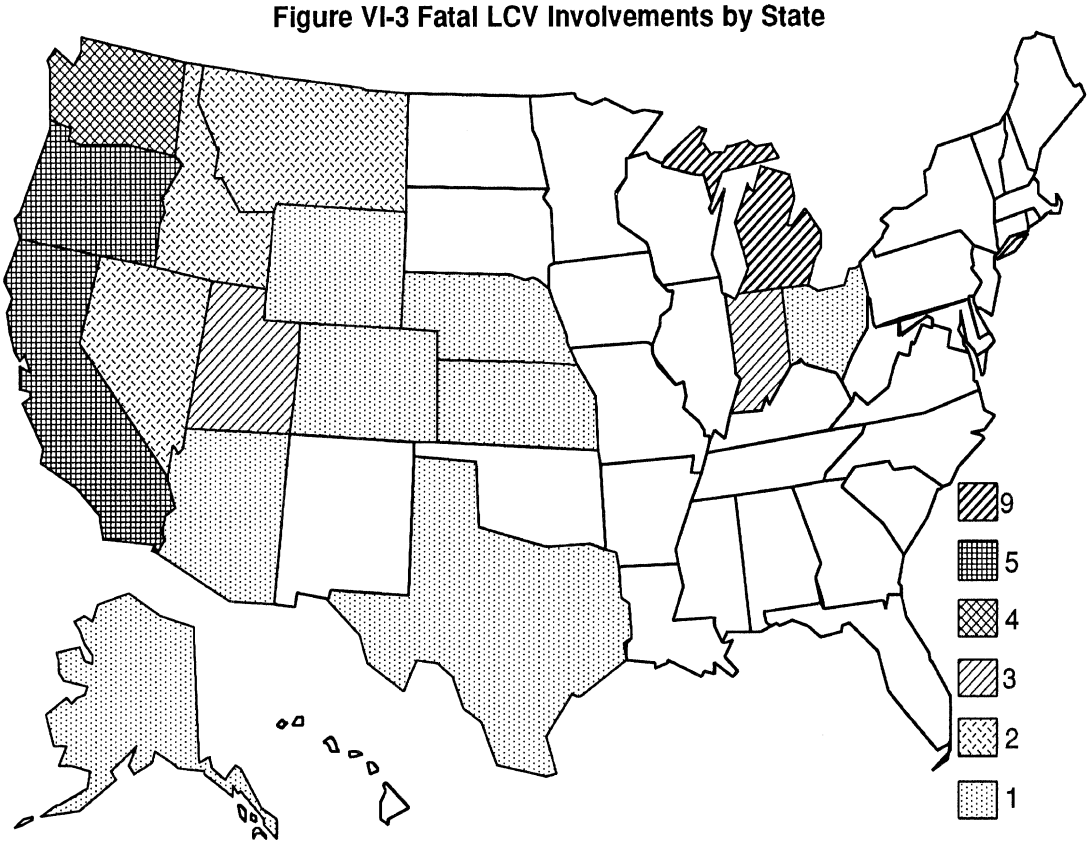
Combination type	Involvements	Total deaths	Deaths per involvement
Longer Combination Vehicles			
Overlength	10	13	1.30
Overweight	18	18	1.00
Both	13	14	1.08
Triple	2	2	1.00
Subtotal	43	47	1.09
Non-LCV tractor and two trailers			
"STAA double"	116	130	1.12
Unknown double	8	8	1.00
Subtotal	124	138	1.11
Other tractor combination			
Tractor-semitrailer	2,799	3,367	1.20

Source: 1994 TIFA

LCV fatal involvements by State

Figure VI-3 shows the distribution of LCV fatal involvements across the United States in 1994. Twenty-six of the 43 LCV involvements occurred in ten contiguous western States, although Michigan had the highest number of fatal involvements with nine. California and Oregon had five, Washington had four, and Utah and Indiana had three each. The western States have historically permitted longer truck combinations than the East, in part because of the great distances between population centers. Michigan's weight laws allow gross combination weights (GCW) up to 164,000 pounds. Trucks with gross weights over 80,000 pounds accounted for seven of Michigan's nine LCV involvements.

Figure VI-3 Fatal LCV Involvements by State



Source: 1994 TIFA

Table VI-4 shows the States in which fatal accidents involving LCVs occurred, broken down by LCV type. In 1994, there was one triple-trailer combination involved in a fatal accident in Oregon and one in Indiana. Michigan and California each had five overweight-only LCV involvements. All but two of the LCVs involved in a fatal accident in Michigan in 1994 weighed over 80,000 pounds.

(Fatal LCV involvements are listed for some States that do not ordinarily permit LCVs. These vehicles were operating either under special permits, exemptions, or illegally.)

Table VI-4 State by LCV Type
Fatal Involvements Only

	Overlength		Overweight		Both		Triple		Total	
State	N	%	N	%	N	%	N	%	N	%
Alaska	1	10	0	0	0	0	0	0	1	2
Arizona	0	0	1	6	0	0	0	0	1	2
California	0	0	5	28	0	0	0	0	5	12
Colorado	0	0	0	0	1	8	0	0	1	2
Idaho	0	0	1	6	1	8	0	0	2	5
Indiana	0	0	0	0	2	15	1	50	3	7
Kansas	0	0	1	6	0	0	0	0	1	2
Michigan	2	20	5	28	2	15	0	0	9	21
Montana	2	20	0	0	0	0	0	0	2	5
Nebraska	0	0	1	6	0	0	0	0	1	2
Nevada	0	0	0	0	2	15	0	0	2	5
Ohio	1	10	0	0	0	0	0	0	1	2
Oregon	2	20	1	6	1	8	1	50	5	12
Texas	0	0	1	6	0	0	0	0	1	2
Utah	1	10	0	0	2	15	0	0	3	7
Washington	1	10	2	11	1	8	0	0	4	9
Wyoming	0	0	0	0	1	8	0	0	1	2
Total	10	100	18	100	13	100	2	100	43	100

Source: 1994 TIFA

Total length

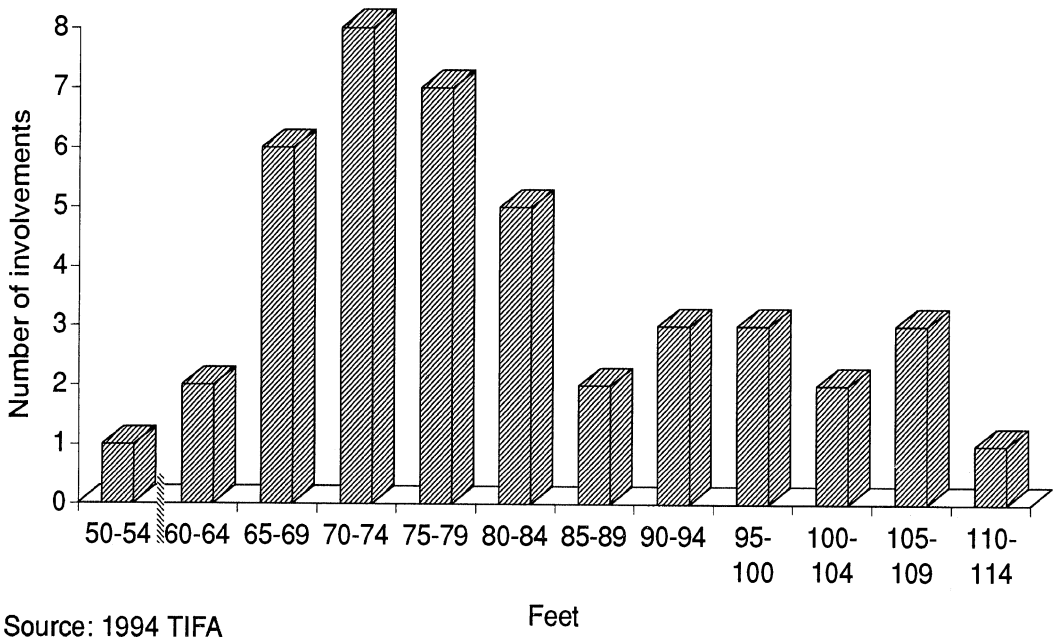
Table VI-5 tabulates total length for each type of LCV while figure VI-4 shows the distribution for all LCVs. Overall, LCVs involved in fatal accidents ranged from 54 to 112 feet long. It is possible for LCVs to qualify as "overlength" with relatively short total lengths, since trailer length is a criterion for an LCV while overall length is not. One of the "overlength" LCVs was only 70 feet long. Most LCVs that met the length criterion ranged from 75 to 85 feet long, while the one triple combination was 105 feet long and the other 108.

Table VI-5 LCV Type by Total Length
Fatal Involvements Only

Length	Overlength		Overweight		Both		Triple		Total	
in feet	N	%	N	%	N	%	N	%	N	%
50-54	0	0	1	6	0	0	0	0	1	2
60-64	0	0	2	11	0	0	0	0	2	5
65-69	0	0	6	33	0	0	0	0	6	14
70-74	1	10	4	22	3	23	0	0	8	19
75-79	3	30	2	11	2	15	0	0	7	16
80-84	2	20	2	11	1	8	0	0	5	12
85-89	1	10	0	0	1	8	0	0	2	5
90-94	1	10	0	0	2	15	0	0	3	7
95-100	1	10	0	0	2	15	0	0	3	7
100-104	0	0	1	6	1	8	0	0	2	5
105-109	0	0	0	0	1	8	2	100	3	7
110-114	1	10	0	0	0	0	0	0	1	2
Total	10	100	18	100	13	100	2	100	43	100

Source: 1994 TIFA

Figure VI-4 Overall Length of LCVs Involved in Fatal Accidents



Source: 1994 TIFA

Gross combination weight

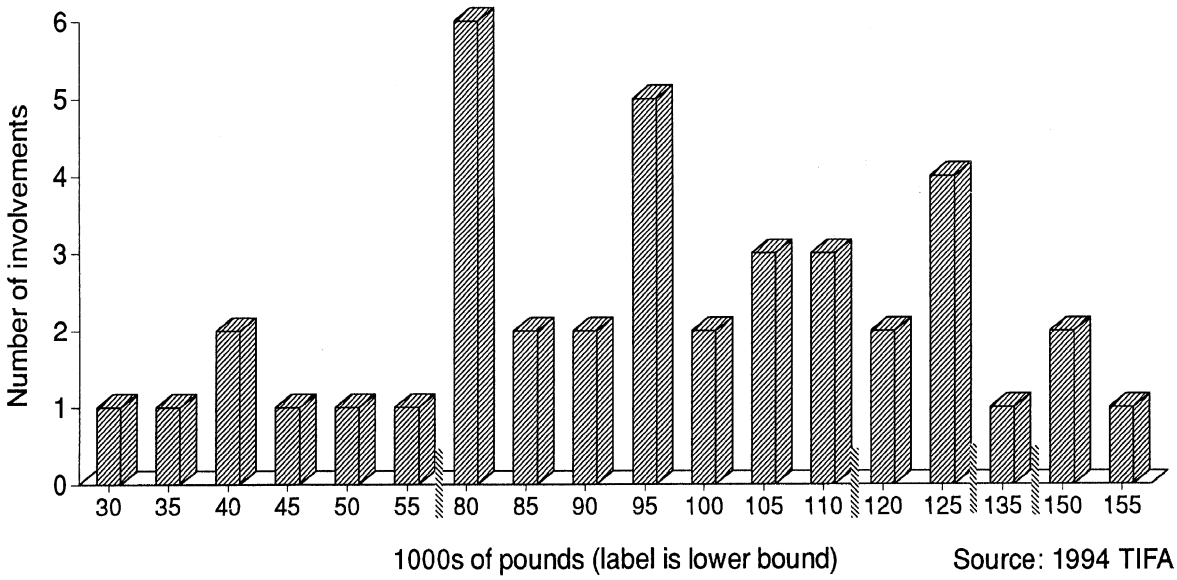
LCVs involved in fatal accidents in 1994 ranged in gross combination weight (GCW) from 34,000 pounds to 156,000 pounds (table VI-6). Thirty-one of the 43 LCVs weighed over 80,000 pounds; 18 weighed over 100,000 pounds. Figure VI-5 shows the distribution of GCW for all LCVs. The peak at 40,000 pounds corresponds to empty or near-empty vehicles. Trucks heavier than 80,000 pounds were likely fully loaded.

