Center for
National Truck Statistics

TRUCKS INVOLVED IN FATAL ACCIDENTS

FACTBOOK 1989

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UMTRI
The University of Michigan
Transportation Research Institute

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16. Abstract

This report contains a series of distributions of variables from UMTRI's file of Trucks Involved in Fatal Accidents, 1989. This file combines the coverage of the Fatal Accident Reporting System (FARS) data with the detail of the Office of Motor Carriers (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 1989 TIFA dataset contains 5,288 cases, down 3.3% from the 5,467 in 1988.

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 1989. The next section provides an overview of the fatal involvements in 1989, 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.

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TIFA Summary Facts and Figures

- From 1980 through 1989, 51,942 medium and heavy trucks were involved in fatal accidents. This is an average of 5,194 fatal involvements per year.
- The total number of fatal involvements for large trucks in 1989 was 5,288, compared with 5,467 in 1988, a decrease of 3.3%.
- 3,765 (71.2%) of the large trucks involved in fatal accidents in 1989 had a tractor as the power unit, and 1,514 (28.6%) were straight trucks.
- Tractor-semitrailers were involved in 3,286 fatal accidents in 1989, and doubles (tractors hauling a semi and a full trailer) were involved in 210 fatal accidents. Triples experienced two[1] fatal involvements in 1989.
- A total of 10,317 vehicles were involved in large truck fatal accidents in 1989.
- These accidents resulted in 5,921 fatalities, 744 (12.6%) of whom were truck drivers.
- The 1989 figure for fatally injured truck drivers represents a drop of 20% since 1980.
- About 62% of all of the 1989 large truck fatal involvements occurred during the daytime, 35% at night, and 4% during the dawn and dusk periods.
- 24% of the 1989 fatal accidents occurred on limited access highways, 55% on major arteries, and 20% on other classes of roads.
- The road surface was wet in 17% of the 1989 fatal accidents and covered with snow or ice in 6%.
- 67% of the 1989 fatal involvements took place in rural areas, compared with 33% in urban areas.
- Of all the large truck fatal involvements in 1989, 23% occurred at intersections.

[1] There were four cases with three trailers in the TIFA 1989 file; two were triples and two were heavy equipment haulers with a jeep, lowboy, booster dolly combination.

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 1990. 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 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

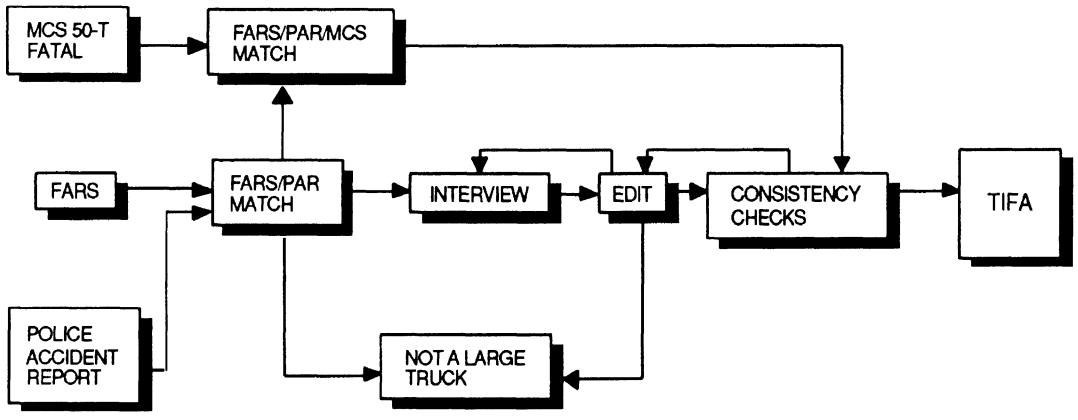

Figure 1-1

Part of editing and consistency checking involves decoding the Vehicle Identification Number (VIN) 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. 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% for most specific factors of interest, an exceptionally low rate for this kind of data.

Sampling and the 1989 File

The 1989 version of TIFA is the third that is not a census of all cases. Stratified 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 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 that, from the FARS coding, 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 coding) were selected for the survey and have a weight of two.

Confidence intervals were calculated for population estimates from the 1989 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 33.3% ± 1.5. The proportion of cases with fires is 4.2% ± 0.6. 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 1989 file *as if* it were a census file, or a simple random sample of all 5,288 cases.[2] 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 ± 1.5. 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 1989 file.

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[2] 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 1989 file are comparable to figures from previous TIFA files.

Conventions Followed

Most of this Factbook concerns the 1989 TIFA file, which was the third year in which sampling was conducted. All of the statistics presented in this document for 1989 are based on *weighted* frequencies from the file. Therefore, the 1989 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 the years 1980 - 1986 were derived from census files and are identical to the number of cases in the files. Annual fatality trends for the years 1980 - 1989 are presented in the next section.

The majority of the comparisons presented in this report are made according to power unit type or configuration. The 1989 TIFA file contains 81 cases of unknown power unit type. Most of these are cases that could not be matched with OMC reports and we 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 81 to nine. Power unit type comparisons are made for straight trucks versus tractor combinations, with the nine unknown cases excluded, in the section entitled *Overview of Large Truck Accident Involvements in 1989*. The same definition of power unit type is used in the separate straight truck and tractor sections, where most of the comparisons are based on cargo body style.

In several places in the Factbook, large trucks are classified according to configuration type. The configuration type classifications are based solely on TIFA variables, not FARS variables, and so include 81 cases of unknown power unit type. Straight trucks are split into single units versus those hauling one trailer. Tractors are divided into bobtails, tractor-semitrailers, and tractor-semitrailer-full trailer combinations. There is no category for triples (tractors hauling a semitrailer and two full trailers) because there were only two triples involved in fatal accidents in 1989. An "other" category includes the triples as well as tractors hauling trailer types other than a semitrailer or a semitrailer and a full trailer, and trucks towing or piggybacking other vehicles. The configuration type variable also includes an "unknown" level. The configuration type classification is used in the *Trends in the TIFA Data, 1980-1989* section, the geographic distributions portion of the Overview section, and the *1989 Fatal Accident Experience of Singles and Doubles* section. The power unit type coding from FARS, with nine cases unknown, is used throughout the remainder of the Factbook.

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, 1980-1989

The ten 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 number of large trucks involved in fatal accidents 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 5,394 in 1985. Instead of continuing to rise as might be expected, the total has remained relatively flat since 1985. The 1989 figure of 5,288 involvements is 4.6% higher than the 1980 total.

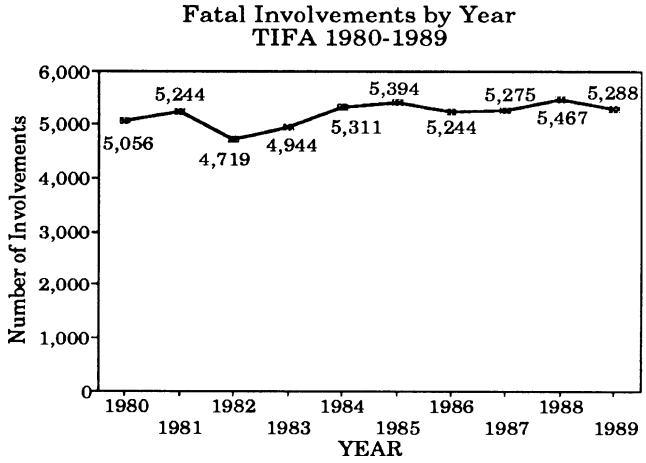


Figure 2-1

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

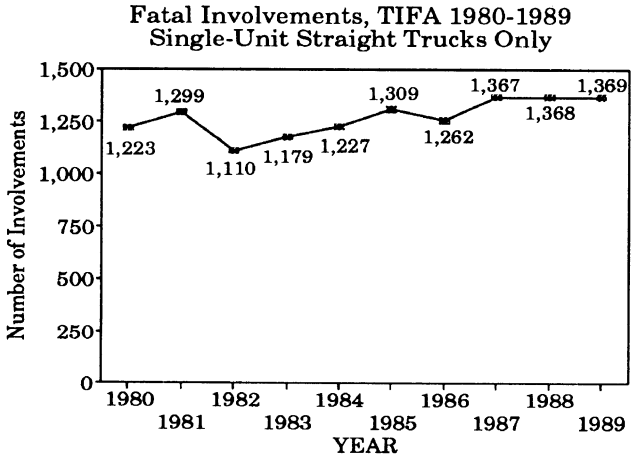


Figure 2-2

Single-unit straight truck involvements correspond closely to the overall trend. While the 1989 figure of 1,369 is 11.9% higher than the 1980 figure, it is virtually unchanged from the two previous years.

While the lowest number of fatal involvements overall occurred in 1982, this had been the peak year for fatal accidents involving straight trucks with one trailer until 1988. The 1989 total of 132 represents a 9.6% decline from the previous year. This configuration type, however, comprises a very small proportion of the large truck population.

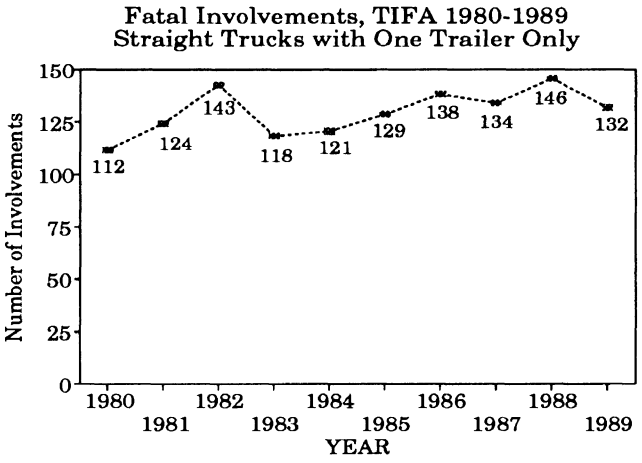


Figure 2-3

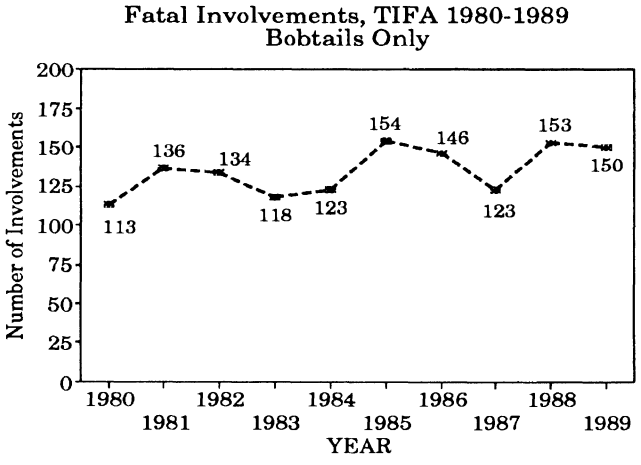


Figure 2-4

Bobtails similarly account for only a minor number of large truck fatal involvements each year. The peak number of bobtail involvements occurred in 1985, with 154. The number declined in the following two years, falling to 123 in 1987. In 1988 there was an increase of 24% to 153, and the 1989 total was 150.

The ten-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. The 3,286 involvements in 1989 represent a drop of 3.7% from 1988.

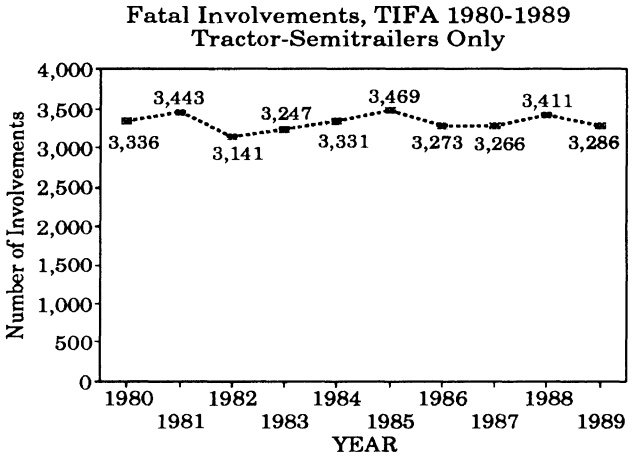


Figure 2-5

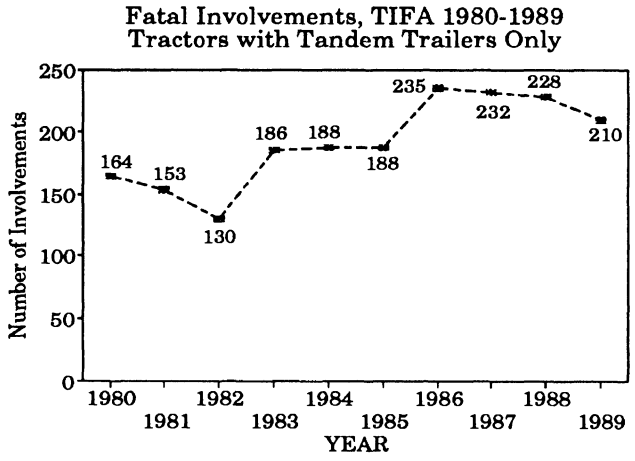


Figure 2-6

Fatal involvements for doubles rose over the period 1982 - 1986 and then remained level for several years. The 1989 figure of 210 represents a drop of almost 8% from the previous year.

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. The peak year for fatalities was 1988 with 6,100, and the low year was 1982 with 5,295. The number of fatalities in 1989 was 5,921, a decrease of almost 3% from the previous year. The 1989 total is 5% higher than the figure for 1980.

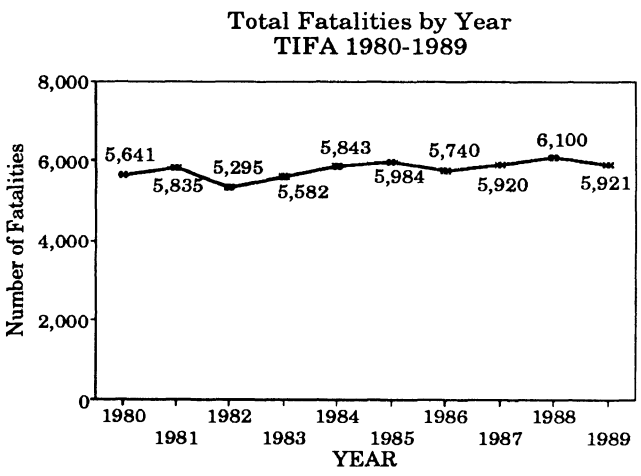


Figure 2-7

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

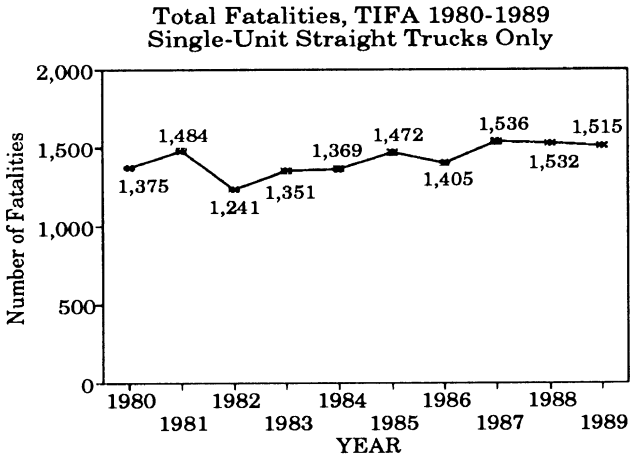


Figure 2-8

After a 9% rise between 1986 and 1987, the number of fatalities resulting from straight truck accidents has dropped 1.4% in the last two years.

The annual number of fatalities resulting from accidents involving straight trucks with one trailer has ranged from 132 in 1984 to 178 in 1982. The 1989 figure of 155 fatalities was a 12% decrease from the previous year.

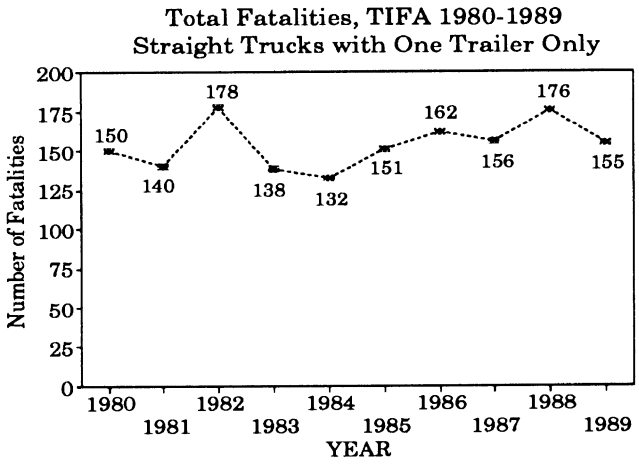


Figure 2-9

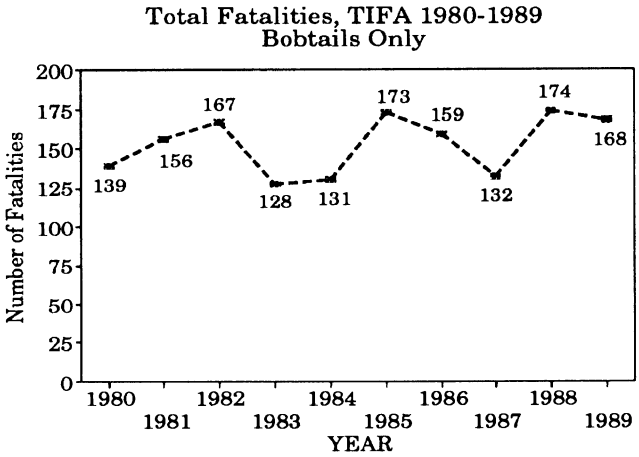


Figure 2-10

In 1989, the number of fatalities resulting from bobtail involvements decreased slightly from 174 in 1988 to 168.

The number of fatalities resulting from singles involvements has remained relatively stable throughout the decade. The 1989 figure of 3,770 fatalities represents a drop of 3.2% from 1988 and a decline of 4.5% from the peak year of 1985.

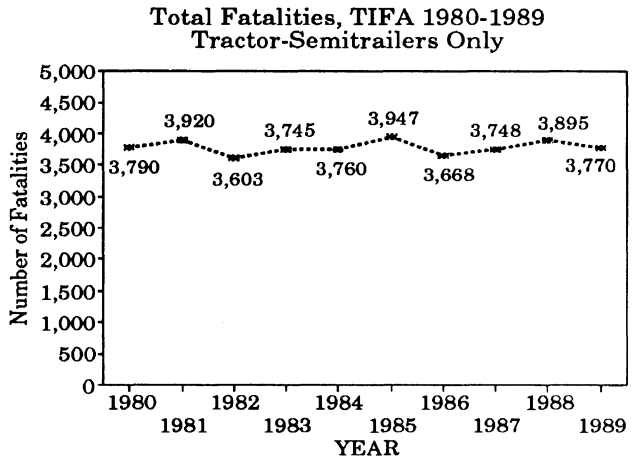


Figure 2-11

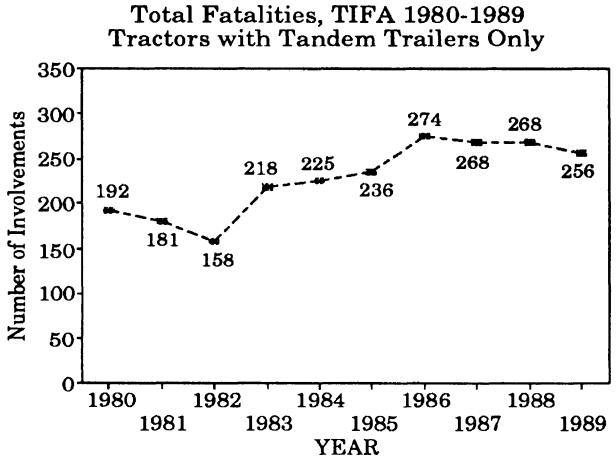


Figure 2-12

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. After reaching a peak in 1986, the total number of fatalities has dropped slightly in the subsequent years. The 1989 figure of 256 fatalities represents a decline of almost 7% from the 1986 total.

Annual Truck Driver Fatalities

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 1989, the number of truck driver fatalities has shown a general decline during this time period. The 1989 figure of 744 represents a 5.5% decrease over the previous year, and it is 20% less than the 1980 total. Furthermore, the *proportion* of truck driver fatalities out of all fatal truck involvements has declined from 18.4% in 1980 to 14.1% in 1989. 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.

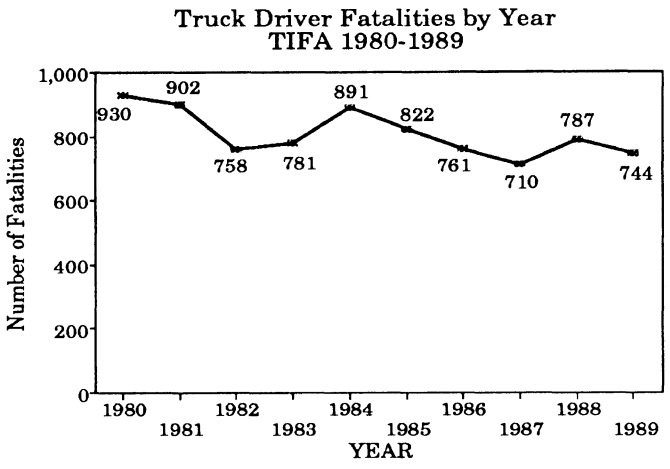


Figure 2-13

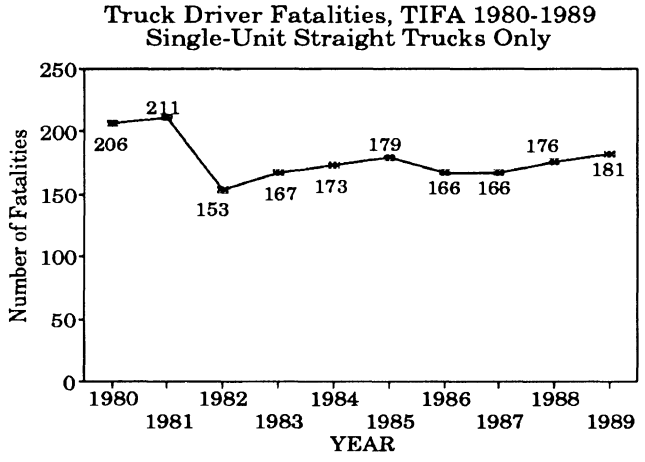


Figure 2-14

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 181 in 1989.

Not surprisingly, there is only a small number of fatalities each year for drivers of straight trucks with one trailer. This number dropped from 16 in 1980 to 8 in 1984 and 1985, but had been increasing steadily until 1989. The nine fatalities in 1989 represent a 55% drop from the previous year.

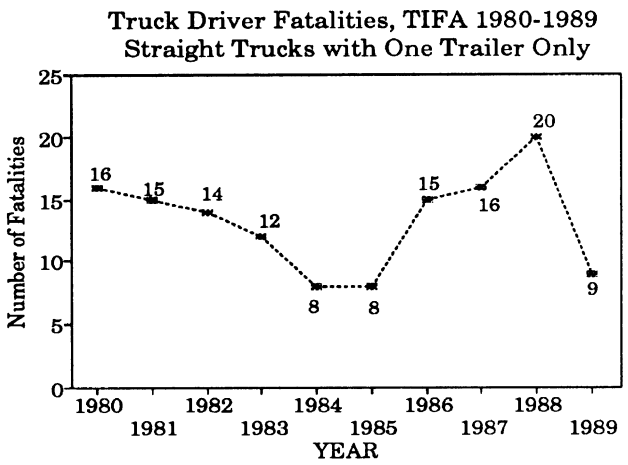


Figure 2-15

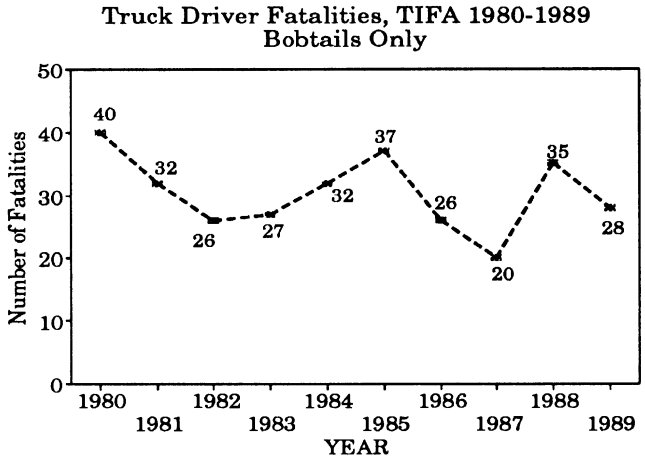


Figure 2-16

The annual number of fatalities for bobtail drivers has fluctuated from year to year. The highest number of fatalities out of the ten years occurred in 1980 (40), while the low was reached in 1987 (20). In 1989 there were 28 bobtail driver fatalities.

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 dropped noticeably in the years between 1984 and 1987. In 1988 the figure increased 9% from the previous year and dropped only slightly to 475 in 1989.

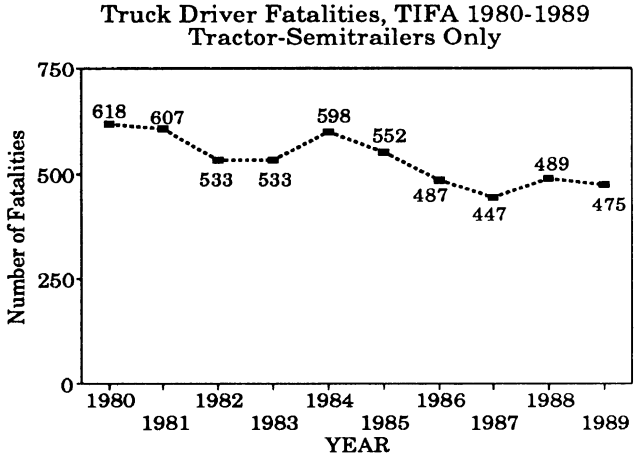


Figure 2-17

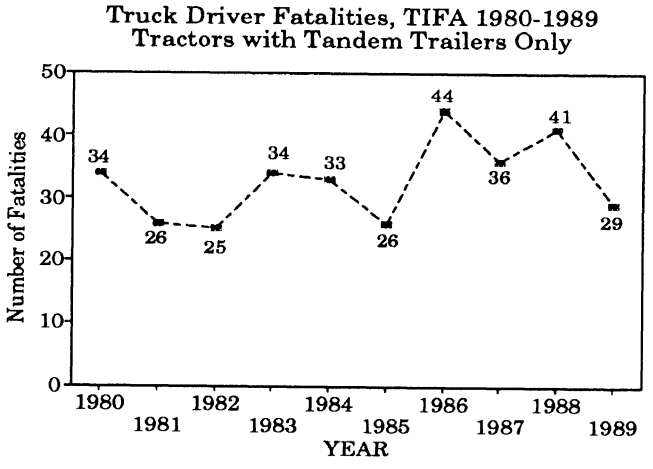


Figure 2-18

The number of fatalities for drivers of doubles shows a good deal of year-to-year variation. The low number (25) occurred in 1982, and the high (44) was reached in 1986. There were 29 fatalities in 1989, a 29% decrease from the previous year.

OVERVIEW OF LARGE TRUCK FATAL ACCIDENT INVOLVEMENTS IN 1989

The information in this section characterizes the general fatal accident experience of medium and heavy trucks in 1989. 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. 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 1989. 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

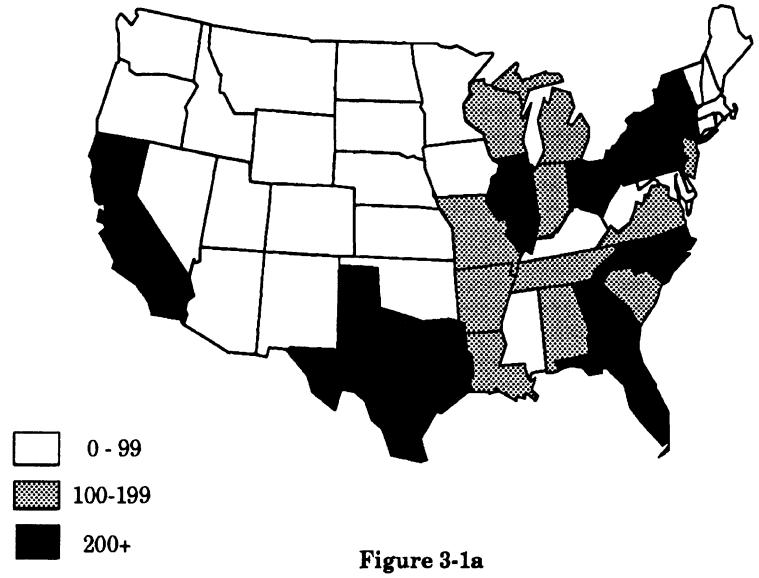


Figure 3-1a

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 210 fatal accidents involving doubles in 1989, 78 took place in California, 18 in Oregon , and 11 in Michigan. These three states accounted for 51% of the total number of doubles involvements, and California alone accounted for 37%.

