UMTRI-91-6

TRUCKS INVOLVED IN FATAL ACCIDENTS 1987 FACTBOOK

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June 1991

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The research reported herein was conducted under general research funds provided by the Motor Vehicle Manufacturers Association and the American Trucking Associations. The opinions, findings, and conclusions expressed in this publication are not necessarily those of the MVMA or ATA.

Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
UMTRI-91-6		

4. Title and Subtitle	5. Report Date
TRUCKS INVOLVED IN FATAL ACCIDENTS 1987 FACTBOOK	June 1991
	6. Performing Organization Code
7. Author(s)	8. Performing Organization Report No.
Dawn L. Massie	UMTRI-91-6
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. 1164
12. Sponsoring Agency Name and Address Motor Vehicle Manufacturers' Association 7430 Second Avenue, Suite 300 Detroit, Michigan 48202	13. Type of Report and Period Covered Final Report 14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

This report contains a series of distributions of variables from UMTRI's file of Trucks Involved in Fatal Accidents, 1987. This file combines the coverage of the Fatal Accident Reporting System (FARS) data with the detail of the Office of Motor Carrier (OMC) data. When no OMC report existed for a medium or heavy truck listed by FARS, UMTRI conducted a telephone interview to obtain the desired information on ownership, type of trip, vehicle configuration, cargo weights, and lengths. The 1987 TIFA dataset contains 5,275 cases, up 0.6% from the 5,244 in 1986.

Following an introductory section on the TIFA survey procedure, a trend section tracks the incidence of large truck fatal involvements from 1980, the initial data year of TIFA, through 1987. The next section provides an overview of the fatal involvements in 1987, with most of the distributions presented on the basis of power unit type, comparing straight trucks with tractor combinations. Most of the variables in the overview section are based on the FARS file variables and describe basic information on the time and place of the accident, environmental conditions, and collision type. Following this are a pair of sections that focus separately on straight trucks and tractor combinations in more detail, with the distributions presented on the basis of cargo body style. The majority of the variables in these sections were derived from telephone interviews and OMC reports and describe the cargo type, cab style, vehicle weight, and trailer and axle configurations of the trucks. The final section compares the fatal accident experience of tractor-semitrailers with that of tractors with twin trailers.

17. Key Words	18. Distribution Statement
Medium trucks, heavy trucks, fatal accident data, power unit type, cargo body style	Unlimited

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
None	None	124	

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TIFA Summary Facts and Figures

- From 1980 through 1987, a total of 41,187 medium and heavy trucks were involved in fatal accidents. This is an average of 5,148 fatal involvements per year.
- The total number of fatal involvements for large trucks in 1987 was 5,275, compared to 5,244 in 1986, an increase of only 0.6%.
- 3,743 (71.0%) of the large trucks involved in fatal accidents in 1987 had a tractor as the power unit, and 1,517 (28.8%) were straight trucks.
- Tractor-semitrailers were involved in 3,266 fatal accidents in 1987, and doubles (tractors hauling a semi- and a full trailer) were involved in 232 fatal accidents. Triples experienced no fatal involvements in 1987.
- A total of 11,078 vehicles were involved in large truck fatal accidents in 1987.
- These accidents resulted in a total of 6,192 fatalities, 710 of which were truck drivers.
- The 1987 figure for fatally-injured truck drivers represents a 20% decrease since 1984 and a drop of nearly 24% since 1980.
- About 60% of all of the 1987 large truck fatal involvements occurred during the daytime, 37% at night, and 3% during the dawn and dusk periods.
- 24% of the 1987 fatal accidents occurred on limited access highways, 57% on major arteries, and 19% on other classes of roads.
- The road surface was wet in 15.5% of the 1987 fatal accidents and covered with snow or ice in 3.2%.
- 66% of the 1987 fatal involvements took place in rural areas, compared to 34% in urban areas.
- Of all the large truck fatal involvements in 1987, 23% occurred at intersections.

INTRODUCTION

In 1981 UMTRI initiated a survey of all large trucks involved in fatal accidents in the continental United States, with 1980 being the initial year covered. The survey combines information from the Fatal Accident Reporting System (FARS) of the U.S. Department of Transportation National Highway Traffic Safety Administration (NHTSA) with data from the Federal Highway Administration Office of Motor Carriers (OMC) MCS 50-T report, state police accident reports, and comprehensive follow-up telephone surveys conducted by UMTRI research staff to produce the datafile called Trucks Involved in Fatal Accidents (TIFA). The TIFA survey has been conducted continuously since 1981 and is currently complete for accident years 1980 through 1987. The dataset provides detailed descriptions of all medium and heavy trucks (greater than 10,000 lbs. gross vehicle weight rating) involved in fatal accidents. Pickup trucks, vans, and utility vehicles are excluded from the file, as are fire trucks and passenger vehicles, such as buses and ambulances.

Survey Methodology

TIFA covers all large trucks included in the public version of the FARS file. The TIFA dataset contains virtually all of the FARS variables—the accident variables, the vehicle variables (for the truck), and the occupant variables (for the driver of the truck). All variables are at the *vehicle* level; i.e., there is one record for each truck involved. The information on trucks supplied by FARS is limited to make, model year, and configuration. The FARS variables contain no information on cargo body style, cargo type and weight, or the weights of any of the units. In addition, there are some configurations that FARS does not identify accurately. Therefore, an additional set of variables in the TIFA file contains the more detailed description of the vehicle and its cargo that is on the OMC MCS 50-T report. Interstate carriers of goods are required to file reports with OMC on accidents resulting in injury or in property damage of at least $4,400. For FARS cases without an OMC report, a follow-up telephone survey is conducted to collect a detailed physical description of the involved truck. The questions cover most of the information reported on the MCS 50-T form. It is the objective of the TIFA survey to obtain the detail of the MCS 50-T information for all large trucks involved in fatal accidents, not just those operated by interstate motor carriers and reported to OMC.

The survey procedure (illustrated in the flow chart on the next page) begins by matching OMC fatal accident reports with FARS cases. In all instances where a computerized match is made, the vehicle description variables from the OMC file are picked up and added to the data already in the FARS file, producing a much fuller record for each event. The FARS/OMC matched cases then proceed directly to Consistency Checking, where a set of computerized algorithms check for the total consistency between elements in each individual dataset. If inconsistencies are found in the vehicle description—for example a vehicle coded as empty but with a high gross weight—the case is reviewed by an editor. If the editor cannot resolve the discrepancy, the case is sent to Interviewing for follow-up calls to gather direct information about the vehicle. Police accident reports (PARs), which are obtained from the states for all large trucks involved in fatal accidents each year, provide the names of individuals to contact for further information. The additional data are added to the record, and it is forwarded to Editing. If all conflicting information can be reconciled, the record is again sent to Consistency Checking and, if passed, added to the TIFA database. In addition to the consistency checking, all OMC cases of double- and triple-trailers are verified through examination of police accident reports and, if necessary, phone interviews.

For cases that cannot be matched, the OMC reports are discarded, and the FARS report is used as the base for creating a complete record by means of a telephone interview. The cases are matched with PARs, and telephone interviews are then conducted to obtain company and vehicle descriptions of the trucks. Interviewers begin by attempting to contact the owner of the vehicle as listed in the police report. If that fails, they try to reach the driver, the investigating police officer, or the tow truck operator if the vehicle was towed from the scene. If no knowledgeable respondent can be found, as much information as possible is coded from the police report. Extensive editing and consistency checking are performed on all information obtained by interview. The typical case will go through the Interviewer/Edit/Consistency Check loop more than once. It is rare that a case is sufficiently developed to proceed directly to the TIFA file with only one interview.

TIFA CASE FLOW

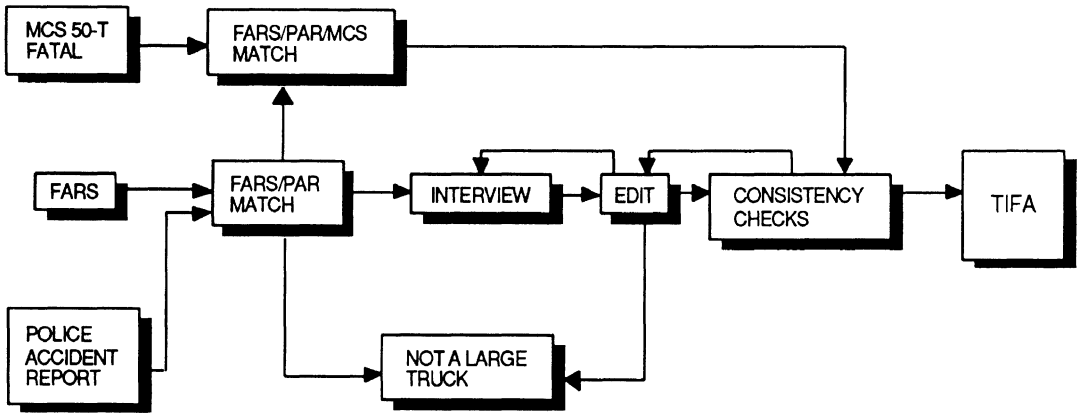


Figure 1-1

Part of editing and consistency checking involves decoding Vehicle Identification Numbers (VINs) from every PAR and FARS record to confirm that the make and model information and the power unit description are consistent with published model specifications. In addition, Edit Data Lists, which are UMTRI-developed editing manuals, are used to evaluate information obtained from interviews to ascertain the accuracy of the reporting, especially concerning the types of freight hauled, the necessary equipment, and the typical hardware configurations used under such conditions. UMTRI has also developed a database on cargo weights and densities so that a cargo weight can, if necessary, be computed from information on cargo type and volume. The scrutiny to which each case is subjected assures the internal consistency of the information in the final product, TIFA itself. And the use of multiple sources of information for the same accident permits a deeper level of description and greater confidence in the accuracy of the file. A prime benefit of this procedure is that the level of missing data in TIFA is on the order of 1-2 percent for most specific factors of interest, an exceptionally low rate for this kind of data.

Sampling and the 1987 File

The 1987 version of TIFA marks the first time that the file is not a census of all cases. Random sampling was done among the two most common truck configurations to limit the number of cases to be interviewed, while preserving the representativeness and accuracy of a

census file. Accordingly, after the FARS cases were matched with the OMC cases, and after all non-sample vehicles were removed from the file, sampling was done on cases that the FARS configuration variables showed to be either a straight truck with no trailer or a tractor pulling a semitrailer. These two vehicle types are the two most common configurations, as well as the configurations most likely to be identified accurately in FARS. After sorting to insure even coverage across the accident year, an interval selection procedure was employed within each accident state to select every other case. As a result, all cases matched with OMC are included in the file, as well as all cases which, from the FARS codings, did *not* appear to be a straight truck or a tractor-semitrailer. These cases have a weight of one. Half of the unmatched straight trucks and tractor-semitrailers (as identified from FARS codings) were selected for the survey and have a weight of two.

Confidence intervals were calculated for population estimates from the 1987 file in two ways. The first took into account the fact that the file is a stratified random sample. The 95% confidence intervals for population proportions are very tight. For example, the proportion of cases in urban areas is 33.9% ± 1.6. The proportion of cases with fires is 4.5% ± 0.7. Six other representative proportions were checked. The widest confidence interval for any of the proportions was ± 1.6%.

Confidence intervals were also calculated using a technique that treats the 1987 file *as if* it were a census file, or a simple random sample of all 5,275 cases.[1] The confidence intervals for the stratified random sample are only about 20% wider than they would have been had all the cases been taken. For example, the 95% confidence interval for the proportion of urban cases would have been ± 1.3 rather than ± 1.6. It is to be expected that sampling would produce somewhat wider confidence intervals, since there is a smaller number of cases, but the difference is not large. The confidence intervals calculated by these two techniques indicate that the limited sampling performed has only a negligible effect on the accuracy of estimates derived from the 1987 file.

Conventions Followed

Most of this Factbook concerns the 1987 TIFA file, which was the first year in which sampling was conducted. All of the statistics presented in this document for 1987 are based on *weighted* frequencies from the file. Therefore, the 1987 figures reflect estimates of the total population based on the sampling technique used, not the actual number of cases contained in the file. Figures quoted for earlier years were derived from census files and are identical to the number of cases in the files.

The majority of the comparisons presented in this report are made according to power unit type or configuration. The 1987 TIFA file contains 112 cases of unknown power unit type. Most of these are cases that could not be matched with OMC reports and where we

[1]Calculating confidence intervals for census data is appropriate and frequently done. It is true that if the proportion of urban accidents in a census file from a particular year is 0.32, then that is the proportion of urban accidents for that year. But in another sense, interest typically is not narrowly in any particular year of accident data but in the relationship between certain factors and the probability of an accident. In that sense, any particular accident year constitutes a sample of accidents, so confidence intervals are properly calculated for the resulting estimates. The point of calculating confidence intervals for the sample actually taken and confidence intervals as if all accidents were taken is to see whether the sampling significantly degrades our ability to discern relationships in the factors of interest. Since the accuracy of the population estimates from the sampled file is comparable to that which would have been obtained had no sampling been done, we can safely assume that the effects of sampling are not significant. Similarly, the estimates calculated from the 1987 file are comparable to figures from previous TIFA files.

were unable to contact any knowledgeable respondent during the interview process. In order to reduce the number of unknowns for the purposes of the Factbook, the FARS coding of power unit type was accepted for those cases coded as unknown in the TIFA file. This reduces the number of unknowns from 112 to 15. Power unit type comparisons are made for straight trucks versus tractor combinations, with the 15 unknown cases excluded.

The configuration type classifications are based solely on survey variables, not FARS variables. Straight trucks are split into single-units versus those hauling one trailer. Tractors are divided into bobtails, tractor-semitrailers, and tractor-semi-full combinations. There is no category for triples (tractors hauling a semitrailer and two full trailers) because no triples were involved in fatal accidents in 1987. An "other" category includes such configurations as straight trucks hauling two trailers, tractors hauling trailer types other than a semitrailer or a semi- and a full trailer, and trucks towing or piggybacking other vehicles. The configuration type variable also includes an "unknown" level.

The usual procedure in the Factbook is to illustrate distributions of variables with both a table and a graph. The tables all include missing data for the particular variables. Since most of the missing data rates are low, the missing data have usually been excluded when graphing the distributions. This facilitates visual comparisons of the distributions and enables a clearer graphic presentation.

TRENDS IN THE TIFA DATA, 1980-1987

The eight years of data currently contained in the TIFA files allow for the analysis of trends in large truck fatal involvements. This section contains graphs illustrating these trends for all fatal involvements, all fatalities, and truck driver fatalities. The graphs are presented for all large trucks together, and separately for each of the five main configurations. These include straight trucks alone, straight trucks hauling a single trailer, bobtails (tractors alone), singles (tractor-semitrailers), and doubles (tractors hauling a semi- and a full trailer).

Annual Fatal Involvements

The total number of fatal accidents involving large trucks has varied only slightly from year to year since 1980. The lowest number of involvements occurred in 1982 with 4,719. This dip corresponds with the recession at the beginning of the decade. The yearly total increased steadily after that, reaching a high of 5,394 in 1985. Instead of continuing to rise as might be expected, the total decreased in 1986 and increased only slightly in 1987. The 1987 total of 5,275 involvements is 4.3% higher than the 1980 figure.

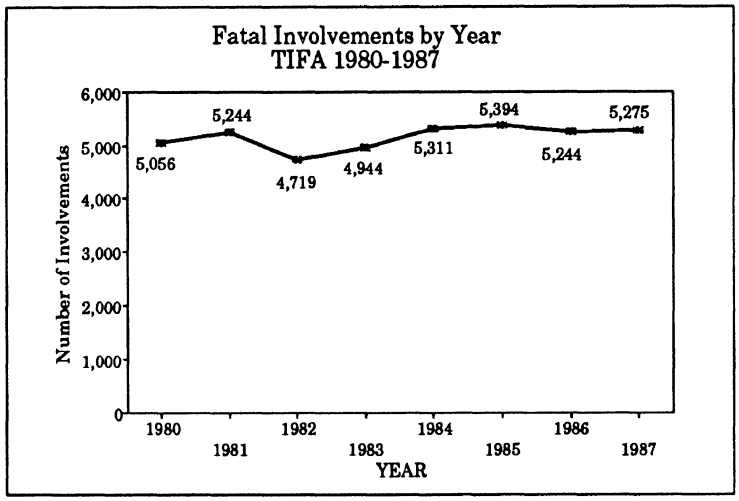


Figure 2-1

The next five graphs depict the annual number of fatal involvements for each of the five main large truck configurations.

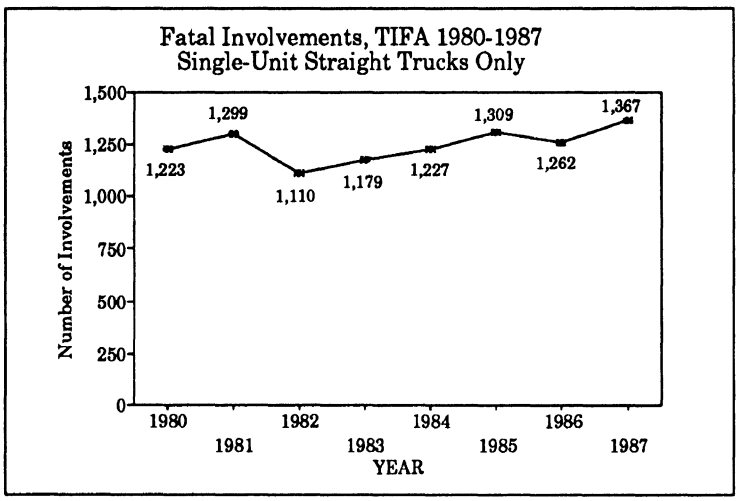


Figure 2-2

Single-unit straight truck involvements correspond closely to the overall trend. The exception is a rise in involvements from 1986 to 1987 of 8.3%. This compares to an increase of only 0.6% for all large trucks.

While the lowest number of fatal involvements overall occurred in 1982, this was the peak year for fatal accidents involving straight trucks with one trailer. However, this configuration type comprises a very small proportion of the large truck population.

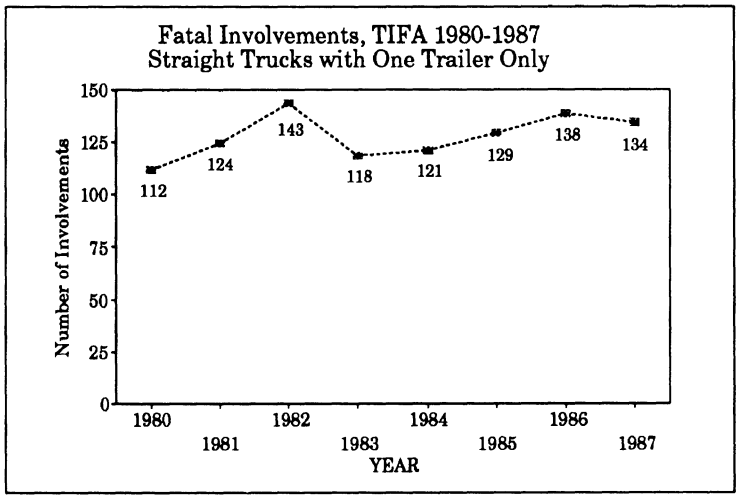


Figure 2-3

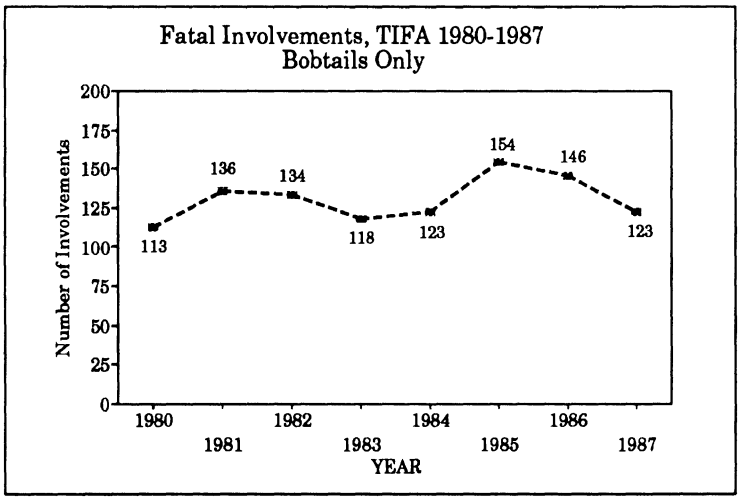


Figure 2-4

Bobtails similarly account for only a minor number of large truck fatal involvements each year. As with large trucks in general, the peak number of bobtail involvements occurred in 1985, with 154. The number declined in the following two years, falling to 123 in 1987. The percentage variation from year to year in the number of fatal involvements is greater for bobtails than for large trucks overall.

The eight-year trend for tractor-semitrailer involvements closely mirrors the overall trend. This is not surprising since this configuration accounts for a majority of all medium and heavy trucks.

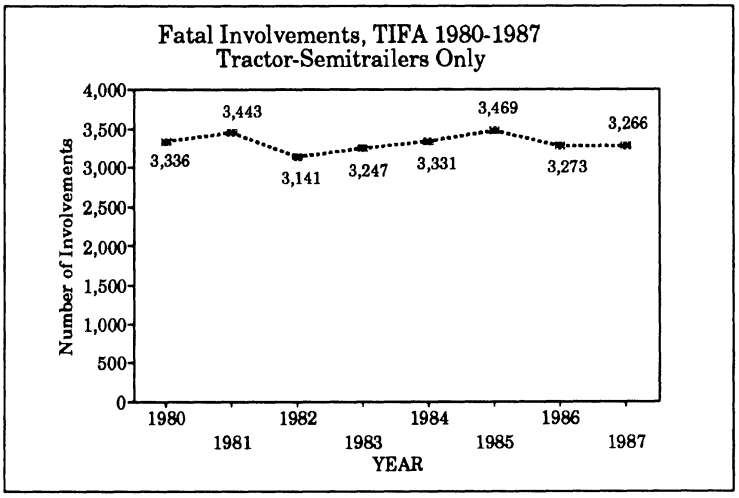


Figure 2-5

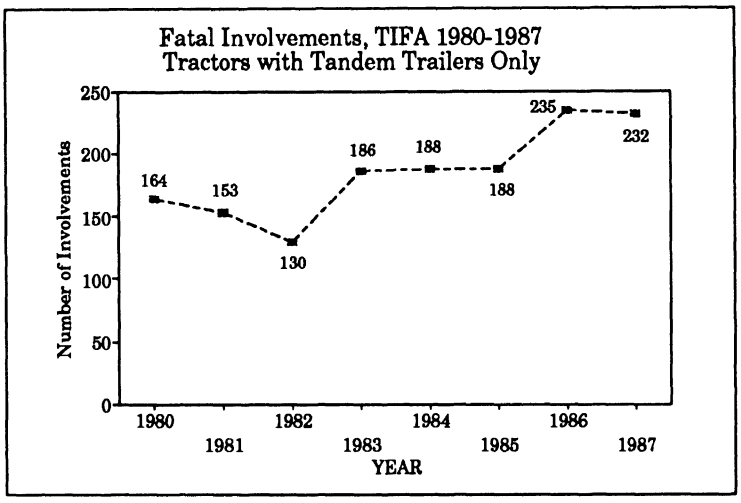


Figure 2-6

Fatal involvements for doubles have risen somewhat in recent years. This probably relates to the increased use of doubles during the decade.

Annual Fatalities

The trend for the annual number of fatalities resulting from accidents involving large trucks closely corresponds to the trend for the annual number of involvements. As with involvements, the peak year for fatalities was 1985 with 6,441, and the low year was 1982 with 5,620. The number of fatalities in 1987 totaled 6,192, a rise of 0.8% from the previous year. The 1987 total is 1.7% higher than the figure for 1980.

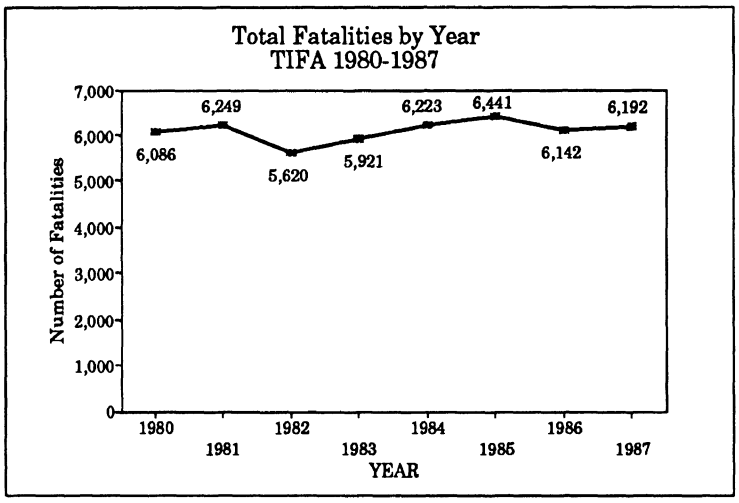


Figure 2-7

The following series of graphs illustrates yearly fatalities for each of the five truck configurations.

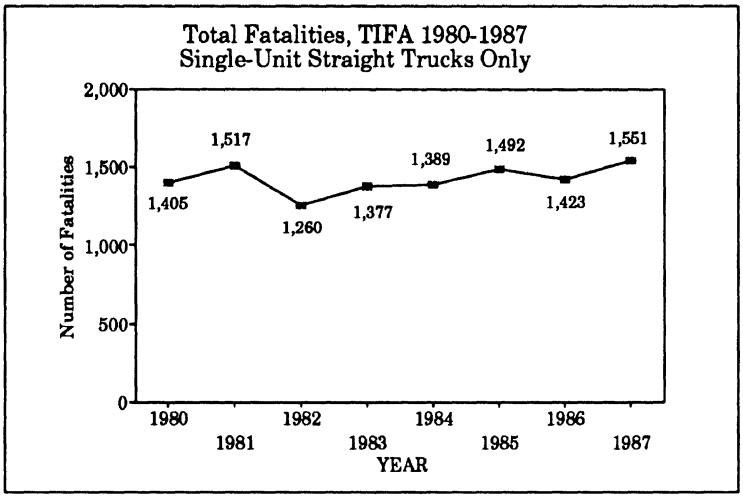


Figure 2-8

As was the case for involvements, the main difference between the straight truck fatality distribution and the overall fatality distribution is the greater increase from 1986 to 1987 for the straight trucks. These fatalities rose from 1,423 to 1,551 between the two years, an increase of 9 percent.

The annual number of fatalities resulting from accidents involving straight trucks with one trailer has ranged from 133 in 1984 to 181 in 1982. The figure for 1987 was 156 fatalities, a slight drop from 162 the year before.

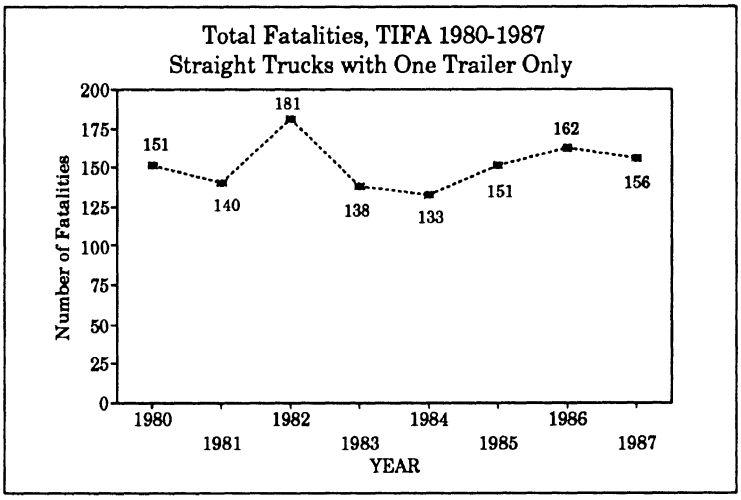


Figure 2-9

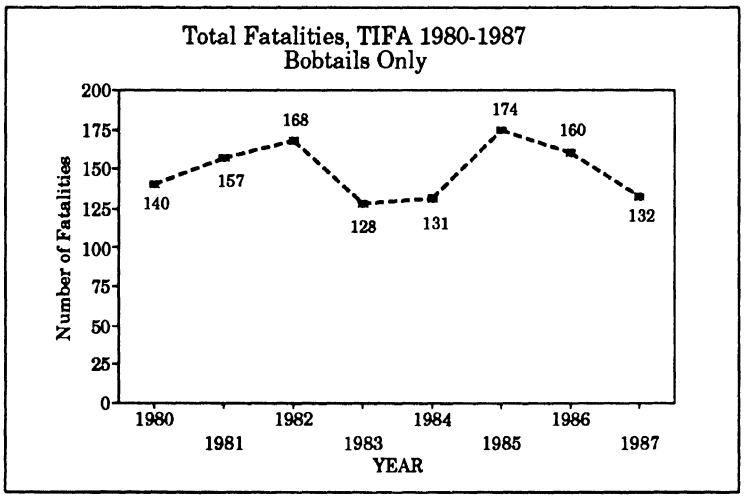


Figure 2-10

Over the last three years considered here, the number of fatalities resulting from bobtail involvements has decreased from 174 to 132, a 24% drop.

The number of fatalities resulting from singles involvements was virtually the same in 1986 and 1987, with 3,889 and 3,893 respectively. There is evidence for a slight downward trend since the beginning of the decade for these fatalities. The 1987 figure represents a 3.9% drop from the 1980 total.

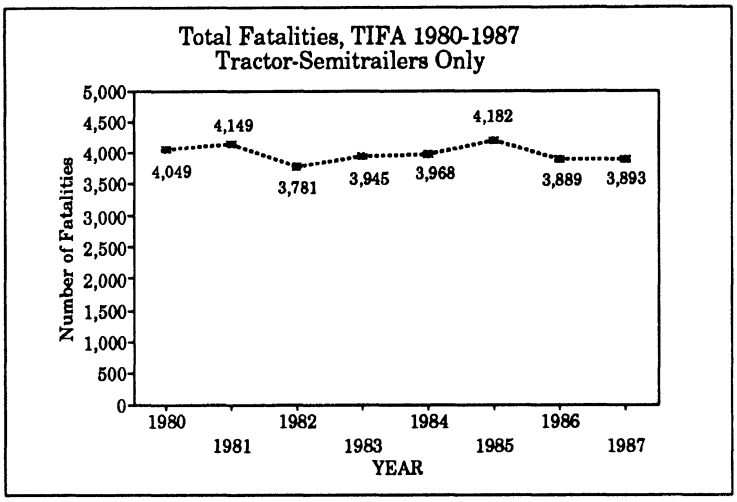


Figure 2-11

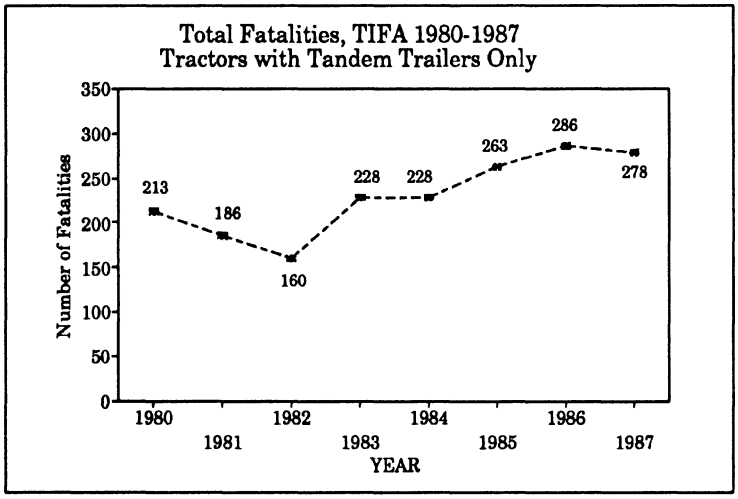


Figure 2-12

In contrast, fatalities resulting from doubles involvements have clearly risen during the 1980s. This increase corresponds with the increased reliance on doubles and the higher number of fatal involvements they have experienced over the past few years. After several years of increases, the 1987 figure of 278 fatalities represents a slight drop from the 286 fatalities the year before.

Annual Truck Driver Fatalities

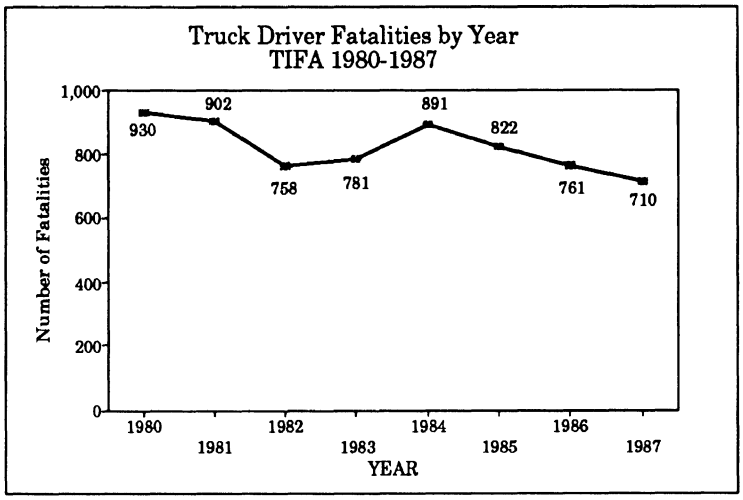


Figure 2-13

While the annual trends for fatal involvements and total fatalities closely resemble each other, the trend for truck driver fatalities is quite different. Despite a fairly constant number of annual involvements from 1984 through 1987, the number of truck driver fatalities has dropped significantly in each of the last three years. Furthermore, the *proportion* of truck driver fatalities out of all fatal involvements has declined steadily from 18.4% in 1980 to 13.5% in 1987. As the next five graphs illustrate, the overall trend for truck driver fatalities is clearly driven by the pattern shown for drivers of tractor-semitrailers.

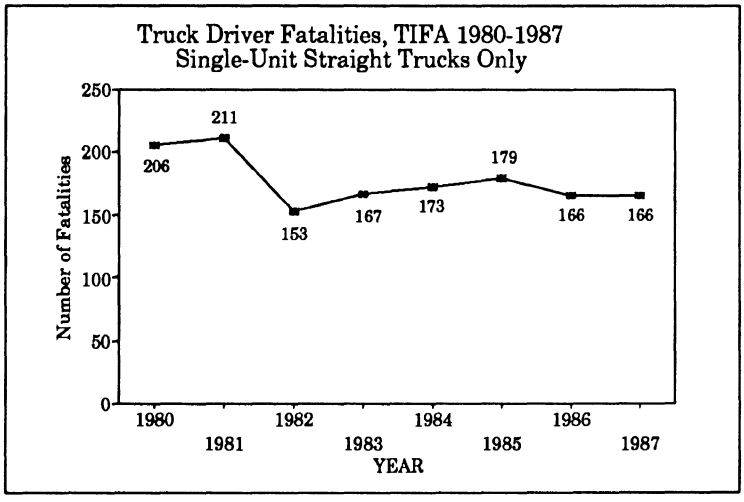


Figure 2-14

In 1980 and 1981 the annual number of fatalities for single-unit straight truck drivers was over 200. Since then the figure has ranged from 153 in 1982 to 179 in 1985. The number of fatalities was 166 in both 1986 and 1987.

Not surprisingly, there are only a small number of fatalities for drivers of straight trucks with one trailer each year. This number steadily declined from 16 in 1980 to 8 in 1984 and 1985 before rising again to 15 in 1986 and 16 in 1987.

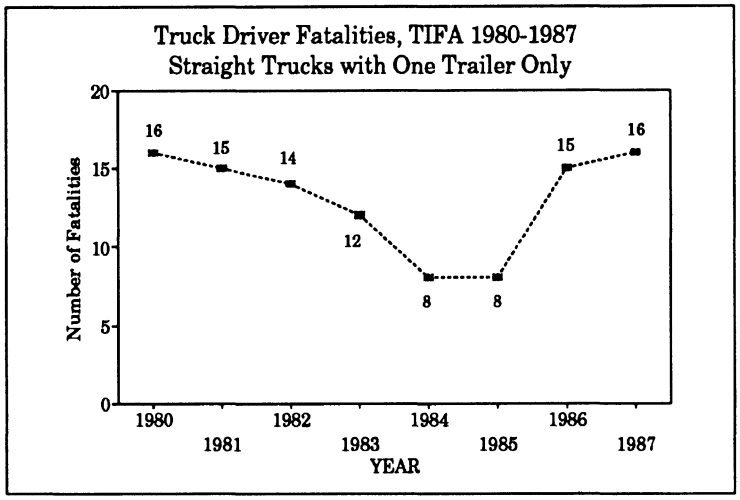


Figure 2-15

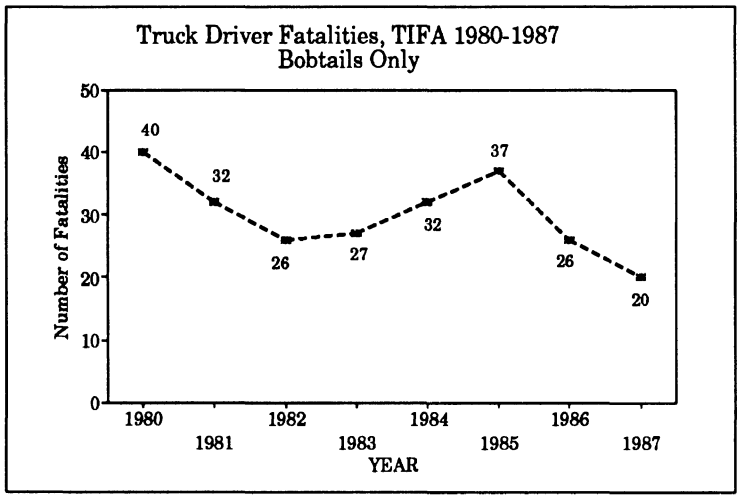


Figure 2-16

The annual number of fatalities for bobtail drivers has fluctuated from year to year. The highest number of fatalities out of the eight years occurred in 1980 with 40, while the low was reached in 1987 with 20.

