Center for
National Truck Statistics

TRUCKS INVOLVED IN FATAL ACCIDENTS

FACTBOOK 1988

Kathleen P. Sullivan
Dawn L. Massie

UMTRI
The University of Michigan
Transportation Research Institute

UMTRI-92-9

TRUCKS INVOLVED IN FATAL ACCIDENTS 1988 FACTBOOK

Kathleen P. Sullivan
Dawn L. Massie

April 1992

Center for National Truck Statistics

The University of Michigan
Transportation Research Institute
Ann Arbor, Michigan 48109-2150

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

Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
UMTRI-92-9		

4. Title and Subtitle	5. Report Date
TRUCKS INVOLVED IN FATAL ACCIDENTS, 1988 FACTBOOK	April, 1992
	6. Performing Organization Code
7. Author(s) Kathleen P. Sullivan, Dawn L. Massie	8. Performing Organization Report No. UMTRI-92-9
9. Performing Organization Name and Address The University of Michigan Transportation Research Institute 2901 Baxter Road, Ann Arbor, Michigan 48109-2150	10. Work Unit No. 11. Contract or Grant No. 2164
12. Sponsoring Agency Name and Address Motor Vehicle Manufacturers Association 7430 Second Avenue, Suite 300 Detroit, Michigan 48202	13. Type of Report and Period Covered Final Report 14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

This report contains a series of distributions of variables from UMTRI's file of Trucks Involved in Fatal Accidents, 1988. This file combines the coverage of the Fatal Accident Reporting System (FARS) data with the detail of the Office of Motor Carrier (OMC) data. When no OMC report existed for a medium or heavy truck listed by FARS, UMTRI conducted a telephone interview to obtain the desired information on ownership, type of trip, vehicle configuration, cargo weights, and lengths. The 1988 TIFA dataset contains 5,467 cases, up 3.6% from the 5,275 in 1987.

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 1988. The next section provides an overview of the fatal involvements in 1988, with most of the distributions presented on the basis of power unit type, comparing straight trucks with tractor combinations. Most of the variables in the overview section are based on the FARS file variables and describe basic information on the time and place of the accident, environmental conditions, and collision type. Following this are a pair of sections that focus separately on straight trucks and tractor combinations in more detail, with the distributions presented on the basis of cargo body style. The majority of the variables in these sections were derived from telephone interviews and OMC reports and describe the cargo type, cab style, vehicle weight, and trailer and axle configurations of the trucks. The final section compares the fatal accident experience of tractor-semitrailers with that of tractors with twin trailers.

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

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
None	None	126	

CONTENTS

List of Tables vii

List of Figures xi

TIFA Summary Facts and Figures 1

Introduction 3
- Survey Methodology 3
- Sampling and the 1988 File 5
- Conventions Followed 6

Trends in the TIFA Data, 1980-1988 7
- Annual Fatal Involvements 7
- Annual Fatalities 9
- Annual Truck Driver Fatalities 12

Overview of Large Truck Fatal Accident Involvements in 1988 15
- Geographic Distributions 17
- Temporal Distributions 21
- Environmental Distributions 24
- Collision Types 32
- Driver Characteristics 37
- Vehicle Characteristics 45

Fatal Accident Experience of Straight Trucks in 1988 53
- Configuration 55
- Use 61
- Accidents 64
- Driver Injury 67

Fatal Accident Experience of Tractor Combinations in 1988 73
- Configuration 75
- Use 83
- Accidents 88
- Driver Injury 95

1988 Fatal Accident Experience of Singles and Doubles 101

Index 111

TABLES

OVERVIEW OF LARGE TRUCK FATAL ACCIDENT INVOLVEMENTS IN 1988

Geographic Distributions

TABLE 3-1A: Distribution of Trucks in Fatal Accidents by State and Type of Truck. . . 19
TABLE 3-1B: Distribution of Trucks in Fatal Accidents by State and Type of Truck, Column Percents. 20

Temporal Distributions

TABLE 3-2: Month of Accident by Power Unit Type 21
TABLE 3-3: Day of Accident by Power Unit Type. 22
TABLE 3-4: Time of Day of Accident by Power Unit Type 23

Environmental Distributions

TABLE 3-5: Land Use by Power Unit Type 24
TABLE 3-6: Light Condition by Power Unit Type. 25
TABLE 3-7: Road Surface Condition by Power Unit Type 26
TABLE 3-8: Road Class by Power Unit Type 27
TABLE 3-9: Road Class by Power Unit Type, Urban Areas Only 28
TABLE 3-10: Road Class by Power Unit Type, Rural Areas Only 29
TABLE 3-11: Relation to Junction by Power Unit Type 30
TABLE 3-12: Traffic Control at Intersection Crashes by Power Unit Type 31
TABLE 3-13: Speed Limit by Power Unit Type. 32

Collision Types

TABLE 3-14: First Harmful Event by Power Unit Type. 33
TABLE 3-15: Manner of Collision by Power Unit Type for Crashes with Another Motor Vehicle. 34
TABLE 3-16: Vehicle Role by Power Unit Type. 35
TABLE 3-17: Occurrence of Rollovers by Power Unit Type 36
TABLE 3-18: Fire Occurrence by Power Unit Type 37

Driver Characteristics

TABLE 3-19: Age of Truck Driver by Power Unit Type 38
TABLE 3-20: Truck Driver Gender by Power Unit Type. 38
TABLE 3-21: Truck Driver Restraint Use by Power Unit Type. 39
TABLE 3-22: Truck Driver Alcohol Use by Power Unit Type 40
TABLE 3-23: Truck Driver Ejection by Power Unit Type 41
TABLE 3-24: Truck Driver Extrication by Power Unit Type 41
TABLE 3-25: Truck Driver Injury Severity by Power Unit Type 42
TABLE 3-26: Hours Driven Prior to Crash by Power Unit Type 43
TABLE 3-27: Truck Driver Related Factors by Power Unit Type. 45

Vehicle Characteristics

TABLE 3-28: Carrier Type by Power Unit Type 46
TABLE 3-29: Trip Type by Power Unit Type 47
TABLE 3-30: Type of Cargo by Power Unit Type. 48
TABLE 3-31: Cab Style by Power Unit Type 49
TABLE 3-32: Number of Trailers by Power Unit Type. 50
TABLE 3-33: Fuel Type by Power Unit Type 51
TABLE 3-34: Model Year of Power Unit by Power Unit Type. 52

FATAL ACCIDENT EXPERIENCE OF STRAIGHT TRUCKS IN 1988

Configuration

TABLE 4-1: GVWR by Body Style, Straight Trucks Only 55
TABLE 4-2: Gross Vehicle Weight by Body Style, Straight Trucks Only 56
TABLE 4-3: Number of Axles on Power Unit by Body Style, Straight Trucks Only . . .58
TABLE 4-4: Number of Axles on Power Unit and Trailers, Straight Trucks Only 58
TABLE 4-5: Cargo Type by Body Style, Straight Trucks Only 59

Use

TABLE 4-6: Carrier Type by Body Style, Straight Trucks Only 61
TABLE 4-7: Trip Type by Body Style, Straight Trucks Only 62
TABLE 4-8: Road Class by Body Style, Straight Trucks Only 63

Accidents

TABLE 4-9: First Harmful Event by Body Style, Straight Trucks Only. 64
TABLE 4-10: Most Harmful Event by Body Style, Straight Trucks Only. 65
TABLE 4-11: Manner of Collision by Body Style for Crashes with Another Motor Vehicle, Straight Trucks Only. 66

Driver Injury

TABLE 4-12: Truck Driver Injury Severity by Body Style, Straight Trucks Only 67
TABLE 4-13A: Driver Injury Severity by Principal Impact Point for Straight Trucks, Frequencies 68
TABLE 4-13B: Driver Injury Severity by Principal Impact Point for Straight Trucks, Column Percentages 68
TABLE 4-14A: Driver Injury Severity by Rollover/Fire/Ejection for Straight Trucks, Frequencies 70
TABLE 4-14B: Driver Injury Severity by Rollover/Fire/Ejection for Straight Trucks, Column Percentages 70

FATAL ACCIDENT EXPERIENCE OF TRACTOR COMBINATIONS IN 1988

Configuration

TABLE 5-1: Number of Trailers by Cab Style, Tractors Only. 75
TABLE 5-2: First Trailer Body Style by Cab Style, Tractors Only. 76
TABLE 5-3: GVWR by First Trailer Body Style, Tractors Only 77
TABLE 5-4: Gross Combination Weight by First Trailer Body Style, Tractors Only. . .78
TABLE 5-5: Number of Axles on Power Unit by First Trailer Body Style, Tractors Only 79
TABLE 5-6: Axle Configuration by Cab Style, Tractors Only. 80
TABLE 5-7: Cargo Type by First Trailer Body Style, Tractors Only. 81
TABLE 5-8: Fuel Type by Cab Style, Tractors Only. 83

Use

TABLE 5-9: Carrier Type by First Trailer Body Style, Tractors Only 84
TABLE 5-10: Trip Type by First Trailer Body Style, Tractors Only. 85
TABLE 5-11: Road Class by First Trailer Body Style, Tractors Only 86
TABLE 5-12: Land Use by First Trailer Body Style, Tractors Only. 87
TABLE 5-13: Light Condition by First Trailer Body Style, Tractors Only 88

Accidents

TABLE 5-14: First Harmful Event by First Trailer Body Style, Tractors Only 89
TABLE 5-15: Most Harmful Event by First Trailer Body Style, Tractors Only 91
TABLE 5-16: Manner of Collision by First Trailer Body Style for Crashes with Another Motor Vehicle, Tractors Only 92
TABLE 5-17: Gross Combination Weight by Rollover Occurrence, Tractors Only 93
TABLE 5-18: Gross Combination Weight by Jackknife Occurrence, Tractors Only. . . . 94

Driver Injury

TABLE 5-19: Truck Driver Injury Severity by First Trailer Body Style, Tractors Only . 95
TABLE 5-20: Truck Driver Injury Severity by Cab Style, Tractors Only 96
TABLE 5-21A: Driver Injury Severity by Principal Impact Point for Tractors, Frequencies. 97
TABLE 5-21B: Driver Injury Severity by Principal Impact Point for Tractors, Column Percentages. 97
TABLE 5-22A: Driver Injury Severity by Rollover/Fire/Ejection for Tractors, Frequencies. 98
TABLE 5-22B: Driver Injury Severity by Rollover/Fire/Ejection for Tractors, Column Percentages. 99

1988 FATAL ACCIDENT EXPERIENCE OF SINGLES AND DOUBLES

TABLE 6-1: Cab Style: Singles vs. Doubles. 103
TABLE 6-2: GVWR: Singles vs. Doubles 104
TABLE 6-3: Gross Combination Weight: Singles vs. Doubles. 105
TABLE 6-4: Power Unit Number of Axles: Singles vs. Doubles. 106
TABLE 6-5: Carrier Type: Singles vs. Doubles 106
TABLE 6-6: Trip Type: Singles vs. Doubles. 107
TABLE 6-7: Road Class: Singles vs. Doubles 108
TABLE 6-8: Land Use: Singles vs. Doubles. 108
TABLE 6-9: Light Condition: Singles vs. Doubles 109

FIGURES

INTRODUCTION

Figure 1-1: TIFA Case Flow 4

TRENDS IN THE TIFA DATA, 1980-1988

Annual Fatal Involvements

Figure 2-1: Fatal Involvements by Year 7
Figure 2-2: Fatal Involvements by Year, Single-Unit Straight Trucks Only 7
Figure 2-3: Fatal Involvements by Year, Straight Trucks with One Trailer Only 8
Figure 2-4: Fatal Involvements by Year, Bobtails Only 8
Figure 2-5: Fatal Involvements by Year, Tractor-Semitrailers Only 8
Figure 2-6: Fatal Involvements by Year, Tractors with Tandem Trailers Only 9

Annual Fatalities

Figure 2-7: Total Fatalities by Year 9
Figure 2-8: Total Fatalities by Year, Single-Unit Straight Trucks Only 10
Figure 2-9: Total Fatalities by Year, Straight Trucks with One Trailer Only 10
Figure 2-10: Total Fatalities by Year, Bobtails Only 10
Figure 2-11: Total Fatalities by Year, Tractor-Semitrailers Only 11
Figure 2-12: Total Fatalities by Year, Tractors with Tandem Trailers Only 11

Annual Truck Driver Fatalities

Figure 2-13: Truck Driver Fatalities by Year 12
Figure 2-14: Truck Driver Fatalities by Year, Single-Unit Straight Trucks Only 12
Figure 2-15: Truck Driver Fatalities by Year, Straight Trucks with One Trailer Only . . 13
Figure 2-16: Truck Driver Fatalities by Year, Bobtails Only 13
Figure 2-17: Truck Driver Fatalities by Year, Tractor-Semitrailers Only 13
Figure 2-18: Truck Driver Fatalities by Year, Tractors with Tandem Trailers Only . . . 14

OVERVIEW OF LARGE TRUCK FATAL ACCIDENT INVOLVEMENTS IN 1988

Geographic Distributions

Figure 3-1a: Truck Fatals by State 17
Figure 3-1b: Truck Fatals by State, Singles Only 18
Figure 3-1c: Truck Fatals by State, Doubles Only 18

Temporal Distributions

Figure 3-2: Month of Accident by Power Unit Type 21
Figure 3-3: Day of Accident by Power Unit Type 22
Figure 3-4: Time of Accident by Power Unit Type 23

Environmental Distributions

Figure 3-5: Land Use by Power Unit Type 24
Figure 3-6: Light Condition by Power Unit Type 25
Figure 3-7: Road Condition by Power Unit Type 26
Figure 3-8: Road Class by Power Unit Type 27
Figure 3-9: Road Class by Power Unit Type, Urban Areas Only 27
Figure 3-10: Road Class by Power Unit Type, Rural Areas Only 28

Figure 3-11: Relation to Junction by Power Unit Type 29
Figure 3-12: Traffic Control by Power Unit Type, Intersection Crashes Only. 30
Figure 3-13: Speed Limit by Power Unit Type 31

Collision Types
Figure 3-14: First Harmful Event by Power Unit Type 33
Figure 3-15: Manner of Collision by Power Unit Type for Crashes with Another Motor Vehicle 34
Figure 3-16: Vehicle Role by Power Unit Type 35
Figure 3-17: Rollovers by Power Unit Type. 36
Figure 3-18: Fire Occurrence by Power Unit Type. 36

Driver Characteristics
Figure 3-19: Driver Age by Power Unit Type. 37
Figure 3-21: Driver Restraint Use by Power Unit Type. 39
Figure 3-22: Driver Alcohol Use by Power Unit Type 40
Figure 3-23: Driver Ejection by Power Unit Type 40
Figure 3-24: Driver Extrication by Power Unit Type 41
Figure 3-25: Injury Severity by Power Unit Type 42
Figure 3-26: Hours Driven by Power Unit Type 43
Figure 3-27: Driver Factors by Power Unit Type. 44

Vehicle Characteristics
Figure 3-28: Carrier Type by Power Unit Type. 46
Figure 3-29: Trip Type by Power Unit Type 47
Figure 3-30a: Cargo Type for Straight Trucks. 48
Figure 3-30b: Cargo Type for Tractors 49
Figure 3-31: Cab Style by Power Unit Type. 49
Figure 3-32: Number of Trailers by Power Unit Type 50
Figure 3-33: Fuel Type by Power Unit Type 51
Figure 3-34: Power Unit Model Year by Power Unit Type 52

FATAL ACCIDENT EXPERIENCE OF STRAIGHT TRUCKS IN 1988

Configuration
Figure 4-1: GVWR by Body Style, Straight Trucks Only. 55
Figure 4-2: Gross Vehicle Weight by Body Style, Straight Trucks Only 57
Figure 4-3: Power Unit Number of Axles by Body Style, Straight Trucks Only 57
Figure 4-5a: Cargo Type for Van Straight Trucks 60
Figure 4-5b: Cargo Type for Flatbed Straight Trucks 60

Use
Figure 4-6: Carrier Type by Body Style, Straight Trucks Only 61
Figure 4-7: Trip Type by Body Style, Straight Trucks Only. 62
Figure 4-8: Road Class by Body Style, Straight Trucks Only 63

Accidents
Figure 4-9: First Harmful Event by Body Style, Straight Trucks Only. 64
Figure 4-10 Most Harmful Event by Body Style Straight Trucks Only 65
Figure 4-11: Manner of Collision by Body Style for Crashes with Another Motor Vehicle, Straight Trucks Only. 66

Driver Injury
Figure 4-12: Driver Injury Severity by Body Style, Straight Trucks Only 67
Figure 4-13: Driver Injury by Principal Impact Area, Straight Trucks Only. 69
Figure 4-14: Driver Injury by Rollover/Fire/Ejection, Straight Trucks Only 71

FATAL ACCIDENT EXPERIENCE OF TRACTOR COMBINATIONS IN 1988

Configuration
Figure 5-1: Number of Trailers by Cab Style, Tractors Only 75
Figure 5-2: First Trailer Body Style by Cab Style, Tractors Only 75
Figure 5-3: GVWR by First Trailer Body Style, Tractors Only. 76
Figure 5-4: GCW by First Trailer Body Style, Tractors Only. 78
Figure 5-5: Power Unit Number of Axles by First Trailer Body Style, Tractors Only . . 79
Figure 5-7a: Cargo Type for Van Trailers 82
Figure 5-7b: Cargo Type for Flatbed Trailers 82

Use
Figure 5-9: Carrier Type by First Trailer Body Style, Tractors Only 83
Figure 5-10: Trip Type by First Trailer Body Style, Tractors Only 84
Figure 5-11: Road Class by First Trailer Body Style, Tractors Only 85
Figure 5-12: Land Use by First Trailer Body Style, Tractors Only 86
Figure 5-13: Light Condition by First Trailer Body Style, Tractors Only. 87

Accidents
Figure 5-14: First Harmful Event by First Trailer Body Style, Tractors Only. 88
Figure 5-15: Most Harmful Event by First Trailer Body Style, Tractors Only 90
Figure 5-16: Manner of Collision by First Trailer Body Style for Crashes with Another Motor Vehicle, Tractors Only. 92
Figure 5-17: GCW by Rollover Occurrence, Tractors Only. 93
Figure 5-18: GCW by Jackknife Occurrence, Tractors Only 94

Driver Injury
Figure 5-19: Driver Injury Severity by First Trailer Body Style, Tractors Only 95
Figure 5-20: Driver Injury Severity by Cab Style, Tractors Only 96
Figure 5-21: Driver Injury by Principal Impact Area, Tractors Only 98
Figure 5-22: Driver Injury by Rollover/Fire/Ejection, Tractors Only 99

1988 FATAL ACCIDENT EXPERIENCE OF SINGLES AND DOUBLES

Figure 6-1: Cab Style: Singles vs. Doubles. 103
Figure 6-2: GVWR: Singles vs. Doubles 103
Figure 6-3: Gross Weight: Singles vs. Doubles 104
Figure 6-4: Power Unit Number of Axles: Singles vs. Doubles. 105
Figure 6-5: Carrier Type: Singles vs. Doubles. 106
Figure 6-6: Trip Type: Singles vs. Doubles. 107
Figure 6-7: Road Class: Singles vs. Doubles. 107
Figure 6-8: Land Use: Singles vs. Doubles. 108
Figure 6-9: Light Condition: Singles vs. Doubles 109

TIFA Summary Facts and Figures

- From 1980 through 1988, a total of 46,654 medium and heavy trucks were involved in fatal accidents. This is an average of 5,184 fatal involvements per year.
- The total number of fatal involvements for large trucks in 1988 was 5,467, compared to 5,275 in 1987, an increase of 3.6%.
- 3,915 (71.6%) of the large trucks involved in fatal accidents in 1988 had a tractor as the power unit, and 1,541 (28.2%) were straight trucks.
- Tractor-semitrailers were involved in 3,411 fatal accidents in 1988, and doubles (tractors hauling a semi and a full trailer) were involved in 228 fatal accidents. Triples experienced two fatal involvements in 1988.
- A total of 10,468 vehicles were involved in large truck fatal accidents in 1988.
- These accidents resulted in a total of 6,100 fatalities, 787 (12.2%) of which were truck drivers.
- The 1988 figure for fatally-injured truck drivers represents an 11.7% decrease since 1984 and a drop of 15.4% since 1980.
- About 61% of all of the 1988 large truck fatal involvements occurred during the daytime, 35% at night, and 4% during the dawn and dusk periods.
- 27% of the 1988 fatal accidents occurred on limited access highways, 53% on major arteries, and 19% on other classes of roads.
- The road surface was wet in 14% of the 1988 fatal accidents and covered with snow or ice in 5%.
- 66% of the 1988 fatal involvements took place in rural areas, compared to 33% in urban areas.
- Of all the large truck fatal involvements in 1988, 21% occurred at intersections.

INTRODUCTION

In 1981 UMTRI initiated a survey of all large trucks involved in fatal accidents in the continental United States, with 1980 being the initial year covered. The survey combines information from the Fatal Accident Reporting System (FARS) of the U.S. Department of Transportation National Highway Traffic Safety Administration (NHTSA) with data from the Federal Highway Administration Office of Motor Carriers (OMC) MCS 50-T report, state police accident reports, and comprehensive follow-up telephone surveys conducted by UMTRI research staff to produce the datafile called Trucks Involved in Fatal Accidents (TIFA). The TIFA survey has been conducted continuously since 1981 and is currently complete for accident years 1980 through 1989. The dataset provides detailed descriptions of all medium and heavy trucks (greater than 10,000 lbs. gross vehicle weight rating) involved in fatal accidents. Pickup trucks, vans, and utility vehicles are excluded from the file, as are fire trucks and passenger vehicles, such as buses and ambulances.

Survey Methodology

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

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

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

TIFA CASE FLOW

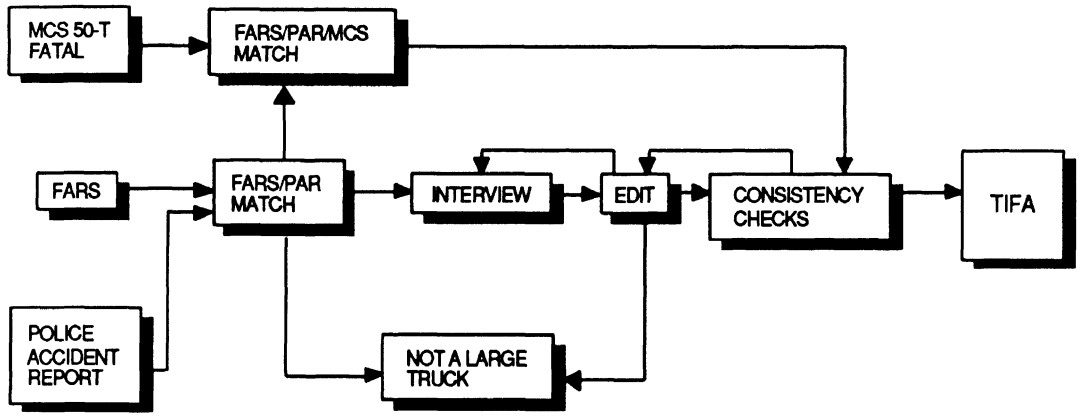


Figure 1-1

Part of editing and consistency checking involves decoding 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 percent for most specific factors of interest, an exceptionally low rate for this kind of data.