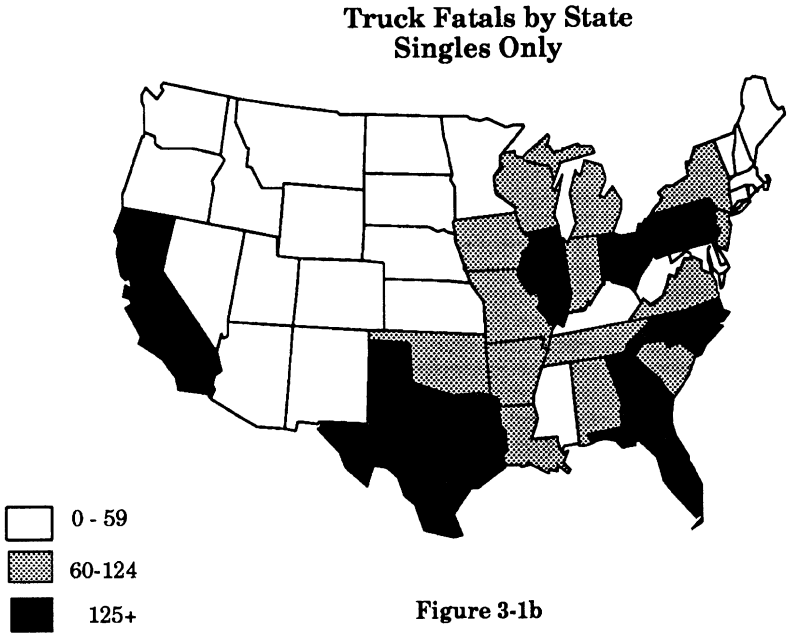


Figure 3-1b

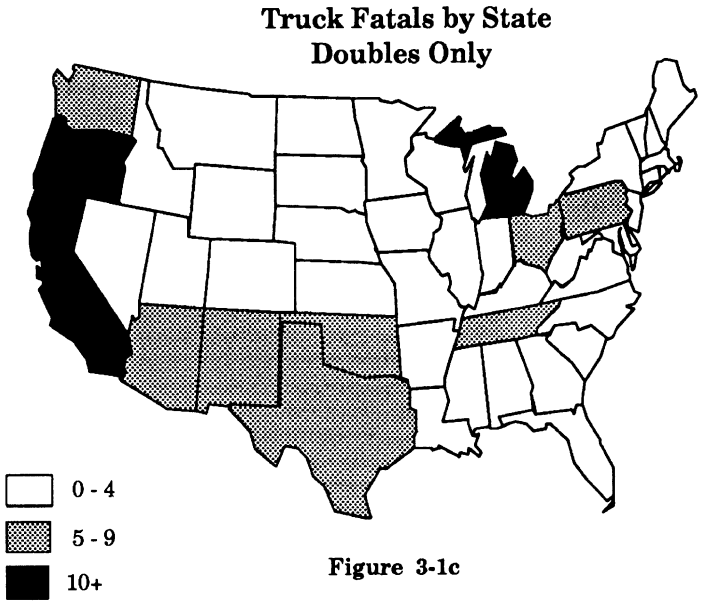


Figure 3-1c

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 (486), followed by Texas (364), and Florida (339). Together these three states accounted for 22.5% of the fatal involvements in 1989.

TABLE 3-1A
Distribution of Trucks in Fatal Accidents by State and Type of Truck, TIFA 1989

State	Total Number	Straight Truck Alone	Straight Truck w/Trailer	Bobtail	Single	Double	Other	Unknown Truck Type
AL	125	25	2	2	91	3	2	0
AZ	72	15	1	1	45	8	2	0
AR	121	18	0	2	98	1	2	0
CA	486	113	45	21	218	78	9	2
CO	52	15	1	2	33	0	1	0
CT	37	11	0	1	24	1	0	0
DE	17	3	0	0	14	0	0	0
DC	3	3	0	0	0	0	0	0
FL	339	104	5	10	215	4	0	1
GA	216	49	6	6	154	1	0	0
ID	24	4	0	0	17	2	1	0
IL	207	40	6	7	149	4	0	1
IN	149	28	1	7	111	2	0	0
IA	83	16	2	1	61	3	0	0
KS	65	19	2	0	43	1	0	0
KY	97	35	1	2	57	2	0	0
LA	126	16	0	3	98	0	9	0
ME	26	6	0	1	18	1	0	0
MD	93	35	0	1	55	1	0	1
MA	51	23	1	1	26	0	0	0
MI	159	42	7	8	87	11	3	1
MN	71	23	2	1	45	0	0	0
MS	96	2	0	0	24	0	0	70
MO	132	38	3	4	80	2	3	2
MT	24	5	2	0	14	2	1	0
NE	57	13	0	2	39	2	1	0
NV	21	4	1	1	12	3	0	0
NH	18	3	2	0	13	0	0	0
NJ	127	56	2	3	62	3	0	1
NM	55	2	2	0	45	6	0	0
NY	227	107	0	5	107	3	3	2
NC	212	56	4	10	136	4	2	0
ND	8	1	0	2	4	1	0	0
OH	205	56	3	6	132	7	1	0
OK	78	12	0	0	60	5	1	0
OR	91	14	2	1	50	18	6	0
PA	268	71	5	3	182	6	1	0
RI	10	5	0	0	5	0	0	0
SC	110	26	7	9	66	0	0	2
SD	18	8	1	0	9	0	0	0
TN	122	35	2	0	80	5	0	0
TX	364	81	8	18	245	8	4	0
UT	29	8	0	0	16	4	1	0
VT	16	11	0	0	5	0	0	0
VA	112	40	1	4	66	0	1	0
WA	70	18	4	1	38	5	4	0
WV	68	20	0	2	46	0	0	0
WI	114	32	1	2	77	2	0	0
WY	17	2	0	0	14	1	0	0
TOTAL	5,288	1,369	132	150	3,286	210	58	83

TABLE 3-1B
Distribution of Trucks in Fatal Accidents by State and Type of Truck, TIFA 1989
Column Percents

State	Total	Straight Truck Alone	Straight Truck w/Trailer	Bobtail	Single	Double	Other	Unknown Truck Type
AL	2.36%	1.83%	1.52%	1.33%	2.77%	1.43%	3.45%	0.00%
AZ	1.36	1.10	0.76	0.67	1.37	3.81	3.45	0.00
AR	2.29	1.31	0.00	1.33	2.98	0.48	3.45	0.00
CA	9.19	8.25	34.09	14.00	6.63	37.14	15.52	2.41
CO	0.98	1.10	0.76	1.33	1.00	0.00	1.72	0.00
CT	0.70	0.80	0.00	0.67	0.73	0.48	0.00	0.00
DE	0.32	0.22	0.00	0.00	0.43	0.00	0.00	0.00
DC	0.06	0.22	0.00	0.00	0.00	0.00	0.00	0.00
FL	6.41	7.60	3.79	6.67	6.54	1.90	0.00	1.20
GA	4.08	3.58	4.55	4.00	4.69	0.48	0.00	0.00
ID	0.45	0.29	0.00	0.00	0.52	0.95	1.72	0.00
IL	3.91	2.92	4.55	4.67	4.53	1.90	0.00	1.20
IN	2.82	2.05	0.76	4.67	3.38	0.95	0.00	0.00
IA	1.57	1.17	1.52	0.67	1.86	1.43	0.00	0.00
KS	1.23	1.39	1.52	0.00	1.31	0.48	0.00	0.00
KY	1.83	2.56	0.76	1.33	1.73	0.95	0.00	0.00
LA	2.38	1.17	0.00	2.00	2.98	0.00	15.52	0.00
ME	0.49	0.44	0.00	0.67	0.55	0.48	0.00	0.00
MD	1.76	2.56	0.00	0.67	1.67	0.48	0.00	1.20
MA	0.96	1.68	0.76	0.67	0.79	0.00	0.00	0.00
MI	3.01	3.07	5.30	5.33	2.65	5.24	5.17	1.20
MN	1.34	1.68	1.52	0.67	1.37	0.00	0.00	0.00
MS	1.82	0.15	0.00	0.00	0.73	0.00	0.00	84.34
MO	2.50	2.78	2.27	2.67	2.43	0.95	5.17	2.41
MT	0.45	0.37	1.52	0.00	0.43	0.95	1.72	0.00
NE	1.08	0.95	0.00	1.33	1.19	0.95	1.72	0.00
NV	0.40	0.29	0.76	0.67	0.37	1.43	0.00	0.00
NH	0.34	0.22	1.52	0.00	0.40	0.00	0.00	0.00
NJ	2.40	4.09	1.52	2.00	1.89	1.43	0.00	1.20
NM	1.04	0.15	1.52	0.00	1.37	2.86	0.00	0.00
NY	4.29	7.82	0.00	3.33	3.26	1.43	5.17	2.41
NC	4.01	4.09	3.03	6.67	4.14	1.90	3.45	0.00
ND	0.15	0.07	0.00	1.33	0.12	0.48	0.00	0.00
OH	3.88	4.09	2.27	4.00	4.02	3.33	1.72	0.00
OK	1.48	0.88	0.00	0.00	1.83	2.38	1.72	0.00
OR	1.72	1.02	1.52	0.67	1.52	8.57	10.34	0.00
PA	5.07	5.19	3.79	2.00	5.54	2.86	1.72	0.00
RI	0.19	0.37	0.00	0.00	0.15	0.00	0.00	0.00
SC	2.08	1.90	5.30	6.00	2.01	0.00	0.00	2.41
SD	0.34	0.58	0.76	0.00	0.27	0.00	0.00	0.00
TN	2.31	2.56	1.52	0.00	2.43	2.38	0.00	0.00
TX	6.88	5.92	6.06	12.00	7.46	3.81	6.90	0.00
UT	0.55	0.58	0.00	0.00	0.49	1.90	1.72	0.00
VT	0.30	0.80	0.00	0.00	0.15	0.00	0.00	0.00
VA	2.12	2.92	0.76	2.67	2.01	0.00	1.72	0.00
WA	1.32	1.31	3.03	0.67	1.16	2.38	6.90	0.00
WV	1.29	1.46	0.00	1.33	1.40	0.00	0.00	0.00
WI	2.16	2.34	0.76	1.33	2.34	0.95	0.00	0.00
WY	0.32	0.15	0.00	0.00	0.43	0.48	0.00	0.00
TOTAL	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

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 trailer. "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 1,514 straight trucks and 3,765 tractors involved in fatal accidents in 1989.

Temporal Distributions

Many of the FARS variables that 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, October, and July. The most were recorded in August (533), while the fewest took place in February (353) and January (364).

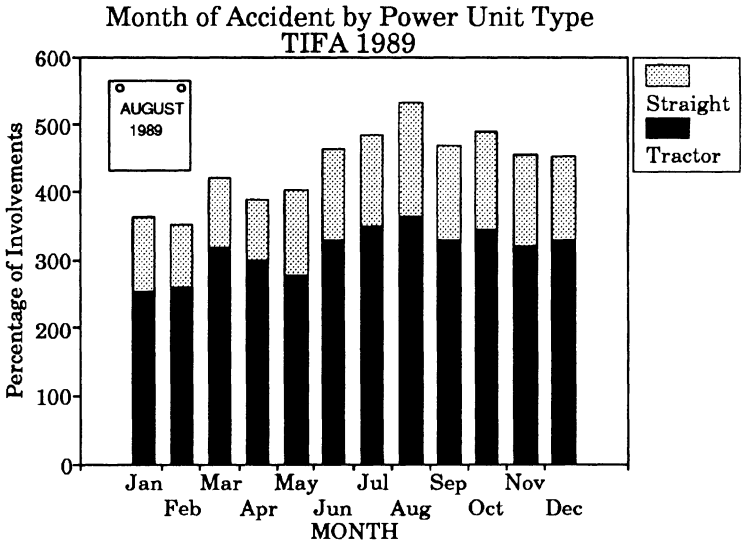


Figure 3-2

TABLE 3-2
Month of Accident by Power Unit Type
TIFA 1989

Month	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
January	109	7.20%	255	6.77%	364	6.90%
February	95	6.27	258	6.85	353	6.69
March	104	6.87	318	8.45	422	7.99
April	91	6.01	298	7.92	389	7.37
May	126	8.32	277	7.36	403	7.63
June	137	9.05	327	8.69	464	8.79
July	136	8.98	350	9.30	486	9.21
August	171	11.29	362	9.61	533	10.10
September	140	9.25	328	8.71	468	8.87
October	147	9.71	344	9.14	491	9.30
November	134	8.85	320	8.50	454	8.60
December	124	8.19	328	8.71	452	8.56
TOTAL	1,514	100.00%	3,765	100.00%	5,279	100.00%

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

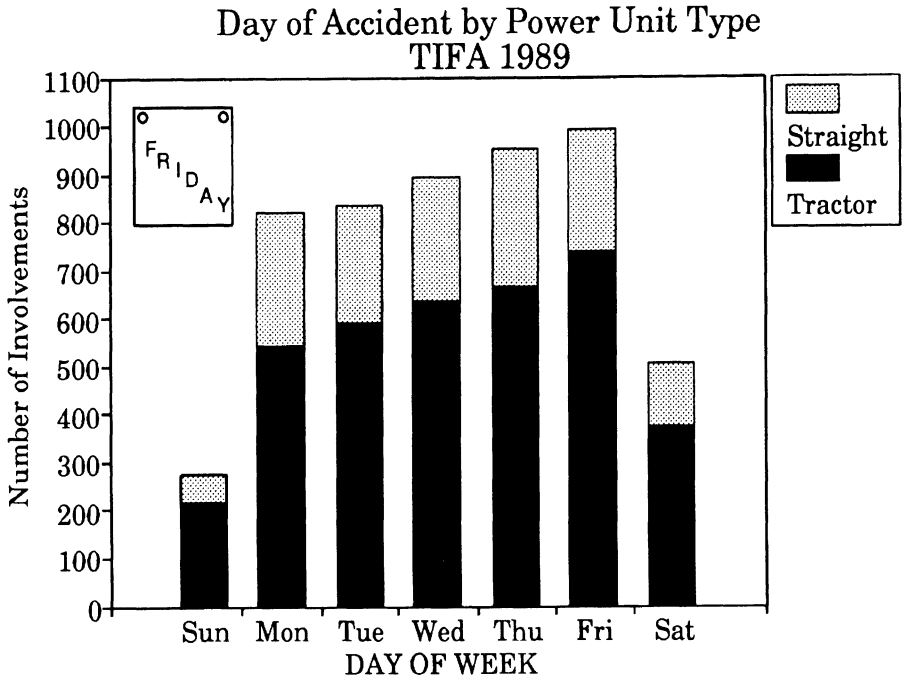


Figure 3-3

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 1989

Day	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
Monday	278	18.36%	545	14.48%	823	15.59%
Tuesday	243	16.05	594	15.78	837	15.86
Wednesday	259	17.11	633	16.81	892	16.90
Thursday	285	18.82	667	17.72	952	18.03
Friday	254	16.78	738	19.60	992	18.79
Saturday	136	8.98	371	9.85	507	9.60
Sunday	59	3.90	217	5.76	276	5.23
TOTAL	1,514	100.00%	3,765	100.00%	5,279	100.00%

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

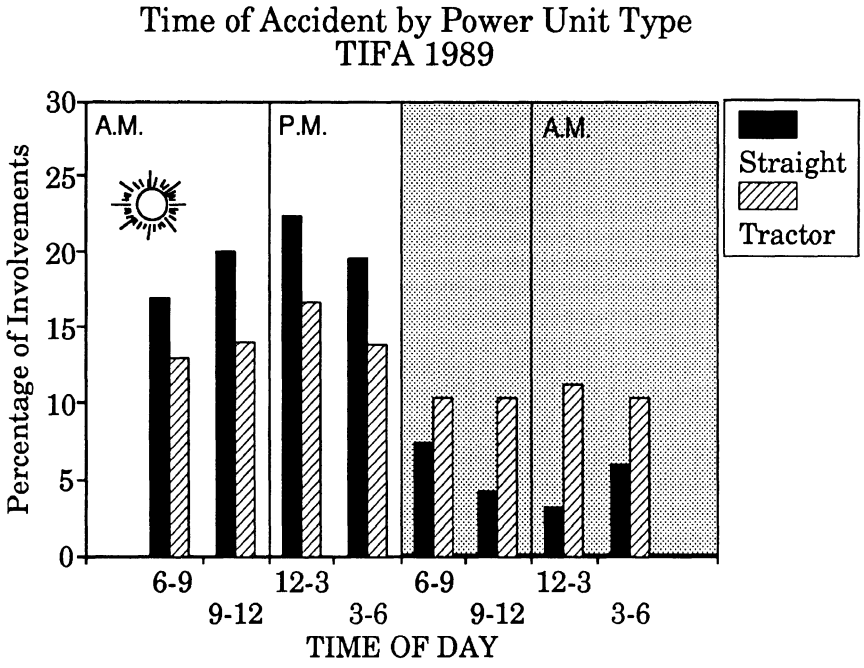


Figure 3-4

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. Almost 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 1989

Time of Day	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
6–9 a.m.	258	17.04%	490	13.01%	748	14.17%
9 a.m.–12 p.m.	303	20.01	528	14.02	831	15.74
12–3 p.m.	340	22.46	630	16.73	970	18.37
3–6 p.m.	297	19.62	521	13.84	818	15.50
6–9 p.m.	112	7.40	389	10.33	501	9.49
9 p.m.–12 a.m.	64	4.23	391	10.39	455	8.62
12–3 a.m.	48	3.17	422	11.21	470	8.90
3–6 a.m.	91	6.01	391	10.39	482	9.13
Unknown	1	0.07	3	0.08	4	0.08
TOTAL	1,514	100.00%	3,765	100.00%	5,279	100.00%

NOTE: The nine 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. In FARS, the Federal Highway Administration's classification of urban and rural areas is used to determine land use. 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 1989. Tractor involvements were especially likely to occur in rural areas; almost 70% took place there.

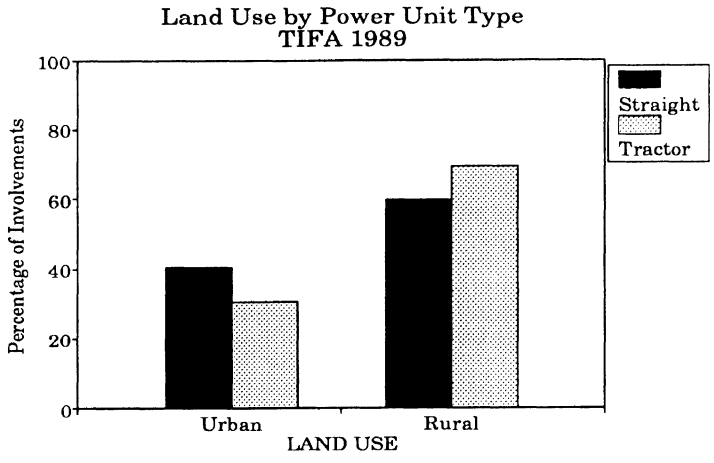


Figure 3-5

TABLE 3-5
Land Use by Power Unit Type
TIFA 1989

Land Use	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
Urban	610	40.29%	1,148	30.49%	1,758	33.30%
Rural	903	59.64	2,610	69.32	3,513	66.55
Unknown	1	0.07	7	0.19	8	0.15
TOTAL	1,514	100.00%	3,765	100.00%	5,279	100.00%

NOTE: The nine 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 trucks and tractors. While 77% of the straight truck involvements took place during daylight, only 55.5% 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 with straight trucks.

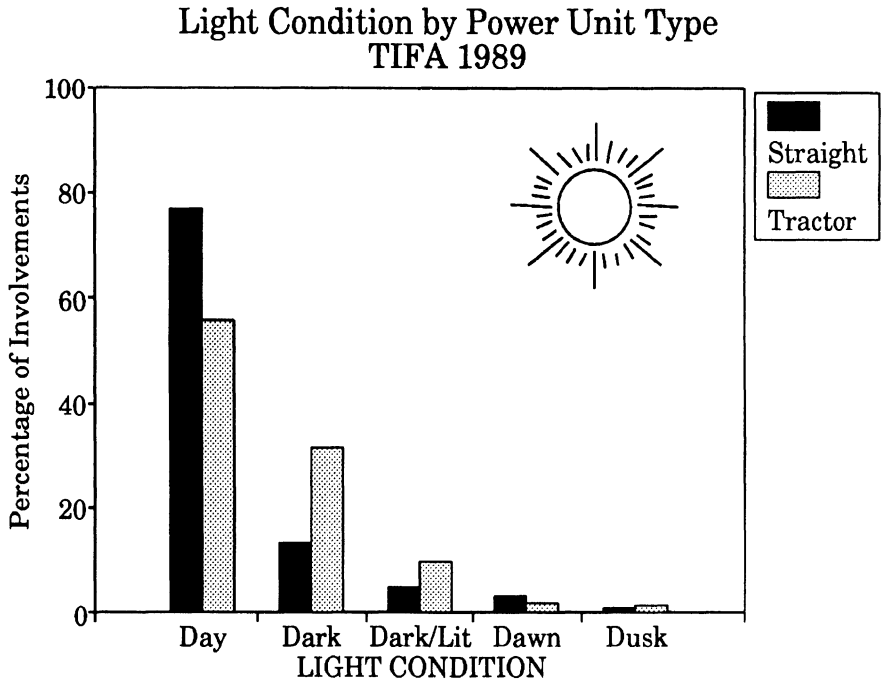


Figure 3-6

TABLE 3-6
Light Condition by Power Unit Type
TIFA 1989

Light Condition	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
Daylight	1,167	77.08%	2,089	55.48%	3,256	61.68%
Dark, not lighted	204	13.47	1,182	31.39	1,386	26.25
Dark, but lighted	77	5.09	365	9.69	442	8.37
Dawn	50	3.30	78	2.07	128	2.42
Dusk	15	0.99	51	1.35	66	1.25
Unknown	1	0.07	0	0.00	1	0.02
TOTAL	1,514	100.00%	3,765	100.00%	5,279	100.00%

NOTE: The nine 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 1989. Over three-fourths of both took place under dry conditions, and about 15% of straight truck involvements and 18% of tractor involvements occurred on wet roadways.

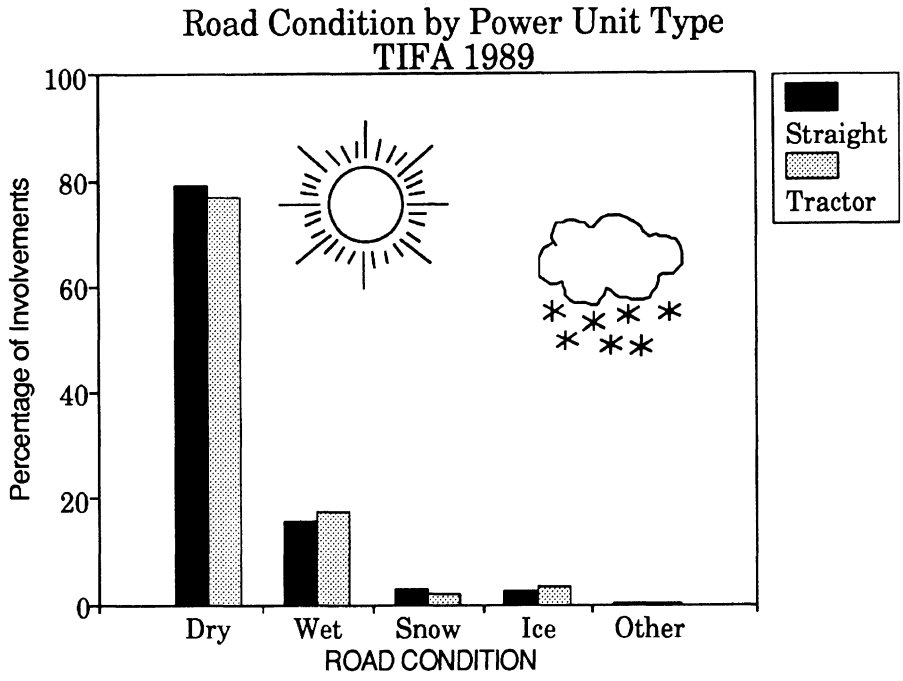


Figure 3-7

TABLE 3-7
Road Surface Condition by Power Unit Type
TIFA 1989

Road Surface Condition	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
Dry	1,193	78.80%	2,882	76.55%	4,075	77.19%
Wet	234	15.46	662	17.58	896	16.97
Snow/Slush	44	2.91	85	2.26	129	2.44
Ice	39	2.58	127	3.37	166	3.14
Sand/Dirt/Oil	1	0.07	2	0.05	3	0.06
Other	1	0.07	1	0.03	2	0.04
Unknown	2	0.13	6	0.16	8	0.15
TOTAL	1,514	100.00%	3,765	100.00%	5,279	100.00%

NOTE: The nine 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.

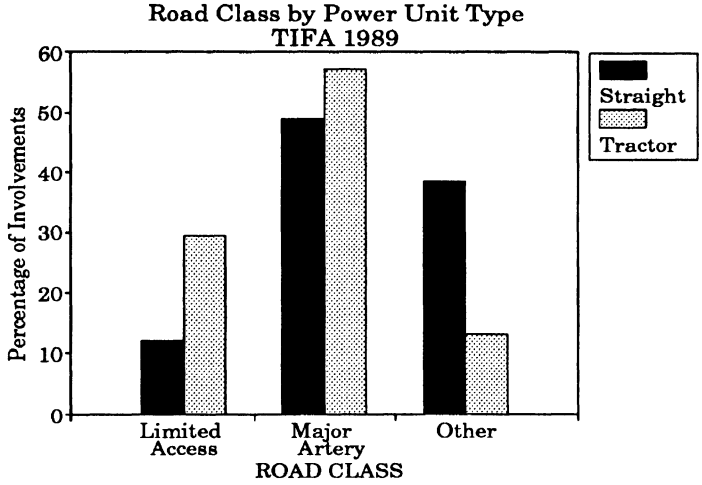


Figure 3-8

The majority of both straight truck and tractor fatal involvements took place on major arteries in 1989. The main difference between the two distributions is in the proportion of involvements that occurred on limited access and on "other" roads. Nearly 30% of tractor involvements were on limited access highways, compared with 12% of straight truck involvements. On the other hand, almost 39% of straight truck fatal accidents occurred on 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 that carry them over the interstate highway system.

TABLE 3-8
Road Class by Power Unit Type
TIFA 1989

Road Class	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
Limited Access	183	12.09%	1,104	29.32%	1,287	24.38%
Major Artery	738	48.75	2,156	57.26	2,894	54.82
Other	583	38.51	497	13.20	1,080	20.46
Unknown	10	0.66	8	0.21	18	0.34
TOTAL	1,514	100.00%	3,765	100.00%	5,279	100.00%

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

Road class distributions were also prepared on the basis of land use. The graph to the right shows the urban road class distributions. The two power unit types had very different patterns of involvements in urban areas in 1989. The major share of tractor involvements was on limited access routes and the least on other roads. Conversely, 48% of straight truck involvements occurred on other roads and 20% on limited access routes.

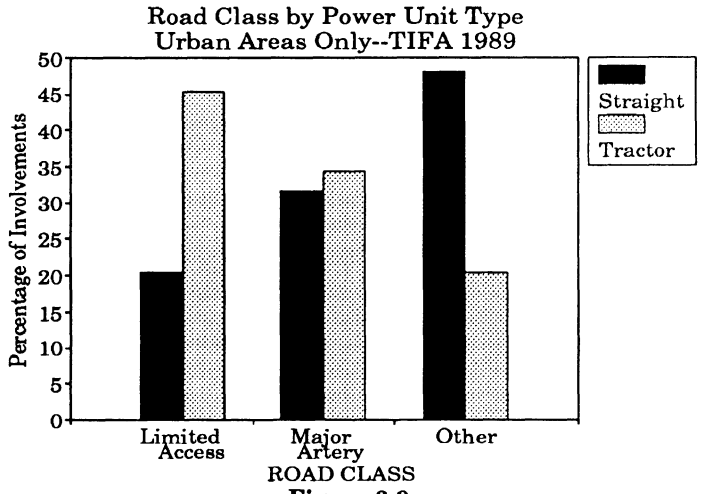


Figure 3-9

TABLE 3-9
Road Class by Power Unit Type
Urban Areas Only
TIFA 1989

Road Class	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
Limited Access	124	20.33%	520	45.30%	644	36.63%
Major Artery	192	31.48	394	34.32	586	33.33
Other	293	48.03	234	20.38	527	29.98
Unknown	1	0.16	0	0.00	1	0.06
TOTAL	610	100.00%	1,148	100.00%	1,758	100.00%

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

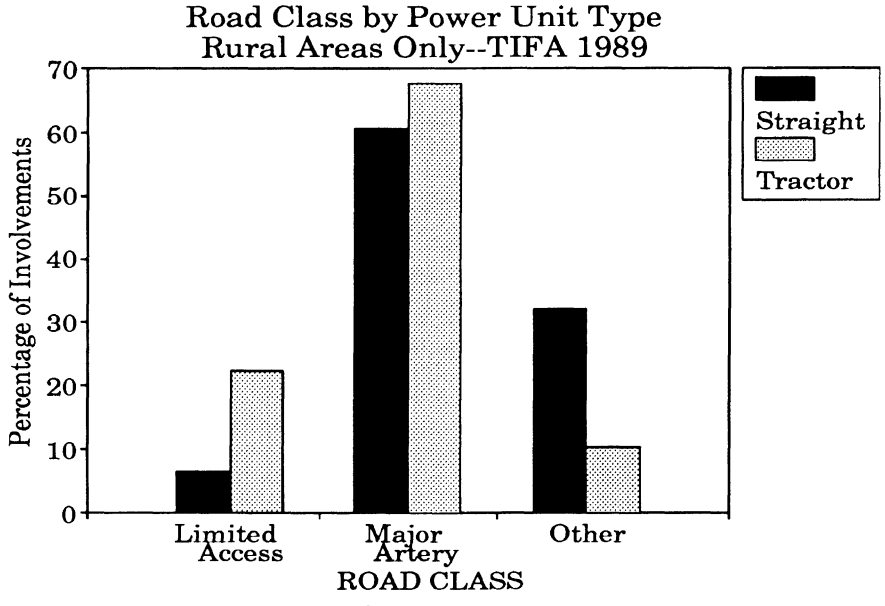


Figure 3-10

The rural area road class distributions are quite different from the urban area distributions. Almost 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 1989

Road Class	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
Limited Access	59	6.53%	584	22.38%	643	18.30%
Major Artery	546	60.47	1,762	67.51	2,308	65.70
Other	290	32.12	263	10.08	553	15.74
Unknown	8	0.89	1	0.04	9	0.26
TOTAL	903	100.00%	2,610	100.00%	3,513	100.00%

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

Relation to Junction by Power Unit Type
TIFA 1989

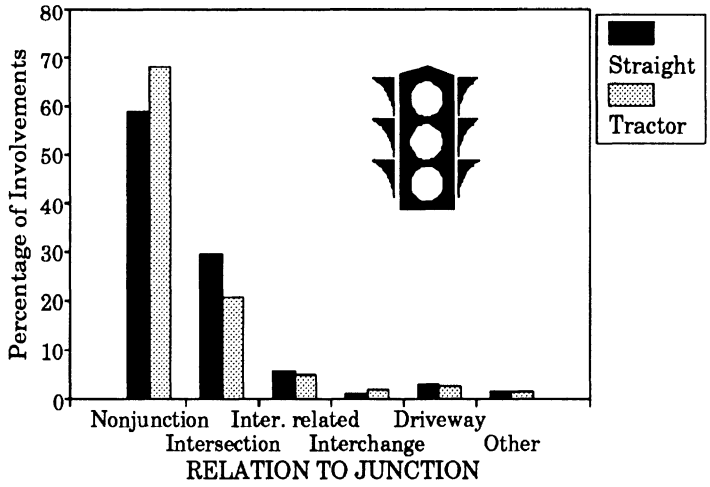


Figure 3-11

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 1989 reveals some interesting differences between straight trucks and tractors, which probably reflect their respective travel patterns. For example, about 29% of straight truck involvements took place at intersections, compared with 21% for tractors. In contrast, 68% of tractor involvements occurred at nonjunctions, compared with 59% for straight trucks. These figures are consistent with tractors logging a greater share of their miles on limited access roads compared with straight trucks.