The fatality trend for singles drivers very closely matches the overall trend for all drivers of large trucks. The number of fatalities for tractor-semitrailer drivers has dropped noticeably in each of the last three years, and the 1987 figure of 447 fatalities is 27.7% lower than the 618 fatalities that took place in 1980.

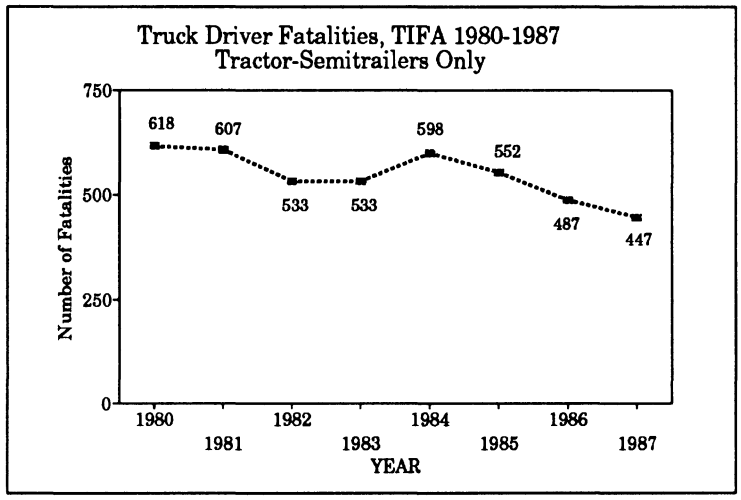


Figure 2-17

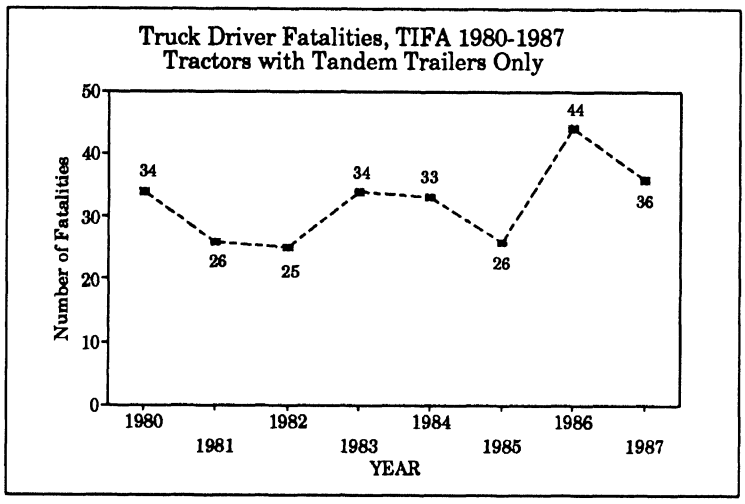


Figure 2-18

The number of fatalities for drivers of doubles shows a good deal of year-to-year variation. The low number occurred in 1982 with 25, and the high was reached in 1986 with 44. The 36 fatalities in 1987 are just two more than the 1980 figure.

OVERVIEW OF LARGE TRUCK FATAL ACCIDENT INVOLVEMENTS IN 1987

The information in this section characterizes the general fatal accident experience of medium and heavy trucks in 1987. The section begins with the distribution of fatal accidents by state. Figures are presented for each of the five main configuration types as in the last section on yearly trends.

The remainder of the section presents the data according to power unit type, contrasting straight trucks with tractor combinations. One focus is on when and where the accidents took place and under what type of conditions, such as day versus night and rural versus urban areas. Some of the other variables describe the accident itself in terms of the type of collision. Another part of the section pertains to the drivers of the trucks and includes information on driver age, restraint use, alcohol use, and injury experience. The section concludes by comparing the involved straight trucks and tractors in terms of physical characteristics of the trucks themselves.

Geographic Distributions

The map of the continental United States below indicates where fatal accidents involving large trucks were concentrated in 1987. Not surprisingly, the more populous states, such as California and those in the northeast and the sunbelt, tended to have the greatest number of fatal accidents. The more sparsely populated western and northwestern states experienced fewer fatal involvements.

Truck Fatals by State

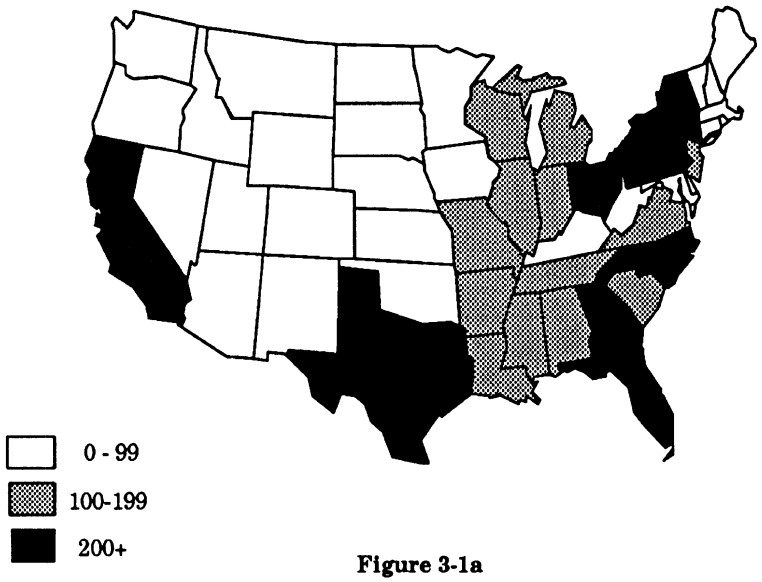


Figure 3-1a

The next two maps illustrate the distribution of fatal involvements for tractor-semitrailers and for tractor doubles. The state distribution for singles corresponds closely to the overall distribution. The doubles distribution shows a shift towards the western portion of the country. Of the 232 fatal accidents involving doubles in 1987, 92 took place in California, 16 in Michigan, and 11 in Washington. These three states accounted for 51.3% of the total, and California alone accounted for nearly 40%.

Truck Fatals by State

Singles Only

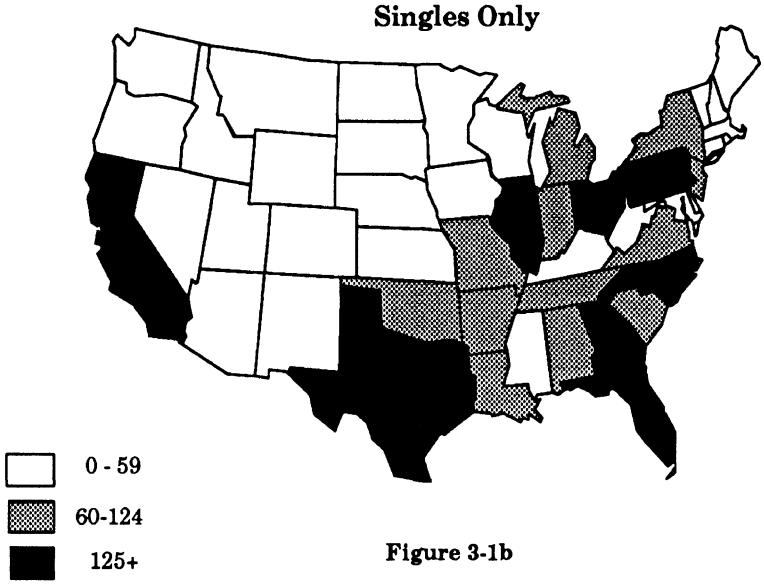


Figure 3-1b

Truck Fatals by State

Doubles Only

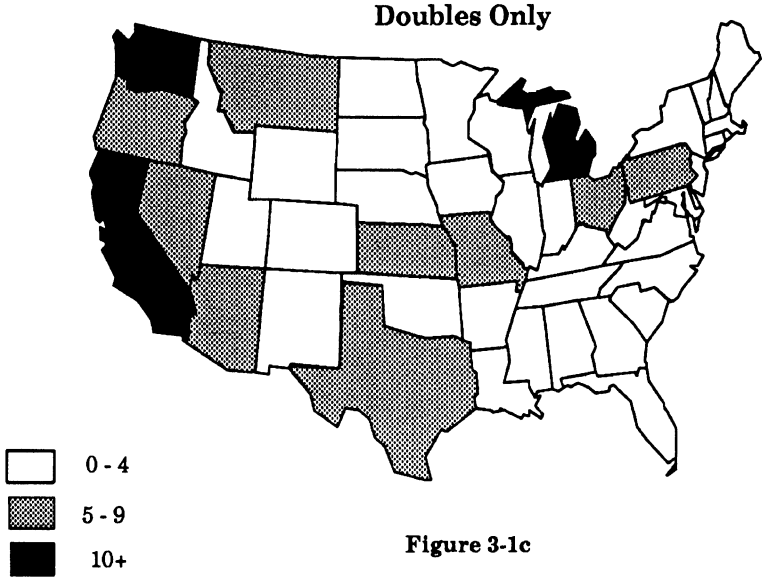


Figure 3-1c

Table 3-1A on the next page lists the number of involvements for each state, with a breakdown according to the five main configuration types. Table 3-1B lists the percentages for each state. California recorded the greatest number of fatal accidents with 508, followed by Texas with 357 and Florida with 320. Together these three states accounted for 22.5% of the fatal involvements in 1987.

TABLE 3-1A
Distribution of Trucks in Fatal Accidents by State and Type of Truck, TIFA 1987

State	Total Number	Straight Truck Alone	Straight Truck w/Trailer	Bobtail	Single	Double	Other	Unknown Truck Type
AL	144	32	1	4	102	2	3	0
AZ	86	18	7	0	53	8	0	0
AR	101	22	0	0	77	2	0	0
CA	508	109	38	13	245	92	8	3
CO	51	19	2	2	26	2	0	0
CT	36	18	0	1	17	0	0	0
DE	26	8	2	0	16	0	0	0
DC	3	2	0	0	1	0	0	0
FL	320	97	7	11	203	2	0	0
GA	212	58	1	8	140	4	1	0
ID	26	4	0	0	19	3	0	0
IL	197	52	2	5	134	1	0	3
IN	167	33	2	3	124	3	2	0
IA	68	14	2	4	45	1	0	2
KS	79	13	0	0	59	7	0	0
KY	86	29	0	1	54	1	0	1
LA	122	28	1	3	83	4	3	0
ME	24	10	0	0	14	0	0	0
MD	95	40	3	2	45	1	0	4
MA	62	27	3	0	30	1	1	0
MI	143	34	9	5	77	16	2	0
MN	59	13	0	1	42	3	0	0
MS	103	4	0	1	14	0	0	84
MO	149	30	4	4	105	6	0	0
MT	22	0	1	0	16	5	0	0
NE	48	13	1	0	31	3	0	0
NV	20	3	0	0	11	6	0	0
NH	15	9	0	0	6	0	0	0
NJ	108	36	2	3	66	0	0	1
NM	57	9	1	1	44	2	0	0
NY	223	97	3	5	114	3	0	1
NC	200	44	1	6	143	3	3	0
ND	11	2	1	0	8	0	0	0
OH	222	56	2	8	147	6	3	0
OK	81	15	2	0	63	1	0	0
OR	56	8	1	2	37	6	2	0
PA	298	90	5	5	188	5	2	3
RI	12	9	0	0	3	0	0	0
SC	106	21	2	1	69	1	0	12
SD	16	4	3	1	6	0	2	0
TN	145	31	3	4	105	2	0	0
TX	357	68	11	11	257	6	4	0
UT	24	5	0	1	13	4	1	0
VT	8	2	0	0	6	0	0	0
VA	126	48	1	3	72	2	0	0
WA	63	18	5	3	26	11	0	0
WV	72	26	0	0	43	3	0	0
WI	103	36	5	1	58	1	2	0
WY	15	3	0	0	9	3	0	0
TOTAL	5,275	1,367	134	123	3,266	232	39	114

TABLE 3-1B
Distribution of Trucks in Fatal Accidents by State and Type of Truck, TIFA 1987
Column Percents

State	Total	Straight Truck Alone	Straight Truck w/Trailer	Bobtail	Single	Double	Other	Unknown Truck Type
AL	2.7%	2.3%	0.7%	3.3%	3.1%	0.9%	7.7%	0.0%
AZ	1.6	1.3	5.2	0.0	1.6	3.4	0.0	0.0
AR	1.9	1.6	0.0	0.0	2.4	0.9	0.0	0.0
CA	9.6	8.0	28.4	10.6	7.5	39.7	20.5	2.6
CO	1.0	1.4	1.5	1.6	0.8	0.9	0.0	0.0
CT	0.7	1.3	0.0	0.8	0.5	0.0	0.0	0.0
DE	0.5	0.6	1.5	0.0	0.5	0.0	0.0	0.0
DC	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
FL	6.1	7.1	5.2	8.9	6.2	0.9	0.0	0.0
GA	4.0	4.2	0.7	6.5	4.3	1.7	2.6	0.0
ID	0.5	0.3	0.0	0.0	0.6	1.3	0.0	0.0
IL	3.7	3.8	1.5	4.1	4.1	0.4	0.0	2.6
IN	3.2	2.4	1.5	2.4	3.8	1.3	5.1	0.0
IA	1.3	1.0	1.5	3.3	1.4	0.4	0.0	1.8
KS	1.5	1.0	0.0	0.0	1.8	3.0	0.0	0.0
KY	1.6	2.1	0.0	0.8	1.7	0.4	0.0	0.9
LA	2.3	2.0	0.7	2.4	2.5	1.7	7.7	0.0
ME	0.5	0.7	0.0	0.0	0.4	0.0	0.0	0.0
MD	1.8	2.9	2.2	1.6	1.4	0.4	0.0	3.5
MA	1.2	2.0	2.2	0.0	0.9	0.4	2.6	0.0
MI	2.7	2.5	6.7	4.1	2.4	6.9	5.1	0.0
MN	1.1	1.0	0.0	0.8	1.3	1.3	0.0	0.0
MS	2.0	0.3	0.0	0.8	0.4	0.0	0.0	73.7
MO	2.8	2.2	3.0	3.3	3.2	2.6	0.0	0.0
MT	0.4	0.0	0.7	0.0	0.5	2.2	0.0	0.0
NE	0.9	1.0	0.7	0.0	0.9	1.3	0.0	0.0
NV	0.4	0.2	0.0	0.0	0.3	2.6	0.0	0.0
NH	0.3	0.7	0.0	0.0	0.2	0.0	0.0	0.0
NJ	2.0	2.6	1.5	2.4	2.0	0.0	0.0	0.9
NM	1.1	0.7	0.7	0.8	1.3	0.9	0.0	0.0
NY	4.2	7.1	2.2	4.1	3.5	1.3	0.0	0.9
NC	3.8	3.2	0.7	4.9	4.4	1.3	7.7	0.0
ND	0.2	0.1	0.7	0.0	0.2	0.0	0.0	0.0
OH	4.2	4.1	1.5	6.5	4.5	2.6	7.7	0.0
OK	1.5	1.1	1.5	0.0	1.9	0.4	0.0	0.0
OR	1.1	0.6	0.7	1.6	1.1	2.6	5.1	0.0
PA	5.6	6.6	3.7	4.1	5.8	2.2	5.1	2.6
RI	0.2	0.7	0.0	0.0	0.1	0.0	0.0	0.0
SC	2.0	1.5	1.5	0.8	2.1	0.4	0.0	10.5
SD	0.3	0.3	2.2	0.8	0.2	0.0	5.1	0.0
TN	2.7	2.3	2.2	3.3	3.2	0.9	0.0	0.0
TX	6.8	5.0	8.2	8.9	7.9	2.6	10.3	0.0
UT	0.5	0.4	0.0	0.8	0.4	1.7	2.6	0.0
VT	0.2	0.1	0.0	0.0	0.2	0.0	0.0	0.0
VA	2.4	3.5	0.7	2.4	2.2	0.9	0.0	0.0
WA	1.2	1.3	3.7	2.4	0.8	4.7	0.0	0.0
WV	1.4	1.9	0.0	0.0	1.3	1.3	0.0	0.0
WI	2.0	2.6	3.7	0.8	1.8	0.4	5.1	0.0
WY	0.3	0.2	0.0	0.0	0.3	1.3	0.0	0.0
TOTAL	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

In the remainder of this section, distributions of TIFA variables will be compared on the basis of power unit type of the involved trucks. "Straight trucks" will include single-unit straight trucks as well as those hauling one or two trailers. "Tractors" will refer to bobtails, singles, doubles, and combinations other than the usual tractor-semitrailer and tractor-semitrailer-full trailer configurations. As explained in the introduction, the FARS power unit type classification was accepted for those cases with unknown power unit type in TIFA for the purposes of this section. This results in weighted totals of 1,517 straight trucks and 3,743 tractors involved in fatal accidents in 1987.

Temporal Distributions

Many of the FARS variables which are included in the TIFA file pertain to the accident itself. Distributions are illustrated here for three FARS variables that describe when the accident took place. Beginning with month of the crash, the greatest number of fatal involvements took place in August, September, and October. The most were recorded in August, with 539, while the fewest took place in January (358) and February (357). The first five months of 1987 each had fewer than 400 fatal involvements.

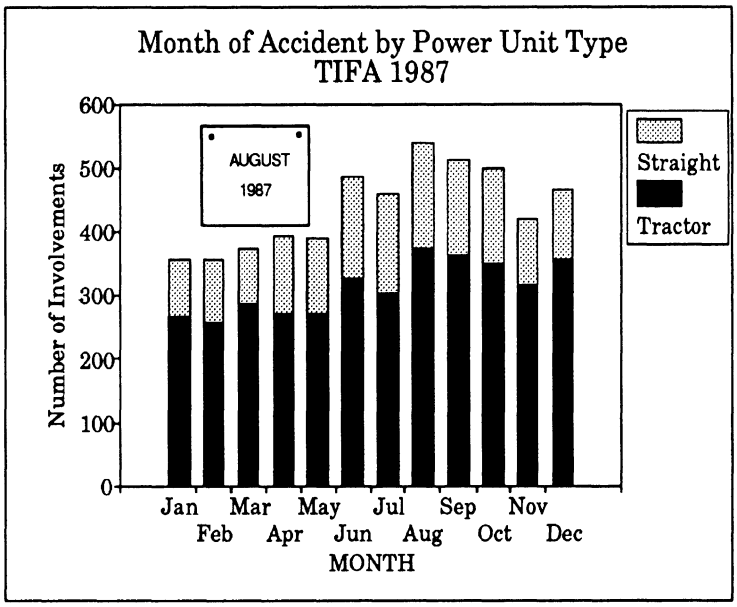


Figure 3-2

TABLE 3-2
Month of Accident by Power Unit Type
TIFA 1987

Month	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
January	91	6.00%	267	7.13%	358	6.81%
February	99	6.53	258	6.89	357	6.79
March	87	5.74	287	7.67	374	7.11
April	121	7.98	272	7.27	393	7.47
May	122	8.04	270	7.21	392	7.45
June	160	10.55	326	8.71	486	9.24
July	156	10.28	304	8.12	460	8.75
August	166	10.94	373	9.97	539	10.25
September	152	10.02	362	9.67	514	9.77
October	149	9.82	350	9.35	499	9.49
November	103	6.79	318	8.50	421	8.00
December	111	7.32	356	9.51	467	8.88
TOTAL	1,517	100.00%	3,743	100.00%	5,260	100.00%

NOTE: The 15 cases of unknown power unit type are excluded from this table.

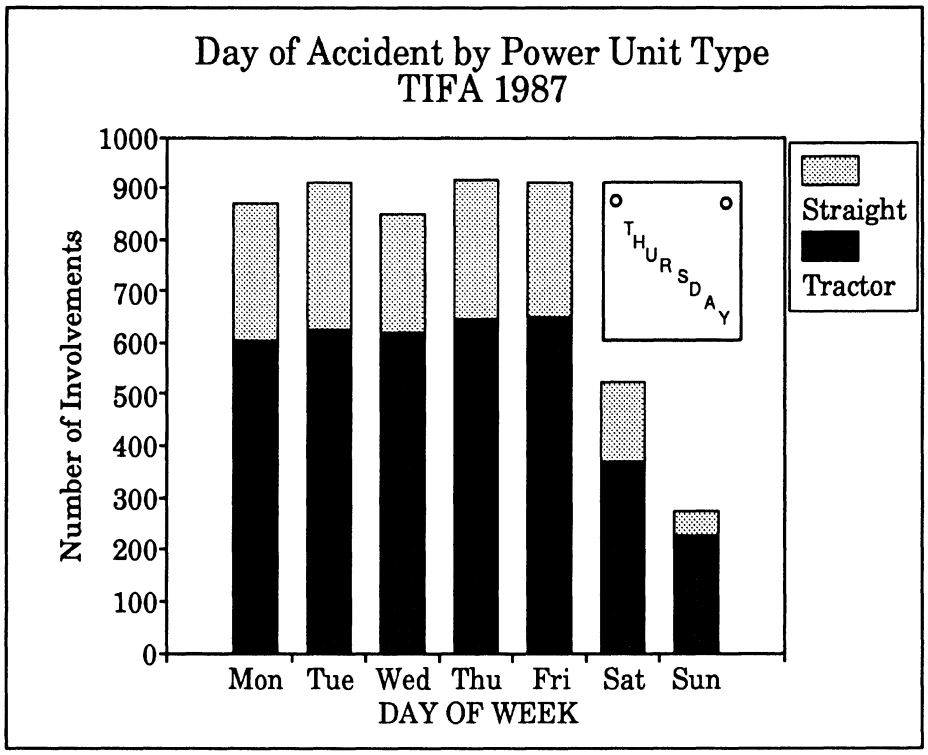


Figure 3-3

Many more fatal involvements took place during the week than on the weekends. An especially low number occurred on Sundays. The drop-off on the weekends is slightly more pronounced for straight trucks than for tractors.

TABLE 3-3
Day of Accident by Power Unit Type
TIFA 1987

Day	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
Monday	266	17.53%	606	16.19%	872	16.58%
Tuesday	282	18.59	627	16.75	909	17.28
Wednesday	234	15.43	618	16.51	852	16.20
Thursday	270	17.80	647	17.29	917	17.43
Friday	261	17.21	649	17.34	910	17.30
Saturday	154	10.15	369	9.86	523	9.94
Sunday	50	3.30	227	6.06	277	5.27
TOTAL	1,517	100.00%	3,743	100.00%	5,260	100.00%

NOTE: The 15 cases of unknown power unit type are excluded from this table.

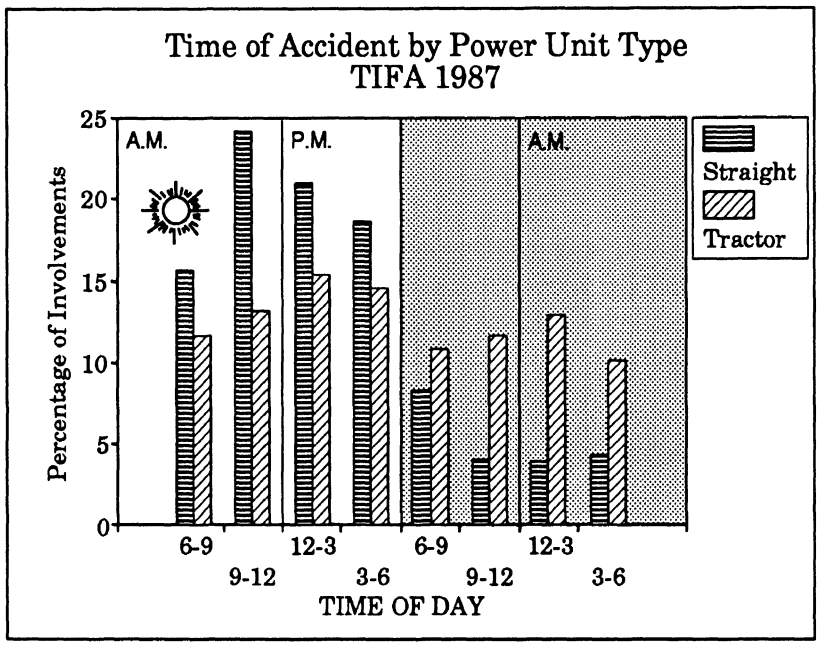


Figure 3-4

The time that the accident took place has been broken down into three-hour blocks in the table and graph shown here. The distribution for straight trucks is concentrated during the daytime. Nearly 80% of straight truck involvements took place between 6 a.m. and 6 p.m., which probably reflects the much greater use of straight trucks during the day than at night. Tractor involvements are more evenly distributed across the hours of the day, although there is somewhat of a drop-off at night. Tractors typically log more nighttime travel than do straight trucks.

TABLE 3-4
Time of Day of Accident by Power Unit Type
TIFA 1987

Time of Day	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
6–9 a.m.	236	15.56%	434	11.59%	670	12.74%
9 a.m.–12 p.m.	366	24.13	493	13.17	859	16.33
12–3 p.m.	318	20.96	574	15.34	892	16.96
3–6 p.m.	282	18.59	542	14.48	824	15.67
6–9 p.m.	125	8.24	402	10.74	527	10.02
9 p.m.–12 a.m.	61	4.02	431	11.51	492	9.35
12–3 a.m.	59	3.89	481	12.85	540	10.27
3–6 a.m.	66	4.35	376	10.05	442	8.40
Unknown	4	0.26	10	0.27	14	0.27
TOTAL	1,517	100.00%	3,743	100.00%	5,260	100.00%

NOTE: The 15 cases of unknown power unit type are excluded from this table.

Environmental Distributions

The FARS files contain a series of variables describing the accident environment in terms of where the accident took place and under what conditions. The FARS land use variable uses the Federal Highway Administration's classification of urban and rural areas. Urban areas have a population of 5,000 people or more, and rural areas have a population of under 5,000 people. A greater share of fatal involvements took place in rural areas than urban areas for both straight trucks and tractors in 1987. Tractor involvements were especially likely to occur in rural areas, with about 70% taking place there.

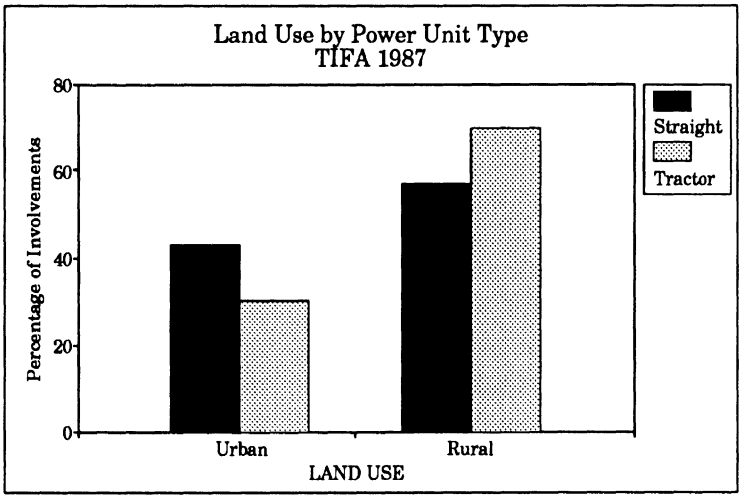


Figure 3-5

TABLE 3-5
Land Use by Power Unit Type
TIFA 1987

Land Use	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
Urban	651	42.91%	1,129	30.16%	1,780	33.84%
Rural	864	56.95	2,612	69.78	3,476	66.08
Unknown	2	0.13	2	0.05	4	0.08
TOTAL	1,517	100.00%	3,743	100.00%	5,260	100.00%

NOTE: The 15 cases of unknown power unit type are excluded from this table.

The light condition at the time of the accident is coded as daylight; dark, not lighted; dark, but lighted; dawn; or dusk. The distribution of this variable differs between straight truck and tractors. While 78% of the straight truck involvements took place during daylight, only 53% of the tractor involvements occurred when it was light. This corresponds with the distribution for the time of the accident, discussed earlier in this section. The distributions of both variables probably reflect the greater share of nighttime travel for tractors compared to straight trucks.

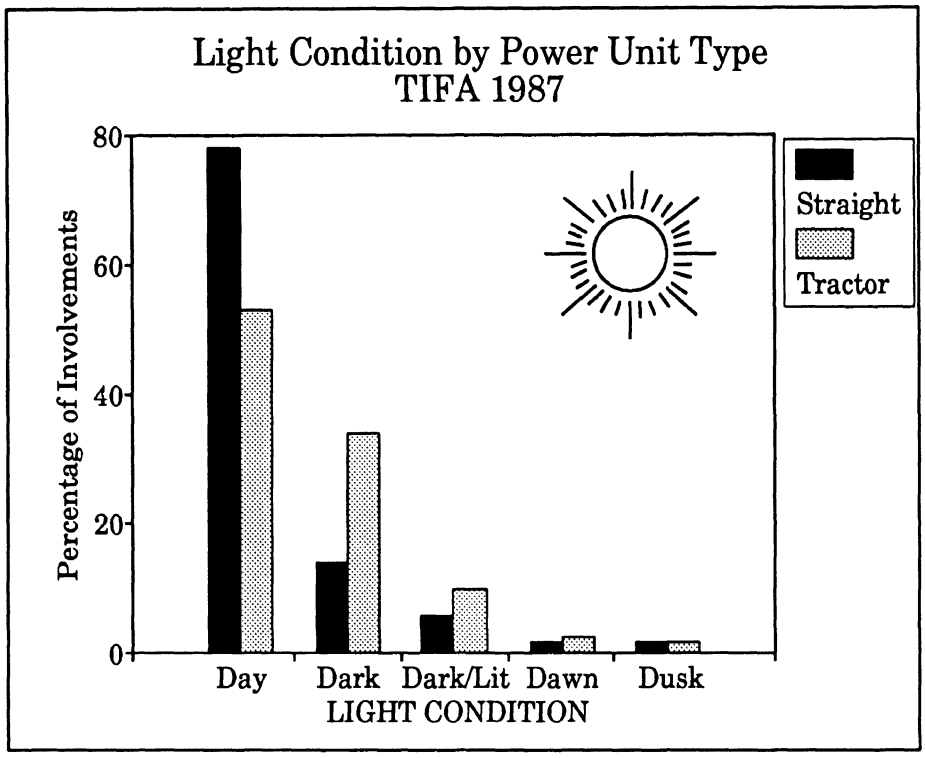


Figure 3-6

TABLE 3-6
Light Condition by Power Unit Type
TIFA 1987

Light Condition	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
Daylight	1,180	77.79%	1,984	53.01%	3,164	60.15%
Dark, not lighted	207	13.65	1,269	33.90	1,476	28.06
Dark, but lighted	86	5.67	360	9.62	446	8.48
Dawn	25	1.65	79	2.11	104	1.98
Dusk	19	1.25	47	1.26	66	1.25
Unknown	0	0.00	4	0.11	4	0.08
TOTAL	1,517	100.00%	3,743	100.00%	5,260	100.00%

NOTE: The 15 cases of unknown power unit type are excluded from this table.

On the next page, the distributions for the roadway surface condition variable are presented. This variable reflects the road conditions reported by the investigating officer. Straight truck and tractor involvements were fairly similar in terms of the road surface condition in 1987. Over 80% of both took place under dry conditions, and about 14% of straight truck involvements and 16% of tractor involvements occurred on wet roadways.

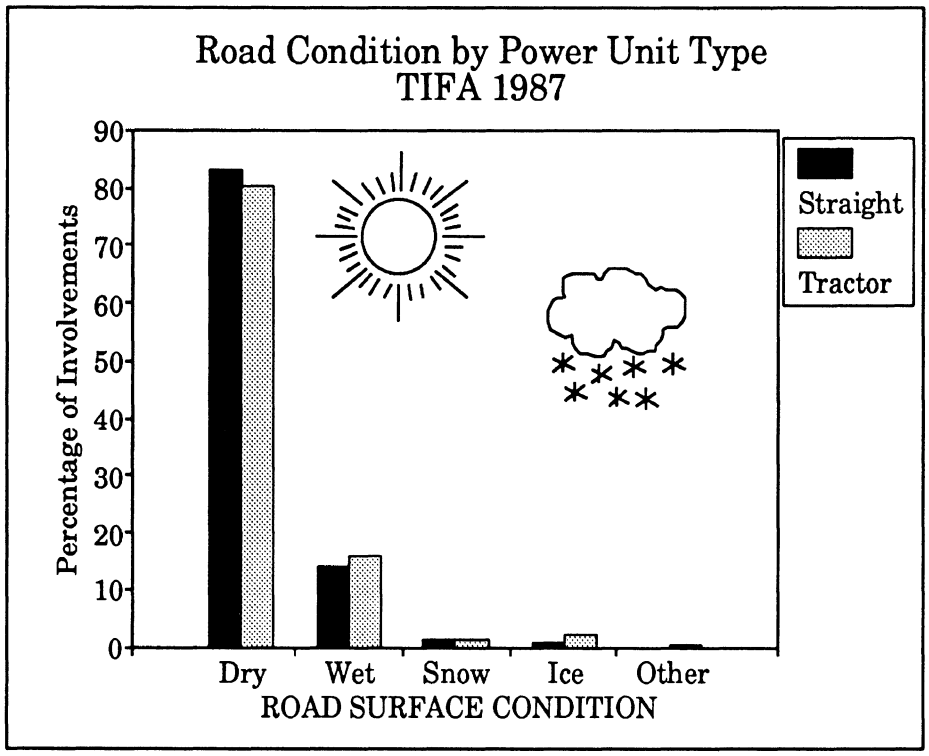


Figure 3-7

TABLE 3-7
Road Surface Condition by Power Unit Type
TIFA 1987

Road Surface Condition	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
Dry	1,260	83.06%	3,005	80.28%	4,265	81.08%
Wet	219	14.44	596	15.92	815	15.49
Snow/Slush	23	1.52	47	1.26	70	1.33
Ice	13	0.86	85	2.27	98	1.86
Sand/Dirt/Oil	1	0.07	0	0.00	1	0.02
Other	1	0.07	7	0.19	8	0.15
Unknown	0	0.00	3	0.08	3	0.06
TOTAL	1,517	100.00%	3,743	100.00%	5,260	100.00%

NOTE: The 15 cases of unknown power unit type are excluded from this table.

The FARS files contain several variables describing the class of road where the accident occurred. These have been recoded into a single three-level road class variable. The category of limited access roadways includes the interstate highway system, as well as state highways that are similar to interstates in that access to them is limited. Major arteries include all U.S. and state routes that do not have limited access, plus some other primary thoroughfares in large urban areas. The "other" road class category includes all public roads that do not fall into the two other classes.

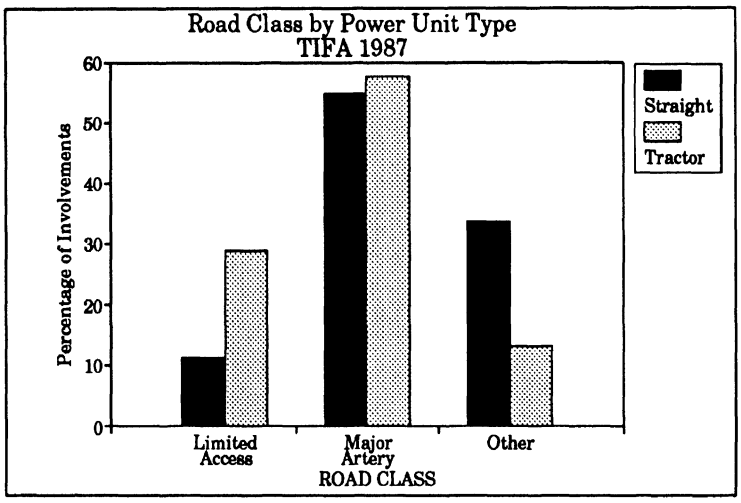


Figure 3-8

The majority of both straight truck and tractor fatal involvements took place on major arteries in 1987. The main difference between the two distributions is in the proportion of involvements that occurred on limited access and on "other" roads. Nearly 29% of tractor involvements were on limited access highways, compared to 11% of straight truck involvements. On the other hand, about 34% of straight truck fatal accidents occurred on the other roads, as opposed to 13% of the tractor involvements. Much of this difference is attributable to the travel patterns of the two kinds of large trucks. Tractors are much more likely than straight trucks to be involved in long-haul operations which carry them over the interstate highway system.