Sampling and the 1988 File

The 1988 version of TIFA is the second 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 all non-sample vehicles were removed from the file, sampling was done on cases that the FARS configuration variables showed to be either a straight truck with no trailer or a tractor pulling a semitrailer. These two vehicle types are the two most common configurations, as well as the configurations most likely to be identified accurately in FARS. After sorting to insure even coverage across the accident year, an interval selection procedure was employed within each accident state to select every other case. As a result, all cases matched with OMC are included in the file, as well as all cases 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 1988 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 33.2% ± 1.5. The proportion of cases with fires is 4.4% ± 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 1988 file *as if* it were a census file, or a simple random sample of all 5,467 cases.[1] The confidence intervals for the stratified random sample are only about 20% wider than they would have been had all the cases been taken. For example, the 95% confidence interval for the proportion of urban cases would have been ± 1.3 rather than ± 1.5. 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 1988 file.

---

[1]Calculating confidence intervals for census data is appropriate and frequently done. It is true that if the proportion of urban accidents in a census file from a particular year is 0.32, then that is the proportion of urban accidents for that year. But in another sense, interest typically is not narrowly in any particular year of accident data but in the relationship between certain factors and the probability of an accident. In that sense, any particular accident year constitutes a sample of accidents, so confidence intervals are properly calculated for the resulting estimates. The point of calculating confidence intervals for the sample actually taken and confidence intervals as if all accidents were taken is to see whether the sampling significantly degrades our ability to discern relationships in the factors of interest. Since the accuracy of the population estimates from the sampled file is comparable to that which would have been obtained had no sampling been done, we can safely assume that the effects of sampling are not significant. Similarly, the estimates calculated from the 1988 file are comparable to figures from previous TIFA files.

Conventions Followed

Most of this Factbook concerns the 1988 TIFA file, which was the second year in which sampling was conducted. All of the statistics presented in this document for 1988 are based on *weighted* frequencies from the file. Therefore, the 1988 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 - 1988 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 1988 TIFA file contains 109 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 109 to 11. Power unit type comparisons are made for straight trucks versus tractor combinations, with the 11 unknown cases excluded, in the section entitled *Overview of Large Truck Accident Involvements in 1988.*

Straight trucks are split into single-units versus those hauling one trailer. Tractors are divided into bobtails, tractor-semitrailers, and tractor-semi-full combinations. There is no category for triples (tractors hauling a semitrailer and two full trailers) because there were only two triples involved in fatal accidents in 1988. An "other" category includes the triples as well as straight trucks hauling two trailers, 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. Descriptive statistics for large trucks with a straight truck as the power unit are presented in the section entitled *Fatal Accident Experience of Straight Trucks in 1988*, and for large trucks with a tractor as the power unit, descriptive statistics are presented in the section entitled *Fatal Accident Experience of Tractors in 1988.* The final section compares the fatal accident experience of tractor-semitrailers (singles) with tractors pulling two trailers (doubles). The configuration type classifications are based solely on survey variables, not FARS variables. Therefore, the power unit type from the TIFA data, with 109 cases unknown, is used in the *Trends in the TIFA Data, 1980-1988* section, the geographic distributions portion of the *Overview of Large Truck Fatal Accident Involvements in 1988* section, and in the *1988 Fatal Accident Experience of Singles and Doubles* section. The power unit type coding from FARS, with 11 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, 1980-1988

The nine 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 fatal accidents involving large trucks has varied only slightly from year to year since 1980. The lowest number of involvements occurred in 1982 with 4,719. This dip corresponds with the recession at the beginning of the decade. The yearly total increased steadily after that, reaching 5,394 in 1985. Instead of continuing to rise as might be expected, the total has remained relatively flat since 1985. The 1988 figure of 5,467 involvements is 8.1% higher than the 1980 total.

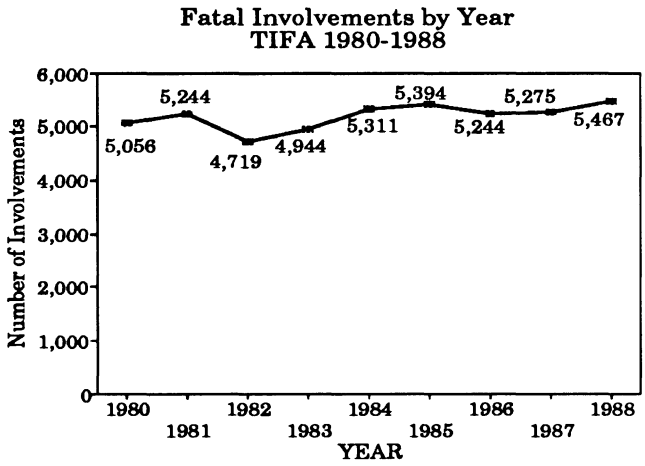


Figure 2-1

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

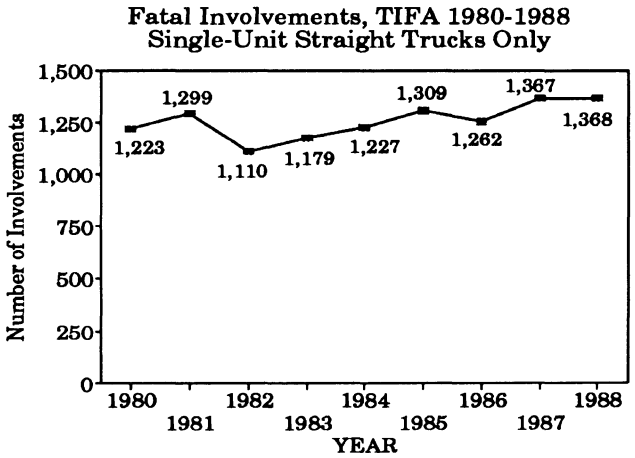


Figure 2-2

Single-unit straight truck involvements correspond closely to the overall trend. The exception is a rise in involvements from 1986 to 1987 of 8.3%. This compares to an increase of only 0.6% for all large trucks. The 1988 figure is virtually unchanged from 1987.

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. However, this configuration type comprises a very small proportion of the large truck population.

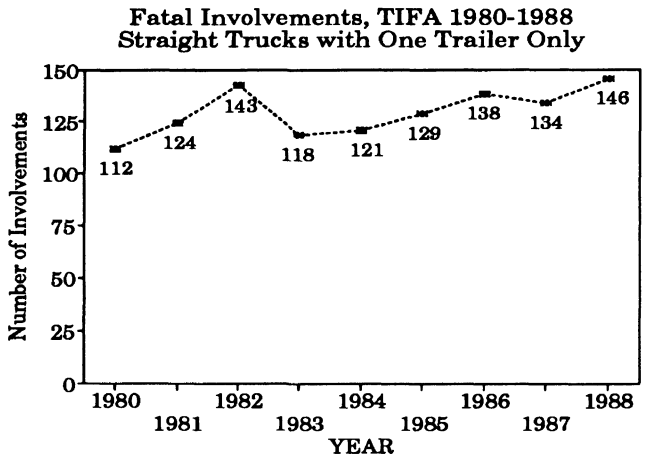


Figure 2-3

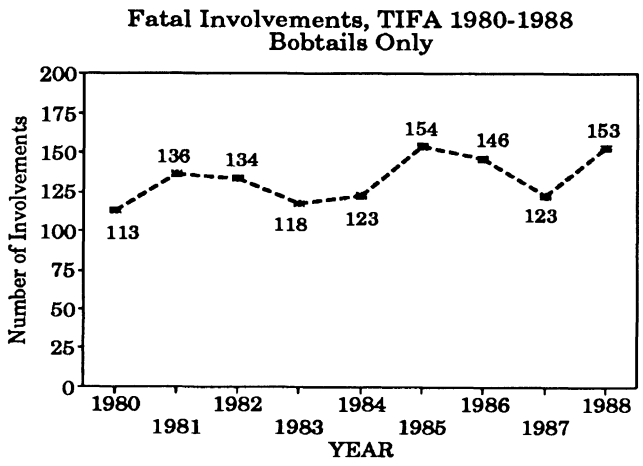


Figure 2-4

Bobtails similarly account for only a minor number of large truck fatal involvements each year. As with large trucks in general, the peak number of bobtail involvements occurred in 1985, with 154. The number declined in the following two years, falling to 123 in 1987. In 1988 there was an increase of 24% to 153. The percentage variation from year to year in the number of fatal involvements is greater for bobtails than for large trucks overall.

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

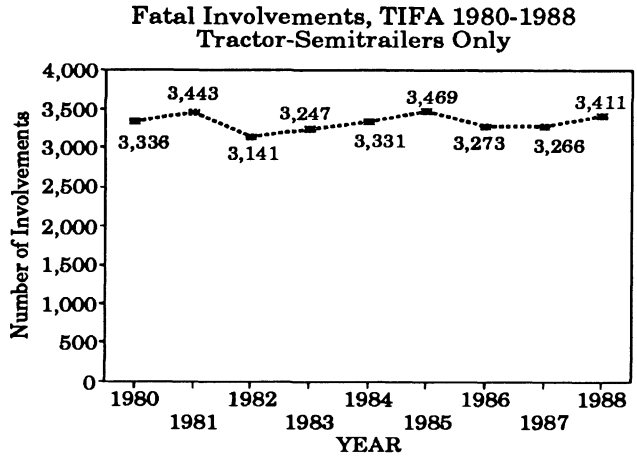


Figure 2-5

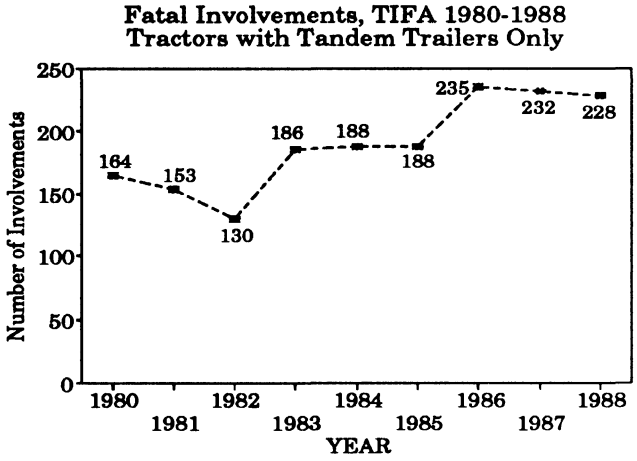


Figure 2-6

Fatal involvements for doubles rose over the period 1982 - 1986 and have remained level since 1986.

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 1988 total represented an increase of 3% from the previous year, and was 8% higher than the figure for 1980.

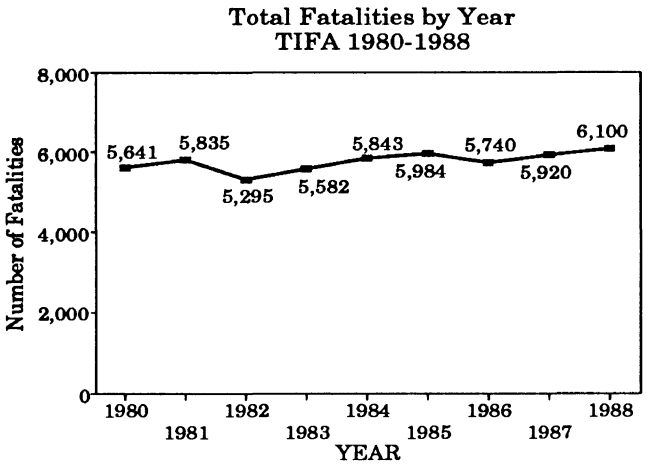


Figure 2-7

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

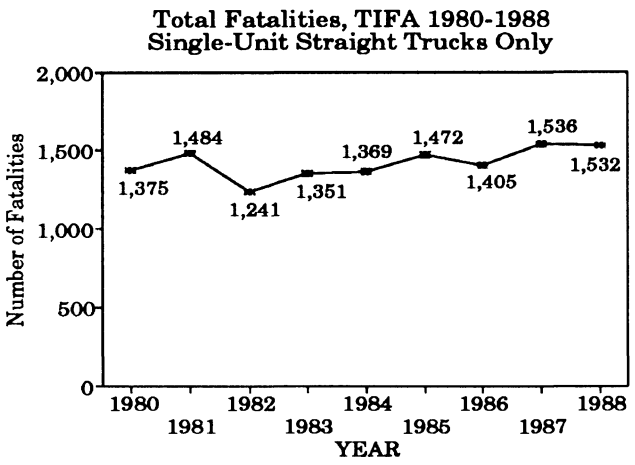


Figure 2-8

As was the case for involvements, the main difference between the straight truck fatality distribution and the overall fatality distribution is the greater increase from 1986 to 1987 for the straight trucks. These fatalities rose from 1,405 to 1,536 between the two years, an increase of 9%. The 1988 figure was virtually unchanged from the previous year.

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 figure for 1988 was 176 fatalities, an increase of 13% from the year before.

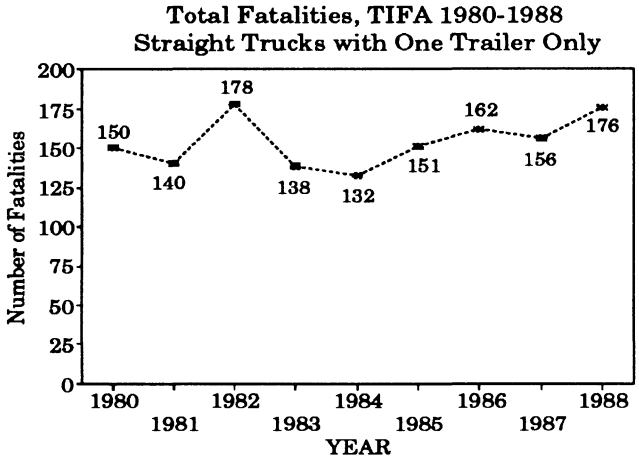


Figure 2-9

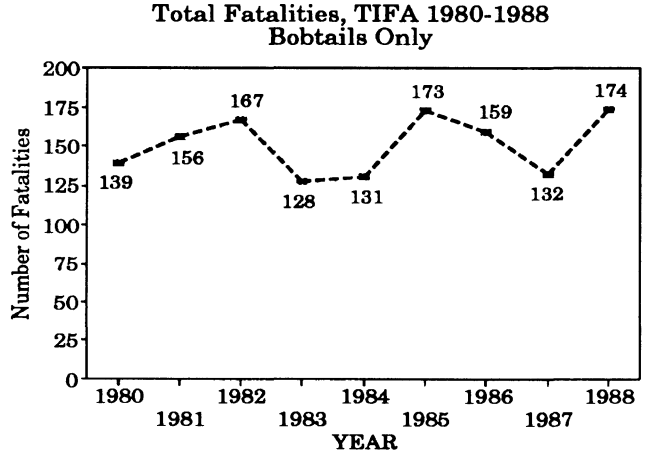


Figure 2-10

In 1988, the number of fatalities resulting from bobtail involvements increased 32% from 132 in 1987 to 174.

The number of fatalities resulting from singles involvements increased 4% from 1987 to 1988. The 1988 figure of 3,895 represents an increase of only 3% from the 1980 total.

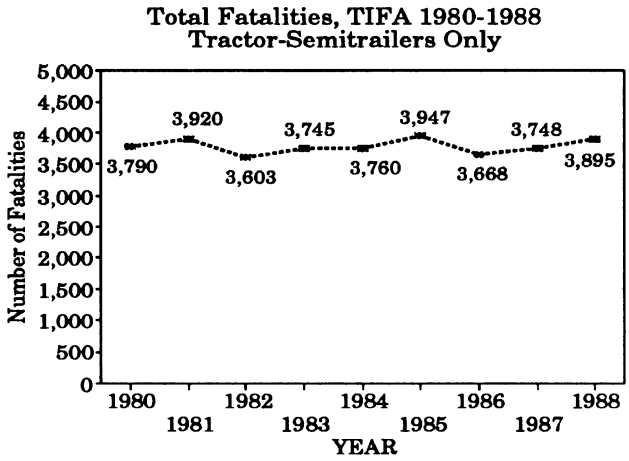


Figure 2-11

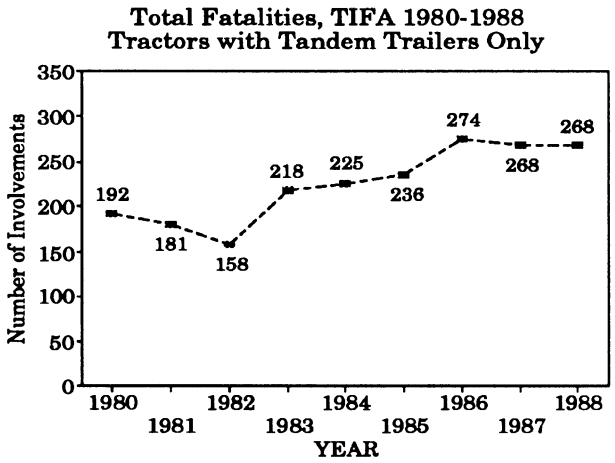


Figure 2-12

In contrast, fatalities resulting from doubles involvements have clearly risen during the 1980s. This increase corresponds with the increased reliance on doubles and the higher number of fatal involvements they have experienced over the past few years. After several years of increases, the total dropped slightly in 1987 and was unchanged in 1988.

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 1988, the number of truck driver fatalities dropped in each of the three years prior to 1988. Although the 1988 figure of 787 represents a 10.8% increase over the previous year, it is 11.7% fewer than the 1984 total. Furthermore, the *proportion* of truck driver fatalities out of all fatal truck crashes has declined from 18.4% in 1980 to 14.4% in 1988. 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.

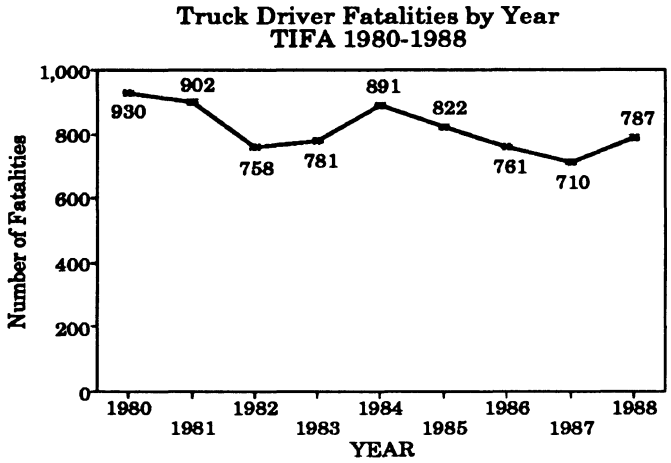


Figure 2-13

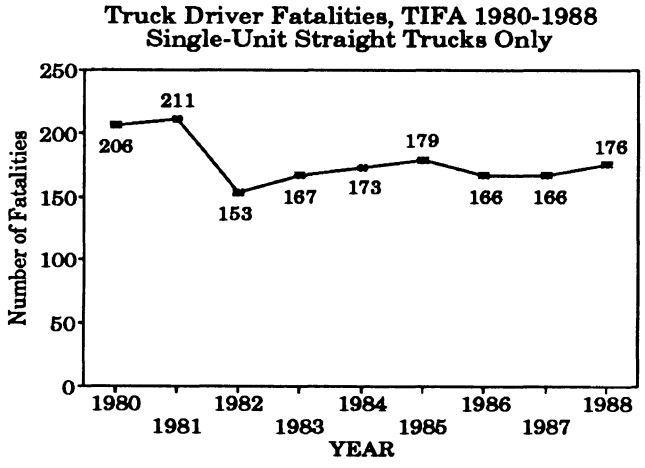


Figure 2-14

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 179 in 1985. There were 176 single-unit straight truck driver fatalities in 1988.

Not surprisingly, there are 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 has been increasing steadily since then.

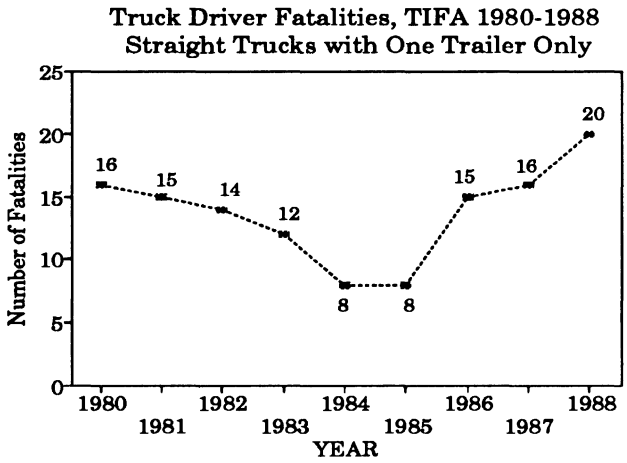


Figure 2-15

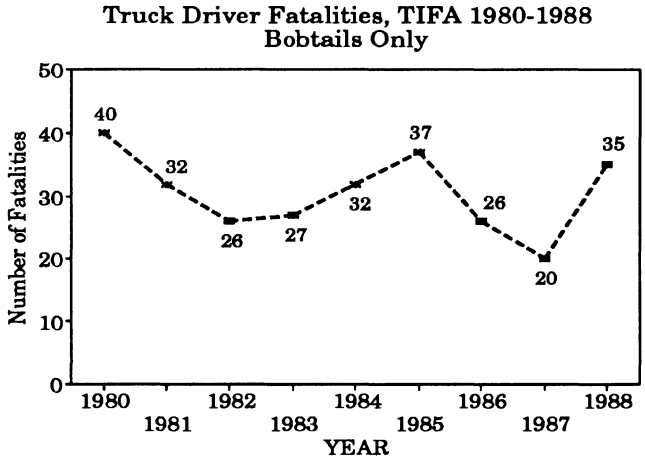


Figure 2-16

The annual number of fatalities for bobtail drivers has fluctuated from year to year. The highest number of fatalities out of the nine years occurred in 1980 with 40, while the low was reached in 1987 with 20. In 1988 there were 35 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. Although the 1988 figure of 489 is an increase of over 9% from the previous year, it is 20.9% lower than the 618 fatalities in 1980.

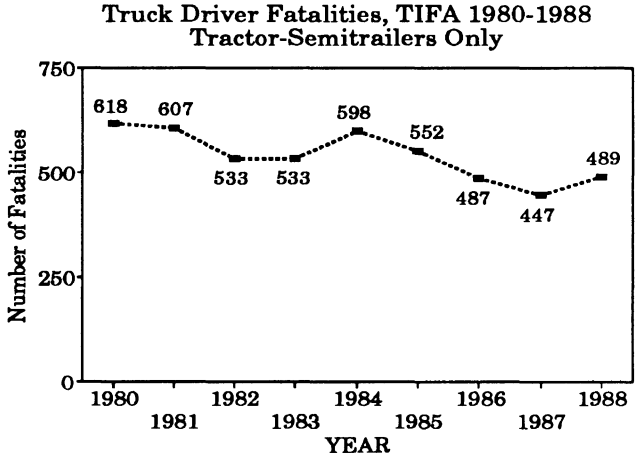


Figure 2-17

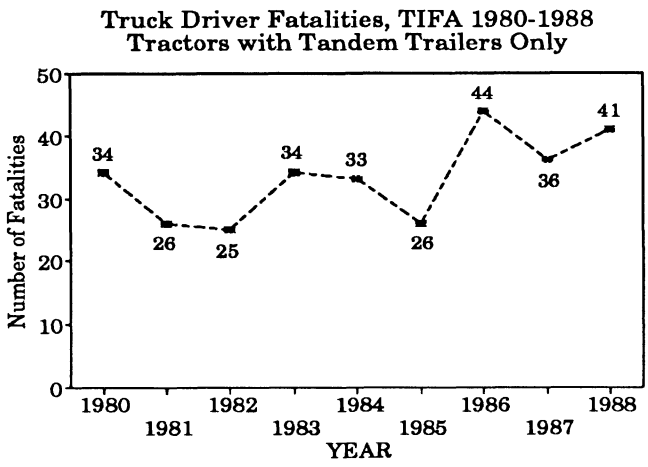


Figure 2-18

The number of fatalities for drivers of doubles shows a good deal of year-to-year variation. The low number occurred in 1982 with 25, and the high was reached in 1986 with 44. There were 41 fatalities in 1988, a 14% increase over the previous year.