TABLE 3-11
Relation to Junction by Power Unit Type
TIFA 1989

Relation to Junction	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
Nonjunction	890	58.78%	2,574	68.37%	3,464	65.62%
Intersection	446	29.46	777	20.64	1,223	23.17
Intersection related	88	5.81	191	5.07	279	5.29
Interchange area	20	1.32	68	1.81	88	1.67
Driveway/alley, etc.	47	3.10	94	2.50	141	2.67
Entrance/exit ramp	2	0.13	14	0.37	16	0.30
Rail grade crossing	19	1.25	36	0.96	55	1.04
In crossover	0	0.00	8	0.21	8	0.15
Unknown	2	0.13	3	0.08	5	0.09
TOTAL	1,514	100.00%	3,765	100.00%	5,279	100.00%

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

In 1989, a total of 1,223 large truck fatal involvements took place at intersections. 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.

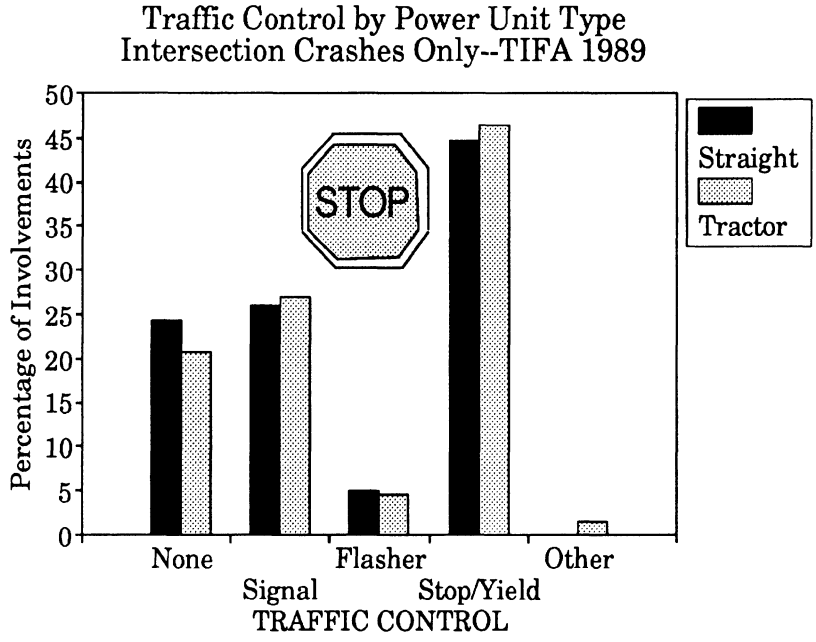


Figure 3-12

TABLE 3-12
Traffic Control at Intersection Crashes by Power Unit Type
TIFA 1989

Traffic Control	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
None	108	24.22%	159	20.46%	267	21.83%
Automated traffic signal	116	26.01	208	26.77	324	26.49
Flasher/other signal	23	5.16	36	4.63	59	4.82
Stop or yield sign	199	44.62	360	46.33	559	45.71
Warning/other sign	0	0.00	11	1.42	11	0.90
Other	0	0.00	3	0.39	3	0.25
TOTAL	446	100.00%	777	100.00%	1,223	100.00%

NOTE: The one case of unknown power unit type is 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 59% for tractors and 47% for straight trucks. A higher proportion of tractor involvements (13.6%) than straight truck involvements (2.8%) 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.

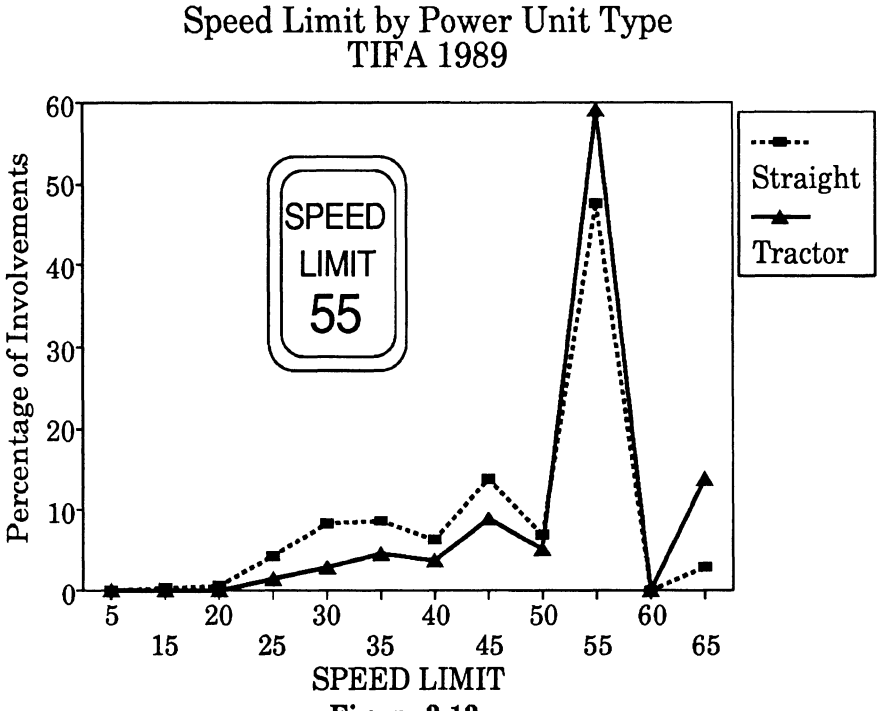


Figure 3-13

TABLE 3-13
Speed Limit by Power Unit Type
TIFA 1989

Speed Limit	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
No statutory limit	4	0.26%	1	0.03%	5	0.09%
5 mph	0	0.00	1	0.03	1	0.02
15 mph	5	0.33	1	0.03	6	0.11
20 mph	6	0.40	2	0.05	8	0.15
25 mph	64	4.23	49	1.30	113	2.14
30 mph	123	8.12	108	2.87	231	4.38
35 mph	126	8.32	177	4.70	303	5.74
40 mph	95	6.27	136	3.61	231	4.38
45 mph	205	13.54	340	9.03	545	10.32
50 mph	104	6.87	199	5.29	303	5.74
55 mph	707	46.70	2,212	58.75	2,919	55.29
60 mph	0	0.00	4	0.11	4	0.08
65 mph	43	2.84	513	13.63	556	10.53
Unknown	32	2.11	22	0.58	54	1.02
TOTAL	1,514	100.00%	3,765	100.00%	5,279	100.00%

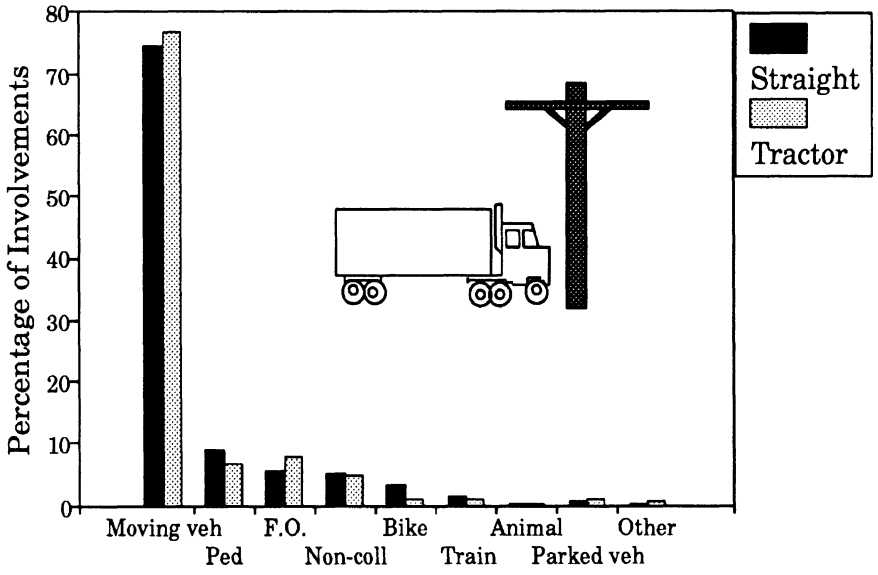
NOTE: The nine cases of unknown power unit type are excluded from this table.

Collision Types

Distributions of several additional 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 1989 were collisions with another motor vehicle in transport. These collisions accounted for 74% of the straight truck and 77% of the tractor involvements. Straight trucks had a slightly higher proportion of non-collisions and involvements with pedestrians and pedalcyclists than did tractors, while tractors were involved more in crashes with fixed objects.

First Harmful Event by Power Unit Type
TIFA 1989



OTHER OBJECT INVOLVED IN COLLISION

Figure 3-14

TABLE 3-14
First Harmful Event by Power Unit Type
TIFA 1989

Collision with:	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
Pedestrian	136	8.98%	247	6.56%	383	7.26%
Pedalcyclist	49	3.24	37	0.98	86	1.63
Train	19	1.25	35	0.93	54	1.02
Animal	1	0.07	13	0.35	14	0.27
Moving vehicle	1,126	74.37	2,893	76.84	4,019	76.13
Parked vehicle	11	0.73	43	1.14	54	1.02
Other non-fixed object	6	0.40	21	0.56	27	0.51
Fixed object	85	5.61	301	7.99	386	7.31
Non-collision	81	5.35	175	4.65	256	4.85
TOTAL	1,514	100.00%	3,765	100.00%	5,279	100.00%

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

A total of 4,019 of the fatal accidents involving large trucks in 1989 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 (41%), followed by head-ons (29%), and rear-end collisions (23%). The straight truck and tractor distributions are fairly similar

overall, but there are some differences. Straight trucks had higher proportions of angle collisions than did tractors. Tractors were more likely to experience rear-end and same direction sideswipe crashes than were straight trucks.

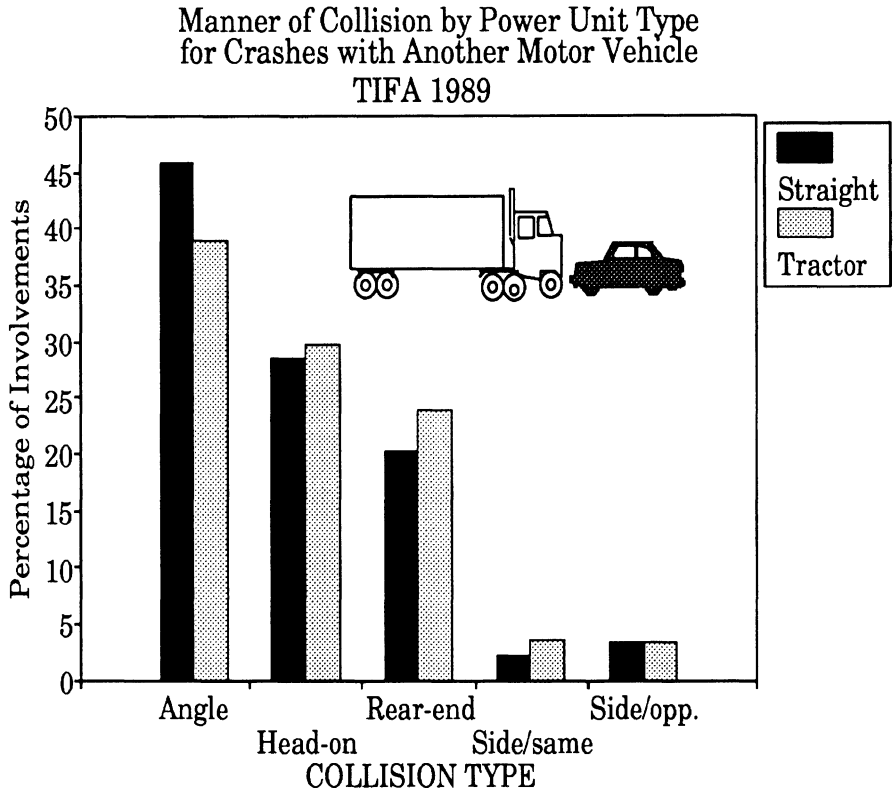


Figure 3-15

TABLE 3-15
Manner of Collision by Power Unit Type
for Crashes with Another Motor Vehicle
TIFA 1989

Manner of Collision	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
Rear-end	227	20.16%	694	23.99%	921	22.92%
Head-on	321	28.51	858	29.66	1,179	29.34
Rear-to-rear	1	0.09	1	0.03	2	0.05
Angle	516	45.83	1,124	38.85	1,640	40.81
Sideswipe, same dir.	24	2.13	108	3.73	132	3.28
Sideswipe, opp. dir.	37	3.29	100	3.46	137	3.41
Unknown	0	0.00	8	0.28	8	0.20
TOTAL	1,126	100.00%	2,893	100.00%	4,019	100.00%

NOTE: The five 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 1989. In over two-thirds of the straight truck and tractor involvements, the truck was coded as the striking vehicle. However, almost one-third of the striking cases were head-on collisions (meaning both vehicles were coded as striking), and almost 15% represented single-vehicle crashes other than collisions with pedestrians or bicyclists. In the remaining multi-vehicle crashes, the truck was 1.3 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.

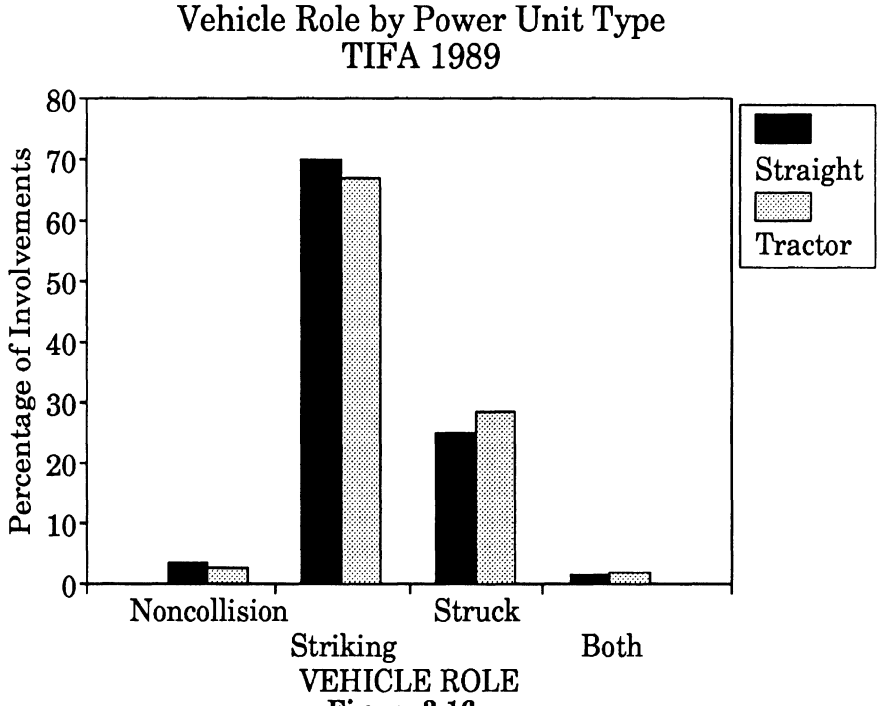


Figure 3-16

TABLE 3-16
Vehicle Role by Power Unit Type
TIFA 1989

Vehicle Role	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
Noncollision	54	3.57%	105	2.79%	159	3.01%
Striking	1,058	69.88	2,524	67.04	3,582	67.85
Struck	378	24.97	1,061	28.18	1,439	27.26
Both	24	1.59	70	1.86	94	1.78
Unknown	0	0.00	5	0.13	5	0.09
TOTAL	1,514	100.00%	3,765	100.00%	5,279	100.00%

NOTE: The nine 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 1989 fatal involvements, the distribution of both first and subsequent event rollovers is virtually identical for straight trucks and tractors.

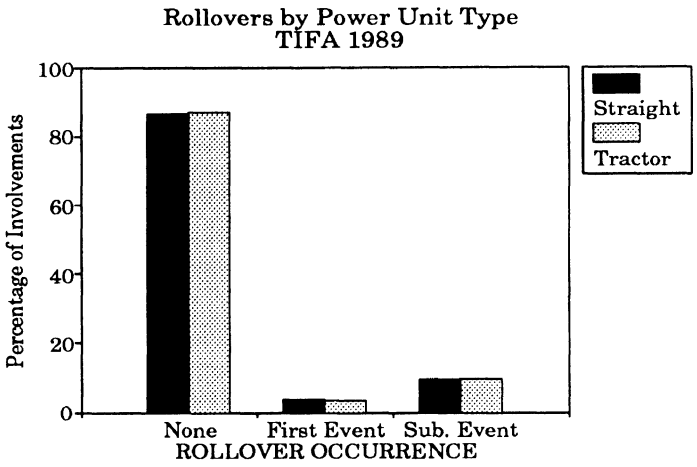


Figure 3-17

TABLE 3-17
Occurrence of Rollovers by Power Unit Type
TIFA 1989

Rollover	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
None	1,312	86.66%	3,274	86.96%	4,586	86.87%
First Event	56	3.70	130	3.45	186	3.52
Subsequent Event	146	9.64	361	9.59	507	9.60
TOTAL	1,514	100.00%	3,765	100.00%	5,279	100.00%

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

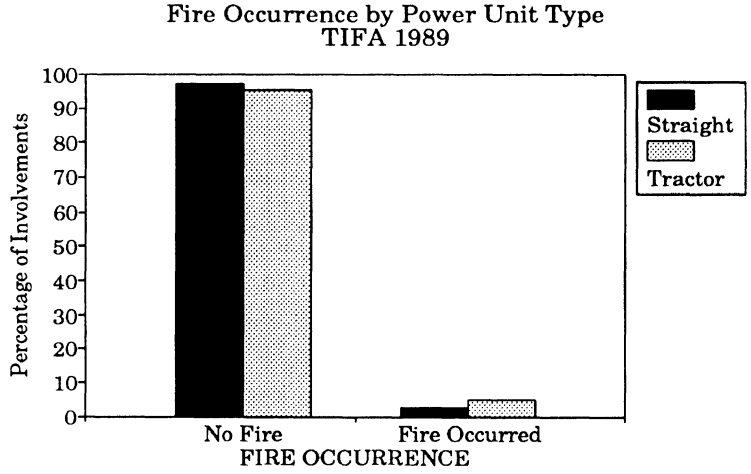


Figure 3-18

Another variable indicates whether a fire occurred on the vehicle during the accident. There was a fire on 2.7% of the straight trucks and 4.9% of the tractors involved in fatal accidents in 1989.

TABLE 3-18
Fire Occurrence by Power Unit Type
TIFA 1989

Fire	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
No Fire	1,473	97.29%	3,582	95.14%	5,055	95.76%
Fire Occurred	41	2.71	183	4.86	224	4.24
TOTAL	1,514	100.00%	3,765	100.00%	5,279	100.00%

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

Driver Characteristics

The next group of variables describes the drivers of the trucks involved in fatal accidents in 1989. These are predominantly FARS variables. The figure below depicts driver age distributions by power unit type. The distributions indicate younger ages for the straight truck drivers compared with the ages of tractor drivers. For the known cases, nearly 56% of the straight truck drivers were 35 or younger, while 60% of the tractor drivers were over 35.

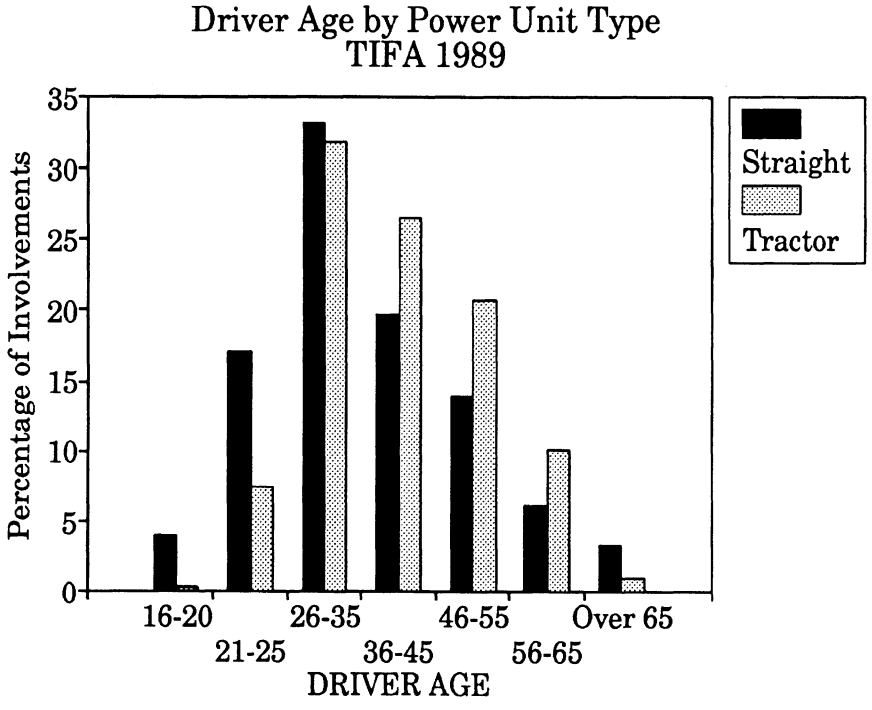


Figure 3-19

TABLE 3-19
Age of Truck Driver by Power Unit Type
TIFA 1989

Driver Age	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
16–20	60	3.96%	11	0.29%	71	1.34%
21–25	259	17.11	280	7.44	539	10.21
26–35	501	33.09	1,199	31.85	1,700	32.20
36–45	297	19.62	1,000	26.56	1,297	24.57
46–55	210	13.87	782	20.77	992	18.79
56–65	91	6.01	381	10.12	472	8.94
Over 65	49	3.24	40	1.06	89	1.69
Unknown	47	3.10	72	1.91	119	2.25
TOTAL	1,514	100.00%	3,765	100.00%	5,279	100.00%

NOTE: The nine 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. Only 1.5% of the drivers were female.

TABLE 3-20
Truck Driver Gender by Power Unit Type
TIFA 1989

Driver Gender	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
Male	1,445	95.44%	3,642	96.73%	5,087	96.36%
Female	27	1.78	54	1.43	81	1.53
Unknown	42	2.77	69	1.83	111	2.10
TOTAL	1,514	100.00%	3,765	100.00%	5,279	100.00%

NOTE: The nine 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, shoulder belt, lap belt only, lap and shoulder belt, restraint used of unknown or other type, and unknown if restraint was used. This last category accounts for 17% of the cases. It appears that a greater proportion of the involved tractor drivers were restrained, compared to the straight truck drivers. Nearly 45% of the tractor drivers were using some kind of restraint device, compared to only 29% of the straight truck drivers. Note that the unknown cases are included in Figure 3-21.

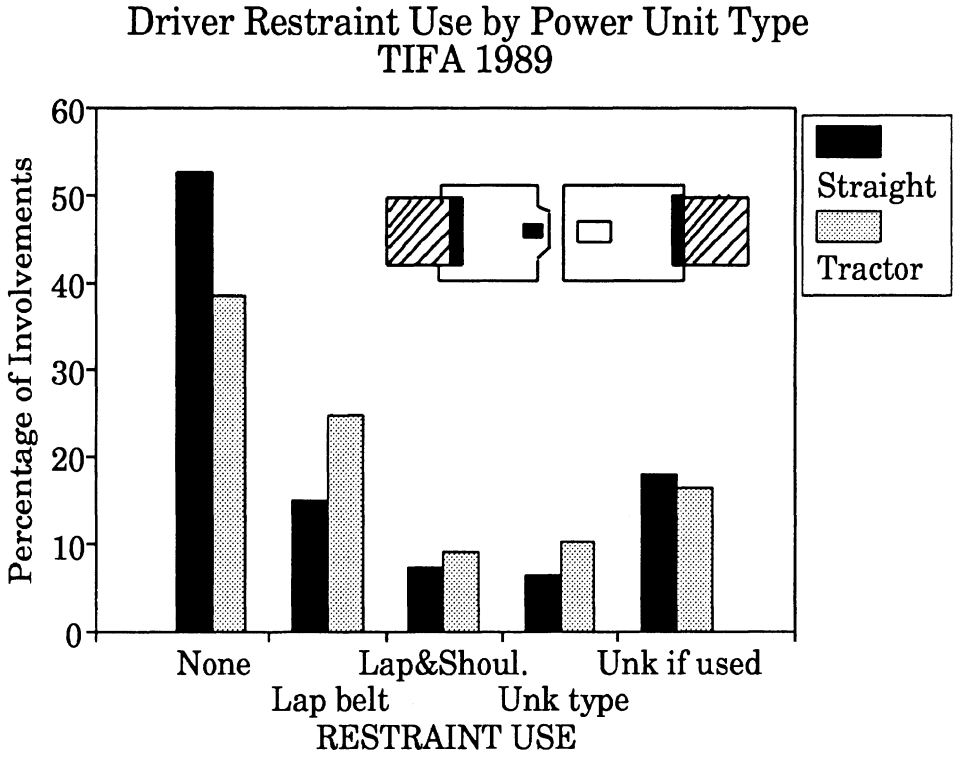


Figure 3-21

TABLE 3-21
Truck Driver Restraint Use by Power Unit Type
TIFA 1989

Driver Restraint Use	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
None used	798	52.71%	1,459	38.75%	2,257	42.75%
Shoulder	0	0.00	3	0.08	3	0.06
Lap belt	230	15.19	936	24.86	1,166	22.09
Lap and shoulder	112	7.40	352	9.35	464	8.79
Restraint used, type unknown	100	6.61	393	10.44	493	9.34
Unknown if used	274	18.10	622	16.52	896	16.97
TOTAL	1,514	100.00%	3,765	100.00%	5,279	100.00%

NOTE: The nine 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 4.6% of the involvements. This figure was 4.4% for drivers of tractors and 5.0% for straight truck drivers.

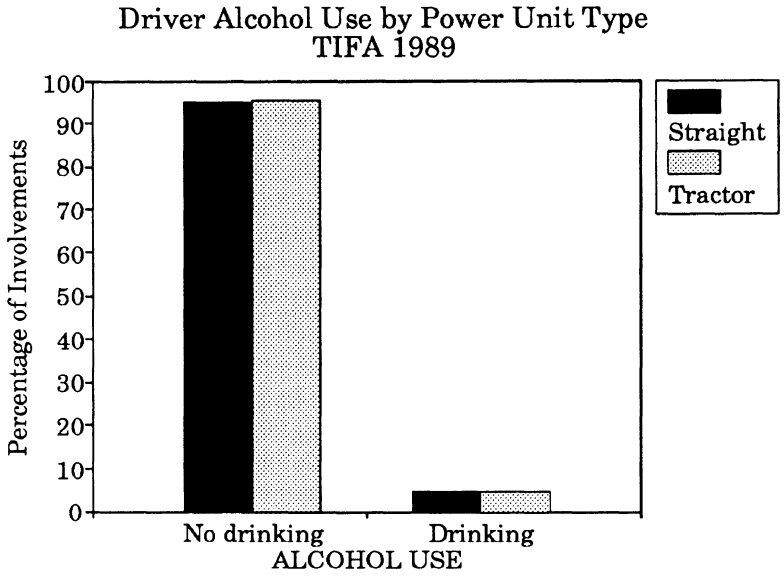


Figure 3-22

TABLE 3-22
Truck Driver Alcohol Use by Power Unit Type
TIFA 1989

Alcohol Use	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
No drinking	1,439	95.05%	3,598	95.56%	5,037	95.42%
Drinking	75	4.95	167	4.44	242	4.58
TOTAL	1,514	100.00%	3,765	100.00%	5,279	100.00%

NOTE: The nine 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 1989, the truck driver was totally ejected in about 4.2% of the fatal involvements and partially ejected in 1.2%. Straight truck drivers were slightly more likely to be ejected in 1989 than tractor drivers.

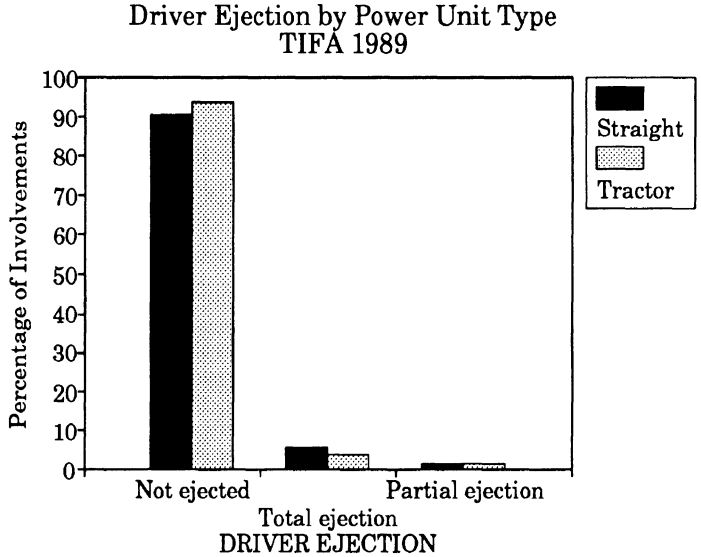


Figure 3-23

TABLE 3-23
Truck Driver Ejection by Power Unit Type
TIFA 1989

Driver Ejection	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
Not ejected	1,371	90.55%	3,524	93.60%	4,895	92.73%
Totally ejected	83	5.48	141	3.75	224	4.24
Partially ejected	18	1.19	43	1.14	61	1.16
Unknown	42	2.77	57	1.51	99	1.88
TOTAL	1,514	100.00%	3,765	100.00%	5,279	100.00%

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

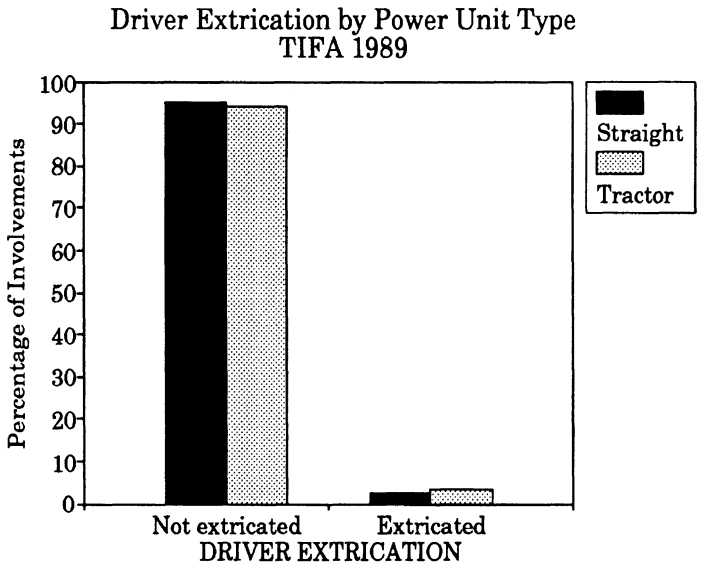


Figure 3-24

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 more common among tractor involvements (3.6%) than among straight truck involvements (2.3%).