Table VI-6 LCV Type by Gross Combination Weight (GCW)
Fatal Involvements Only

	Overlength		Overweight		Both		Triple		Total	
GCW	N	%	N	%	N	%	N	%	N	%
30,001-35,000	1	10	0	0	0	0	0	0	1	2
35,001-40,000	1	10	0	0	0	0	0	0	1	2
40,001-45,000	2	20	0	0	0	0	0	0	2	5
45,001-50,000	1	10	0	0	0	0	0	0	1	2
50,001-55,000	1	10	0	0	0	0	0	0	1	2
55,001-60,000	1	10	0	0	0	0	0	0	1	2
80,001-85,000	0	0	6	33	0	0	0	0	6	14
85,001-90,000	0	0	2	11	0	0	0	0	2	5
90,001-95,000	0	0	1	6	1	8	0	0	2	5
95,001-100,000	0	0	1	6	2	15	2	100	5	12
100,001-105,000	0	0	1	6	1	8	0	0	2	5
105,001-110,000	0	0	2	11	1	8	0	0	3	7
110,001-115,000	0	0	2	11	1	8	0	0	3	7
120,001-125,000	0	0	0	0	2	15	0	0	2	5
125,001-130,000	0	0	1	6	3	23	0	0	4	9
135,001-140,000	0	0	0	0	1	8	0	0	1	2
150,001-155,000	0	0	2	11	0	0	0	0	2	5
155,001-160,000	0	0	0	0	1	8	0	0	1	2
Unknown	3	30	0	0	0	0	0	0	3	7
Total	10	100	18	100	13	100	2	100	43	100

Source: 1994 TIFA

Figure VI-5 Gross Combination Weight of LCVs
Fatal Involvements Only



Cargo body style and cargo

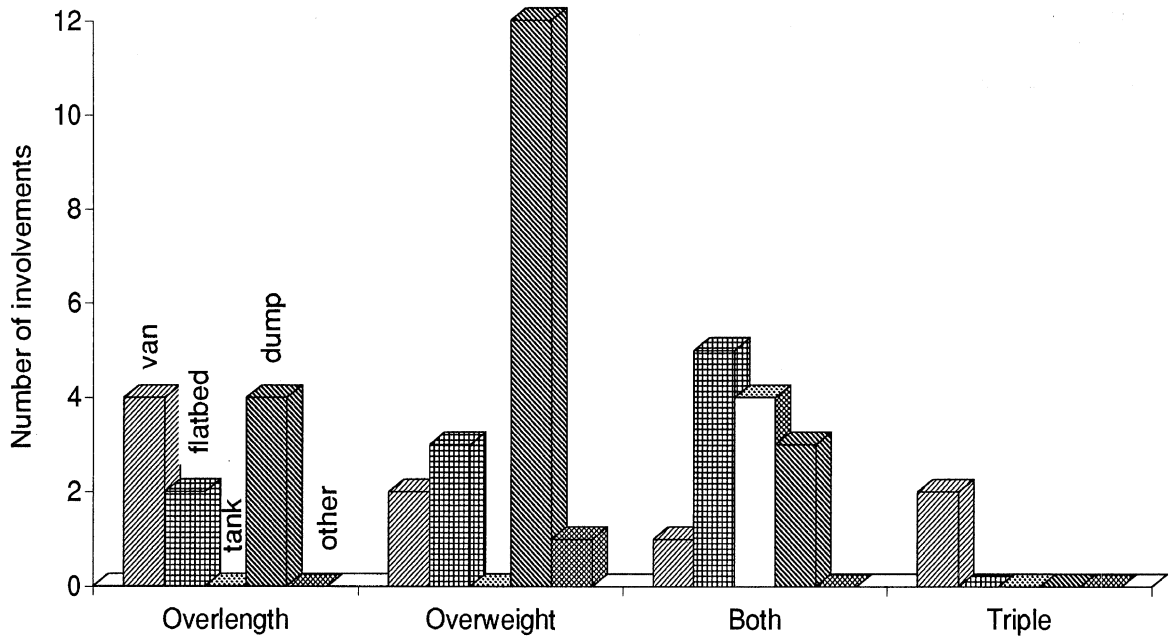
Table VI-7 shows the cargo body type of LCVs involved in fatal accidents. Both triple-trailer LCVs pulled van trailers. This reflects the common usage of triples in long-haul general freight carriage. The diversity of trailer cargo body types is striking. Seven of the 23 LCVs that met the length criterion ("overlength" and "both") had flatbed trailers, but there were also seven dumps, five vans, and four tank trailer combinations. Similarly, though LCVs with GCWs over 80,000 pounds ("overweight" and "both") included fifteen dump and four tank combinations, there were also eight flatbeds and three van combination. Without exposure data, it is impossible to know if these distributions reflect the diversity of LCVs or differential risk associated with particular cargo bodies.

Table VI-7 Cargo Body Style by LCV Type
Fatal Involvements Only

Cargo	Overlength		Overweight		Both		Triple		Total	
body	N	%	N	%	N	%	N	%	N	%
Van	4	40	2	11	1	8	2	100	9	21
Flatbed	2	20	3	17	5	38	0	0	10	23
Tank	0	0	0	0	4	31	0	0	4	9
Dump	4	40	12	67	3	23	0	0	19	44
Other	0	0	1	6	0	0	0	0	1	2
Total	10	100	18	100	13	100	2	100	43	100

Source: 1994 TIFA

Figure VI-6 Cargo Body Style by LCV Type
Fatal Involvements Only



Source: 1994 TIFA

Only six of the 43 LCVs were empty at the time of the accident; the remaining 37 carried a variety of cargoes, as the diversity of cargo bodies indicated in table VI-7 would suggest. Of the 31 LCVs that met the weight criterion ("overweight" and "both"), fourteen were loaded with solids in bulk (e.g., gravel, wood chips, coal), five hauled farm products, three carried metal objects (e.g., coils of steel or steel beams) and lumber, and one was loaded with large objects. LCVs that were overlength only were primarily either empty (six) or carried general freight (two). Five of the LCVs included hazardous materials in their cargo and two experienced cargo spillage.

This table illustrates one aspect of including weight in the LCV definition. Combinations that qualify as overweight when fully loaded are not LCVs when empty. For weight-related LCVs, being an LCV is not an intrinsic quality of the vehicle itself, but an aspect of its use.

Table VI-8 Cargo Carried by LCV Type
Fatal Involvements Only

	Overlength		Overweight		Both		Triple		Total	
Cargo type	N	%	N	%	N	%	N	%	N	%
Empty	6	60	0	0	0	0	0	0	6	14
General freight	2	20	2	11	0	0	2	100	6	14
Metal	1	10	1	6	2	15	0	0	4	9
Large objects	0	0	1	6	0	0	0	0	1	2
Gases in bulk	0	0	0	0	1	8	0	0	1	2
Solids in bulk	1	10	9	50	5	38	0	0	15	35
Liquids in bulk	0	0	0	0	2	15	0	0	2	5
Lumber	0	0	1	6	2	15	0	0	3	7
Farm products	0	0	4	22	1	8	0	0	5	12
Total	10	100	18	100	13	100	2	100	43	100

Source: 1994 TIFA

Road type

Nineteen fatal LCV involvements (44.2%) occurred on rural major arteries. Eleven of the 43 LCV fatal involvements (25.6%) occurred on Interstate highways, including both triple involvements. Taken together, these proportions are similar to those for all truck fatal involvements (table III-5), though since LCV involvements are few, a small number of cases can have a large effect on proportions.

Table VI-9 Road Class/Area Type by LCV Type
Fatal Involvements Only

Road class/ area type	Overlength		Overweight		Both		Triple		Total	
	N	%	N	%	N	%	N	%	N	%
Interstate/Urban	0	0	0	0	1	8	0	0	1	2
Interstate/Rural	3	30	2	11	3	23	2	100	10	23
Major/Urban	1	10	2	11	2	15	0	0	5	12
Major/Rural	6	60	8	44	5	38	0	0	19	44
Other/Urban	0	0	3	17	1	8	0	0	4	9
Other/Rural	0	0	3	17	1	8	0	0	4	9
Unknown	0	0	0	0	0	0	0	0	0	0
Total	10	100	18	100	13	100	2	100	43	100

Source: 1994 TIFA

Company type

Twenty-five of the 43 LCVs involved in fatal accidents in 1994 were operated by interstate for-hire carriers (table VI-10). Together with the seven LCVs operated by private interstate carriers, almost 75% of the LCVs involved in fatal accidents were interstate. Note that LCVs meeting only the weight criterion ("overweight") were somewhat more likely to be intrastate for-hire vehicles, that is, trucks operated only within a single State's boundaries. Several of these vehicles operated in Michigan, which permits very heavy combinations.

Table VI-10 Company Type by LCV Type
Fatal Involvements Only

Company type	Overlength		Overweight		Both		Triple		Total	
	N	%	N	%	N	%	N	%	N	%
Interstate:										
Private	4	40	0	0	3	23	0	0	7	16
For-hire	3	30	13	72	7	54	2	100	25	58
Intrastate:										
Private	2	20	0	0	1	8	0	0	3	7
For-hire	1	10	5	28	2	15	0	0	8	19
Total	10	100	18	100	13	100	2	100	43	100

Source: 1994 TIFA

First harmful event

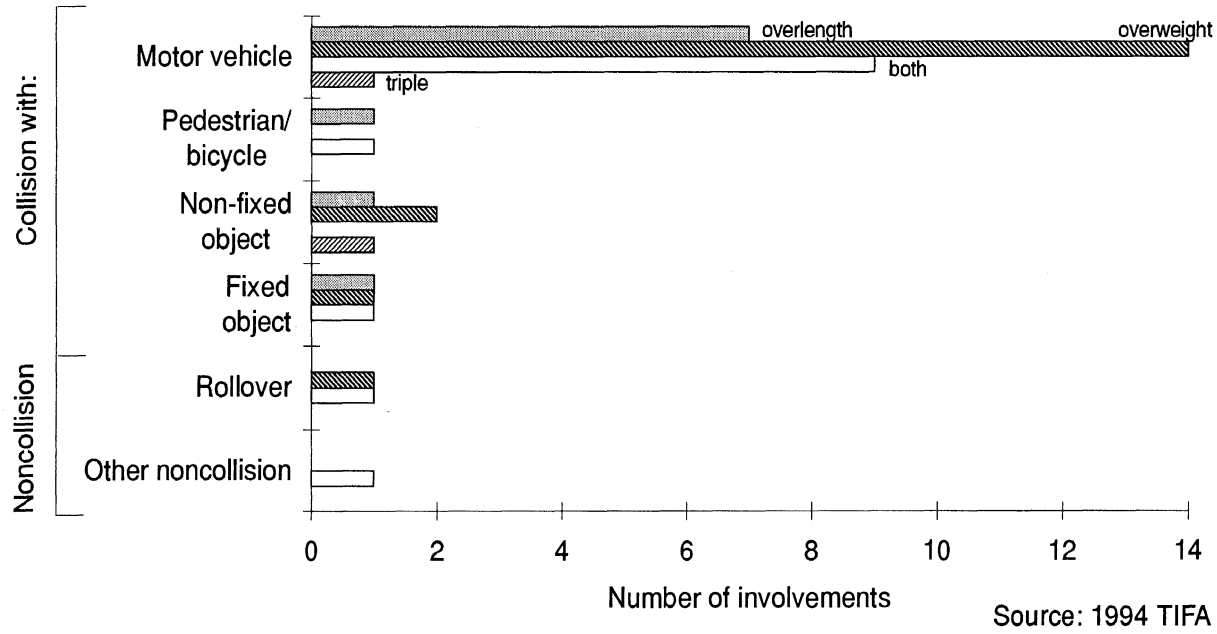
Table VI-11 shows the first harmful event in fatal accidents involving LCVs in 1994. Figure VI-7 displays the same data in graphical form. As with all trucks (table III-7) a collision with a motor vehicle in transport was the most frequent first harmful event. Thirty-one of the 43 LCVs had a collision with another motor vehicle as the first harmful event. Collisions with fixed and non-fixed objects accounted for seven of the remaining 12 cases in 1994. With so few cases, however, it is impossible to infer any association.

Table VI-11 First Harmful Event by LCV Type
Fatal Involvements Only

First harmful event	Overlength		Overweight		Both		Triple		Total	
	N	%	N	%	N	%	N	%	N	%
Collision:										
Motor vehicle	7	70	14	78	9	69	1	50	31	72
Pedestrian/bicyclist	1	10	0	0	1	8	0	0	2	5
Non-fixed object	1	10	2	11	0	0	1	50	4	9
Fixed object	1	10	1	6	1	8	0	0	3	7
Noncollision										
Rollover	0	0	1	6	1	8	0	0	2	5
Other noncollision	0	0	0	0	1	8	0	0	1	2
Total	10	100	18	100	13	100	2	100	43	100

Source: 1994 TIFA

Figure VI-7 First Harmful Event by LCV Type
Fatal Involvements Only



Source: 1994 TIFA

VII. Bus Accidents

This section presents statistics on the involvement of buses in traffic accidents in 1994. All traffic accident statistics in the section are taken from the 1994 FARS file or the 1994 GES file. The GES file has a relatively small sample of bus cases, which limits the amount of detail that can be shown in the tables. The SafetyNet accident system, when all States are fully reporting, will provide a census of all bus accidents and, consequently, a much improved description of them.

A **bus** is defined as a vehicle designed to carry at least sixteen people including the driver. Two types of buses are distinguished. A **school bus** is the familiar yellow-and-black vehicle commonly used to transport children to school. The **other bus** category includes transit (intracity) buses and cross-country (intercity) buses.

Note: All figures for involvements in fatal accidents and fatalities are taken from the FARS file. When the number is taken from FARS, it is shown exactly. Estimates based solely on GES or that combine information from FARS and GES are rounded to the nearest thousand.

Trends and overview of bus traffic accidents

In 1994, over 670,000 buses were registered to operate on U.S. roads (table VII-1). Together, they accumulated over 6.4 billion miles, each bus travelling an average of 9,570 miles per year. Buses were involved in an estimated 16,000 traffic accidents, with a total of 16,000 buses involved. An estimated 6,000 of these were school buses, 10,000 were other buses, and bus type could not be determined for fewer than 500.