OVERVIEW OF LARGE TRUCK FATAL ACCIDENT INVOLVEMENTS IN 1988

The information in this section characterizes the general fatal accident experience of medium and heavy trucks in 1988. 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 1988. 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

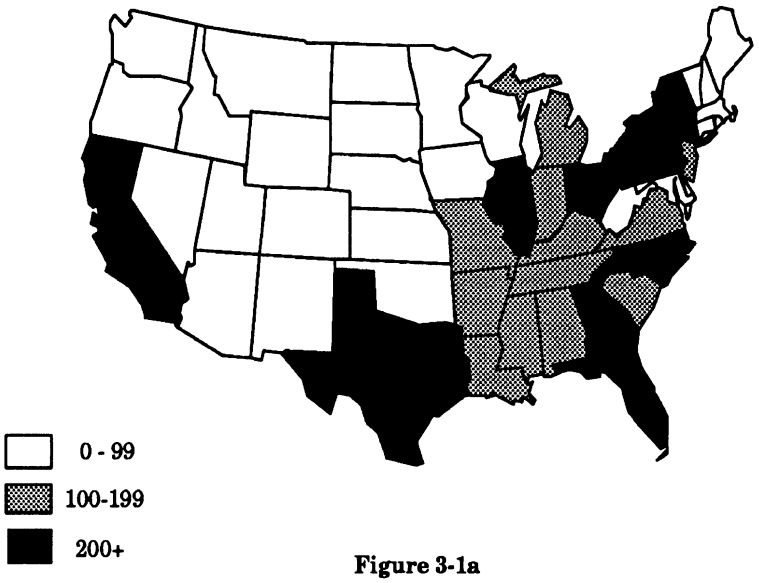


Figure 3-1a

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 228 fatal accidents involving doubles in 1988, 109 took place in California, 13 in Michigan, and 10 in Arizona. These three states accounted for 57.9% of the total, and California alone accounted for nearly 48%.

Truck Fatals by State
Singles Only

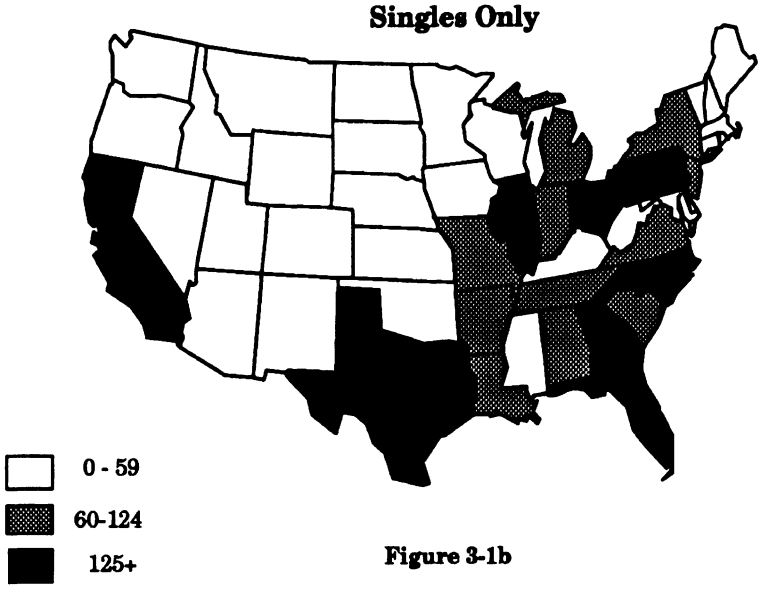


Figure 3-1b

Truck Fatals by State
Doubles Only

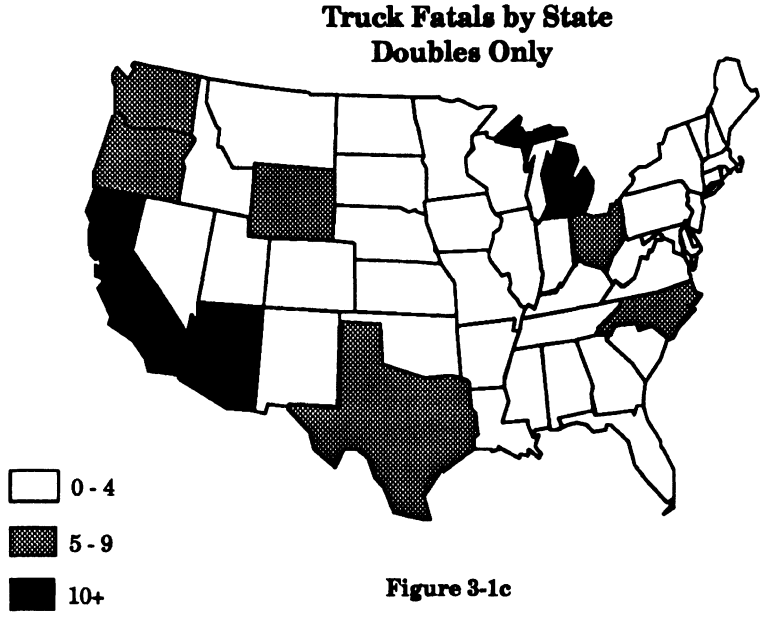


Figure 3-1c

Table 3-1A on the next page lists the number of involvements for each state, with a breakdown according to the five main configuration types. Table 3-1B lists the percentages for each state. California recorded the greatest number of fatal accidents with 517, followed by Texas with 385, Pennsylvania with 321, and Florida with 319. Together these four states accounted for 28.2% of the fatal involvements in 1988.

TABLE 3-1A
Distribution of Trucks in Fatal Accidents by State and Type of Truck, TIFA 1988

State	Total Number	Straight Truck Alone	Straight Truck w/Trailer	Bobtail	Single	Double	Other	Unknown Truck Type
AL	136	23	0	4	109	0	0	0
AZ	86	19	6	4	46	10	1	0
AR	104	16	2	1	80	2	3	0
CA	517	91	26	15	260	109	10	6
CO	48	6	0	1	40	0	1	0
CT	38	19	0	0	18	1	0	0
DE	20	4	0	1	15	0	0	0
DC	2	0	0	0	2	0	0	0
FL	319	101	6	13	193	1	3	2
GA	230	52	11	11	150	1	5	0
ID	31	5	1	0	21	4	0	0
IL	235	54	5	6	164	3	0	3
IN	166	35	5	4	119	3	0	0
IA	78	12	2	2	53	1	0	8
KS	57	14	0	3	35	3	2	0
KY	106	41	1	5	59	0	0	0
LA	106	18	4	1	82	0	1	0
ME	40	10	3	2	25	0	0	0
MD	93	45	3	0	43	1	0	1
MA	57	19	2	2	34	0	0	0
MI	179	46	2	5	112	13	0	1
MN	66	18	2	2	43	1	0	0
MS	107	2	0	1	17	1	0	86
MO	110	39	1	2	68	0	0	0
MT	17	2	1	0	12	2	0	0
NE	43	13	2	1	26	1	0	0
NV	22	4	0	1	14	3	0	0
NH	20	11	2	0	7	0	0	0
NJ	129	50	0	5	69	4	1	0
NM	37	4	1	0	28	4	0	0
NY	233	114	6	7	103	1	1	1
NC	217	60	2	11	134	8	2	0
ND	11	3	0	1	7	0	0	0
OH	259	53	6	10	181	9	0	0
OK	74	8	2	2	58	4	0	0
OR	79	16	6	1	45	7	4	0
PA	321	70	9	9	229	4	0	0
RI	9	5	0	0	4	0	0	0
SC	100	15	1	2	72	1	1	8
SD	12	6	1	0	5	0	0	0
TN	135	32	1	3	95	3	1	0
TX	385	79	3	6	288	6	3	0
UT	32	8	1	0	20	0	3	0
VT	15	8	0	2	5	0	0	0
VA	133	39	3	5	84	1	1	0
WA	71	16	14	0	30	9	2	0
WV	57	18	0	2	36	1	0	0
WI	91	38	1	0	51	1	0	0
WY	34	7	2	0	20	5	0	0
TOTAL	5,467	1,368	146	153	3,411	228	45	116

TABLE 3-1B
Distribution of Trucks in Fatal Accidents by State and Type of Truck, TIFA 1988
Column Percents

State	Total	Straight Truck Alone	Straight Truck w/Trailer	Bobtail	Single	Double	Other	Unknown Truck Type
AL	2.49%	1.68%	0.00%	2.61%	3.20%	0.00%	0.00%	0.00%
AZ	1.57	1.39	4.11	2.61	1.35	4.39	2.22	0.00
AR	1.90	1.17	1.37	0.65	2.35	0.88	6.67	0.00
CA	9.46	6.65	17.81	9.80	7.62	47.81	22.22	5.17
CO	0.88	0.44	0.00	0.65	1.17	0.00	2.22	0.00
CT	0.70	1.39	0.00	0.00	0.53	0.44	0.00	0.00
DE	0.37	0.29	0.00	0.65	0.44	0.00	0.00	0.00
DC	0.04	0.00	0.00	0.00	0.06	0.00	0.00	0.00
FL	5.84	7.38	4.11	8.50	5.66	0.44	6.67	1.72
GA	4.21	3.80	7.53	7.19	4.40	0.44	11.11	0.00
ID	0.57	0.37	0.68	0.00	0.62	1.75	0.00	0.00
IL	4.30	3.95	3.42	3.92	4.81	1.32	0.00	2.59
IN	3.04	2.56	3.42	2.61	3.49	1.32	0.00	0.00
IA	1.43	0.88	1.37	1.31	1.55	0.44	0.00	6.90
KS	1.04	1.02	0.00	1.96	1.03	1.32	4.44	0.00
KY	1.94	3.00	0.68	3.27	1.73	0.00	0.00	0.00
LA	1.94	1.32	2.74	0.65	2.40	0.00	2.22	0.00
ME	0.73	0.73	2.05	1.31	0.73	0.00	0.00	0.00
MD	1.70	3.29	2.05	0.00	1.26	0.44	0.00	0.86
MA	1.04	1.39	1.37	1.31	1.00	0.00	0.00	0.00
MI	3.27	3.36	1.37	3.27	3.28	5.70	0.00	0.86
MN	1.21	1.32	1.37	1.31	1.26	0.44	0.00	0.00
MS	1.96	0.15	0.00	0.65	0.50	0.44	0.00	74.14
MO	2.01	2.85	0.68	1.31	1.99	0.00	0.00	0.00
MT	0.31	0.15	0.68	0.00	0.35	0.88	0.00	0.00
NE	0.79	0.95	1.37	0.65	0.76	0.44	0.00	0.00
NV	0.40	0.29	0.00	0.65	0.41	1.32	0.00	0.00
NH	0.37	0.80	1.37	0.00	0.21	0.00	0.00	0.00
NJ	2.36	3.65	0.00	3.27	2.02	1.75	2.22	0.00
NM	0.68	0.29	0.68	0.00	0.82	1.75	0.00	0.00
NY	4.26	8.33	4.11	4.58	3.02	0.44	2.22	0.86
NC	3.97	4.39	1.37	7.19	3.93	3.51	4.44	0.00
ND	0.20	0.22	0.00	0.65	0.21	0.00	0.00	0.00
OH	4.74	3.87	4.11	6.54	5.31	3.95	0.00	0.00
OK	1.35	0.58	1.37	1.31	1.70	1.75	0.00	0.00
OR	1.45	1.17	4.11	0.65	1.32	3.07	8.89	0.00
PA	5.87	5.12	6.16	5.88	6.71	1.75	0.00	0.00
RI	0.16	0.37	0.00	0.00	0.12	0.00	0.00	0.00
SC	1.83	1.10	0.68	1.31	2.11	0.44	2.22	6.90
SD	0.22	0.44	0.68	0.00	0.15	0.00	0.00	0.00
TN	2.47	2.34	0.68	1.96	2.79	1.32	2.22	0.00
TX	7.04	5.77	2.05	3.92	8.44	2.63	6.67	0.00
UT	0.59	0.58	0.68	0.00	0.59	0.00	6.67	0.00
VT	0.27	0.58	0.00	1.31	0.15	0.00	0.00	0.00
VA	2.43	2.85	2.05	3.27	2.46	0.44	2.22	0.00
WA	1.30	1.17	9.59	0.00	0.88	3.95	4.44	0.00
WV	1.04	1.32	0.00	1.31	1.06	0.44	0.00	0.00
WI	1.66	2.78	0.68	0.00	1.50	0.44	0.00	0.00
WY	0.62	0.51	1.37	0.00	0.59	2.19	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 or two trailers. "Tractors" will refer to bobtails, singles, doubles, and combinations other than the usual tractor-semitrailer and tractor-semitrailer-full trailer configurations. As explained in the introduction, the FARS power unit type classification was accepted for those cases with unknown power unit type in TIFA for the purposes of this section. This results in weighted totals of 1,541 straight trucks and 3,915 tractors involved in fatal accidents in 1988.

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 December. The most were recorded in August, with 501, while the fewest took place in January (379) and February (393).

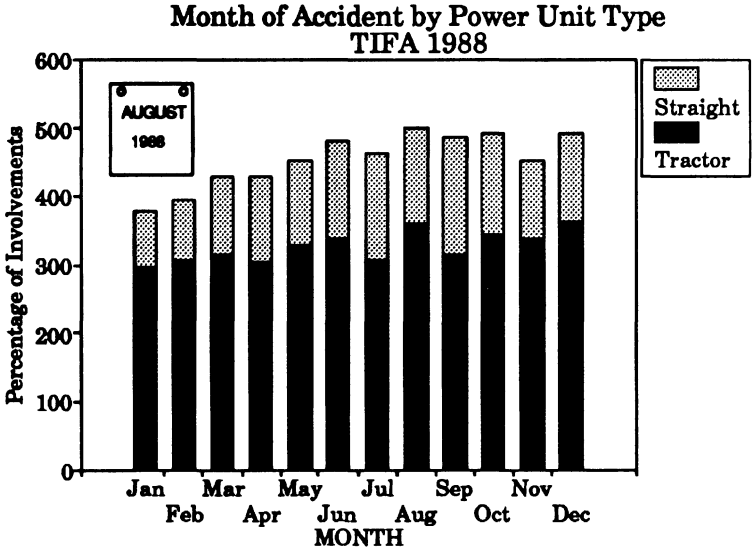


Figure 3-2

TABLE 3-2
Month of Accident by Power Unit Type
TIFA 1988

Month	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
January	82	5.32%	297	7.59%	379	6.95%
February	86	5.58	307	7.84	393	7.20
March	114	7.40	316	8.07	430	7.88
April	126	8.18	303	7.74	429	7.86
May	124	8.05	328	8.38	452	8.28
June	143	9.28	340	8.68	483	8.85
July	156	10.12	307	7.84	463	8.49
August	142	9.21	359	9.17	501	9.18
September	171	11.10	315	8.05	486	8.91
October	150	9.73	344	8.79	494	9.05
November	115	7.46	338	8.63	453	8.30
December	132	8.57	361	9.22	493	9.04
TOTAL	1,541	100.00%	3,915	100.00%	5,456	100.00%

NOTE: The 11 cases of unknown power unit type are excluded from this table.

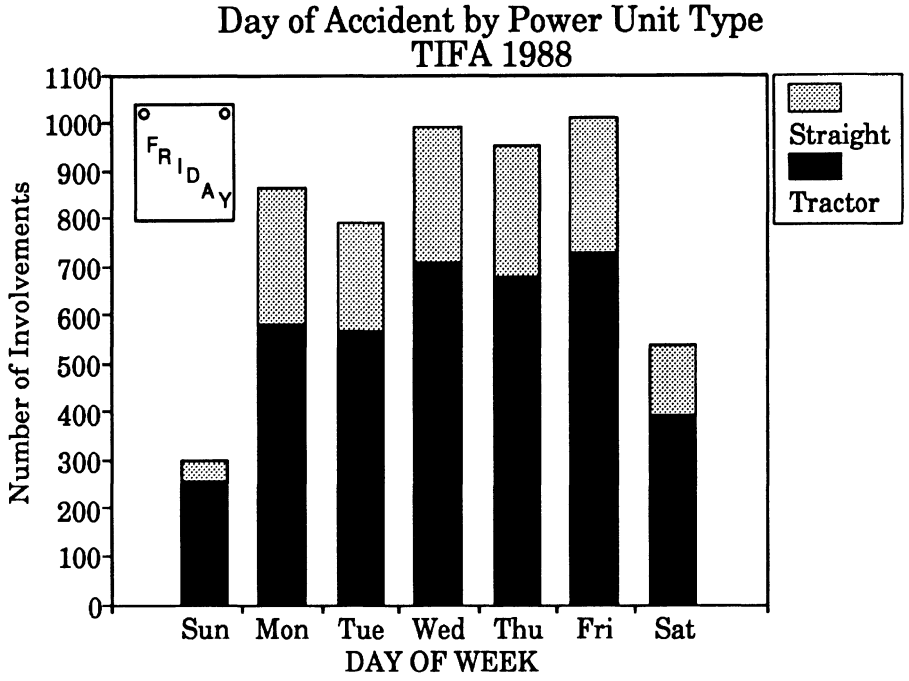


Figure 3-3

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 1988

Day	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
Monday	281	18.23%	583	14.89%	864	15.84%
Tuesday	224	14.54	568	14.51	792	14.52
Wednesday	286	18.56	707	18.06	993	18.20
Thursday	272	17.65	681	17.39	953	17.47
Friday	286	18.56	726	18.54	1012	18.55
Saturday	146	9.47	392	10.01	538	9.86
Sunday	46	2.99	258	6.59	304	5.57
TOTAL	1,541	100.00%	3,915	100.00%	5,456	100.00%

NOTE: The 11 cases of unknown power unit type are excluded from this table.

Time of Accident by Power Unit Type
TIFA 1988

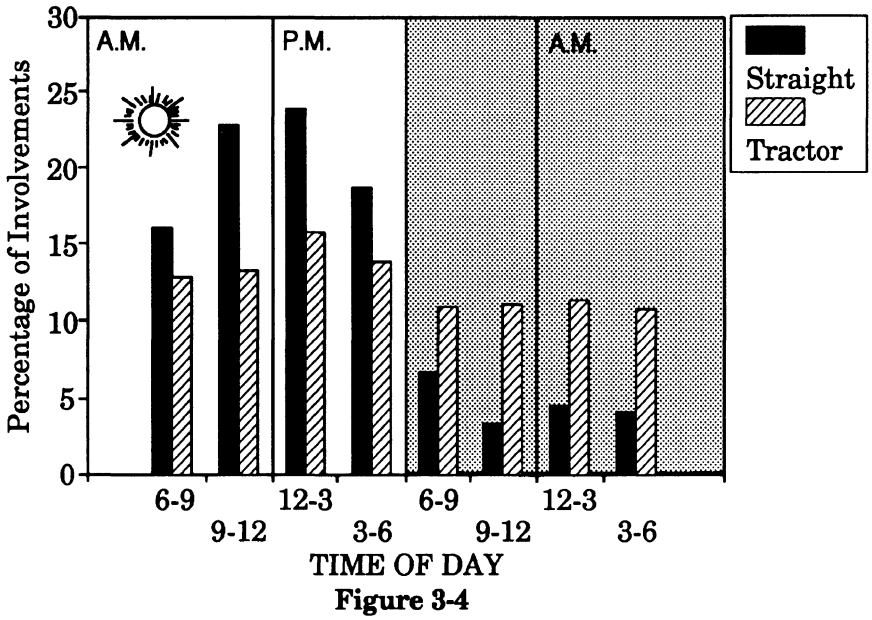


Figure 3-4

The time that the accident took place has been broken down into three-hour blocks in the table and graph shown here. The distribution for straight trucks is concentrated during the daytime. Nearly 82% 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 1988

Time of Day	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
6–9 a.m.	248	16.09%	502	12.82%	750	13.75%
9 a.m.–12 p.m.	352	22.84	519	13.26	871	15.96
12–3 p.m.	368	23.88	617	15.76	985	18.05
3–6 p.m.	289	18.75	544	13.90	833	15.27
6–9 p.m.	103	6.68	430	10.98	533	9.77
9 p.m.–12 a.m.	51	3.31	433	11.06	484	8.87
12–3 a.m.	69	4.48	445	11.37	514	9.42
3–6 a.m.	61	3.96	423	10.80	484	8.87
Unknown	0	0.00	2	0.05	2	0.04
TOTAL	1,541	100.00%	3,915	100.00%	5,456	100.00%

NOTE: The 11 cases of unknown power unit type are excluded from this table.

Environmental Distributions

The FARS files contain a series of variables describing the accident environment in terms of where the accident took place and under what conditions. The FARS land use variable uses the Federal Highway Administration's classification of urban and rural areas. Urban areas have a population of 5,000 people or more, and rural areas have a population of under 5,000 people. A greater share of fatal involvements took place in rural areas than urban areas for both straight trucks and tractors in 1988. Tractor involvements were especially likely to occur in rural areas, with about 70% taking place there.

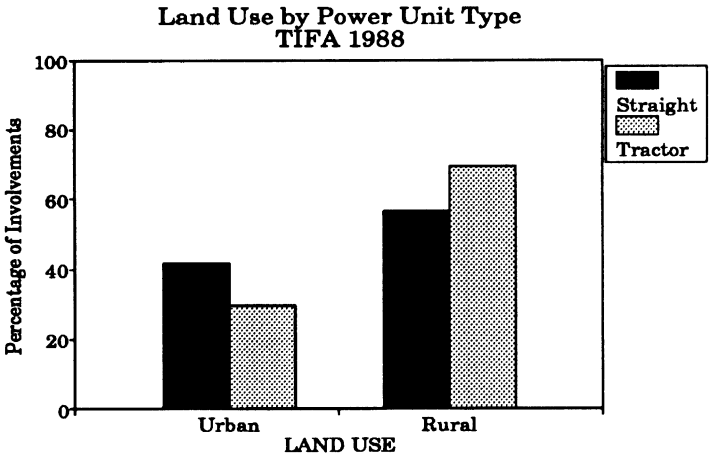


Figure 3-5

TABLE 3-5
Land Use by Power Unit Type
TIFA 1988

Land Use	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
Urban	642	41.66%	1,166	29.78%	1,808	33.14%
Rural	872	56.59	2,720	69.48	3,592	65.84
Unknown	27	1.75	29	0.74	56	1.03
TOTAL	1,541	100.00%	3,915	100.00%	5,456	100.00%

NOTE: The 11 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 80% of the straight truck involvements took place during daylight, only 54% of the tractor involvements occurred when it was light. This corresponds with the distribution for the time of the accident, discussed earlier in this section. The distributions of both variables probably reflect the greater share of nighttime travel for tractors compared to straight trucks.