TABLE 3-24
Truck Driver Extrication by Power Unit Type
TIFA 1989

Driver Extrication	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
Not extricated	1,439	95.05%	3,543	94.10%	4,982	94.37%
Extricated	35	2.31	134	3.56	169	3.20
Unknown	40	2.64	88	2.34	128	2.42
TOTAL	1,514	100.00%	3,765	100.00%	5,279	100.00%

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

The injury severity distributions for the truck drivers are shown in this figure. "C," "B," and "A" injuries correspond to possible, nonincapacitating, and incapacitating injuries, respectively. FARS records fatalities that 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 14% of the cases. While distributions are similar, straight truck drivers had a slightly higher incidence of non-fatal injuries, and drivers of tractors had a slightly higher proportion of fatalities.

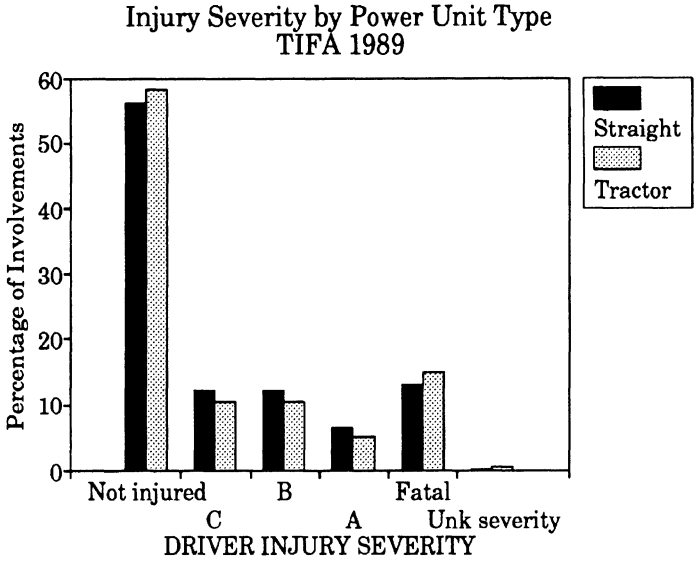


Figure 3-25

TABLE 3-25
Truck Driver Injury Severity by Power Unit Type
TIFA 1989

Injury Severity	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
Not injured	826	54.56%	2,152	57.16%	2,978	56.41%
C injury	179	11.82	388	10.31	567	10.74
B injury	177	11.69	392	10.41	569	10.78
A injury	96	6.34	194	5.15	290	5.49
Fatal injury	190	12.55	552	14.66	742	14.06
Injured, severity unknown	3	0.20	17	0.45	20	0.38
Unknown if injured	43	2.84	70	1.86	113	2.14
TOTAL	1,514	100.00%	3,765	100.00%	5,279	100.00%

NOTE: The nine 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 that the truck driver had been driving at the time of the accident since his last period of eight consecutive hours off duty. The "not applicable" level of this variable refers to accidents in which 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."

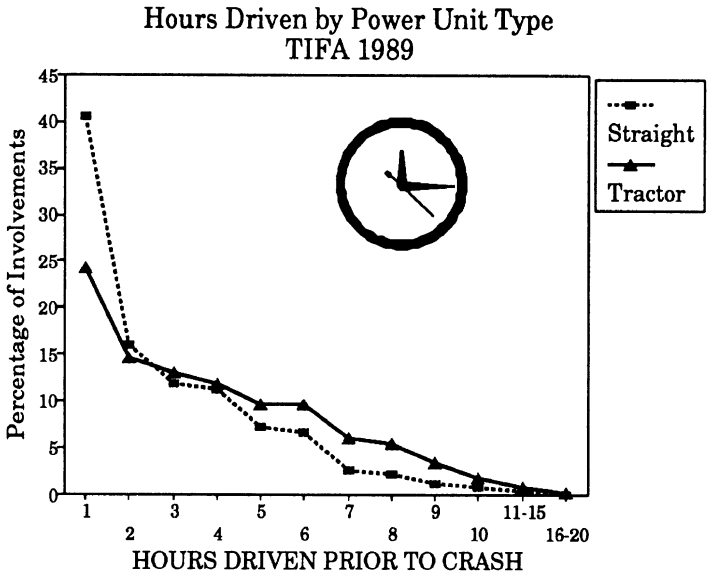


Figure 3-26

A large proportion (19%) 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, 40% of the straight truck drivers had been driving for only an hour, compared with 24% of the tractor drivers. In contrast, only 4.5% of the straight truck drivers had been on duty for eight or more hours prior to the crash, compared with 11.2% 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 1989

Hours Driven	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
1	495	32.69%	743	19.73%	1,238	23.45%
2	197	13.01	446	11.85	643	12.18
3	145	9.58	398	10.57	543	10.29
4	136	8.98	362	9.61	498	9.43
5	86	5.68	290	7.70	376	7.12
6	79	5.22	295	7.84	374	7.08
7	31	2.05	178	4.73	209	3.96
8	26	1.72	166	4.41	192	3.64
9	14	0.92	100	2.66	114	2.16
10	10	0.66	53	1.41	63	1.19
11–15	5	0.33	23	0.61	28	0.53
16–20	0	0.00	1	0.03	1	0.02
N/A	47	3.10	209	5.55	256	4.85
Unknown	243	16.05	501	13.31	744	14.09
TOTAL	1,514	100.00%	3,765	100.00%	5,279	100.00%

NOTE: The nine 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 (7.8%), passing/lane change violations (7.0%), and right-of-way/traffic control violations (6.5%). 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 speed violations/tailgating among the drivers of tractors.

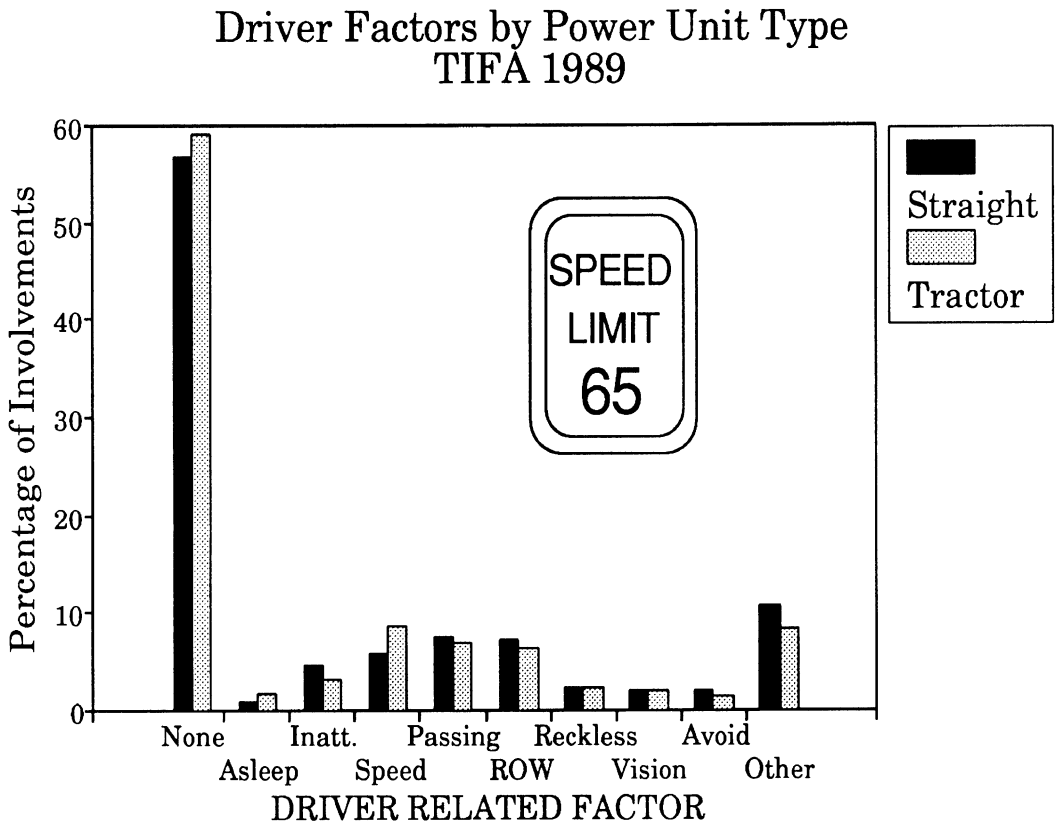


Figure 3-27

TABLE 3-27
Truck Driver Related Factors by Power Unit Type
TIFA 1989

Driver Factor	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
None	854	56.41%	2,196	58.33%	3,050	57.78%
Asleep/Ill	14	0.92	64	1.70	78	1.48
Drugs	1	0.07	11	0.29	12	0.23
Inattentive	68	4.49	122	3.24	190	3.60
Speed violations/ tailgating	89	5.88	320	8.50	409	7.75
Passing/lane change violations	111	7.33	257	6.83	368	6.97
Right-of-way/traffic control violations	110	7.27	232	6.16	342	6.48
Reckless driving	37	2.44	86	2.28	123	2.33
Vision obscured	29	1.92	77	2.05	106	2.01
Avoiding/swerving	29	1.92	56	1.49	85	1.61
Other	159	10.50	311	8.26	470	8.90
Unknown	13	0.86	33	0.88	46	0.87
TOTAL	1,514	100.00%	3,765	100.00%	5,279	100.00%

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

Vehicle Characteristics

This overview section of TIFA 1989 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.

Trucks involved in fatal accidents in 1989 showed great differences in carrier type according to the type of power unit. Of the known cases of carrier type, 41% of the straight trucks fell into the intrastate private category, while 61% of the tractors were in the interstate authorized class. Over 83% of the tractors were owned by interstate companies, compared with only 39% of the straight trucks. Over 70% of the straight trucks were operated by private carriers, compared with only 27% of the tractors.

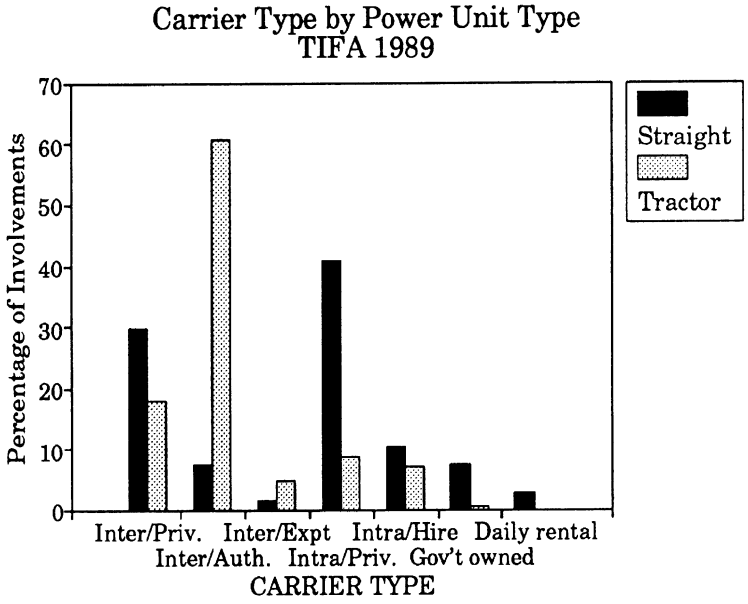


Figure 3-28

TABLE 3-28
Carrier Type by Power Unit Type
TIFA 1989

Carrier Type	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
Interstate private	428	28.27%	642	17.05%	1,070	20.27%
Interstate authorized	107	7.07	2,191	58.19	2,298	43.53
Interstate exempt	24	1.59	170	4.52	194	3.67
Intrastate private	589	38.90	317	8.42	906	17.16
Intrastate for hire	149	9.84	264	7.01	413	7.82
Government owned	108	7.13	23	0.61	131	2.48
Daily rental	39	2.58	0	0.00	39	0.74
Unknown	70	4.62	158	4.20	228	4.32
TOTAL	1,514	100.00%	3,765	100.00%	5,279	100.00%

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

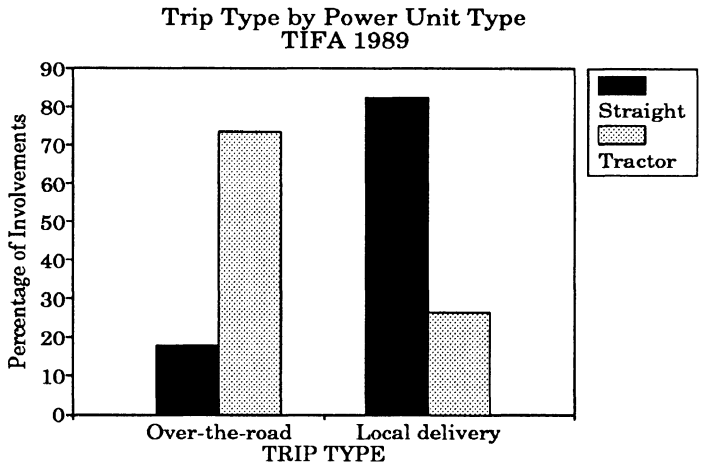


Figure 3-29

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 1989

Trip Type	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
Over-the-road	261	17.24%	2,644	70.23%	2,905	55.03%
Local delivery	1,204	79.52	947	25.15	2,151	40.75
Unknown	49	3.24	174	4.62	223	4.22
TOTAL	1,514	100.00%	3,765	100.00%	5,279	100.00%

NOTE: The nine 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 35% of the straight trucks and 30% 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 (12%), liquids in bulk (6%), and farm products (4%). For tractors, the cargo type distribution included general freight (24%), solids in bulk (9%), refrigerated food (7%), and logs and lumber (5%). The unknown cargo category was excluded from the pie charts.

TABLE 3-30
Type of Cargo by Power Unit Type
TIFA 1989

Cargo Type	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
General freight	180	11.89%	917	24.36%	1,097	20.78%
Household goods	35	2.31	61	1.62	96	1.82
Metal	22	1.45	158	4.20	180	3.41
Heavy machinery	36	2.38	128	3.40	164	3.11
Motor vehicles	2	0.13	23	0.61	25	0.47
Driveaway/towaway	11	0.73	29	0.77	40	0.76
Gases in bulk	17	1.12	12	0.32	29	0.55
Solids in bulk	332	21.93	352	9.35	684	12.96
Liquids in bulk	90	5.94	170	4.52	260	4.93
Explosives	0	0.00	2	0.05	2	0.04
Logs/lumber	37	2.44	196	5.21	233	4.41
Empty	529	34.94	1,144	30.38	1,673	31.69
Refrigerated food	45	2.97	263	6.99	308	5.83
Mobile home	0	0.00	10	0.27	10	0.19
Farm products	63	4.16	149	3.96	212	4.02
Other	79	5.22	24	0.64	103	1.95
Unknown	36	2.38	127	3.37	163	3.09
TOTAL	1,514	100.00%	3,765	100.00%	5,279	100.00%

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

Cargo Type for Straight Trucks
TIFA 1989

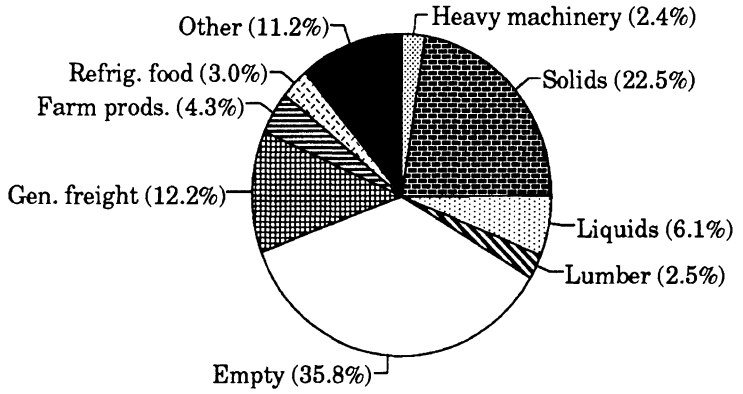


Figure 3-30a

Cargo Type for Tractors
TIFA 1989

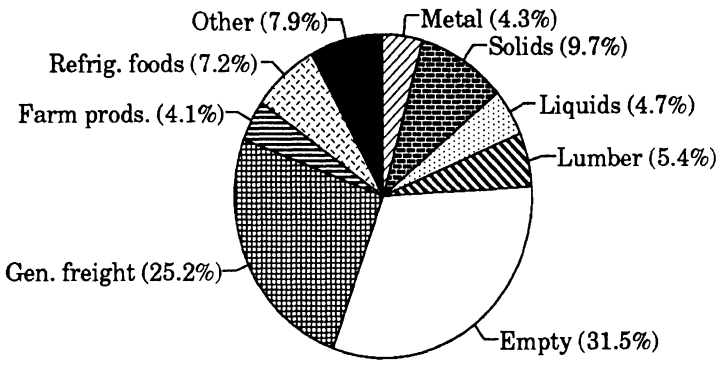


Figure 3-30b

Cab style is split into conventional cabs versus cabover engine and cab-forward cabs. Most of the straight trucks involved in fatal accidents in 1989 had conventional cabs. The majority of involved tractors were also conventional cabs, but to a lesser extent than the straight trucks.

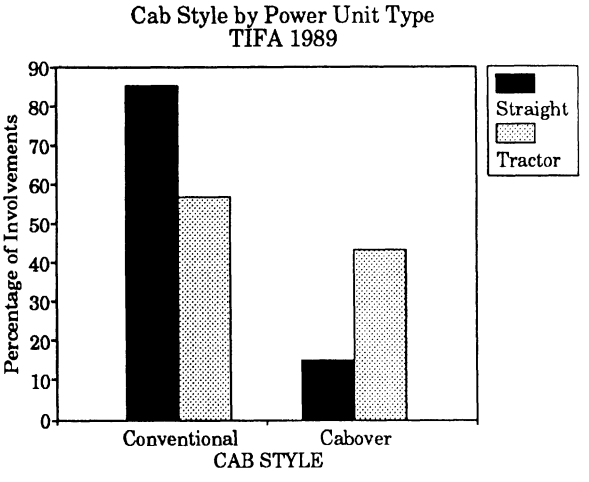


Figure 3-31

TABLE 3–31
Cab Style by Power Unit Type
TIFA 1989

Cab Style	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
Conventional	1,279	84.48%	2,088	55.46%	3,367	63.78%
Cabover/Cab-forward	227	14.99	1,584	42.07	1,811	34.31
Unknown	8	0.53	93	2.47	101	1.91
TOTAL	1,514	100.00%	3,765	100.00%	5,279	100.00%

NOTE: The nine 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, 91% of the straight trucks were not hauling a trailer, and nearly 88% of the tractors were hauling a single trailer. While there were four tractors with three trailing units, only two were triples (three cargo units), and the other two were heavy equipment haulers with a jeep, lowboy and booster dolly combination.

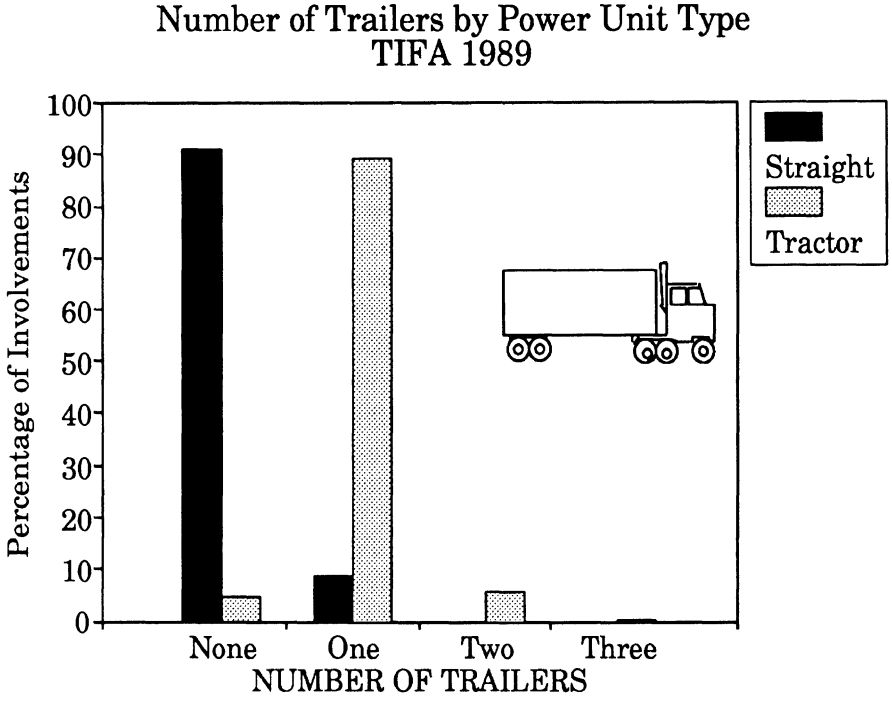


Figure 3-32

TABLE 3-32
Number of Trailers by Power Unit Type
TIFA 1989

Number of Trailers	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
No trailers	1,378	91.02%	178	4.73%	1,556	29.48%
One trailer	132	8.72	3,299	87.62	3,431	64.99
Two trailers	0	0.00	214	5.68	214	4.05
Three trailers	0	0.00	4	0.11	4	0.08
Unknown	4	0.26	70	1.86	74	1.40
TOTAL	1,514	100.00%	3,765	100.00%	5,279	100.00%

NOTE: The nine 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, or all other types. Again there is a great difference according to power unit type. Over 97% of the involved tractors used diesel fuel, while the straight trucks were split between diesel and gasoline, 66% and 32% respectively.

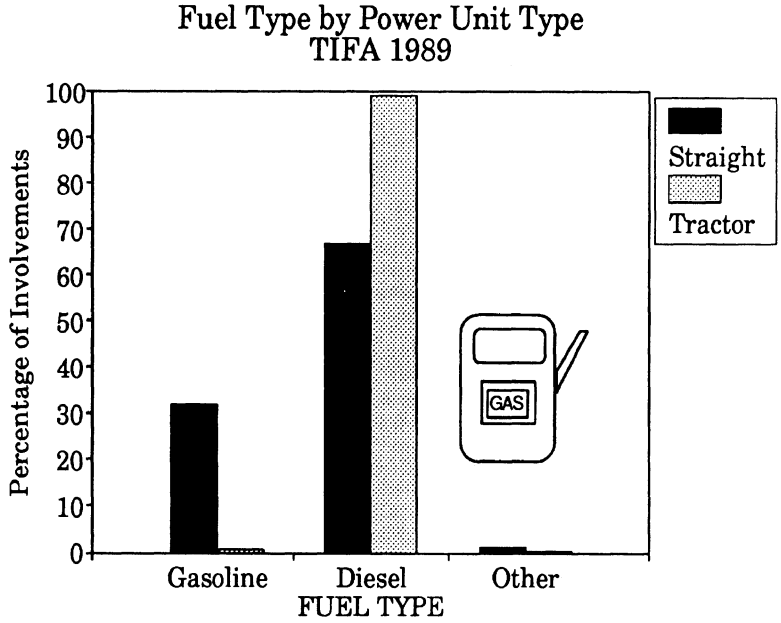


Figure 3-33

TABLE 3-33
Fuel Type by Power Unit Type
TIFA 1989

Fuel Type	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
Gasoline	481	31.77%	17	0.45%	498	9.43%
Diesel	1,005	66.38	3,654	97.05	4,659	88.26
Other	20	1.32	7	0.18	27	0.51
Unknown	8	0.53	87	2.31	95	1.80
TOTAL	1,514	100.00%	3,765	100.00%	5,279	100.00%

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

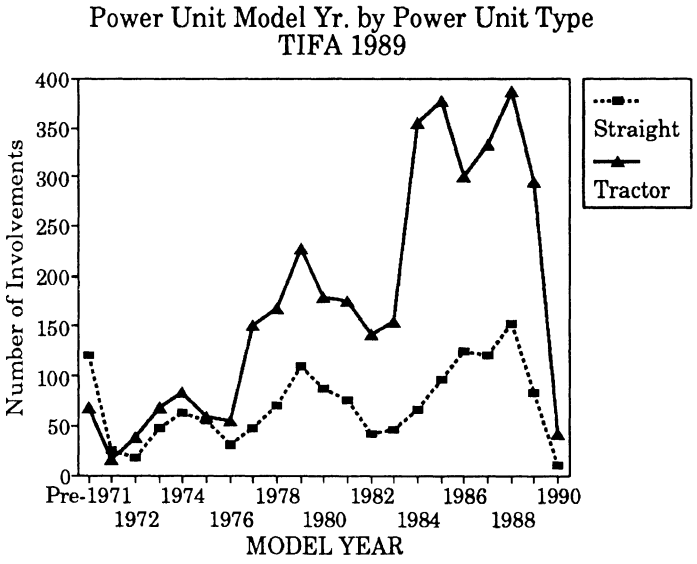


Figure 3-34

The line graph on the left depicts the number of fatal involvements in 1989 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, 57% of the tractors were from model years 1984-1990, compared with 44% of the straight trucks. On the other hand, over 22% of the straight trucks dated from 1975 and earlier, as opposed to 9% 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.

TABLE 3-34
Model Year of Power Unit by Power Unit Type
TIFA 1989

Model Year	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
1950–1970	122	8.06%	69	1.83%	191	3.62%
1971	26	1.72	17	0.45	43	0.81
1972	19	1.25	40	1.06	59	1.12
1973	49	3.24	69	1.83	118	2.24
1974	64	4.23	84	2.23	148	2.80
1975	55	3.63	60	1.59	115	2.18
1976	31	2.05	56	1.49	87	1.65
1977	48	3.17	150	3.98	198	3.75
1978	71	4.69	169	4.49	240	4.55
1979	110	7.27	227	6.03	337	6.38
1980	87	5.75	179	4.75	266	5.04
1981	77	5.09	176	4.67	253	4.79
1982	43	2.84	142	3.77	185	3.50
1983	46	3.04	155	4.12	201	3.81
1984	66	4.36	354	9.40	420	7.96
1985	97	6.41	376	9.99	473	8.96
1986	124	8.19	300	7.97	424	8.03
1987	121	7.99	331	8.79	452	8.56
1988	153	10.11	386	10.25	539	10.21
1989	84	5.55	294	7.81	378	7.16
1990	11	0.73	43	1.14	54	1.02
Unknown	10	0.66	88	2.34	98	1.86
TOTAL	1,514	100.00%	3,765	100.00%	5,279	100.00%

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

FATAL ACCIDENT EXPERIENCE OF STRAIGHT TRUCKS IN 1989

Distributions that characterize fatal accident involvements of straight trucks in 1989 are presented in this section. Most of the variables are presented according to the cargo body style of the trucks. Cargo body style is known for 99.6% of the 1,514 straight trucks in the TIFA 1989 file. Of the known cases, 28% were dumps, 23% vans, 9% refuse, 9% tanks, and 7% flatbeds. 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 its rated capacity. Of the known cases of GVWR, 88.6% 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. The GVWR distributions vary according to cargo body style. Vans and flatbeds were represented throughout the range of GVWRs. Tanks, dumps, and refuse trucks typically had GVWRs in classes 6 through 8.