Table VII-1 Bus Statistics, 1994

	School Bus	Other Bus	Unknown	Total
Vehicles				
Registrations	**	**	**	670,423
Miles traveled (millions)	**	**	**	6,416
Average travel	**	**	**	9,570
Accidents				
Number	6,000	9,000	*	16,000
Number of buses involved	6,000	10,000	*	16,000
Bus Involvements by Accident Severity				
Fatal	110	144	12	266
Injury	3,000	6,000	*	9,000
Towaway	3,000	3,000	*	6,000
Total	6,000	10,000	*	16,000

** Not available

* GES estimate less than 500

Sources: *Highway Statistics 1994*;
1994 FARS; 1994 GES

The number of buses involved in traffic accidents was stable at about 16,000 involvements per year from 1991 to 1994. The greatest estimated number of accidents occurred in 1990 with 19,000 bus involvements (table VII-2). The number of buses in fatal accidents also has fluctuated within a narrow range, from a high of 288 in 1990 to a low of 266 in 1994. Counts of fatal involvements are taken from the FARS file, a census file of all fatal traffic accidents, so they are expected to be precise. Estimates of injury and towaway involvements are generated from the GES file. Since the GES file is based on a sample of accidents, each estimate has an associated sampling error. (See the Technical Appendix for more information on sampling errors in GES.) Tests of significance have been calculated for the differences between the annual totals. None of the year-to-year differences in the counts of injury or towaway involvements is statistically significant.

Table VII-2 Bus Involvements by Accident Severity 1990-1994

	Fatal		Injury		Towaway		Total	
Year	N	%	N	%	N	%	N	%
1990	288	1.5	9,000	49.1	9,000	49.3	19,000	100.0
1991	276	1.8	8,000	51.2	7,000	47.1	16,000	100.0
1992	284	1.9	8,000	50.9	7,000	47.2	15,000	100.0
1993	275	1.7	9,000	53.4	7,000	44.9	17,000	100.0
1994	266	1.6	9,000	58.6	6,000	39.8	16,000	100.0

Sources: 1994 FARS, 1994 GES

Table VII-3 shows the number of fatalities and injuries in bus-involved accidents, 1990-1994. The greatest number of deaths occurred in 1990 (339), and that year also had the largest estimated number of injuries (38,000). The number of injuries declined the following year to 26,000 and then to 25,000 in 1992 and 1993. Although the differences between the estimated number of injuries in 1990 and each other year are statistically significant, they may be due to a change in the GES sampling procedures for trucks and buses in 1990. None of the other year-to-year differences is statistically significant, in part because GES includes only a relatively small sample of bus involvements.

Table VII-3 Total Fatalities and Injuries in Bus Accidents, 1990-1994

Year	Fatalities	Injuries	Total
1990	339	38,000	38,000
1991	306	26,000	26,000
1992	315	25,000	25,000
1993	308	25,000	25,000
1994	289	24,000	25,000
Annual average	311	28,000	28,000

Sources: 1994 FARS, 1994 GES

Bus type and accident severity

Table VII-4 shows bus involvements by bus type and accident severity in 1994. An estimated 6,000 of the 16,000 buses involved in traffic accidents were school buses. School buses accounted for 39.3% of all bus involvements; they were 41.4% of bus involvements in fatal accidents and 35.5% of bus involvements in injury accidents. School buses may have had a lower proportion of fatal and injury involvements because school buses commonly operate in residential areas where traffic speeds are low.

Table VII-4 Bus Involvements by Bus Type and Accident Severity

	Fatal		Injury		Towaway		Total	
Bus type	N	%	N	%	N	%	N	%
School	110	41.4	3,000	35.5	3,000	44.7	6,000	39.3
Other bus	144	54.1	6,000	64.0	3,000	52.2	10,000	59.1
Unknown	12	4.5	*	0.5	*	3.0	*	1.6
Total	266	100.0	9,000	100.0	6,000	100.0	16,000	100.0

* GES estimate less than 500

Sources: 1994 FARS, 1994 GES

A total of 289 persons died in accidents involving buses in 1994 (table VII-5). Over 40% (120) of the fatalities occurred in accidents in which a school bus was involved, and 53.3% (154) occurred in accidents involving an other type of bus. These fatalities include all deaths as a consequence of the accident, whether the fatality was in a bus or not. An estimated 24,000 persons were injured in traffic accidents involving buses, including 12,000 in school bus accidents and 12,000 in other bus accidents. (The totals in this table are the actual number of persons killed or injured, rather than the sums of the columns. If an accident involved both a school and an other bus, killed and injured persons in the accident are included in both the school and the other bus categories. Summing the categories would double-count such cases.)

Table VII-5 Total Fatalities and Injuries by Bus Type

	Fatalities		Injuries		Total	
Bus type	N	%	N	%	N	%
School	120	41.5	12,000	47.8	12,000	47.7
Other bus	154	53.3	12,000	51.5	13,000	51.5
Unknown	16	5.5	*	0.8	*	0.8
Total	289	100.0	24,000	100.0	25,000	100.0

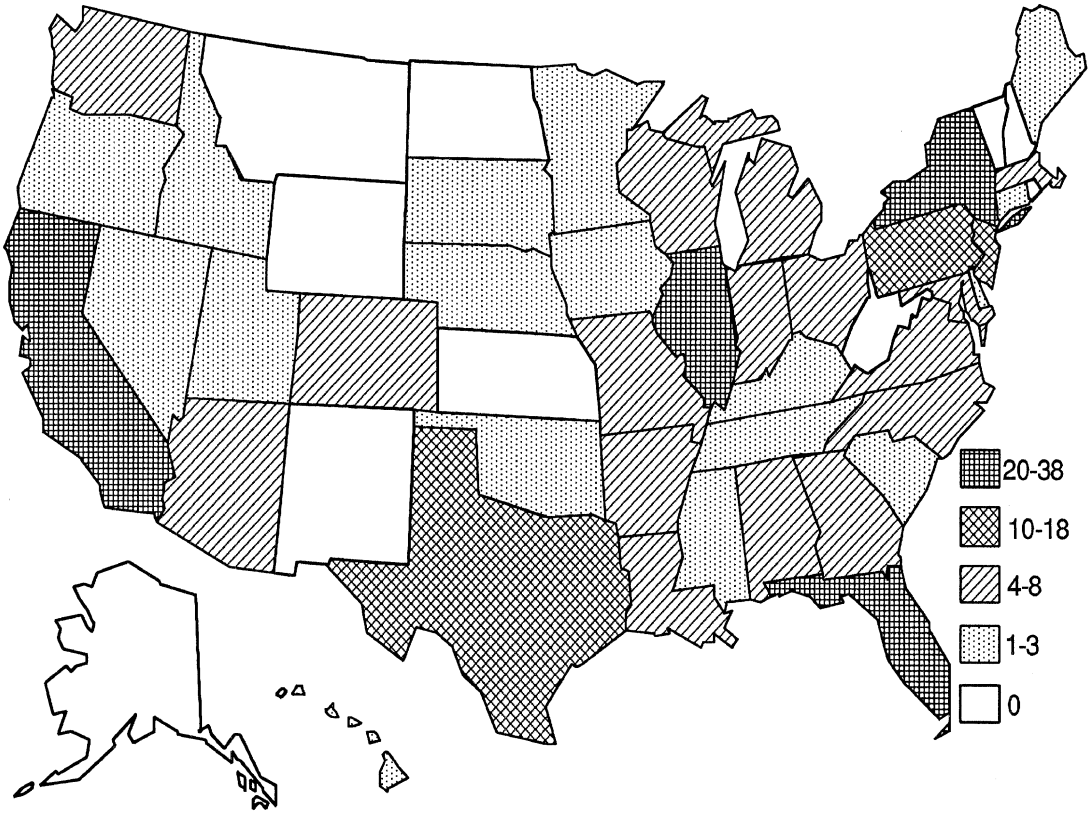
* GES estimate less than 500

Sources: 1994 FARS, 1994 GES

Fatal bus involvements by State

Figure VII-1 shows the distribution of bus involvements across the U.S. in 1994. Only fatal bus involvements are shown, because only the FARS file identifies the State where the accident took place. (The State location of accidents of all severities will be available once the SafetyNet accident system is fully implemented.) New York, Illinois, California, and Florida had the greatest number of bus involvements; they are also four of the most populous States. Rhode Island, New Hampshire, Vermont, West Virginia, Kansas, New Mexico, Montana, North Dakota, Wyoming, and Alaska all had no fatal bus involvements in 1994. Table VII-6 shows the number of fatal involvements of school buses, other buses, and unknown bus types separately for each State.

Figure VII-1 Fatal Bus Involvements, 1994



Source: 1994 FARS

Table VII-6 Fatal Bus Involvements by State and Bus Type, 1994

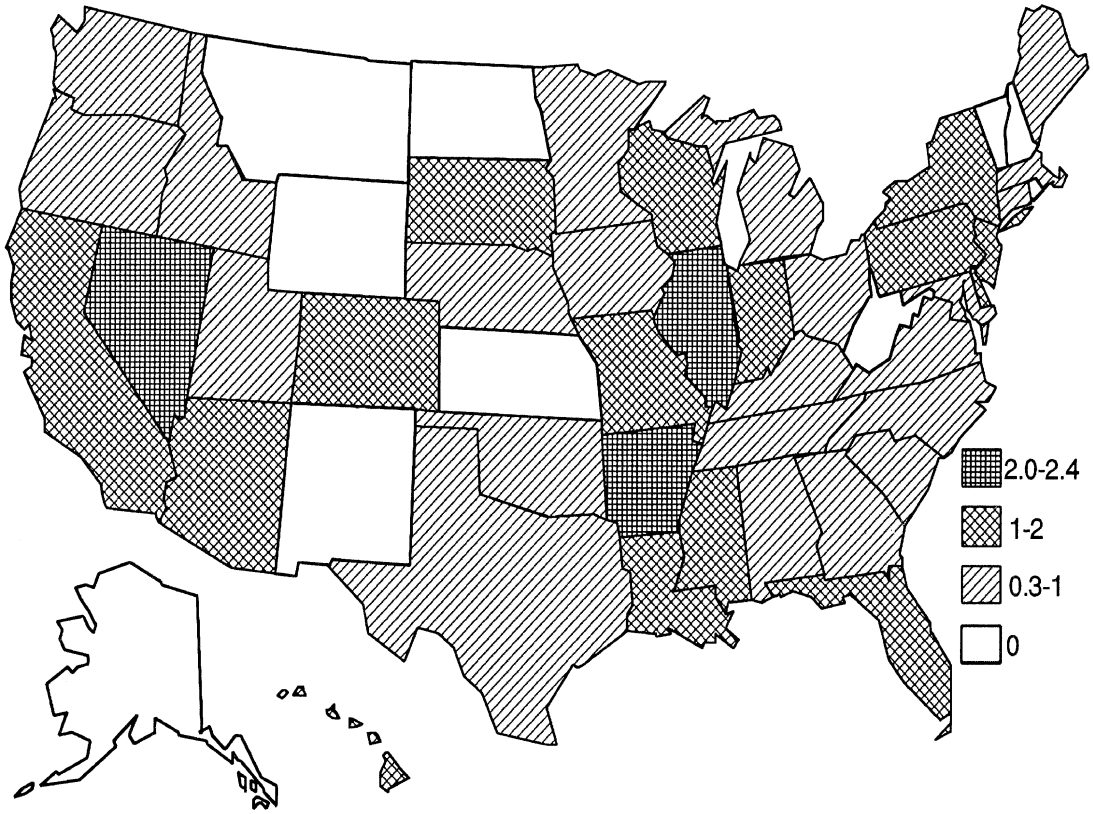
State	School		Other bus		Unknown		Total	
	N	%	N	%	N	%	N	%
Alabama	2	1.8	2	1.4	0	0.0	4	1.5
Alaska	0	0.0	0	0.0	0	0.0	0	0.0
Arizona	4	3.6	1	0.7	1	8.3	6	2.3
Arkansas	5	4.5	1	0.7	0	0.0	6	2.3
California	8	7.3	29	20.1	1	8.3	38	14.3
Colorado	1	0.9	3	2.1	0	0.0	4	1.5
Connecticut	0	0.0	2	1.4	0	0.0	2	0.8
Delaware	1	0.9	0	0.0	0	0.0	1	0.4
D.C.	0	0.0	1	0.7	0	0.0	1	0.4
Florida	8	7.3	9	6.3	3	25.0	20	7.5
Georgia	3	2.7	4	2.8	0	0.0	7	2.6
Hawaii	1	0.9	1	0.7	0	0.0	2	0.8
Idaho	1	0.9	0	0.0	0	0.0	1	0.4
Illinois	12	10.9	14	9.7	0	0.0	26	9.8
Indiana	3	2.7	2	1.4	1	8.3	6	2.3
Iowa	1	0.9	0	0.0	0	0.0	1	0.4
Kansas	0	0.0	0	0.0	0	0.0	0	0.0
Kentucky	2	1.8	0	0.0	0	0.0	2	0.8
Louisiana	3	2.7	2	1.4	1	8.3	6	2.3
Maine	1	0.9	0	0.0	0	0.0	1	0.4
Maryland	3	2.7	1	0.7	0	0.0	4	1.5
Massachusetts	3	2.7	1	0.7	0	0.0	4	1.5
Michigan	3	2.7	4	2.8	1	8.3	8	3.0
Minnesota	2	1.8	1	0.7	0	0.0	3	1.1
Mississippi	2	1.8	1	0.7	0	0.0	3	1.1
Missouri	1	0.9	5	3.5	0	0.0	6	2.3
Montana	0	0.0	0	0.0	0	0.0	0	0.0
Nebraska	1	0.9	0	0.0	0	0.0	1	0.4
Nevada	0	0.0	3	2.1	0	0.0	3	1.1
New Hampshire	0	0.0	0	0.0	0	0.0	0	0.0
New Jersey	1	0.9	9	6.3	0	0.0	10	3.8
New Mexico	0	0.0	0	0.0	0	0.0	0	0.0
New York	7	6.4	14	9.7	1	8.3	22	8.3
N.Carolina	2	1.8	3	2.1	0	0.0	5	1.9
N.Dakota	0	0.0	0	0.0	0	0.0	0	0.0
Ohio	3	2.7	3	2.1	0	0.0	6	2.3
Oklahoma	1	0.9	0	0.0	0	0.0	1	0.4
Oregon	0	0.0	3	2.1	0	0.0	3	1.1
Pennsylvania	7	6.4	11	7.6	0	0.0	18	6.8
Rhode Island	0	0.0	0	0.0	0	0.0	0	0.0
S.Carolina	2	1.8	0	0.0	0	0.0	2	0.8
S.Dakota	1	0.9	0	0.0	0	0.0	1	0.4
Tennessee	0	0.0	2	1.4	0	0.0	2	0.8
Texas	5	4.5	5	3.5	3	25.0	13	4.9
Utah	1	0.9	0	0.0	0	0.0	1	0.4
Vermont	0	0.0	0	0.0	0	0.0	0	0.0
Virginia	3	2.7	1	0.7	0	0.0	4	1.5
Washington	0	0.0	5	3.5	0	0.0	5	1.9
W.Virginia	0	0.0	0	0.0	0	0.0	0	0.0
Wisconsin	6	5.5	1	0.7	0	0.0	7	2.6
Wyoming	0	0.0	0	0.0	0	0.0	0	0.0
Total	110	100.0	144	100.0	12	100.0	266	100.0