TABLE 3-8
Road Class by Power Unit Type
TIFA 1987

Road Class	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
Limited Access	170	11.21%	1,084	28.96%	1,254	23.84%
Major Artery	827	54.52	2,154	57.55	2,981	56.67
Other	510	33.62	492	13.14	1,002	19.05
Unknown	10	0.66	13	0.35	23	0.44
TOTAL	1,517	100.00%	3,743	100.00%	5,260	100.00%

NOTE: The 15 cases of unknown power unit type are excluded from this table.

Road class distributions were also prepared on the basis of the land use variable. The graph to the right illustrates the road class distributions in urban areas. The two power unit types had very different patterns of involvements in urban areas in 1987. The greatest share of tractor involvements took place on limited access routes and the least on other roads. The opposite was true of straight trucks, where 45%

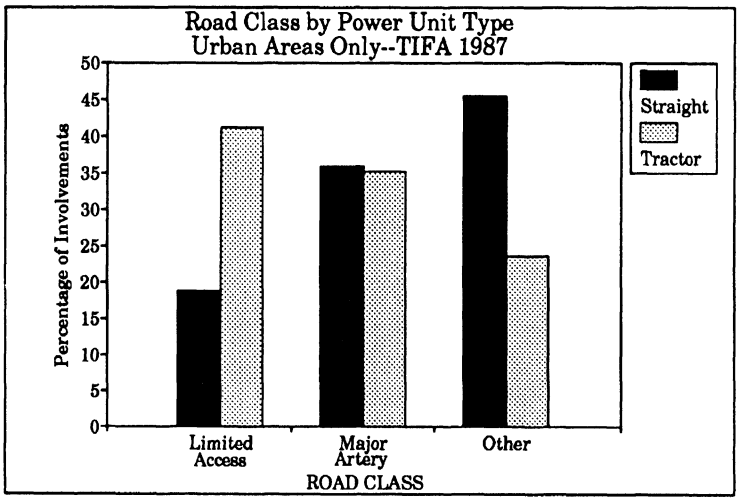


Figure 3-9

of involvements occurred on other roads and less than 19% on limited access routes.

TABLE 3-9
Road Class by Power Unit Type
Urban Areas Only
TIFA 1987

Road Class	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
Limited Access	122	18.74%	462	40.92%	584	32.81%
Major Artery	232	35.64	396	35.08	628	35.28
Other	293	45.01	266	23.56	559	31.40
Unknown	4	0.61	5	0.44	9	0.51
TOTAL	651	100.00%	1,129	100.00%	1,780	100.00%

NOTE: The 6 cases of unknown power unit type are excluded from this table.

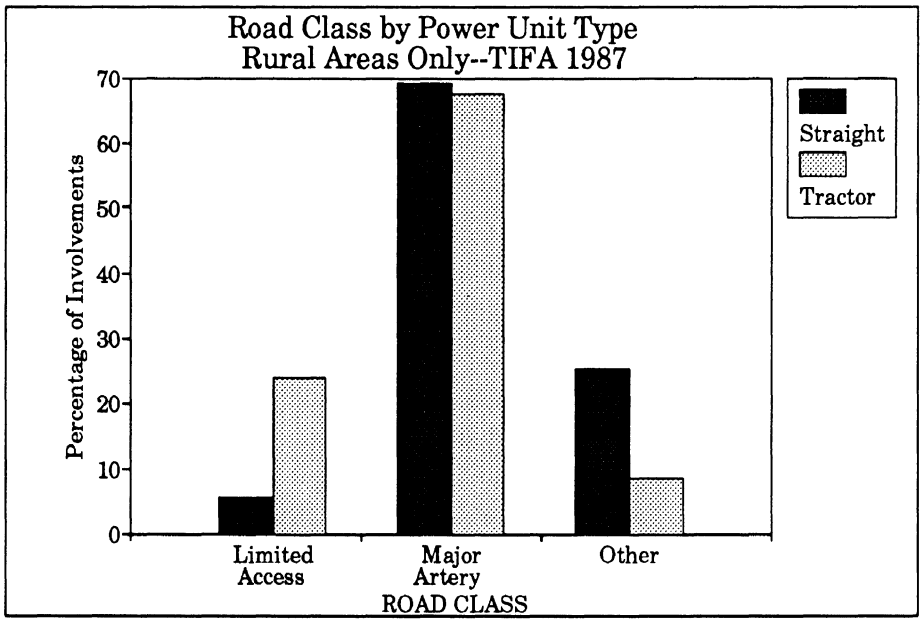


Figure 3-10

The rural area road class distributions are quite different from the urban area distributions. Over two-thirds of both straight truck and tractor rural area involvements occurred on major arteries. The proportion taking place on limited access routes was much lower for both types of trucks than it was on limited access routes in urban areas. These patterns are consistent with rural limited access roads being generally considered the safest for travel.

TABLE 3-10
Road Class by Power Unit Type
Rural Areas Only
TIFA 1987

Road Class	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
Limited Access	48	5.56%	622	23.81%	670	19.28%
Major Artery	595	68.87	1,756	67.23	2,351	67.64
Other	217	25.12	226	8.65	443	12.74
Unknown	4	0.46	8	0.31	12	0.35
TOTAL	864	100.00%	2,612	100.00%	3,476	100.00%

NOTE: The 9 cases of unknown power unit type are excluded from this table.

The relation to junction variable indicates whether the accident occurred on a nonjunction section of road, or at such locations as an intersection, driveway, or interchange. The location of involvements in 1987 reveals some interesting differences between straight trucks and tractors, which probably reflect their respective travel patterns. For example, about 30% of straight truck involvements took place at intersections, compared to only 20% for tractors. Also, a higher percentage of straight truck fatal accidents occurred at driveways than for tractors. In contrast, 69% of tractor involvements occurred at nonjunctions, compared to 59% for straight trucks. Tractors also experienced a higher share of involvements at interchanges than did straight trucks. These figures are consistent with tractors logging a greater share of their miles on limited access roads compared to straight trucks.

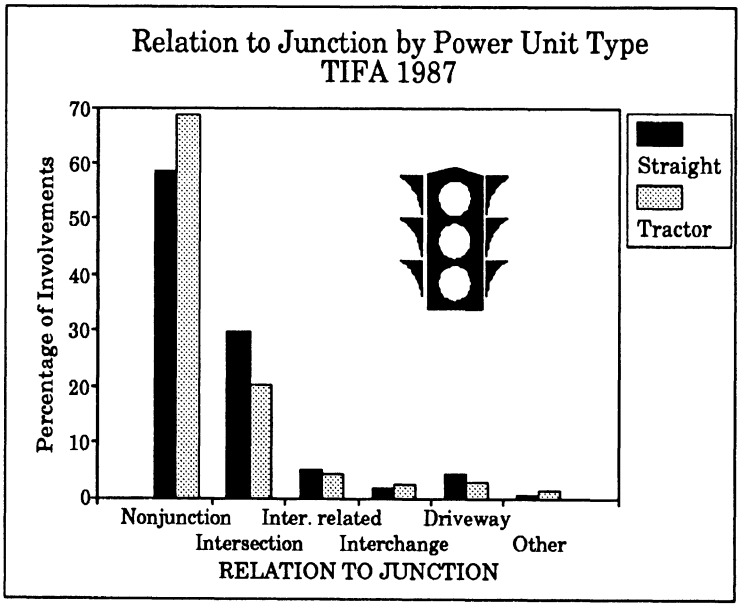


Figure 3-11

TABLE 3-11
Relation to Junction by Power Unit Type
TIFA 1987

Relation to Junction	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
Nonjunction	888	58.54%	2,571	68.69%	3,459	65.76%
Intersection	450	29.66	758	20.25	1,208	22.97
Intersection related	76	5.01	163	4.35	239	4.54
Interchange area	26	1.71	90	2.40	116	2.21
Driveway/alley, etc.	67	4.42	111	2.97	178	3.38
Entrance/exit ramp	1	0.07	16	0.43	17	0.32
Rail grade crossing	9	0.59	20	0.53	29	0.55
In crossover	0	0.00	13	0.35	13	0.25
Unknown	0	0.00	1	0.03	1	0.02
TOTAL	1,517	100.00%	3,743	100.00%	5,260	100.00%

NOTE: The 15 cases of unknown power unit type are excluded from this table.

In 1987, a total of 1,208 large truck fatal involvements took place at an intersection. Distributions were prepared for the type of traffic control at these intersection accidents. The traffic control distributions are fairly similar for straight trucks and tractors. The main differences are that a greater proportion of straight truck involvements took place at signalized intersections, while a larger share of tractor involvements occurred at intersections marked by a stop or yield sign or a flashing signal.

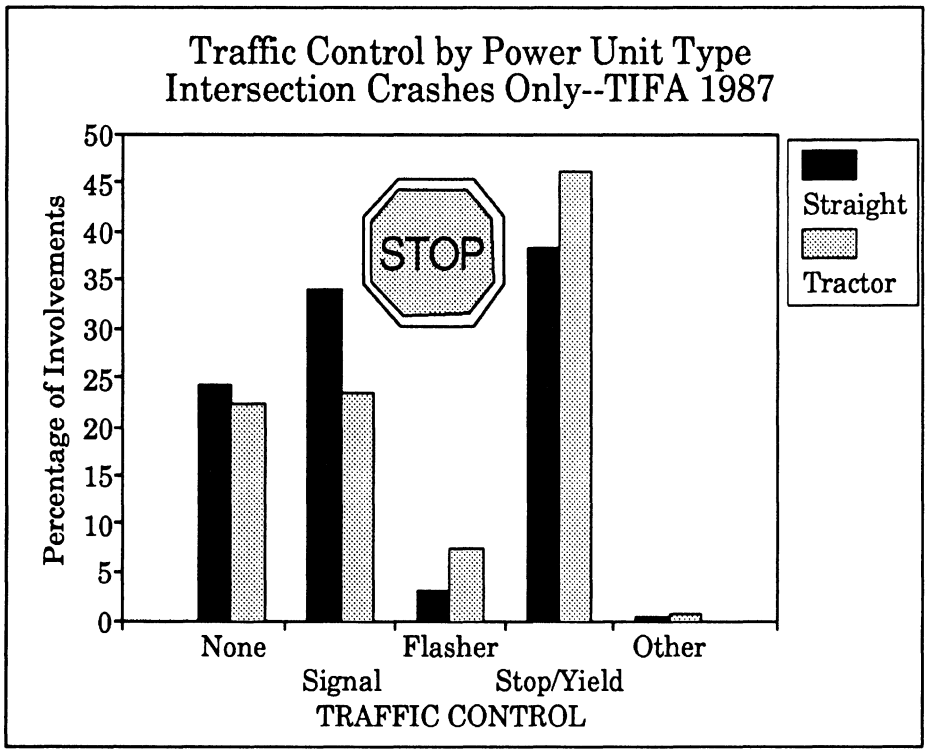


Figure 3-12

TABLE 3-12
Traffic Control at Intersection Crashes by Power Unit Type
TIFA 1987

Traffic Control	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
None	109	24.22%	169	22.30%	278	23.01%
Automated traffic signal	153	34.00	176	23.22	329	27.24
Flasher/other signal	14	3.11	56	7.39	70	5.79
Stop or yield sign	172	38.22	349	46.04	521	43.13
Warning/other sign	2	0.44	5	0.66	7	0.58
Other	0	0.00	1	0.13	1	0.08
Unknown	0	0.00	2	0.26	2	0.17
TOTAL	450	100.00%	758	100.00%	1,208	100.00%

NOTE: The 7 cases of unknown power unit type are excluded from this table.

A final variable pertaining to the accident environment is the legal speed limit where the accident took place. The greatest share of involvements for both power unit types occurred in 55 mph zones, with 64% for tractors and 48% for straight trucks. A higher proportion of tractor involvements (7%) than straight truck involvements (1.5%) took place in 65 mph zones as well. The relatively greater share of straight truck fatal accidents that occurred on lower speed roads corresponds with the typical travel patterns of these trucks.

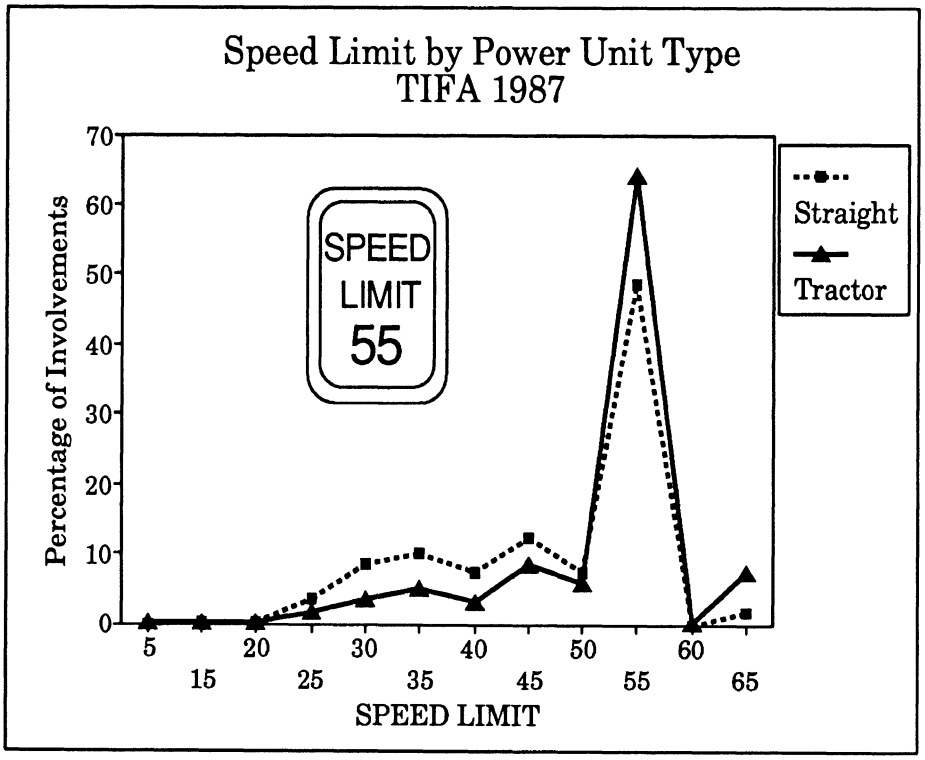


Figure 3-13

TABLE 3-13
Speed Limit by Power Unit Type
TIFA 1987

Speed Limit	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
No statutory limit	2	0.13%	5	0.13%	7	0.13%
5 mph	0	0.00	2	0.05	2	0.04
15 mph	4	0.26	2	0.05	6	0.11
20 mph	5	0.33	4	0.11	9	0.17
25 mph	51	3.36	58	1.55	109	2.07
30 mph	124	8.17	126	3.37	250	4.75
35 mph	151	9.95	188	5.02	339	6.44
40 mph	112	7.38	122	3.26	234	4.45
45 mph	185	12.20	314	8.39	499	9.49
50 mph	108	7.12	220	5.88	328	6.24
55 mph	728	47.99	2,384	63.69	3,112	59.16
60 mph	0	0.00	8	0.21	8	0.15
65 mph	22	1.45	275	7.35	297	5.65
Unknown	25	1.65	35	0.94	60	1.14
TOTAL	1,517	100.00%	3,743	100.00%	5,260	100.00%

NOTE: The 15 cases of unknown power unit type are excluded from this table.

Collision Types

Distributions of several more of the FARS variables contained in the TIFA files are illustrated here. They characterize the crash itself in terms of the object struck and the manner of collision. On the next page, the distributions for first harmful event by power unit type are illustrated. The first harmful event refers to the first event in the crash that results in injury or property damage. FARS categorizes this variable into non-collisions, collisions with fixed objects, and collisions with non-fixed objects. All of the non-collisions, such as rollovers and incidents of an occupant falling from a vehicle, have been combined into a single group. Similarly, all of the crashes where the first harmful event is a collision with a fixed object are considered together here. Fixed objects include bridges, guardrails, embankments, and trees, among others. The major classes of non-fixed objects, such as a motor vehicle in transport or a pedestrian, are represented separately here. The remaining non-fixed objects, which include things like thrown or falling objects and loose boulders, have been combined into one group.

The majority of fatal accidents involving large trucks in 1987 were collisions with another motor vehicle in transport. These collisions accounted for 76% of both the straight truck and tractor involvements. Straight trucks had a slightly higher proportion of involvements with pedestrians and pedalcyclists than did tractors, while tractors were involved more in non-collisions and in crashes with fixed objects.

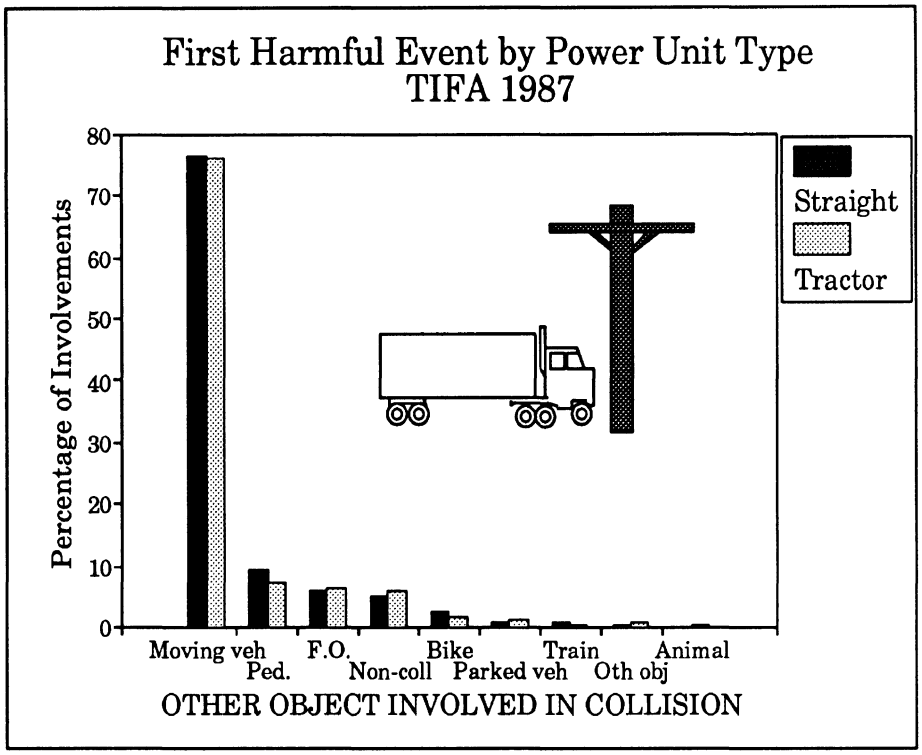


Figure 3-14

TABLE 3-14
First Harmful Event by Power Unit Type
TIFA 1987

Collision with:	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
Pedestrian	138	9.10%	267	7.13%	405	7.70%
Pedalcyclist	38	2.50	57	1.52	95	1.81
Train	9	0.59	18	0.48	27	0.51
Animal	0	0.00	15	0.40	15	0.29
Moving vehicle	1,158	76.33	2,853	76.22	4,011	76.25
Parked vehicle	9	0.59	46	1.23	55	1.05
Other non-fixed object	3	0.20	26	0.69	29	0.55
Fixed object	89	5.87	245	6.55	334	6.35
Non-collision	73	4.81	216	5.77	289	5.49
TOTAL	1,517	100.00%	3,743	100.00%	5,260	100.00%

NOTE: The 15 cases of unknown power unit type are excluded from this table.

A total of 4,011 of the fatal accidents involving large trucks in 1987 were collisions with another motor vehicle in transport. The distributions of the manner of collision variable for these accidents are illustrated on the following page. Overall, the most common collision type among the fatal involvements was angle crashes (40%), followed by head-ons (30%), and

rear-end collisions (22.5%). The straight truck and tractor distributions are fairly similar overall, but there are some differences. Straight trucks had higher proportions of angle and head-on collisions than did tractors. Tractors were more likely to experience rear-end and sideswipe crashes than were straight trucks.

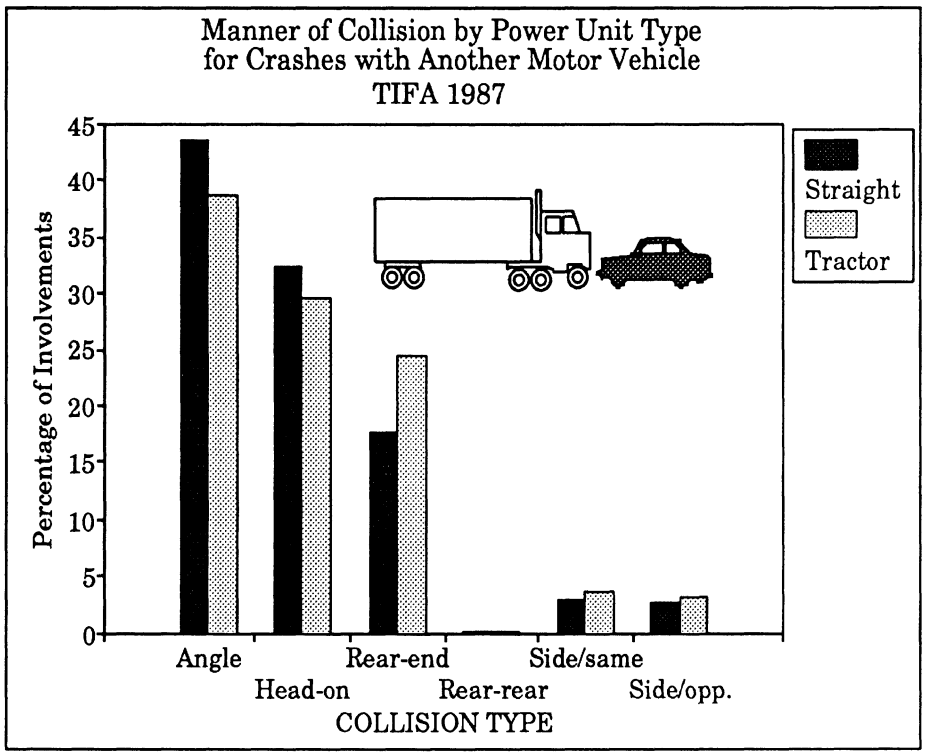


Figure 3-15

TABLE 3–15
Manner of Collision by Power Unit Type
for Crashes with Another Motor Vehicle
TIFA 1987

Manner of Collision	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
Rear-end	206	17.79%	696	24.40%	902	22.49%
Head-on	376	32.47	842	29.51	1,218	30.37
Rear-to-rear	3	0.26	7	0.25	10	0.25
Angle	505	43.61	1,106	38.77	1,611	40.16
Sideswipe, same dir.	35	3.02	106	3.72	141	3.52
Sideswipe, opp. dir.	33	2.85	93	3.26	126	3.14
Unknown	0	0.00	3	0.11	3	0.07
TOTAL	1,158	100.00%	2,853	100.00%	4,011	100.00%

NOTE: The 9 cases of unknown power unit type are excluded from this table.

The vehicle role variable describes whether the case vehicle was the striking or struck vehicle in the collision. In all head-on collisions, both vehicles are coded as striking. If a vehicle is coded as both striking and struck, the events must either occur at different points on the vehicle, or at the same point at different times. Below are the vehicle role distributions for straight trucks and tractors in 1987. In over two-thirds of the straight truck and tractor involvements, the truck was coded as the striking vehicle. However, about one-third of the striking cases were head-on collisions (meaning both vehicles were coded as striking), and over 10% represented single-vehicle crashes other than collisions with pedestrians or bicyclists. In the remaining multi-vehicle crashes, the truck was 1.2 times as likely to be the striking vehicle as the struck vehicle. In evaluating this statistic, it should be remembered that the accidents under consideration typically involved the collision of a truck with a much lighter vehicle, with the fatality occurring in the other vehicle.

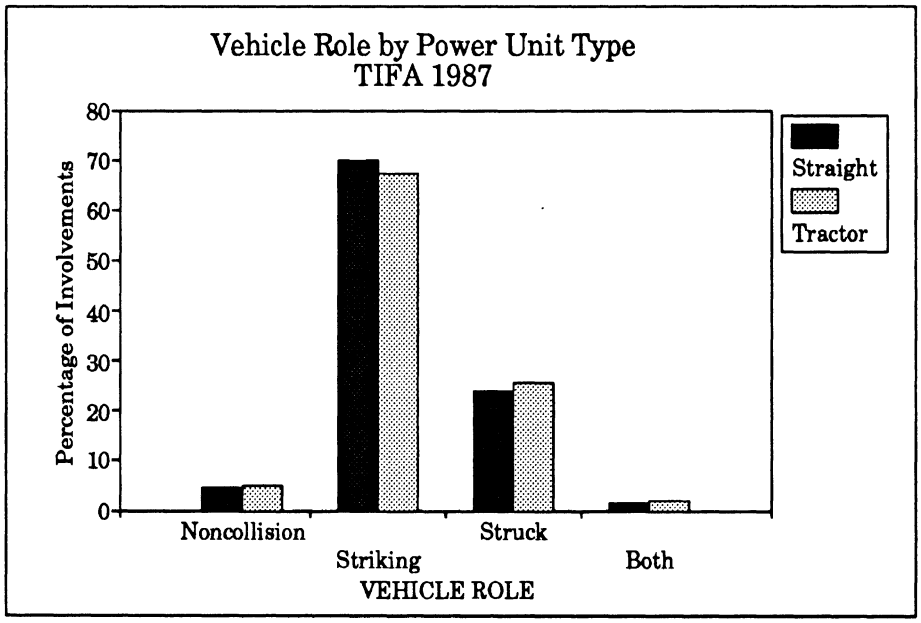


Figure 3-16

TABLE 3-16
Vehicle Role by Power Unit Type
TIFA 1987

Vehicle Role	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
Noncollision	72	4.75%	186	4.97%	258	4.90%
Striking	1,057	69.68	2,506	66.95	3,563	67.74
Struck	362	23.86	962	25.70	1,324	25.17
Both	24	1.58	80	2.14	104	1.98
Unknown	2	0.13	9	0.24	11	0.21
TOTAL	1,517	100.00%	3,743	100.00%	5,260	100.00%

NOTE: The 15 cases of unknown power unit type are excluded from this table.

The rollover variable indicates whether or not the case vehicle overturned during the accident. Rollovers are divided into those that occurred as the first harmful event and those that took place subsequently. In the 1987 fatal involvements, straight trucks (15%) were slightly more likely to experience a rollover than were tractors (13%). However, rollovers as the first event in an accident were more common among the tractors than the straight trucks.

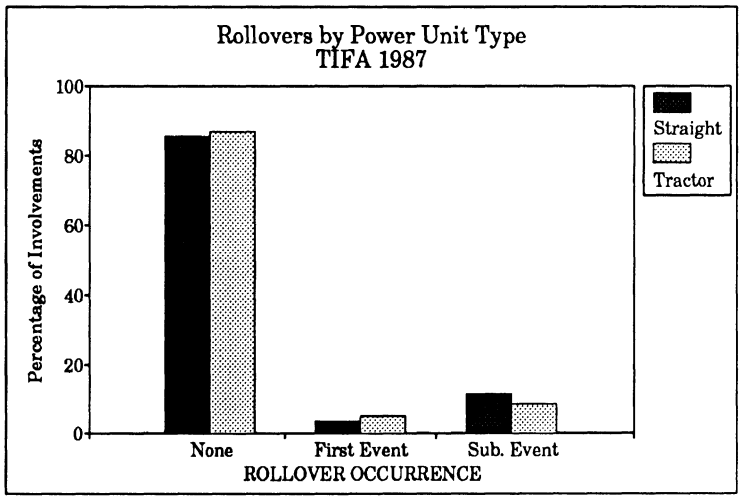


Figure 3-17

TABLE 3-17
Occurrence of Rollovers by Power Unit Type
TIFA 1987

Rollover	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
None	1,291	85.10%	3,242	86.62%	4,533	86.18%
First Event	55	3.63	179	4.78	234	4.45
Subsequent Event	171	11.27	322	8.60	493	9.37
TOTAL	1,517	100.00%	3,743	100.00%	5,260	100.00%

NOTE: The 15 cases of unknown power unit type are excluded from this table.

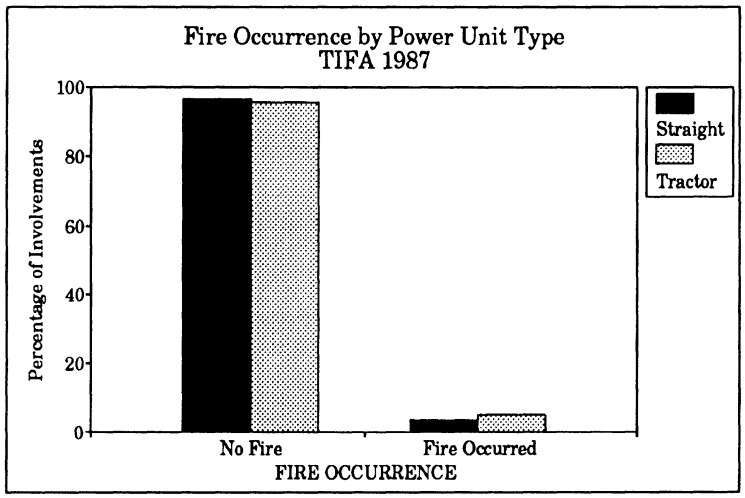


Figure 3-18

Another variable indicates whether a fire occurred in the vehicle during the accident. There was a fire in 3.6% of the straight trucks and 4.8% of the tractors involved in fatal accidents in 1987.

TABLE 3-18
Fire Occurrence by Power Unit Type
TIFA 1987

Fire	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
No Fire	1,462	96.37%	3,562	95.16%	5,024	95.51%
Fire Occurred	55	3.63	181	4.84	236	4.49
TOTAL	1,517	100.00%	3,743	100.00%	5,260	100.00%

NOTE: The 15 cases of unknown power unit type are excluded from this table.

Driver Characteristics

Turning now to some variables that describe the drivers of the trucks involved in fatal accidents in 1987, the figure below depicts driver age distributions by power unit type. The distributions indicate younger ages for the straight truck drivers compared to the tractor drivers. For the known cases, over 56% of the straight truck drivers were 35 or younger, while 58.5% of the tractor drivers were over 35.

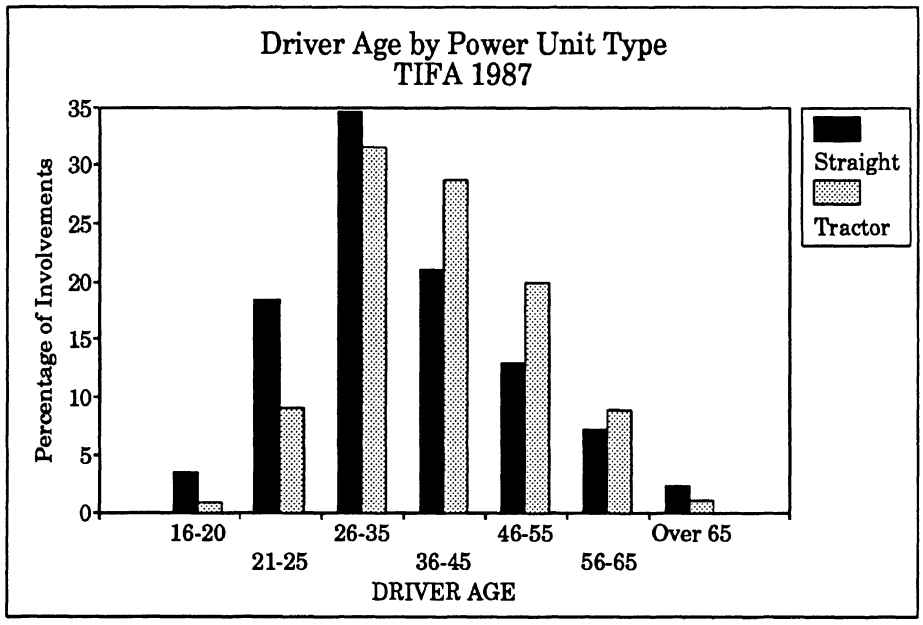


Figure 3-19

TABLE 3-19
Age of Truck Driver by Power Unit Type
TIFA 1987

Driver Age	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
16–20	51	3.36%	33	0.88%	84	1.60%
21–25	276	18.19	331	8.84	607	11.54
26–35	515	33.95	1,158	30.94	1,673	31.81
36–45	316	20.83	1,053	28.13	1,369	26.03
46–55	194	12.79	733	19.58	927	17.62
56–65	107	7.05	324	8.66	431	8.19
Over 65	35	2.31	38	1.02	73	1.39
Unknown	23	1.52	73	1.95	96	1.83
TOTAL	1,517	100.00%	3,743	100.00%	5,260	100.00%

NOTE: The 15 cases of unknown power unit type are excluded from this table.

For both the straight truck and tractor drivers, males were overwhelmingly represented among the fatal involvements. Slightly over 1% of the drivers were female.

TABLE 3-20
Truck Driver Sex by Power Unit Type
TIFA 1987

Driver Sex	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
Male	1,481	97.63%	3,624	96.82%	5,105	97.05%
Female	15	0.99	52	1.39	67	1.27
Unknown	21	1.38	67	1.79	88	1.67
TOTAL	1,517	100.00%	3,743	100.00%	5,260	100.00%

NOTE: The 15 cases of unknown power unit type are excluded from this table.

The distributions for driver restraint use are presented on the next page. The categories for this variable are no restraint used; lap belt only; lap and shoulder belt; restraint used, type unknown or other; and unknown if restraint was used. This last category accounts for 20% of the cases. It appears that a greater proportion of the involved tractor drivers were restrained, compared to the straight truck drivers. Nearly 37% of the tractor drivers were using some kind of restraint device, compared to only 23.7% of the straight truck drivers. Note that the unknown cases are included in Figure 3-21.

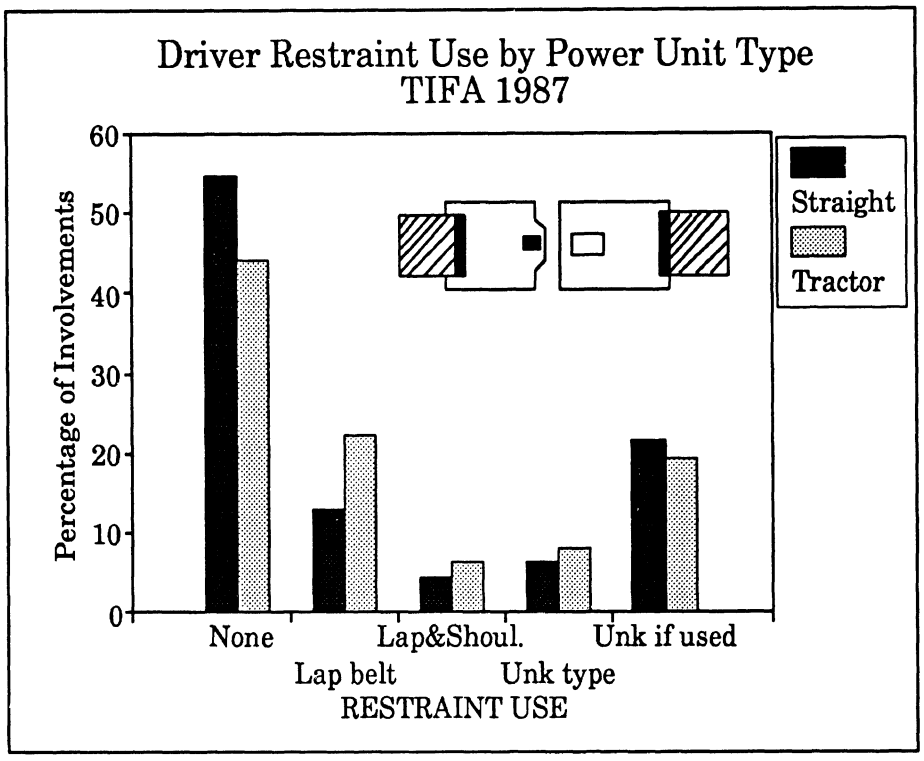


Figure 3-21

TABLE 3-21
Truck Driver Restraint Use by Power Unit Type
TIFA 1987

Driver Restraint Use	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
None used	832	54.85%	1,648	44.03%	2,480	47.15%
Lap belt	199	13.12	831	22.20	1,030	19.58
Lap and shoulder	65	4.28	240	6.41	305	5.80
Restraint used, type unknown	95	6.26	300	8.01	395	7.51
Unknown if used	326	21.49	724	19.34	1,050	19.96
TOTAL	1,517	100.00%	3,743	100.00%	5,260	100.00%

NOTE: The 15 cases of unknown power unit type are excluded from this table.

On the following page are the distributions for driver alcohol use. Overall, drinking was reported for the driver of the truck in 4.3% of the involvements. This figure was 3.9% for drivers of tractors and 5.3% for straight truck drivers.