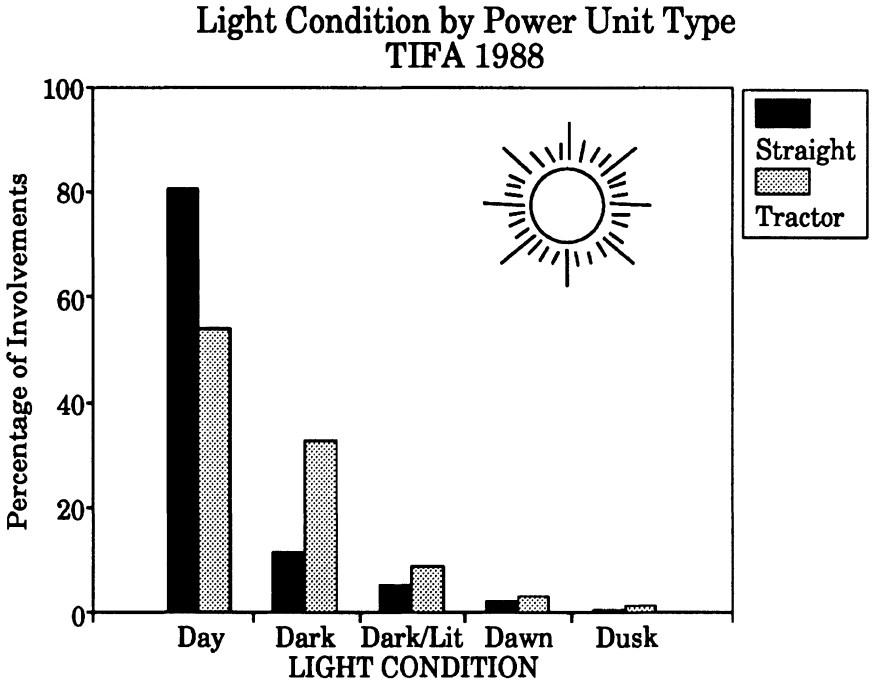


Figure 3-6

TABLE 3-6
Light Condition by Power Unit Type
TIFA 1988

Light Condition	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
Daylight	1,238	80.34%	2,113	53.97%	3,351	61.42%
Dark, not lighted	180	11.68	1,283	32.77	1,463	26.81
Dark, but lighted	81	5.26	343	8.76	424	7.77
Dawn	34	2.21	118	3.01	152	2.79
Dusk	8	0.52	54	1.38	62	1.14
Unknown	0	0.00	4	0.10	4	0.07
TOTAL	1,541	100.00%	3,915	100.00%	5,456	100.00%

NOTE: The 11 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 1988. Close to 80% of both took place under dry conditions, and about 13% of straight truck involvements and 14% of tractor involvements occurred on wet roadways.

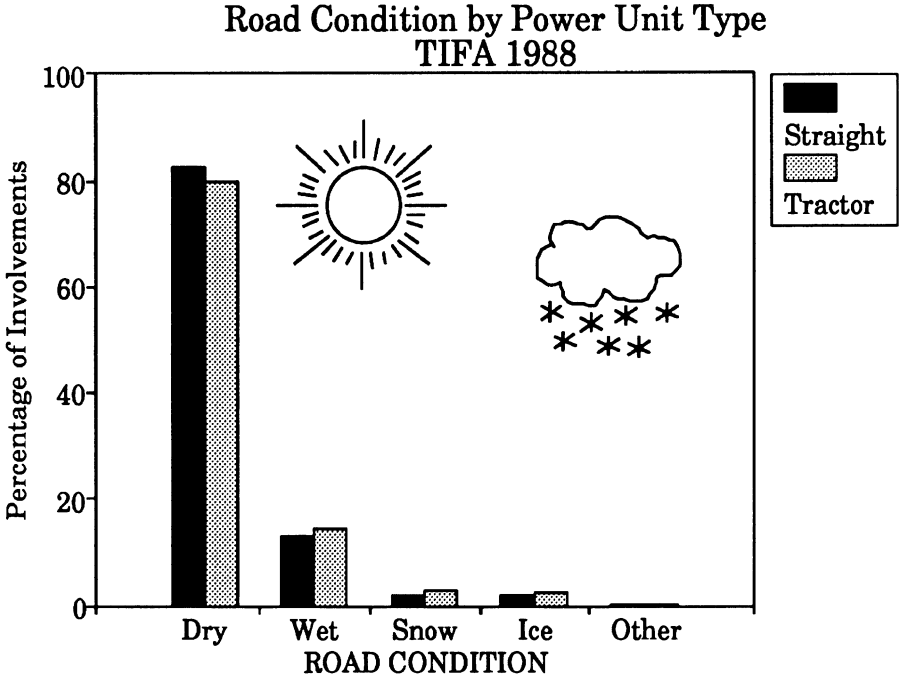


Figure 3-7

TABLE 3-7
Road Surface Condition by Power Unit Type
TIFA 1988

Road Surface Condition	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
Dry	1,273	82.61%	3,123	79.77%	4,396	80.57%
Wet	202	13.11	562	14.36	764	14.00
Snow/Slush	31	2.01	109	2.78	140	2.57
Ice	28	1.82	104	2.66	132	2.42
Sand/Dirt/Oil	0	0.00	2	0.05	2	0.04
Other	4	0.26	8	0.20	12	0.22
Unknown	3	0.19	7	0.18	10	0.18
TOTAL	1,541	100.00%	3,915	100.00%	5,456	100.00%

NOTE: The 11 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.

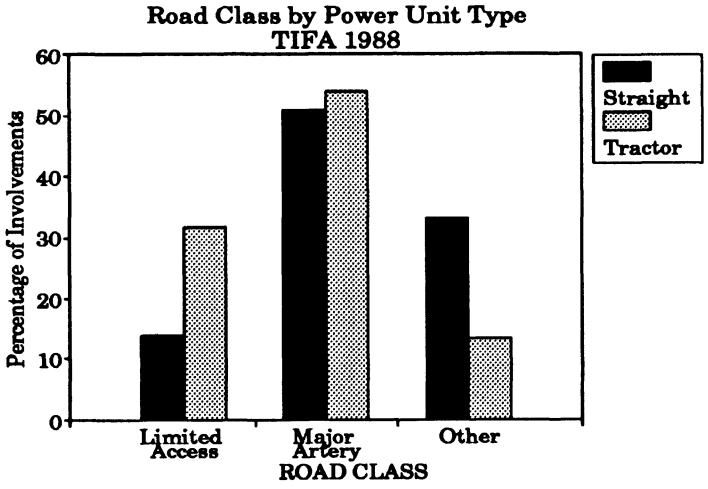


Figure 3-8

The majority of both straight truck and tractor fatal involvements took place on major arteries in 1988. The main difference between the two distributions is in the proportion of involvements that occurred on limited access and on "other" roads. Nearly 32% of tractor involvements were on limited access highways, compared to 14% of straight truck involvements. On the other hand, about 33% 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 1988

Road Class	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
Limited Access	215	13.95%	1,240	31.67%	1,455	26.67%
Major Artery	785	50.94	2,110	53.90	2,895	53.06
Other	513	33.29	527	13.46	1,040	19.06
Unknown	28	1.82	38	0.97	66	1.21
TOTAL	1,541	100.00%	3,915	100.00%	5,456	100.00%

NOTE: The 11 cases of unknown power unit type are excluded from this table.

Road class distributions were also prepared on the basis of the land use variable. The graph to the right shows the urban road class distributions. The two power unit types had very different patterns of involvements in urban areas in 1988. The major share of tractor involvements was on limited access routes and the least on other roads. Conversely, 44% of straight truck involvements occurred on other roads and less than 22% on limited access routes.

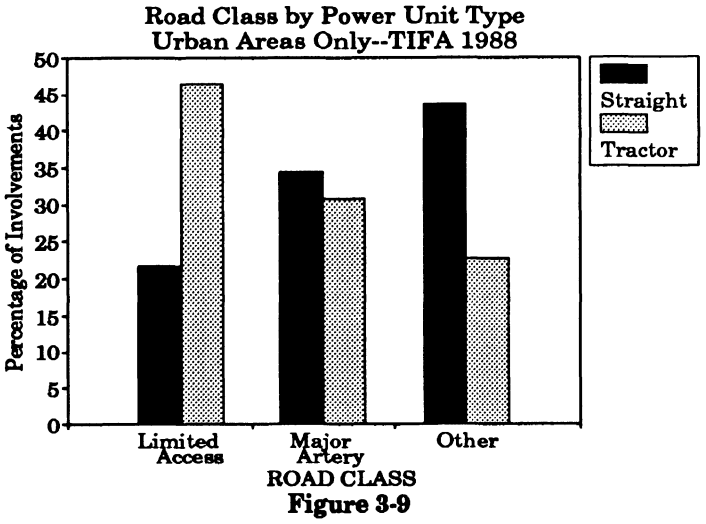


Figure 3-9

TABLE 3-9
Road Class by Power Unit Type
Urban Areas Only
TIFA 1988

Road Class	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
Limited Access	139	21.65%	540	46.31%	679	37.56%
Major Artery	220	34.27	359	30.79	579	32.02
Other	281	43.77	266	22.81	547	30.25
Unknown	2	0.31	1	0.09	3	0.17
TOTAL	642	100.00%	1,166	100.00%	1,808	100.00%

NOTE: The 11 cases of unknown power unit type are excluded from this table.

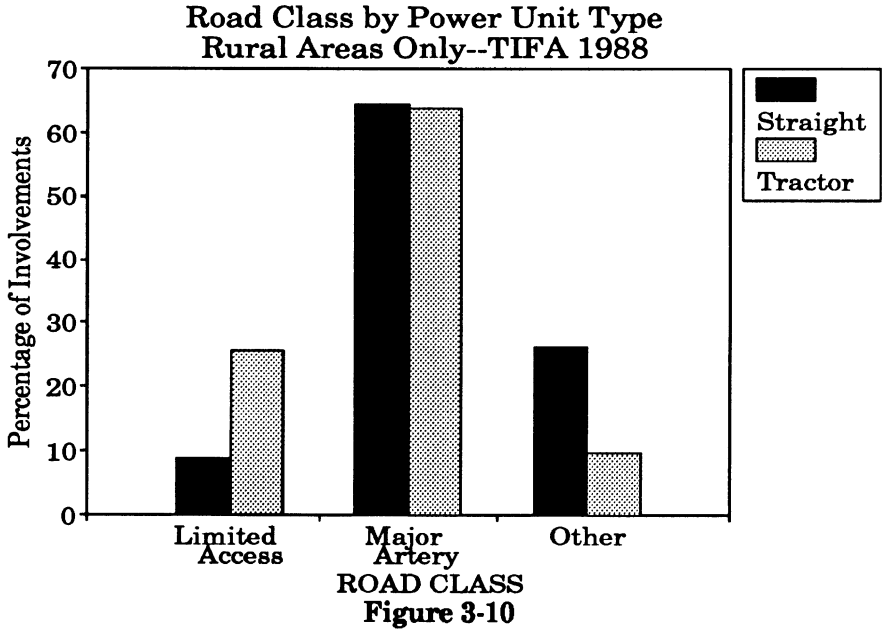


Figure 3-10

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 1988

Road Class	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
Limited Access	76	8.72%	698	25.66%	774	21.55%
Major Artery	562	64.45	1,737	63.86	2,299	64.00
Other	230	26.38	261	9.60	491	13.67
Unknown	4	0.46	24	0.88	28	0.78
TOTAL	872	100.00%	2,720	100.00%	3,592	100.00%

NOTE: The 11 cases of unknown power unit type are excluded from this table.

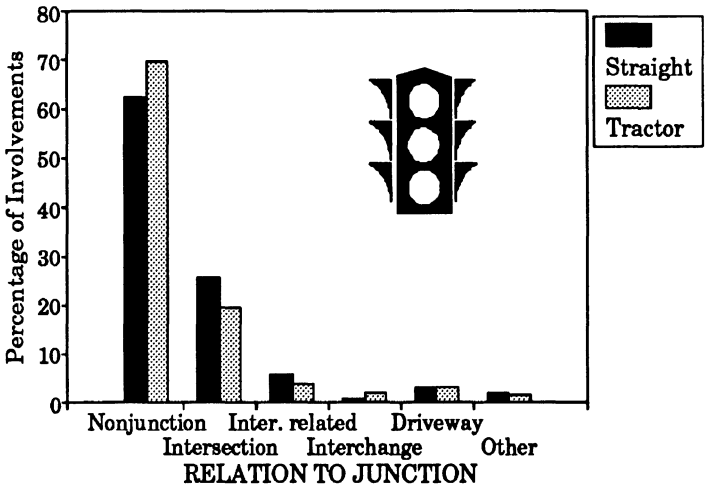


Figure 3-11

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 1988 reveals some interesting differences between straight trucks and tractors, which probably reflect their respective travel patterns. For example, about 26% of straight truck involvements took place at intersections, compared to 20% for tractors. In contrast, 70% of tractor involvements occurred at nonjunctions, compared to 63% for straight trucks. Tractors also experienced a higher share of involvements at interchanges than did straight trucks. These figures are consistent with tractors logging a greater share of their miles on limited access roads compared to straight trucks.

TABLE 3-11
Relation to Junction by Power Unit Type
TIFA 1988

Relation to Junction	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
Nonjunction	963	62.49%	2,735	69.86%	3,698	67.78%
Intersection	398	25.83	769	19.64	1,167	21.39
Intersection related	88	5.71	154	3.93	242	4.44
Interchange area	15	0.97	82	2.09	97	1.78
Driveway/alley, etc.	50	3.24	121	3.09	171	3.13
Entrance/exit ramp	3	0.19	18	0.46	21	0.38
Rail grade crossing	18	1.17	27	0.69	45	0.82
In crossover	4	0.26	8	0.20	12	0.22
Unknown	2	0.13	1	0.03	3	0.05
TOTAL	1,541	100.00%	3,915	100.00%	5,456	100.00%

NOTE: The 11 cases of unknown power unit type are excluded from this table.

In 1988, a total of 1,167 large truck fatal involvements took place at an intersection. Distributions were prepared for the type of traffic control at these intersection accidents. The traffic control distributions are fairly similar for straight trucks and tractors. The main differences are that a greater proportion of straight truck involvements took place at signalized intersections, while a larger share of tractor involvements occurred at intersections marked by a stop or yield sign.

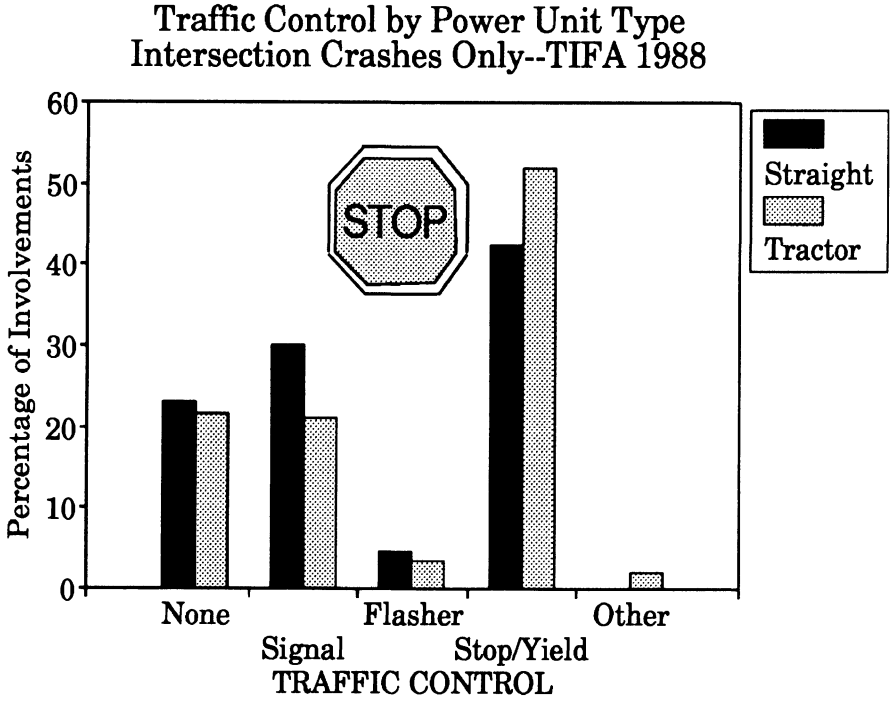


Figure 3-12

TABLE 3-12
Traffic Control at Intersection Crashes by Power Unit Type
TIFA 1988

Traffic Control	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
None	91	22.86%	166	21.59%	257	22.02%
Automated traffic signal	119	29.90	162	21.07	281	24.08
Flasher/other signal	18	4.52	27	3.51	45	3.86
Stop or yield sign	168	42.21	399	51.89	567	48.59
Warning/other sign	0	0.00	15	1.95	15	1.29
Unknown	2	0.50	0	0.00	2	0.17
TOTAL	398	100.00%	769	100.00%	1,167	100.00%

NOTE: The 1 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 58% for tractors and 48% for straight trucks. A higher proportion of tractor involvements (14.3%) than straight truck involvements (3.9%) 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.

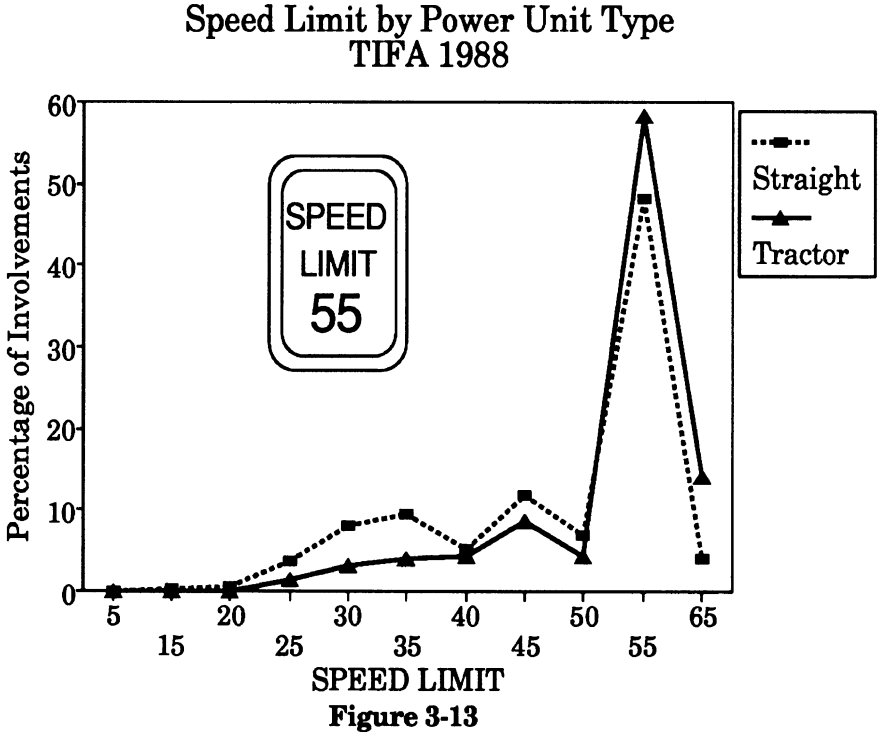


Figure 3-13

TABLE 3-13
Speed Limit by Power Unit Type
TIFA 1988

Speed Limit	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
No statutory limit	0	0.00%	1	0.03%	1	0.02%
10 mph	1	0.06	0	0.00	1	0.02
15 mph	5	0.32	3	0.08	8	0.15
20 mph	6	0.39	2	0.05	8	0.15
25 mph	57	3.70	55	1.40	112	2.05
30 mph	126	8.18	126	3.22	252	4.62
35 mph	149	9.67	162	4.14	311	5.70
40 mph	81	5.26	170	4.34	251	4.60
45 mph	184	11.94	345	8.81	529	9.70
50 mph	108	7.01	172	4.39	280	5.13
55 mph	741	48.09	2,283	58.31	3,024	55.43
65 mph	60	3.89	558	14.25	618	11.33
Unknown	23	1.49	38	0.97	61	1.12
TOTAL	1,541	100.00%	3,915	100.00%	5,456	100.00%

NOTE: The 11 cases of 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 1988 were collisions with another motor vehicle in transport. These collisions accounted for 71% of the straight truck and 78% 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 and non-fixed objects.

First Harmful Event by Power Unit Type
TIFA 1988

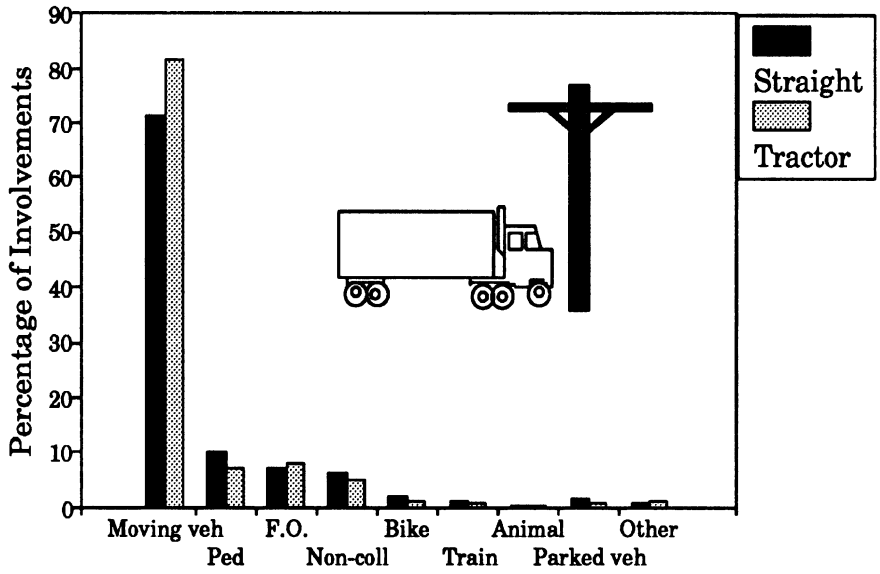


Figure 3-14

TABLE 3-14
First Harmful Event by Power Unit Type
TIFA 1988

Collision with:	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
Pedestrian	159	10.32%	264	6.74%	423	7.75%
Pedalcyclist	30	1.95	38	0.97	68	1.25
Train	17	1.10	24	0.61	41	0.75
Animal	2	0.13	9	0.23	11	0.20
Moving vehicle	1,098	71.25	3,047	77.83	4,145	75.97
Parked vehicle	21	1.36	26	0.66	47	0.86
Other non-fixed object	9	0.58	35	0.89	44	0.81
Fixed object	107	6.94	291	7.74	398	7.29
Non-collision	98	6.36	181	4.62	279	5.11
TOTAL	1,541	100.00%	3,915	100.00%	5,456	100.00%

NOTE: The 11 cases of unknown power unit type are excluded from this table.