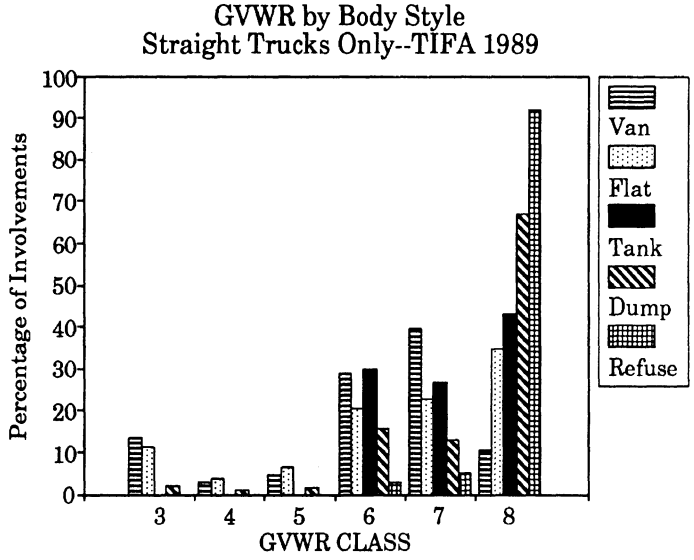


Figure 4-1

TABLE 4-1
GVWR by Body Style
Straight Trucks Only
TIFA 1989

GVWR Class/ Weight Range	BODY STYLE (Frequencies and Column Percents							
	Van	Flatbed	Tank	Dump	Refuse	Other	Unknown	TOTAL
3 10,001–14,000	44 12.87	12 10.91	0 0.00	8 1.89	0 0.00	27 7.54	0 0.00	91 6.01
4 14,001–16,000	9 2.63	4 3.64	0 0.00	4 0.95	0 0.00	12 3.35	2 33.33	31 2.05
5 16,001–19,500	15 4.39	7 6.36	0 0.00	6 1.42	0 0.00	15 4.19	0 0.00	43 2.84
6 19,501–26,000	94 27.49	22 20.00	41 28.87	63 14.89	4 3.01	80 22.35	0 0.00	304 20.08
7 26,001–33,000	127 37.13	24 21.82	37 26.06	52 12.29	7 5.26	47 13.13	1 16.67	295 19.48
8 33,001+	34 9.94	37 33.64	59 41.55	269 63.59	121 90.98	158 44.13	1 16.67	679 44.85
Unknown	19 5.56	4 3.64	5 3.52	21 4.96	1 0.75	19 5.31	2 33.33	71 4.69
TOTAL	342 100.00	110 100.00	142 100.00	423 100.00	133 100.00	358 100.00	6 100.00	1,514 100.00

TABLE 4-2
Gross Vehicle Weight by Body Style
Straight Trucks Only
TIFA 1989

Gross Weight (Frequencies and Col. Pcts.)	Van	Flatbed	Tank	Dump	Refuse	Other	Unknown	TOTAL
< 20,000	212 61.99	58 52.73	35 24.65	111 26.24	1 0.75	139 38.83	0 0.00	556 36.72
20,000	52 15.20	27 24.55	46 32.39	109 25.77	32 24.06	70 19.55	0 0.00	336 22.19
30,000	12 3.51	4 3.64	17 11.97	43 10.17	46 34.59	39 10.89	2 33.33	163 10.77
40,000	0 0.00	1 0.91	10 7.04	38 8.98	19 14.29	16 4.47	0 0.00	84 5.55
50,000	1 0.29	4 3.64	13 9.15	36 8.51	5 3.76	23 6.42	0 0.00	82 5.42
60,000	1 0.29	2 1.82	0 0.00	21 4.96	4 3.01	8 2.23	0 0.00	36 2.38
70,000	0 0.00	1 0.91	1 0.70	18 4.26	2 1.50	2 0.56	0 0.00	24 1.59
80,000+	0 0.00	2 1.82	5 3.52	10 2.36	4 3.01	3 0.84	0 0.00	24 1.59
Unknown	64 18.71	11 10.00	15 10.56	37 8.75	20 15.04	58 16.20	4 66.67	209 13.80
TOTAL	342 100.00	110 100.00	142 100.00	423 100.00	133 100.00	358 100.00	6 100.00	1,514 100.00

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 1989 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 14% of the straight truck cases. For the known cases, 68% were operating at a gross weight of under 30,000 pounds, and 81% had a gross weight of less than 40,000 pounds. Of course the gross vehicle weight varied according to the cargo body style. Less than 1% of the involved vans were at a weight of at least 40,000 pounds, compared with 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 78% of the dumps, 85% of the tanks, and 99.3% of the vans were operating at a gross weight under 50,000 pounds.

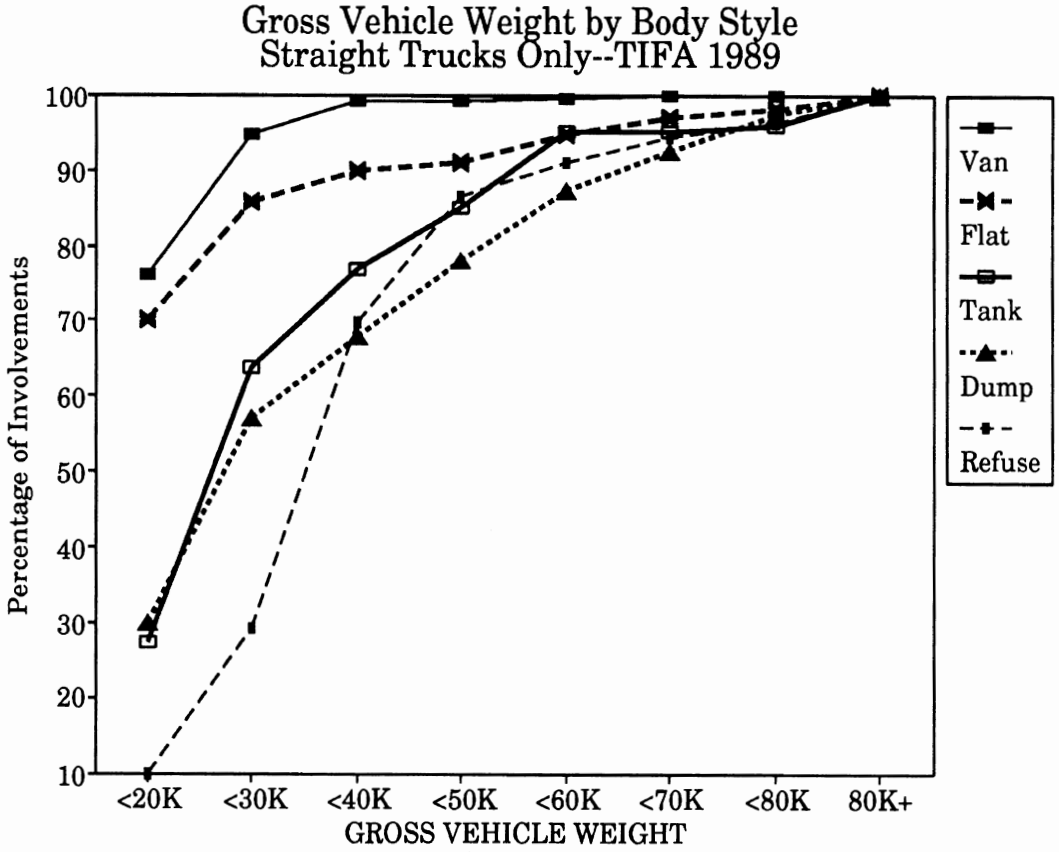


Figure 4-2

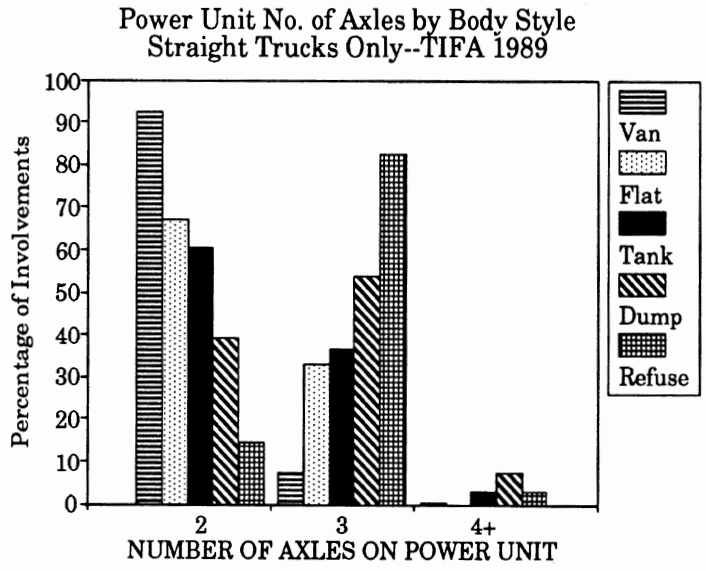


Figure 4-3

The number of axles on the power unit for the 1989 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 over 7% of the dumps and smaller proportions of the tanks and refuse trucks.

TABLE 4-3
Number of Axles on Power Unit by Body Style
Straight Trucks Only
TIFA 1989

Power Unit No. of Axles (Frequencies and Col. Pcts.)	Van	Flatbed	Tank	Dump	Refuse	Other	Unknown	TOTAL
2	316 92.40	73 66.36	86 60.56	165 39.01	19 14.29	211 58.94	0 0.00	870 57.46
3	25 7.31	36 32.73	52 36.62	227 53.66	110 82.71	123 34.36	2 33.33	575 37.98
4+	1 0.29	0 0.00	4 2.82	31 7.33	4 3.01	23 6.42	0 0.00	63 4.16
Unknown	0 0.00	1 0.91	0 0.00	0 0.00	0 0.00	1 0.28	4 66.67	6 0.40
TOTAL	342 100.00	110 100.00	142 100.00	423 100.00	133 100.00	358 100.00	6 100.00	1,514 100.00

The table below attempts to characterize the configuration of the straight trucks in terms of the 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, and for trucks when it was unknown if they were 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 1,514 straight trucks was a 2-axle truck not hauling a trailer, with 816 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 55 cases.

TABLE 4-4
Number of Axles on Power Unit and Trailers
Straight Trucks Only
TIFA 1989

Power Unit No. of Axles	Number of Trailers/Number of Axles on Trailer							
		One Trailer					Unknown if Trailer	TOTAL
	No Trailer	1	2	3	4+	Unk.		
2	816	17	32	5	0	0	0	870
3	505	5	55	8	2	0	0	575
4+	56	0	2	0	5	0	0	63
Unknown	1	0	0	0	0	1	4	6
TOTAL	1,378	22	89	13	7	1	4	1,514

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 20.5% of the vans to 46.4% of the flatbeds.

TABLE 4-5
Cargo Type by Body Style
Straight Trucks Only
TIFA 1989

Cargo Type (Frequencies and Col. Pcts.)	Van	Flatbed	Tank	Dump	Refuse	Other	Unknown	TOTAL
General freight	151 44.15	11 10.00	0 0.00	0 0.00	0 0.00	17 4.75	1 16.67	180 11.89
Household goods	34 9.94	0 0.00	0 0.00	0 0.00	0 0.00	1 0.28	0 0.00	35 2.31
Metal	3 0.88	5 4.55	0 0.00	1 0.24	0 0.00	13 3.63	0 0.00	22 1.45
Heavy machinery	4 1.17	4 3.64	0 0.00	11 2.60	0 0.00	17 4.75	0 0.00	36 2.38
Motor vehicles	0 0.00	0 0.00	0 0.00	2 0.47	0 0.00	0 0.00	0 0.00	2 0.13
Driveaway/tow	0 0.00	0 0.00	0 0.00	1 0.24	0 0.00	10 2.23	0 0.00	11 0.59
Gases in bulk	0 0.00	0 0.00	17 11.97	0 0.00	0 0.00	0 0.00	0 0.00	17 1.12
Solids in bulk	7 2.05	4 3.64	0 0.00	185 43.74	79 59.40	57 15.92	0 0.00	332 21.93
Liquids in bulk	0 0.00	0 0.00	88 61.97	0 0.00	0 0.00	2 0.56	0 0.00	90 5.94
Logs/lumber	2 0.58	14 12.73	0 0.00	7 1.65	0 0.00	14 3.91	0 0.00	37 2.44
Empty	70 20.47	51 46.36	36 25.35	177 41.84	50 37.59	144 40.22	1 16.67	529 34.94
Refrig. food	45 13.16	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	45 2.97
Farm products	7 2.05	10 9.09	0 0.00	28 6.62	0 0.00	18 5.03	0 0.00	63 4.16
Other	4 1.17	6 5.45	1 0.70	4 0.95	0 0.00	64 17.88	0 0.00	79 5.22
Unknown	15 4.39	5 4.55	0 0.00	7 1.65	4 3.01	1 0.28	4 66.67	36 2.38
TOTAL	342 100.00	110 100.00	142 100.00	423 100.00	133 100.00	358 100.00	6 100.00	1,514 100.00

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. Cases with unknown cargo have been omitted from the pie graphs.

Cargo Type for Van Straight Trucks
TIFA 1989

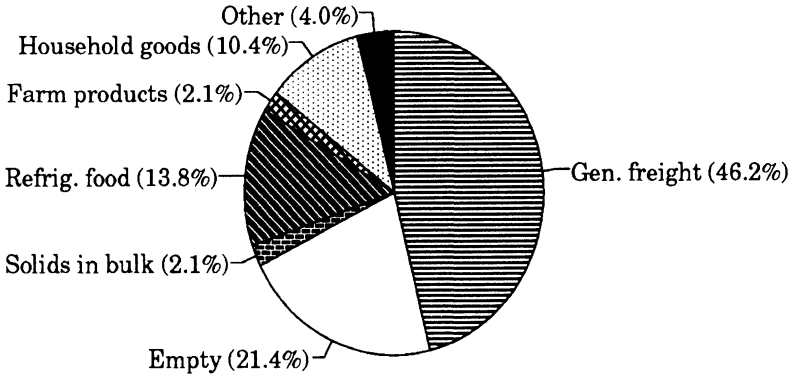


Figure 4-5a

Cargo Type for Flatbed Straight Trucks
TIFA 1989

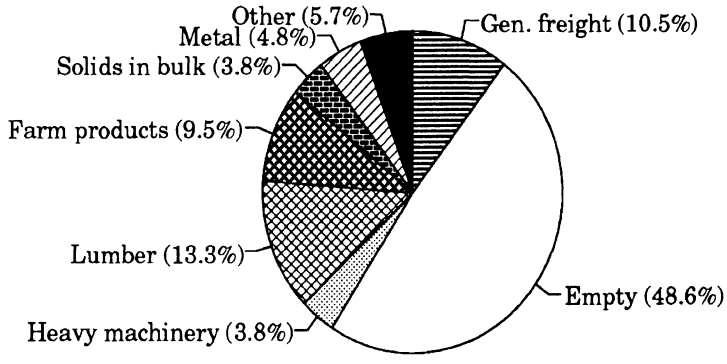


Figure 4-5b

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 52% of the known cases. Vans also had the highest percentage of interstate authorized carriers at 13%. On the other hand, dumps were characterized by the highest proportion of intrastate carriers, with 62%, and refuse trucks by the highest percentage of intrastate private carriers, with 58% of the known cases.

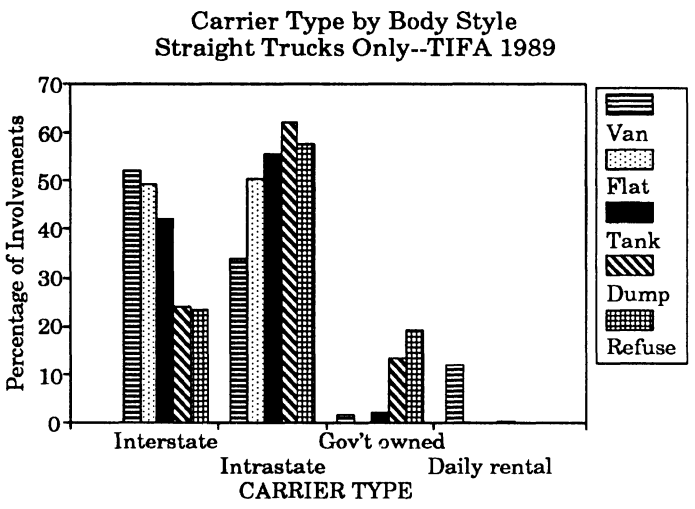


Figure 4-6

TABLE 4-6
Carrier Type by Body Style
Straight Trucks Only
TIFA 1989

Carrier Type (Frequencies and Col. Pcts.)	Van	Flatbed	Tank	Dump	Refuse	Other	Unknown	TOTAL
Interstate private	122 35.67	42 38.18	40 28.17	62 14.66	24 18.05	137 38.27	1 16.67	428 28.27
Interstate authorized	43 12.57	9 8.18	12 8.45	30 7.09	1 0.75	11 3.07	1 16.67	107 7.07
Interstate exempt	2 0.58	0 0.00	8 5.63	6 1.42	4 3.01	4 1.12	0 0.00	24 1.59
Intrastate private	88 25.73	42 38.18	68 47.89	169 39.95	72 54.14	150 41.90	0 0.00	589 38.90
Intrastate for hire	20 5.85	10 9.09	11 7.75	85 20.09	0 0.00	23 6.42	0 0.00	149 9.84
Government owned	6 1.75	0 0.00	3 2.11	55 13.00	24 18.05	20 5.59	0 0.00	108 7.13
Daily rental	33 9.65	1 0.91	0 0.00	2 0.47	0 0.00	3 0.84	0 0.00	39 2.58
Unknown	23 6.73	7 6.36	0 0.00	15 3.55	8 6.02	13 3.63	4 66.67	70 4.62
TOTAL	342 100.00	110 100.00	142 100.00	423 100.00	133 100.00	358 100.00	6 100.00	1,514 100.00

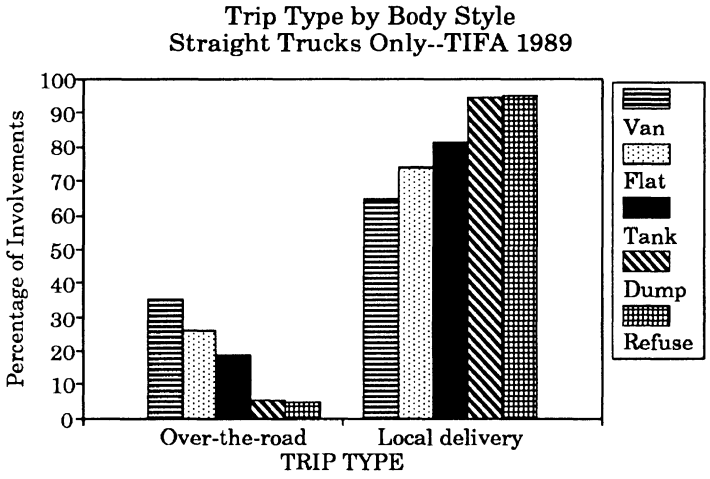


Figure 4-7

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 (35%), followed by flatbeds (26%), tanks (18%), dumps (6%), and refuse trucks (5%).

TABLE 4-7
Trip Type by Body Style
Straight Trucks Only
TIFA 1989

Trip Type (Frequencies and Col. Pcts.)	Van	Flatbed	Tank	Dump	Refuse	Other	Unknown	TOTAL
Over-the-road	114 33.33	27 24.55	26 18.31	23 5.44	6 4.51	64 17.88	1 16.67	261 17.24
Local delivery	210 61.40	76 69.09	115 80.99	393 92.91	121 90.98	288 80.45	1 16.67	1,204 79.52
Unknown	18 5.26	7 6.36	1 0.70	7 1.65	6 4.51	6 1.68	4 66.67	49 3.24
TOTAL	342 100.00	110 100.00	142 100.00	423 100.00	133 100.00	358 100.00	6 100.00	1,514 100.00

There is less variation among the different types of straight trucks for the class of road where the accident occurred. Overall, nearly 49% of the straight truck involvements occurred on major arteries, and all categories of cargo body styles had a substantial proportion of involvements on these roads. Only 12% of the overall involvements occurred on limited access roads, but the percentages for flatbeds and vans were slightly higher. Almost 39% of all the accidents took place on the "other" class of roads, but this category was under represented among the vans, and over represented among refuse and tank trucks.

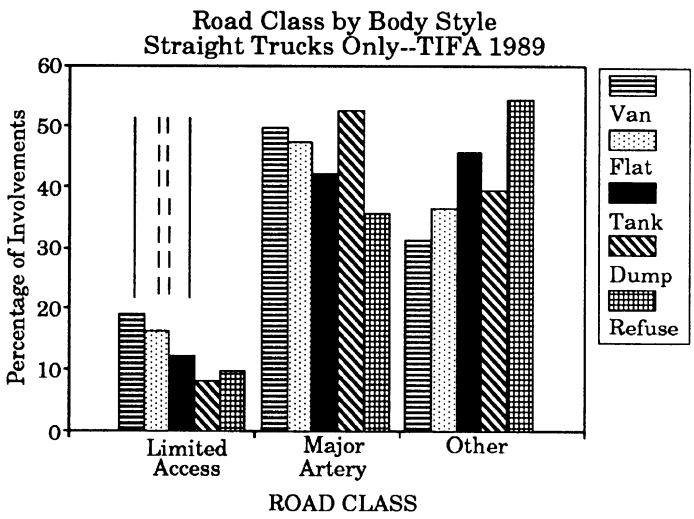


Figure 4-8

TABLE 4-8
Road Class by Body Style
Straight Trucks Only
TIFA 1989

Road Class (Frequencies and Col. Pcts.)	Van	Flatbed	Tank	Dump	Refuse	Other	Unknown	TOTAL
Limited Access	65 19.01	18 16.36	17 11.97	34 8.04	13 9.77	36 10.06	0 0.00	183 12.09
Major Artery	169 49.42	52 47.27	59 41.55	220 52.01	47 35.34	188 52.51	3 50.00	738 48.75
Other	106 30.99	40 36.36	64 45.07	165 39.01	72 54.14	133 37.15	3 50.00	583 38.51
Unknown	2 0.58	0 0.00	2 1.41	4 0.95	1 0.75	1 0.28	0 0.00	10 0.66
TOTAL	342 100.00	110 100.00	142 100.00	423 100.00	133 100.00	358 100.00	6 100.00	1,514 100.00

Accidents

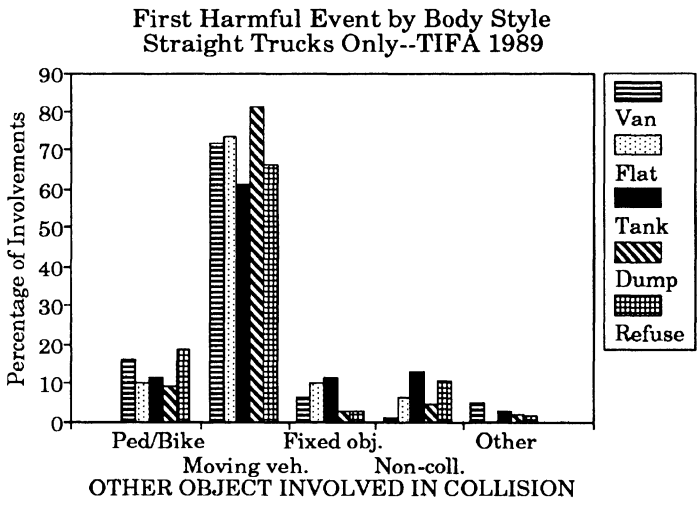


Figure 4-9

The graph on the left illustrates the distribution of the first harmful event in the accident for the 1989 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 among the different straight trucks include a higher proportion of pedestrian accidents among refuse trucks and vans, and a higher incidence of non-collisions among tanks.

TABLE 4-9
First Harmful Event by Body Style
Straight Trucks Only
TIFA 1989

First Harmful Event (Frequencies and Col. Pcts.)	Van	Flatbed	Tank	Dump	Refuse	Other	Unknown	TOTAL
Pedestrian	39 11.40	8 7.27	12 8.45	29 6.86	19 14.29	26 7.26	3 50.00	136 8.98
Pedalcyclist	16 4.68	3 2.73	4 2.82	10 2.36	6 4.51	10 2.79	0 0.00	49 3.24
Train	5 1.46	0 0.00	4 2.82	6 1.42	1 0.75	3 0.84	0 0.00	19 1.25
Moving vehicle	245 71.64	81 73.64	87 61.27	344 81.32	88 66.17	278 77.65	3 50.00	1,126 74.37
Parked vehicle	8 2.34	0 0.00	0 0.00	1 0.24	1 0.75	1 0.28	0 0.00	11 0.72
Other non-fixed object	4 1.17	0 0.00	0 0.00	2 0.47	0 0.00	1 0.28	0 0.00	7 0.46
Fixed object	21 6.14	11 10.00	16 11.27	12 2.84	4 3.01	21 5.87	0 0.00	85 5.61
Non-collision	4 1.17	7 6.36	19 13.38	19 4.49	14 10.53	18 5.03	0 0.00	81 5.35
TOTAL	342 100.00	110 100.00	142 100.00	423 100.00	133 100.00	358 100.00	6 100.00	1,514 100.00

Most harmful event is a FARS variable that categorizes the most severe event in the accident sequence for each vehicle. The graph on the right illustrates the distribution of most harmful event for the 1989 TIFA straight trucks by body style. In comparing the most harmful event with the first harmful event, the primary differences are the higher incidence of non-collisions, such as rollovers, explosions, and fires, among tanks and the lower incidence of fixed object collisions for all five cargo body styles.

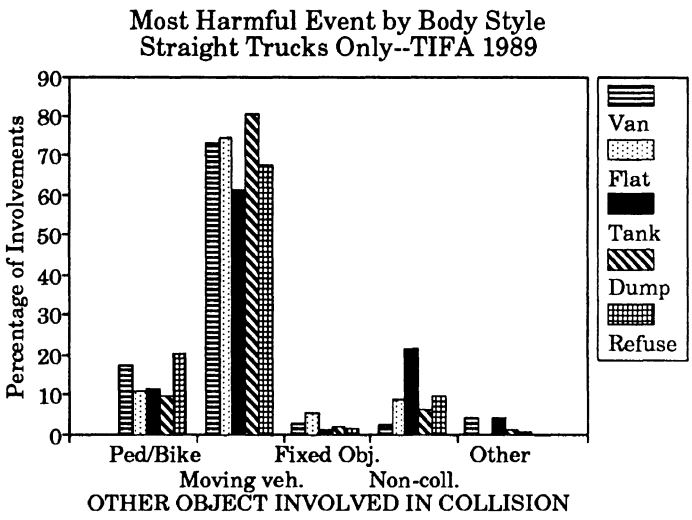


Figure 4-10

TABLE 4-10
Most Harmful Event by Body Style
Straight Trucks Only
TIFA 1989

Most Harmful Event (Frequencies and Col. Pcts.)	Van	Flatbed	Tank	Dump	Refuse	Other	Unknown	TOTAL
Pedestrian	44 12.87	9 8.18	12 8.45	31 7.33	21 15.79	27 7.54	3 50.00	147 9.71
Pedalcyclist	16 4.68	3 2.73	4 2.82	10 2.36	6 4.51	10 2.79	0 0.00	49 3.24
Train	5 1.46	0 0.00	4 2.82	6 1.42	1 0.75	3 0.84	0 0.00	19 1.25
Moving vehicle	250 73.10	82 74.55	87 61.27	341 80.61	90 67.67	270 75.42	3 50.00	1,123 74.17
Parked vehicle	4 1.17	0 0.00	2 1.41	0 0.00	0 0.00	1 0.28	0 0.00	7 0.46
Other non-fixed object	5 1.46	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	5 0.33
Fixed object	10 2.92	6 5.45	2 1.41	9 2.13	2 1.50	16 4.47	0 0.00	45 2.97
Non-collision	8 2.34	10 9.09	31 21.83	26 6.15	13 9.77	31 8.66	0 0.00	119 7.86
TOTAL	342 100.00	110 100.00	142 100.00	423 100.00	133 100.00	358 100.00	6 100.00	1,514 100.00

The manner of collision distributions are shown in the graph at right for the 1,126 straight truck involvements where the first harmful event was a collision with another motor vehicle. Overall, angle collisions were the most common type (46%), followed by head-ons (29%), rear-ends (20%), and sideswipes (5%). Most of the different cargo body styles had collision type distributions similar to the overall pattern. The major exceptions were the overinvolvement of vans (34.7%) in head-on collisions, and of flatbeds (54.3%) and tanks (54.0%) in angle collisions. Tanks had the lowest percentage of rear-end collisions (11.5%).

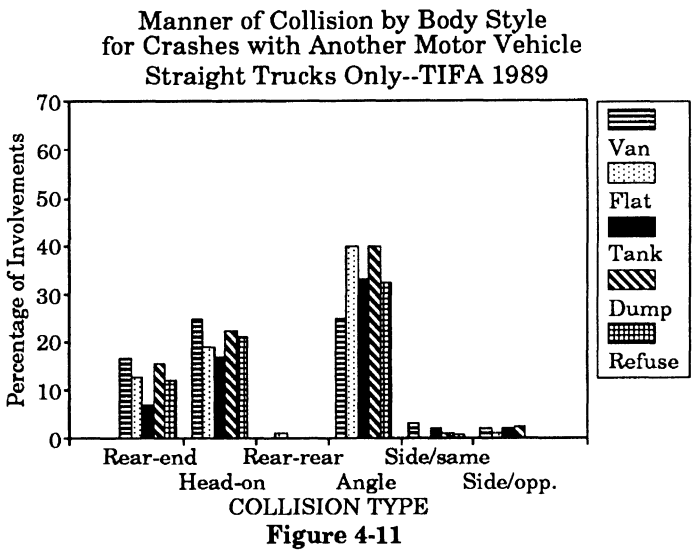


Figure 4-11

TABLE 4-11
Manner of Collision by Body Style
for Crashes with Another Motor Vehicle
Straight Trucks Only
TIFA 1989

Manner of Collision (Frequencies and Col. Pcts.)	Van	Flatbed	Tank	Dump	Refuse	Other	Unknown	TOTAL
Rear-end	57 23.27	14 17.28	10 11.49	66 19.19	16 18.18	64 23.02	0 0.00	227 20.16
Head-on	85 34.69	21 25.93	24 27.59	95 27.62	28 31.82	68 24.46	0 0.00	321 28.51
Rear-to-rear	0 0.00	1 1.23	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	1 0.09
Angle	85 34.69	44 54.32	47 54.02	169 49.13	43 48.86	125 44.96	3 100.00	516 45.83
Sideswipe, same dir.	11 4.49	0 0.00	3 3.45	4 1.16	1 1.14	5 1.80	0 0.00	24 2.13
Sideswipe, opp. dir.	7 2.86	1 1.23	3 3.45	10 2.91	0 0.00	16 5.76	0 0.00	37 3.29
TOTAL	245 100.00	81 100.00	87 100.00	344 100.00	88 100.00	278 100.00	3 100.00	1,126 100.00

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 proportion of casualties among tank truck drivers, 57.7% of the known cases, compared to the overall average of 43.8%. The incidence of driver fatality was especially high among tank trucks with 32.8% of the known cases. The overall incidence of fatalities among the straight truck drivers was 12.6%.