Source: 1994 FARS

Fatal bus involvements per capita

Figure VII-2 provides a context for interpreting figure VII-1. Figure VII-2 shows fatal bus involvements per million population in each of the fifty States. Note that most of the States with the greatest number of fatal bus involvements (i.e., California, New York, and Florida) have only average involvements per million population. Moreover, the range of fatal involvement rates is relatively narrow, from zero in States with no fatal involvements to under three involvements per million for Arkansas, Illinois, and Nevada. The narrow range suggests that State-to-State differences are not large, particularly since the rates themselves are relatively low. Since there are so few fatal bus involvements, a change of one or two involvements in a small State can make a large difference in the involvement rate per capita for that State.

Figure VII-2 Fatal Bus Involvements per Million Population, 1994

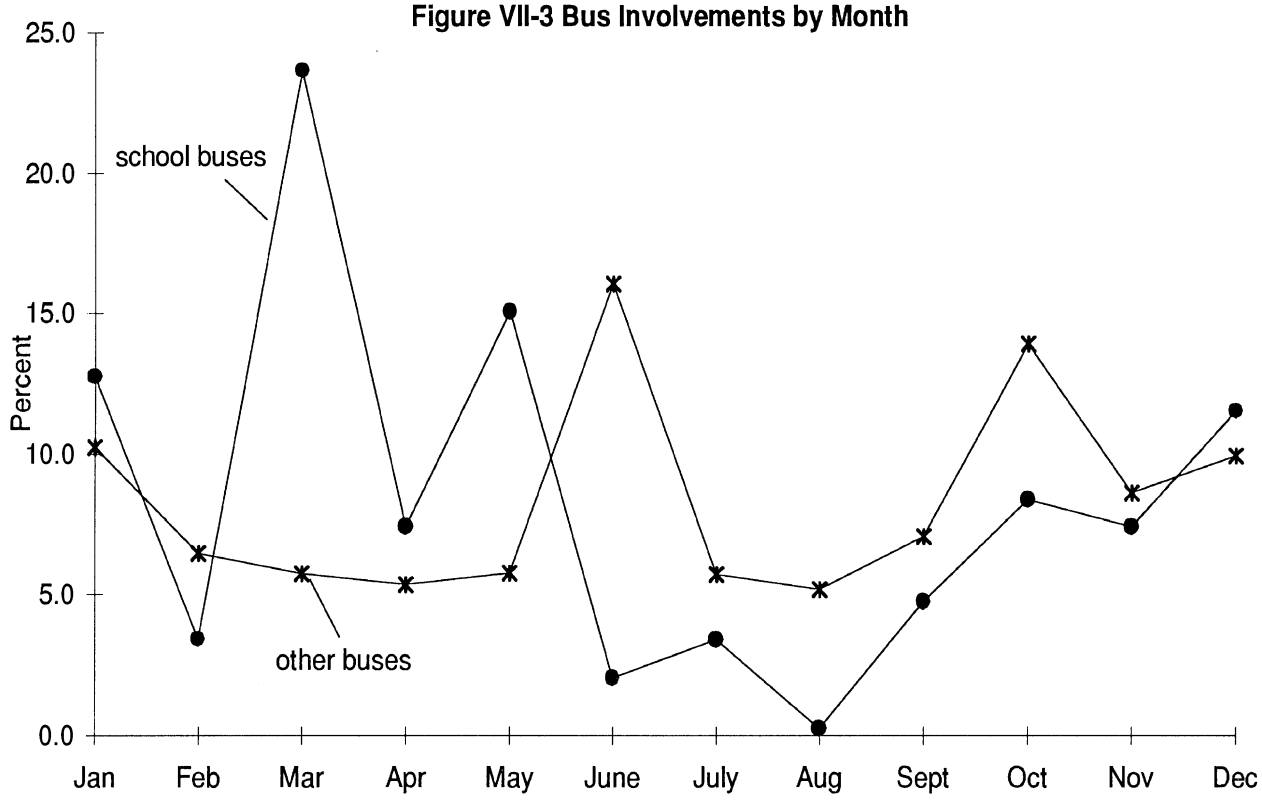


Source: 1994 FARS,
Statistical Abstract, 1994

Bus involvements by month, day of week, and time of day

Bus accident involvements show interesting variations by month (figure VII-3). School bus involvements were lowest during the summer months but fluctuate in a wide range during the school year, peaking in March with almost 24% of all school bus involvements. Other buses showed some tendency toward a higher proportion of involvements in the summer travel season with the highest percentage of involvements in June. The GES file includes only a limited number of bus cases. The SafetyNet accident system, which will include all bus involvements, should clarify the picture.

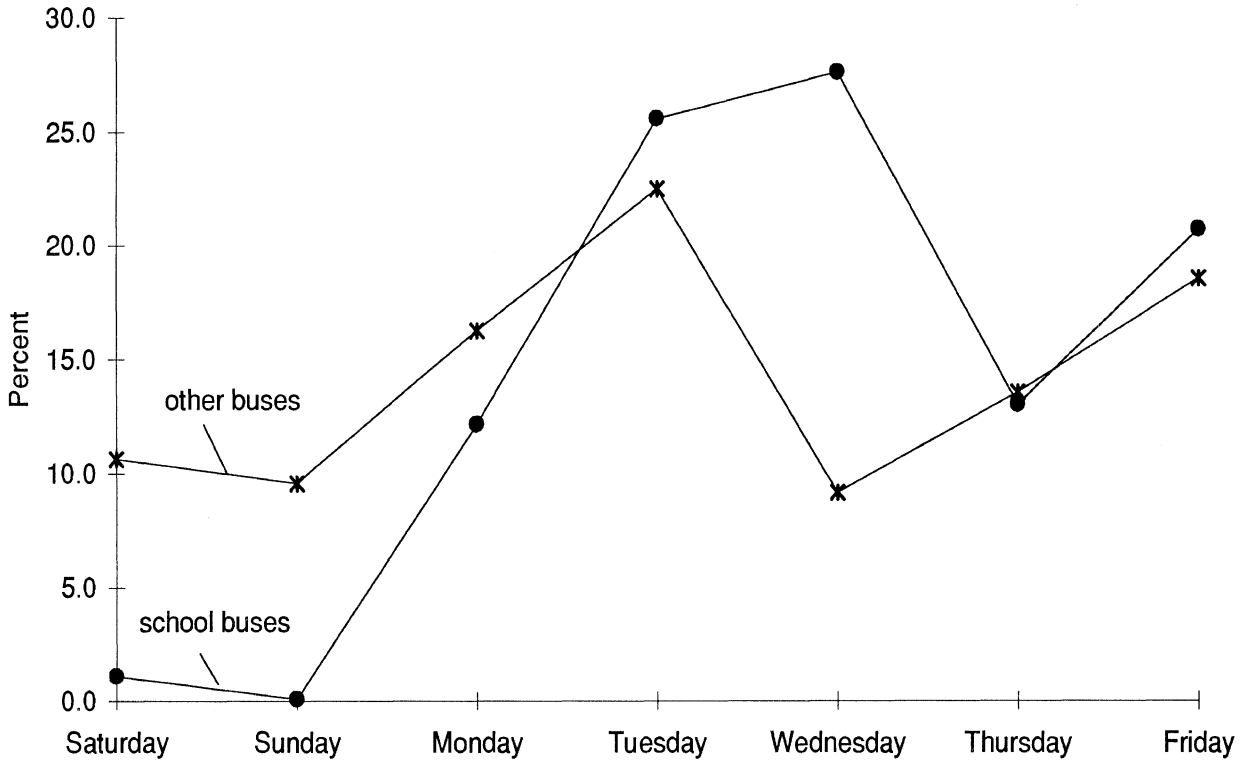
Figure VII-3 Bus Involvements by Month



Sources: 1994 FARS, 1994 GES

School bus accident involvements in 1994 occurred primarily during the week (figure VII-4). Only a handful occurred over the weekend. Wednesday had the highest proportion of involvements with 27.6%, while the lowest percentage of weekday involvements (12.0%) occurred on Mondays. Involvements of other buses also showed a definite pattern through the week. Other buses include both intracity transit buses and intercity cross-country buses. Involvements were low over the weekend and rose to a peak on Tuesday when 22.5% of all other bus accident involvements occurred. For the remainder of the work week proportions of other bus involvements were between 9% and 18%.

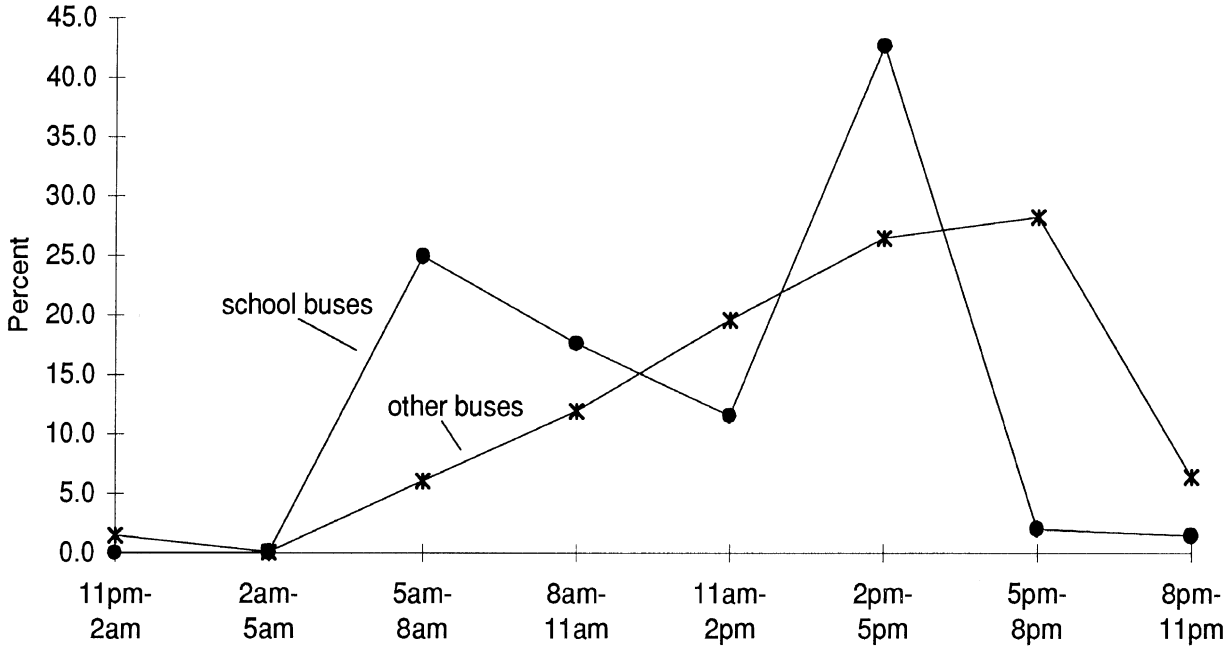
Figure VII-4 Bus Involvements by Day of Week



Sources: 1994 FARS, 1994 GES

Figure VII-5 shows the distribution of school bus and other bus involvements in 1994 by time of day in three-hour increments. The patterns of involvement over the course of the day clearly followed the typical usage of both school and other buses. School bus involvements had two major peaks, from 5 a.m. to 8 a.m. and from 2 p.m. to 5 p.m., corresponding to the periods of travel to and from school. Other buses show similar, though less dramatic, peaks that encompass morning and afternoon rush hours in most cities. School buses had few involvements between 5 p.m. and 5 a.m. Other buses, which include city transit buses as well as passenger buses between cities, had significant numbers of involvements until about 8 p.m.