A total of 4,145 of the fatal accidents involving large trucks in 1988 were collisions with another motor vehicle in transport. The distributions of the manner of collision variable for these accidents are illustrated on the following page. Overall, the most common collision type among the fatal involvements was angle crashes (40%), followed by head-ons (28%), and rear-end collisions (24%). The straight truck and tractor distributions are fairly similar

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

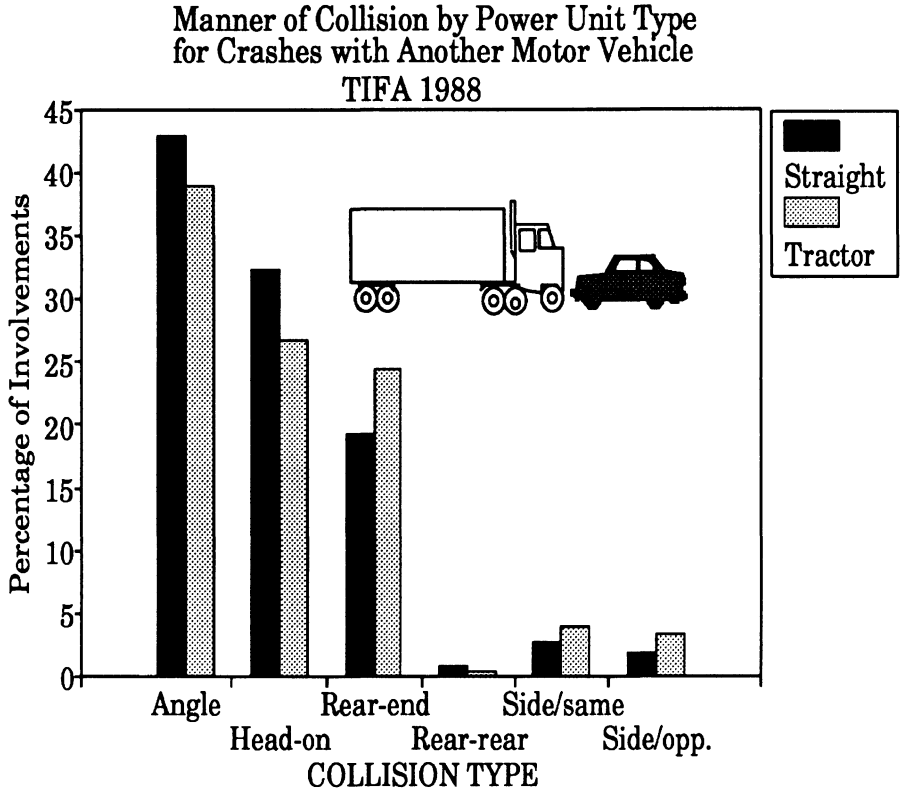


Figure 3-15

TABLE 3–15
Manner of Collision by Power Unit Type
for Crashes with Another Motor Vehicle
TIFA 1988

Manner of Collision	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
Rear-end	212	19.31%	793	26.03%	1,005	24.25%
Head-on	355	32.33	817	26.81	1,172	28.24
Rear-to-rear	8	0.73	13	0.43	21	0.50
Angle	471	42.90	1,190	39.05	1,661	40.06
Sideswipe, same dir.	30	2.73	119	3.91	149	3.59
Sideswipe, opp. dir.	20	1.82	103	3.38	123	2.97
Unknown	2	0.18	12	0.39	14	0.34
TOTAL	1,098	100.00%	3,047	100.00%	4,145	100.00%

NOTE: The 8 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 1988. 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 over 13% represented single-vehicle crashes other than collisions with pedestrians or bicyclists. In the remaining multi-vehicle crashes, the truck was 1.4 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.

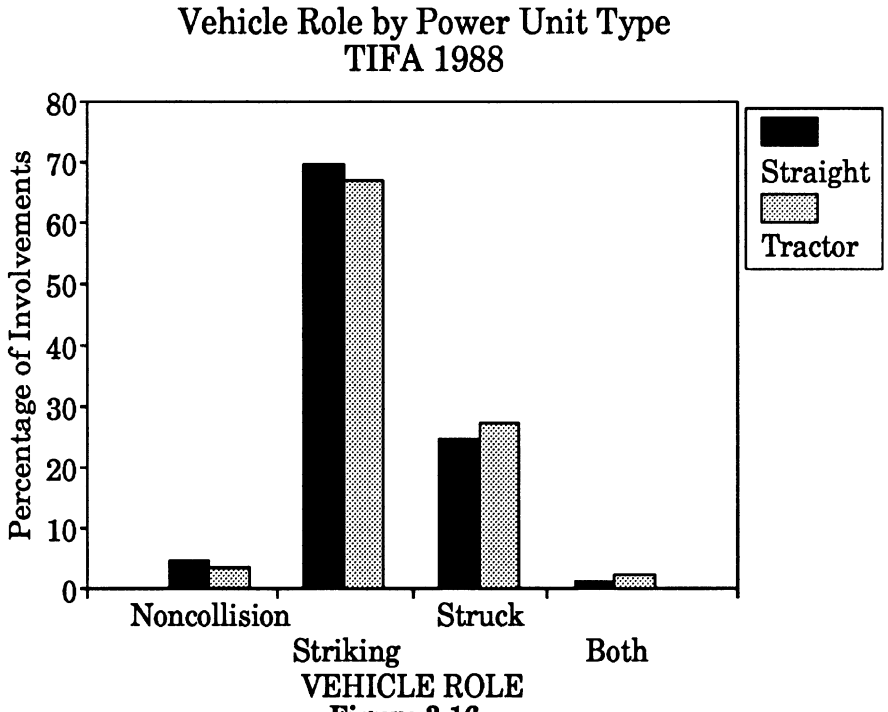


Figure 3-16

TABLE 3-16
Vehicle Role by Power Unit Type
TIFA 1988

Vehicle Role	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
Noncollision	72	4.67%	141	3.60%	213	3.90%
Striking	1,072	69.57	2,612	66.72	3,684	67.52
Struck	378	24.53	1,069	27.31	1,447	26.52
Both	19	1.23	89	2.27	108	1.98
Unknown	0	0.00	4	0.10	4	0.07
TOTAL	1,541	100.00%	3,915	100.00%	5,456	100.00%

NOTE: The 11 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 1988 fatal involvements, straight trucks (14%) were slightly more likely to experience a rollover than were tractors (13%).

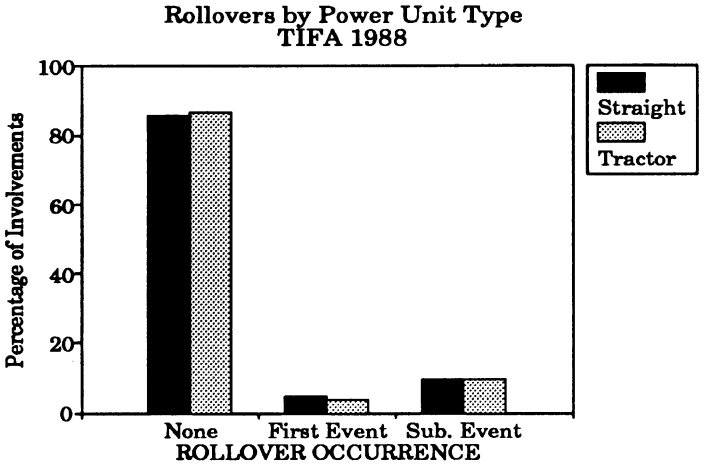


Figure 3-17

TABLE 3-17
Occurrence of Rollovers by Power Unit Type
TIFA 1988

Rollover	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
None	1,321	85.72%	3,389	86.56%	4,710	86.33%
First Event	71	4.61	153	3.91	224	4.11
Subsequent Event	149	9.67	373	9.53	522	9.57
TOTAL	1,541	100.00%	3,915	100.00%	5,456	100.00%

NOTE: The 11 cases of unknown power unit type are excluded from this table.

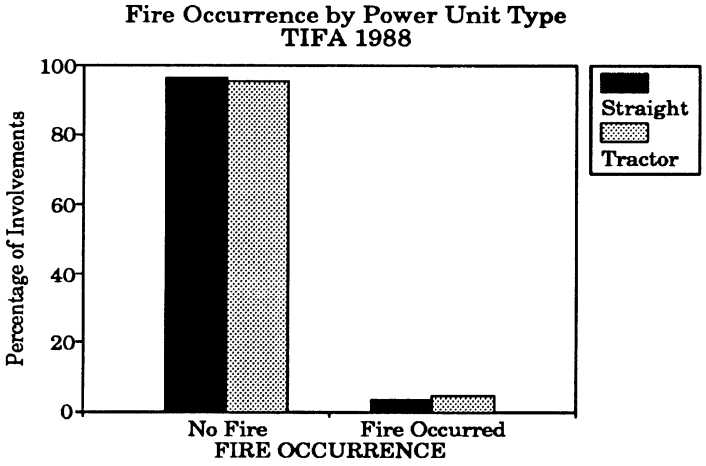


Figure 3-18

Another variable indicates whether a fire occurred in the vehicle during the accident. There was a fire in 3.5% of the straight trucks and 4.8% of the tractors involved in fatal accidents in 1988.

TABLE 3-18
Fire Occurrence by Power Unit Type
TIFA 1988

Fire	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
No Fire	1,487	96.50%	3,729	95.25%	5,216	95.60%
Fire Occurred	54	3.50	186	4.75	240	4.40
TOTAL	1,541	100.00%	3,915	100.00%	5,456	100.00%

NOTE: The 11 cases of unknown power unit type are excluded from this table.

Driver Characteristics

Turning now to some variables that describe the drivers of the trucks involved in fatal accidents in 1988, the figure below depicts driver age distributions by power unit type. The distributions indicate younger ages for the straight truck drivers compared to the tractor drivers. For the known cases, over 56% of the straight truck drivers were 35 or younger, while 59% of the tractor drivers were over 35.

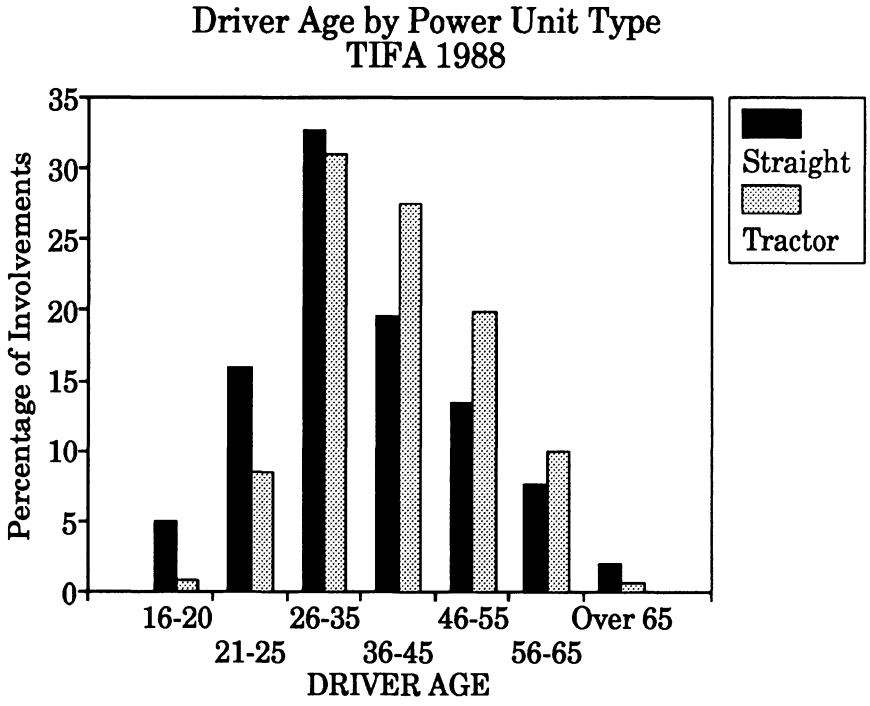


Figure 3-19

TABLE 3-19
Age of Truck Driver by Power Unit Type
TIFA 1988

Driver Age	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
16–20	77	5.00%	33	0.84%	110	2.02%
21–25	245	15.90	331	8.45	576	10.56
26–35	504	32.71	1,211	30.93	1,715	31.43
36–45	301	19.53	1,073	27.41	1,374	25.18
46–55	208	13.50	779	19.90	987	18.09
56–65	118	7.66	390	9.96	508	9.31
Over 65	30	1.95	23	0.59	53	0.97
Unknown	58	3.76	75	1.92	133	2.44
TOTAL	1,541	100.00%	3,915	100.00%	5,456	100.00%

NOTE: The 11 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 1.4% of the drivers were female.

TABLE 3-20
Truck Driver Gender by Power Unit Type
TIFA 1988

Driver Gender	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
Male	1,460	94.74%	3,789	96.78%	5,249	96.21%
Female	25	1.62	52	1.33	77	1.41
Unknown	56	3.63	74	1.89	130	2.38
TOTAL	1,541	100.00%	3,915	100.00%	5,456	100.00%

NOTE: The 11 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, type unknown or other; 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 43% of the tractor drivers were using some kind of restraint device, compared to only 27% of the straight truck drivers. Note that the unknown cases are included in Figure 3-21.

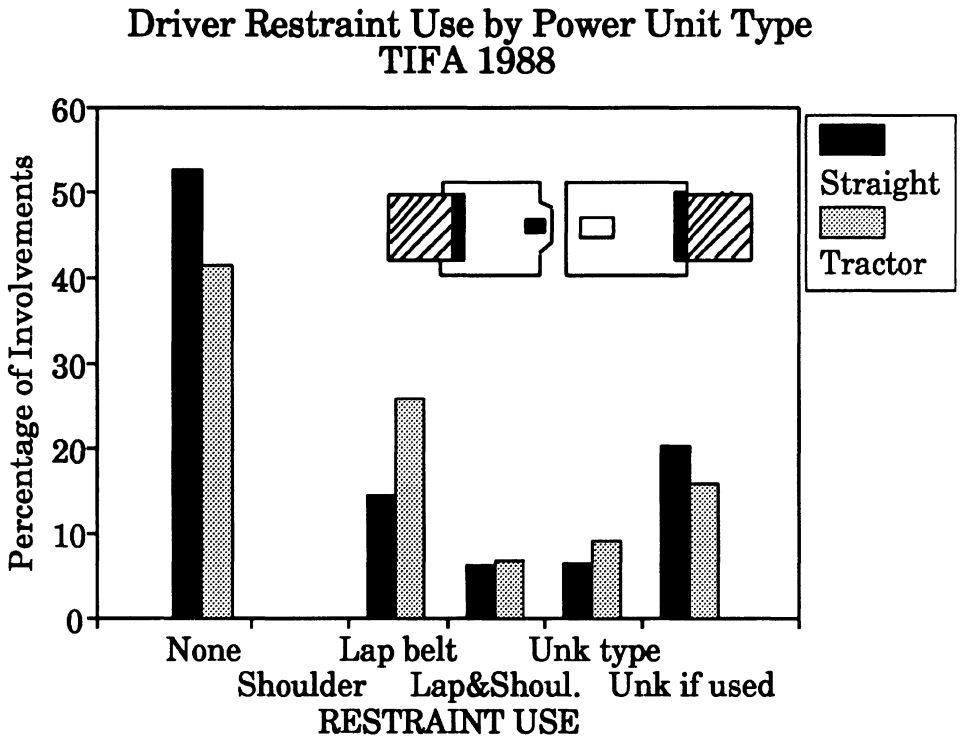


Figure 3-21

TABLE 3-21
Truck Driver Restraint Use by Power Unit Type
TIFA 1988

Driver Restraint Use	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
None used	813	52.76%	1,625	41.51%	2,438	44.68%
Shoulder belt	0	0.00	3	0.08	3	0.05
Lap belt	223	14.47	1,023	26.13	1,246	22.84
Lap and Shoulder	94	6.10	273	6.97	367	6.73
Restraint used type unknown	98	6.36	366	9.35	464	8.50
Unknown if used	313	20.31	625	15.96	938	17.19
TOTAL	1,541	100.00%	3,915	100.00%	5,456	100.00%

NOTE: The 11 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 4.2% of the involvements. This figure was 3.9% for drivers of tractors and 5.0% for straight truck drivers.

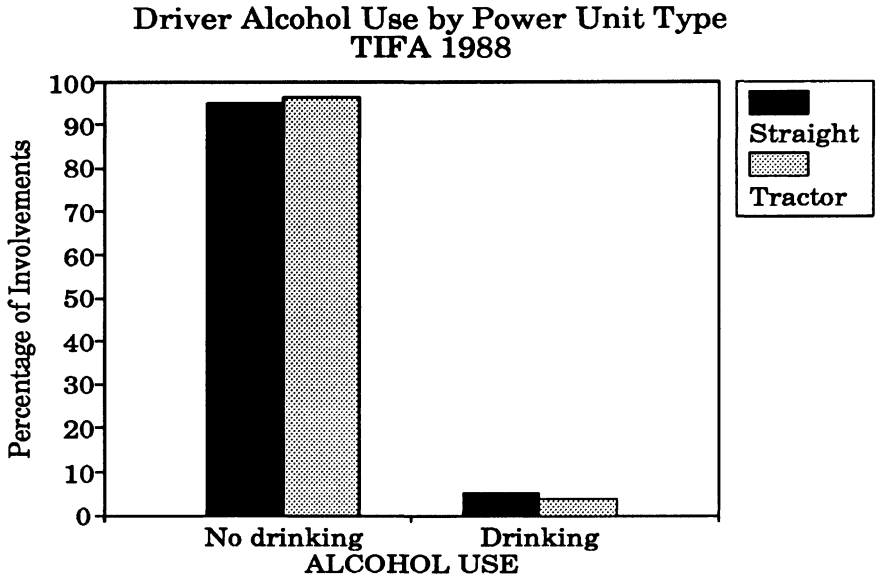


Figure 3-22

TABLE 3-22
Truck Driver Alcohol Use by Power Unit Type
TIFA 1988

Alcohol Use	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
No Drinking	1,464	95.00%	3,761	96.07%	5,225	95.77%
Drinking	77	5.00	154	3.93	231	4.23
TOTAL	1,541	100.00%	3,915	100.00%	5,456	100.00%

NOTE: The 11 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 1988, the truck driver was totally ejected in about 4.8% of the fatal involvements and partially ejected in 1.2%. Straight truck drivers were slightly more likely to be ejected in 1988.

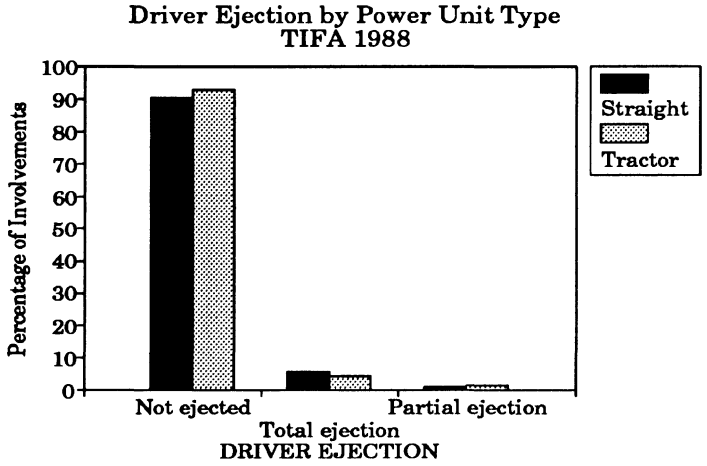


Figure 3-23

TABLE 3-23
Truck Driver Ejection by Power Unit Type
TIFA 1988

Driver Ejection	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
Not Ejected	1,387	90.01%	3,626	92.62%	5,013	91.88%
Totally Ejected	84	5.45	175	4.47	259	4.75
Partially Ejected	13	0.84	50	1.28	63	1.15
Unknown	57	3.70	64	1.63	121	2.22
TOTAL	1,541	100.00%	3,915	100.00%	5,456	100.00%

NOTE: The 11 cases of unknown power unit type are excluded from this table.

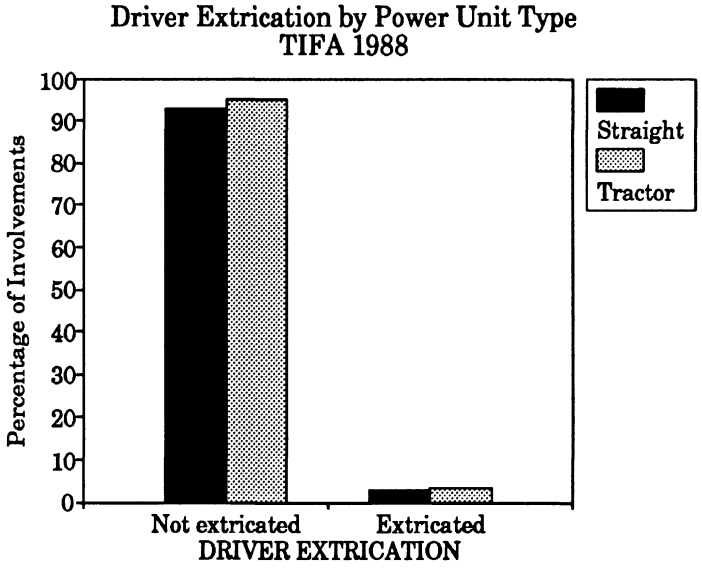


Figure 3-24

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. In 1988 the frequency was similar for drivers of tractors and straight trucks.

TABLE 3-24
Truck Driver Extrication by Power Unit Type
TIFA 1988

Driver Extrication	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
No Extrication	1,431	92.86%	3,711	94.79%	5,142	94.24%
Extrication	46	2.99	129	3.30	175	3.21
Unknown	64	4.15	75	1.92	139	2.55
TOTAL	1,541	100.00%	3,915	100.00%	5,456	100.00%

NOTE: The 11 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 which occur up to 30 days after an accident. While all of the accidents considered here resulted in at least one fatality, the truck driver was fatally injured in only 14.4% of the cases. While distributions are similar, straight truck drivers had a slightly higher incidence of incapacitating injuries, and drivers of tractors had a slightly higher proportion of fatalities.

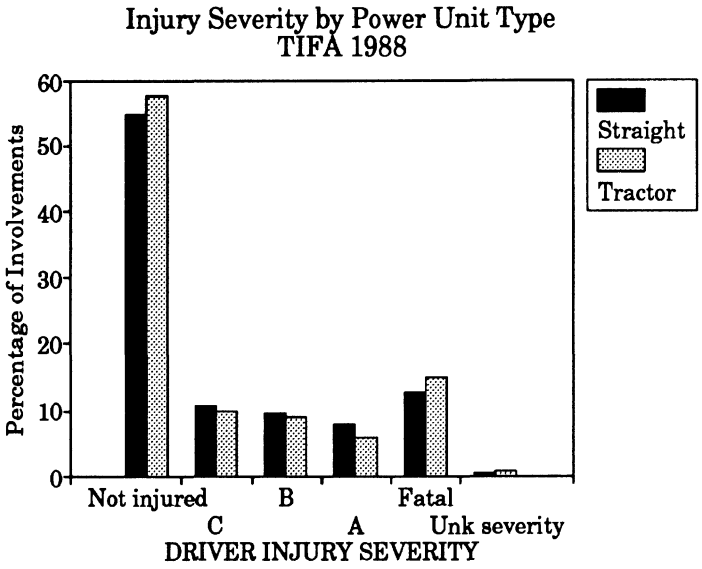


Figure 3-25

TABLE 3-25
Truck Driver Injury Severity by Power Unit Type
TIFA 1988

Injury Severity	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
Not injured	845	54.83%	2,253	57.55%	3,098	56.78%
C injury	166	10.77	389	9.94	555	10.17
B injury	147	9.54	358	9.14	505	9.26
A injury	121	7.85	232	5.93	353	6.47
Fatal injury	198	12.85	588	15.02	786	14.41
Injured, severity unknown	8	0.52	29	0.74	37	0.68
Died prior to accident	1	0.06	0	0.00	1	0.02
Unknown if injured	55	3.57	66	1.69	121	2.22
TOTAL	1,541	100.00%	3,915	100.00%	5,456	100.00%

NOTE: The 11 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".