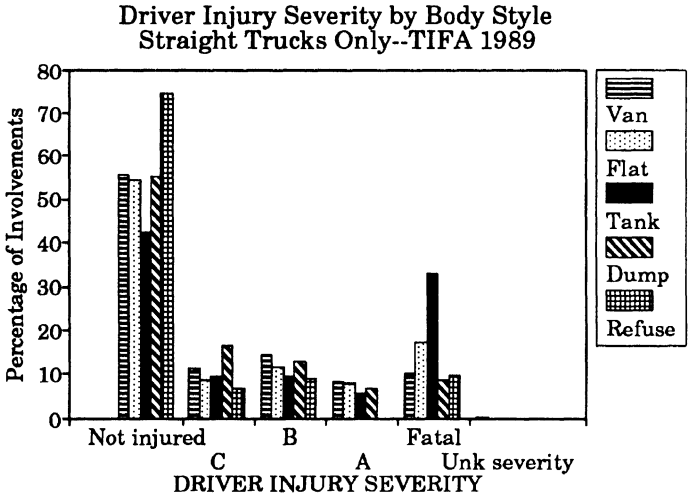


Figure 4-12

TABLE 4–12
Truck Driver Injury Severity by Body Style
Straight Trucks Only
TIFA 1989

Injury Severity (Frequencies and Col. Pcts.)	Van	Flatbed	Tank	Dump	Refuse	Other	Unknown	TOTAL
Not injured	184 53.80	56 50.91	58 40.85	231 54.61	99 74.44	194 54.19	4 66.67	826 54.56
C injury, possible	37 10.82	9 8.18	13 9.15	69 16.31	9 6.77	42 11.73	0 0.00	179 11.82
B injury, not incapacitating	48 14.04	12 10.91	13 9.15	53 12.53	12 9.02	37 10.34	2 33.33	177 11.69
A injury, incapacitating	28 8.19	8 7.27	8 5.63	29 6.86	0 0.00	23 6.42	0 0.00	96 6.34
Fatal injury	33 9.65	18 16.36	45 31.69	36 8.51	13 9.77	45 12.57	0 0.00	190 12.55
Injured, severity unknown	1 0.29	0 0.00	0 0.00	0 0.00	0 0.00	2 0.56	0 0.00	3 0.20
Unknown if injured	11 3.22	7 6.36	5 3.52	5 1.18	0 0.00	15 4.19	0 0.00	43 2.84
TOTAL	342 100.00	110 100.00	142 100.00	423 100.00	133 100.00	358 100.00	6 100.00	1,514 100.00

Next, driver injury severity is considered for all TIFA 1989 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 (56%), followed by the rear (15%) and the right side (11%). Although non-collisions represented only 3.5% of all fatal involvements, they accounted for 17.4% of the cases in which the truck driver died.

TABLE 4-13A
Driver Injury Severity by Principal Impact Point
for Straight Trucks—Frequencies
TIFA 1989

Principal Impact Point	Driver Injury Severity							
	Not Injured	C	B	A	Fatal	Injured, severity unk	Unknown if injured	TOTAL
Noncollision	14	0	1	5	33	0	0	53
Right side	93	26	21	5	25	1	0	171
Rear	152	21	17	2	8	0	27	227
Left side	60	7	12	5	10	0	8	102
Front	436	113	119	74	98	2	3	845
Top	1	4	1	3	8	0	2	19
Undercarriage	58	4	2	1	4	0	1	70
Override	2	2	2	0	0	0	0	6
Unknown	10	2	2	1	4	0	2	21
TOTAL	826	179	177	96	190	3	43	1,514

TABLE 4-13B
Driver Injury Severity by Principal Impact Point
for Straight Trucks—Column Percentages
TIFA 1989

Principal Impact Point	Driver Injury Severity							
	Not Injured	C	B	A	Fatal	Injured, sev unk	Unk if injured	TOTAL
Noncollision	1.69%	0.00%	0.56%	5.21%	17.37%	0.00%	0.00%	3.50%
Right side	11.26	14.53	11.86	5.21	13.16	33.33	0.00	11.29
Rear	18.40	11.73	9.60	2.08	4.21	0.00	62.79	14.99
Left side	7.26	3.91	6.78	5.21	5.26	0.00	18.60	6.74
Front	52.78	63.13	67.23	77.08	51.58	66.67	6.98	55.81
Top	0.12	2.23	0.56	3.13	4.21	0.00	4.65	1.25
Undercar.	7.02	2.23	1.13	1.04	2.11	0.00	2.33	4.62
Override	0.24	1.12	1.13	0.00	0.00	0.00	0.00	0.40
Unknown	1.21	1.12	1.13	1.04	2.11	0.00	4.65	1.39
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 (62%), and resulted in driver casualties in 74% of the cases. The category with the next highest percentage of truck driver casualties was front area impacts (48%). Involvements in which the principal impact area was the rear of the truck were among the safest for the truck driver. The driver was uninjured in 76% of these cases.

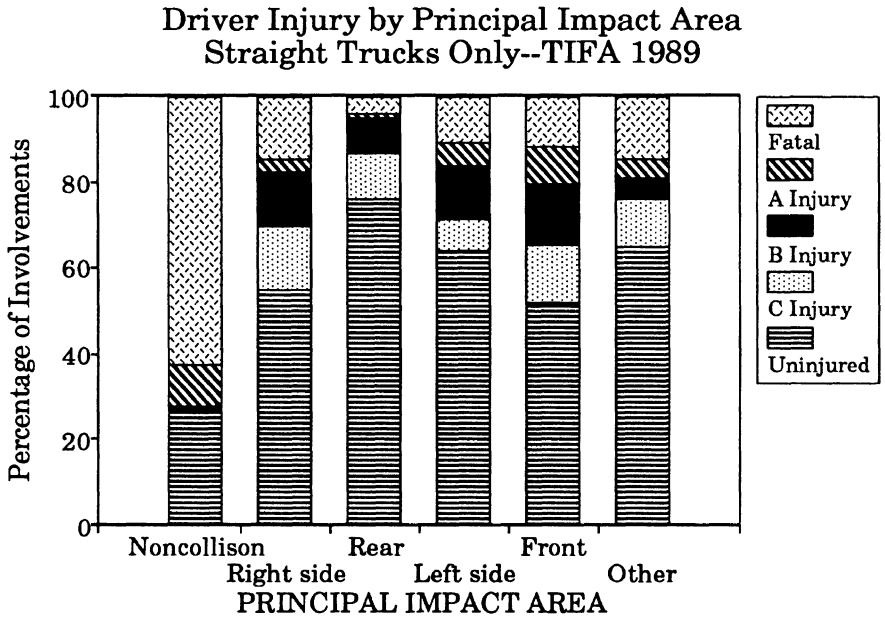


Figure 4-13

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 79% of the straight truck involvements, there was no rollover, fire, or ejection. In 9% 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 in which 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 17% there was a rollover only; and in 19% 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 95%.

TABLE 4-14A
Driver Injury Severity by Rollover/Fire/Ejection for Straight Trucks—Frequencies
TIFA 1989

Occurrence of Rollover/Fire/Ejection	Driver Injury Severity							
	Not Injured	C	B	A	Fatal	Injured, severity unk	Unknown if injured	TOTAL
None	784	155	139	56	59	2	4	1,199
Rollover only	30	24	26	26	32	0	2	140
Fire only	10	0	7	2	3	0	2	24
Ejection only	1	0	2	9	36	0	0	48
Rollover/Fire	0	0	0	0	12	1	0	13
Fire/Ejection	0	0	2	1	1	0	0	4
Rollover/Ejection	0	0	0	2	47	0	0	49
Unknown	1	0	1	0	0	0	35	37
TOTAL	826	179	177	96	190	3	43	1,514

TABLE 4-14B
Driver Injury Severity by Rollover/Fire/Ejection for Straight Trucks—Column Percentages
TIFA 1989

Occurrence of Rollover/Fire/Ejection	Driver Injury Severity							
	Not Injured	C	B	A	Fatal	Injured, sev unk	Unk if injured	TOTAL
None	94.92%	86.59%	78.53%	58.33%	31.05%	66.67%	9.30%	79.19%
Rollover only	3.63	13.41	14.69	27.08	16.84	0.00	4.65	9.25
Fire only	1.21	0.00	3.95	2.08	1.58	0.00	4.65	1.59
Ejection only	0.12	0.00	1.13	9.38	18.95	0.00	0.00	3.17
Rollover/Fire	0.00	0.00	0.00	0.00	6.32	33.33	0.00	0.86
Fire/Ejection	0.00	0.00	1.13	1.04	0.53	0.00	0.00	0.26
Roll/Eject	0.00	0.00	0.00	2.08	24.74	0.00	0.00	3.24
Unknown	0.12	0.00	0.56	0.00	0.00	0.00	81.40	2.44
TOTAL	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

The following figure displays the driver injury severity outcome for each of the categories of rollover/fire/ejection occurrence. In collisions when none of those events took place, the driver was uninjured 66% of the time. This was true of only 22% of the cases when only a rollover occurred, 45% when only a fire took place, and just once when the driver was ejected. As one would expect, combinations of these events, although rare, proved especially hazardous to the driver.

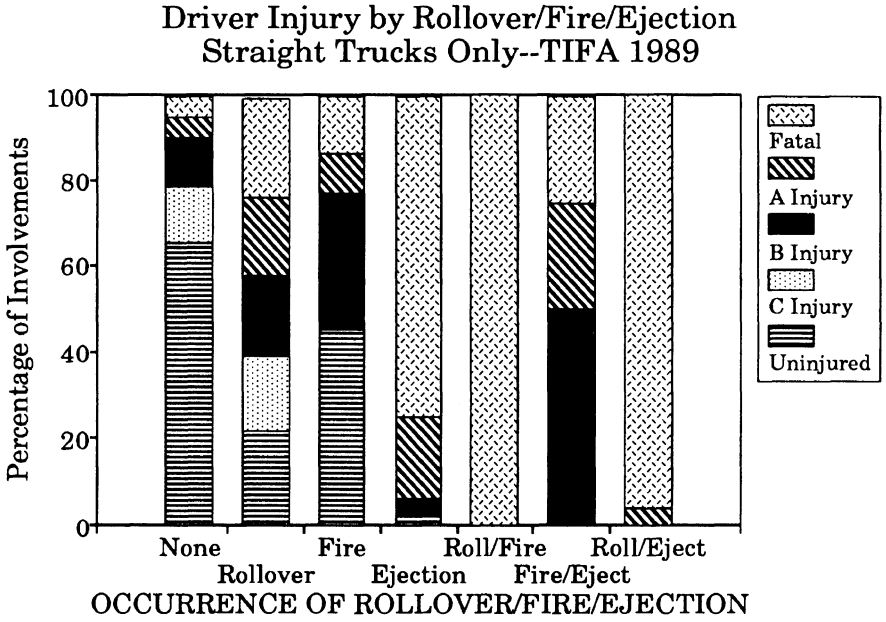


Figure 4-14

FATAL ACCIDENT EXPERIENCE OF TRACTOR COMBINATIONS IN 1989

This section focuses exclusively on the fatal accident experience of tractor combinations in 1989. 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 71% of the fatal large truck accidents in 1989, a greater number of variables is 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 1989 were conventional cabs in almost 57% of the cases in which cab style was known. The proportion of conventional cabs has increased steadily in the last three years. In 1987 conventional cabs were 50.3% of the known cases, and increased to 53.8% in 1988. The distributions for the number of trailers hauled by these two cab styles are illustrated in the graph at right. The two distributions are virtually identical.

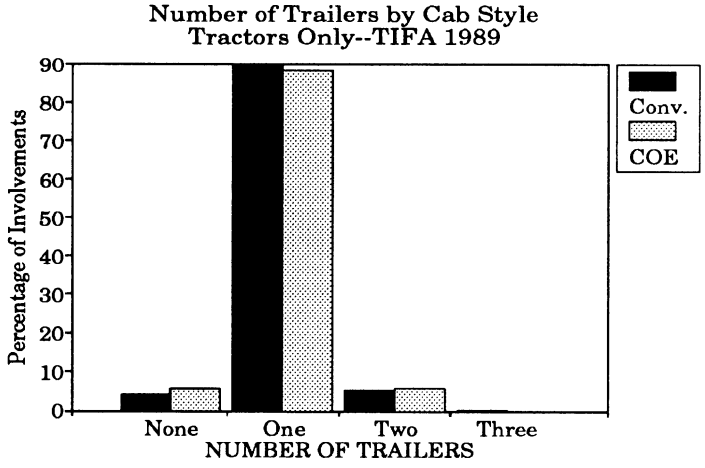


Figure 5-1

TABLE 5-1
Number of Trailers by Cab Style
Tractors Only
TIFA 1989

Number of Trailers	Conventional		Cabover/ Cab-forward		Unknown		TOTAL	
	No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.
No trailers	88	4.21%	90	5.68%	0	0.00%	178	4.73%
One trailer	1,879	89.99	1,399	88.32	21	22.58	3,299	87.62
Two trailers	117	5.60	95	6.00	2	2.15	214	5.68
Three trailers	4	0.19	0	0.00	0	0.00	4	0.11
Unknown	0	0.00	0	0.00	70	75.27	70	1.86
TOTAL	2,088	100.00%	1,584	100.00%	93	100.00%	3,765	100.00%

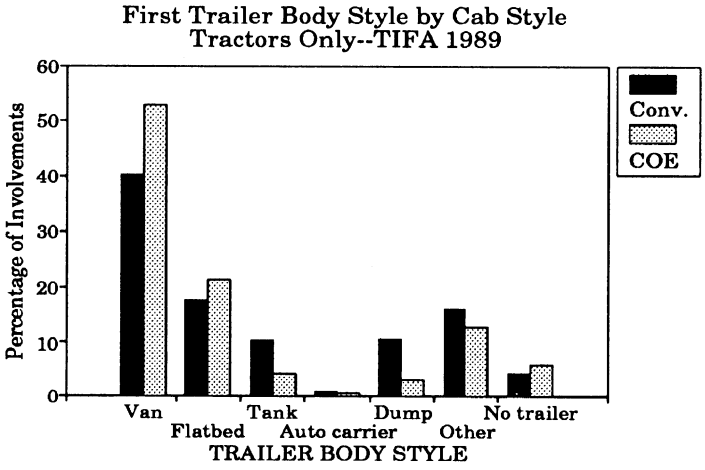


Figure 5-2

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, cabovers were more likely to be hauling a van (53%) or a flatbed (21%) as the first trailer. 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 1989

First Trailer Body Style	Conventional		Cabover/ Cab-forward		Unknown		TOTAL	
	No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.
Van	836	40.04%	835	52.71%	11	11.83%	1,682	44.67%
Flatbed	369	17.67	335	21.15	0	0.00	704	18.70
Tank	216	10.34	63	3.98	5	5.38	284	7.54
Auto carrier	20	0.96	6	0.38	0	0.00	26	0.69
Dump	223	10.68	46	2.90	0	0.00	269	7.14
Other	332	15.90	202	12.75	2	2.15	536	14.24
No first trailer	88	4.21	90	5.68	0	0.00	178	4.73
Unknown	4	0.19	7	0.44	75	80.65	86	2.28
TOTAL	2,088	100.00%	1,584	100.00%	93	100.00%	3,765	100.00%

Table 5-2 above indicates the relative proportions of the different first trailer body styles for the TIFA 1989 tractors. If the cases are restricted to those where there was a first trailer and its body style was known, then 48.0% of the involved tractors were hauling a van as the first trailer, 20.1% a flatbed, 8.1% a tank, 0.7% an auto carrier, 7.7% a dump, and the remaining 15% 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 1989 TIFA tractors. The GVWR pertains to only 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 94% of the tractors involved in fatal accidents in 1989 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. Slightly lower percentages of the vans (91%) and auto carriers (92%) were hauled by class 8 tractors.

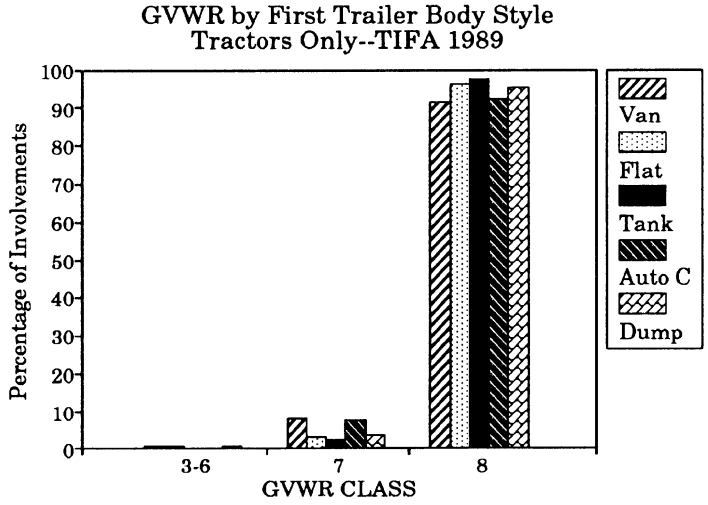


Figure 5-3

TABLE 5-3
GVWR by First Trailer Body Style
Tractors Only
TIFA 1989

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	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	1 0.38	1 0.03
4 14,001–16,000	1 0.06	2 0.28	0 0.00	0 0.00	1 0.37	0 0.00	0 0.00	4 0.11
5 16,001–19,500	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	1 0.19	0 0.00	1 0.03
6 19,501–26,000	11 0.65	3 0.43	0 0.00	0 0.00	1 0.37	7 1.31	5 1.89	27 0.72
7 26,001–33,000	131 7.79	22 3.13	6 2.11	2 7.69	10 3.72	10 1.87	21 7.95	202 5.37
8 33,001+	1,516 90.13	669 95.03	276 97.18	24 92.31	256 95.17	507 94.59	201 76.14	3,449 91.61
Unknown	23 1.37	8 1.14	2 0.70	0 0.00	1 0.37	11 2.05	36 13.64	81 2.15
TOTAL	1,682 100.00	704 100.00	284 100.00	26 100.00	269 100.00	536 100.00	264 100.00	3,765 100.00

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 55% of tanks (of all known cases), 43% of flatbeds, 39% of dumps, 28% of vans, and just 15% 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, tank combinations typically had the highest GCWs.

TABLE 5-4
Gross Combination Weight by First Trailer Body Style
Tractors Only
TIFA 1989

Gross Weight (Frequencies and Col. Pcts.)	Van	Flatbed	Tank	Auto Carrier	Dump	Other	Unknown/ No Trailer	TOTAL
< 20,000	7 0.42	4 0.57	0 0.00	0 0.00	0 0.00	3 0.56	147 55.68	161 4.28
20,000	212 12.60	113 16.05	53 18.66	0 0.00	60 22.30	133 24.81	23 8.71	594 15.78
30,000	315 8.73	134 19.03	46 16.20	6 23.08	72 26.77	70 13.06	5 1.89	648 17.21
40,000	221 13.14	27 3.84	3 1.06	5 19.23	8 2.97	6 1.12	3 1.14	273 7.25
50,000	181 10.76	43 6.11	5 1.76	1 3.85	12 4.46	19 3.54	1 0.38	262 6.96
60,000	212 12.60	57 8.10	15 5.28	10 38.46	6 2.23	24 4.48	1 0.38	325 8.63
70,000	394 23.42	245 34.80	110 38.73	3 11.54	69 25.65	168 31.34	3 1.14	992 26.35
80,000+	44 2.62	40 5.68	38 13.38	1 3.85	34 12.64	80 14.93	0 0.00	237 6.29
Unknown	96 5.71	41 5.82	14 4.93	0 0.00	8 2.97	33 6.16	81 30.68	273 7.25
TOTAL	1,682 100.00	704 100.00	284 100.00	26 100.00	269 100.00	536 100.00	264 100.00	3,765 100.00

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

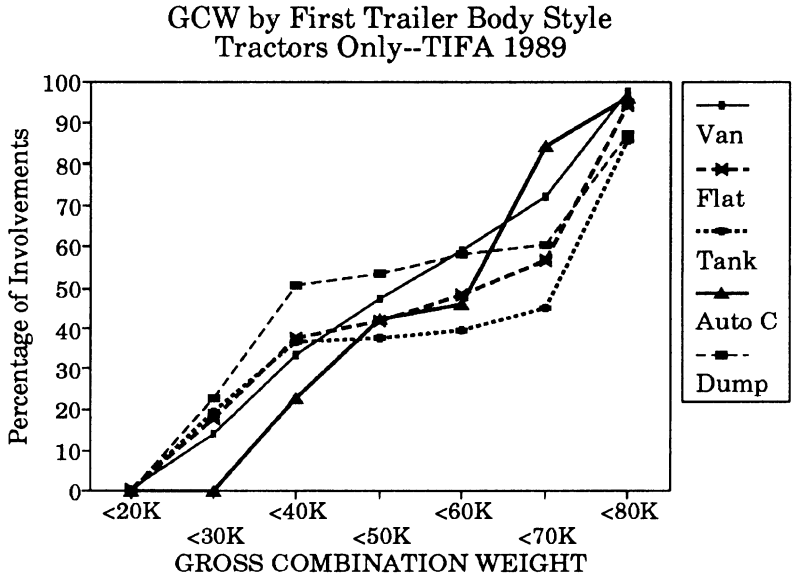


Figure 5-4

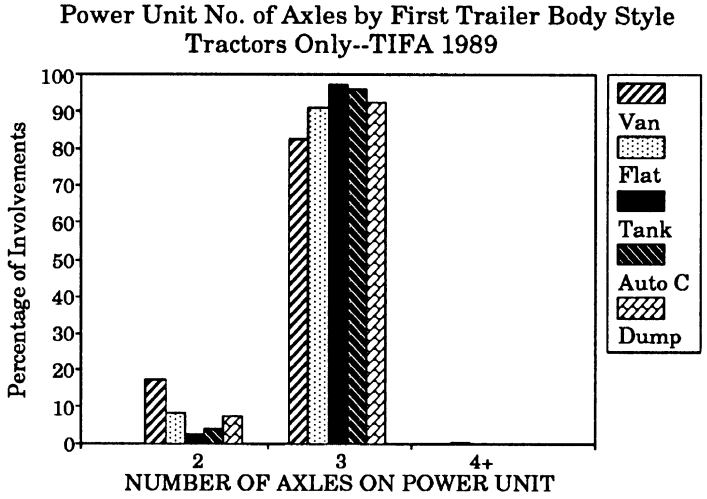


Figure 5-5

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 percentage of 2-axle tractors (17%) was found among the van trailers.

TABLE 5-5
Number of Axles on Power Unit by First Trailer Body Style
Tractors Only
TIFA 1989

Power Unit No. of Axles (Frequencies and Col. Pcts.)	Van	Flatbed	Tank	Auto Carrier	Dump	Other	Unknown/ No Trailer	TOTAL
2	290 17.24	58 8.24	7 2.46	1 3.85	20 7.43	49 9.14	50 18.94	475 12.62
3	1,387 82.46	641 91.05	276 97.18	25 96.15	249 92.57	484 90.30	139 52.65	3,201 85.02
4+	0 0.00	4 0.57	0 0.00	0 0.00	0 0.00	1 0.19	0 0.00	5 0.13
Unknown	5 0.30	1 0.14	1 0.35	0 0.00	0 0.00	2 0.37	75 28.41	84 2.23
TOTAL	1,682 100.00	704 100.00	284 100.00	26 100.00	269 100.00	536 100.00	264 100.00	3,765 100.00

The next table indicates the unit and axle configurations of the 1989 TIFA tractors according to cab style. The tractors are split into those with no trailers, with one, two or three trailers, and tractors hauling an unknown number of trailers. For the purposes of this table, "one" represents a tractor hauling a single trailer, which is usually, but not always, a semitrailer. Similarly "two" indicates a tractor hauling double trailers, which are usually, but not always, a semitrailer and a full trailer, and "three" indicates a tractor with three trailing units, which are usually, but not always, a semitrailer and two full trailers. The table indicates the number of axles on the tractor and on each of the trailers (if any). 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 single and double trailer combinations were characterized by a wide variety of axle configurations.

TABLE 5-6
Axle Configuration by Cab Style
Tractors Only
TIFA 1989

Number of Trailers	Axle Config.	Cab Style							
		Conventional		Cabover/ Cab-forward		Unknown		TOTAL	
		No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.
None	2	21	1.01%	26	1.64%	0	0.00%	47	1.25%
	3	67	3.21	64	4.04	0	0.00	131	3.48
One	2/1	42	2.01%	31	1.96%	0	0.00%	73	1.94%
	2/2	135	6.47	69	4.36	0	0.00	204	5.42
	2/3	7	0.34	6	0.38	0	0.00	13	0.35
	3/1	7	0.34	11	0.69	0	0.00	18	0.48
	3/2	1,590	76.15	1,237	78.09	17	18.28	2,844	75.54
	3/3	75	3.59	31	1.96	0	0.00	106	2.82
	Other*	13	0.62	7	0.44	0	0.00	20	0.53
	Unknown	10	0.48	7	0.44	4	4.30	21	0.56
Two	2/1/2	68	3.26%	57	3.60%	0	0.00%	125	3.32%
	2/2/2	6	0.29	3	0.19	0	0.00	9	0.24
	3/1/2	17	0.81	17	1.07	0	0.00	34	0.90
	3/2/2	11	0.53	8	0.51	0	0.00	19	0.50
	Other**	13	0.62	9	0.57	0	0.00	22	0.58
	Unknown	2	0.10	1	0.06	2	2.15	5	0.13
Three***		4	0.19%	0	0.00%	0	0.00%	4	0.11%
Unknown No. of Trailers		0	0.00%	0	0.00%	70	75.27%	70	1.86%
TOTAL		2,088	100.00%	1,584	100.00%	93	100.00%	3,765	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 2/4+; 3/4+; 4+/2; 4+/3.
** Includes 2/1/3; 3/2/1; 3/2/3; 2/2/4+; 3/3/4+.
*** Includes 3/1/2/2; 3/2/2/2; 3/3/3/2.

The table on the next page presents cargo type distributions by first trailer body style. Of all the cases of known cargo type, over 31% 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 1989

Cargo Type (Frequencies and Col. Pcts.)	No Trailer	Van	Flatbed	Tank	Auto Carrier	Dump	Other	Unknown	TOTAL
General freight	0 0.00	851 50.59	51 7.24	2 0.70	0 0.00	1 0.37	9 1.68	3 3.49	917 24.36
Household goods	0 0.00	55 3.27	6 0.85	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	61 1.62
Metal	0 0.00	21 1.25	125 17.76	0 0.00	0 0.00	1 0.37	11 2.05	0 0.00	158 4.20
Heavy machinery	0 0.00	10 0.59	110 15.63	0 0.00	0 0.00	0 0.00	8 1.49	0 0.00	128 3.40
Motor vehicles	0 0.00	0 0.00	6 0.85	0 0.00	17 65.38	0 0.00	0 0.00	0 0.00	23 0.61
Driveaway/tow	28 15.73	0 0.00	1 0.14	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	29 0.77
Gases in bulk	0 0.00	0 0.00	0 0.00	12 4.23	0 0.00	0 0.00	0 0.00	0 0.00	12 0.32
Solids in bulk	0 0.00	46 2.73	46 6.53	0 0.00	0 0.00	119 44.24	140 26.12	1 1.16	352 9.35
Liquids in bulk	0 0.00	0 0.00	0 0.00	170 59.86	0 0.00	0 0.00	0 0.00	0 0.00	170 4.52
Explosives	0 0.00	1 0.06	1 0.14	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	2 0.05
Logs/lumber	0 0.00	5 0.30	105 14.91	0 0.00	0 0.00	0 0.00	86 16.04	0 0.00	196 5.21
Empty	150 84.27	351 20.87	203 28.84	97 34.15	9 34.62	144 53.53	189 35.26	1 1.16	1,144 30.39
Refrig. food	0 0.00	263 15.64	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	263 6.99
Mobile home	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	10 1.87	0 0.00	10 0.27
Farm products	0 0.00	34 2.02	33 4.69	0 0.00	0 0.00	3 1.12	79 14.74	0 0.00	149 3.96
Other	0 0.00	9 0.54	13 1.85	0 0.00	0 0.00	0 0.00	1 0.19	1 1.16	24 0.64
Unknown	0 0.00	36 2.14	4 0.57	3 1.06	0 0.00	1 0.37	3 0.56	80 93.02	127 3.37
TOTAL	178 100.00	1,682 100.00	704 100.00	284 100.00	26 100.00	269 100.00	536 100.00	86 100.00	3,765 100.00

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; all of the auto carriers were hauling motor vehicles; and the dumps were usually carrying solids in bulk. Vans and flatbeds, as illustrated in the pie graphs below, had a more varied range of cargo types. The unknown cargo category has been omitted from the pie graphs.

Cargo Type for Van Trailers
TIFA 1989

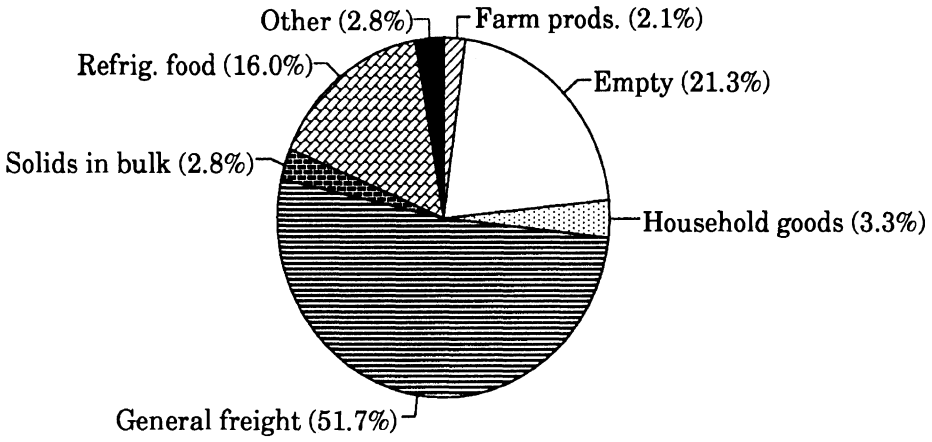


Figure 5-7a

Cargo Type for Flatbed Trailers
TIFA 1989

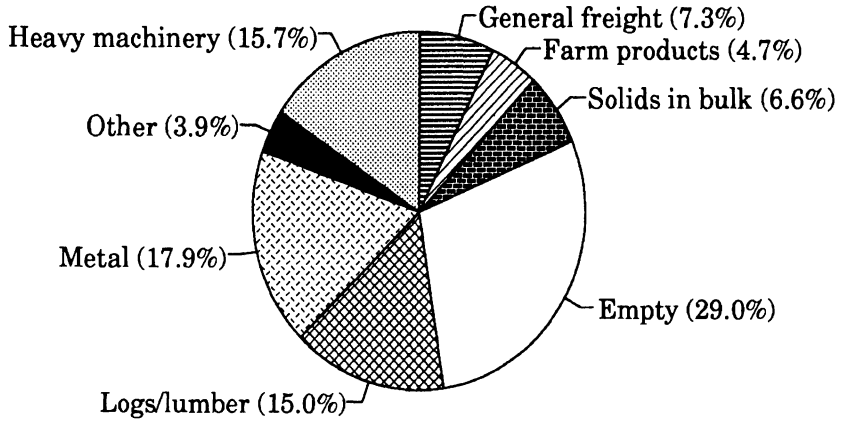


Figure 5-7b

The overwhelming majority of tractors involved in fatal accidents in 1989 used diesel fuel, as indicated in the table below.