Figure VII-5 Bus Involvements by Time of Day



Sources: 1994 FARS, 1994 GES

Manner of collision

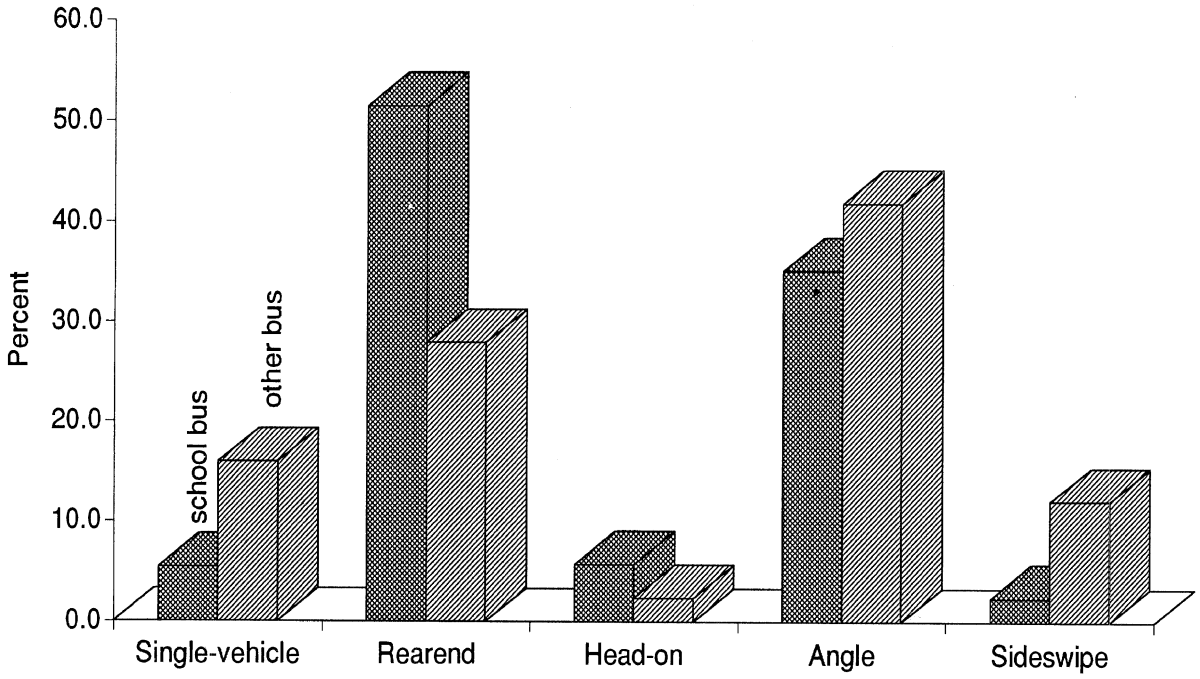
School buses had a lower proportion of single-vehicle, sideswipe, and angle involvements than other buses, while they had a higher proportion of rearend and head-on collisions (table VII-7). These differences are not statistically significant due to small sample sizes, though they may be real nevertheless. Overall, the distribution of manner of collision for buses is similar to the distribution for trucks (table III-6), though buses had a lower proportion of single-vehicle involvements, while trucks had a much lower proportion of rearend collisions. Fully 51.4% of school bus involvements were rearends, compared with 27.3% for trucks.

Table VII-7 Bus Accident Involvements by Manner of Collision

Collision Type	School bus		Other bus		All	
	N	%	N	%	N	%
Single-vehicle	*	5.4	2,000	16.0	2,000	11.7
Rearend	3,000	51.4	3,000	27.9	6,000	37.0
Head-on	*	5.7	*	2.3	1,000	4.1
Angle	2,000	35.0	4,000	41.8	6,000	39.1
Sideswipe	*	2.4	1,000	12.0	1,000	8.1
Total	6,000	100.0	10,000	100.0	16,000	100.0

* GES estimate less than 500 or less than 0.05.
Note: Total includes an estimated fewer than 500 cases with unknown bus type.
Sources: 1994 FARS, 1994 GES

Figure VII-6 Manner of Collision by Bus Type



Sources: 1994 FARS, 1994 GES

Driver age and sex

Table VII-8 shows the age distribution for drivers of school and other buses involved in a traffic accident in 1994. The age distributions of both bus types are similar, and the differences are not large enough to be statistically significant. The table includes a column for the age distribution of accident-involved truck drivers for comparison. Bus drivers in traffic accidents were older than accident-involved truck drivers. About 2.6% of bus drivers were younger than 25, compared with an estimated 10.0% of accident-involved truck drivers. An estimated 47.5% of bus drivers involved in an accident were aged 45-64, compared with 28.8% of truck drivers.

Table VII-8 Bus Accident Involvements by Driver Age

	Bus drivers							
	School bus		Other bus		Total		Truck drivers	
Driver age	N	%	N	%	N	%	N	
<25	*	3.1	*	2.3	*	2.6	15,000	10.0
25-44	3,000	44.0	4,000	46.7	7,000	46.1	88,000	58.8
45-64	3,000	47.2	5,000	48.4	8,000	47.5	43,000	28.8
>64	*	5.6	*	2.6	1,000	3.8	4,000	2.5
Total	6,000	100.0	10,000	100.0	16,000	100.0	150,000	100.0

* GES estimate less than 500 or less than 0.05.

Note: Total for bus drivers includes fewer than 500 cases with unknown bus type.

Sources: 1994 GES, 1994 TIFA, 1994 FARS

Overall, bus drivers involved in traffic accidents in 1994 were predominantly male, with 65.8% (table VII-9). Females were more likely to drive school buses, while most other bus drivers were male. Even so, the share of males among accident-involved truck drivers was much higher than for buses. An estimated 96.7% of accident-involved truck drivers in 1994 were male.

Table VII-9 Bus Accident Involvements by Driver Sex

	Bus drivers							
	School bus		Other bus		Total		Truck drivers	
Driver sex	N	%	N	%	N	%	N	%
Male	3,000	44.6	8,000	79.2	11,000	65.8	145,000	96.7
Female	4,000	55.4	2,000	19.9	5,000	33.7	5,000	3.3
Total	6,000	100.0	10,000	100.0	16,000	100.0	150,000	100.0

Note: Total for bus drivers includes fewer than 500 cases with unknown bus type.

Sources: 1994 GES, 1994 TIFA, 1994 FARS

VIII. Accident Type and Related Factors

This section presents statistics concerning the configuration of truck accident involvements in 1994, and driver-related factors that contributed to the accident. Accident configuration represents the relative position and movements of the vehicles for the first harmful event in the accident. The first harmful event is the first injury- or damage-producing event in the accident. Driver-related factors presented here are factors that, in the opinion of the reporting police officer or analyst, contributed to the occurrence of the accident. Both accident configuration and driver-related factors can be used to impute "fault" or "causation." The reader is cautioned, however, to make any such inferences with care. Traffic accidents are typically complex series of events in which driver, vehicle, roadway, and environment all can play a role. Highlights of this section:

- In fatal rearend collisions, the truck is struck about twice as often as it is the striking vehicle

- In two-vehicle fatal accidents, involving a truck and another vehicle, a driver-related factor is coded for the other driver alone in 67.0% of the accidents and for the truck driver alone in 18.4% of the accidents

- In two-vehicle fatal accidents, top driver-related factors for the truck driver are failure to yield (13.2%), speeding (10.8%), and failure to keep in lane (8.1%)

- In two-vehicle fatal accidents, top driver-related factors for the other driver are failure to keep in lane (21.8%), failure to yield (17.4%), and speeding (14.2%)

Accident type

Accident type presents the relative position of vehicles in the first harmful event of an accident. The first harmful event is the first property-damaging or injury producing event. Accident type is divided into six general categories that capture basic vehicle orientation. Within each general class, the levels indicate finer details about the relative motion of the colliding vehicles. The arrow diagrams on the next page represent common accident configurations in each general category. Table VIII-1 tabulates accident type by accident severity for truck involvements in 1994. Accident type is shown from the truck's point of view, so "turn across path" indicates that the truck turned across another vehicle's path.

Table VIII-1 Accident Type by Accident Severity

Accident type	Fatal N	Fatal %	Injury N	Injury %	Towaway N	Towaway %	Total N	Total %
			1. Single vehicle**					
Ran off road	348	7.3	5,000	8.7	11,000	12.4	16,000	10.9
Hit object in road	497	10.4	2,000	4.1	2,000	2.2	5,000	3.2
			2. Same direction, same trafficway					
Rearend, truck striking	258	5.4	8,000	13.3	8,000	9.3	16,000	10.7
Rearend, truck struck	465	9.7	6,000	9.9	11,000	12.0	17,000	11.1
Sideswipe, in other's lane	57	1.2	3,000	5.4	6,000	7.0	9,000	6.2
Sideswipe, in truck's lane	134	2.8	2,000	3.3	6,000	6.8	8,000	5.4
			3. Opposite direction, same trafficway					
Head-on, in other's lane	150	3.1	*	0.2	*	0.1	*	0.2
Head-on, in truck's lane	909	19.0	1,000	1.3	*	0.5	2,000	1.4
Sideswipe, in other's lane	43	0.9	1,000	2.4	2,000	1.9	3,000	2.0
Sideswipe, in truck's lane	191	4.0	2,000	3.4	2,000	2.1	4,000	2.7
			4. Change traffic way, one vehicle turning					
Truck turn across path	172	3.6	5,000	9.1	8,000	8.4	13,000	8.6
Other turn across path	279	5.8	4,000	7.6	5,000	5.4	9,000	6.2
			5. Intersecting paths					
Straight, into other	199	4.2	2,000	4.4	3,000	3.0	5,000	3.6
Straight, other into	543	11.3	3,000	4.6	3,000	2.8	6,000	3.8
			6. Other					
Back into other	24	0.5	1,000	1.0	4,000	4.4	5,000	3.0
Other back into	4	0.1	*	0.1	*	0.2	*	0.2
Untripped roll	56	1.2	1,000	1.5	2,000	1.9	3,000	1.8
Other	376	7.8	10,000	18.0	13,000	14.9	24,000	15.8
Unknown	90	1.9	1,000	1.5	4,000	4.5	5,000	3.3
Total	4,795	100.0	56,000	100.0	90,000	100.0	151,000	100.0

* GES estimate less than 500.

** See "Definitions of accident types" on page 83.

Sources: 1994 TIFA, 1994 GES

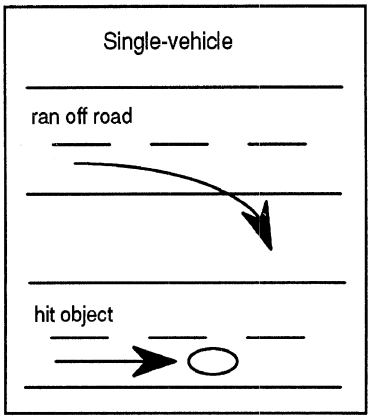
The reader is cautioned that these categories do not necessarily imply "fault." The turn-across-path category, for example, does not include information on which vehicle had the right-of-way.

In fatal rearend collisions in 1994, the truck was the struck vehicle almost twice as often as it was the striking vehicle. The differences for injury and towaway involvements are not statistically significant. Fatal same direction sideswipes occurred about twice as often in the truck's lane (that is, the other vehicle moved into the truck's lane) as in the other vehicle's lane, but injury and towaway same-direction sideswipes occurred more often in the other vehicle's lane. However, again, the differences from injury and towaway involvements are not significant statistically.

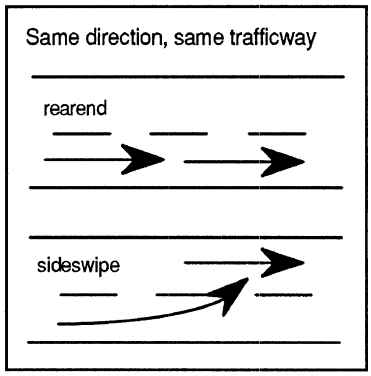
Opposite direction involvements, head-on and sideswipe, occurred most often in the truck's lane for all accident severity levels. The differences are most marked for fatal involvements, where 909 head-on collisions occurred in the truck's lane, compared with 150 in the other vehicle's lane. A higher proportion of fatal involvements fall into the "opposite direction, same trafficway" category than injury or towaway, 27.0% to 7.3% and 4.6% respectively.

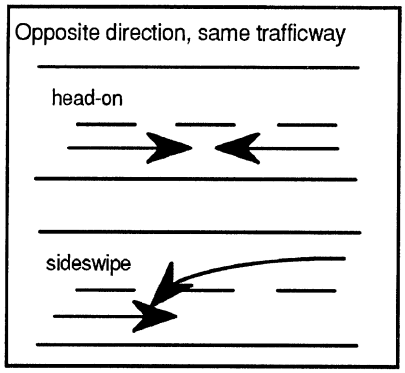
Definitions of accident types

1. Single-vehicle accidents include ran-off-road and collisions with objects in the roadway. Though the arrow diagram shows the ran-off-road departure to the right, both rightside and leftside roadway departures are included. Objects in the roadway can include legally parked vehicles, animals, bicyclists, pedestrians, and other objects.