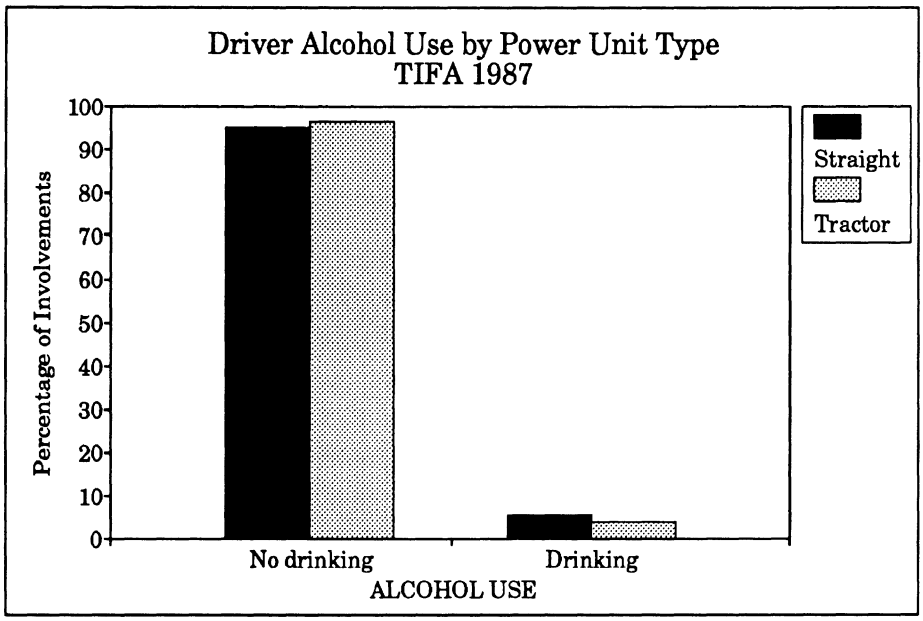


Figure 3-22

TABLE 3-22
Truck Driver Alcohol Use by Power Unit Type
TIFA 1987

Alcohol Use	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
No drinking	1,436	94.66%	3,597	96.10%	5,033	95.68%
Drinking	81	5.34	146	3.90	227	4.32
TOTAL	1,517	100.00%	3,743	100.00%	5,260	100.00%

NOTE: The 15 cases of unknown power unit type are excluded from this table.

The ejection variable refers to the driver of the truck being thrown from the cab during the course of the crash. Ejections are classified by FARS as total and partial. In 1987, the truck driver was totally ejected in about 4.5% of the fatal involvements and partially ejected in 1.1%. The distribution of this variable is very similar for drivers of tractors and straight trucks.

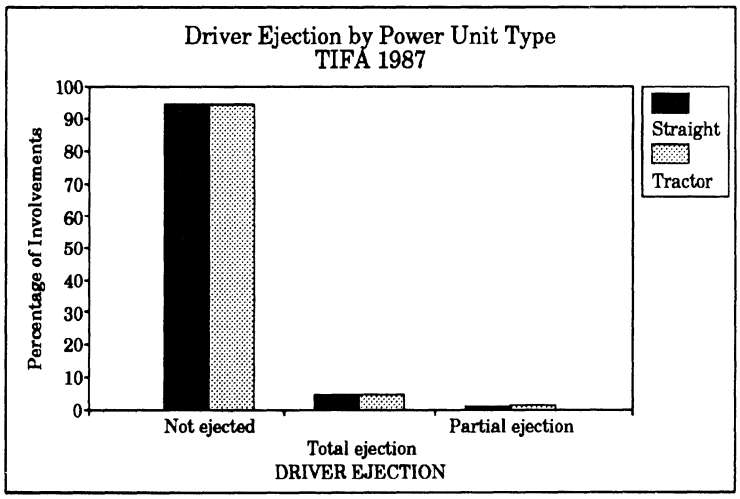


Figure 3-23

TABLE 3-23
Truck Driver Ejection by Power Unit Type
TIFA 1987

Driver Ejection	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
Not ejected	1,417	93.41%	3,487	93.16%	4,904	93.23%
Totally ejected	68	4.48	167	4.46	235	4.47
Partially ejected	14	0.92	45	1.20	59	1.12
Unknown	18	1.19	44	1.18	62	1.18
TOTAL	1,517	100.00%	3,743	100.00%	5,260	100.00%

NOTE: The 15 cases of unknown power unit type are excluded from this table.

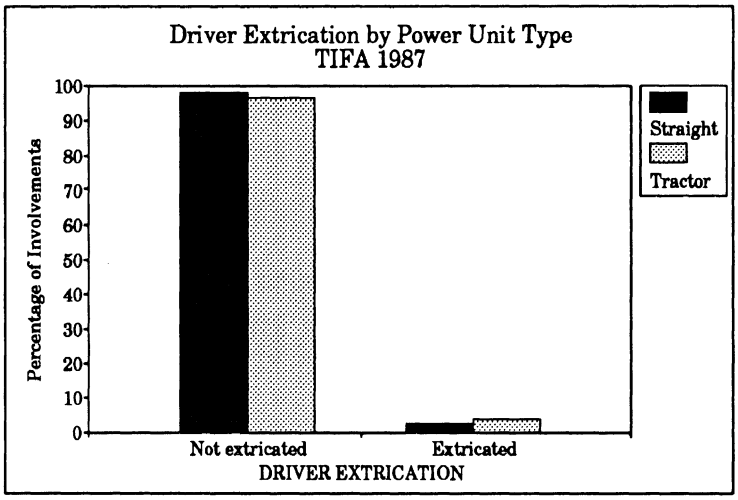


Figure 3-24

The driver extrication variable refers to the use of equipment or other force to remove the driver from the truck. In other words, more than carrying or lifting was required to get the driver out of the wreckage. Extrication of the truck driver occurred in a very small proportion of the fatal involvements, but was slightly more common among the drivers of tractors (3.7%) than straight trucks (2.1%).

TABLE 3-24
Truck Driver Extrication by Power Unit Type
TIFA 1987

Driver Extrication	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
Not extricated	1,467	96.70%	3,547	94.76%	5,014	95.32%
Extricated	32	2.11	138	3.69	170	3.23
Unknown	18	1.19	58	1.55	76	1.44
TOTAL	1,517	100.00%	3,743	100.00%	5,260	100.00%

NOTE: The 15 cases of unknown power unit type are excluded from this table.

The injury severity distributions for the drivers of the trucks are shown in this figure. "C", "B", and "A" injuries correspond to possible, nonincapacitating, and incapacitating injuries respectively. FARS records fatalities which occur up to 30 days after an accident. While all of the accidents considered here resulted in at least one fatality, the truck driver was fatally injured in only 13.4% of the cases. The distributions are similar for the two types of power units. Straight truck drivers had a slightly higher incidence of incapacitating injuries, while drivers of tractors had a slightly higher proportion of fatalities.

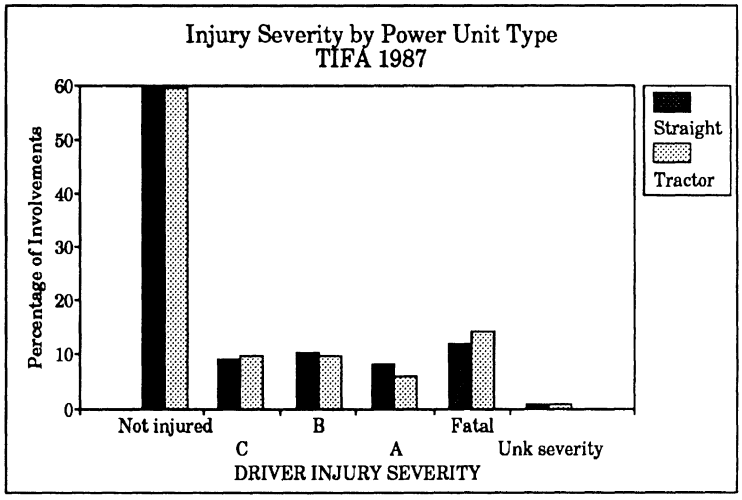


Figure 3-25

TABLE 3-25
Truck Driver Injury Severity by Power Unit Type
TIFA 1987

Injury Severity	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
Not injured	892	58.80%	2,203	58.86%	3,095	58.84%
C injury	138	9.10	367	9.80	505	9.60
B injury	154	10.15	355	9.48	509	9.68
A injury	124	8.17	214	5.72	338	6.43
Fatal injury	182	12.00	525	14.03	707	13.44
Injured, severity unknown	10	0.66	32	0.85	42	0.80
Unknown if injured	17	1.12	47	1.26	64	1.22
TOTAL	1,517	100.00%	3,743	100.00%	5,260	100.00%

NOTE: The 15 cases of unknown power unit type are excluded from this table.

The next variable, hours driven, is not a part of the FARS files but is included in the OMC reports and is part of the telephone interviews conducted by UMTRI. It records the number of hours at the time of the accident that the truck driver had been driving since his last period of eight consecutive hours off duty. The "not applicable" level of this variable refers to accidents where the truck was not in transport when the accident occurred, as in the case of a parked truck. In addition, OMC records anything over 12 hours as "not applicable."

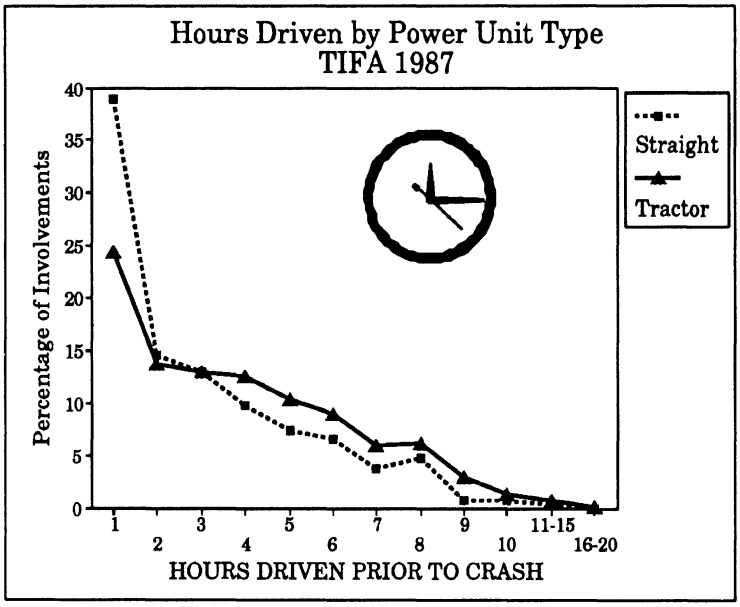


Figure 3-26

Even though a large proportion of cases were coded unknown or not applicable for the hours driven variable, these cases have been removed from the distributions shown in the graph at left so that straight trucks and tractors may be more easily compared. In general, the involved straight truck drivers had been driving for a shorter period of time prior to the crash than the tractor drivers. Of the known cases, nearly 39% of the straight truck drivers had been driving for only an hour, compared to 24% of the tractor drivers. In contrast, only 6% of the straight truck drivers had been on duty for eight or more hours prior to the crash, compared to 11% of the tractor drivers. To a large extent, this probably reflects the differential reliance on straight trucks and tractors in short-haul versus long-haul operations.

TABLE 3-26
Hours Driven Prior to Crash
by Power Unit Type
TIFA 1987

Hours Driven	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
1	436	28.74%	685	18.30%	1,121	21.31%
2	164	10.81	388	10.37	552	10.49
3	146	9.62	363	9.70	509	9.68
4	109	7.19	353	9.43	462	8.78
5	83	5.47	290	7.75	373	7.09
6	74	4.88	250	6.68	324	6.16
7	41	2.70	168	4.49	209	3.97
8	52	3.43	169	4.52	221	4.20
9	8	0.53	82	2.19	90	1.71
10	7	0.46	35	0.94	42	0.80
11–15	2	0.13	21	0.56	23	0.44
16–20	0	0.00	4	0.11	4	0.08
N/A	21	1.38	147	3.93	168	3.19
Unknown	374	24.65	788	21.05	1,162	22.09
TOTAL	1,517	100.00%	3,743	100.00%	5,260	100.00%

NOTE: The 15 cases of unknown power unit type are excluded from this table.

The driver-related factors variable is coded by FARS from a list of nearly 100 possibilities. The variable is coded based on information recorded in the narrative section of the accident report filed by the investigating officer, not on the basis of citations. Up to three possible contributing factors may be recorded for each driver, but the distributions here are based on the first factor coded for each case. The numerous levels of the FARS variable have been combined into general categories. Note that not all of the levels of this variable imply culpability on the part of the driver. Examples include the cases of obscured vision and swerving to avoid an object.

The majority of straight truck and tractor drivers had no contributing factors recorded. Some of the more common factors that were coded were speeding/tailgating violations (7.0%), passing/lane change violations (6.6%), and right-of-way/traffic control violations (5.0%). The straight truck and tractor distributions are fairly similar, and many of the observed differences are probably related to typical travel patterns. An example is the higher incidence of right-of-way/traffic control violations among the drivers of straight trucks.

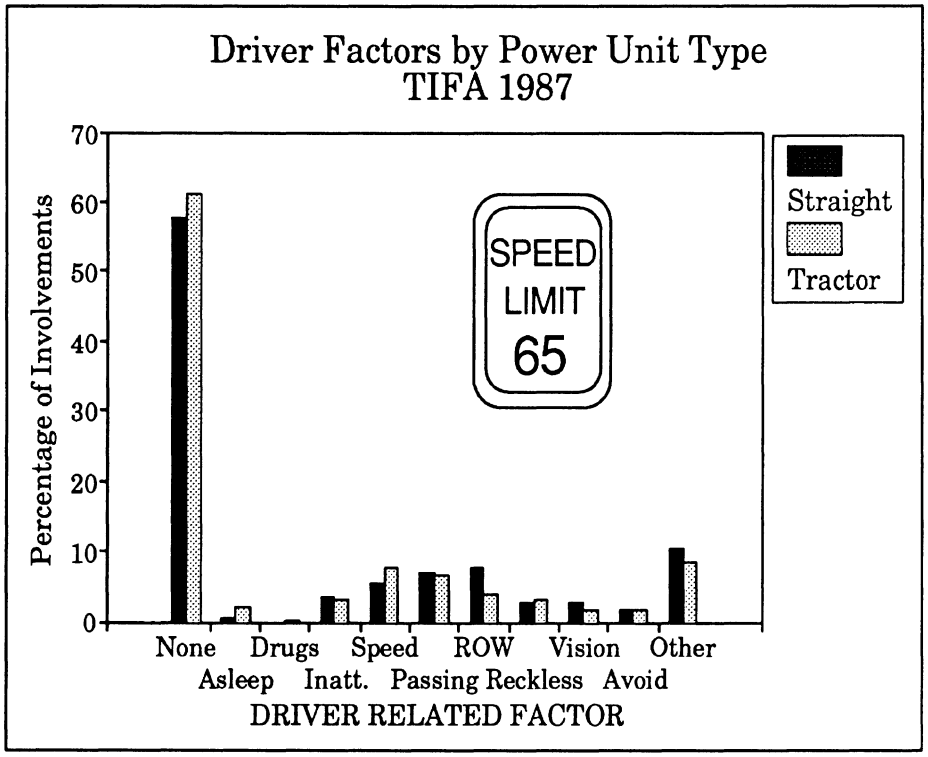


Figure 3-27

TABLE 3–27
Truck Driver Related Factors by Power Unit Type
TIFA 1987

Driver Factor	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
None	870	57.35%	2,277	60.83%	3,147	59.83%
Asleep/Ill	9	0.59	79	2.11	88	1.67
Drugs	0	0.00	6	0.16	6	0.11
Inattentive	56	3.69	114	3.05	170	3.23
Speed violations/ tailgating	80	5.27	290	7.75	370	7.03
Passing/lane change violations	103	6.79	246	6.57	349	6.63
Right-of-way/traffic control violations	116	7.65	149	3.98	265	5.04
Reckless driving	42	2.77	121	3.23	163	3.10
Vision obscured	40	2.64	65	1.74	105	2.00
Avoiding/swerving	28	1.85	64	1.71	92	1.75
Other	158	10.42	308	8.23	466	8.86
Unknown	15	0.99	24	0.64	39	0.74
TOTAL	1,517	100.00%	3,743	100.00%	5,260	100.00%

NOTE: Up to three factors reported for each case by FARS. This table based on first response for each case. The 15 cases of unknown power unit type are excluded from this table.

Vehicle Characteristics

This overview section of TIFA 1987 concludes with some additional comparisons of straight trucks and tractors, this time focusing on features of the trucks themselves. All of these variables are derived from telephone interviews and OMC reports, not from the FARS files. They are examples of the detailed information concerning large trucks that is contained in the TIFA files.

On the following page are the distributions by power unit type for carrier type of the involved trucks. Carrier type is broken down into *inter*state and *intra*state carriers and then further separated into private versus for-hire companies. Interstate for-hire are then divided into ICC-*authorized* carriers—the common and contract carriers—and those hauling ICC-*exempt* commodities. There are also separate categories for government owned and daily rental trucks.

The trucks involved in fatal accidents in 1987 showed great differences in carrier type according to the type of power unit. Of the known cases of carrier type, 48% of the straight trucks fell into the intrastate private category, while 61% of the tractors were in the interstate authorized class. A total of 85% of the tractors were owned by interstate companies, compared to only 36% of the straight trucks. Nearly three-fourths of the straight trucks were private carriers, compared to only 28% of the tractors.

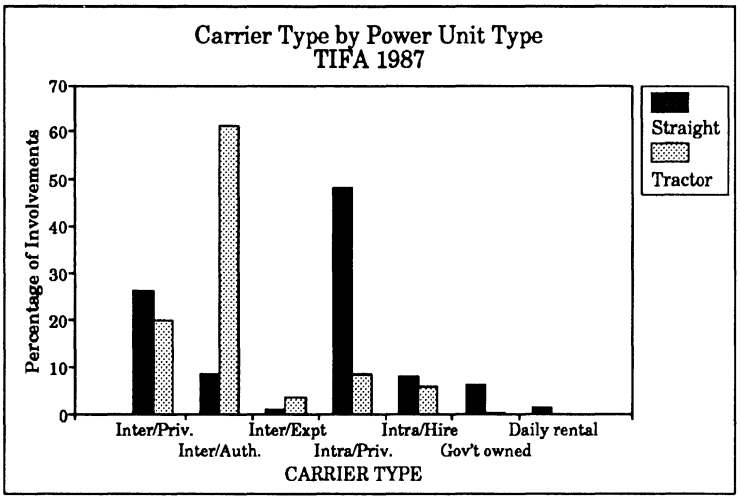


Figure 3-28

TABLE 3-28
Carrier Type by Power Unit Type
TIFA 1987

Carrier Type	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
Interstate private	358	23.60%	668	17.85%	1,026	19.51%
Interstate authorized	114	7.51	2,053	54.85	2,167	41.20
Interstate exempt	19	1.25	125	3.34	144	2.74
Intrastate private	655	43.18	285	7.61	940	17.87
Intrastate for hire	110	7.25	195	5.21	305	5.80
Government owned	87	5.74	13	0.35	100	1.90
Daily rental	21	1.38	6	0.16	27	0.51
Unknown	153	10.09	398	10.63	551	10.48
TOTAL	1,517	100.00%	3,743	100.00%	5,260	100.00%

NOTE: The 15 cases of unknown power unit type are excluded from this table.

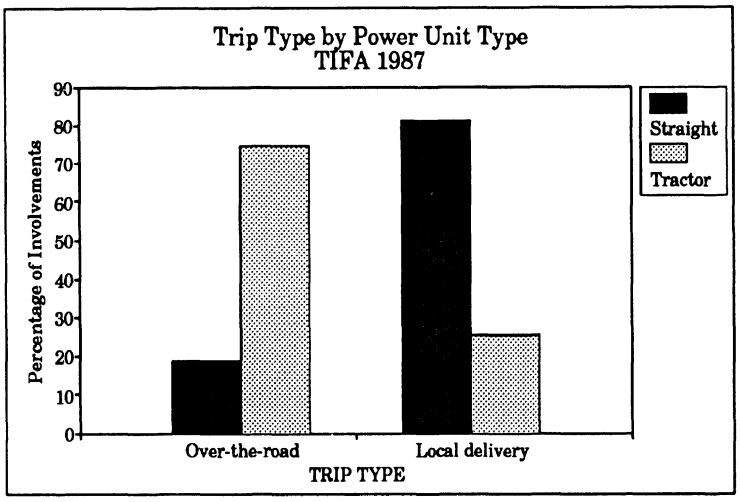


Figure 3-29

The trip type variable is split into over-the-road (one-way trip distance of at least 50 miles) versus local delivery (within a 50 mile radius of base). Again there is a tremendous difference between the straight trucks and tractors. The majority of the involved straight trucks were making local delivery trips at the time of the accident, while most of the tractors were involved in over-the-road operations.

TABLE 3-29
Trip Type by Power Unit Type
TIFA 1987

Trip Type	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
Over-the-road	257	16.94%	2,573	68.74%	2,830	53.80%
Local delivery	1,121	73.90	877	23.43	1,998	37.98
Unknown	139	9.16	293	7.83	432	8.21
TOTAL	1,517	100.00%	3,743	100.00%	5,260	100.00%

NOTE: The 15 cases of unknown power unit type are excluded from this table.

The table and pie graphs on the following pages present the cargo type distributions for the involved trucks. Nearly 33% of the straight trucks and 26% of the tractors were empty at the time of the accident. The most common types of cargo hauled by the loaded straight trucks were solids in bulk (22% of all cases), general freight (9%), heavy machinery (5.5%), and liquids in bulk (4.75%). For tractors, the cargo type distribution included general freight (22%), refrigerated food (7%), solids in bulk (6.5%), and logs and lumber (5.7%).

TABLE 3-30
Type of Cargo by Power Unit Type
TIFA 1987

Cargo Type	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
General freight	135	8.90%	836	22.34%	971	18.46%
Household goods	28	1.85	39	1.04	67	1.27
Metal	10	0.66	170	4.54	180	3.42
Heavy machinery	84	5.54	124	3.31	208	3.95
Motor vehicles	5	0.33	20	0.53	25	0.48
Driveaway/towaway	9	0.59	9	0.24	18	0.34
Gases in bulk	6	0.40	19	0.51	25	0.48
Solids in bulk	336	22.15	244	6.52	580	11.03
Liquids in bulk	72	4.75	156	4.17	228	4.33
Explosives	0	0.00	1	0.03	1	0.02
Logs/lumber	46	3.03	215	5.74	261	4.96
Empty	498	32.83	990	26.45	1,488	28.29
Refrigerated food	46	3.03	261	6.97	307	5.84
Mobile home	0	0.00	9	0.24	9	0.17
Farm products	56	3.69	142	3.79	198	3.76
Other	84	5.54	223	5.96	307	5.84
Unknown	102	6.72	285	7.61	387	7.36
TOTAL	1,517	100.00%	3,743	100.00%	5,260	100.00%

NOTE: The 15 cases of unknown power unit type are excluded from this table.

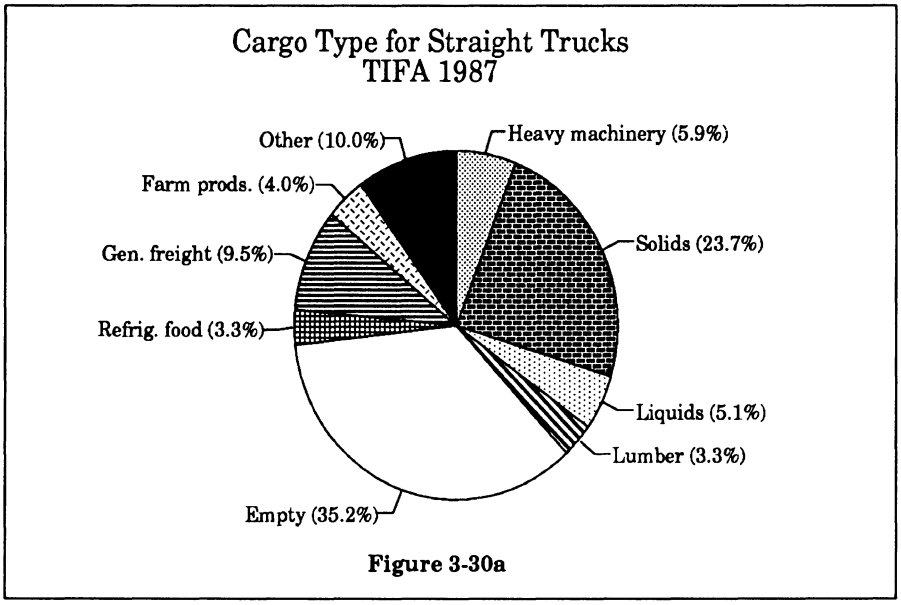


Figure 3-30a

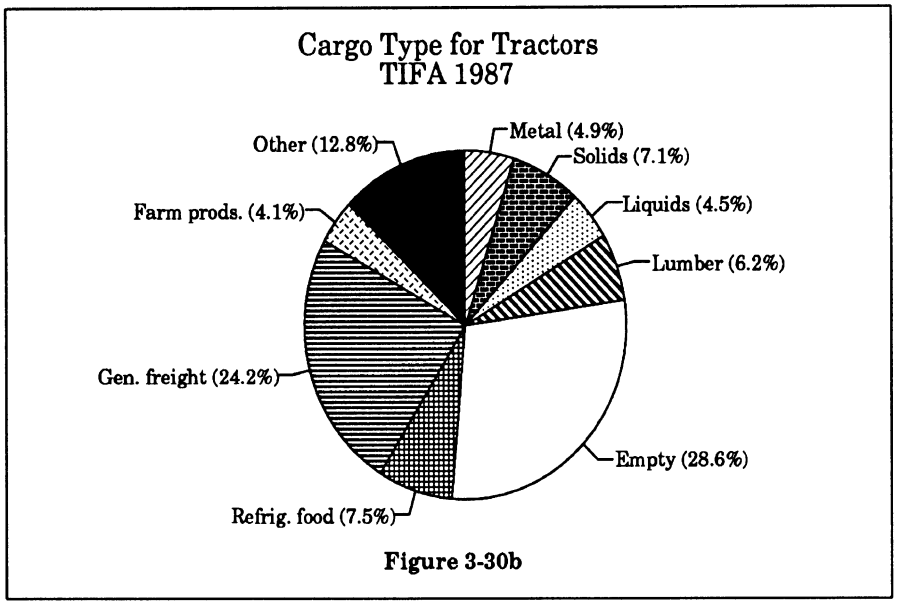


Figure 3-30b

Cab style is split into conventional cabs versus cabover engine and cab-forward cabs. Most of the straight trucks involved in fatal accidents in 1987 had conventional cabs. Tractors were evenly split between conventional and cabover engine cabs.

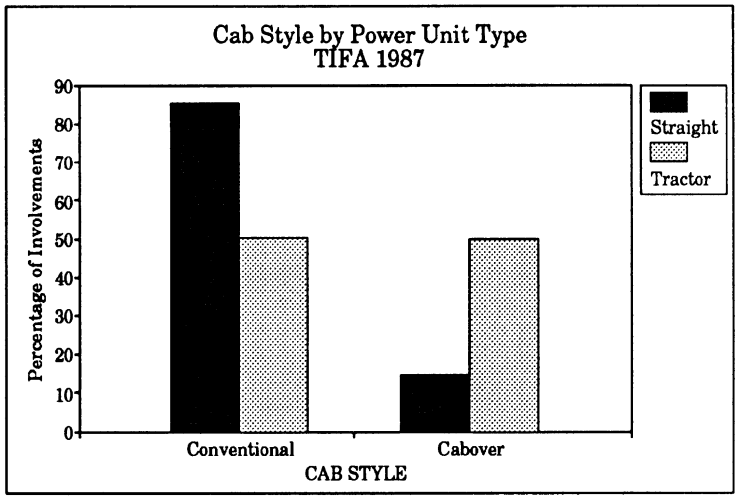


Figure 3-31

TABLE 3-31
Cab Style by Power Unit Type
TIFA 1987

Cab Style	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
Conventional	1,270	83.72%	1,799	48.06%	3,069	58.35%
Cabover/Cab-forward	220	14.50	1,774	47.40	1,994	37.91
Unknown	27	1.78	170	4.54	197	3.75
TOTAL	1,517	100.00%	3,743	100.00%	5,260	100.00%

NOTE: The 15 cases of unknown power unit type are excluded from this table.

The graph below depicts the number of trailers being hauled by the power unit at the time of the accident. If the power unit was towing or piggybacking another vehicle, but not hauling any trailers, the number of trailers was coded as none. Not surprisingly, almost 91% of the straight trucks were not hauling a trailer, while nearly 88% of the tractors were hauling a single trailer.

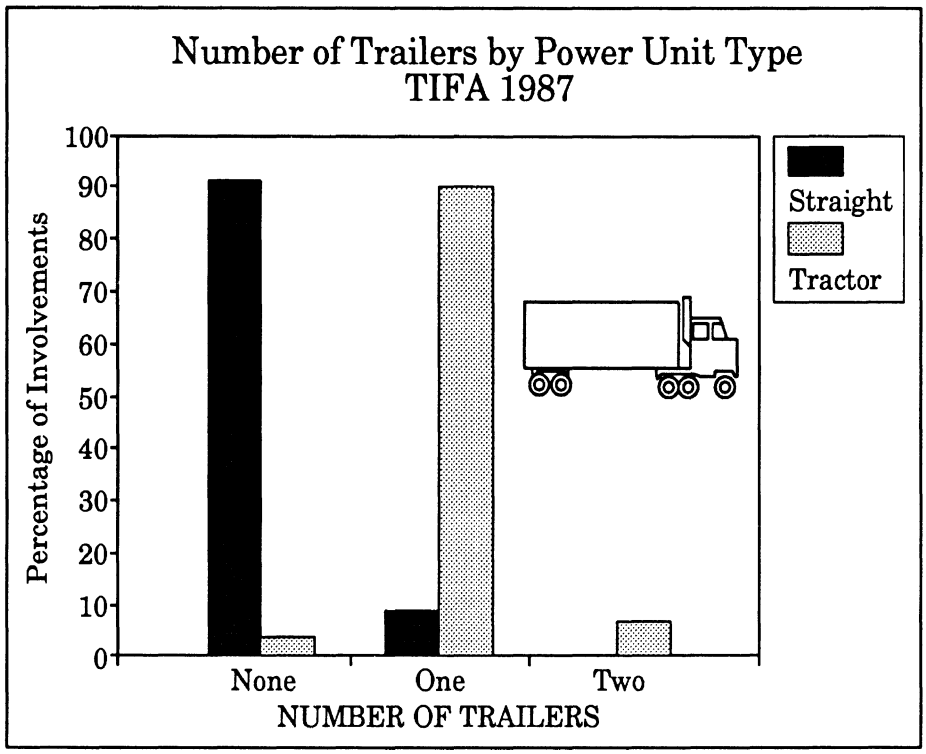


Figure 3-32

TABLE 3-32
Number of Trailers by Power Unit Type
TIFA 1987

Number of Trailers	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
No trailers	1,376	90.71%	131	3.50%	1,507	28.65%
One trailer	134	8.83	3,284	87.74	3,418	64.98
Two trailers	1	0.07	236	6.31	237	4.51
Unknown	6	0.40	92	2.46	98	1.86
TOTAL	1,517	100.00%	3,743	100.00%	5,260	100.00%

NOTE: The 15 cases of unknown power unit type are excluded from this table.

The type of fuel used by each involved truck was coded as gasoline, diesel fuel, liquid petroleum gas, or all other types. Again there is a great difference according to power unit type. Over 95% of the involved tractors used diesel fuel, while the straight trucks were split between diesel and gasoline, 64% to 34% respectively.

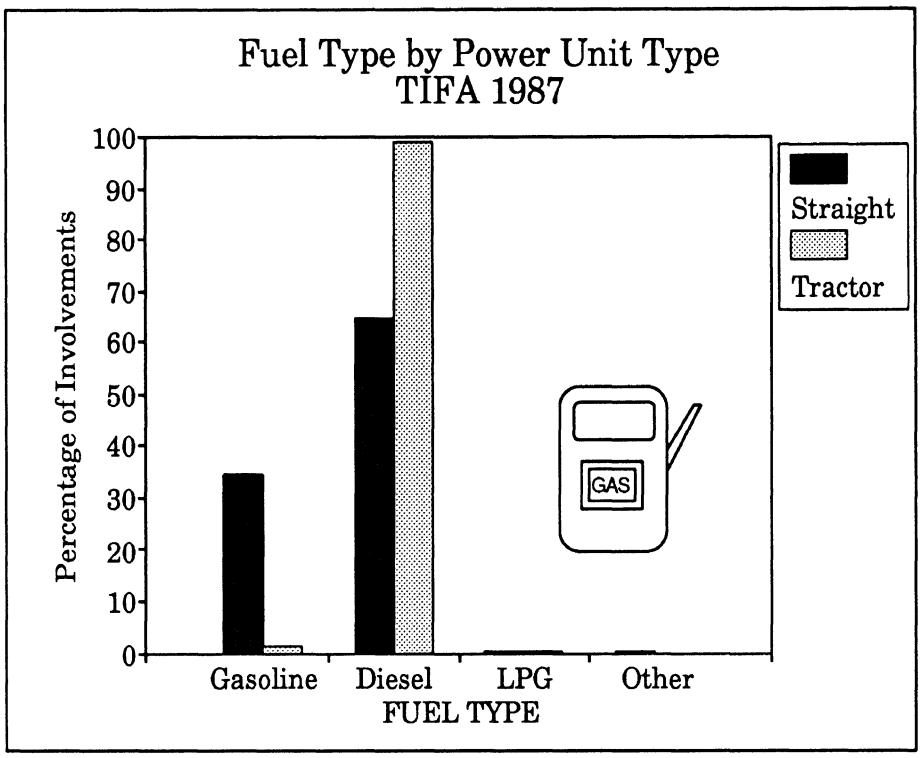


Figure 3-33

TABLE 3-33
Fuel Type by Power Unit Type
TIFA 1987

Fuel Type	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
Gasoline	517	34.08%	44	1.18%	561	10.67%
Diesel	967	63.74	3,574	95.48	4,541	86.33
L. P. G.	3	0.20	2	0.05	5	0.10
Other	8	0.53	0	0.00	8	0.15
Unknown	22	1.45	123	3.29	145	2.76
TOTAL	1,517	100.00%	3,743	100.00%	5,260	100.00%

NOTE: The 15 cases of unknown power unit type are excluded from this table.

The line graph on the next page depicts the number of fatal involvements in 1987 according to the model year of the power unit. Tractors involved in fatal accidents were relatively newer than the straight trucks. Of the known cases, nearly 40% of the tractors were from model years 1984-1988, compared to only 30% of the straight trucks. On the other

hand, 27% of the straight trucks dated from 1975 and earlier, as opposed to 14% of the tractors. This difference is probably related to the typically high annual mileage of tractors, relative to straight trucks, which limits their number of years of service.

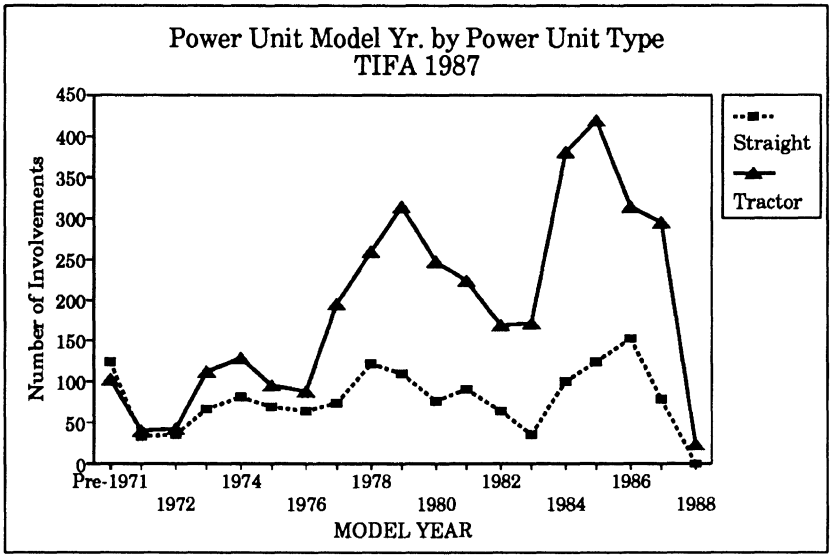


Figure 3-34

TABLE 3-34
Model Year of Power Unit by Power Unit Type
TIFA 1987

Model Year	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
1950–1970	123	8.11%	102	2.73%	225	4.28%
1971	34	2.24	41	1.10	75	1.43
1972	35	2.31	44	1.18	79	1.50
1973	68	4.48	112	2.99	180	3.42
1974	81	5.34	129	3.45	210	3.99
1975	69	4.55	94	2.51	163	3.10
1976	65	4.28	89	2.38	154	2.93
1977	73	4.81	194	5.18	267	5.08
1978	122	8.04	259	6.92	381	7.24
1979	110	7.25	314	8.39	424	8.06
1980	76	5.01	248	6.63	324	6.16
1981	91	6.00	222	5.93	313	5.95
1982	65	4.28	169	4.52	234	4.45
1983	35	2.31	171	4.57	206	3.92
1984	100	6.59	380	10.15	480	9.13
1985	123	8.11	418	11.17	541	10.29
1986	153	10.09	313	8.36	466	8.86
1987	79	5.21	295	7.88	374	7.11
1988	1	0.07	25	0.67	26	0.49
Unknown	14	0.92	124	3.31	138	2.62
TOTAL	1,517	100.00%	3,743	100.00%	5,260	100.00%

NOTE: The 15 cases of unknown power unit type are excluded from this table.