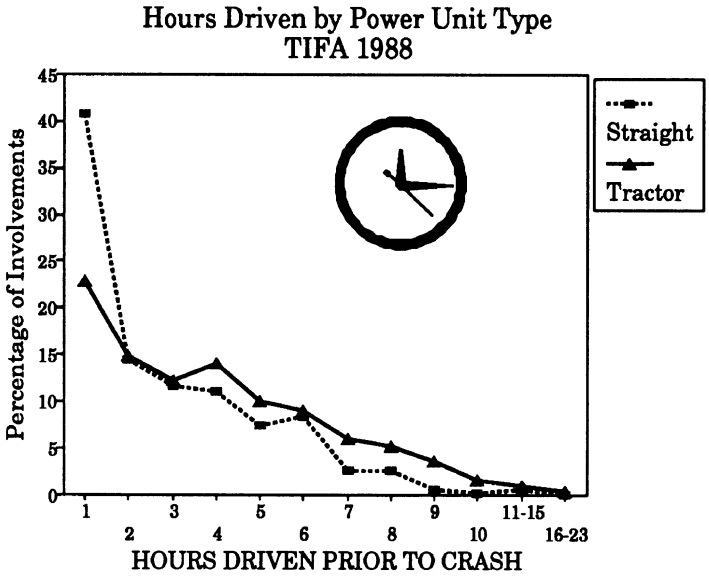


Figure 3-26

Even though a large proportion of cases were coded unknown or not applicable for the hours driven variable, these cases have been removed from the distributions shown in the graph at left so that straight trucks and tractors may be more easily compared. In general, the involved straight truck drivers had been driving for a shorter period of time prior to the crash than the tractor drivers. Of the known cases, 41% of the straight truck drivers had been driving for only an hour, compared to 23% of the tractor drivers. In contrast, only 4% of the straight truck drivers had been on duty for eight or more hours prior to the crash, compared to 11% of the tractor drivers. To a large extent, this probably reflects the differential reliance on straight trucks and tractors in short-haul versus long-haul operations.

TABLE 3-26
Hours Driven Prior to Crash
by Power Unit Type
TIFA 1988

Hours Driven	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
1	478	31.02%	672	17.16%	1,150	21.08%
2	169	10.97	436	11.14	605	11.09
3	136	8.83	355	9.07	491	9.00
4	129	8.37	413	10.55	542	9.93
5	86	5.58	290	7.41	376	6.89
6	99	6.42	262	6.69	361	6.62
7	30	1.95	171	4.37	201	3.68
8	30	1.95	150	3.83	180	3.30
9	7	0.45	102	2.61	109	2.00
10	1	0.06	45	1.15	46	0.84
11–15	6	0.39	26	0.66	32	0.59
16–23	0	0.00	8	0.20	115	2.11
N/A	46	2.99	246	6.28	185	3.39
Unknown	324	21.03	739	18.88	1,063	19.48
TOTAL	1,541	100.00%	3,915	100.00%	5,456	100.00%

NOTE: The 11 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 passing/lane change violations (6.9%), speeding/tailgating violations (6.8%), and right-of-way/traffic control violations (6.2%). The straight truck and tractor distributions are fairly similar, and many of the observed differences are probably related to typical travel patterns. An example is the higher incidence of right-of-way/traffic control violations among the drivers of straight trucks.

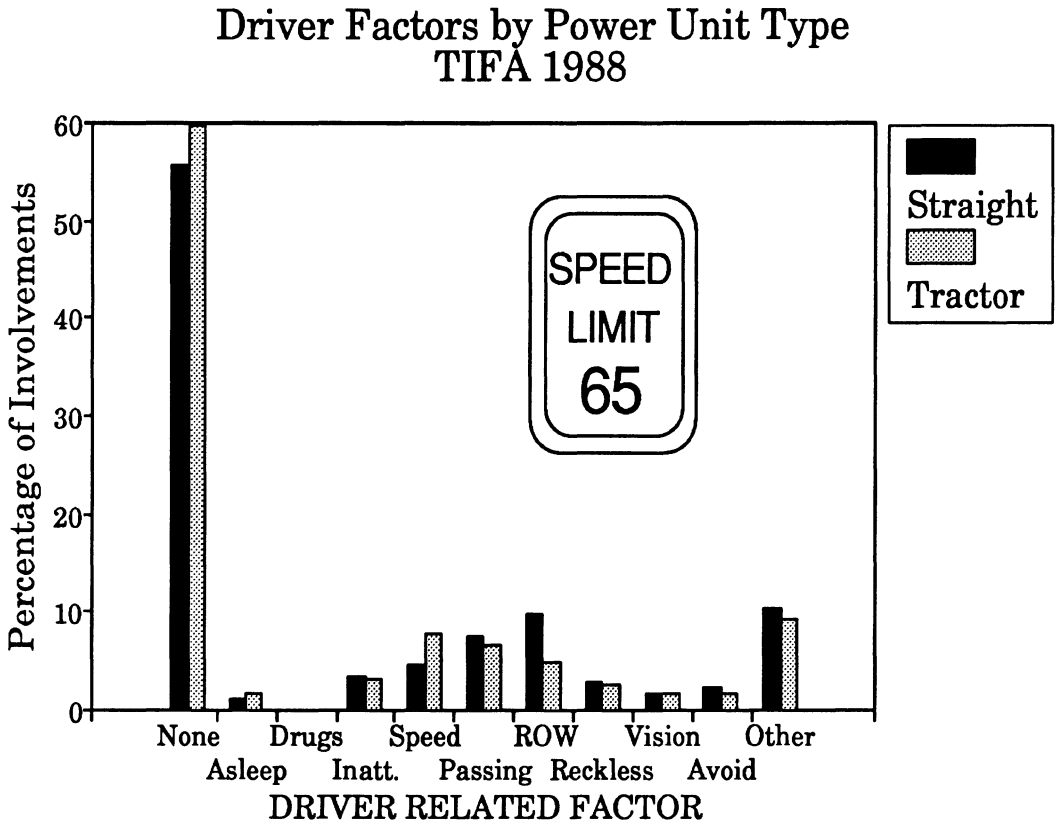


Figure 3-27

TABLE 3-27
Truck Driver Related Factors by Power Unit Type
TIFA 1988

Driver Factor	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
None	857	55.61%	2,335	59.64%	3,192	58.50%
Asleep/Ill	19	1.23	72	1.84	91	1.67
Drugs	1	0.06	4	0.10	5	0.09
Inattentive	53	3.44	130	3.32	183	3.35
Speed violations/ tailgating	70	4.54	302	7.71	372	6.82
Passing/lane change violations	115	7.46	259	6.62	374	6.85
Right-of-way/traffic control violations	150	9.73	188	4.80	338	6.20
Reckless driving	45	2.92	105	2.68	150	2.75
Vision obscured	25	1.62	67	1.71	92	1.69
Avoiding/swerving	34	2.21	65	1.66	99	1.81
Other	162	10.51	357	9.12	519	9.51
Unknown	10	0.65	31	0.79	41	0.75
TOTAL	1,541	100.00%	3,915	100.00%	5,456	100.00%

NOTE: Up to three factors reported for each case by FARS. This table based on first response for each case. The 11 cases of unknown power unit type are excluded from this table.

Vehicle Characteristics

This overview section of TIFA 1988 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 1988 showed great differences in carrier type according to the type of power unit. Of the known cases of carrier type, 39.2% of the straight trucks fell into the intrastate private category, while 62.5% of the tractors were in the interstate authorized class. Almost 86% of the tractors were owned by interstate companies, compared to only 42% of the straight trucks. Over two-thirds of the straight trucks were operated by private carriers, compared to only 26% of the tractors.

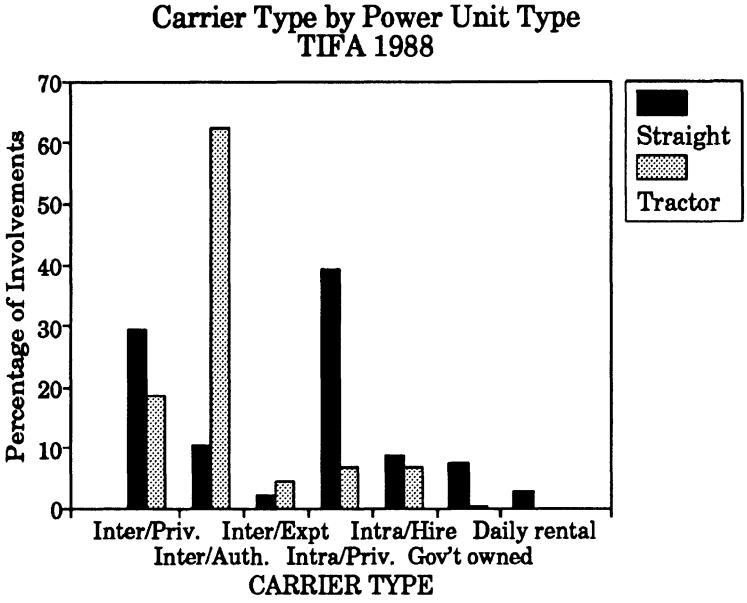


Figure 3-28

TABLE 3-28
Carrier Type by Power Unit Type
TIFA 1988

Carrier Type	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
Interstate private	411	26.67%	680	17.37%	1,091	20.00%
Interstate authorized	145	9.41	2,269	57.96	2,414	44.24
Interstate exempt	30	1.95	168	4.29	198	3.63
Intrastate private	549	35.63	254	6.49	803	14.72
Intrastate for hire	123	7.98	245	6.26	368	6.74
Government owned	103	6.68	15	0.38	118	2.16
Daily rental	39	2.53	0	0.00	39	0.71
Unknown	141	9.15	284	7.25	425	7.79
TOTAL	1,541	100.00%	3,915	100.00%	5,456	100.00%

NOTE: The 11 cases of unknown power unit type are excluded from this table.

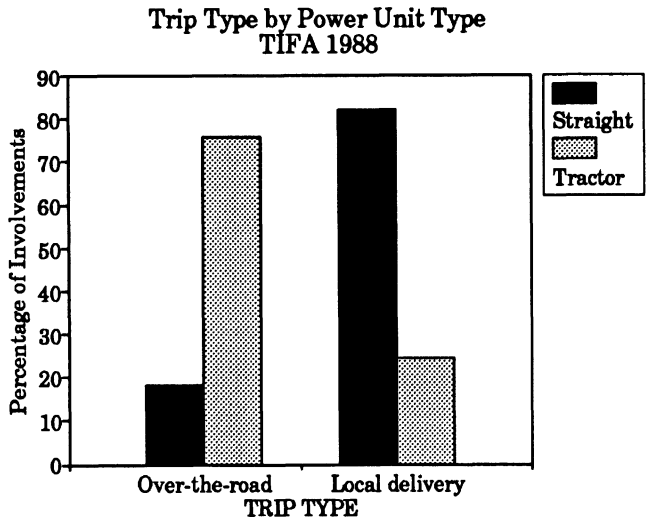


Figure 3-29

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 1988

Trip Type	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
Over-the-road	257	16.68%	2,710	69.22%	2,967	54.38%
Local delivery	1,152	74.76	833	21.28	1,985	36.38
Unknown	132	8.57	372	9.50	504	9.24
TOTAL	1,541	100.00%	3,915	100.00%	5,456	100.00%

NOTE: The 11 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 32% of the straight trucks and 28% 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 (18.9% of all cases), general freight (11.3%), heavy machinery (5.3%), and liquids in bulk (3.2%). For tractors, the cargo type distribution included general freight (20.9%), solids in bulk (6.5%), refrigerated food (5.2%), and logs and lumber (5%).

TABLE 3-30
Type of Cargo by Power Unit Type
TIFA 1988

Cargo Type	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
General freight	174	11.29%	817	20.87%	991	18.16%
Household goods	26	1.69	41	1.05	67	1.23
Metal	12	0.78	196	5.01	208	3.81
Heavy machinery	81	5.26	112	2.86	193	3.54
Motor vehicles	7	0.45	37	0.95	44	0.81
Driveaway/towaway	13	0.84	14	0.36	27	0.49
Gases in bulk	11	0.71	13	0.33	24	0.44
Solids in bulk	292	18.95	252	6.44	544	9.97
Liquids in bulk	50	3.24	173	4.42	223	4.09
Explosives	0	0.00	1	0.03	1	0.02
Logs/lumber	26	1.69	196	5.01	222	4.07
Empty	488	31.67	1,108	28.30	1,596	29.25
Refrigerated food	48	3.11	202	5.16	250	4.58
Mobile home	0	0.00	10	0.26	10	0.18
Farm products	60	3.89	172	4.39	232	4.25
Other	159	10.32	282	7.20	441	8.08
Unknown	94	6.10	289	7.38	383	7.02
TOTAL	1,541	100.00%	3,915	100.00%	5,456	100.00%

NOTE: The 11 cases of unknown power unit type are excluded from this table.

Cargo Type for Straight Trucks
TIFA 1988

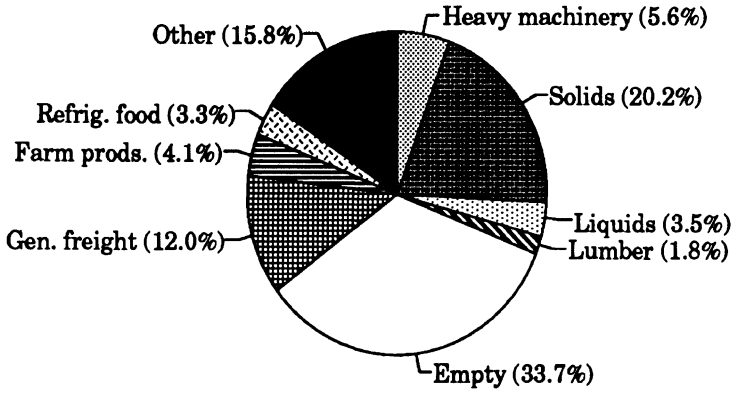


Figure 3-30a

Cargo Type for Tractors
TIFA 1988

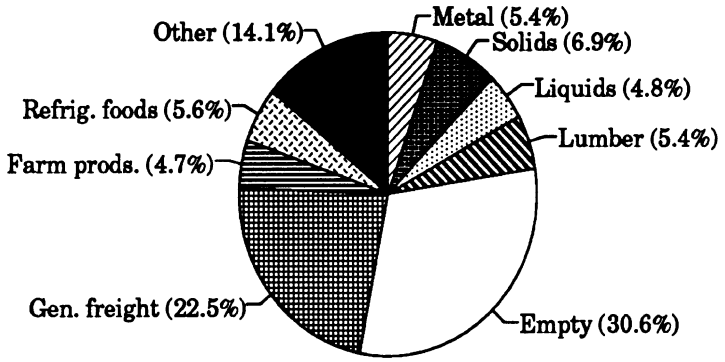


Figure 3-30b

Cab style is split into conventional cabs versus cabover engine and cab-forward cabs. Most of the straight trucks involved in fatal accidents in 1988 had conventional cabs. Tractors showed a slight decrease in the percentage of cabover engine cabs from 1987 (47.4%) to 1988 (43.8%).

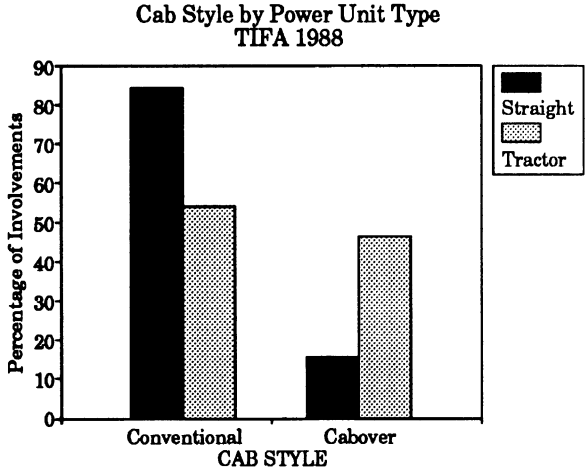


Figure 3-31

TABLE 3-31
Cab Style by Power Unit Type
TIFA 1988

Cab Style	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
Conventional	1,281	83.13%	1,993	50.91%	3,274	60.01%
Cabover/Cab-forward	235	15.25	1,714	43.78	1,949	35.72
Unknown	25	1.62	208	5.31	233	4.27
TOTAL	1,541	100.00%	3,915	100.00%	5,456	100.00%

NOTE: The 11 cases of unknown power unit type are excluded from this table.

The graph below depicts the number of trailers being hauled by the power unit at the time of the accident. If the power unit was towing or piggybacking another vehicle, but not hauling any trailers, the number of trailers was coded as none. Not surprisingly, almost 90% of the straight trucks were not hauling a trailer, while nearly 88% of the tractors were hauling a single trailer.

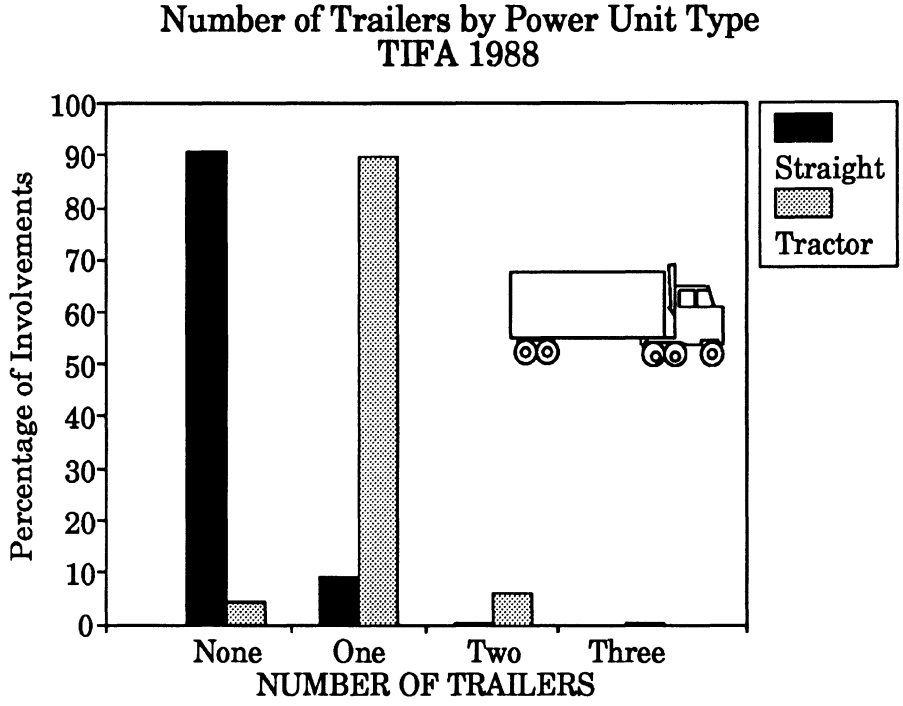


Figure 3-32

TABLE 3-32
Number of Trailers by Power Unit Type
TIFA 1988

Number of Trailers	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
No trailers	1,379	89.49%	168	4.29%	1,547	28.35%
One trailer	144	9.34	3,424	87.46	3,568	65.40
Two trailers	3	0.19	230	5.87	233	4.27
Three trailers	0	0.00	3	0.08	3	0.05
Unknown	15	0.97	90	2.30	105	1.92
TOTAL	1,541	100.00%	3,915	100.00%	5,456	100.00%

NOTE: The 11 cases of unknown power unit type are excluded from this table.

The type of fuel used by each involved truck was coded as gasoline, diesel fuel, liquid petroleum gas, or all other types. Again there is a great difference according to power unit type. Over 96% of the involved tractors used diesel fuel, while the straight trucks were split between diesel and gasoline, 65% to 33% respectively.

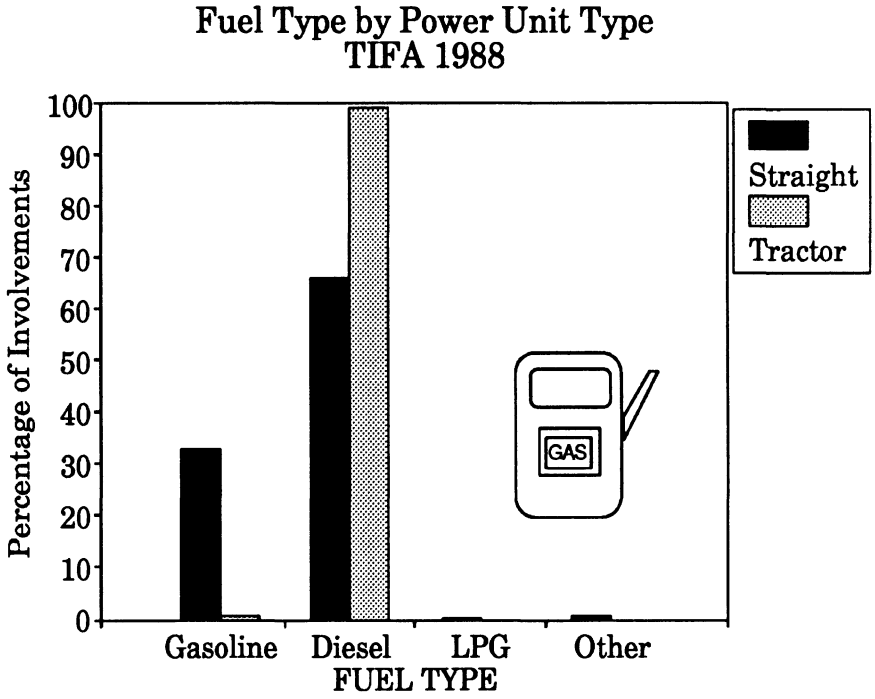


Figure 3-33

TABLE 3-33
Fuel Type by Power Unit Type
TIFA 1988

Fuel Type	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
Gasoline	502	32.58%	23	0.59%	525	9.62%
Diesel	1,004	65.15	3,775	96.42	4,779	87.59
L. P. G.	3	0.19	0	0.00	3	0.05
Other	11	0.71	0	0.00	11	0.20
Unknown	21	1.36	117	2.99	138	2.53
TOTAL	1,541	100.00%	3,915	100.00%	5,456	100.00%

NOTE: The 11 cases of unknown power unit type are excluded from this table.

The line graph on the next page depicts the number of fatal involvements in 1988 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, over 48% of the tractors were from model years 1984-1989, compared to 43% of the straight trucks. On the other hand,

almost 23% of the straight trucks dated from 1975 and earlier, as opposed to 11% of the tractors. This difference is probably related to the typically high annual mileage of tractors, relative to straight trucks, which limits their number of years of service.

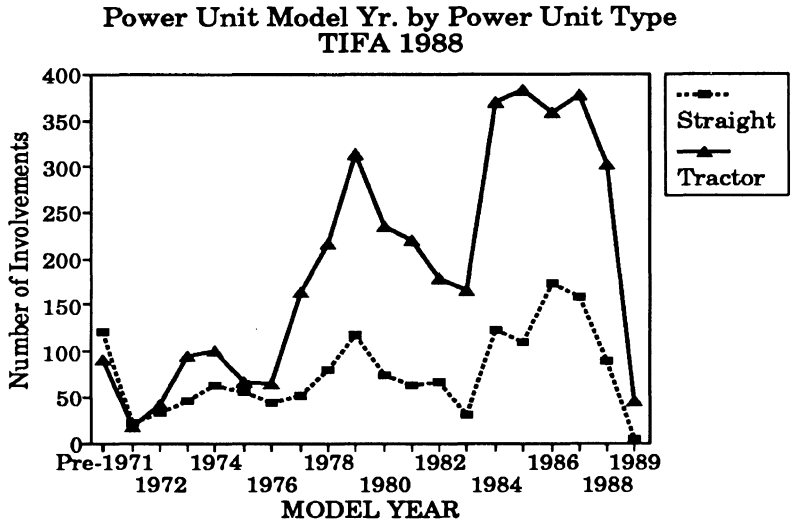


Figure 3-34

TABLE 3-34
Model Year of Power Unit by Power Unit Type
TIFA 1988

Model Year	Straight Truck		Tractor		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
1947–1970	121	7.85%	91	2.32%	212	4.04%
1971	23	1.49	18	0.46	41	0.78
1972	33	2.14	42	1.07	75	1.43
1973	47	3.05	95	2.43	142	2.71
1974	64	4.15	101	2.58	165	3.15
1975	56	3.63	67	1.71	123	2.35
1976	44	2.86	65	1.66	109	2.08
1977	51	3.31	164	4.19	215	4.10
1978	79	5.13	216	5.52	295	5.63
1979	118	7.66	313	7.99	431	8.22
1980	74	4.80	235	6.00	309	5.89
1981	63	4.09	220	5.62	283	5.40
1982	66	4.28	178	4.55	244	4.65
1983	31	2.01	165	4.21	196	3.74
1984	123	7.98	369	9.43	492	9.38
1985	109	7.07	383	9.78	492	9.38
1986	173	11.23	358	9.14	531	10.13
1987	158	10.25	376	9.60	534	10.18
1988	89	5.78	302	7.71	391	7.46
1989	5	0.32	46	1.17	51	0.97
Unknown	14	0.91	111	2.84	125	2.38
TOTAL	1,541	100.00%	3,915	100.00%	5,456	100.00%

NOTE: The 11 cases of unknown power unit type are excluded from this table.