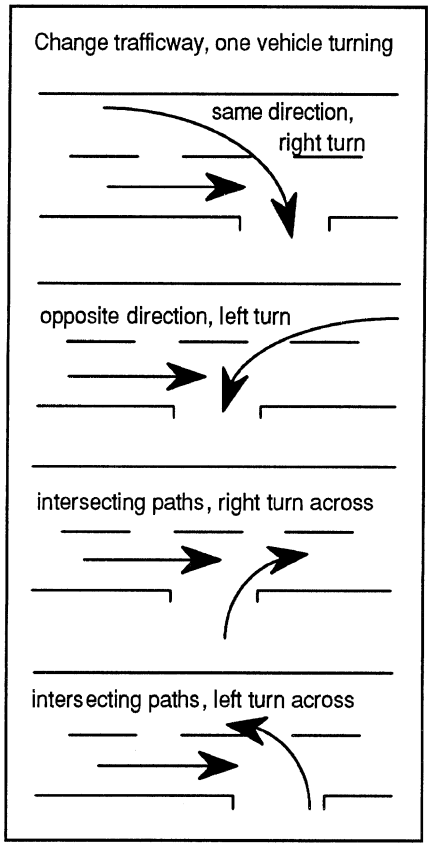


2. Same direction, same trafficway involvements include rearend collisions and sideswipes. Both vehicles were traveling in the same direction and on the same trafficway. For the rearends, the lead vehicle may have been stopped, going slower than the following vehicle, or decelerating, and either turning or going straight. In same-direction sideswipes, the sideswipe could have been from either side of the vehicle.

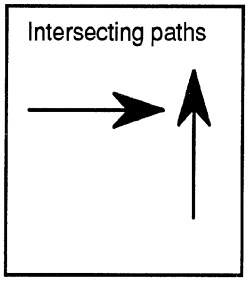




3. Opposite-direction, same trafficway involvements include head-on collisions and opposite-direction sideswipes. Both vehicles were traveling in opposite directions on the same trafficway. In head-on collisions, the frontal area of one vehicle impacted the frontal area of the other. In the sideswipes, the vehicles were traveling in opposite directions and the side of one or both vehicles was struck.



4. Change trafficway, one vehicle turning involvements include a number of different configurations. In each case, one vehicle, while turning from one road to another, has turned across the path of another vehicle. This can occur when both vehicles are going in the same direction and one turned either right, from the inside lane, or left, from the outside lane, across the path of the other vehicle. In the case of opposite direction collisions, one vehicle turned left across the path of an oncoming vehicle. The other set of cases included in this group are those in which the vehicles were on different roadways initially and one turned across the path of the other, either to the right or left, to get on the same roadway as the other vehicle.



5. Intersecting path involvements are those in which the vehicles were on different but intersecting roadways, each vehicle going straight ahead. The collision occurred at an intersection.

6. Other involvements include all other accident types. These are primarily accidents in which one or the other vehicle was backing, untripped rollovers, and accident types that could not be classified among the categories above.

Driver-related factors in two-vehicle, truck/other accidents

In 1994, 3,165 trucks were involved in a fatal accident with one other vehicle. Up to three driver-related factors are coded for the drivers of each vehicle. Driver-related factors are factors that contributed to the accident. They typically involve driving errors such as speeding, failure to yield, failure to obey traffic controls, and improper turns. The driver related factors are assigned by a FARS analyst, based on the police report and any other available information. It is important to note that while the actions noted may involve violations of traffic ordinances, they do not indicate that any violation was charged to the driver. The factors presented here are simply driver errors noted by the police officer or the FARS analyst. However, the reader should bear in mind that in fatal accidents, the fatality most often occurs outside of the truck. Some researchers feel that driver-related factors in truck-other fatal involvements could be biased by the fact that the truck driver is more often available and may influence what the police officer records.

Table VIII-2 shows driver-related factors coded in two-vehicle, truck/other fatal accidents in 1994. Percentages shown are for the total number of two-vehicle fatal accidents. In over two-thirds of the accidents, a driver-related factor was coded for the other vehicle but not the truck. Factors were coded for the truck only in 18.4% of the accidents, and for both the truck driver and the other driver in 10.9% of the accidents. Overall, no factor was coded for almost 70% of the truck drivers, while 78.3% of the other drivers had at least one factor coded.

Table VIII-2 Driver-Related Factors Coded for Truck and Other Vehicle
Two-Vehicle Fatal Truck Involvements

		Other vehicle							
		None		Factor coded		Unknown		Total	
		N	%	N	%	N	%	N	%
Truck	None	74	2.3	2,122	67.0	12	0.4	2,208	69.8
	Factor coded	583	18.4	345	10.9	8	0.3	936	29.6
	Unknown	4	0.1	10	0.3	7	0.2	21	0.7
	Total	661	20.9	2,477	78.3	27	0.9	3,165	100.0

Source: 1994 TIFA

Tables VIII-3 and VIII-4 show the most common driver-related factors coded for the truck driver and the other driver involved in a two-vehicle, truck/other fatal traffic accident in 1994. Up to three factors can be coded for each driver. Both truck and other vehicle drivers had the same four most common factors, though in a different order. For truck drivers, the four most common factors coded were failure to yield right-of-way (13.2% of all factors), speeding (10.8%), failure to keep in lane (8.1%), and failure to obey signs (6.6%). For the other vehicle the four most common factors were failure to keep in lane (21.8%), failure to yield (17.4%), speeding (14.2%), and failure to obey signs (8.9%). Note that the high proportion of failure to keep in lane for the other vehicle is consistent with

the results in Table VIII-1 that showed head-on and opposite-direction sideswipes most often occurred in the truck's lane. Note also that drowsiness or sleepiness is not included among the fifteen most frequent factors for truck drivers, though it is the eighth most common, with 2.8% of all factors, among other vehicle drivers. Many researchers, however, feel that fatigue is underreported in accident data.

Table VIII-3 Driver-Related Factors for the Truck Driver
Two-Vehicle Truck-Other Fatal Involvements

Factor	N	%
Failure to yield	200	13.2
Speeding	163	10.8
Failure to keep in lane	123	8.1
Failure to obey signs	100	6.6
Other non-moving violation	95	6.3
Inattentive (talking, eating, etc.)	93	6.1
Non-traffic violation	89	5.9
Erratic, reckless, careless	67	4.4
Following improperly	44	2.9
Stopping in roadway	43	2.8
Improper turn	37	2.4
Operating w/o required equipment	35	2.3
Wrong side of road	35	2.3
Vision obscured by weather	29	1.9
Improper lane change	27	1.8
Other	273	18.0
Unknown	63	4.2
Total	1,516	100.0

Source: 1994 TIFA

Table VIII-4 Driver-Related Factors for the Other Driver
Two-Vehicle Truck-Other Fatal involvements

Factor	N	%
Failure to keep in lane	791	21.8
Failure to yield	630	17.4
Speeding	517	14.2
Failure to obey signs	323	8.9
Inattentive (talking, eating, etc.)	285	7.8
Erratic, reckless, careless	185	5.1
Wrong side of road	137	3.8
Drowsy, sleepy	102	2.8
Swerving due to slick road	83	2.3
Following improperly	71	2.0
Improper turn	70	1.9
Other non-moving violation	56	1.5
Improper lane change	52	1.4
Drugs, non-medication	44	1.2
Over-correcting	42	1.2
Other	162	4.5
Unknown	81	2.2
Total	3,631	100.0

Source: 1994 TIFA

IX. A Look at Preliminary SafetyNet Data

All States participating in the Motor Carrier Safety Assistance Program (MCSAP) were required to report qualifying truck and bus accidents through the SafetyNet accident system beginning January 1, 1994. Forty-nine States and the District of Columbia reported truck or bus accidents for 1994. Some of the reporting States did not supply complete data for all records, and other States reported only a handful of cases. However, several States reported a substantial number of cases, and for a few, reporting appears to be substantially complete, supplying all SafetyNet data elements on all qualifying accidents.

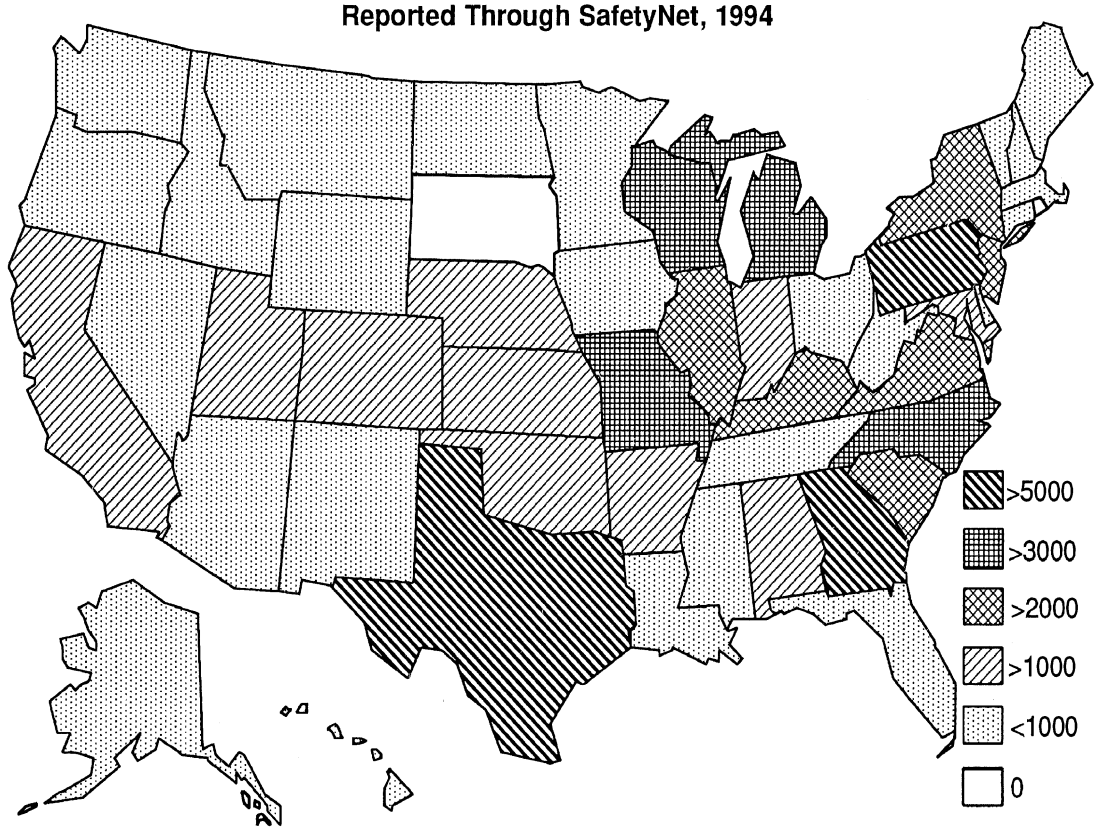
This section presents statistics on truck accidents derived from the 1994 SafetyNet accident file. Data from twenty States have been selected to provide a preliminary look at SafetyNet accident data. The States include Connecticut, New Hampshire, Vermont, North Carolina, Georgia, Pennsylvania, Michigan, Illinois, Kentucky, Wisconsin, Missouri, Nebraska, Kansas, Texas, North Dakota, Montana, Idaho, Utah, Wyoming, and Oregon. In these States, it appears that reporting of cases is close to complete. In addition, the selected States also provide broadly representative and geographically diverse coverage of the United States.

Only percent distributions are presented in this section. Frequencies are omitted so as not to mislead the reader that SafetyNet accident reporting is currently complete. On the other hand, the States represented in this section account for over a third of the total number of cases expected in SafetyNet when full reporting is achieved. They also broadly cover the diversity of the U.S. trucking industry, so it is likely that percentage distributions in the data elements are representative of truck accident involvements generally.

States reporting to SafetyNet

Forty-nine States and the District of Columbia (figure IX-1) reported at least some accident data for 1994, the first year of mandatory reporting. These States reported a total of 87,580 cases. Reporting by the States through SafetyNet replaces reporting by carriers to the Office of Motor Carriers using the MCS 50-T (truck) and MCS 50-B (bus) forms. SafetyNet accident data will significantly improve the coverage of truck and bus accidents. The OMC 50-T and 50-B data were subject to the criticism that they were provided by the carriers themselves, and only carriers that operated in interstate commerce were required to report. Thus, coverage was incomplete. SafetyNet covers all truck and bus accidents that meet the accident severity criteria, regardless of whether the vehicle is operated in interstate commerce. In addition, shifting reporting responsibility from carriers to the States will improve the census of truck and bus accidents.

Figure IX-1 Truck and Bus Accident Records Reported Through SafetyNet, 1994



Vehicle configuration

SafetyNet provides more detail about vehicle configuration, at least for trucks, than is available in the GES data while minimizing unknown configurations. Straight trucks can be separated from tractors and the bobtail tractor configuration distinguished from single-unit straight trucks. Table IX-1 shows the distribution of configuration type for fatal, injury, and towaway accidents. Note that configuration is unknown for about 22% of all truck involvements. Tractor-semitrailers were the primary configuration in all three accident types. About 58% of the trucks involved in fatal accidents in the selected States were tractor-semitrailers. The proportion was somewhat less for injury and towaway involvements. Straight trucks as a group (2-axle truck, 3-axle truck, and truck with trailer) account for about 26% of all accident involvements, tractors for about 53%, and the configuration is unknown for the remaining 22%. Bear in mind that these data are preliminary.