FATAL ACCIDENT EXPERIENCE OF STRAIGHT TRUCKS IN 1987

Distributions are presented in this section that characterize fatal accident involvements of straight trucks in 1987. Most of the variables are presented according to the cargo body style of the trucks. Cargo body style is known for over 98% of the 1,517 straight trucks in the TIFA 1987 file. Of the known cases, 30% were dumps, 22% vans, 10% refuse, 8% flatbeds, and 7% tanks. The remaining straight trucks had some other type of cargo body style. Many of the variables discussed in this section concern specific physical characteristics of the trucks themselves. This type of information is not available in the FARS files.

The section begins by characterizing the configuration of the straight trucks according to cargo body style, weight, number of axles, number of trailers, and type of cargo. Next are descriptions of the use of the trucks, in terms of carrier type, trip type, and road class. Following these are distributions pertaining to collision type, and the section concludes with information on the injury experience of the straight truck drivers.

Configuration

The graph at right illustrates the gross vehicle weight rating (GVWR) distributions for van, flatbed, tank, dump, and refuse straight trucks. The GVWR indicates what the truck would weigh if loaded to the rated capacity of its axles. Of the known cases of GVWR, 93% were class 6, 7, or 8. These classes correspond to weight ranges of 19,501-26,000 lbs., 26,001-33,000 lbs., and over 33,000 lbs. respectively. Not surprisingly, the GVWR distributions vary according to cargo body style. Flatbeds and especially vans tended to belong to lighter GVWR classes, while tanks, dumps, and especially refuse trucks typically had higher GVWRs.

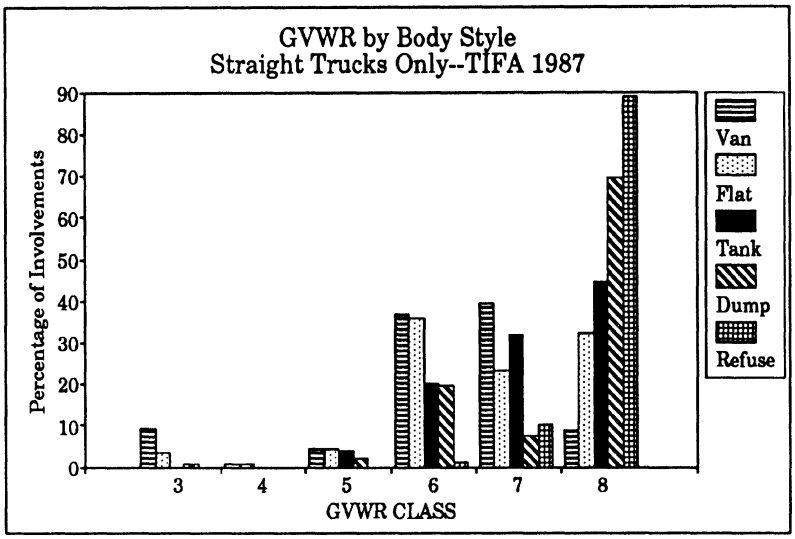


Figure 4-1

TABLE 4–1
GVWR by Body Style
Straight Trucks Only
TIFA 1987

GVWR Class/ Weight Range	BODY STYLE (Frequencies and Column Percents)							
	Van	Flatbed	Tank	Dump	Refuse	Other	Unknown	TOTAL
3 10,001–14,000	29 8.71	4 3.36	0 0.00	3 0.68	0 0.00	8 2.37	1 3.57	45 2.97
4 14,001–16,000	3 0.90	1 0.84	0 0.00	0 0.00	0 0.00	2 0.59	0 0.00	6 0.40
5 16,001–19,500	14 4.20	5 4.20	4 3.81	9 2.04	0 0.00	12 3.56	5 17.86	49 3.23
6 19,501–26,000	115 34.53	41 34.45	21 20.00	86 19.50	2 1.30	89 26.41	9 32.14	363 23.93
7 26,001–33,000	123 36.94	27 22.69	33 31.43	33 7.48	15 9.74	49 14.54	4 14.29	284 18.72
8 33,001+	28 8.41	37 31.09	46 43.81	301 68.25	133 86.36	159 47.18	5 17.86	709 46.74
Unknown	21 6.31	4 3.36	1 0.95	9 2.04	4 2.60	18 5.34	4 14.29	61 4.02
TOTAL	333 100.00	119 100.00	105 100.00	441 100.00	154 100.00	337 100.00	28 100.00	1,517 100.00

TABLE 4-2
Gross Vehicle Weight by Body Style
Straight Trucks Only
TIFA 1987

Gross Weight (Frequencies and Col. Pcts.)	Van	Flatbed	Tank	Dump	Refuse	Other	Unknown	TOTAL
< 20,000	189 56.76	54 45.38	15 14.29	117 26.53	10 6.49	120 35.61	0 0.00	505 33.29
20,000	50 15.02	21 17.65	25 23.81	119 26.98	25 16.23	76 22.55	0 0.00	316 20.83
30,000	21 6.31	5 4.20	13 12.38	29 6.58	51 33.12	34 10.09	0 0.00	153 10.09
40,000	3 0.90	8 6.72	4 3.81	32 7.26	19 12.34	13 3.86	0 0.00	79 5.21
50,000	3 0.90	3 2.52	0 0.00	30 6.80	11 7.14	20 5.93	0 0.00	67 4.42
60,000	0 0.00	2 1.68	0 0.00	35 7.94	2 1.30	7 2.08	0 0.00	46 3.03
70,000	2 0.60	2 1.68	3 2.86	21 4.76	2 1.30	3 0.89	0 0.00	33 2.18
80,000+	0 0.00	0 0.00	3 2.86	7 1.59	2 1.30	4 1.19	0 0.00	16 1.05
Unknown	65 19.52	24 20.17	42 40.00	51 11.56	32 20.78	60 17.80	28 100.00	302 19.91
TOTAL	333 100.00	119 100.00	105 100.00	441 100.00	154 100.00	337 100.00	28 100.00	1,517 100.00

NOTE: The figures in the left column indicate the low end of each gross weight range.

The table above presents the gross vehicle weight distributions for straight trucks in the 1987 TIFA file according to cargo body style. Gross vehicle weight refers to the total weight of the configuration and its cargo at a particular time, in this case the time of the accident. Gross vehicle weight is unknown for 20% of the straight truck cases. For the known cases, 67.6% were operating at a gross weight of under 30,000 pounds, and 80.2% had a gross weight of less than 40,000 pounds. Of course the gross vehicle weight varied according to the cargo body style. Only 3% of the involved vans were at a weight of at least 40,000 pounds, compared to 32% of the dumps.

On the following page, the gross vehicle weights of the known cases are depicted in a cumulative frequency diagram based on percentages. In general, the lower the line on the graph, the heavier the typical gross weight for that cargo body style. For example, the graph indicates that 76% of the dumps, 90% of the tanks, and 98% of the vans were operating at a gross weight under 50,000 pounds.

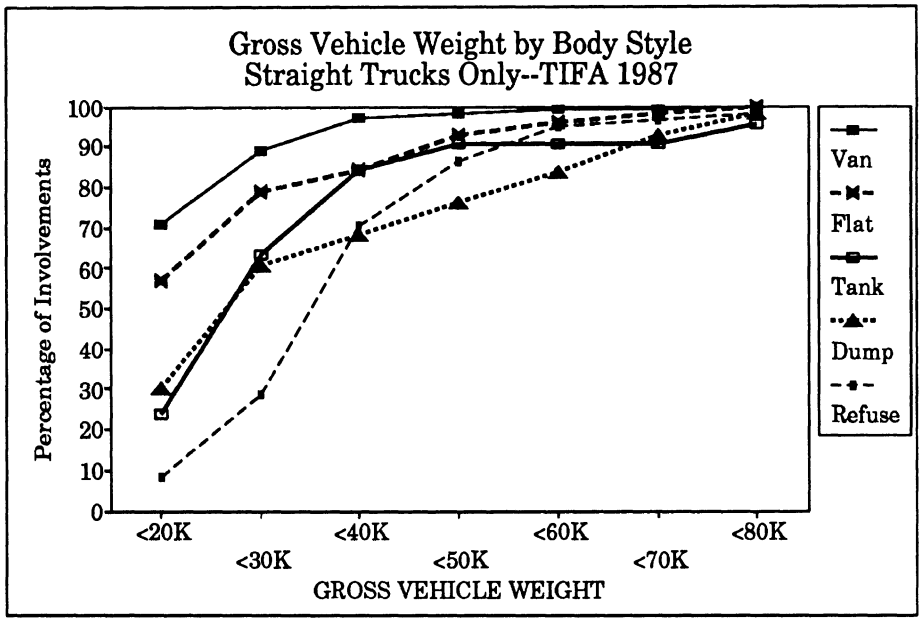


Figure 4-2

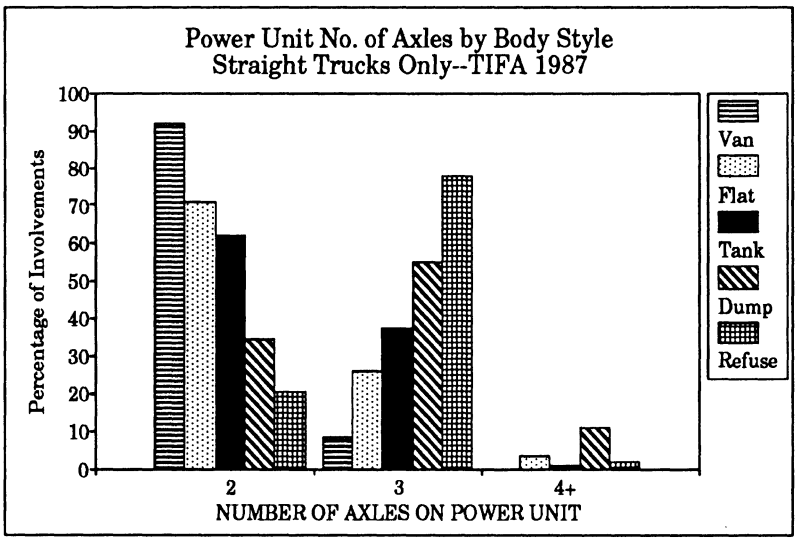


Figure 4-3

The number of axles on the power unit for the 1987 TIFA straight trucks is directly related to the trucks' cargo body style. The highest percentage of 2-axle trucks was found among the vans, followed by flatbeds, tanks, dumps, and refuse trucks. The reverse order held for 3-axle trucks. Power units with 4 or more axles were relatively uncommon but comprised nearly 11% of the dumps and smaller proportions of the flatbeds and refuse trucks.

TABLE 4-3
Number of Axles on Power Unit by Body Style
Straight Trucks Only
TIFA 1987

Power Unit No. of Axles (Frequencies and Col. Pcts.)	Van	Flatbed	Tank	Dump	Refuse	Other	Unknown	TOTAL
2	305 91.59	84 70.59	65 61.90	151 34.24	31 20.13	180 53.41	18 64.29	834 54.98
3	28 8.41	31 26.05	39 37.14	240 54.42	118 76.62	150 44.51	5 17.86	611 40.28
4+	0 0.00	4 3.36	1 0.95	47 10.66	3 1.95	7 2.08	0 0.00	62 4.09
Unknown	0 0.00	0 0.00	0 0.00	3 0.68	2 1.30	0 0.00	5 17.86	10 0.66
TOTAL	333 100.00	119 100.00	105 100.00	441 100.00	154 100.00	337 100.00	28 100.00	1,517 100.00

The table below attempts to characterize the configuration of the straight trucks in terms of number of units and number of axles on each unit. The rows of the table indicate the number of axles on the power unit, with possibilities of 2, 3, 4 or more, and unknown. The columns list frequencies for trucks without a trailer, with one trailer, two trailers, and for trucks where it was unknown if it was hauling a trailer. Subheadings of the trailer columns indicate the number of axles on the trailer. So, for example, the most common configuration among the 1,517 straight trucks was a 2-axle truck not hauling a trailer, with 773 cases. Among the cases of trucks hauling a single trailer, the most common axle configuration was a 3-axle power unit and a 2-axle trailer, with 56 cases. The single case of a two-trailer truck had 3 axles on the power unit and 2 axles on each of the trailers.

TABLE 4-4
Number of Axles on Power Unit and Trailers
Straight Trucks Only
TIFA 1987

Power Unit No. of Axles	Number of Trailers/Number of Axles on Trailer								
		One Trailer					Two Trailers	Unknown if Trailer	TOTAL
	No Trailer	1	2	3	4+	Unk.	2,2		
2	773	8	36	13	1	2	0	1	834
3	541	4	56	4	1	3	1	1	611
4+	57	0	0	1	4	0	0	0	62
Unknown	5	0	1	0	0	0	0	4	10
TOTAL	1,376	12	93	18	6	5	1	6	1,517

The table below presents the cargo type distributions of the straight trucks according to cargo body style. The proportion of the trucks that were empty at the time of the accident ranged from 21% of the tanks to 42% of the dumps.

TABLE 4-5
Cargo Type by Body Style
Straight Trucks Only
TIFA 1987

Cargo Type (Frequencies and Col. Pcts.)	Van	Flatbed	Tank	Dump	Refuse	Other	Unknown	TOTAL
General freight	116 34.83	6 5.04	0 0.00	2 0.45	0 0.00	11 3.26	0 0.00	135 8.90
Household goods	26 7.81	2 1.68	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	28 1.85
Metal	1 0.30	5 4.20	0 0.00	0 0.00	0 0.00	4 1.19	0 0.00	10 0.66
Heavy machinery	3 0.90	24 20.17	0 0.00	30 6.80	1 0.65	26 7.72	0 0.00	84 5.54
Motor vehicles	0 0.00	2 1.68	0 0.00	0 0.00	0 0.00	3 0.89	0 0.00	5 0.33
Driveaway/tow	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	9 2.67	0 0.00	9 0.59
Gases in bulk	0 0.00	0 0.00	6 5.71	0 0.00	0 0.00	0 0.00	0 0.00	6 0.40
Solids in bulk	8 2.40	2 1.68	0 0.00	181 41.04	89 57.79	56 16.62	0 0.00	336 22.15
Liquids in bulk	0 0.00	0 0.00	70 66.67	0 0.00	0 0.00	2 0.59	0 0.00	72 4.75
Logs/lumber	1 0.30	13 10.92	0 0.00	7 1.59	0 0.00	25 7.42	0 0.00	46 3.03
Empty	78 23.42	46 38.66	22 20.95	187 42.40	52 33.77	113 33.53	0 0.00	498 32.83
Refrig. food	46 13.81	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	46 3.03
Farm products	10 3.00	9 7.56	0 0.00	15 3.40	0 0.00	22 6.53	0 0.00	56 3.69
Other	19 5.71	4 3.36	1 0.95	3 0.68	0 0.00	57 16.91	0 0.00	84 5.54
Unknown	25 7.51	6 5.04	6 5.71	16 3.63	12 7.79	9 2.67	28 100.00	102 6.72
TOTAL	333 100.00	119 100.00	105 100.00	441 100.00	154 100.00	337 100.00	28 100.00	1,517 100.00

Obviously the various types of cargo bodies were designed to haul different kinds of goods, so the distributions vary a great deal from one type of cargo body to another. Virtually all the loaded tanks were carrying liquids or gases in bulk, while most of the loaded dumps and refuse trucks were hauling solids in bulk. Vans and flatbeds were more variable in the type of cargo they were hauling, as the pie graphs below indicate.

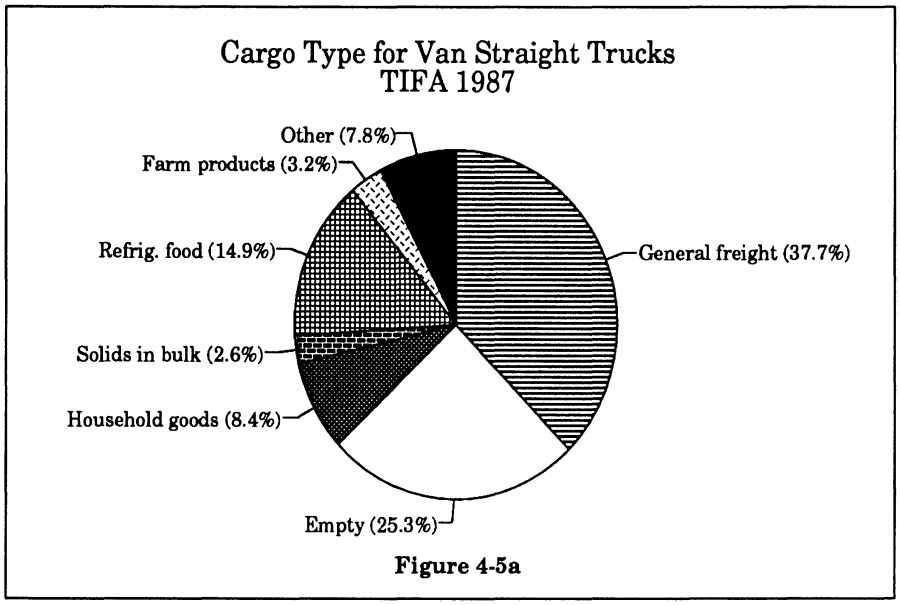


Figure 4-5a

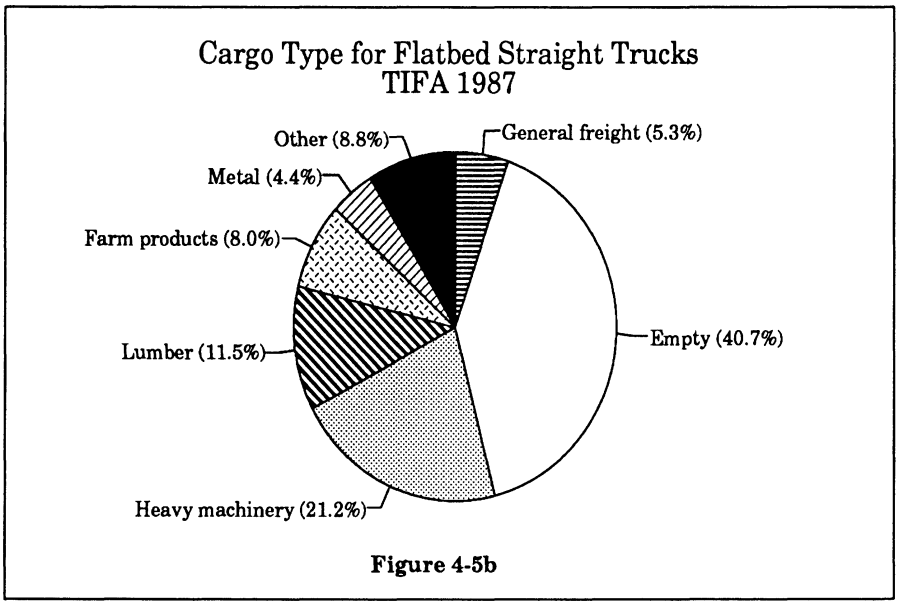


Figure 4-5b

Use

Carrier type, which was discussed earlier for straight trucks versus tractors, is shown here for straight trucks according to cargo body style. In the graph all interstate carriers and all intrastate carriers have been combined, but in the table below they are separated into private and for-hire groups. Not surprisingly, the carrier type of the involved trucks varies according to the cargo body style. The highest proportion of interstate carriers was found among the vans with 56% of the known cases. Vans also had the highest percentage of interstate authorized carriers at 18%. On the other hand, dumps were characterized by the highest proportion of intrastate carriers, with nearly 70%, and refuse trucks by the highest percentage of intrastate private carriers, with 60%.

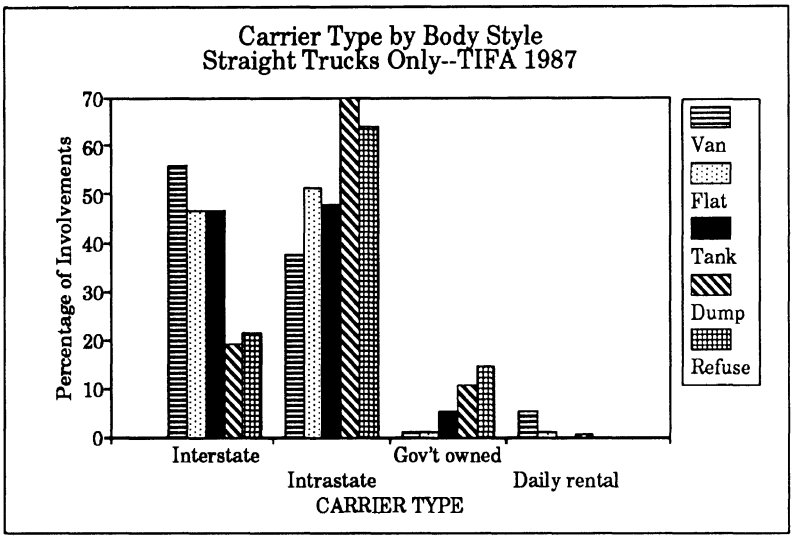


Figure 4-6

TABLE 4-6
Carrier Type by Body Style
Straight Trucks Only
TIFA 1987

Carrier Type (Frequencies and Col. Pcts.)	Van	Flatbed	Tank	Dump	Refuse	Other	Unknown	TOTAL
Interstate private	106 31.83	37 31.09	30 28.57	46 10.43	29 18.83	108 32.05	2 7.14	358 23.60
Interstate authorized	54 16.22	7 5.88	11 10.48	32 7.26	2 1.30	8 2.37	0 0.00	114 7.51
Interstate exempt	6 1.80	3 2.52	3 2.86	1 0.23	0 0.00	6 1.78	0 0.00	19 1.25
Intrastate private	94 28.23	48 40.34	41 39.05	213 48.30	87 56.49	172 51.04	0 0.00	655 43.18
Intrastate for hire	18 5.41	4 3.36	4 3.81	73 16.55	5 3.25	6 1.78	0 0.00	110 7.25
Government owned	3 0.90	1 0.84	5 4.76	44 9.98	21 13.64	12 3.56	1 3.57	87 5.74
Daily rental	16 4.80	1 0.84	0 0.00	2 0.45	0 0.00	2 0.59	0 0.00	21 1.38
Unknown	36 10.81	18 15.13	11 10.48	30 6.80	10 6.49	23 6.82	25 89.29	153 10.09
TOTAL	333 100.00	119 100.00	105 100.00	441 100.00	154 100.00	337 100.00	28 100.00	1,517 100.00

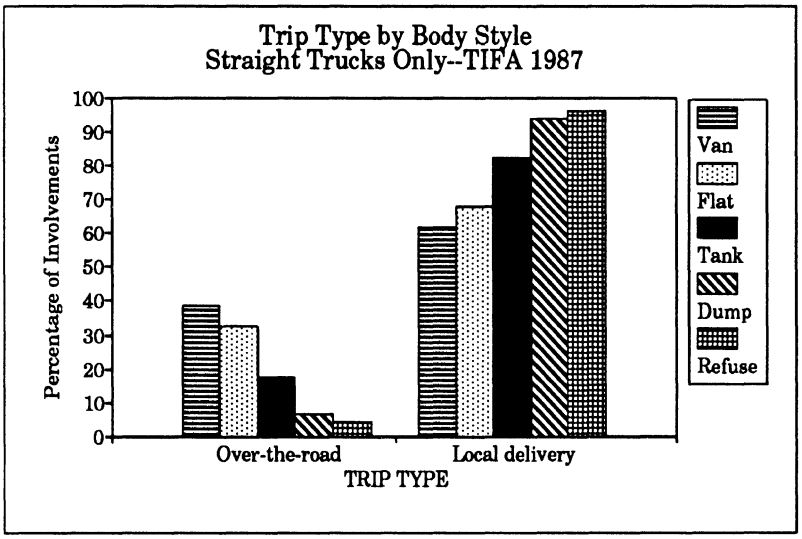


Figure 4-7

For all five kinds of cargo body styles considered, the majority of involved straight trucks were conducting local delivery trips at the time of the accident. Of the known cases, vans had the highest proportion making over-the-road trips (38%), followed by flatbeds (32%), tanks (18%), dumps (6%), and refuse trucks (4%).

TABLE 4-7
Trip Type by Body Style
Straight Trucks Only
TIFA 1987

Trip Type (Frequencies and Col. Pcts.)	Van	Flatbed	Tank	Dump	Refuse	Other	Unknown	TOTAL
Over-the-road	116 34.83	34 28.57	17 16.19	26 5.90	6 3.90	55 16.32	3 10.71	257 16.94
Local delivery	187 56.16	71 59.66	79 75.24	389 88.21	132 85.71	263 78.04	0 0.00	1,121 73.90
Unknown	30 9.01	14 11.76	9 8.57	26 5.90	16 10.39	19 5.64	25 89.29	139 9.16
TOTAL	333 100.00	119 100.00	105 100.00	441 100.00	154 100.00	337 100.00	28 100.00	1,517 100.00

There is less variation among the different types of straight trucks for the class of road where the accident occurred. Overall, nearly 55% of the straight truck involvements occurred on major arteries, and all five categories of cargo body styles had a substantial proportion of involvements on these roads. Only 11% of the overall involvements occurred on limited access roads, but the percentages for flatbeds and vans were slightly higher. About one-third of all the accidents took place on the "other" class of roads, but this category was over-represented among the tanks and refuse trucks.

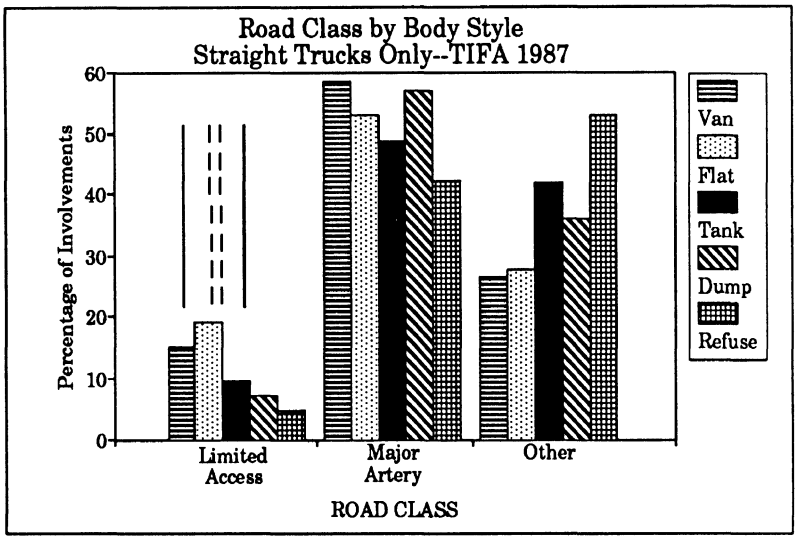


Figure 4-8

TABLE 4-8
Road Class by Body Style
Straight Trucks Only
TIFA 1987

Road Class (Frequencies and Col. Pcts.)	Van	Flatbed	Tank	Dump	Refuse	Other	Unknown	TOTAL
Limited Access	51 15.32	23 19.33	10 9.52	32 7.26	7 4.55	40 11.87	7 25.00	170 11.21
Major Artery	194 58.26	63 52.94	51 48.57	249 56.46	62 40.26	200 59.35	8 28.57	827 54.52
Other	88 26.43	33 27.73	44 41.90	157 35.60	78 50.65	97 28.78	13 46.43	510 33.62
Unknown	0 0.00	0 0.00	0 0.00	3 0.68	7 4.55	0 0.00	0 0.00	10 0.66
TOTAL	333 100.00	119 100.00	105 100.00	441 100.00	154 100.00	337 100.00	28 100.00	1,517 100.00

Accidents

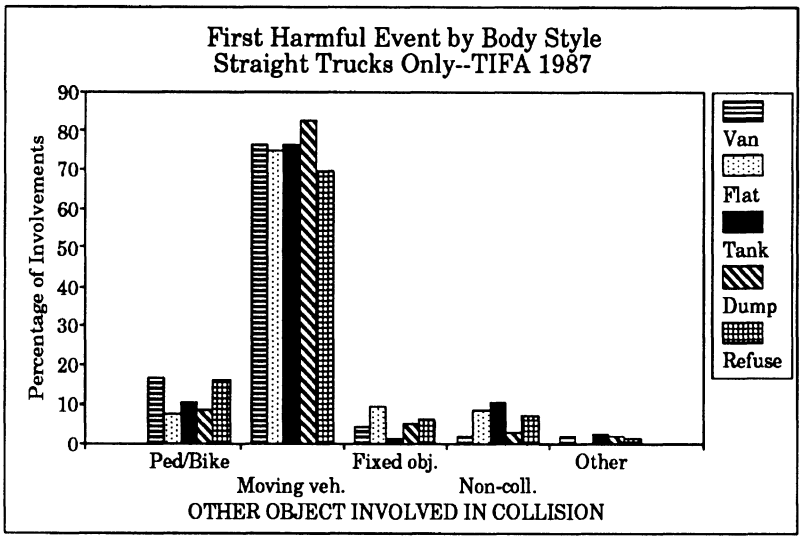


Figure 4-9

The graph on the left illustrates the distribution of the first harmful event in the accident for the 1987 TIFA straight trucks by cargo body style. The distribution of this variable does not show much variation from one type of straight truck to the next. For all five cargo body styles, the first harmful event in the majority of cases was a collision with a motor vehicle in transport. Some of the differences that do exist among the different straight trucks include a higher proportion of pedestrian accidents among vans and refuse trucks and a higher incidence of non-collisions, such as rollovers, fires, and explosions, among tanks, flatbeds, and refuse trucks.

TABLE 4-9
First Harmful Event by Body Style
Straight Trucks Only
TIFA 1987

First Harmful Event (Frequencies and Col. Pcts.)	Van	Flatbed	Tank	Dump	Refuse	Other	Unknown	TOTAL
Pedestrian	47 14.11	7 5.88	7 6.67	26 5.90	24 15.58	26 7.72	1 3.57	138 9.10
Pedalcyclist	8 2.40	2 1.68	4 3.81	10 2.27	1 0.65	11 3.26	2 7.14	38 2.50
Train	0 0.00	0 0.00	0 0.00	7 1.59	2 1.30	0 0.00	0 0.00	9 0.59
Moving vehicle	254 76.28	89 74.79	80 76.19	363 82.31	107 69.48	243 72.11	22 78.57	1,158 76.33
Parked vehicle	5 1.50	0 0.00	0 0.00	1 0.23	0 0.00	3 0.89	0 0.00	9 0.59
Other non-fixed object	0 0.00	0 0.00	2 1.90	0 0.00	0 0.00	1 0.30	0 0.00	3 0.20
Fixed object	13 3.90	11 9.24	1 0.95	22 4.99	9 5.84	31 9.20	2 7.14	89 5.87
Non-collision	6 1.80	10 8.40	11 10.48	12 2.72	11 7.14	22 6.53	1 3.57	73 4.81
TOTAL	333 100.00	119 100.00	105 100.00	441 100.00	154 100.00	337 100.00	28 100.00	1,517 100.00

The manner of collision distributions are shown in the graph at right for the 1,158 straight truck involvements where the first harmful event was a collision with another motor vehicle. Overall, angle collisions were the most common type (44%), followed by head-ons (32%), rear-ends (18%), and sideswipes (6%). Most of the different cargo body styles had collision type distributions similar to the overall pattern. The only major exception was for tanks, which were involved in a higher proportion of angle collisions (60%) and a lower percentage of rear-end collisions (7.5%).

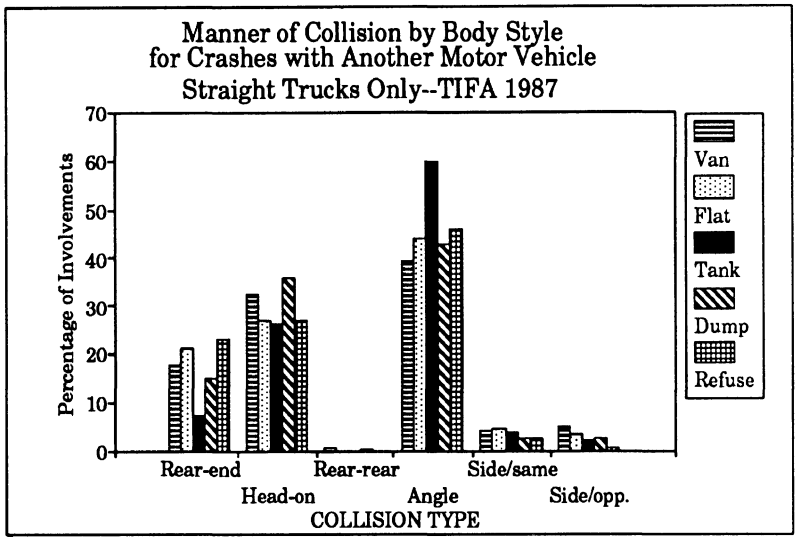


Figure 4-10

TABLE 4-10
Manner of Collision by Body Style
for Crashes with Another Motor Vehicle
Straight Trucks Only
TIFA 1987

Manner of Collision (Frequencies and Col. Pcts.)	Van	Flatbed	Tank	Dump	Refuse	Other	Unknown	TOTAL
Rear-end	45 17.72	19 21.35	6 7.50	55 15.15	25 23.36	49 20.16	7 31.82	206 17.79
Head-on	83 32.68	24 26.97	21 26.25	131 36.09	29 27.10	79 32.51	9 40.91	376 32.47
Rear-to-rear	2 0.79	0 0.00	0 0.00	1 0.28	0 0.00	0 0.00	0 0.00	3 0.26
Angle	100 39.37	39 43.82	48 60.00	156 42.98	49 45.79	107 44.03	6 27.27	505 43.61
Sideswipe, same dir.	11 4.33	4 4.49	3 3.75	10 2.75	3 2.80	4 1.65	0 0.00	35 3.02
Sideswipe, opp. dir.	13 5.12	3 3.37	2 2.50	10 2.75	1 0.93	4 1.65	0 0.00	33 2.85
TOTAL	254 100.00	89 100.00	80 100.00	363 100.00	107 100.00	243 100.00	22 100.00	1,158 100.00

One of the TIFA survey variables is associated accident event. It records whether or not an explosion, fire, or spillage of hazardous or non-hazardous cargo occurred as a subsequent event in the accident for the case truck. The variable is coded hierarchically in the order just listed. For example, if both an explosion and a fire occurred, only the explosion is coded for the vehicle. Also, while the fire occurrence variable discussed earlier is a FARS variable and is therefore based on police reports, the associated accident event variable is derived from OMC reports and telephone interviews. Therefore, the two variables will not necessarily give identical estimates of the incidence of fire.

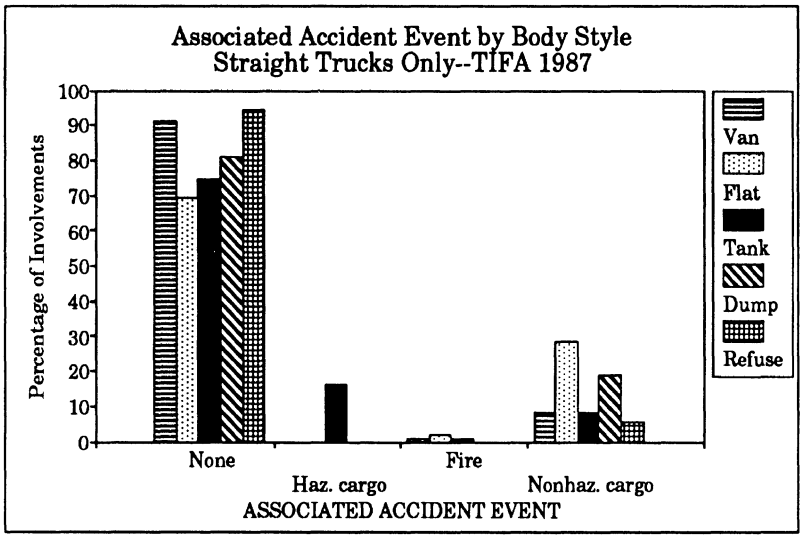


Figure 4-11

No explosions occurred among the straight trucks involved in fatal accidents in 1987. Five fires were recorded (0.4% of all known cases), and there were 18 instances of spillage of hazardous cargo (1.3% of all known cases), 16 of which involved tanks. More common was the spillage of non-hazardous cargo, which occurred in almost 15% of all known cases and which was most common among the flatbeds.

TABLE 4-11
Associated Accident Event by Body Style
Straight Trucks Only
TIFA 1987

Associated Event (Frequencies and Col. Pcts.)	Van	Flatbed	Tank	Dump	Refuse	Other	Unknown	TOTAL
None	287 86.19	75 63.03	73 69.52	337 76.42	132 85.71	265 78.64	1 3.57	1,170 77.13
Spillage of hazardous cargo	0 0.00	0 0.00	16 15.24	0 0.00	0 0.00	2 0.59	0 0.00	18 1.19
Fire	2 0.60	2 1.68	1 0.95	0 0.00	0 0.00	0 0.00	0 0.00	5 0.33
Spillage of nonhaz. cargo	26 7.81	31 26.05	8 7.62	78 17.69	8 5.19	57 16.91	0 0.00	208 13.71
Unknown	18 5.41	11 9.24	7 6.67	26 5.90	14 9.09	13 3.86	27 96.43	116 7.65
TOTAL	333 100.00	119 100.00	105 100.00	441 100.00	154 100.00	337 100.00	28 100.00	1,517 100.00

Driver Injury

The graph at right shows the distributions for the injury severity sustained by the straight truck drivers. There is not a lot of variation among the different cargo body styles. One minor difference is the higher incidence of casualties among flatbed drivers—49% of the known cases compared to the overall average of 40%. The lowest proportion of fatalities occurred among tank (9.5%) and refuse truck (8.6%) drivers. The overall incidence of fatalities among the straight truck drivers was 12%.