FATAL ACCIDENT EXPERIENCE OF STRAIGHT TRUCKS IN 1988

Distributions are presented in this section that characterize fatal accident involvements of straight trucks in 1988. Most of the variables are presented according to the cargo body style of the trucks. Cargo body style is known for over 97% of the 1,541 straight trucks in the TIFA 1988 file. Of the known cases, 28% were dumps, 28% vans, 8% refuse, 9% flatbeds, and 6% tanks. The remaining straight trucks had some other type of cargo body style. Many of the variables discussed in this section concern specific physical characteristics of the trucks themselves. This type of information is not available in the FARS files.

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

Configuration

The graph at right illustrates the gross vehicle weight rating (GVWR) distributions for van, flatbed, tank, dump, and refuse straight trucks. The GVWR indicates what the truck would weigh if loaded to its rated capacity. Of the known cases of GVWR, 88.2% 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. Tanks, dumps, and refuse trucks typically had GVWRs in classes 6 through 8. The increase in class 3 straight trucks from 45 in 1987 to 110 in 1988 can be partially explained by a corresponding increase in 1981 and later model year vehicles in the 1988 sample. These trucks have a GVWR code in their VIN, which allows the vehicles with a rating of over 10,000 pounds to be accurately identified. The GVWR determinations were more difficult to make for older trucks, hence they were less frequently included in the study.

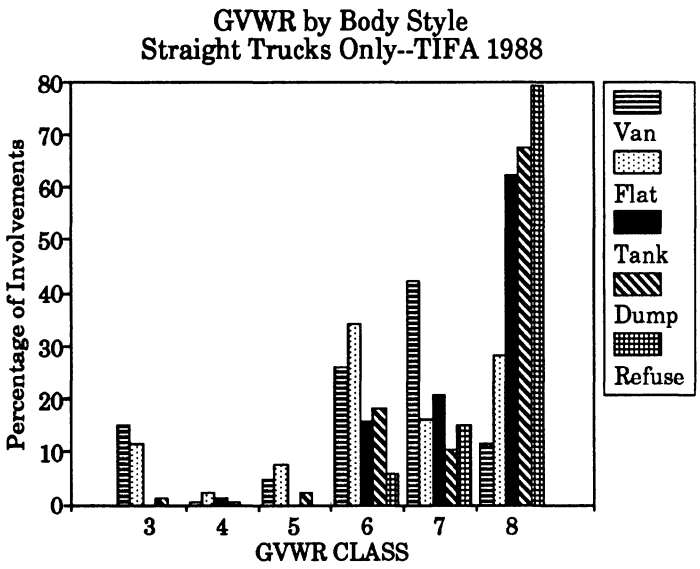


Figure 4-1

TABLE 4-1
GVWR by Body Style
Straight Trucks Only
TIFA 1988

GVWR Class/ Weight Range	BODY STYLE (Frequencies and Column Percents)							
	Van	Flatbed	Tank	Dump	Refuse	Other	Unknown	TOTAL
3 10,001–14,000	58 13.84	15 10.56	0 0.00	5 1.18	0 0.00	31 10.03	1 2.94	110 7.14
4 14,001–16,000	2 0.48	3 2.11	1 1.15	2 0.47	0 0.00	6 1.94	0 0.00	14 0.91
5 16,001–19,500	18 4.30	10 7.04	0 0.00	10 2.35	0 0.00	7 2.27	3 8.82	48 3.11
6 19,501–26,000	101 24.11	45 31.69	13 14.94	75 17.65	7 5.60	72 23.30	11 32.35	324 21.03
7 26,001–33,000	163 38.90	21 14.79	17 19.54	43 10.12	18 14.40	54 17.48	1 2.94	317 20.57
8 33,001+	44 10.50	37 26.06	51 58.62	279 65.65	94 75.20	124 40.13	12 35.29	641 41.60
Unknown	33 7.88	11 7.75	5 5.75	11 2.59	6 4.80	15 4.85	6 17.65	87 5.65
TOTAL	419 100.00	142 100.00	87 100.00	425 100.00	125 100.00	309 100.00	34 100.00	1,541 100.00

TABLE 4-2
Gross Vehicle Weight by Body Style
Straight Trucks Only
TIFA 1988

Gross Weight (Frequencies and Col. Pcts.)	Van	Flatbed	Tank	Dump	Refuse	Other	Unknown	TOTAL
< 20,000	257 61.34	83 58.45	22 25.29	118 27.76	10 8.00	132 42.72	1 2.94	623 40.43
20,000	79 18.85	15 10.56	30 34.48	136 32.00	21 16.80	67 21.68	1 2.94	349 22.65
30,000	21 5.01	10 7.04	10 11.49	19 4.47	33 26.40	35 11.33	1 2.94	129 8.37
40,000	2 0.48	0 0.00	3 3.45	38 8.94	17 13.60	13 4.21	0 0.00	73 4.74
50,000	0 0.00	3 2.11	4 4.60	25 5.88	17 13.60	10 3.24	0 0.00	59 3.83
60,000	1 0.24	2 1.41	1 1.15	27 6.35	2 1.60	9 2.91	0 0.00	42 2.73
70,000	0 0.00	2 1.41	3 3.45	18 4.24	0 0.00	3 0.97	0 0.00	26 1.69
80,000+	0 0.00	3 2.11	7 8.05	12 2.82	0 0.00	3 0.97	0 0.00	25 1.62
Unknown	59 14.08	24 16.90	7 8.05	32 7.53	25 20.00	37 11.97	31 91.18	215 13.95
TOTAL	419 100.00	142 100.00	87 100.00	425 100.00	125 100.00	309 100.00	34 100.00	1,541 100.00

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 1988 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, 73.3% were operating at a gross weight of under 30,000 pounds, and 83% 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 to 30.5% 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 79% of the dumps, 81.3% of the tanks, and 99.7% of the vans were operating at a gross weight under 50,000 pounds.

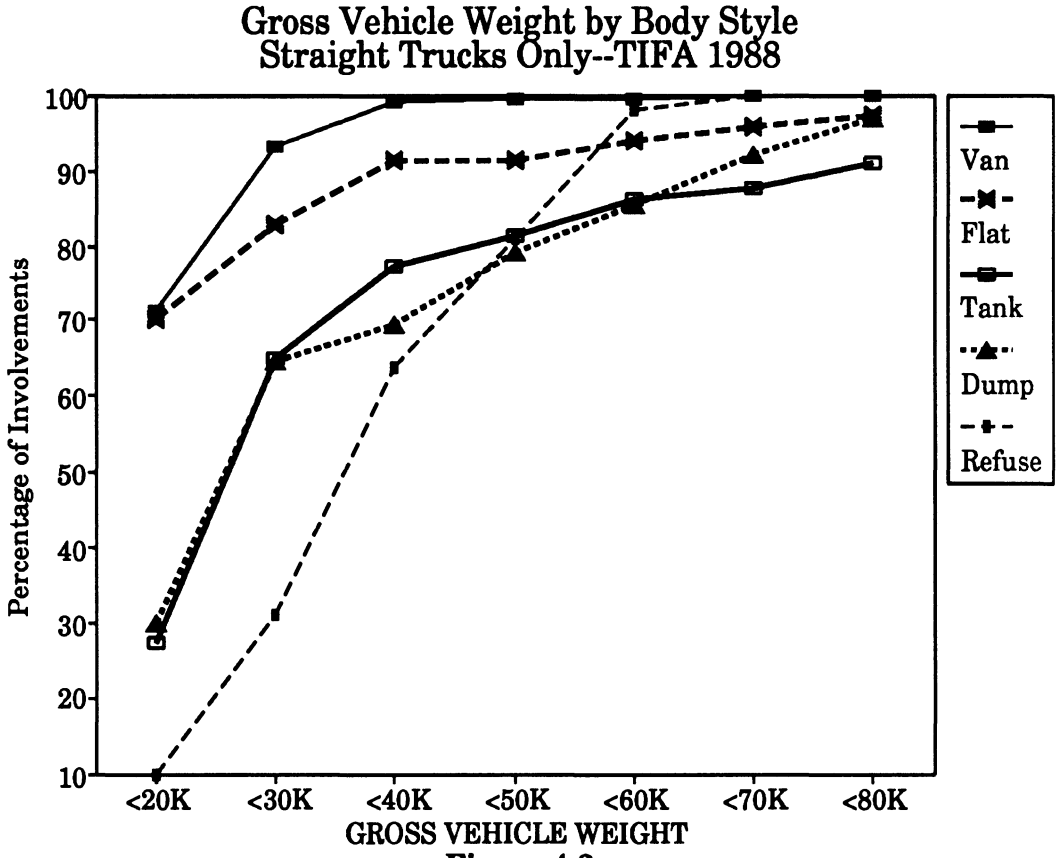


Figure 4-2

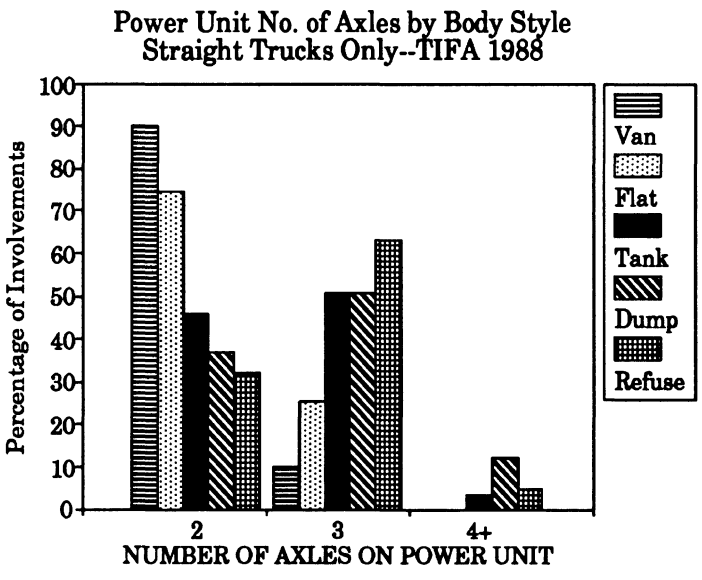


Figure 4-3

The number of axles on the power unit for the 1988 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 12% 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 1988

Power Unit No. of Axles (Frequencies and Col. Pcts.)	Van	Flatbed	Tank	Dump	Refuse	Other	Unknown	TOTAL
2	377 89.98	105 73.94	40 45.98	157 36.94	40 32.00	194 62.78	12 35.29	925 60.03
3	41 9.79	36 25.35	44 50.57	216 50.82	79 63.20	106 34.30	10 29.41	532 34.52
4+	0 0.00	0 0.00	3 3.45	52 12.24	6 4.80	9 2.91	0 0.00	70 4.54
Unknown	1 0.24	1 0.70	0 0.00	0 0.00	0 0.00	0 0.00	12 35.29	14 0.91
TOTAL	419 100.00	142 100.00	87 100.00	425 100.00	125 100.00	309 100.00	34 100.00	1,541 100.00

The table below attempts to characterize the configuration of the straight trucks in terms of number of units and number of axles on each unit. The rows of the table indicate the number of axles on the power unit, with possibilities of 2, 3, 4 or more, and unknown. The columns list frequencies for trucks without a trailer, with one trailer, two trailers, and for trucks when it was unknown if they where 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 1,541 straight trucks was a 2-axle truck not hauling a trailer, with 850 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 53 cases. The three cases of two-trailer trucks had 2 axles on each of the trailers.

TABLE 4-4
Number of Axles on Power Unit and Trailers
Straight Trucks Only
TIFA 1988

Power Unit No. of Axles	Number of Trailers/Number of Axles on Trailer								
		One Trailer					Two Trailers	Unknown if Trailer	TOTAL
	No Trailer	1	2	3	4+	Unk.	2,2		
2	850	15	43	10	0	3	1	3	925
3	461	2	53	3	8	2	2	1	532
4+	65	0	2	3	0	0	0	0	70
Unknown	3	0	0	0	0	0	0	11	14
TOTAL	1,379	17	98	16	8	5	3	15	1,541

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 44% of the dumps.

TABLE 4-5
Cargo Type by Body Style
Straight Trucks Only
TIFA 1988

Cargo Type (Frequencies and Col. Pcts.)	Van	Flatbed	Tank	Dump	Refuse	Other	Unknown	TOTAL
General freight	155 36.99	10 7.04	0 0.00	1 0.24	0 0.00	8 2.59	0 0.00	174 11.29
Household goods	26 6.21	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	26 1.69
Metal	4 0.95	1 0.70	0 0.00	1 0.24	1 0.80	3 0.97	2 5.88	12 0.78
Heavy machinery	8 1.91	27 19.01	0 0.00	26 6.12	0 0.00	20 6.47	0 0.00	81 5.26
Motor vehicles	0 0.00	5 3.52	0 0.00	0 0.00	0 0.00	2 0.65	0 0.00	7 0.45
Driveaway/tow	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	13 4.21	0 0.00	13 0.84
Gases in bulk	0 0.00	0 0.00	11 12.64	0 0.00	0 0.00	0 0.00	0 0.00	11 0.71
Solids in bulk	8 1.91	9 6.34	1 1.15	151 35.53	81 64.80	42 13.59	0 0.00	292 18.95
Liquids in bulk	0 0.00	0 0.00	48 55.17	0 0.00	0 0.00	2 0.65	0 0.00	50 3.24
Logs/lumber	1 0.24	6 4.23	0 0.00	8 1.88	0 0.00	11 3.56	0 0.00	26 1.69
Empty	86 20.53	48 33.80	23 26.44	187 44.00	34 27.20	109 35.28	1 2.94	488 31.67
Refrig. food	48 11.46	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	48 3.11
Farm products	10 2.39	6 4.23	0 0.00	20 4.71	0 0.00	24 7.77	0 0.00	60 3.89
Other	54 12.89	17 11.97	1 1.15	19 4.47	3 2.40	63 20.39	2 5.88	159 10.32
Unknown	19 4.53	13 9.15	3 3.45	12 2.82	6 4.80	12 3.88	29 85.29	94 6.10
TOTAL	419 100.00	142 100.00	87 100.00	425 100.00	125 100.00	309 100.00	34 100.00	1,541 100.00

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.

Cargo Type for Van Straight Trucks
TIFA 1988

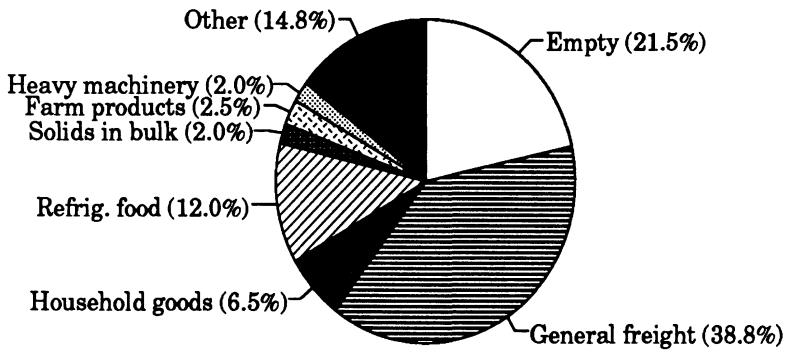


Figure 4-5a

Cargo Type for Flatbed Straight Trucks
TIFA 1988

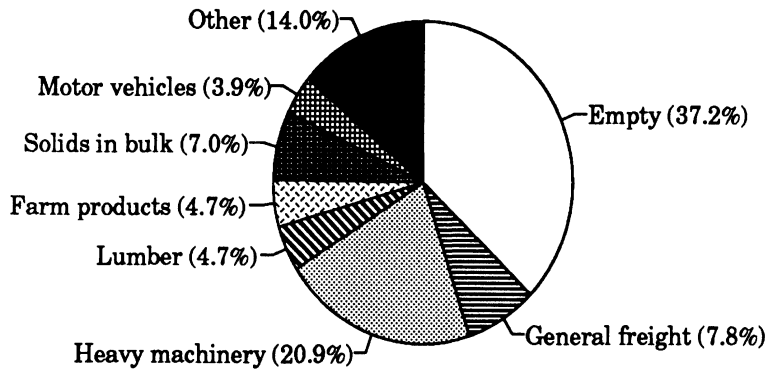


Figure 4-5b

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 60% of the known cases. Vans also had the highest percentage of interstate authorized carriers at 20%. On the other hand, dumps were characterized by the highest proportion of intrastate carriers, with 61%, and refuse trucks by the highest percentage of intrastate private carriers, with 54%.

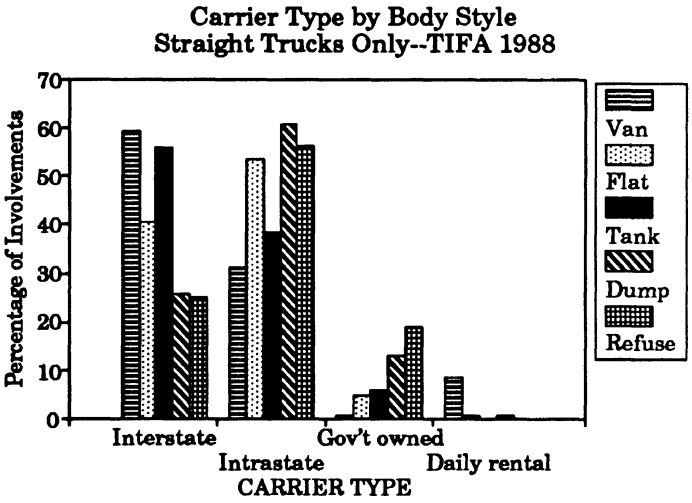


Figure 4-6

TABLE 4-6
Carrier Type by Body Style
Straight Trucks Only
TIFA 1988

Carrier Type (Frequencies and Col. Pcts.)	Van	Flatbed	Tank	Dump	Refuse	Other	Unknown	TOTAL
Interstate private	150 35.80	41 28.87	33 37.93	63 14.82	27 21.60	97 31.39	0 0.00	411 26.67
Interstate authorized	79 18.85	6 4.23	10 11.49	29 6.82	0 0.00	20 6.47	1 2.94	145 9.41
Interstate exempt	3 0.72	3 2.11	5 5.75	11 2.59	1 0.80	5 1.62	2 5.88	30 1.95
Intrastate private	105 25.06	55 38.73	33 37.93	162 38.12	60 48.00	134 43.37	0 0.00	549 35.63
Intrastate for hire	17 4.06	11 7.75	0 0.00	82 19.29	3 2.40	9 2.91	1 2.94	123 7.98
Government owned	3 0.72	6 4.23	5 5.75	52 12.24	21 16.80	16 5.18	0 0.00	103 6.68
Daily rental	33 7.88	1 0.70	0 0.00	2 0.47	0 0.00	3 0.97	0 0.00	39 2.53
Unknown	29 6.92	19 13.38	1 1.15	24 5.65	13 10.40	25 8.09	30 88.24	141 9.15
TOTAL	419 100.00	142 100.00	87 100.00	425 100.00	125 100.00	309 100.00	34 100.00	1,541 100.00

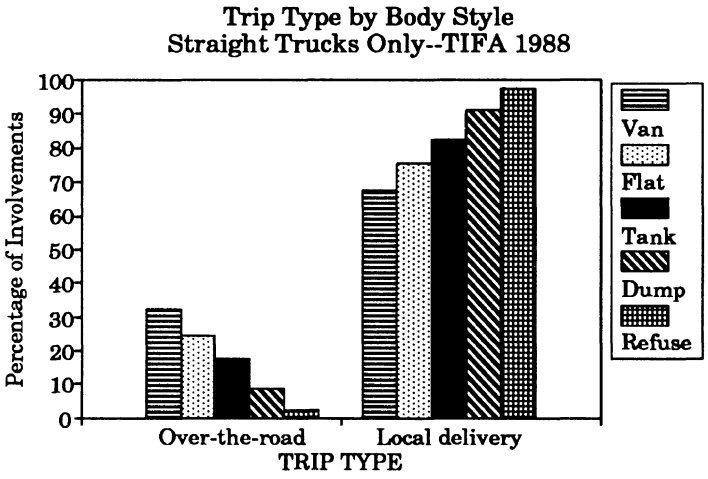


Figure 4-7

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 (32%), followed by flatbeds (25%), tanks (18%), dumps (9%), and refuse trucks (3%).

TABLE 4-7
Trip Type by Body Style
Straight Trucks Only
TIFA 1988

Trip Type (Frequencies and Col. Pcts.)	Van	Flatbed	Tank	Dump	Refuse	Other	Unknown	TOTAL
Over-the-road	124 29.59	30 21.13	15 17.24	35 8.24	3 2.40	48 15.53	2 5.88	257 16.68
Local delivery	258 61.58	92 64.79	69 79.31	368 86.59	114 91.20	246 79.61	5 14.71	1,152 74.76
Unknown	37 8.83	20 14.08	3 3.45	22 5.18	8 6.40	15 4.85	27 79.41	132 8.57
TOTAL	419 100.00	142 100.00	87 100.00	425 100.00	125 100.00	309 100.00	34 100.00	1,541 100.00

There is less variation among the different types of straight trucks for the class of road where the accident occurred. Overall, nearly 51% of the straight truck involvements occurred on major arteries, and all five categories of cargo body styles had a substantial proportion of involvements on these roads. Only 14% of the overall involvements occurred on limited access roads, but the percentages for flatbeds, vans, and "others" were slightly higher. About one-third of all the accidents took place on the "other" class of roads, but this category was under-represented among the vans.