Table IX-1 Truck Configuration by Accident Severity
Selected States

Configuration	Fatal %	Injury %	Towaway %	All %
2-axle truck	9	11	10	11
3-axle truck	11	9	7	8
Truck with trailer	7	8	6	7
Bobtail tractor	3	3	3	3
Tractor-semitrailer	58	48	47	48
Tractor double trailers	2	2	2	2
Tractor triple trailers	0	0	0	0
Unknown	10	19	26	22
Total	100	100	100	100

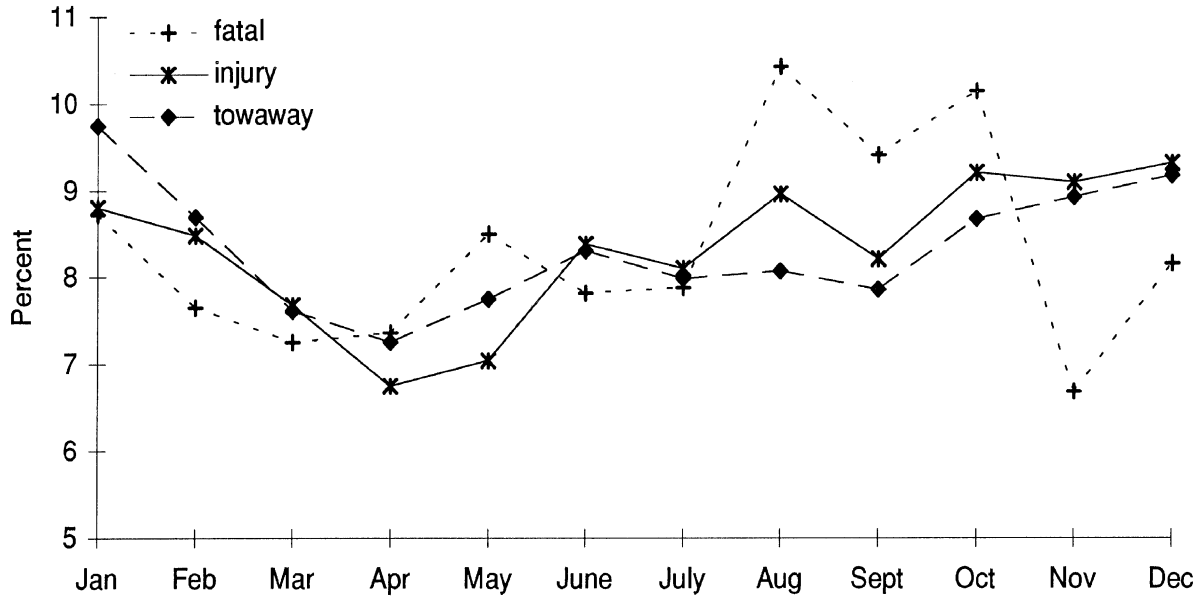
Source: 1994 SafetyNet

The SafetyNet vehicle type classification currently does not distinguish between school, transit, and intercity buses. In the data of the States selected for this preliminary look, buses accounted for about 9% of all vehicle-involvements reported. About 1% of the bus involvements were in fatal accidents, 61% in injury accidents, and the remaining 38% in towaway accidents. Of the truck accident involvements, about 3% were in fatal accidents, 52% in injury accidents, and 45% in towaway accidents. The remainder of this section deals only with truck involvements.

Truck involvements: Month and time of day

Just as was the case for the graph based on TIFA and GES data (figure III-1), there does not appear to be a strong seasonal pattern to the distribution of injury and towaway truck involvements in the SafetyNet data reported by the selected States (figure IX-2). However, there does seem to be some seasonality to the occurrence of fatal involvements, with a lower proportion in the late winter and spring, and a higher proportion in the late summer. This pattern is similar to that found in the TIFA data.

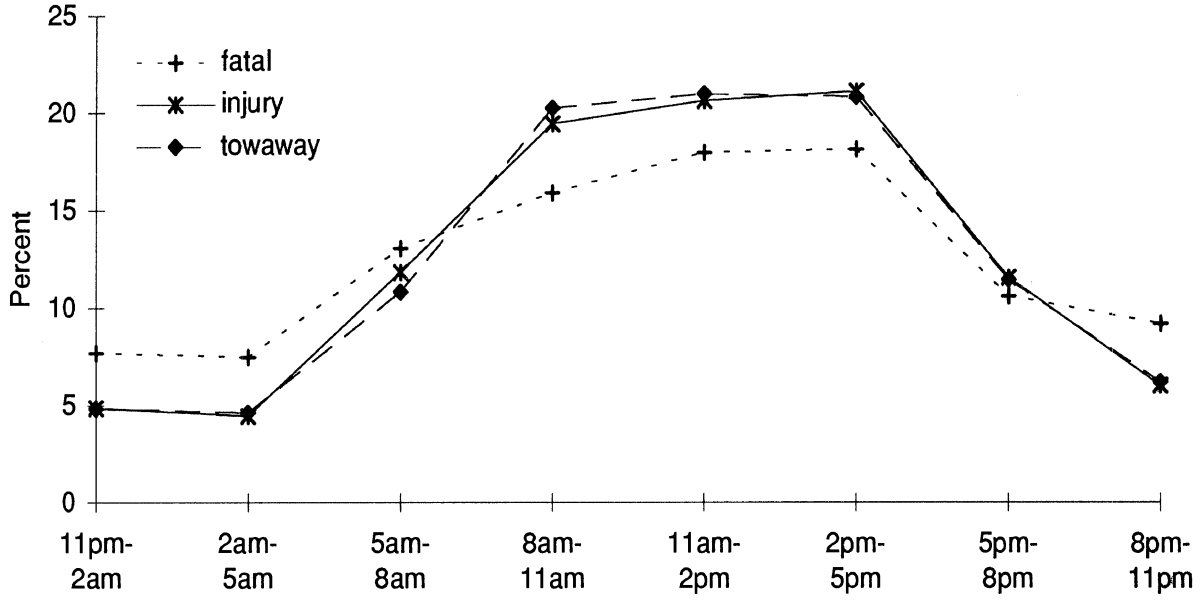
Figure IX-2 Month by Truck Accident Severity
Selected States



Source: 1994 SafetyNet

The distribution of truck involvements by time of day for the selected States in the SafetyNet data is also similar to that for TIFA/GES (figure III-3 and figure IX-3). Nonfatal involvements (injury and towaway) were relatively low over night and rose during the day so that about 20% of involvements occurred during each succeeding three-hour block of time after 8 a.m. A higher proportion of fatal involvements than injury or towaway occurred over night, with about 8% of all fatal involvements occurring between 11 p.m. and 2 a.m. and 8% between 2 a.m. and 5 a.m. The proportion of truck fatal involvements rose during the day, with about 18% of all fatal involvements occurring between 2 p.m and 5 p.m.

Figure IX-3 Time of Day by Truck Accident Severity
Selected States



Source: 1994 SafetyNet

Light condition, weather, and road condition

Figures IX-4 and IX-5 show the lighting for fatal and nonfatal truck involvements, as reported in the 1994 SafetyNet data for selected States. The proportions reported here are reasonably similar to those reported in figures III-4 and III-5, which are based on TIFA and GES data. Most truck accidents occur during the daylight hours, but a higher proportion of fatals occur during darkness, 19% to 13%. Fatal involvements also have a higher proportion of involvements in dark/lighted conditions. These include involvements that occur on lighted urban streets and freeways.

Figure IX-4 Light Condition for Fatal Truck Accidents Selected States

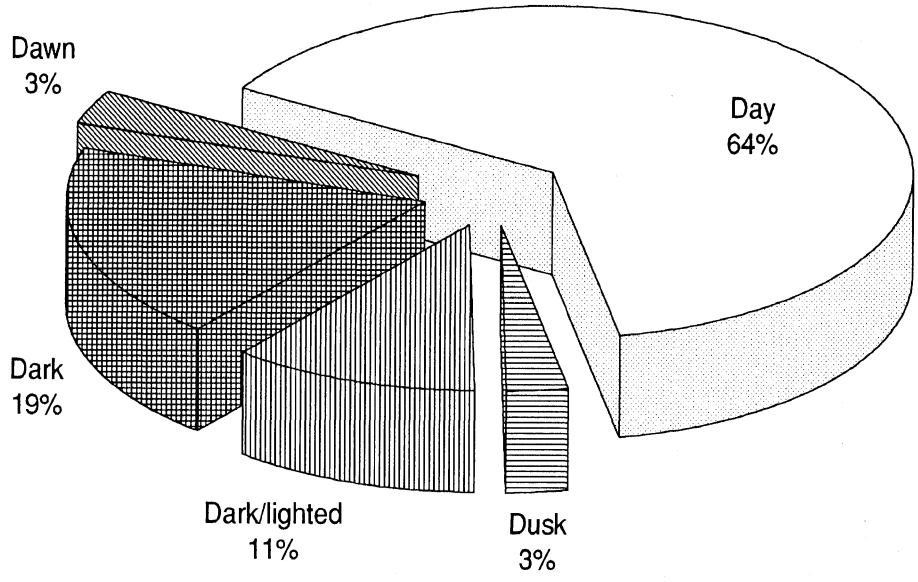
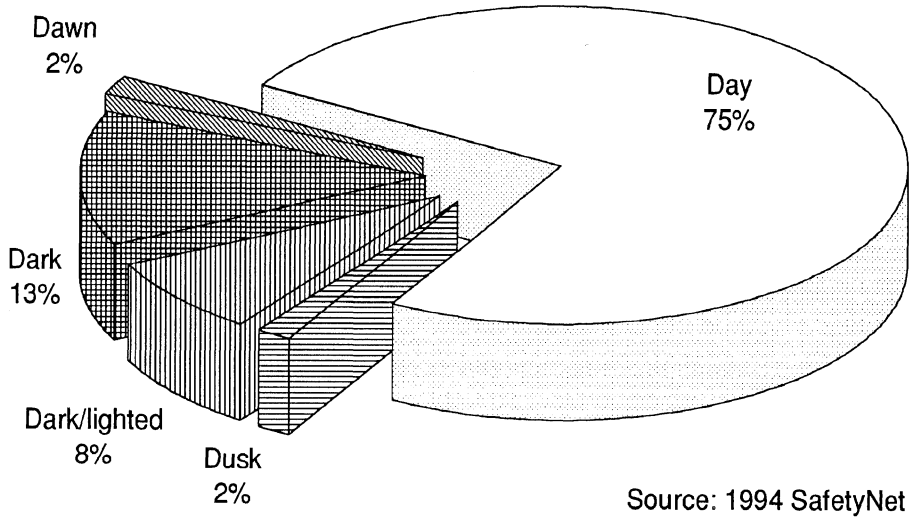


Figure IX-5 Light Condition for Nonfatal Truck Accidents Selected States



Source: 1994 SafetyNet

Figures IX-6 and IX-7 show weather and road condition by accident severity using SafetyNet data from selected States. These two figures are comparable to Tables III-3 and III-4, which used TIFA and GES data. Most accident involvements occur with no adverse weather conditions on dry roads. Fatal involvements are somewhat more likely to occur on dry roads than the other accident types.