TABLE 5-8
Fuel Type by Cab Style
Tractors Only
TIFA 1989

Fuel Type	Conventional		Cabover/ Cab-forward		Unknown		TOTAL	
	No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.
Gasoline	14	0.67%	3	0.19%	0	0.00%	17	0.45%
Diesel	2,063	98.80	1,578	99.62	13	13.98	3,654	97.05
Other	5	0.24	2	0.13	0	0.00	7	0.19
Unknown	6	0.29	1	0.06	80	86.02	87	2.31
TOTAL	2,088	100.00%	1,584	100.00%	93	100.00%	3,765	100.00%

Use

Next is a series of 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 difference among the five trailer body styles is in the proportion of intrastate carriers. Of the known cases, 45% of the involved dumps were intrastate carriers, but this percentage was only 0-16% for each of the other four trailer body styles. Tanks had the highest proportion of interstate private carriers (27% of the known cases), while auto carriers had the highest proportion of interstate authorized carriers (100%). 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 26 fatal accidents involving auto carriers took place in 1989.

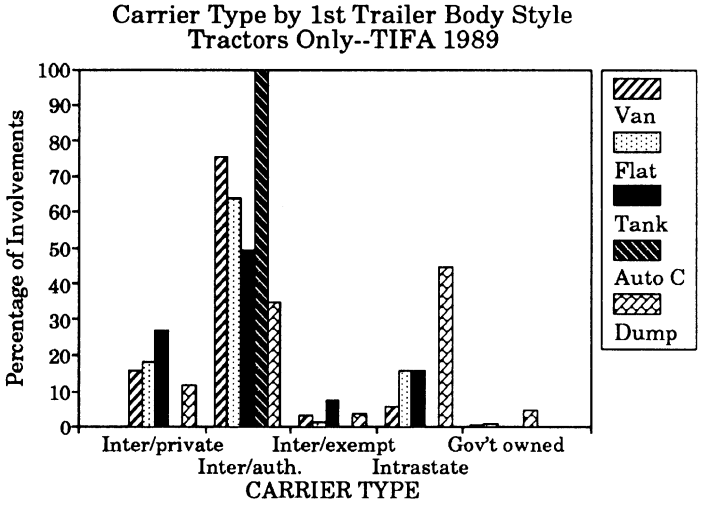


Figure 5-9

TABLE 5-9
Carrier Type by First Trailer Body Style
Tractors Only
TIFA 1989

Carrier Type (Frequencies and Col. Pcts.)	Van	Flatbed	Tank	Auto Carrier	Dump	Other	Unknown/ No Trailer	TOTAL
Interstate private	257 15.28	125 17.76	75 26.41	0 0.00	31 11.52	121 22.57	33 12.50	642 17.05
Interstate authorized	1,248 74.20	439 62.36	139 48.94	26 100.00	92 34.20	153 28.54	94 35.61	2,191 58.19
Interstate exempt	53 3.15	11 1.56	21 7.39	0 0.00	10 3.72	68 12.69	7 2.65	170 4.52
Intrastate private	47 2.79	71 10.09	33 11.62	0 0.00	47 17.47	105 19.59	14 5.30	317 8.42
Intrastate for hire	43 2.56	38 5.40	12 4.23	0 0.00	70 26.02	73 13.62	28 10.61	264 7.01
Government owned	4 0.24	5 0.71	0 0.00	0 0.00	12 4.46	0 0.00	2 0.76	23 0.61
Unknown	30 1.78	15 2.13	4 1.41	0 0.00	7 2.60	16 2.99	86 32.58	158 4.20
TOTAL	1,682 100.00	704 100.00	284 100.00	26 100.00	269 100.00	536 100.00	264 100.00	3,765 100.00

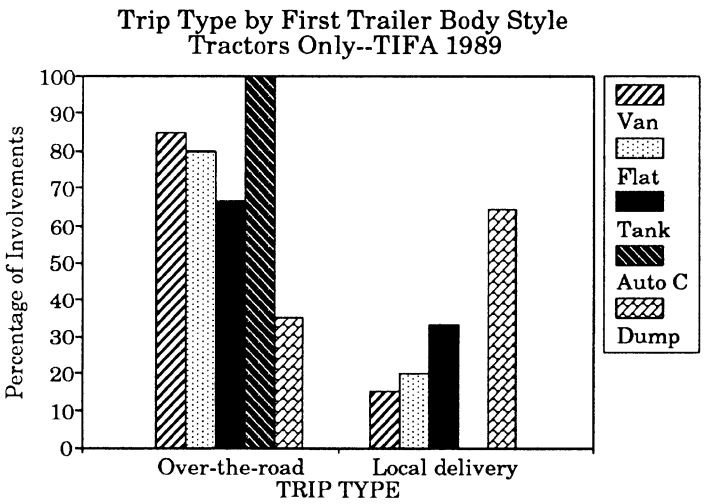


Figure 5-10

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 proportion 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, 100% of the auto carriers were conducting over-the-road

trips, followed by vans (85%), flatbeds (80%), tanks (67%), and dumps (35%). 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 1989

Trip Type (Frequencies and Col. Pcts.)	Van	Flatbed	Tank	Auto Carrier	Dump	Other	Unknown/ No Trailer	TOTAL
Over-the-road	1,393 82.82	552 78.41	183 64.44	26 100.00	93 34.57	301 56.16	96 36.36	2,644 70.23
Local delivery	248 14.74	140 19.89	91 32.04	0 0.00	170 63.20	218 40.67	80 30.30	947 25.15
Unknown	41 2.44	12 1.70	10 3.52	0 0.00	6 2.23	17 3.17	88 33.33	174 4.62
TOTAL	1,682 100.00	704 100.00	284 100.00	26 100.00	269 100.00	536 100.00	264 100.00	3,765 100.00

For all trailer body styles, except vans, 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 40% of the van involvements occurred on limited access routes, followed by 29% of flatbeds, 27% of auto carriers, 19% of tanks, and 16% of dumps. A very nearly reverse order held for other road class involvements, with dumps having the highest proportion, followed by tanks, flatbeds, vans, and auto carriers.

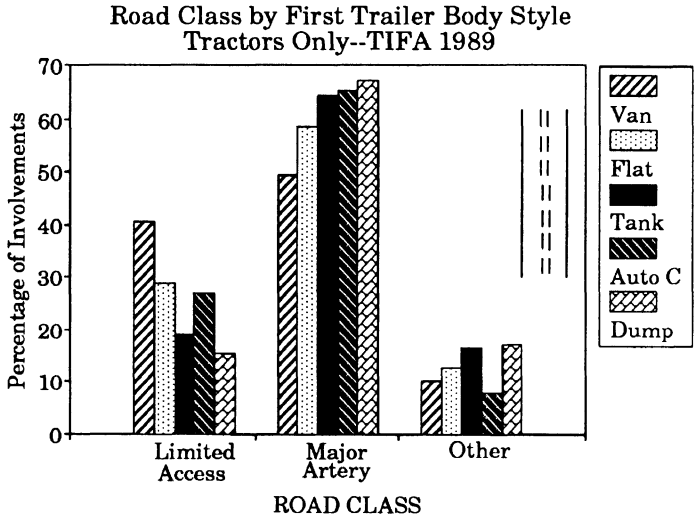


Figure 5-11

TABLE 5-11
Road Class by First Trailer Body Style
Tractors Only
TIFA 1989

Road Class (Frequencies and Col. Pcts.)	Van	Flatbed	Tank	Auto Carrier	Dump	Other	Unknown/ No Trailer	TOTAL
Limited Access	681 40.49	202 28.69	54 19.01	7 26.92	42 15.61	60 11.19	58 21.97	1,104 29.32
Major Artery	829 49.29	411 58.38	183 64.44	17 65.38	181 67.29	384 71.64	151 57.20	2,156 57.26
Other	167 9.93	89 12.64	47 16.55	2 7.69	46 17.10	91 16.98	55 20.83	497 13.20
Unknown	5 0.30	2 0.28	0 0.00	0 0.00	0 0.00	1 0.19	0 0.00	8 0.21
TOTAL	1,682 100.00	704 100.00	284 100.00	26 100.00	269 100.00	536 100.00	264 100.00	3,765 100.00

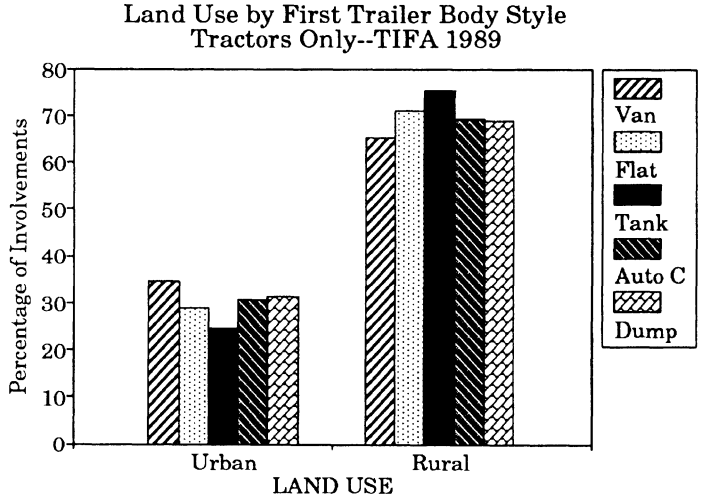


Figure 5-12

The land use distributions are very stable from one trailer body style to another. For vans, flatbeds, tanks, auto carriers and dumps, the proportion of involvements in urban areas ranged from 25% to 35%, while the proportion in rural areas varied from 65% to 75%.

TABLE 5-12
Land Use by First Trailer Body Style
Tractors Only
TIFA 1989

Land Use (Frequencies and Col. Pcts.)	Van	Flatbed	Tank	Auto Carrier	Dump	Other	Unknown/ No Trailer	TOTAL
Urban	581 34.54	203 28.84	70 24.65	8 30.77	84 31.23	111 20.71	91 34.47	1,148 30.49
Rural	1,096 65.16	499 70.88	214 75.35	18 69.23	185 68.77	425 79.29	173 65.53	2,610 69.32
Unknown	5 0.30	2 0.28	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	7 0.19
TOTAL	1,682 100.00	704 100.00	284 100.00	26 100.00	269 100.00	536 100.00	264 100.00	3,765 100.00

The light condition at the time of the accident is indicated for the five different trailer body styles in the graph below. Dumps had the highest proportion of daylight involvements and the lowest proportion of involvements taking place in the dark. On the other hand, slightly under half of the van involvements occurred at night as did 46% of the tank, 45% of the flatbed and 23% of the auto carrier 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.

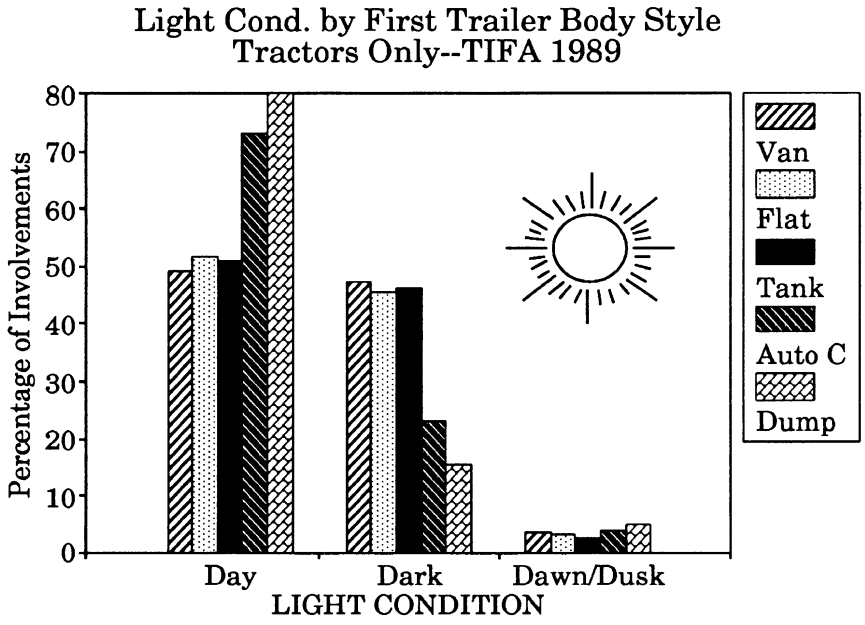


Figure 5-13

TABLE 5-13
Light Condition by First Trailer Body Style
Tractors Only
TIFA 1989

Light Condition (Frequencies and Col. Pcts.)	Van	Flatbed	Tank	Auto Carrier	Dump	Other	Unknown/ No Trailer	TOTAL
Daylight	828 49.23	363 51.56	145 51.06	19 73.08	215 79.93	351 65.49	168 63.64	2,089 55.48
Dark, not lighted	601 35.73	255 36.22	100 35.21	5 19.23	25 9.29	134 25.00	62 23.48	1,182 31.39
Dark, but lighted	196 11.65	65 9.23	32 11.27	1 3.85	16 5.95	32 5.97	23 8.71	365 9.69
Dawn	27 1.61	13 1.85	6 2.11	0 0.00	11 4.09	15 2.80	6 2.27	78 2.07
Dusk	30 1.78	8 1.14	1 0.35	1 3.85	2 0.74	4 0.75	5 1.89	51 1.35
TOTAL	1,682 100.00	704 100.00	284 100.00	26 100.00	269 100.00	536 100.00	264 100.00	3,765 100.00

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 the fatal tractor accidents involved a collision with another motor vehicle in transport. This event ranged from 73% of the tank involvements to 88% of the auto carrier involvements. Vans

First Harmful Event by 1st Trailer Body Style
Tractors Only--TIFA 1989

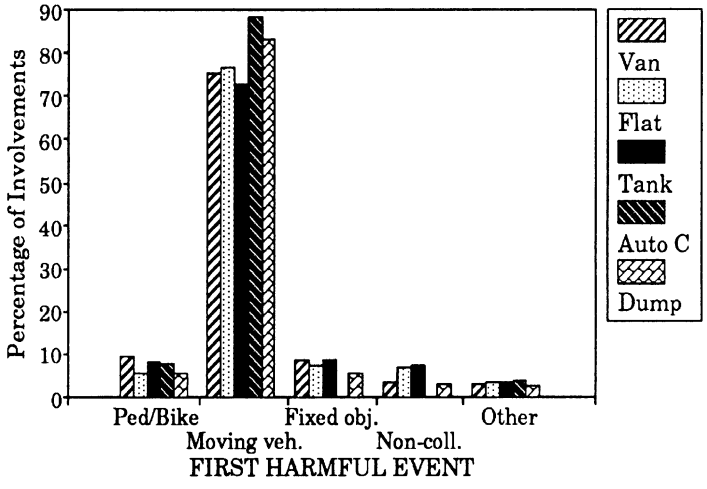


Figure 5-14

experienced relatively more pedestrian, and fixed object involvements, while tanks and flatbeds had relatively higher percentages of non-collisions than the other trailer body styles.

TABLE 5-14
First Harmful Event by First Trailer Body Style
Tractors Only
TIFA 1989

First Harmful Event (Frequencies and Col. Pcts.)	Van	Flatbed	Tank	Auto Carrier	Dump	Other	Unknown/ No Trailer	TOTAL
Pedestrian	135 8.03	37 5.26	22 7.75	2 7.69	14 5.20	22 4.10	15 5.68	247 6.56
Pedalcyclist	23 1.37	3 0.43	1 0.35	0 0.00	1 0.37	8 1.49	1 0.38	37 0.98
Train	9 0.54	6 0.85	3 1.06	1 3.85	4 1.49	12 2.24	0 0.00	35 0.93
Animal	4 0.24	6 0.85	1 0.35	0 0.00	0 0.00	2 0.37	0 0.00	13 0.35
Moving vehicle	1,269 75.45	539 76.56	206 72.54	23 88.46	224 83.27	426 79.48	206 78.03	2,893 76.84
Parked vehicle	28 1.66	6 0.85	4 1.41	0 0.00	3 1.12	2 0.37	0 0.00	43 1.14
Other non-fixed object	8 0.48	6 0.85	2 0.70	0 0.00	0 0.00	4 0.75	1 0.38	21 0.56
Fixed object	149 8.86	52 7.39	24 8.45	0 0.00	15 5.58	31 5.78	30 11.36	301 7.99
Non-collision	57 3.39	49 6.96	21 7.39	0 0.00	8 2.97	29 5.41	11 4.17	175 4.65
TOTAL	1,682 100.00	704 100.00	284 100.00	26 100.00	269 100.00	536 100.00	264 100.00	3,765 100.00

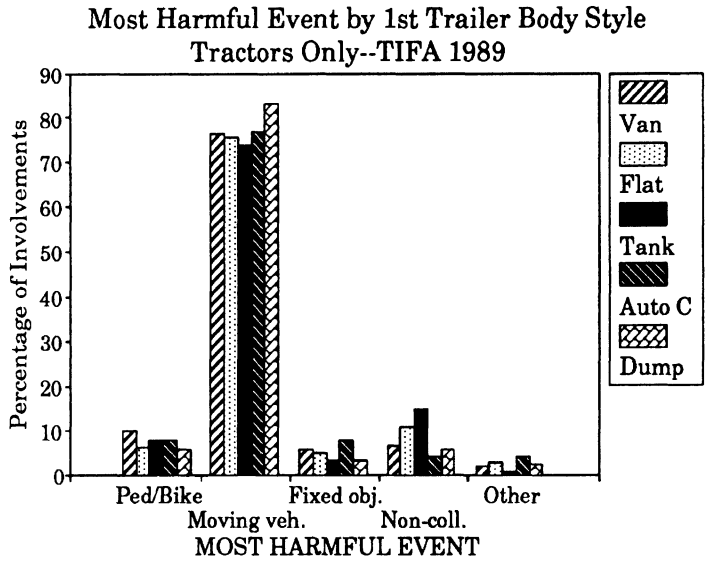


Figure 5-15

The graph on the left illustrates the most harmful event for 1989 TIFA tractors by the first trailer body style. The major difference between the most harmful and the first harmful event for tractors is the increase in non-collisions (rollovers, explosions, and fires) as the most harmful event for vans, flatbeds, tanks, and dumps. None of the collisions with an animal as the first harmful event were retained as the most harmful accident event.

TABLE 5-15
Most Harmful Event by First Trailer Body Style
Tractors Only
TIFA 1989

Most Harmful Event (Frequencies and Col. Pcts.)	Van	Flatbed	Tank	Auto Carrier	Dump	Other	Unknown/ No Trailer	TOTAL
Pedestrian	142 8.44	40 5.68	21 7.39	2 7.69	15 5.58	23 4.29	16 6.06	259 6.88
Pedalcyclist	23 1.37	3 0.43	1 0.35	0 0.00	1 0.37	8 1.49	1 0.38	37 0.98
Train	9 0.54	5 0.71	1 0.35	1 3.85	4 1.49	12 2.24	0 0.00	32 0.85
Moving vehicle	1,282 76.22	532 75.57	209 73.59	20 76.92	224 83.27	430 80.22	209 79.17	2,906 77.18
Parked vehicle	18 1.07	9 1.28	1 0.35	0 0.00	2 0.74	0 0.00	0 0.00	30 0.80
Other non-fixed object	6 0.36	4 0.57	0 0.00	0 0.00	0 0.00	2 0.37	0 0.00	12 0.32
Fixed object	93 5.53	35 4.97	9 3.17	2 7.69	8 2.97	15 2.80	14 5.30	176 4.67
Non-collision	109 6.48	76 10.80	42 14.79	1 3.85	15 5.58	46 8.58	24 9.09	313 8.31
TOTAL	1,682 100.00	704 100.00	284 100.00	26 100.00	269 100.00	536 100.00	264 100.00	3,765 100.00

The graph and table on this page illustrate the manner of collision for the 2,893 tractors involved, as the first harmful event, in fatal accidents with another moving motor vehicle. There is some variation among the different first trailer body styles. For example, vans experienced the highest proportion of rear-end collisions, auto carriers the highest percentage of sideswipes, and dumps the highest percentage of head-on collisions. Overall, angle collisions were the most common collision type, representing almost 39% of all tractor involvements, followed by head-ons (29.7%) and rear-ends (24%).

Manner of Collision by 1st Trailer Body Style
for Crashes with Another Motor Vehicle
Tractors Only--TIFA 1989

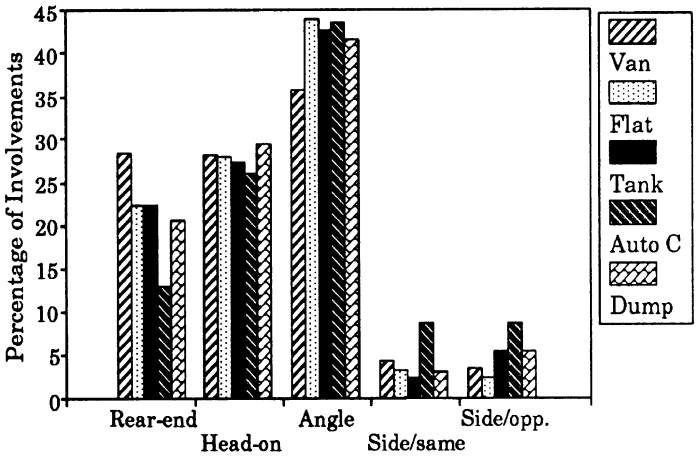


Figure 5-16

TABLE 5-16
Manner of Collision by First Trailer Body Style
for Crashes with Another Motor Vehicle
Tractors Only
TIFA 1989

Manner of Collision (Frequencies and Col. Pcts.)	Van	Flatbed	Tank	Auto Carrier	Dump	Other	Unknown/ No Trailer	TOTAL
Rear-end	359 28.29	120 22.26	46 22.33	3 13.04	46 20.54	77 18.08	43 20.87	694 23.99
Head-on	356 28.05	150 27.83	56 27.18	6 26.09	66 29.46	143 33.57	81 39.32	858 29.66
Rear-to-rear	1 0.08	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	1 0.03
Angle	451 35.54	236 43.78	88 42.72	10 43.48	93 41.52	176 41.31	70 33.98	1,124 38.85
Sideswipe, same dir.	54 4.26	18 3.34	5 2.43	2 8.70	7 3.13	13 3.05	9 4.37	108 3.73
Sideswipe, opp. dir.	43 3.39	13 2.41	11 5.34	2 8.70	12 5.36	17 3.99	2 0.97	100 3.46
Unknown	5 0.39	2 0.37	0 0.00	0 0.00	0 0.00	0 0.00	1 0.49	8 0.28
TOTAL	1,269 100.00	539 100.00	206 100.00	23 100.00	224 100.00	426 100.00	206 100.00	2,893 100.00

TABLE 5-17
Gross Combination Weight by Rollover Occurrence
Tractors Only
TIFA 1989

Gross Weight	Rollover Occurrence							
	None		First Event		Subsequent Event		TOTAL	
	No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.
< 20,000	137	85.09%	7	4.35%	17	10.56%	161	100.00%
20,000	567	95.45	4	0.67	23	3.87	594	100.00
30,000	617	95.22	4	0.62	27	4.17	648	100.00
40,000	244	89.38	4	1.47	25	9.16	273	100.00
50,000	234	89.31	7	2.67	21	8.02	262	100.00
60,000	267	82.15	22	6.77	36	11.08	325	100.00
70,000	789	79.54	62	6.25	141	14.21	992	100.00
80,000+	176	74.26	18	7.59	43	18.14	237	100.00
Unknown	243	89.01	2	0.73	28	10.26	273	100.00
TOTAL	3,274	86.96%	130	3.45%	361	9.59%	3,765	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 three heaviest GCW categories (60,000-69,999, 70,000-79,999 and 80,000+ pounds) had the highest proportions of first-event rollovers, with 6.8%, 6.3% and 7.6% respectively. Subsequent-event rollovers were also more common among the heavier GCW categories. Only 3.9% of the 20,000-29,999 pound class experienced subsequent-event rollovers, compared to 14% and 18% for the two heaviest GCW categories.

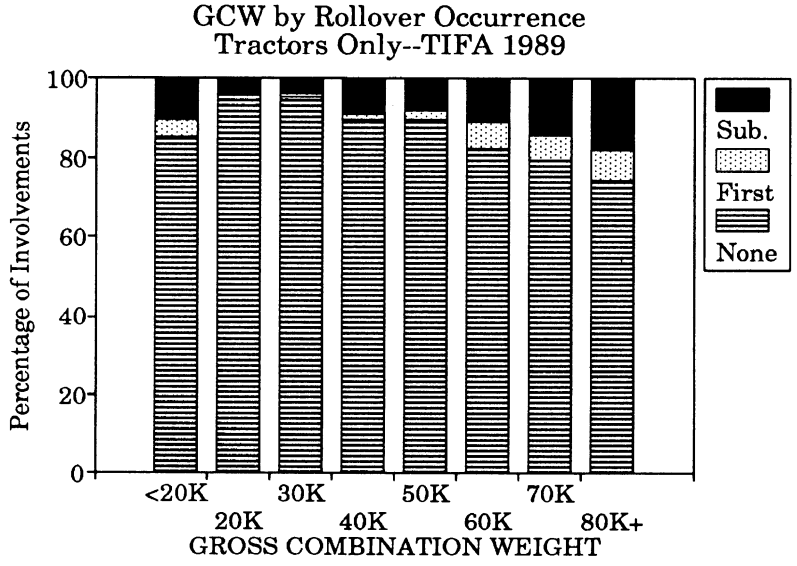


Figure 5-17

TABLE 5-18
Gross Combination Weight by Jackknife Occurrence
Tractors Only
TIFA 1989

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	56	34.78%	0	0.00%	0	0.00%	105	65.22%	161	100.00%
20,000	420	70.71	31	5.22	66	11.11	77	12.96	594	100.00
30,000	504	77.78	28	4.32	54	8.33	62	9.57	648	100.00
40,000	226	82.78	2	0.73	14	5.13	31	11.36	273	100.00
50,000	220	83.97	5	1.91	16	6.11	21	8.02	262	100.00
60,000	273	84.00	12	3.69	13	4.00	27	8.31	325	100.00
70,000	846	85.28	15	1.51	40	4.03	91	9.17	992	100.00
80,000+	205	86.50	4	1.69	12	5.06	16	6.75	237	100.00
Unknown	181	66.30	0	0.00	11	4.03	81	29.67	273	100.00
TOTAL	2,931	77.85%	97	2.58%	226	6.00%	511	13.57%	3,765	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 (6% of all tractor involvements) rather than the primary event (2.6%). The tractor combinations with a GCW of 20,000-39,999 pounds had a higher incidence of jackknifes than the heavier combinations. This is particularly true for subsequent-event jackknifes. Over 11% of the tractors in the 20,000-29,999 pound group and 8.3% in the 30,000-39,999 group jackknifed as the subsequent event in the accident. This compares with 4% in the 70,000-79,999 pound group and 5% of the 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.

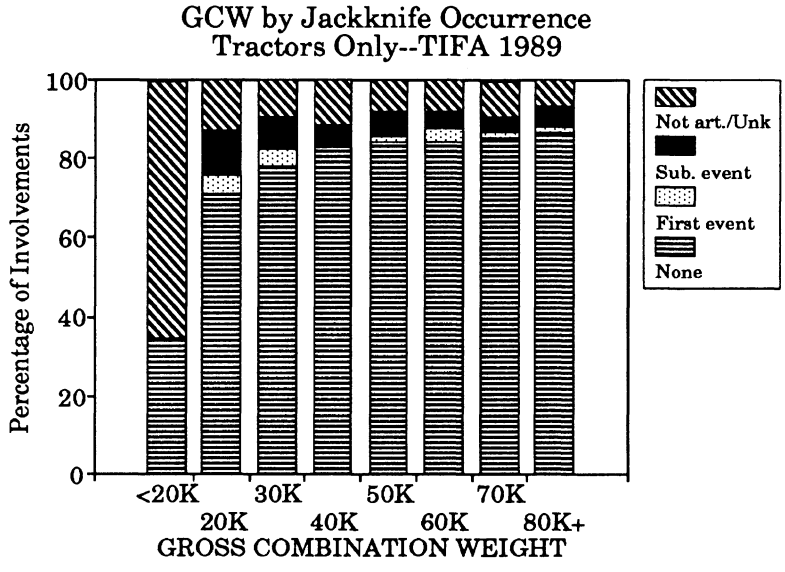


Figure 5-18

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 (73%), compared with the overall average of 57%. Auto carriers also had the lowest proportion of fatalities among drivers at 7.7% compared with 14.7% overall. In general, however, the injury severity distributions are similar among the different trailer body styles.