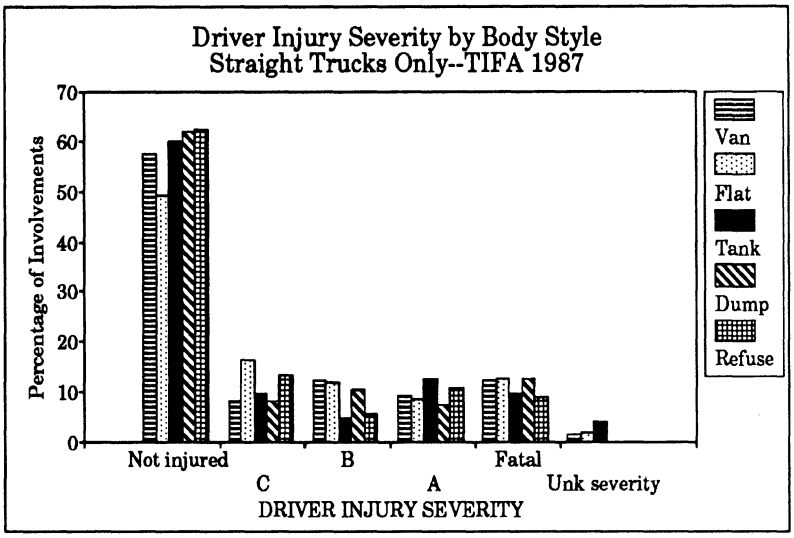


Figure 4-12

TABLE 4–12
Truck Driver Injury Severity by Body Style
Straight Trucks Only
TIFA 1987

Injury Severity (Frequencies and Col. Pcts.)	Van	Flatbed	Tank	Dump	Refuse	Other	Unknown	TOTAL
Not injured	187 56.16	58 48.74	63 60.00	271 61.45	94 61.04	203 60.24	16 57.14	892 58.80
C injury, possible	26 7.81	19 15.97	10 9.52	35 7.94	20 12.99	28 8.31	0 0.00	138 9.10
B injury, not incapacitating	40 12.01	14 11.76	5 4.76	45 10.20	8 5.19	37 10.98	5 17.86	154 10.15
A injury, incapacitating	30 9.01	10 8.40	13 12.38	32 7.26	16 10.39	23 6.82	0 0.00	124 8.17
Fatal injury	39 11.71	15 12.61	10 9.52	54 12.24	13 8.44	45 13.35	6 21.43	182 12.00
Injured, severity unknown	4 1.20	2 1.68	4 3.81	0 0.00	0 0.00	0 0.00	0 0.00	10 0.66
Unknown if injured	7 2.10	1 0.84	0 0.00	4 0.91	3 1.95	1 0.30	1 3.57	17 1.12
TOTAL	333 100.00	119 100.00	105 100.00	441 100.00	154 100.00	337 100.00	28 100.00	1,517 100.00

Next driver injury severity is considered for all TIFA 1987 straight trucks according to the principal point of impact on the truck. Table 4-13A below shows the frequencies for impact area versus injury severity, while Table 4-13B lists the percentage that each impact area comprised of each injury severity category. The front of the truck was the most common principal impact area (55%), followed by the rear (13%) and the right side (12%). Although non-collisions represented only 4.1% of all fatal involvements, they accounted for 20.3% of the cases where the truck driver died and 7.3% of the cases where the driver suffered an incapacitating injury.

TABLE 4-13A
Driver Injury Severity by Principal Impact Point for Straight Trucks—Frequencies
TIFA 1987

Principal Impact Point	Driver Injury Severity							
	Not Injured	C	B	A	Fatal	Injured, severity unk	Unknown if injured	TOTAL
Noncollision	13	1	2	9	37	0	0	62
Right side	123	15	12	9	26	0	0	185
Rear	142	16	13	12	7	1	12	203
Left side	83	10	10	3	11	1	1	119
Front	446	90	114	85	85	8	4	832
Top	6	4	2	2	9	0	0	23
Undercarriage	61	2	1	4	2	0	0	70
Override	6	0	0	0	0	0	0	6
Unknown	12	0	0	0	5	0	0	17
TOTAL	892	138	154	124	182	10	17	1,517

TABLE 4-13B
Driver Injury Severity by Principal Impact Point for Straight Trucks—Column Percentages
TIFA 1987

Principal Impact Point	Driver Injury Severity							
	Not Injured	C	B	A	Fatal	Injured, sev unk	Unk if injured	TOTAL
Noncollision	1.46%	0.72%	1.30%	7.26%	20.33%	0.00%	0.00%	4.09%
Right side	13.79	10.87	7.79	7.26	14.29	0.00	0.00	12.20
Rear	15.92	11.59	8.44	9.68	3.85	10.00	70.59	13.38
Left side	9.30	7.25	6.49	2.42	6.04	10.00	5.88	7.84
Front	50.00	65.22	74.03	68.55	46.70	80.00	23.53	54.85
Top	0.67	2.90	1.30	1.61	4.95	0.00	0.00	1.52
Undercar.	6.84	1.45	0.65	3.23	1.10	0.00	0.00	4.61
Override	0.67	0.00	0.00	0.00	0.00	0.00	0.00	0.40
Unknown	1.35	0.00	0.00	0.00	2.75	0.00	0.00	1.12
TOTAL	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

The stacked bar graph below represents the proportion that each injury severity level (excluding the unknown if injured and injured, severity unknown categories) comprised of each impact area. Non-collisions were characterized by the highest proportion of driver fatalities, with 60%, and resulted in driver casualties in 79% of the cases. The category with the next highest percentage of truck driver casualties was front area impacts with 46%. Involvements where the principal impact area was the rear of the truck were among the safest for the truck driver. The driver was uninjured in 75% of these cases.

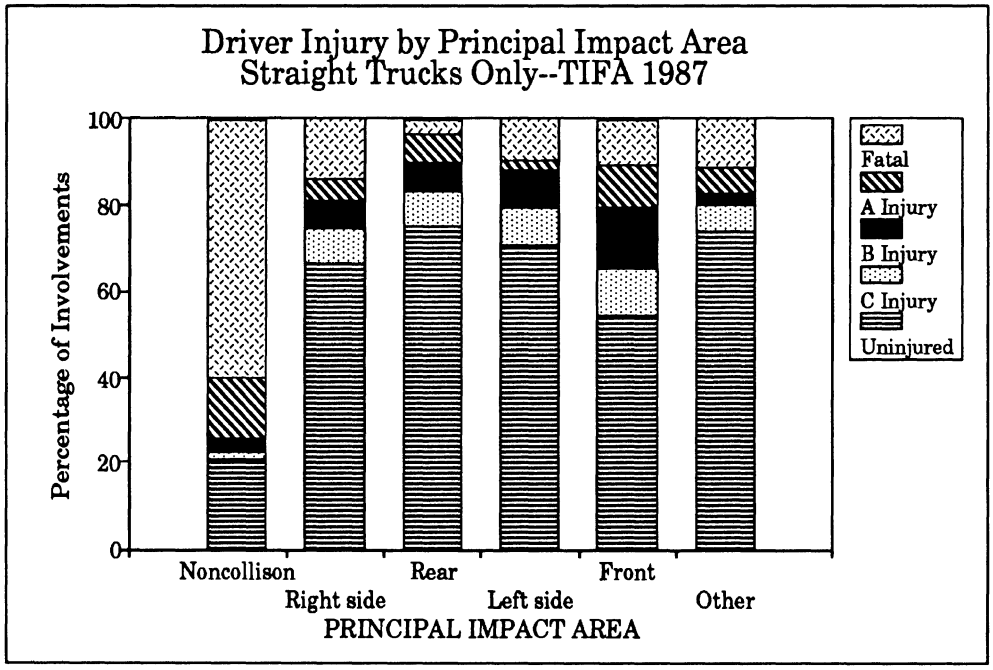


Figure 4-13

In the final set of tabulations for straight trucks, levels of driver injury severity are compared across a variable that indicates whether or not the truck experienced a rollover or fire or whether the driver was ejected. This variable was based on the three FARS variables that record the occurrence of each of these events. Table 4-14A on the following page presents the frequencies of the driver injury severity variable versus the rollover/fire/ejection variable. Table 4-14B lists the percentages that the latter comprised of each of the injury severity categories.

In 80% of the straight truck involvements, there was no rollover, fire, or ejection. In 10% of the cases, the truck experienced a rollover only, and in the remainder there was a fire, ejection, or some combination of all three. Among the accidents where the truck driver died, only 31% did not include a rollover, fire, or ejection. In 25% of the truck driver fatals, there was a rollover and the driver was ejected; in 20% there was a rollover only; and in 10% there was an ejection only. At the other extreme, among the cases where the truck driver was not injured, there was no rollover, fire, or ejection in 94%.

TABLE 4-14A
Driver Injury Severity by Rollover/Fire/Ejection for Straight Trucks—Frequencies
TIFA 1987

Occurrence of Rollover/Fire/Ejection	Driver Injury Severity							
	Not Injured	C	B	A	Fatal	Injured, severity unk	Unknown if injured	TOTAL
None	840	115	116	78	56	9	1	1,215
Rollover only	35	20	28	37	36	1	0	157
Fire only	11	1	5	4	8	0	0	29
Ejection only	4	0	0	4	19	0	0	27
Rollover/Fire	2	2	1	1	12	0	0	18
Fire/Ejection	0	0	2	0	2	0	0	4
Rollover/Ejection	0	0	2	0	45	0	0	47
Rollover/Fire/Ejection	0	0	0	0	4	0	0	4
Unknown	0	0	0	0	0	0	16	16
TOTAL	892	138	154	124	182	10	17	1,517

TABLE 4-14B
Driver Injury Severity by Rollover/Fire/Ejection for Straight Trucks—Column Percentages
TIFA 1987

Occurrence of Rollover/Fire/Ejection	Driver Injury Severity							
	Not Injured	C	B	A	Fatal	Injured, sev unk	Unk if injured	TOTAL
None	94.17%	83.33%	75.32%	62.90%	30.77%	90.00%	5.88%	80.09%
Rollover only	3.92	14.49	18.18	29.84	19.78	10.00	0.00	10.35
Fire only	1.23	0.72	3.25	3.23	4.40	0.00	0.00	1.91
Ejection only	0.45	0.00	0.00	3.23	10.44	0.00	0.00	1.78
Rollover/Fire	0.22	1.45	0.65	0.81	6.59	0.00	0.00	1.19
Fire/Ejection	0.00	0.00	1.30	0.00	1.10	0.00	0.00	0.26
Roll/Eject	0.00	0.00	1.30	0.00	24.73	0.00	0.00	3.10
Roll/Fire/Eject	0.00	0.00	0.00	0.00	2.20	0.00	0.00	0.26
Unknown	0.00	0.00	0.00	0.00	0.00	0.00	94.12	1.05
TOTAL	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

The figure on the following page displays the driver injury severity outcome for each of the categories of rollover/fire/ejection occurrence. When none of those events took place, the driver was uninjured 70% of the time. This was true of only 22% of the cases where a rollover only occurred, 38% where a fire only took place, and 15% where the driver was ejected. As one would expect, combinations of these events, although rare, proved especially hazardous to the driver. The four instances where all three events took place all resulted in driver fatalities.

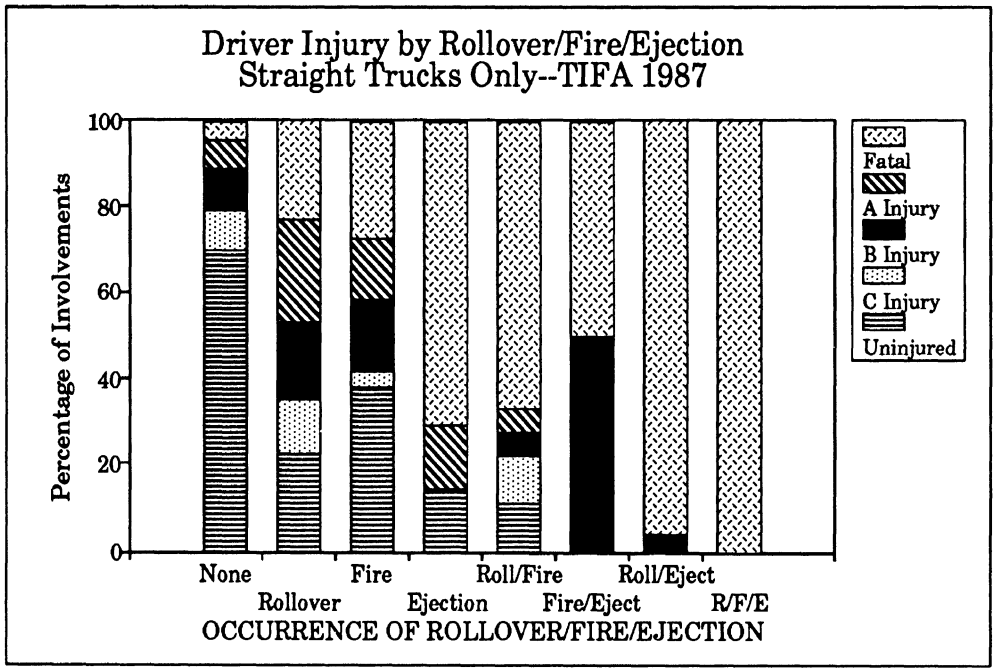

Driver Injury by Rollover/Fire/Ejection
Straight Trucks Only--TIFA 1987
Percentage of Involvements
100
80
60
40
20
0
Fatal
A Injury
B Injury
C Injury
Uninjured
None
Rollover
Fire
Ejection
Roll/Fire
Fire/Eject
Roll/Eject
R/F/E
OCCURRENCE OF ROLLOVER/FIRE/EJECTION

Figure 4-14

FATAL ACCIDENT EXPERIENCE OF TRACTOR COMBINATIONS IN 1987

This section focuses exclusively on the fatal accident experience of tractor combinations in 1987. Bobtails, singles, and doubles are all included in this section. Most of the distributions are presented according to either the trailer body style or cab style of the trucks. As in the last section on straight trucks, many of the variables presented describe detailed physical information about the trucks that is not available in the FARS files.

Since tractors were involved in over 70% of the fatal large truck accidents in 1987, a greater number of variables are discussed for the tractors than was the case for the straight trucks. The configuration of the involved tractors is characterized according to cab style, trailer body style, number of trailers, weight, axle configuration, cargo type, and fuel type. Following that are descriptions of the use of the tractors, including carrier type, trip type, road class, land use, and light condition. Next is a series of collision type distributions, including the occurrence of rollovers and jackknifes according to gross combination weight. The final portion of the section concerns the injury experience of the tractor drivers.

Configuration

Cab style is coded in TIFA as either conventional or cabover/cab-forward. The tractors involved in fatal accidents in 1987 were almost evenly split between conventional and cabover cabs. The distributions for the number of trailers hauled by these two cab styles are illustrated in the graph at right. The main difference is that doubles were almost twice as likely to be hauled by cabover as conventional cabs.

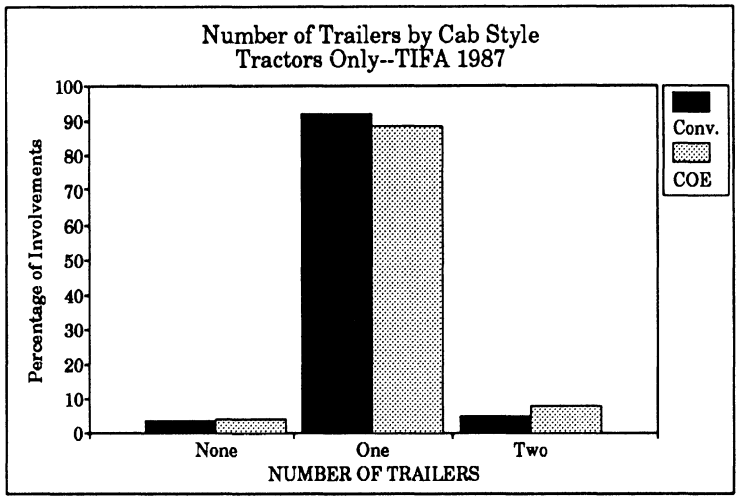


Figure 5-1

TABLE 5-1
Number of Trailers by Cab Style
Tractors Only
TIFA 1987

Number of Trailers	Conventional		Cabover/ Cab-forward		Unknown		TOTAL	
	No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.
No trailers	64	3.56%	65	3.66%	2	1.18%	131	3.50%
One trailer	1,650	91.72	1,565	88.22	69	40.59	3,284	87.74
Two trailers	83	4.61	144	8.12	9	5.29	236	6.31
Unknown	2	0.11	0	0.00	90	52.94	92	2.46
TOTAL	1,799	100.00%	1,774	100.00%	170	100.00%	3,743	100.00%

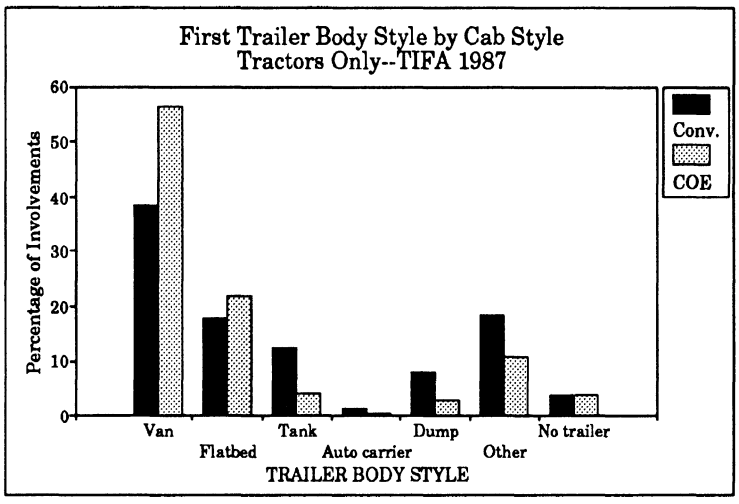


Figure 5-2

The graph at left shows the distributions of the first trailer body style according to the cab style of the involved tractors. Of the known cases of trailer body style, 56% of the cabovers were hauling a van as the first trailer. This compares to only 38% of the conventional cabs. Cabovers also were more likely to be hauling a flatbed trailer than were conventional cabs, while conventionals had higher proportions of tanks and dumps as the first trailer than did the cabovers.

TABLE 5-2
First Trailer Body Style by Cab Style
Tractors Only
TIFA 1987

First Trailer Body Style	Conventional		Cabover/ Cab-forward		Unknown		TOTAL	
	No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.
Van	675	37.52%	975	54.96%	16	9.41%	1,666	44.51%
Flatbed	313	17.40	377	21.25	15	8.82	705	18.84
Tank	216	12.01	70	3.95	6	3.53	292	7.80
Auto carrier	23	1.28	6	0.34	2	1.18	31	0.83
Dump	142	7.89	51	2.87	3	1.76	196	5.24
Other	326	18.12	189	10.65	7	4.12	522	13.95
No first trailer	64	3.56	65	3.66	2	1.18	131	3.50
Unknown	40	2.22	41	2.31	119	70.00	200	5.34
TOTAL	1,799	100.00%	1,774	100.00%	170	100.00%	3,743	100.00%

Table 5-2 above indicates the relative proportions of the different first trailer body styles for the TIFA 1987 tractors. If the cases are restricted to those where there was a first trailer and its body style was known, then 48.8% of the involved tractors were hauling a van as the first trailer, 20.7% a flatbed, 8.6% a tank, 0.9% an auto carrier, 5.7% a dump, and the remaining 15.3% were hauling some other type of trailer. Many of the distributions presented in the rest of this section are given according to the first trailer body style, using the categories of van, flatbed, tank, auto carrier, and dump, so the proportion that each trailer type comprises out of the total should be kept in mind.

The graph at right illustrates GVWR distributions for the 1987 TIFA tractors. The GVWR pertains only to the power unit, so in this case it indicates the rated weight capacity of the axles of the tractor itself. For the cases where GVWR was known, about 93% of the tractors involved in fatal accidents in 1987 were class 8 (over 33,000 lbs.). An even higher proportion of tractors hauling flatbeds, tanks, or dumps as the first trailer were class 8 vehicles. On the other hand, somewhat lower percentages of the vans (91%) and auto carriers (77%) were hauled by class 8 tractors.

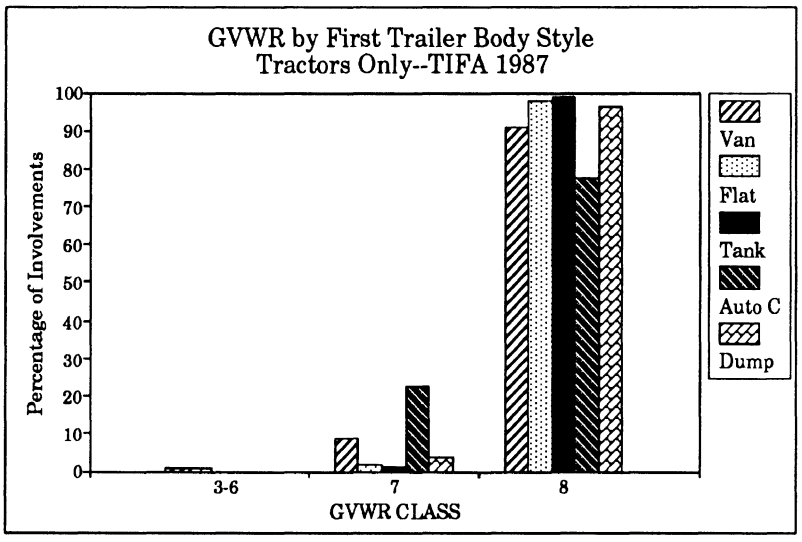


Figure 5-3

TABLE 5–3
GVWR by First Trailer Body Style
Tractors Only
TIFA 1987

GVWR Class/ Weight Range	BODY STYLE (Frequencies and Column Percents)							
	Van	Flatbed	Tank	Auto Carrier	Dump	Other	Unknown/ No Trailer	TOTAL
3 10,001–14,000	1 0.06	1 0.14	0 0.00	0 0.00	0 0.00	2 0.38	0 0.00	4 0.11
4 14,001–16,000	1 0.06	0 0.00	0 0.00	0 0.00	0 0.00	1 0.19	0 0.00	2 0.05
5 16,001–19,500	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	1 0.30	1 0.03
6 19,501–26,000	9 0.54	4 0.57	0 0.00	0 0.00	0 0.00	6 1.15	10 3.02	29 0.77
7 26,001–33,000	140 8.40	11 1.56	4 1.37	7 22.58	7 3.57	20 3.83	20 6.04	209 5.58
8 33,001+	1,486 89.20	674 95.60	285 97.60	24 77.42	186 94.90	481 92.15	226 68.28	3,362 89.82
Unknown	29 1.74	15 2.13	3 1.03	0 0.00	3 1.53	12 2.30	74 22.36	136 3.63
TOTAL	1,666 100.00	705 100.00	292 100.00	31 100.00	196 100.00	522 100.00	331 100.00	3,743 100.00

Table 5-4 on the following page shows the gross combination weight distributions of the involved tractors by first trailer body style. The gross combination weight refers to the total weight of the tractor, any trailers, and any cargo that was being hauled at the time of the accident. The GCW distributions show variation from one trailer body style to another. GCWs of at least 70,000 pounds represented 54% of tanks (of all known cases), 41% of flatbeds, 40% of dumps, 30% of vans, and just 11% of auto carriers.

Following the table is a cumulative frequency diagram (Figure 5-4) of GCW according to percentage of involvements. In general the lower lines represent trailer body styles with heavier gross combination weights. Thus auto carriers typically had the lowest GCWs and tanks the highest, with the other three trailer body styles intermediate.

TABLE 5-4
Gross Combination Weight by First Trailer Body Style
Tractors Only
TIFA 1987

Gross Weight (Frequencies and Col. Pcts.)	Van	Flatbed	Tank	Auto Carrier	Dump	Other	Unknown/ No Trailer	TOTAL
< 20,000	9 0.54	5 0.71	0 0.00	0 0.00	2 1.02	6 1.15	106 32.02	128 3.42
20,000	224 13.45	131 18.58	61 20.89	4 12.90	51 26.02	97 18.58	17 5.14	585 15.63
30,000	263 15.79	68 9.65	42 14.38	11 35.48	33 16.84	70 13.41	4 1.21	491 13.12
40,000	199 11.94	35 4.96	7 2.40	2 6.45	6 3.06	23 4.41	3 0.91	275 7.35
50,000	176 10.56	48 6.81	6 2.05	1 3.23	4 2.04	11 2.11	0 0.00	246 6.57
60,000	207 12.42	80 11.35	6 2.05	6 19.35	13 6.63	44 8.43	1 0.30	357 9.54
70,000	402 24.13	218 30.92	109 37.33	3 9.68	57 29.08	175 33.52	3 0.91	967 25.83
80,000+	51 3.06	39 5.53	33 11.30	0 0.00	15 7.65	52 9.96	2 0.60	192 5.13
Unknown	135 8.10	81 11.49	28 9.59	4 12.90	15 7.65	44 8.43	195 58.91	502 13.41
TOTAL	1,666 100.00	705 100.00	292 100.00	31 100.00	196 100.00	522 100.00	331 100.00	3,743 100.00

NOTE: The figures in the left column indicate the low end of each gross weight range.

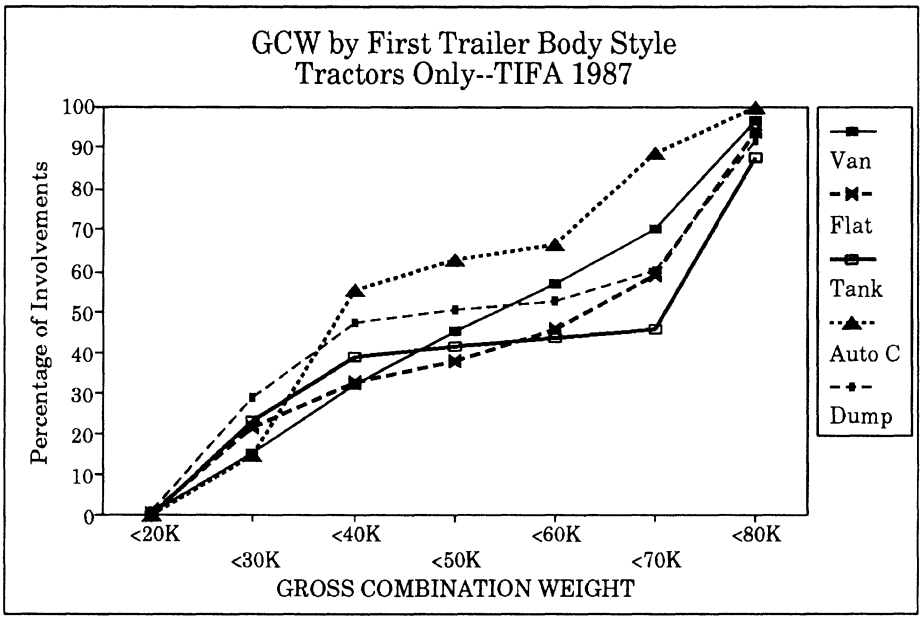


Figure 5-4

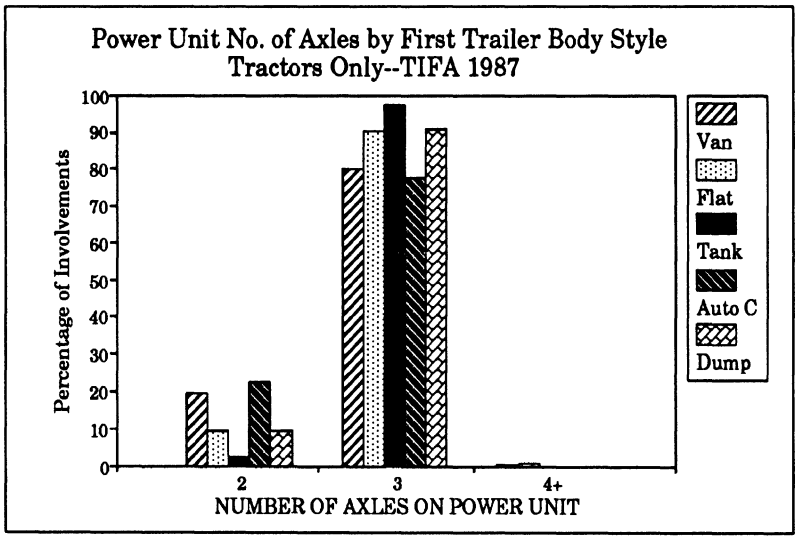


Figure 5-5

The graph at left depicts the number of axles on the tractor according to the first trailer body style. The vast majority of all five trailer body categories were hauled by 3-axle tractors. The highest percentages of 2-axle tractors were found among the auto carrier (23%) and van (20%) trailers.

TABLE 5-5
Number of Axles on Power Unit by First Trailer Body Style
Tractors Only
TIFA 1987

Power Unit No. of Axles (Frequencies and Col. Pcts.)	Van	Flatbed	Tank	Auto Carrier	Dump	Other	Unknown/ No Trailer	TOTAL
2	327 19.63	64 9.08	7 2.40	7 22.58	18 9.18	58 11.11	61 18.43	542 14.48
3	1,335 80.13	630 89.36	283 96.92	24 77.42	176 89.80	460 88.12	149 45.02	3,057 81.67
4+	1 0.06	5 0.71	0 0.00	0 0.00	0 0.00	4 0.77	1 0.30	11 0.29
Unknown	3 0.18	6 0.85	2 0.68	0 0.00	2 1.02	0 0.00	120 36.25	133 3.55
TOTAL	1,666 100.00	705 100.00	292 100.00	31 100.00	196 100.00	522 100.00	331 100.00	3,743 100.00

The table below indicates the unit and axle configurations of the 1987 TIFA tractors according to cab style. The tractors are split into bobtails, singles, doubles, and tractors hauling an unknown number of trailers. For the purposes of this table, "single" represents a tractor hauling one trailer, which is usually, but not always, a semitrailer. Similarly "double" indicates a tractor hauling two trailers, which are usually, but not always, a semi- and a full trailer. The table indicates the number of axles on the tractor and on each of the trailers (if any). Not surprisingly, by far the most common axle configuration among both the conventional and cabover cab styles was a 3-axle tractor hauling a 2-axle trailer. Among the doubles, the 2/1/2 axle configuration was the most prevalent. In addition to these typical configurations, the table indicates that both singles and doubles were characterized by a wide variety of axle configurations.

TABLE 5-6
Axle Configuration by Cab Style
Tractors Only
TIFA 1987

Tractor Config.	Axle Config.	Cab Style							
		Conventional		Cabover/ Cab-forward		Unknown		TOTAL	
		No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.
Bobtail	2	12	0.67%	14	0.79%	0	0.00%	26	0.69%
	3	52	2.89	50	2.82	1	0.59	103	2.75
	4+	0	0.00	1	0.06	0	0.00	1	0.03
	Unknown	0	0.00	0	0.00	1	0.59	1	0.03
Single	2/1	31	1.72%	28	1.58%	0	0.00%	59	1.58%
	2/2	157	8.73	107	6.03	5	2.94	269	7.19
	2/3	5	0.28	6	0.34	0	0.00	11	0.29
	3/1	8	0.44	10	0.56	0	0.00	18	0.48
	3/2	1,358	75.49	1,365	76.94	27	15.88	2,750	73.47
	3/3	52	2.89	24	1.35	0	0.00	76	2.03
	Other*	16	0.89	5	0.28	0	0.00	21	0.56
	Unknown	23	1.28	20	1.13	37	21.76	80	2.14
Double	2/1/2	44	2.45%	82	4.62%	6	3.53%	132	3.53%
	2/2/2	1	0.06	7	0.39	0	0.00	8	0.21
	3/1/2	10	0.56	11	0.62	1	0.59	22	0.59
	3/2/2	8	0.44	8	0.45	0	0.00	16	0.43
	Other**	13	0.72	20	1.13	1	0.59	34	0.91
	Unknown	7	0.39	16	0.90	1	0.59	24	0.64
Unknown No.	of Trailers	2	0.11%	0	0.00%	90	52.94%	92	2.46%
TOTAL		1,799	100.00%	1,774	100.00%	170	100.00%	3,743	100.00%

NOTE: Number of axles is given for each unit, e.g., 2/1/2 is a two-axle tractor hauling a one-axle trailer followed by a two-axle trailer.
* Includes 2,3/4+ and 4+/2,3,4+.
** Includes 2/1/1,3; 2/2/3,4+; 3/1/3; 3/2/3,4+; 3/3/2,4+; and 3/4+/3.

The table on the next page presents cargo type distributions by first trailer body style. Of all the cases of known cargo type, nearly 29% of the tractors, including the bobtails, were empty at the time of the accident.

TABLE 5-7
Cargo Type by First Trailer Body Style
Tractors Only
TIFA 1987

Cargo Type (Frequencies and Col. Pcts.)	No Trailer	Van	Flatbed	Tank	Auto Carrier	Dump	Other	Unknown	TOTAL
General freight	0 0.00	763 45.80	52 7.38	0 0.00	0 0.00	0 0.00	14 2.68	7 3.50	836 22.34
Household goods	0 0.00	37 2.22	2 0.28	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	39 1.04
Metal	0 0.00	24 1.44	137 19.43	0 0.00	0 0.00	0 0.00	8 1.53	1 0.50	170 4.54
Heavy machinery	0 0.00	11 0.66	104 14.75	0 0.00	2 6.45	0 0.00	7 1.34	0 0.00	124 3.31
Motor vehicles	0 0.00	2 0.12	5 0.71	0 0.00	12 38.71	0 0.00	1 0.19	0 0.00	20 0.53
Driveaway/tow	7 5.34	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	2 0.38	0 0.00	9 0.24
Gases in bulk	0 0.00	0 0.00	0 0.00	19 6.51	0 0.00	0 0.00	0 0.00	0 0.00	19 0.51
Solids in bulk	0 0.00	36 2.16	23 3.26	0 0.00	0 0.00	92 46.94	93 17.82	0 0.00	244 6.52
Liquids in bulk	0 0.00	0 0.00	0 0.00	156 53.42	0 0.00	0 0.00	0 0.00	0 0.00	156 4.17
Explosives	0 0.00	1 0.06	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	1 0.03
Logs/lumber	0 0.00	6 0.36	106 15.04	0 0.00	0 0.00	2 1.02	101 19.35	0 0.00	215 5.74
Empty	124 94.66	294 17.65	184 26.10	110 37.67	15 48.39	87 44.39	167 31.99	9 4.50	990 26.45
Refrig. food	0 0.00	261 15.67	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	261 6.97
Mobile home	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	9 1.72	0 0.00	9 0.24
Farm products	0 0.00	42 2.52	15 2.13	0 0.00	0 0.00	9 4.59	75 14.37	1 0.50	142 3.79
Other	0 0.00	136 8.16	51 7.23	1 0.34	0 0.00	1 0.51	33 6.32	1 0.50	223 5.96
Unknown	0 0.00	53 3.18	26 3.69	6 2.05	2 6.45	5 2.55	12 2.30	181 90.50	285 7.61
TOTAL	131 100.00	1,666 100.00	705 100.00	292 100.00	31 100.00	196 100.00	522 100.00	200 100.00	3,743 100.00

As was the case for the straight trucks, some of the tractor trailer body styles are rather limited in the possible types of cargo they haul. Most of the tankers were carrying liquids or gases in bulk at the time of the accident, the majority of the auto carriers were hauling motor vehicles or heavy machinery, and the dumps were usually carrying solids in bulk, or less frequently farm products or lumber. Vans and flatbeds, as illustrated in the pie graphs below, had a more varied range of cargo types.