Figure IX-6 Weather Condition by Truck Accident Severity
Selected States

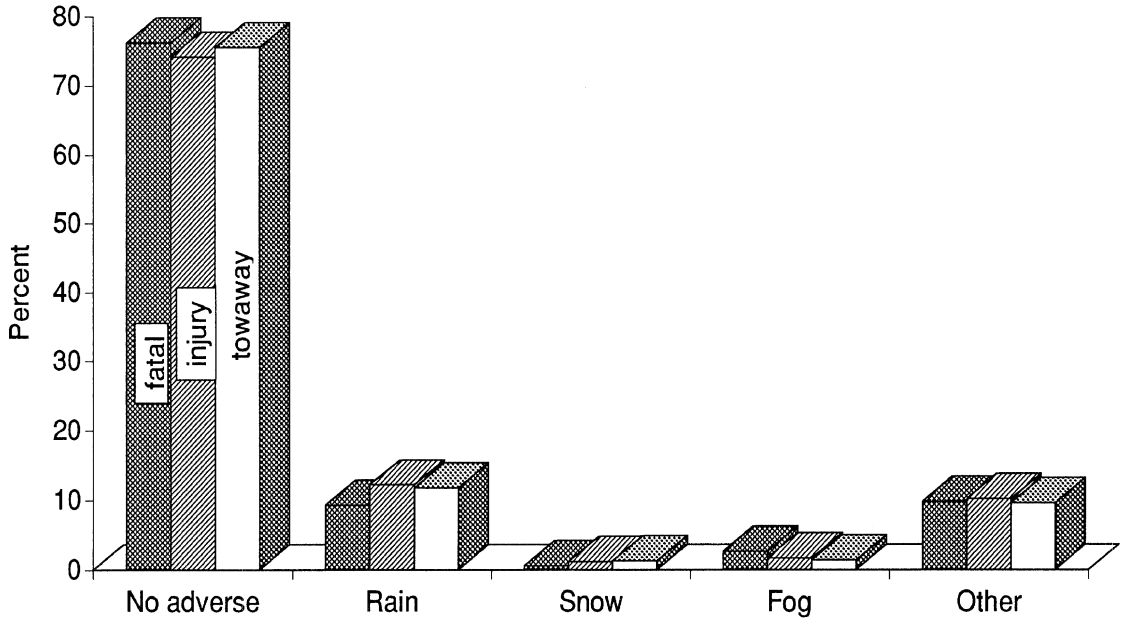
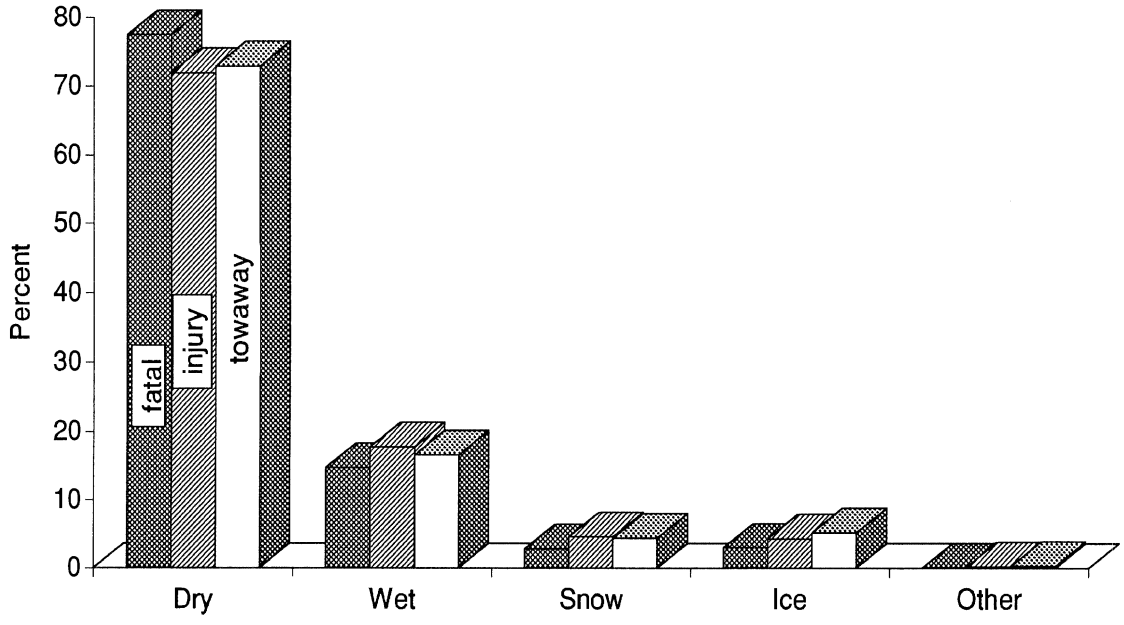


Figure IX-7 Road Condition by Truck Accident Severity
Selected States



Source: 1994 SafetyNet

Glossary

Accident severity: A measure of traffic accident consequences in terms of the most severe injury produced by the event. See *injury severity.*

Accident: See *traffic accident*

Authorized carrier: A for-hire carrier that operates across state lines and has authorization from the Federal Highway Administration (FHWA). See *exempt carrier.*

Bobtail: A tractor operating without a trailer.

Bus: A passenger-carrying vehicle designed to seat at least sixteen people, including the driver.

Double: A combination vehicle consisting of a tractor pulling two trailers.

Ejection: Ejection is when a person is completely or partially thrown from the vehicle during the accident.

Exempt carrier: A for-hire carrier exempt from some FHWA regulations because of the type of commodities carried. Most exempt commodities are those whose delivery is time-critical, such as air freight and perishable farm products. See *authorized carrier.*

Fatal Accident Reporting System (FARS): See page five in the Introduction.

Fatal accident: An accident in which the most serious event is one or more people killed as a consequence of the accident. This includes any person involved in the accident, including pedestrians and bicyclists, as well as occupants of passenger cars, trucks, and buses.

Fatal involvement: The involvement of a vehicle in a fatal accident. The fatality does not necessarily occur in the vehicle.

For-hire carrier: A company that transports goods for hire. Examples include moving companies, parcel services, and truckload carriers. For-hire carriers, if operating in interstate commerce, are either *authorized* or *exempt.*

General Estimates System (GES): See page five in the Introduction.

Injury accident: An accident in which the most serious event is one or

more persons transported for medical attention to injuries incurred in the accident. This includes any person involved in the accident, including pedestrians and bicyclists, as well as occupants of passenger cars, trucks, and buses. If there is a fatality in the accident, it is classified as a fatal accident, regardless of whether anyone was transported for medical attention.

Injury involvement: The involvement of a vehicle in an injury accident. The injury does not have to occur in the vehicle.

Injury severity: Injuries are classified as either A, B, or C:

> A injury An incapacitating injury, other than fatal, that prevents a person from walking, driving, or normally performing the activities the person was capable of before the injury.
>
> B injury A non-incapacitating injury that is visible or evident to observers at the scene of the accident.
>
> C injury A possible injury that is reported or claimed, but which is neither incapacitating nor evident to observers at the scene of the accident.

Interstate carrier: A private, authorized, or exempt carrier that transports goods across State lines.

Intrastate carrier: A private or for-hire carrier that operates entirely within one State. An intrastate carrier does not transport goods across State lines.

Jackknife: Jackknife occurs in a multi-unit combination when the trailers rotate on their vertical axes with respect to the tractor in an uncontrolled fashion, often resulting in contact between the units and damage. In the case of a tractor-semitrailer, the combination folds up like a pocket knife.

Limited-access road: A road to which access is limited to certain points only, as in the case of Interstate highways.

Major arterial: A U.S. or State numbered route which is not a *limited-access* highway.

Multitrailer: A truck, either tractor or straight truck, operating with two or more trailers. A multitrailer combination is most often a tractor pulling two trailers.

One-trailer: A truck, either tractor or straight truck, operating with one trailer. A one-trailer combination is most often a tractor pulling one semitrailer.

Other road: Any road which is not a *limited-access* road or a *major arterial.*

Private carrier: A private carrier uses its trucks to carry its own goods. Farms, construction companies, and grocery distributors are all examples of private carriers.

Rollover: Rollover occurs when the vehicle overturns. Rollover includes any number of quarter turns. A truck that turned onto its side would

count as a rollover.

Rural: A rural area is any area not in an *urban* area.

Semitrailer: A trailer pulled by a tractor, with one or more axles located toward the rear of the trailer. The trailer is connected to the tractor by means of a kingpin/fifth-wheel connection.

Single-unit: A truck with no trailer. These are primarily *straight trucks*, but also include some tractors operating without a trailer. See *straight truck* and *bobtail*.

Single: A combination vehicle consisting of a tractor pulling a semitrailer.

Straight truck: A power unit that includes a permanently mounted cargo body (e.g., a dump truck).

Towaway accident: An accident in which there is no fatality or injury but one or more involved vehicles towed from the scene due to disabling damage from the accident. Disabling damage is damage that renders the vehicle unsafe to drive under the conditions. An accident that involves either a fatality or an injury transported for treatment is classified as a fatal or injury accident, respectively.

Towaway involvement: The involvement of a vehicle in a towaway accident, whether the vehicle itself is towed or not.

Tractor: A heavy truck, with little or no cargo-carrying capacity, designed to pull semitrailers and full trailers.

Traffic accident: An unintended traffic event involving motor vehicles in transport on public roads that includes at least one harmful event. In this document, all traffic accidents conform to the SafetyNet harm threshold, with at least one of the following:

- one or more persons killed as a result of the accident
- one or more persons transported from the scene for immediate medical attention
- one or more vehicles towed from the accident as a result of disabling damage sustained in the accident

Triple: A combination vehicle consisting of a tractor pulling three trailers, most often a semitrailer and two full trailers.

Truck configuration: A classification of the combination of power unit type and number of trailers. See *single*, *double*, and *straight truck*.

Truck: A cargo-carrying vehicle with at least two axles and six tires. Includes tractors as well as straight trucks. Excludes buses, motorhomes, and farm and construction equipment not designed to carry cargo on public roads.

Trucks Involved in Fatal Accidents (TIFA): See page five in the Introduction.

Urban: An urban area is an area with a population of 5,000 or more whose boundaries are fixed by State and local authorities and approved by the Federal Highway Administration. The boundaries do not necessarily correspond to political boundaries.

Technical Appendix

GES sample design

The police accident reports (PARs) from which the GES data are coded are a probability sample of police-reported accidents that occurred in the United States. Since each accident had a chance of being selected, the design makes it possible to compute not only national estimates but also probable errors associated with the estimates.

The selection of the sample of PARs for the GES sample was accomplished in three stages. The first stage is a sample of geographic areas, called Primary Sampling Units (PSUs), from across the United States. A PSU is either a central city, a county surrounding a central city, an entire county, or group of contiguous counties. The U.S. was divided into 1,195 of these PSUs. The PSUs were then grouped into 12 categories according to the following geographic regions and types of PSUs:

- Geographic region—Northeast, South, Central, and West
- Type—Large Central City, Large Suburban Area, All others

The second stage of selection is a sample of police jurisdictions within the geographic areas. In most areas, the number of police jurisdictions is more than can be reasonably visited by a data collector. All jurisdictions within a PSU were enumerated and the number of accidents investigated by each was determined. A probability sample of jurisdictions within each PSU was selected with probability proportional to the number of accidents investigated. That is, as the number of accidents investigated increased, the probability of selecting that jurisdiction increased. An average of six or seven police jurisdictions are selected within each area.

The third and final stage of the sample is the selection of PARs within the sample police jurisdictions. The GES data collectors make weekly, biweekly, or monthly visits to each of the jurisdictions in the sample. During the visit, the data collectors list all PARs not previously listed. The PARs are grouped, or stratified, into four groups:

- Group 1. All accidents involving a towed passenger vehicle (i.e., a passenger car, light truck, or van, but no medium or heavy trucks)
- Group 2. All accidents involving a medium or heavy truck and where at least one passenger vehicle was towed or an involved person was injured

- Group 3. All accidents not involving a towed passenger vehicle or medium or heavy truck, but in which an involved person was injured

- Group 4. All other accidents

Within each of these groups a systematic sample of accidents is selected, based on different sampling ratios. In some very large police jurisdictions the number of police-investigated accidents is too large for reasonable listing. In these jurisdictions the data collector will list a subsample of PARs, with those listed depending on the Police Accident Report Number.

The data collector obtains copies of the selected PARs and sends them to a central contractor, who extracts the required data, codes them into a common format and enters the data into an electronic file. In 1994 55,759 PARs were sampled.

GES estimates

In order to calculate estimates of national characteristics, cases from each selected sample PAR must be weighted to reflect their probability of selection. Because there are three stages in the GES sampling process, the sample weight is the product of the inverse of the probability of selection at each of these stages. These sample weights are appended to the record for that sample PAR in the electronic data file. By summing the sampling weights for each PAR on the electronic data file that have a certain characteristic, an estimate of the National total for the characteristic can be produced.

Estimates of accuracy

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. The standard error of an estimate is a measure of the precision or reliability with which an estimate from this particular GES sample approximates the results of a census.

It is impractical to compute and provide a standard error for each estimate in the *Factbook*. Instead, generalized standard errors for estimates of totals are provided in the following table. Generalized standard errors are shown for accident characteristics, vehicle characteristics, and people characteristics. The generalized errors were produced separately for the accident, vehicle, and people estimates using three steps:

1. The standard errors for selected estimates in the report were calculated using a Taylor series approximation.

2. An equation that best fit these standard errors was found using regression techniques.

3. Approximate standard errors were generated from this equation and the generalized errors shown in the table were produced.

The table lists several representative estimated population values and an estimate of one standard error for that value derived from 1994 GES data. By adding and subtracting one standard error to the associated estimate, approximate 68% confidence intervals for an estimate can be created. For example, the estimated number of trucks involved in traffic accidents in 1994 is given in table II-2 as 151,000. To calculate one standard error for this involvement estimate, use the column headed "vehicles" in the table. Since the figure 151,000 does not appear in the column, use linear interpolation from the standard error values for 150,000 and 160,000. One approximate standard error would be 12,200 + 70 = 12,270. The 68% confidence interval for this estimate would be 151,000 ± 12,270 or 138,730 to 163,270. Twice the standard error gives approximately the 95% confidence interval. For the number of trucks involved in traffic accidents in 1994, the 95% confidence interval would be 126,460 to 175,540.

More information on standard error estimates can be obtained from the National Center for Statistics and Analysis in the National Traffic Highway Safety Administration.

Standard errors for estimates of accidents, vehicles, and people from 1994 GES file

	Standard errors		
Estimate	accidents	vehicles	people
1,000	400	400	400
2,000	600	600	500
3,000	800	700	700
4,000	900	900	800
5,000	1,000	1,000	900
10,000	1,600	1,500	1,400
15,000	2,100	2,000	1,900
20,000	2,600	2,500	2,300
25,000	3,100	2,900	2,700
30,000	3,500	3,300	3,100
35,000	3,900	3,800	3,400
40,000	4,400	4,200	3,800
45,000	4,800	4,600	4,100
50,000	5,200	4,900	4,500
60,000	6,000	5,700	5,200
70,000	6,700	6,500	5,900
80,000	7,500	7,200	6,500
90,000	8,300	7,900	7,200
100,000	9,000	8,600	7,800
110,000	9,700	9,400	8,500
120,000	10,500	10,100	9,100
130,000	11,200	10,800	9,800
140,000	11,900	11,500	10,400
150,000	12,700	12,200	11,000
160,000	13,400	12,900	11,700

Index