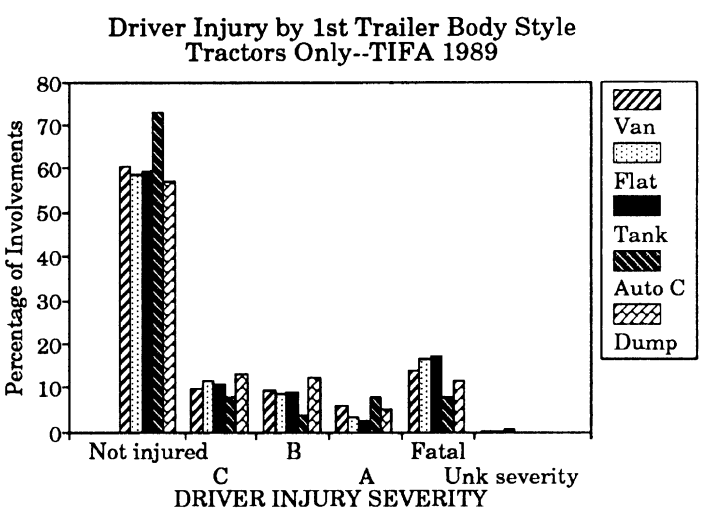


Figure 5-19

TABLE 5–19
Truck Driver Injury Severity by First Trailer Body Style
Tractors Only
TIFA 1989

Injury Severity (Frequencies and Col. Pcts.)	Van	Flatbed	Tank	Auto Carrier	Dump	Other	Unk/ No Trail	TOTAL
Not injured	998 59.33	406 57.67	165 58.10	19 73.08	150 55.76	290 54.10	124 46.97	2,152 57.16
C injury, possible	164 9.75	82 11.65	30 10.56	2 7.69	35 13.01	46 8.58	29 10.98	388 10.31
B injury, not incapacitating	155 9.22	61 8.66	25 8.80	1 3.85	33 12.27	79 14.74	38 14.39	392 10.41
A injury, incapacitating	97 5.77	24 3.41	7 2.46	2 7.69	14 5.20	33 6.16	17 6.44	194 5.15
Fatal injury	229 13.61	116 16.48	49 17.25	2 7.69	31 11.52	80 14.93	45 17.05	552 14.66
Injured, severity unknown	6 0.36	3 0.43	2 0.70	0 0.00	0 0.00	4 0.75	2 0.76	17 0.45
Unknown if injured	33 1.96	12 1.70	6 2.11	0 0.00	6 2.23	4 0.75	9 3.41	70 1.86
TOTAL	1,682 100.00	704 100.00	284 100.00	26 100.00	269 100.00	536 100.00	264 100.00	3,765 100.00

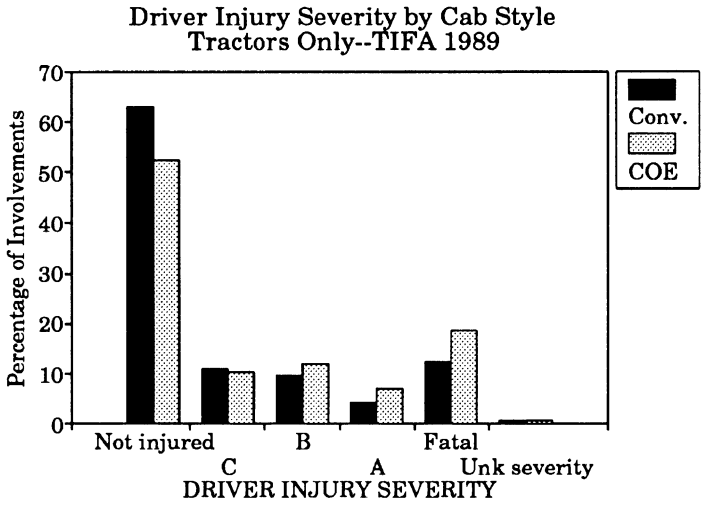


Figure 5-20

Here the truck driver injury severity distributions are compared according to the cab style of the tractor. While the differences between the injury 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 "B" (non-incapacitating), "A" (incapacitating), and fatal injuries.

TABLE 5-20
Truck Driver Injury Severity by Cab Style
Tractors Only
TIFA 1989

Injury Severity	Conventional		Cabover/ Cab-forward		Unknown		TOTAL	
	No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.
Not injured	1,287	61.64%	818	51.64%	47	50.64%	2,152	57.16%
C injury	223	10.68	157	9.91	8	8.60	388	10.31
B injury	195	9.34	185	11.68	12	12.90	392	10.41
A injury	85	4.06	106	6.69	3	3.23	194	5.15
Fatal injury	246	11.78	292	18.43	14	15.05	552	14.66
Injured, severity unknown	10	0.48	7	0.44	0	0.00	17	0.45
Unknown if injured	42	2.01	19	1.20	9	9.68	70	1.86
TOTAL	2,088	100.00%	1,584	100.00%	93	100.00%	3,765	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 over 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 70% of the cases. Non-collisions accounted for 2.7% of all involvements but 16% of the involvements that were fatal to the truck driver.

TABLE 5-21A
Driver Injury Severity by Principal Impact Point for Tractors—Frequencies
TIFA 1989

Principal Impact Point	Driver Injury Severity							
	Not Injured	C	B	A	Fatal	Injured, severity unk	Unknown if injured	TOTAL
Noncollision	10	0	1	2	88	0	0	101
Right side	227	38	46	22	71	0	6	410
Rear	377	57	20	6	17	2	27	506
Left side	359	25	14	13	29	0	16	456
Front	972	250	295	137	300	11	13	1,978
Top	4	4	2	6	28	1	0	45
Undercarriage	149	9	8	0	9	0	8	183
Override	21	5	3	2	0	0	0	31
Unknown	33	0	3	6	10	3	0	55
TOTAL	2,152	388	392	194	552	17	70	3,765

TABLE 5-21B
Driver Injury Severity by Principal Impact Point for Tractors—Column Percentages
TIFA 1989

Principal Impact Point	Driver Injury Severity							
	Not Injured	C	B	A	Fatal	Injured, sev unk	Unk if injured	TOTAL
Noncollision	0.46%	0.00%	0.26%	1.03%	15.94%	0.00%	0.00%	2.68%
Right side	10.55	9.79	11.73	11.34	12.86	0.00	8.57	10.89
Rear	17.52	14.69	5.10	3.09	3.08	11.76	38.57	13.44
Left side	16.68	6.44	3.57	6.70	5.25	0.00	22.86	12.11
Front	45.17	64.43	75.26	70.62	54.35	64.71	18.57	52.54
Top	0.19	1.03	0.51	3.09	5.07	5.88	0.00	1.20
Undercar.	6.92	2.32	2.04	0.00	1.63	0.00	11.43	4.86
Override	0.98	1.29	0.77	1.03	0.00	0.00	0.00	0.82
Unknown	1.53	0.00	0.77	3.09	1.81	17.65	0.00	1.46
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. Collisions in which the left side or the rear of the truck was struck were the safest for the truck driver. The driver was uninjured in 80% of the known cases in these categories. On the other hand, 87% of the non-collisions resulted in the death of the driver, and the driver was uninjured in only 9.9% of these cases.

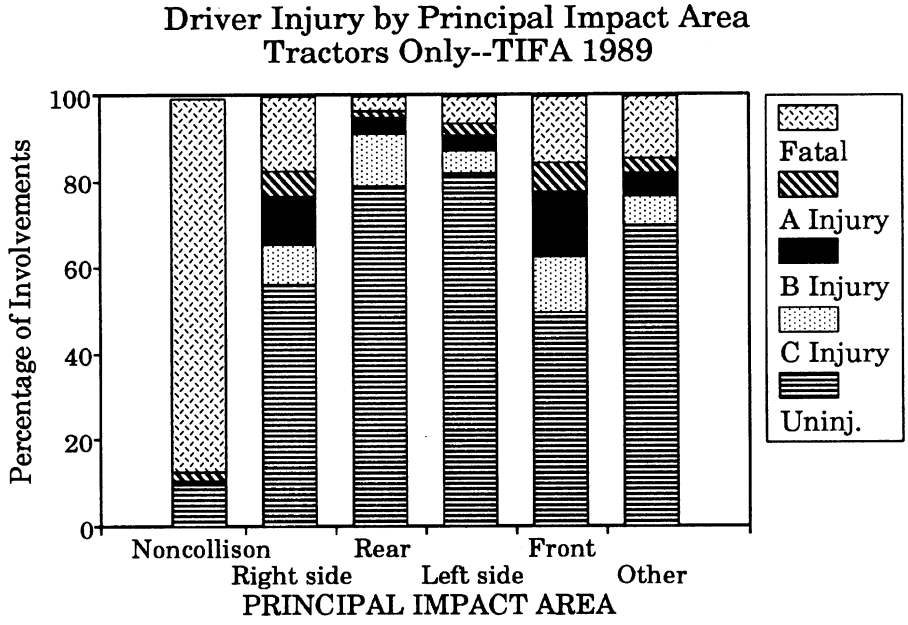


Figure 5-21

Finally, driver injury severity is compared across the levels of the variable that indicates whether or not the truck experienced a rollover, 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 9.6% of the involvements but accounted for 15.8% of the cases of drivers with "B" injuries, 21.1% of those with "A" injuries, and 32.2% of those with fatal injuries. Ejections alone took place in 2.4% of the involvements but represented 13.4% of the cases in which the driver was killed. Only 2.1% of the involvements included both a rollover and the ejection of the driver, but 13% of the cases in which the driver was killed fell into this category.

TABLE 5-22A
Driver Injury Severity by Rollover/Fire/Ejection for Tractors—Frequencies TIFA 1989

Occurrence of Rollover/Fire/Ejection	Driver Injury Severity							
	Not Injured	C	B	A	Fatal	Injured, severity unk	Unknown if injured	TOTAL
None	2,070	326	300	128	144	12	20	3,000
Rollover only	42	32	62	41	178	5	3	363
Fire only	37	21	13	9	45	0	3	128
Ejection only	0	3	4	9	74	0	0	90
Rollover/Fire	0	2	10	1	28	0	0	41
Fire/Ejection	0	2	0	0	5	0	0	7
Rollover/Ejection	0	2	0	6	72	0	0	80
Rollover/Fire/Ejection	0	0	2	0	5	0	0	7
Unknown	3	0	1	0	1	0	44	49
TOTAL	2,152	388	392	194	552	17	70	3,765

TABLE 5-22B
Driver Injury Severity by Rollover/Fire/Ejection
for Tractors—Column Percentages
TIFA 1989

Occurrence of Rollover/Fire/ Ejection	Driver Injury Severity							
	Not Injured	C	B	A	Fatal	Injured, sev unk	Unk if injured	TOTAL
None	96.19%	84.02%	76.53%	65.98%	26.09%	70.59%	28.57%	79.68%
Rollover only	1.95	8.25	15.82	21.13	32.25	29.41	4.29	9.64
Fire only	1.72	5.41	3.32	4.64	8.15	0.00	4.29	3.40
Ejection only	0.00	0.77	1.02	4.64	13.41	0.00	0.00	2.39
Rollover/Fire	0.00	0.52	2.55	0.52	5.07	0.00	0.00	1.09
Fire/Ejection	0.00	0.52	0.00	0.00	0.91	0.00	0.00	0.19
Roll/Eject	0.00	0.52	0.00	3.09	13.04	0.00	0.00	2.12
Roll/Fire/Eject	0.00	0.00	0.51	0.00	0.91	0.00	0.00	0.19
Unknown	0.14	0.00	0.26	0.00	0.18	0.00	62.86	1.30
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 70% of the cases where none of these events took place. This compares with 30% of the cases when a fire alone occurred, 12% of the cases when a rollover alone took place, and none of the cases when there was only an ejection. Combinations of these events proved more perilous to the driver. In 71% of the cases in which there was a fire and an ejection, and 90% of the cases in which there was a rollover and an ejection, the crash resulted in the death of the driver.

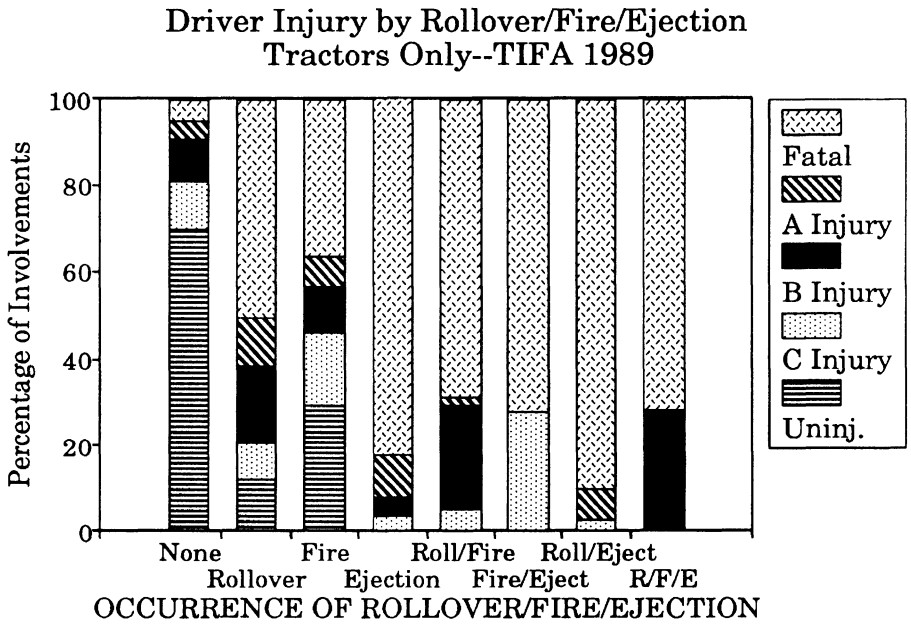
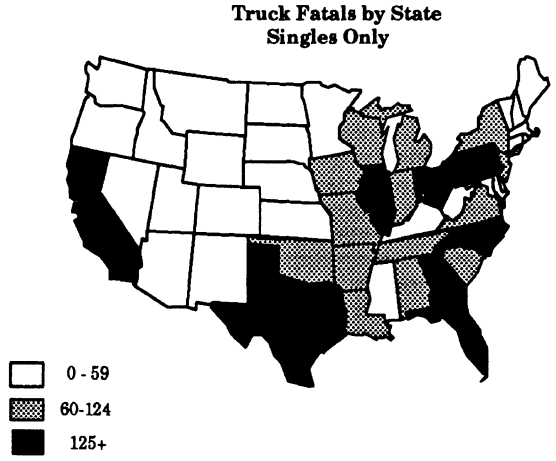


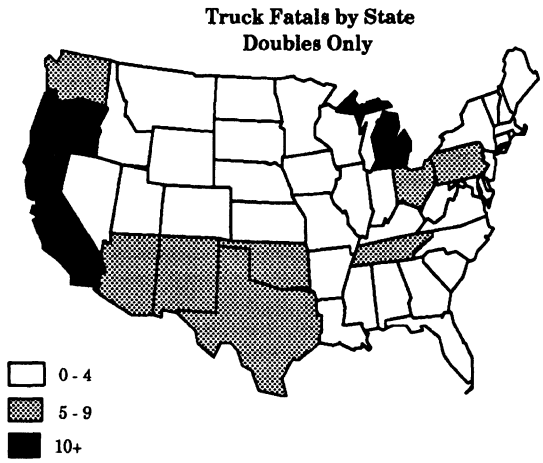
Figure 5-22

1989 FATAL ACCIDENT EXPERIENCE OF SINGLES AND DOUBLES

In this final section of the 1989 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 1989 there were 3,286 fatal accidents involving singles and 210 involving doubles. The maps illustrating the distributions of singles and doubles involvements across the country are repeated 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 1989 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. Both singles and doubles were more likely to have a conventional cab, and the distribution is almost identical; 57% of the singles and 54% of the doubles had conventional cabs.

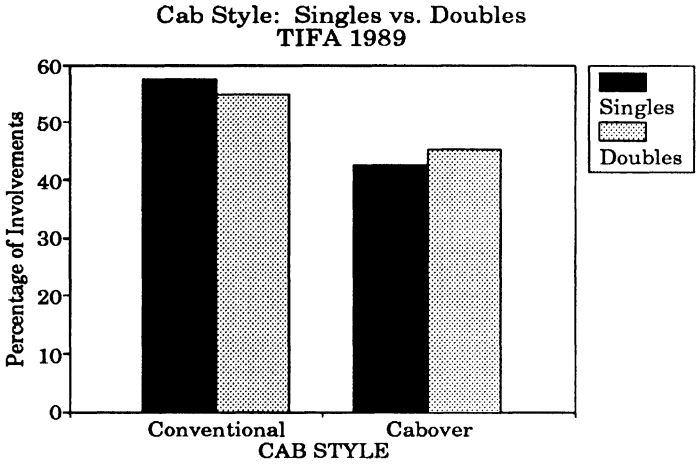


Figure 6-1

TABLE 6-1
Cab Style: Singles vs. Doubles
TIFA 1989

Cab Style	Singles		Doubles		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
Conventional	1,876	57.09%	114	54.29%	1,990	56.92%
Cabover/Cab-forward	1,389	42.27	94	44.76	1,483	42.42
Unknown	21	0.64	2	0.95	23	0.66
TOTAL	3,286	100.00%	210	100.00%	3,496	100.00%

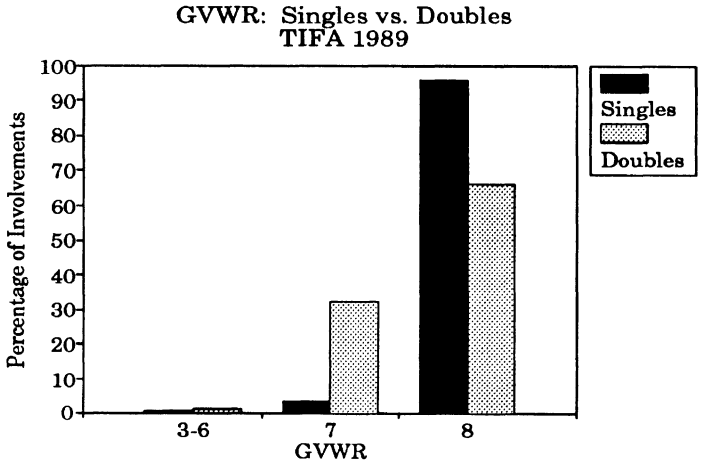


Figure 6-2

The graph at left shows the distributions for the gross vehicle weight ratings of the involved singles and doubles. Almost 96% of the singles with a known GVWR were class 8 (over 33,000 lbs.), while only 66% of the known cases of doubles were class 8.

TABLE 6-2
GVWR: Singles vs. Doubles
TIFA 1989

GVWR Class	Singles		Doubles		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
4	4	0.12%	0	0.00%	4	0.11%
5	1	0.03	0	0.00	1	0.03
6	19	0.58	2	0.95	21	0.60
7	114	3.47	62	29.52	176	5.03
8	3,119	94.92	125	59.52	3,244	92.79
Unknown	29	0.88	21	10.00	50	1.43
TOTAL	3,286	100.00%	210	100.00%	3,496	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. Over 37% of the known cases are included in the 20,000-39,999 pound weight range, while another 31% of the known cases fall into a peak representing the 70,000-79,999 pound category. In contrast, only 13% of the involved doubles had a GCW of 30,000-39,999 pounds. Most of the known doubles cases (53%) fall into the three heaviest GCW categories, indicating weights of 60,000 pounds and above.

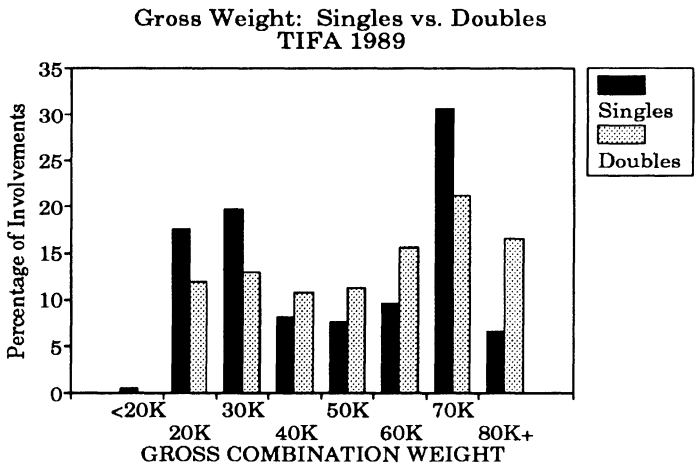


Figure 6-3

TABLE 6-3
Gross Combination Weight: Singles vs. Doubles
TIFA 1989

Gross Weight	Singles		Doubles		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
< 20,000	12	0.37%	0	0.00%	12	0.34%
20,000	545	16.59	23	10.95	568	16.25
30,000	611	18.59	25	11.90	636	18.19
40,000	250	7.61	21	10.00	271	7.75
50,000	237	7.21	22	10.48	259	7.41
60,000	295	8.98	30	14.29	325	9.30
70,000	951	28.94	41	19.52	992	28.38
80,000+	203	6.18	32	15.24	235	6.72
Unknown	182	5.54	16	7.62	198	5.66
TOTAL	3,286	100.00%	210	100.00%	3,496	100.00%

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

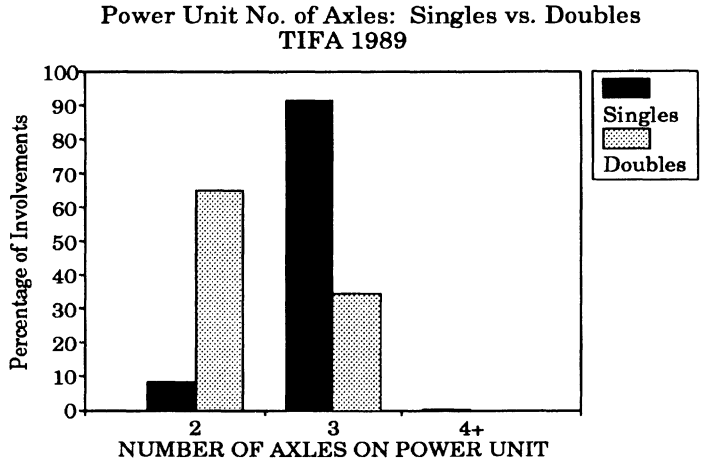


Figure 6-4

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 was 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 1989

Power Unit No. of Axles	Singles		Doubles		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
2	279	8.49%	135	64.29%	414	11.84%
3	2,991	91.02	72	34.29	3,063	87.61
4+	5	0.15	0	0.00	5	0.14
Unknown	11	0.33	3	1.43	14	0.40
TOTAL	3,286	100.00%	210	100.00%	3,496	100.00%

The main difference between the carrier type distributions for singles and doubles is the percentage of interstate and intrastate carriers. Of the known cases of carrier type, 84.4% of the involved singles and 73.2% of the doubles were interstate carriers. Conversely, 14.9% of the involved singles and 26.8% of the doubles were intrastate carriers.

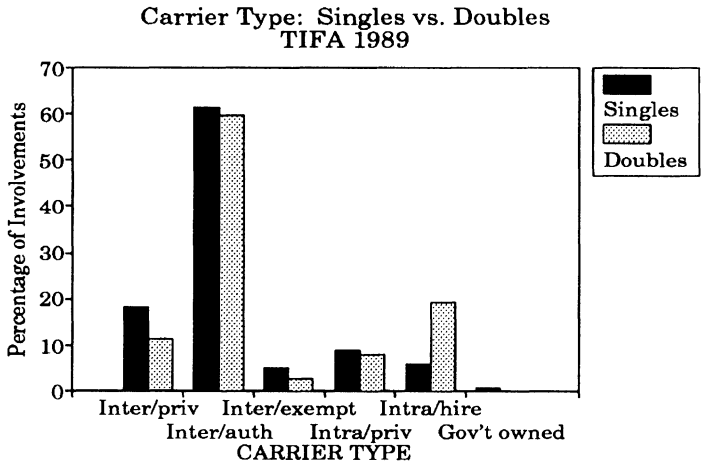


Figure 6-5

TABLE 6-5
Carrier Type: Singles vs. Doubles
TIFA 1989

Carrier Type	Singles		Doubles		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
Interstate private	585	17.80%	23	10.95%	608	17.39%
Interstate authorized	1,970	59.95	122	58.10	2,092	59.84
Interstate exempt	158	4.81	5	2.38	163	4.66
Intrastate private	285	8.67	16	7.62	301	8.61
Intrastate for hire	194	5.90	39	18.57	233	6.66
Government owned	21	0.64	0	0.00	21	0.60
Unknown	73	2.22	5	2.38	78	2.23
TOTAL	3,286	100.00%	210	100.00%	3,496	100.00%

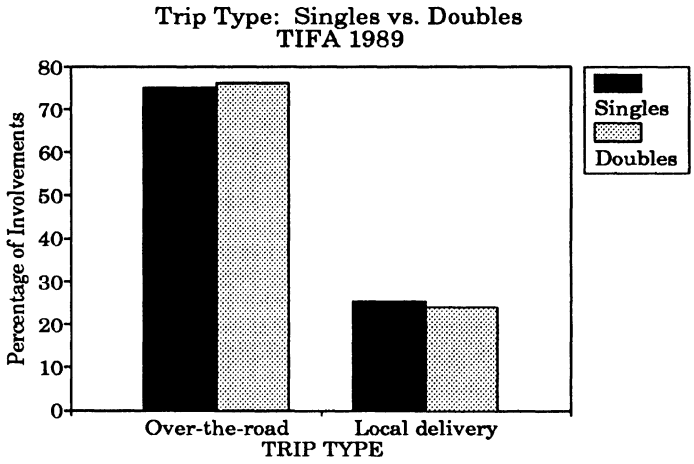


Figure 6-6

In terms of the type of trip at the time of the accident, the majority of singles and doubles were making over-the-road trips. Of the known cases, about 75% of both the singles and doubles were conducting over-the-road trips.

TABLE 6-6
Trip Type: Singles vs. Doubles
TIFA 1989

Trip Type	Singles		Doubles		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
Over-the-road	2,392	72.79%	152	72.38%	2,544	72.77%
Local delivery	812	24.71	48	22.86	860	24.60
Unknown	82	2.50	10	4.76	92	2.63
TOTAL	3,286	100.00%	210	100.00%	3,496	100.00%

The road class distributions are shown in the graph at right. Relatively more doubles involvements took place on limited access routes and fewer on major arteries compared with singles involvements. Of the known cases, 46% of the doubles accidents occurred on limited access roads and 42% occurred on major arteries. The respective figures for singles were 33% and 54%.

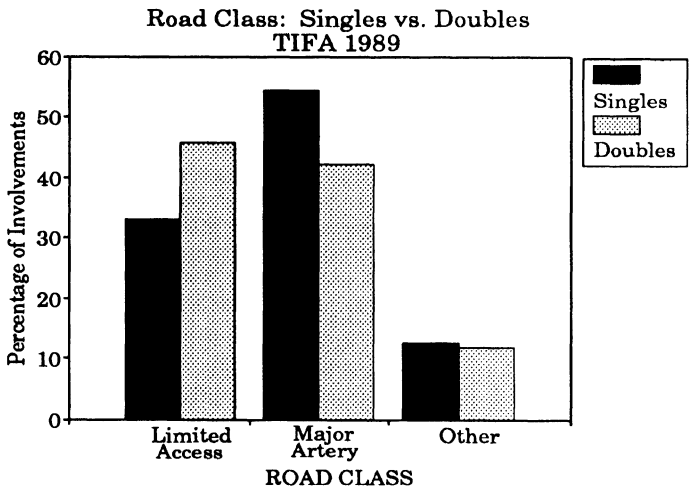


Figure 6-7

TABLE 6-7
Road Class: Singles vs. Doubles
TIFA 1989

Road Class	Singles		Doubles		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
Limited Access	1,087	33.08%	96	45.71%	1,183	33.84%
Major Artery	1,782	54.23	89	42.38	1,871	53.52
Other	409	12.45	25	11.90	434	12.41
Unknown	8	0.24	0	0.00	8	0.23
TOTAL	3,286	100.00%	210	100.00%	3,496	100.00%

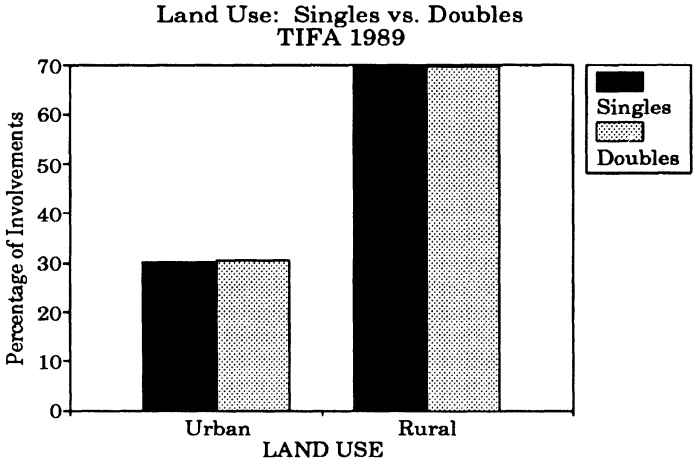


Figure 6-8

The land use distributions, whether the accident took place in a rural or urban area, are virtually identical for singles and doubles. Considering all singles and doubles combined, 70% of the involvements occurred in rural areas and 30% in urban areas.

TABLE 6-8
Land Use: Singles vs. Doubles
TIFA 1989

Land Use	Singles		Doubles		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
Urban	992	30.19%	64	30.48%	1,056	30.21%
Rural	2,287	69.60	146	69.52	2,433	69.59
Unknown	7	0.21	0	0.00	7	0.20
TOTAL	3,286	100.00%	210	100.00%	3,496	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 with singles. Over 55% of the singles involvements occurred during daylight, compared with 43% of the doubles involvements. On the other hand, 55% with the doubles involvements took place at night, compared to 41% of the singles involvements. This probably reflects a greater proportion of nighttime travel for doubles compared to singles.

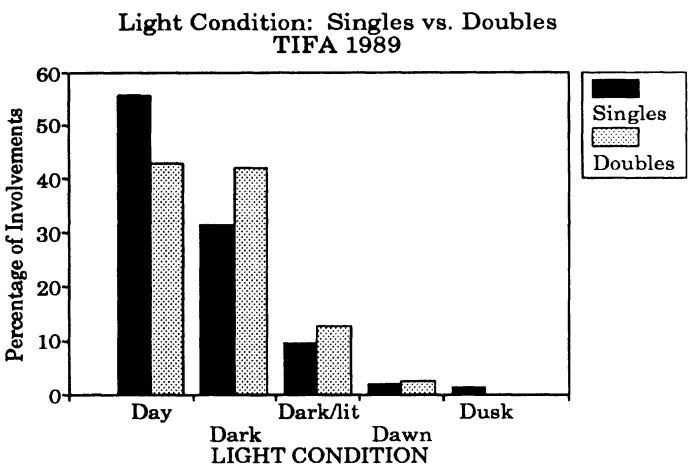


Figure 6-9

TABLE 6-9
Light Condition: Singles vs. Doubles
TIFA 1989

Light Condition	Singles		Doubles		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
Daylight	1,826	55.57%	90	42.86%	1,916	54.81%
Dark, not lighted	1,035	31.50	88	41.90	1,123	32.12
Dark, but lighted	312	9.49	27	12.86	339	9.70
Dawn	67	2.04	5	2.38	72	2.06
Dusk	46	1.40	0	0.00	46	1.32
TOTAL	3,286	100.00%	210	100.00%	3,496	100.00%

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