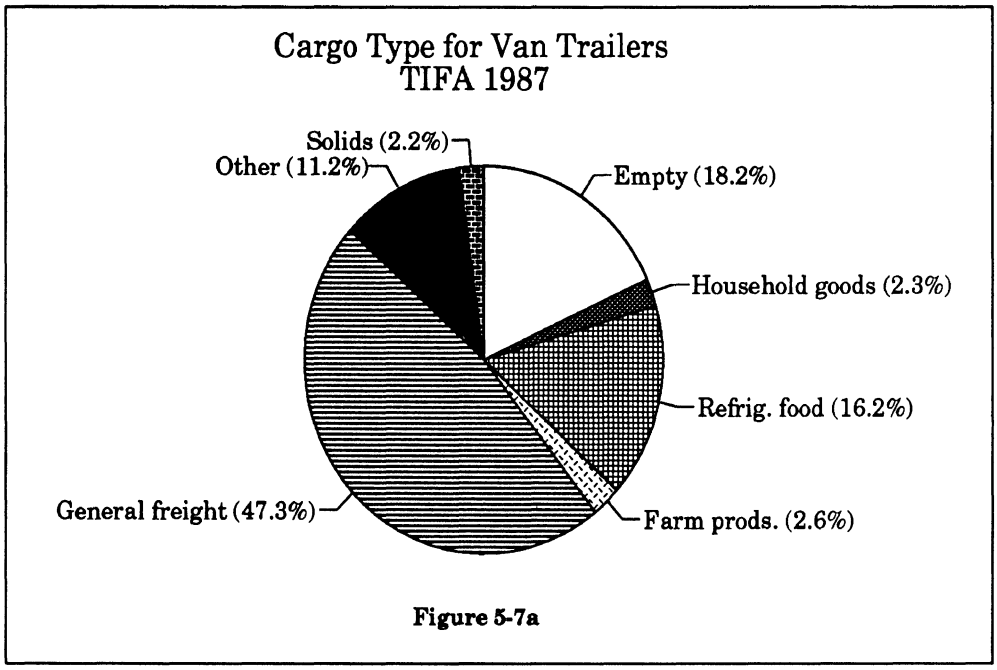


Figure 5-7a

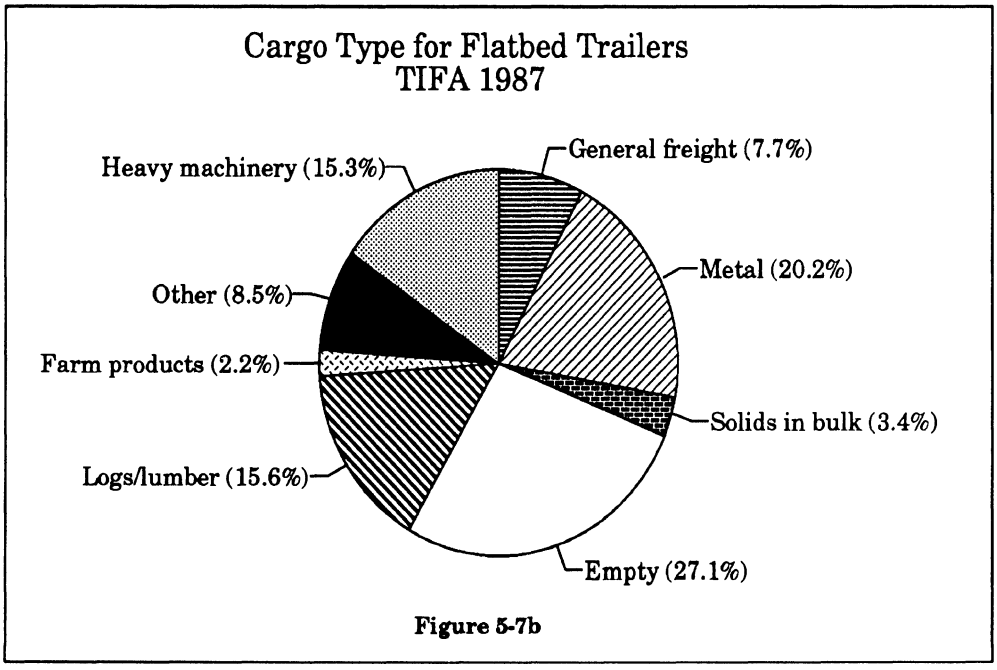


Figure 5-7b

The overwhelming majority of tractors involved in fatal accidents in 1987 used diesel fuel, as indicated in the table below. Gasoline tractors were slightly more common among those with conventional, rather than cabover or cab-forward, cab styles.

TABLE 5-8
Fuel Type by Cab Style
Tractors Only
TIFA 1987

Fuel Type	Conventional		Cabover/ Cab-forward		Unknown		TOTAL	
	No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.
Gasoline	32	1.78%	12	0.68%	0	0.00%	44	1.18%
Diesel	1,766	98.17	1,758	99.10	50	29.41	3,574	95.48
L. P. G.	1	0.06	1	0.06	0	0.00	2	0.05
Unknown	0	0.00	3	0.17	120	70.59	123	3.29
TOTAL	1,799	100.00%	1,774	100.00%	170	100.00%	3,743	100.00%

Use

Moving now to some of the variables that pertain to the use of the involved tractors, the graph at right shows the distributions of carrier type by first trailer body style. Intrastate private and for-hire have been combined in the graph but are listed separately in the table on the next page. One notable difference among the five trailer body styles is in the proportion of intrastate carriers. Of the known cases, 56% of the involved dumps were intrastate carriers, but this percentage was only 5-14% for each of the other four trailer body styles. Tanks had the highest proportion of interstate private carriers, with 32% of the known cases, while auto carriers had the highest proportion of interstate authorized carriers at 85%.

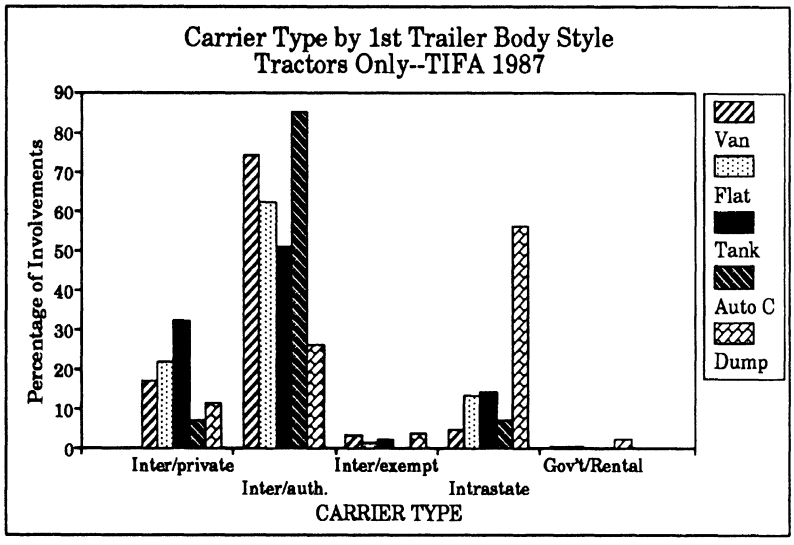


Figure 5-9

TABLE 5-9
Carrier Type by First Trailer Body Style
Tractors Only
TIFA 1987

Carrier Type (Frequencies and Col. Pcts.)	Van	Flatbed	Tank	Auto Carrier	Dump	Other	Unknown/ No Trailer	TOTAL
Interstate private	269 16.15	142 20.14	89 30.48	2 6.45	21 10.71	123 23.56	22 6.65	668 17.85
Interstate authorized	1,175 70.53	403 57.16	139 47.60	23 74.19	48 24.49	177 33.91	88 26.59	2,053 54.85
Interstate exempt	55 3.30	11 1.56	7 2.40	0 0.00	7 3.57	39 7.47	6 1.81	125 3.34
Intrastate private	55 3.30	60 8.51	29 9.93	2 6.45	38 19.39	79 15.13	22 6.65	285 7.61
Intrastate for hire	24 1.44	25 3.55	10 3.42	0 0.00	65 33.16	62 11.88	9 2.72	195 5.21
Government owned	4 0.24	2 0.28	0 0.00	0 0.00	4 2.04	2 0.38	1 0.30	13 0.35
Daily rental	4 0.24	2 0.28	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	6 0.16
Unknown	80 4.80	60 8.51	18 6.16	4 12.90	13 6.63	40 7.66	183 55.29	398 10.63
TOTAL	1,666 100.00	705 100.00	292 100.00	31 100.00	196 100.00	522 100.00	331 100.00	3,743 100.00

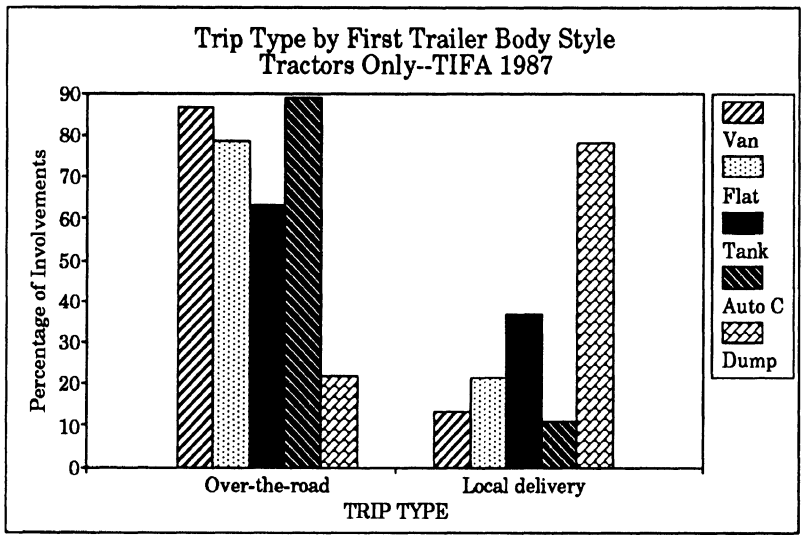


Figure 5-10

There is a close correspondence between the percentage of interstate authorized carriers from the last graph and the percentage of over-the-road trips in the graph to the left. The trailer types with the highest proportions of interstate authorized carriers had the highest proportion of trucks making over-the-road trips at the time of the accident. Of the known cases, nearly 89% of the auto carriers were conducting over-the-road

trips, followed by vans (86.4%), flatbeds (78.4%), tanks (63.2%), and dumps (22.1%). This same order of trailer body styles was observed when calculating the proportions of interstate authorized carriers. Note also that dumps, which had by far the highest percentage of intrastate carriers, also had by far the highest percentage of trucks making local deliveries at the time of the accident.

TABLE 5-10
Trip Type by First Trailer Body Style
Tractors Only
TIFA 1987

Trip Type (Frequencies and Col. Pcts.)	Van	Flatbed	Tank	Auto Carrier	Dump	Other	Unknown/ No Trailer	TOTAL
Over-the-road	1,407 84.45	524 74.33	177 60.62	24 77.42	40 20.41	276 52.87	125 37.76	2,573 68.74
Local delivery	221 13.27	144 20.43	103 35.27	3 9.68	141 71.94	212 40.61	53 16.01	877 23.43
Unknown	38 2.28	37 5.25	12 4.11	4 12.90	15 7.65	34 6.51	153 46.22	293 7.83
TOTAL	1,666 100.00	705 100.00	292 100.00	31 100.00	196 100.00	522 100.00	331 100.00	3,743 100.00

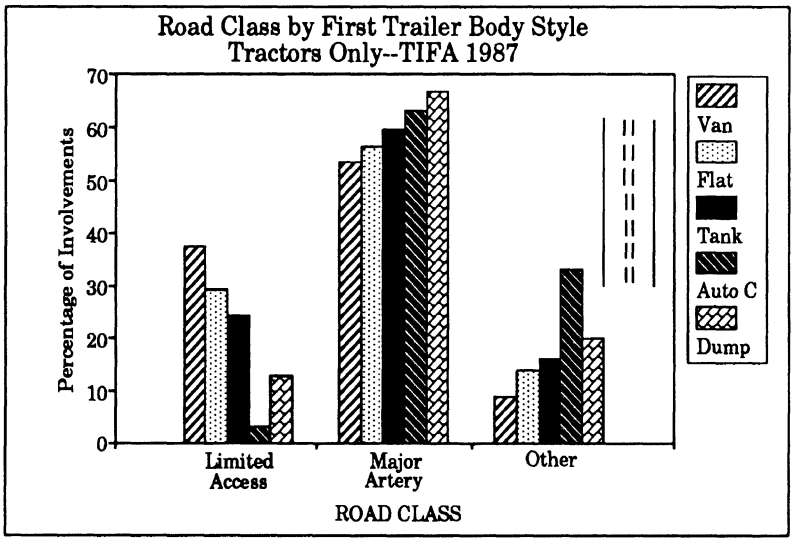


Figure 5-11

For all five trailer body styles, the majority of tractor involvements took place on major arteries. The main differences in the road class distributions among the different trailer body styles are in the proportions of involvements that took place on limited access versus "other" classes of roads. Over 37% of the van involvements occurred on limited access routes, followed by 29% for flatbeds, 24% for tanks, 13% for dumps and 3% for auto carriers. The reverse order held for "other" road class involvements, with auto carriers having the highest proportion, followed by dumps, tanks, flatbeds, and vans. In this as in other distributions, the percentages for auto carriers may be more affected by problems of sample size than the percentages for the other trailer types since only 31 fatal accidents involving auto carriers took place in 1987. In the case of road class, only one of these accidents occurred on a limited access road, resulting in a very low percentage of limited access involvements for auto carriers.

TABLE 5-11
Road Class by First Trailer Body Style
Tractors Only
TIFA 1987

Road Class (Frequencies and Col. Pcts.)	Van	Flatbed	Tank	Auto Carrier	Dump	Other	Unknown/ No Trailer	TOTAL
Limited Access	623 37.39	207 29.36	70 23.97	1 3.23	25 12.76	73 13.98	85 25.68	1,084 28.96
Major Artery	891 53.48	399 56.60	173 59.25	19 61.29	130 66.33	389 74.52	153 46.22	2,154 57.55
Other	146 8.76	98 13.90	46 15.75	10 32.26	39 19.90	60 11.49	93 28.10	492 13.14
Unknown	6 0.36	1 0.14	3 1.03	1 3.23	2 1.02	0 0.00	0 0.00	13 0.35
TOTAL	1,666 100.00	705 100.00	292 100.00	31 100.00	196 100.00	522 100.00	331 100.00	3,743 100.00

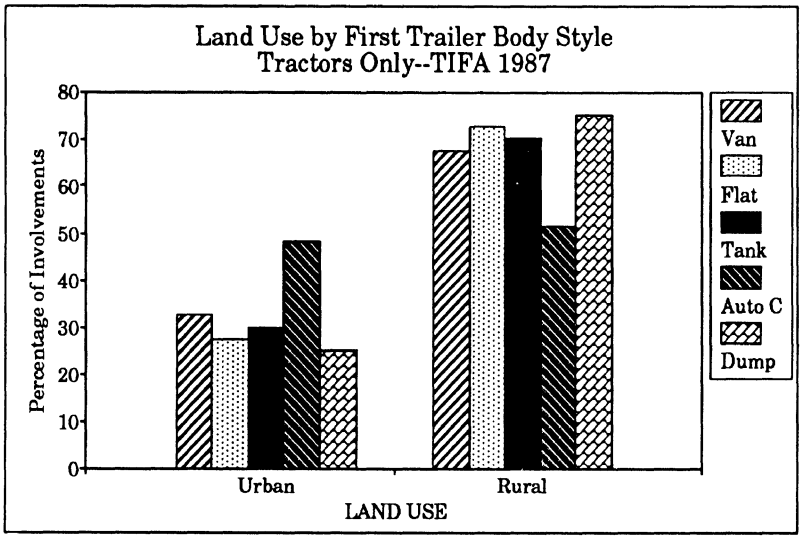


Figure 5-12

Except for the case of the auto carriers, the land use distributions are very stable from one trailer body style to another. For vans, flatbeds, tanks, and dumps, the proportion of involvements in urban areas ranged from 25% to 33%, while the proportion in rural areas varied from 67% to 75%. Auto carrier involvements, on the other hand, were about evenly split between urban and rural areas.

TABLE 5-12
Land Use by First Trailer Body Style
Tractors Only
TIFA 1987

Land Use (Frequencies and Col. Pcts.)	Van	Flatbed	Tank	Auto Carrier	Dump	Other	Unknown/ No Trailer	TOTAL
Urban	547 32.83	193 27.38	87 29.79	15 48.39	49 25.00	96 18.39	142 42.90	1,129 30.16
Rural	1,119 67.17	510 72.34	205 70.21	16 51.61	147 75.00	426 81.61	189 57.10	2,612 69.78
Unknown	0 0.00	2 0.28	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	2 0.05
TOTAL	1,666 100.00	705 100.00	292 100.00	31 100.00	196 100.00	522 100.00	331 100.00	3,743 100.00

The light condition at the time of the accident is indicated for the five different trailer body styles in the graph below. Dumps and auto carriers had the highest proportions of daylight involvements and the lowest proportions of involvements taking place in the dark. On the other hand, slightly over half of the van involvements occurred at night, as did 45% of the flatbed and 42% of the tank involvements. The typical travel schedules of the different trailer types probably account in large part for the differences in light condition at the time of the accident.

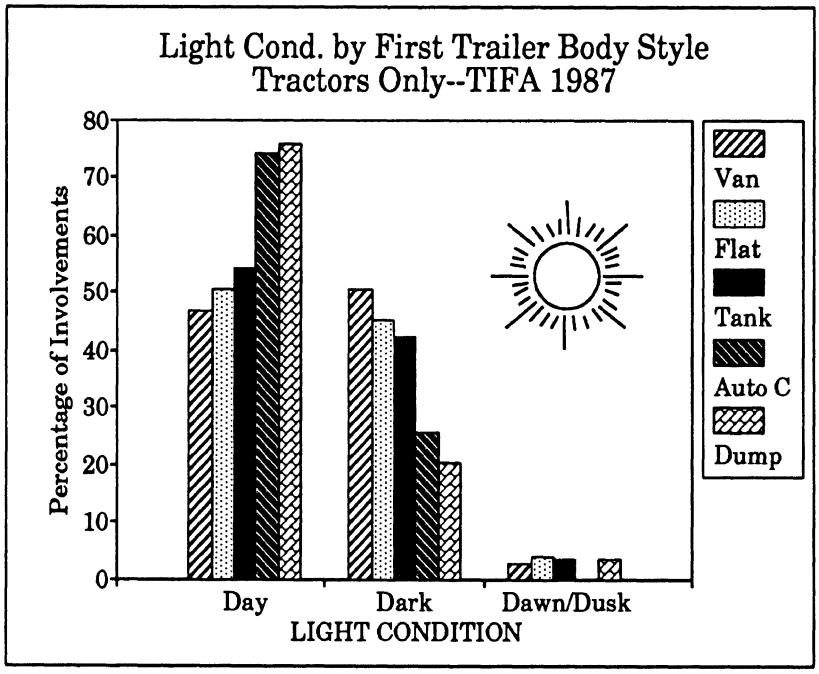


Figure 5-13

TABLE 5-13
Light Condition by First Trailer Body Style
Tractors Only
TIFA 1987

Light Condition (Frequencies and Col. Pcts.)	Van	Flatbed	Tank	Auto Carrier	Dump	Other	Unknown/ No Trailer	TOTAL
Daylight	778 46.70	355 50.35	158 54.11	23 74.19	149 76.02	316 60.54	205 61.93	1,984 53.01
Dark, not lighted	656 39.38	261 37.02	94 32.19	7 22.58	35 17.86	150 28.74	66 19.94	1,269 33.90
Dark, but lighted	189 11.34	57 8.09	30 10.27	1 3.23	5 2.55	31 5.94	47 14.20	360 9.62
Dawn	24 1.44	20 2.84	9 3.08	0 0.00	7 3.57	16 3.07	3 0.91	79 2.11
Dusk	19 1.14	8 1.13	1 0.34	0 0.00	0 0.00	9 1.72	10 3.02	47 1.26
Unknown	0 0.00	4 0.57	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	4 0.11
TOTAL	1,666 100.00	705 100.00	292 100.00	31 100.00	196 100.00	522 100.00	331 100.00	3,743 100.00

Accidents

This subsection will discuss variables pertaining to the accidents in which the tractors were involved. The graph at right illustrates the distributions for the first harmful event in the accident according to first trailer body style. The distributions are relatively stable from one type of trailer to the next. The great majority of all the fatal accidents involved a collision with another motor vehicle in transport. This event ranged from 74% of the tank and auto carrier involvements up to 84% of the dump involvements. Auto carriers and vans experienced relatively more pedestrian and pedalcyclist involvements than the

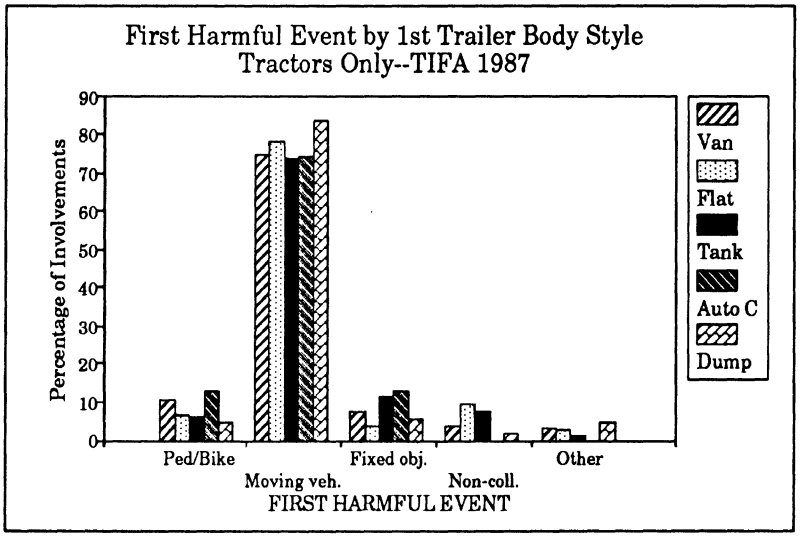


Figure 5-14

other trailer body styles, while auto carriers and tanks had relatively higher numbers of collisions with fixed objects.

TABLE 5-14
First Harmful Event by First Trailer Body Style
Tractors Only
TIFA 1987

First Harmful Event (Frequencies and Col. Pcts.)	Van	Flatbed	Tank	Auto Carrier	Dump	Other	Unknown/ No Trailer	TOTAL
Pedestrian	151 9.06	37 5.25	13 4.45	4 12.90	3 1.53	19 3.64	40 12.08	267 7.13
Pedalcyclist	26 1.56	8 1.13	5 1.71	0 0.00	6 3.06	5 0.96	7 2.11	57 1.52
Train	4 0.24	4 0.57	1 0.34	0 0.00	6 3.06	0 0.00	3 0.91	18 0.48
Animal	5 0.30	3 0.43	0 0.00	0 0.00	0 0.00	4 0.77	3 0.91	15 0.40
Moving vehicle	1,247 74.85	549 77.87	216 73.97	23 74.19	164 83.67	419 80.27	235 71.00	2,853 76.22
Parked vehicle	30 1.80	6 0.85	1 0.34	0 0.00	1 0.51	2 0.38	6 1.81	46 1.23
Other non-fixed object	15 0.90	6 0.85	1 0.34	0 0.00	2 1.02	2 0.38	0 0.00	26 0.69
Fixed object	129 7.74	27 3.83	33 11.30	4 12.90	11 5.61	24 4.60	17 5.14	245 6.55
Non-collision	59 3.54	65 9.22	22 7.53	0 0.00	3 1.53	47 9.00	20 6.04	216 5.77
TOTAL	1,666 100.00	705 100.00	292 100.00	31 100.00	196 100.00	522 100.00	331 100.00	3,743 100.00

On the following page are a graph and table illustrating the manner of collision for the 2,853 tractors involved in fatal accidents with another motor vehicle. There is some variation among the different first trailer body styles. For example, flatbeds experienced the highest proportion of rear-end collisions, vans and tanks the highest percentages of head-ons, and auto carriers the highest percentage of angle collisions. Overall, angle collisions were the most common collision type, representing nearly 39% of all tractor involvements, followed by head-ons (29.5%) and rear-ends (24.4%).

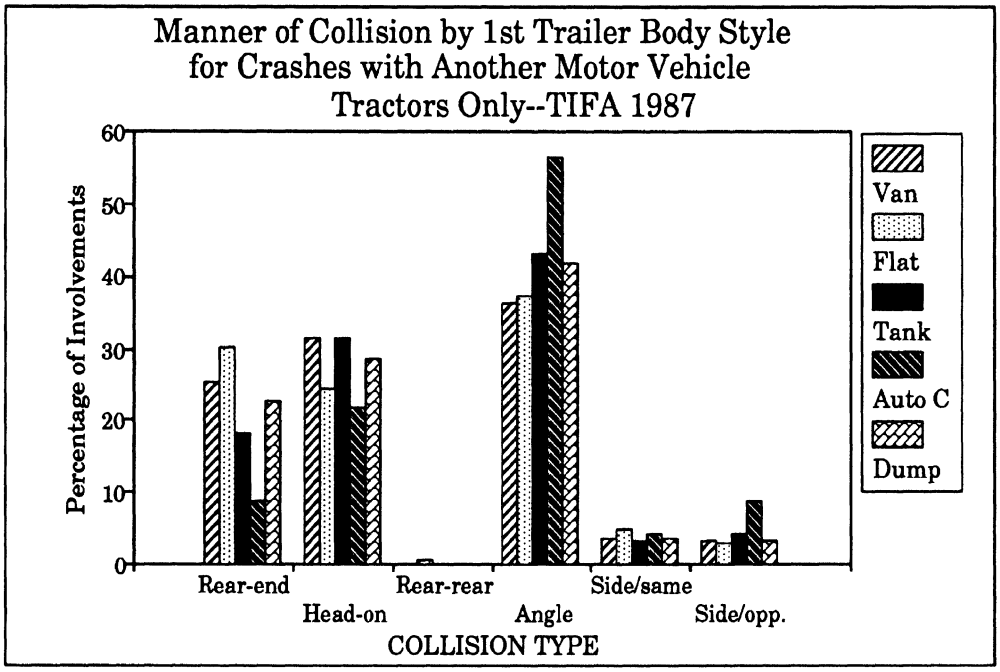


Figure 5-15

TABLE 5-15
Manner of Collision by First Trailer Body Style
for Crashes with Another Motor Vehicle
Tractors Only
TIFA 1987

Manner of Collision (Frequencies and Col. Pcts.)	Van	Flatbed	Tank	Auto Carrier	Dump	Other	Unknown/ No Trailer	TOTAL
Rear-end	314 25.18	166 30.24	39 18.06	2 8.70	37 22.56	80 19.09	58 24.68	696 24.40
Head-on	392 31.44	134 24.41	68 31.48	5 21.74	47 28.66	127 30.31	69 29.36	842 29.51
Rear-to-rear	1 0.08	3 0.55	0 0.00	0 0.00	0 0.00	3 0.72	0 0.00	7 0.25
Angle	452 36.25	204 37.16	93 43.06	13 56.52	69 42.07	183 43.68	92 39.15	1,106 38.77
Sideswipe, same dir.	44 3.53	26 4.74	7 3.24	1 4.35	6 3.66	14 3.34	8 3.40	106 3.72
Sideswipe, opp. dir.	41 3.29	16 2.91	9 4.17	2 8.70	5 3.05	12 2.86	8 3.40	93 3.26
Unknown	3 0.24	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	3 0.11
TOTAL	1,247 100.00	549 100.00	216 100.00	23 100.00	164 100.00	419 100.00	235 100.00	2,853 100.00

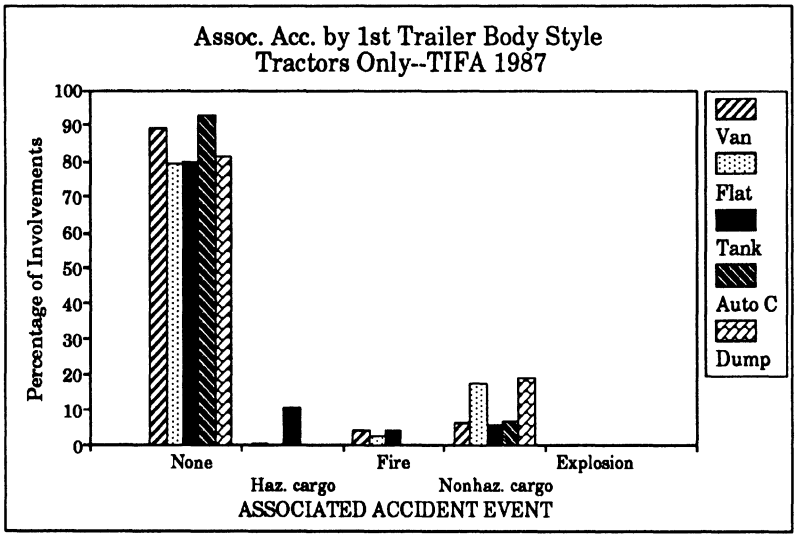


Figure 5-16

The graph at left shows the distributions for the associated accident event variable. This variable records whether or not an explosion, fire, or spillage of hazardous or non-hazardous cargo occurred as a subsequent event in the accident for the case truck (see comments on page 66 regarding the coding of this variable). Overall there was no such associated accident event in 85% of the tractor involvements, for the known cases. The most common associated event that did take place was the spillage of non-hazardous cargo. This occurred in 11% of the known cases and was particularly common among the dumps and flatbeds. Fires occurred in 3% of the known cases, primarily among tanks, vans, and flatbeds. Spillage of hazardous cargo took place in 1% of the known cases, mainly involving tanks. Out of the 3,743 tractor involvements in 1987, only 7 were recorded as involving an explosion, 3 of which involved vans and 2 flatbeds.

TABLE 5-16
Associated Accident Event by First Trailer Body Style
Tractors Only
TIFA 1987

Associated Event (Frequencies and Col. Pcts.)	Van	Flatbed	Tank	Auto Carrier	Dump	Other	Unknown/ No Trailer	TOTAL
None	1,438 86.31	531 75.32	224 76.71	27 87.10	154 78.57	401 76.82	133 40.18	2,908 77.69
Spillage of hazardous cargo	7 0.42	0 0.00	30 10.27	0 0.00	0 0.00	0 0.00	0 0.00	37 0.99
Fire	67 4.02	19 2.70	12 4.11	0 0.00	0 0.00	5 0.96	3 0.91	106 2.83
Spillage of nonhaz. cargo	98 5.88	119 16.88	16 5.48	2 6.45	36 18.37	94 18.01	6 1.81	371 9.91
Explosion	3 0.18	2 0.28	0 0.00	0 0.00	0 0.00	1 0.19	1 0.30	7 0.19
Unknown	53 3.18	34 4.82	10 3.42	2 6.45	6 3.06	21 4.02	188 56.80	314 8.39
TOTAL	1,666 100.00	705 100.00	292 100.00	31 100.00	196 100.00	522 100.00	331 100.00	3,743 100.00

TABLE 5-17
Gross Combination Weight by Rollover Occurrence
Tractors Only
TIFA 1987

Gross Weight	Rollover Occurrence							
	None		First Event		Subsequent Event		TOTAL	
	No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.
< 20,000	108	84.38%	14	10.94%	6	4.69%	128	100.00%
20,000	561	95.90	8	1.37	16	2.74	585	100.00
30,000	464	94.50	2	0.41	25	5.09	491	100.00
40,000	254	92.36	6	2.18	15	5.45	275	100.00
50,000	212	86.18	10	4.07	24	9.76	246	100.00
60,000	295	82.63	20	5.60	42	11.76	357	100.00
70,000	750	77.56	80	8.27	137	14.17	967	100.00
80,000+	149	77.60	16	8.33	27	14.06	192	100.00
Unknown	449	89.44	23	4.58	30	5.98	502	100.00
TOTAL	3,242	86.62%	179	4.78%	322	8.60%	3,743	100.00%

NOTE: The figures in the left column indicate the low end of each gross weight range.

The next two distributions concern the gross combination weight of the tractors. The table above and the figure below present distributions of rollover occurrence according to GCW categories. The under 20,000 pound GCW category experienced the highest proportion of first-event rollovers, with 11%, compared to the overall average of 5%. Many of these trucks were bobtails. The two heaviest GCW categories (70,000-79,999 and 80,000+ pounds) had the next highest proportions of first-event rollovers, with 8.3% each. In general, the subsequent-event rollovers were more common among the heavier GCW categories. Only 2.7% of the 20,000-29,999 pound class experienced subsequent-event rollovers, compared to 14% for both of the two heaviest GCW categories.

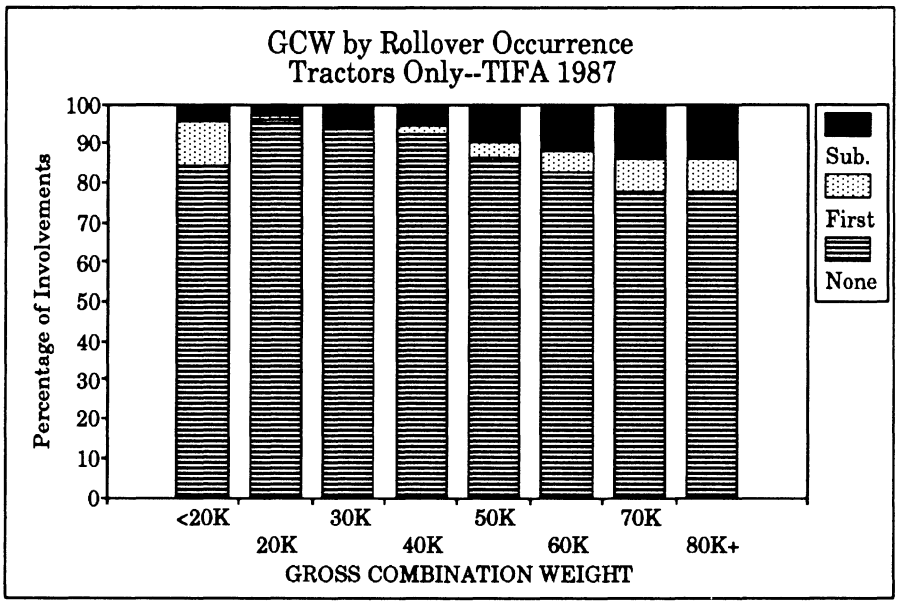


Figure 5-17

TABLE 5-18
Gross Combination Weight by Jackknife Occurrence
Tractors Only
TIFA 1987

Gross Weight	Jackknife Occurrence									
	None		First Event		Subsequent Event		Not articulated/ Unknown		TOTAL	
	No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.
< 20,000	46	35.94%	4	3.13%	0	0.00%	78	60.94%	128	100.00%
20,000	458	78.29	35	5.98	47	8.03	45	7.69	585	100.00
30,000	401	81.67	20	4.07	33	6.72	37	7.54	491	100.00
40,000	227	82.55	9	3.27	20	7.27	19	6.91	275	100.00
50,000	207	84.15	4	1.63	15	6.10	20	8.13	246	100.00
60,000	296	82.91	6	1.68	30	8.40	25	7.00	357	100.00
70,000	852	88.11	17	1.76	29	3.00	69	7.14	967	100.00
80,000+	167	86.98	0	0.00	10	5.21	15	7.81	192	100.00
Unknown	374	74.50	11	2.19	22	4.38	95	18.92	502	100.00
TOTAL	3,028	80.90%	106	2.83%	206	5.50%	403	10.77%	3,743	100.00%

NOTE: The figures in the left column indicate the low end of each gross weight range.

On this page are the distributions of jackknife occurrence according to gross combination weight. In general, jackknifes were more common as a subsequent event in the accident (5.5% of all tractor involvements) rather than the primary event (2.8%). Considering the tractor combinations with a GCW of at least 20,000 pounds, the lighter weight categories had a higher incidence of jackknifes than the heavier combinations. This is particularly true for first-event jackknifes. Nearly 6% of the tractors in the 20,000-29,999 pound group and 4% in the 30,000-39,999 group jackknifed as the first event in the accident. This compares with 1.8% in the 70,000-79,999 pound group and none of the 192 tractors in the 80,000+ pound category. These figures are consistent with the common belief that empty or lightly-loaded trailers are more likely to jackknife than heavier combinations.

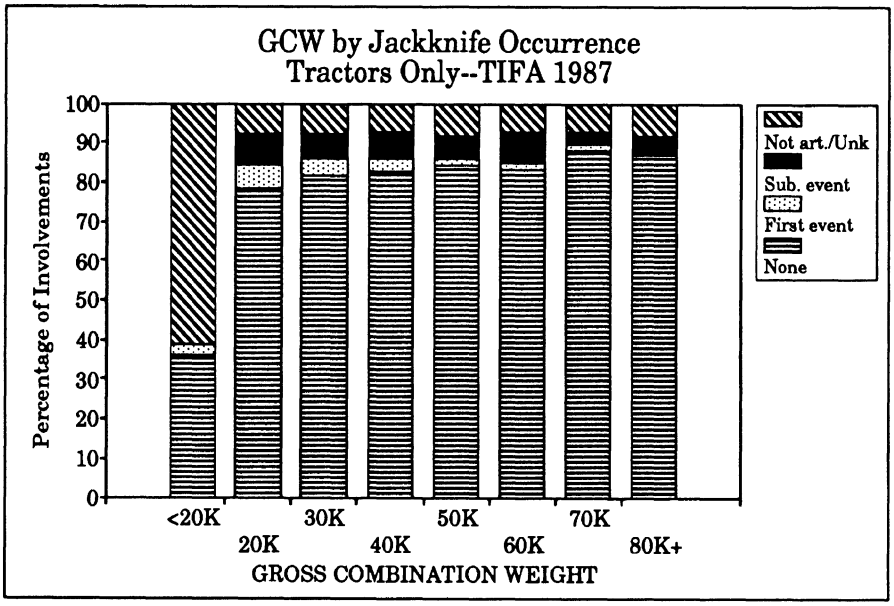


Figure 5-18

Driver Injury

This section on tractor involvements concludes with several distributions concerning the injury experience of the truck drivers. The graph at right shows injury severity distributions according to first trailer body style. Auto carriers had the highest proportion of uninjured drivers, with 69% of the known cases compared to the overall average of 60%. Tank drivers experienced the lowest proportion of uninjured cases at 51% and the highest percentage of fatals, with 19% of the cases compared to the overall average of 14%. In general, however, the injury severity distributions are similar among the different trailer body styles.

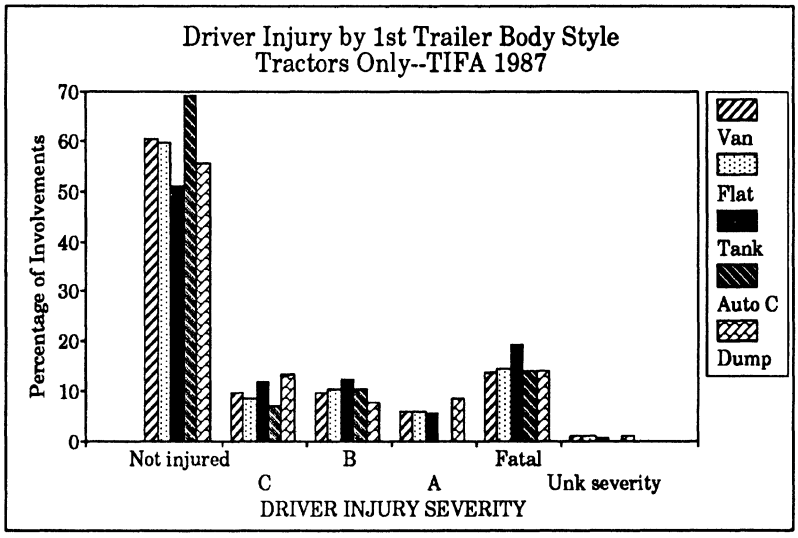


Figure 5-19

TABLE 5-19
Truck Driver Injury Severity by First Trailer Body Style
Tractors Only
TIFA 1987

Injury Severity (Frequencies and Col. Pcts.)	Van	Flatbed	Tank	Auto Carrier	Dump	Other	Unk/ No Trail	TOTAL
Not injured	993 59.60	418 59.29	147 50.34	20 64.52	108 55.10	314 60.15	203 61.33	2,203 58.86
C injury, possible	159 9.54	60 8.51	34 11.64	2 6.45	26 13.27	49 9.39	37 11.18	367 9.80
B injury, not incapacitating	156 9.36	71 10.07	35 11.99	3 9.68	15 7.65	47 9.00	28 8.46	355 9.48
A injury, incapacitating	96 5.76	42 5.96	15 5.14	0 0.00	16 8.16	31 5.94	14 4.23	214 5.72
Fatal injury	225 13.51	101 14.33	55 18.84	4 12.90	27 13.78	68 13.03	45 13.60	525 14.03
Injured, severity unknown	16 0.96	7 0.99	2 0.68	0 0.00	2 1.02	5 0.96	0 0.00	32 0.85
Unknown if injured	21 1.26	6 0.85	4 1.37	2 6.45	2 1.02	8 1.53	4 1.21	47 1.26
TOTAL	1,666 100.00	705 100.00	292 100.00	31 100.00	196 100.00	522 100.00	331 100.00	3,743 100.00

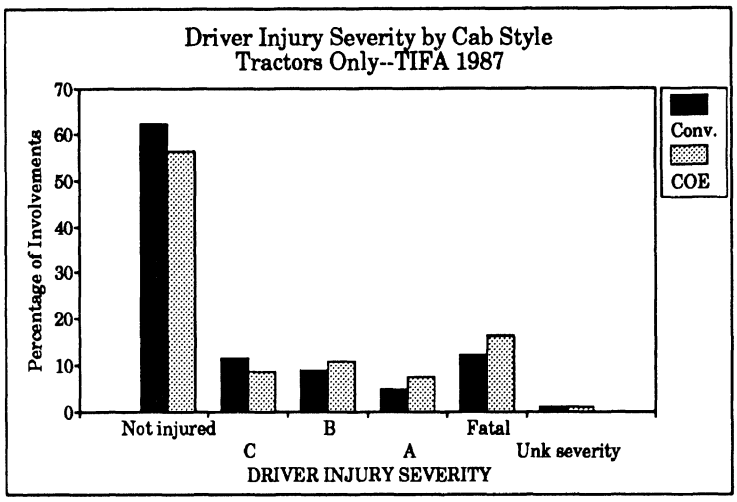


Figure 5-20

Here the truck driver injury severity distributions are compared according to the cab style of the tractor. While the differences between the two distributions are not great, it appears that the drivers of cabovers experienced more severe injuries than the drivers of conventional cabs. The conventional cab drivers had higher proportions of no injuries and "C" (possible) injuries, while the cabover drivers had higher percentages of "A" (incapacitating), "B" (non-incapacitating), and fatal injuries.

TABLE 5-20
Truck Driver Injury Severity by Cab Style
Tractors Only
TIFA 1987

Injury Severity	Conventional		Cabover/ Cab-forward		Unknown		TOTAL	
	No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.
Not injured	1,109	61.65%	985	55.52%	109	64.12%	2,203	58.86%
C injury	200	11.12	148	8.34	19	11.18	367	9.80
B injury	160	8.89	188	10.60	7	4.12	355	9.48
A injury	84	4.67	123	6.93	7	4.12	214	5.72
Fatal injury	213	11.84	287	16.18	25	14.71	525	14.03
Injured, severity unknown	14	0.78	18	1.01	0	0.00	32	0.85
Unknown if injured	19	1.06	25	1.41	3	1.76	47	1.26
TOTAL	1,799	100.00%	1,774	100.00%	170	100.00%	3,743	100.00%

The two tables on the following page list the driver injury severity distributions according to the principal point of impact on the truck. In about half of the involvements, the principal point of impact was the front of the truck. For involvements that resulted in non-fatal injuries to the driver, the front of the truck was the principal point of impact in 65% of the cases. Non-collisions accounted for 4.7% of all involvements but 24.6% of the involvements that were fatal to the truck driver.

TABLE 5-21A
Driver Injury Severity by Principal Impact Point for Tractors—Frequencies
TIFA 1987

Principal Impact Point	Driver Injury Severity							
	Not Injured	C	B	A	Fatal	Injured, severity unk	Unknown if injured	TOTAL
Noncollision	16	3	5	19	129	0	2	174
Right side	308	37	33	29	70	1	0	478
Rear	357	45	16	8	7	6	25	464
Left side	318	28	16	14	15	0	11	402
Front	958	233	244	131	259	25	6	1,856
Top	8	6	13	5	31	0	0	63
Undercarriage	185	6	15	3	1	0	3	213
Override	19	5	7	4	0	0	0	35
Unknown	34	4	6	1	13	0	0	58
TOTAL	2,203	367	355	214	525	32	47	3,743

TABLE 5-21B
Driver Injury Severity by Principal Impact Point for Tractors—Column Percentages
TIFA 1987

Principal Impact Point	Driver Injury Severity							
	Not Injured	C	B	A	Fatal	Injured, sev unk	Unk if injured	TOTAL
Noncollision	0.73%	0.82%	1.41%	8.88%	24.57%	0.00%	4.26%	4.65%
Right side	13.98	10.08	9.30	13.55	13.33	3.13	0.00	12.77
Rear	16.21	12.26	4.51	3.74	1.33	18.75	53.19	12.40
Left side	14.43	7.63	4.51	6.54	2.86	0.00	23.40	10.74
Front	43.49	63.49	68.73	61.21	49.33	78.13	12.77	49.59
Top	0.36	1.63	3.66	2.34	5.90	0.00	0.00	1.68
Undercar.	8.40	1.63	4.23	1.40	0.19	0.00	6.38	5.69
Override	0.86	1.36	1.97	1.87	0.00	0.00	0.00	0.94
Unknown	1.54	1.09	1.69	0.47	2.48	0.00	0.00	1.55
TOTAL	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

The stacked bar graph on the next page shows the truck driver injury severity distributions for each of six principal impact area categories. Not surprisingly, collisions where the rear of the truck was struck were the safest for the truck driver. The driver was uninjured in 82% of the known cases in this category and fatally injured in only 1.6%. Left side impacts were nearly as safe as rear impacts for the truck driver. On the other hand, 75% of the non-collisions resulted in the death of the driver, and the driver was uninjured in only 9.3% of these cases.

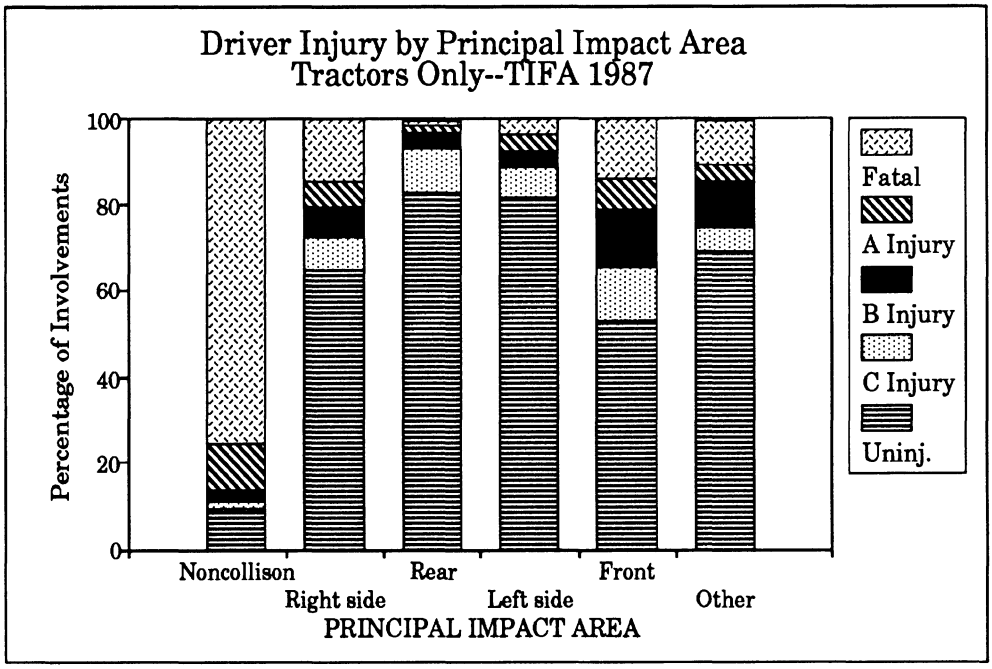


Figure 5-21

Finally, driver injury severity is compared across the levels of the variable that indicates whether or not the truck experienced a rollover or fire or whether the driver was ejected. As Tables 5-22A and 5-22B indicate, about 80% of the involvements did not include any of these events. Rollovers alone occurred in 9.5% of the involvements but accounted for 19.4% of the cases of drivers with "B" injuries, 25.2% of those with "A" injuries, and 32.4% of those with fatal injuries. Ejections alone took place in 2.5% of the involvements but represented 12.8% of the cases where the driver was killed. About 2.6% of the involvements included both a rollover and the ejection of the driver, but 17.1% of the cases where the driver was killed fell into this category.

TABLE 5-22A
Driver Injury Severity by Rollover/Fire/Ejection for Tractors—Frequencies
TIFA 1987

Occurrence of Rollover/Fire/Ejection	Driver Injury Severity							
	Not Injured	C	B	A	Fatal	Injured, severity unk	Unknown if injured	TOTAL
None	2,119	327	256	121	121	26	6	2,976
Rollover only	41	22	69	54	170	1	0	357
Fire only	32	11	16	16	39	3	2	119
Ejection only	5	2	5	11	67	2	0	92
Rollover/Fire	6	5	5	7	16	0	0	39
Fire/Ejection	0	0	1	0	14	0	0	15
Rollover/Ejection	0	0	2	5	90	0	0	97
Rollover/Fire/Ejection	0	0	1	0	7	0	0	8
Unknown	0	0	0	0	1	0	39	40
TOTAL	2,203	367	355	214	525	32	47	3,743

TABLE 5-22B
Driver Injury Severity by Rollover/Fire/Ejection
for Tractors—Column Percentages
TIFA 1987

Occurrence of Rollover/Fire/ Ejection	Driver Injury Severity							
	Not Injured	C	B	A	Fatal	Injured, sev unk	Unk if injured	TOTAL
None	96.19%	89.10%	72.11%	56.54%	23.05%	81.25%	12.77%	79.51%
Rollover only	1.86	5.99	19.44	25.23	32.38	3.13	0.00	9.54
Fire only	1.45	3.00	4.51	7.48	7.43	9.38	4.26	3.18
Ejection only	0.23	0.54	1.41	5.14	12.76	6.25	0.00	2.46
Rollover/Fire	0.27	1.36	1.41	3.27	3.05	0.00	0.00	1.04
Fire/Ejection	0.00	0.00	0.28	0.00	2.67	0.00	0.00	0.40
Roll/Eject	0.00	0.00	0.56	2.34	17.14	0.00	0.00	2.59
Roll/Fire/Eject	0.00	0.00	0.28	0.00	1.33	0.00	0.00	0.21
Unknown	0.00	0.00	0.00	0.00	0.19	0.00	82.98	1.07
TOTAL	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

The figure below illustrates the driver injury severity distributions for each category of the rollover/fire/ejection variable. The driver was uninjured in 72% of the cases where none of these events took place. This compares to 28% of the cases where a fire alone occurred, 11.5% of the cases where a rollover alone took place, and 5.6% of the cases where there was only an ejection. Combinations of these events generally proved more severe to the driver, not surprisingly. About 93% of the cases where there was a fire and an ejection or a rollover and an ejection resulted in the death of the driver.

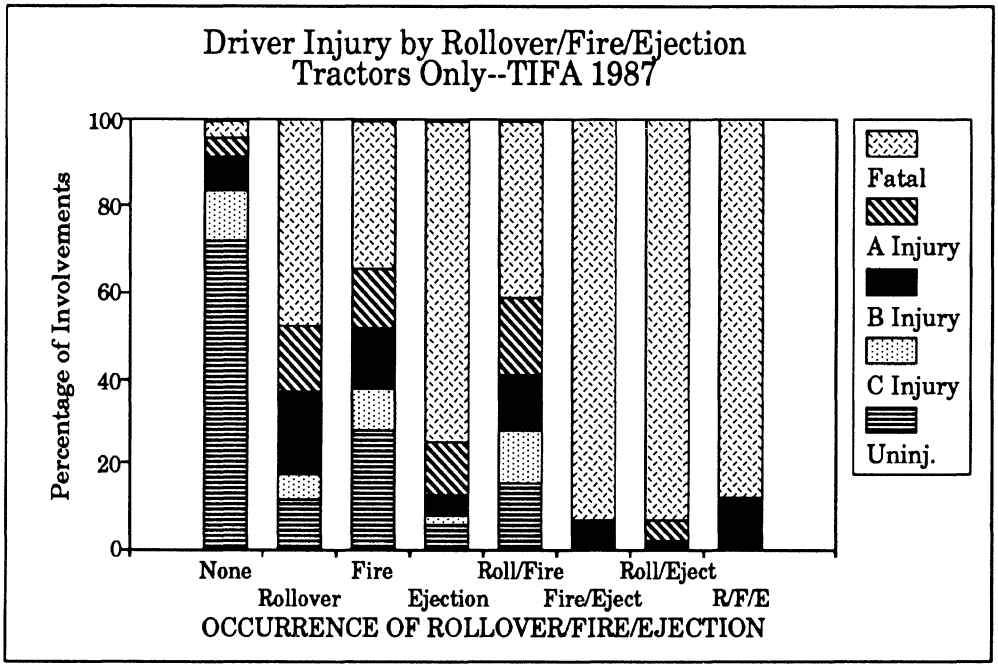
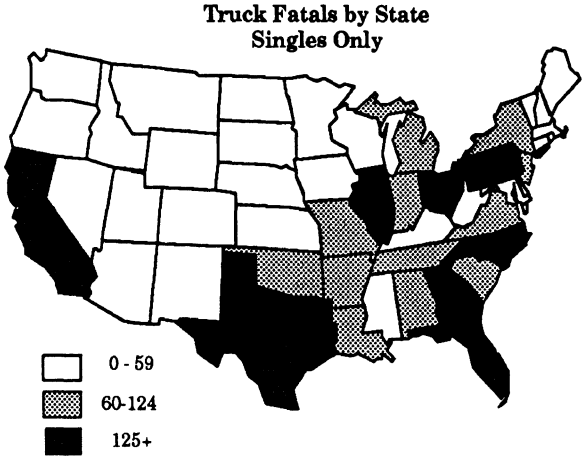


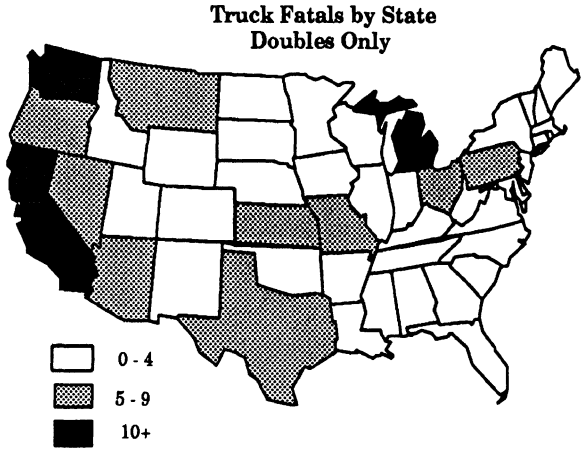
Figure 5-22

1987 FATAL ACCIDENT EXPERIENCE OF SINGLES AND DOUBLES

In this final section of the 1987 TIFA Factbook, a series of comparisons is made between singles and doubles. Throughout this section a single refers to a tractor hauling a semitrailer, and a double indicates a tractor hauling a semitrailer and a full trailer. In 1987 there were 3,266 fatal accidents involving singles and 232 involving doubles. The maps illustrating the distributions of singles and doubles involvements across the country are repeated again below.

Previously in the Factbook, singles and doubles have been considered only as part of all tractor combinations in general. Because these two configurations account for a large share of the mileage accumulated by the trucking industry and because of the sheer size of these vehicles, there is a great deal of interest in their accident experience. The purpose of this section then is to describe in more detail the singles and doubles that were involved in fatal accidents in 1987 and examine the similarities and differences between them. The distributions presented in this section concern variables relating to the physical characteristics and usage of the trucks. All of these variables have been discussed earlier in comparisons based on the power unit type of the involved vehicles.





The first comparison between singles and doubles concerns the cab style of the involved trucks. The singles were nearly evenly split between conventional and cabover engine cab styles, with the former slightly more common. In contrast, the majority of the doubles were cabovers (61% of all cases).

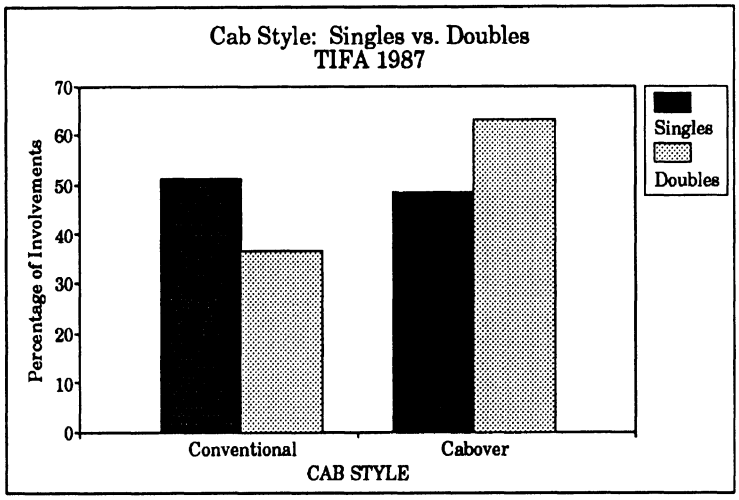


Figure 6-1

TABLE 6-1
Cab Style: Singles vs. Doubles
TIFA 1987

Cab Style	Singles		Doubles		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
Conventional	1,643	50.31%	82	35.34%	1,725	49.31%
Cabover/Cab-forward	1,554	47.58	141	60.78	1,695	48.46
Unknown	69	2.11	9	3.88	78	2.23
TOTAL	3,266	100.00%	232	100.00%	3,498	100.00%

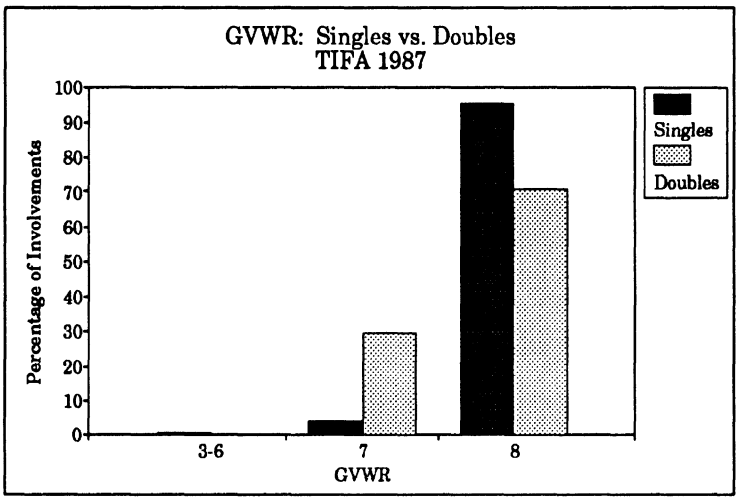


Figure 6-2

The graph at left shows the distributions for the gross vehicle weight ratings of the involved singles and doubles. Again there is a difference in the distributions. Over 95% of the singles with a known GVWR were class 8 (over 33,000 lbs.). Only 71% of the known cases of doubles were class 8, with the remaining 29% class 7 (26,001-33,000 lbs.).

TABLE 6-2
GVWR: Singles vs. Doubles
TIFA 1987

GVWR Class	Singles		Doubles		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
3	4	0.12%	0	0.00%	4	0.11%
4	1	0.03	0	0.00	1	0.03
5	0	0.00	0	0.00	0	0.00
6	17	0.52	0	0.00	17	0.49
7	134	4.10	59	25.43	193	5.52
8	3,041	93.11	143	61.64	3,184	91.02
Unknown	69	2.11	30	12.93	99	2.83
TOTAL	3,266	100.00%	232	100.00%	3,498	100.00%

Next are the distributions for gross combination weight—the total combined weight of the tractor, trailer(s), and cargo at the time of the accident. The graph at right indicates that the GCWs of the involved doubles were more evenly spread out over the spectrum than the GCWs of the singles. The GCW distribution for singles is bimodal, presumably representing empty and loaded vehicles. Nearly 19% of the known cases are included in the peak in the 20,000-29,999 pound weight range, while another 32% of the cases fall into a peak representing the 70,000-79,999 pound category. In contrast, only 6.6% of the involved doubles had a GCW of 20,000-29,999 pounds. There is a general rise in the percentage of doubles represented under each 10,000 pound increment of GCW. Most of the known cases (53%) fall into the three heaviest GCW categories, indicating weights of 60,000 pounds and above.

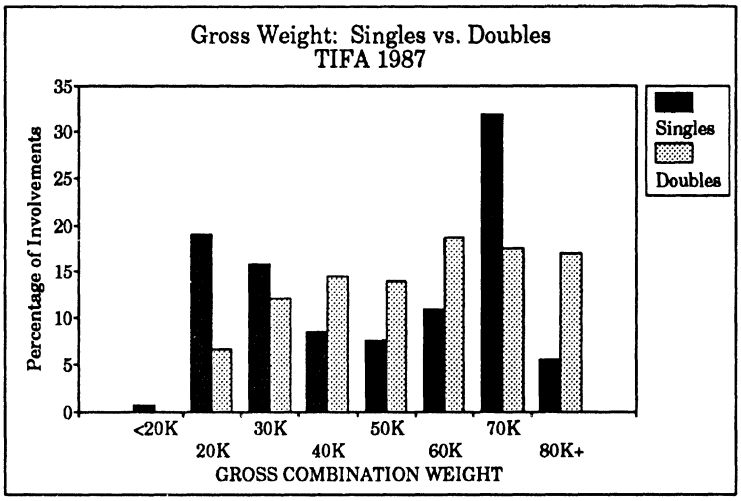


Figure 6-3

TABLE 6-3
Gross Combination Weight: Singles vs. Doubles
TIFA 1987

Gross Weight	Singles		Doubles		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
< 20,000	19	0.58%	0	0.00%	19	0.54%
20,000	555	16.99	11	4.74	566	16.18
30,000	463	14.18	20	8.62	483	13.81
40,000	249	7.62	24	10.34	273	7.80
50,000	223	6.83	23	9.91	246	7.03
60,000	323	9.89	31	13.36	354	10.12
70,000	937	28.69	29	12.50	966	27.62
80,000+	163	4.99	28	12.07	191	5.46
Unknown	334	10.23	66	28.45	400	11.44
TOTAL	3,266	100.00%	232	100.00%	3,498	100.00%

NOTE: The figures in the left column indicate the low end of each gross weight range.

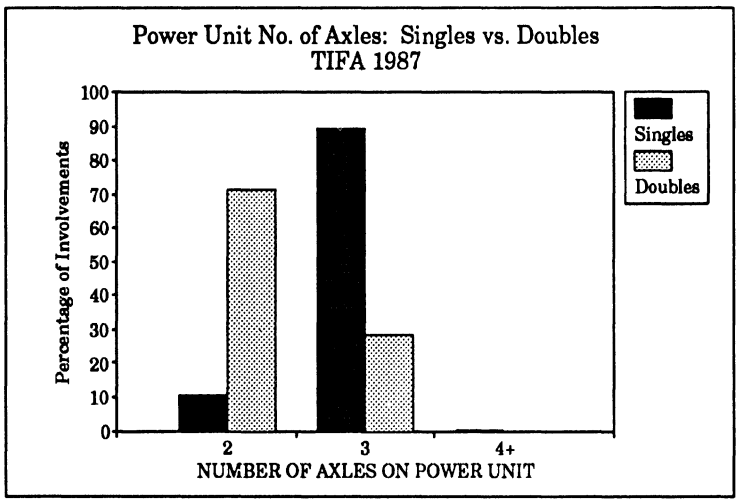


Figure 6-4

This graph illustrates the distributions for the number of axles on the tractor for the involved singles and doubles. Not surprisingly, most of the singles were hauled by 3-axle tractors, while the majority of the doubles were hauled by 2-axle tractors. As was noted earlier, the most common axle configuration for singles was a 3-axle tractor hauling a 2-axle trailer, while for doubles it was a 2-axle tractor, followed by a 1-axle semitrailer and a 2-axle full trailer.

TABLE 6-4
Power Unit Number of Axles: Singles vs. Doubles
TIFA 1987

Power Unit No. of Axles	Singles		Doubles		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
2	337	10.32%	165	71.12%	502	14.35%
3	2,878	88.12	66	28.45	2,944	84.16
4+	10	0.31	0	0.00	10	0.29
Unknown	41	1.26	1	0.43	42	1.20
TOTAL	3,266	100.00%	232	100.00%	3,498	100.00%

The main differences between the carrier type distributions for singles and doubles are in the percentages of interstate private and interstate authorized carriers. Of the known cases of carrier type, 85% of the involved doubles were interstate authorized carriers and only 5% were interstate private carriers. Singles were dominated by interstate authorized carriers as well, but this category accounted for only 60% of the known cases, while interstate private carriers represented 21%.

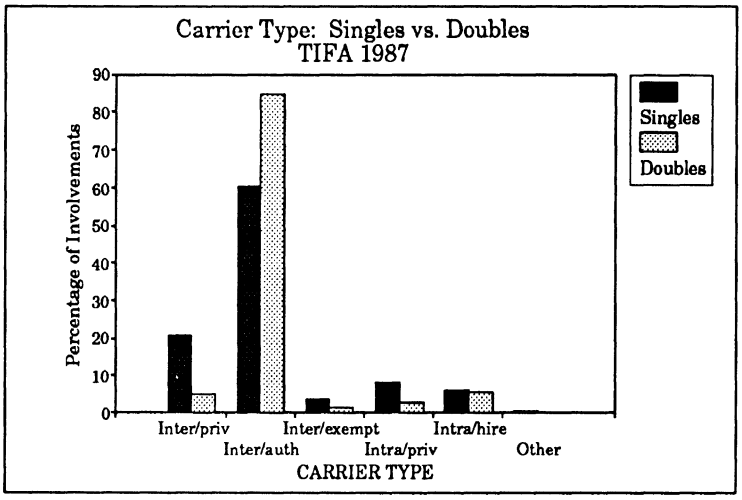


Figure 6-5

TABLE 6-5
Carrier Type: Singles vs. Doubles
TIFA 1987

Carrier Type	Singles		Doubles		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
Interstate private	633	19.38%	9	3.88%	642	18.35%
Interstate authorized	1,835	56.18	149	64.22	1,984	56.72
Interstate exempt	116	3.55	3	1.29	119	3.40
Intrastate private	261	7.99	5	2.16	266	7.60
Intrastate for hire	178	5.45	10	4.31	188	5.37
Government owned	12	0.37	0	0.00	12	0.34
Daily rental	6	0.18	0	0.00	6	0.17
Unknown	225	6.89	56	24.14	281	8.03
TOTAL	3,266	100.00%	232	100.00%	3,498	100.00%

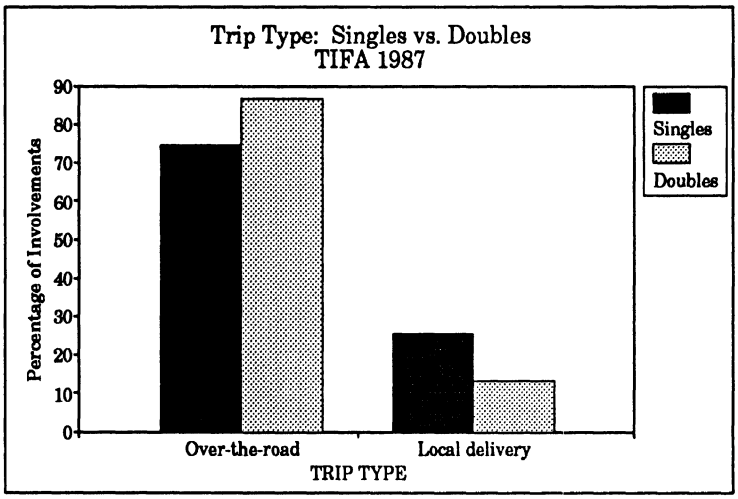


Figure 6-6

In terms of the type of trip being conducted when the accident occurred, the majority of singles and doubles were making over-the-road trips. However, of the known cases, 87% of the doubles were conducting over-the-road trips, compared to only 74% of the singles. This probably reflects the tendency for doubles to be used even more than singles in long-haul operations.

TABLE 6-6
Trip Type: Singles vs. Doubles
TIFA 1987

Trip Type	Singles		Doubles		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
Over-the-road	2,319	71.00%	167	71.98%	2,486	71.07%
Local delivery	797	24.40	26	11.21	823	23.53
Unknown	150	4.59	39	16.81	189	5.40
TOTAL	3,266	100.00%	232	100.00%	3,498	100.00%

Consistent with the differences in the trip type distributions are the differences in the road class distributions shown in the graph at right. Relatively more doubles involvements took place on limited access routes and fewer on major arteries compared to singles involvements. Of the known cases, 40% of the doubles accidents occurred on limited access roads and 44% occurred on major arteries. The respective figures for singles were 29% and 59%.

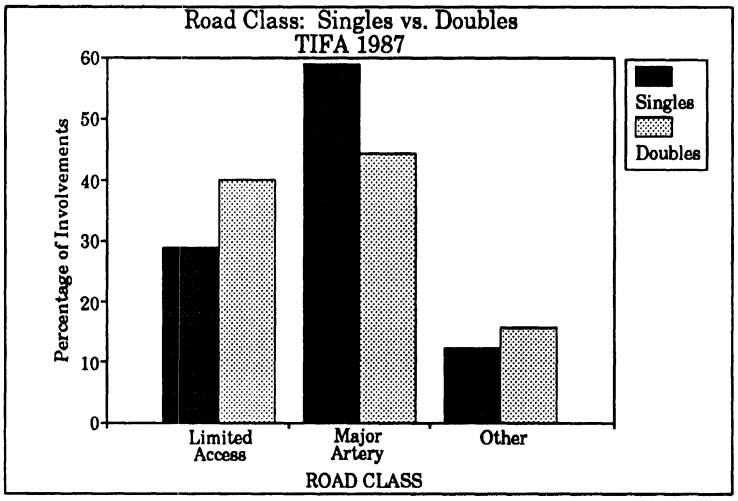


Figure 6-7

TABLE 6-7
Road Class: Singles vs. Doubles
TIFA 1987

Road Class	Singles		Doubles		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
Limited Access	942	28.84%	91	39.22%	1,033	29.53%
Major Artery	1,916	58.67	101	43.53	2,017	57.66
Other	399	12.22	36	15.52	435	12.44
Unknown	9	0.28	4	1.72	13	0.37
TOTAL	3,266	100.00%	232	100.00%	3,498	100.00%

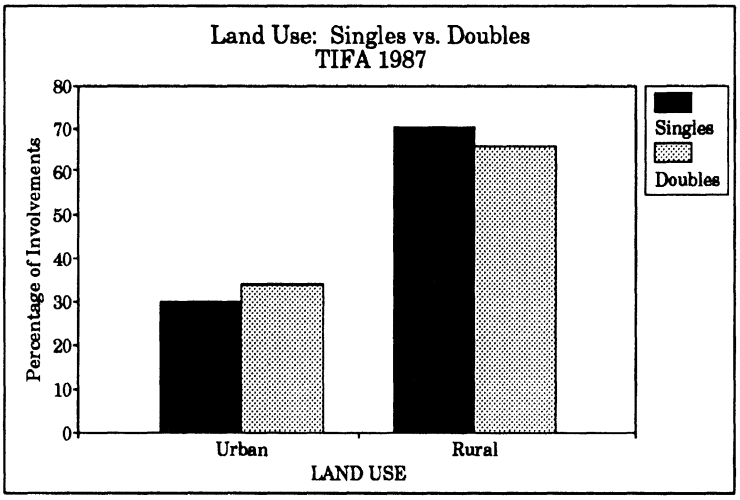


Figure 6-8

The land use distributions, whether the accident took place in a rural or urban area, are very similar between singles and doubles. Considering all singles and doubles combined, 70% of the involvements occurred in rural areas and 30% in urban areas. A slightly higher proportion of doubles was involved in accidents in urban areas compared to the singles.

TABLE 6-8
Land Use: Singles vs. Doubles
TIFA 1987

Land Use	Singles		Doubles		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
Urban	969	29.67%	79	34.05%	1,048	29.96%
Rural	2,295	70.27	153	65.95	2,448	69.98
Unknown	2	0.06	0	0.00	2	0.06
TOTAL	3,266	100.00%	232	100.00%	3,498	100.00%

The final comparison concerns the light condition at the time of the accident. The main difference is the higher incidence of nighttime accidents and lower incidence of daytime involvements for doubles compared to singles. Over 53% of the singles involvements occurred during daylight, compared to 41% of the doubles involvements. On the other hand, 54% of the doubles involvements took place at night, compared to 44% of the singles involvements. This probably reflects a greater proportion of nighttime travel for doubles compared to singles.

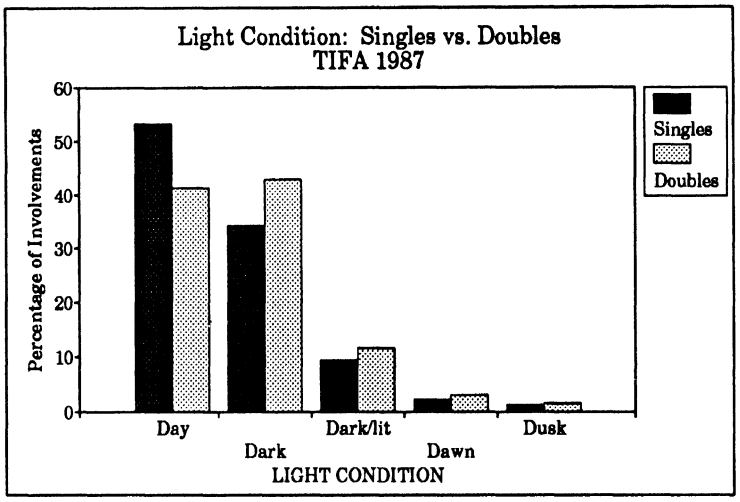


Figure 6-9

TABLE 6-9
Light Condition: Singles vs. Doubles
TIFA 1987

Light Condition	Singles		Doubles		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
Daylight	1,736	53.15%	96	41.38%	1,832	52.37%
Dark, not lighted	1,116	34.17	99	42.67	1,215	34.73
Dark, but lighted	307	9.40	27	11.64	334	9.55
Dawn	68	2.08	7	3.02	75	2.14
Dusk	35	1.07	3	1.29	38	1.09
Unknown	4	0.12	0	0.00	4	0.11
TOTAL	3,266	100.00%	232	100.00%	3,498	100.00%

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