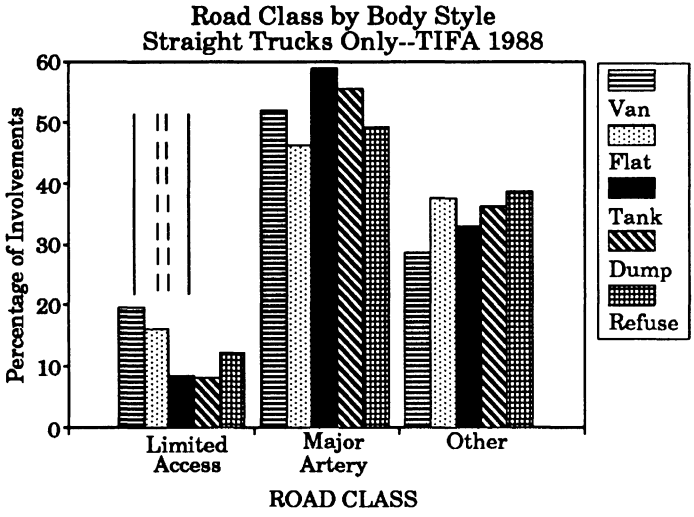


Figure 4-8

TABLE 4-8
Road Class by Body Style
Straight Trucks Only
TIFA 1988

Road Class (Frequencies and Col. Pcts.)	Van	Flatbed	Tank	Dump	Refuse	Other	Unknown	TOTAL
Limited Access	80 19.09	22 15.49	7 8.05	34 8.00	15 12.00	48 15.53	9 26.47	215 13.95
Major Artery	212 50.60	64 45.07	50 57.47	233 54.82	61 48.80	154 49.84	11 32.35	785 50.94
Other	117 27.92	52 36.62	28 32.18	152 35.76	48 38.40	102 33.01	14 41.18	513 33.29
Unknown	10 2.39	4 2.82	2 2.30	6 1.41	1 0.80	5 1.62	0 0.00	28 1.82
TOTAL	419 100.00	142 100.00	87 100.00	425 100.00	125 100.00	309 100.00	34 100.00	1,541 100.00

Accidents

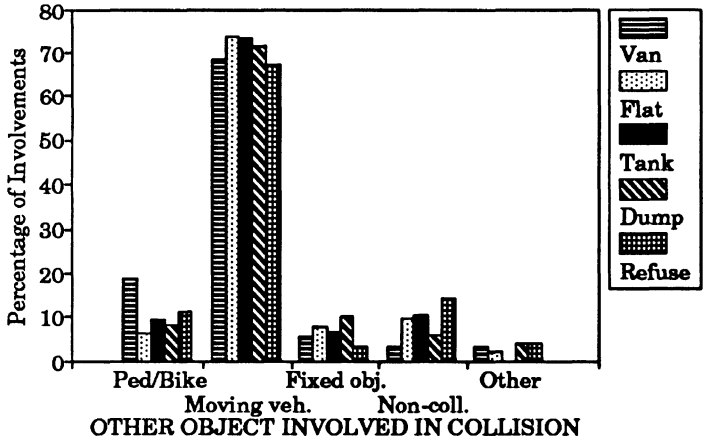


Figure 4-9

The graph on the left illustrates the distribution of the first harmful event in the accident for the 1988 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 vans, and a higher incidence of non-collisions among refuse trucks.

TABLE 4-9
First Harmful Event by Body Style
Straight Trucks Only
TIFA 1988

First Harmful Event (Frequencies and Col. Pcts.)	Van	Flatbed	Tank	Dump	Refuse	Other	Unknown	TOTAL
Pedestrian	64 15.27	5 3.52	8 9.20	34 8.00	12 9.60	31 10.03	5 14.71	159 10.32
Pedalcyclist	16 3.82	4 2.82	0 0.00	2 0.47	2 1.60	4 1.29	2 5.88	30 1.95
Train	3 0.72	2 1.41	0 0.00	11 2.59	0 0.00	1 0.32	0 0.00	17 1.10
Moving vehicle	287 68.50	105 73.94	64 73.56	304 71.53	84 67.20	236 76.38	18 52.94	1,098 71.25
Parked vehicle	9 2.15	1 0.70	0 0.00	2 0.47	5 4.00	3 0.97	1 2.94	21 1.36
Other non-fixed object	3 0.72	0 0.00	0 0.00	4 0.94	0 0.00	4 1.29	0 0.00	11 0.58
Fixed object	24 5.73	11 7.75	6 6.90	43 10.12	4 3.20	13 4.21	6 17.65	107 6.94
Non-collision	13 3.10	14 9.86	9 10.34	25 5.88	18 14.40	17 5.50	2 5.88	98 6.36
TOTAL	419 100.00	142 100.00	87 100.00	425 100.00	125 100.00	309 100.00	34 100.00	1,541 100.00

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 1988 TIFA straight trucks by body style. In comparing the most harmful event to the first harmful event, the primary difference is the higher incidence of non-collisions, such as rollovers, explosions, and fires, among tanks and flatbeds.

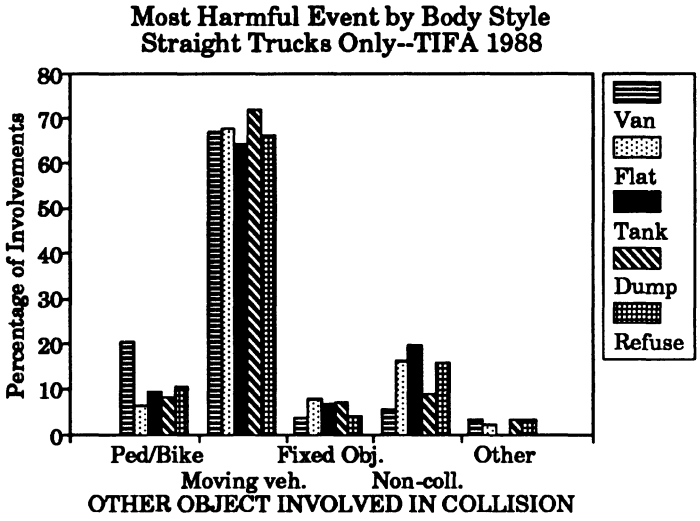


Figure 4-10

TABLE 4-10
Most Harmful Event by Body Style
Straight Trucks Only
TIFA 1988

Most Harmful Event (Frequencies and Col. Pcts.)	Van	Flatbed	Tank	Dump	Refuse	Other	Unknown	TOTAL
Pedestrian	70 16.71	5 3.52	8 9.20	34 8.00	11 8.80	33 10.68	8 23.53	169 10.97
Pedalcyclist	16 3.82	4 2.82	0 0.00	2 0.47	2 1.60	4 1.29	2 5.88	30 1.95
Train	3 0.72	2 1.41	0 0.00	11 2.59	0 0.00	1 0.32	0 0.00	17 1.10
Moving vehicle	281 67.06	96 67.61	56 64.37	306 72.00	83 66.40	224 72.49	20 58.82	1,066 69.18
Parked vehicle	6 1.43	1 0.70	0 0.00	2 0.47	2 1.60	3 0.97	0 0.00	14 0.91
Other non-fixed object	4 0.95	0 0.00	0 0.00	2 0.47	2 1.60	3 0.97	0 0.00	11 0.71
Fixed object	16 3.82	11 7.75	6 6.90	30 7.06	5 4.00	14 4.53	2 5.88	84 5.45
Non-collision	23 5.49	23 16.20	17 19.54	38 8.94	20 16.00	27 8.74	2 5.88	150 9.73
TOTAL	419 100.00	142 100.00	87 100.00	425 100.00	125 100.00	309 100.00	34 100.00	1,541 100.00

The manner of collision distributions is shown in the graph at right for the 1,098 straight truck involvements where the first harmful event was a collision with another motor vehicle. Overall, angle collisions were the most common type (43%), followed by head-ons (32%), rear-ends (19%), 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 tanks (46.9%), and vans (37.6%) in head-on collisions, and of dumps (52.6%) in angle collisions. Tanks had the lowest percentage of rear-end collisions (4.7%).

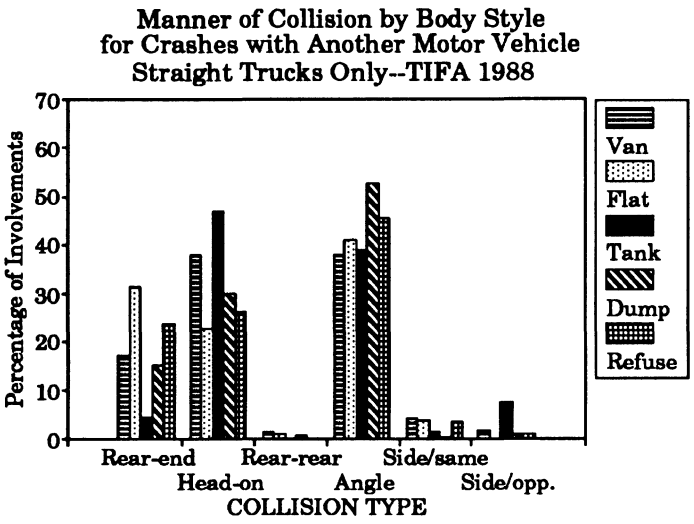


Figure 4-11

TABLE 4-11
Manner of Collision by Body Style
for Crashes with Another Motor Vehicle
Straight Trucks Only
TIFA 1988

Manner of Collision (Frequencies and Col. Pcts.)	Van	Flatbed	Tank	Dump	Refuse	Other	Unknown	TOTAL
Rear-end	49 17.07	33 31.43	3 4.69	46 15.13	20 23.81	56 23.73	5 27.78	212 19.31
Head-on	108 37.63	24 22.86	30 46.88	91 29.93	22 26.19	75 31.78	5 27.78	355 32.33
Rear-to-rear	4 1.39	1 0.95	0 0.00	2 0.66	0 0.00	1 0.42	0 0.00	8 0.73
Angle	109 37.98	43 40.95	25 39.06	160 52.63	38 45.24	91 38.56	5 27.78	471 42.90
Sideswipe, same dir.	12 4.18	4 3.81	1 1.56	1 0.33	3 3.57	6 2.54	3 16.67	30 2.73
Sideswipe, opp. dir.	5 1.74	0 0.00	5 7.81	4 1.32	1 1.19	5 2.12	0 0.00	20 1.82
Unknown	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	2 0.85	0 0.00	2 0.18
TOTAL	287 100.00	105 100.00	64 100.00	304 100.00	84 100.00	236 100.00	18 100.00	1,098 100.00

Driver Injury

The graph at right shows the distributions for the injury severity sustained by the straight truck drivers. There is not a lot of variation among the different cargo body styles. One minor difference is the higher incidence of casualties among tank truck drivers—56.3% of the known cases compared to the overall average of 43.1%. The lowest proportion of fatalities occurred among refuse truck (8.6%) and van (10.1%) drivers. The overall incidence of fatalities among the straight truck drivers was 12.9%.

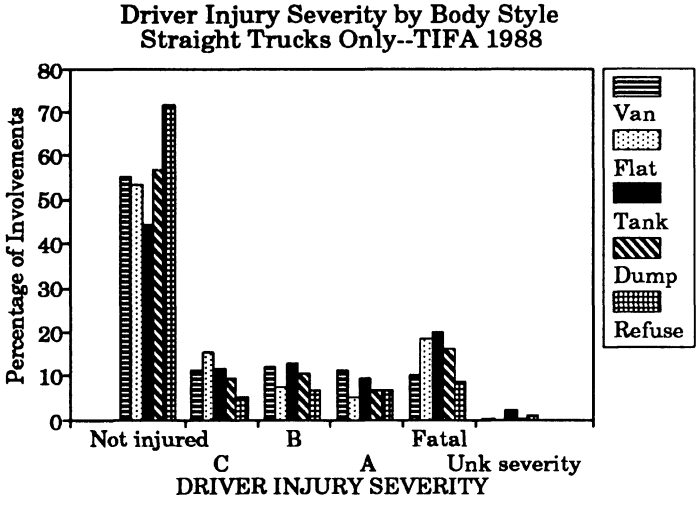


Figure 4-12

TABLE 4–12
Truck Driver Injury Severity by Body Style
Straight Trucks Only
TIFA 1988

Injury Severity (Frequencies and Col. Pcts.)	Van	Flatbed	Tank	Dump	Refuse	Other	Unknown	TOTAL
Not injured	229 54.65	72 50.70	38 43.68	236 55.53	83 66.40	166 53.72	21 61.76	845 54.83
C injury, possible	46 10.98	21 14.79	10 11.49	39 9.18	6 4.80	42 13.59	2 5.88	166 10.77
B injury, not incapacitating	50 11.93	10 7.04	11 12.64	44 10.35	8 6.40	22 7.12	2 5.88	147 9.54
A injury, incapacitating	46 10.98	7 4.93	8 9.20	28 6.59	8 6.40	22 7.12	2 5.88	121 7.85
Fatal injury	42 10.02	25 17.61	17 19.54	67 15.76	10 8.00	35 11.33	2 5.88	198 12.85
Injured, severity unknown	1 0.24	0 0.00	2 2.30	2 0.47	1 0.80	2 0.65	0 0.00	8 0.52
Died prior to accident	0 0.00	0 0.00	1 1.15	0 0.00	0 0.00	0 0.00	0 0.00	1 0.06
Unknown if injured	5 1.19	7 4.93	0 0.00	9 2.12	9 7.20	20 6.47	5 14.71	55 3.57
TOTAL	419 100.00	142 100.00	87 100.00	425 100.00	125 100.00	309 100.00	34 100.00	1,541 100.00

Next, driver injury severity is considered for all TIFA 1988 straight trucks according to the principal point of impact on the truck. Table 4-13A below shows the frequencies for impact area versus injury severity, while Table 4-13B lists the percentage that each impact area comprised of each injury severity category. The front of the truck was the most common principal impact area (55%), followed by the rear (13%) and the right side (12%). Although non-collisions represented only 4.4% of all fatal involvements, they accounted for 22.2% of the cases in which the truck driver died.

TABLE 4-13A
Driver Injury Severity by Principal Impact Point for Straight Trucks—Frequencies
TIFA 1988

Principal Impact Point	Driver Injury Severity							
	Not Injured	C	B	A	Fatal	Injured, severity unk	Unknown if injured	TOTAL†
Noncollision	15	0	3	4	44	1	0	67
Right side	114	25	18	11	19	0	1	188
Rear	131	22	2	4	8	1	28	196
Left side	67	14	9	6	10	2	16	124
Front	443	95	107	85	100	4	7	841
Top	2	4	2	9	7	0	0	24
Undercarriage	54	3	6	0	3	0	2	68
Underride	1	1	0	2	1	0	0	5
Override	18	2	0	0	5	0	1	26
Unknown	0	0	0	0	1	0	0	1
TOTAL	845	166	147	121	198	8	55	1,540

TABLE 4-13B
Driver Injury Severity by Principal Impact Point for Straight Trucks—Column Percentages
TIFA 1988

Principal Impact Point	Driver Injury Severity							
	Not Injured	C	B	A	Fatal	Injured, sev unk	Unk if injured	TOTAL†
Noncollision	1.78%	0.00%	2.04%	3.31%	22.22%	12.50%	0.00%	4.35%
Right side	13.49	15.06	12.24	9.09	9.60	0.00	1.82	12.20
Rear	15.50	13.25	1.36	3.31	4.04	12.50	50.91	12.72
Left side	7.93	8.43	6.12	4.96	5.05	25.00	29.09	8.05
Front	52.43	57.23	72.79	70.25	50.51	50.00	12.73	54.61
Top	0.24	2.41	1.36	7.44	3.54	0.00	0.00	1.56
Undercar.	6.39	1.81	4.08	0.00	1.52	0.00	3.64	4.41
Underride	0.12	0.60	0.00	1.65	0.51	0.00	0.00	0.32
Override	2.13	1.20	0.00	0.00	2.53	0.00	1.82	1.69
Unknown	0.00	0.00	0.00	0.00	0.51	0.00	0.00	0.06
TOTAL	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

† One case coded "died prior to accident" in FARS has been excluded.

The stacked bar graph below represents the proportion that each injury severity level (excluding the unknown if injured and injured, severity unknown categories) comprised of each impact area. Non-collisions were characterized by the highest proportion of driver fatalities, with 67%, and resulted in driver casualties in 77% of the cases. The category with the next highest percentage of truck driver casualties was front area impacts with 47%. 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 78% of these cases.

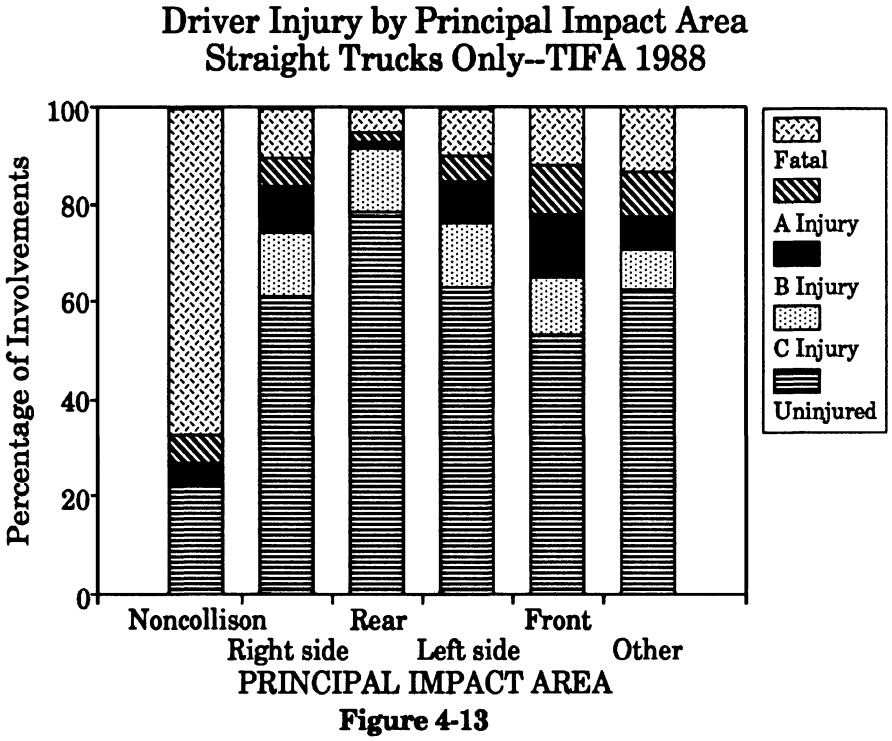


Figure 4-13

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 78% 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 29% did not include a rollover, fire, or ejection. In 26% of the truck driver fatals, there was a rollover and the driver was ejected; in 23% there was a rollover only; and in 13% 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 96%.

TABLE 4-14A
Driver Injury Severity by Rollover/Fire/Ejection
for Straight Trucks—Frequencies
TIFA 1988

Occurrence of Rollover/Fire/Ejection	Driver Injury Severity							
	Not Injured	C	B	A	Fatal	Injured, severity unk	Unknown if injured	TOTAL†
None	808	145	110	67	57	5	4	1,196
Rollover only	23	15	27	32	45	3	0	145
Fire only	12	4	3	6	10	0	0	35
Ejection only	0	0	0	7	25	0	0	32
Rollover/Fire	1	2	3	1	6	0	0	13
Fire/Ejection	0	0	0	1	3	0	0	4
Rollover/Ejection	0	0	2	6	51	0	0	59
Rollover/Fire/Ejection	0	0	0	1	1	0	0	2
Unknown	1	0	2	0	0	0	51	54
TOTAL	845	166	147	121	198	8	55	1,540

TABLE 4-14B
Driver Injury Severity by Rollover/Fire/Ejection
for Straight Trucks—Column Percentages
TIFA 1988

Occurrence of Rollover/Fire/ Ejection	Driver Injury Severity							
	Not Injured	C	B	A	Fatal	Injured, sev unk	Unk if injured	TOTAL†
None	95.62%	87.35%	74.83%	55.37%	28.79%	62.50%	7.27%	77.66%
Rollover only	2.72	9.04	18.37	26.45	22.73	37.50	0.00	9.42
Fire only	1.42	2.41	2.04	4.96	5.05	0.00	0.00	2.27
Ejection only	0.00	0.00	0.00	5.79	12.63	0.00	0.00	2.08
Rollover/Fire	0.12	1.20	2.04	0.83	3.03	0.00	0.00	0.84
Fire/Ejection	0.00	0.00	0.00	0.83	1.52	0.00	0.00	0.26
Roll/Eject	0.00	0.00	1.36	4.96	25.76	0.00	0.00	3.83
Roll/Fire/Eject	0.00	0.00	0.00	0.83	0.51	0.00	0.00	0.13
Unknown	0.12	0.00	1.36	0.00	0.00	0.00	92.73	3.51
TOTAL	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

† One case coded "died prior to accident" in FARS has been excluded.

The figure on the following page displays the driver injury severity outcome for each of the categories of rollover/fire/ejection occurrence. When none of those events took place, the driver was uninjured 68% of the time. This was true of only 16% of the cases when a rollover only occurred, 34% when a fire only took place, and never when the driver was ejected. As one would expect, combinations of these events, although rare, proved especially hazardous to the driver. The two instances when all three events took place resulted in one driver fatality and one incapacitating injury.

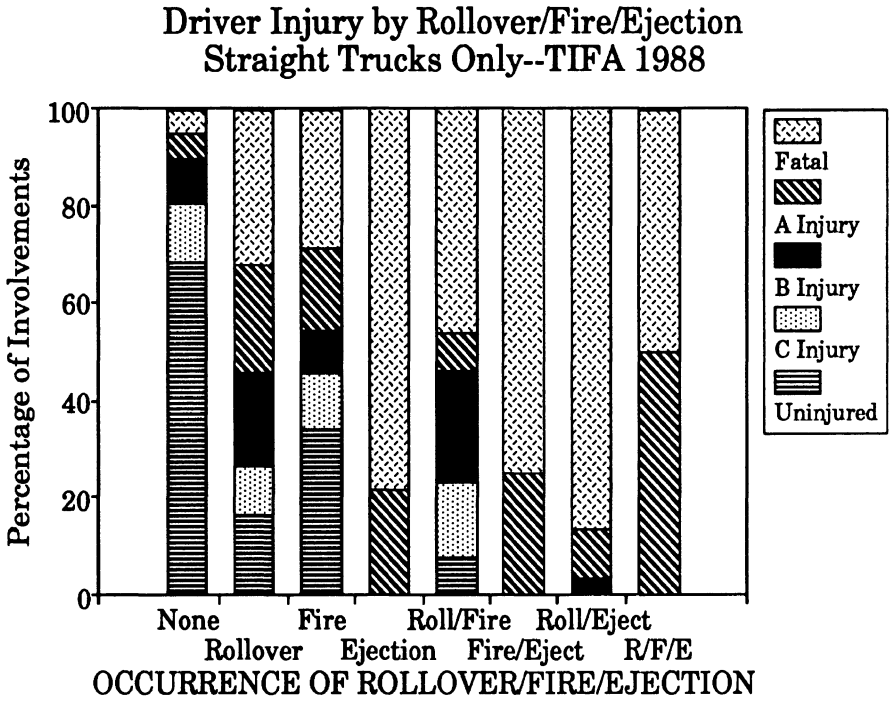

Driver Injury by Rollover/Fire/Ejection
Straight Trucks Only--TIFA 1988
Percentage of Involvements
100
80
60
40
20
0
Fatal
A Injury
B Injury
C Injury
Uninjured
None
Rollover
Fire
Ejection
Roll/Fire
Fire/Eject
Roll/Eject
R/F/E
OCCURRENCE OF ROLLOVER/FIRE/EJECTION

Figure 4-14

FATAL ACCIDENT EXPERIENCE OF TRACTOR COMBINATIONS IN 1988

This section focuses exclusively on the fatal accident experience of tractor combinations in 1988. 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 almost 72% of the fatal large truck accidents in 1988, a greater number of variables are discussed for the tractors than was the case for the straight trucks. The configuration of the involved tractors is characterized according to cab style, trailer body style, number of trailers, weight, axle configuration, cargo type, and fuel type. Following that are descriptions of the use of the tractors, including carrier type, trip type, road class, land use, and light condition. Next is a series of collision type distributions, including the occurrence of rollovers and jackknifes according to gross combination weight. The final portion of the section concerns the injury experience of the tractor drivers.

Configuration

Cab style is coded in TIFA as either conventional or cabover/cab-forward. The tractors involved in fatal accidents in 1988 were conventional cabs in almost 54% of the cases in which cab style was known. The distributions for the number of trailers hauled by these two cab styles are illustrated in the graph at right. The main difference is that doubles were more likely to be hauled by cabover than conventional cabs.

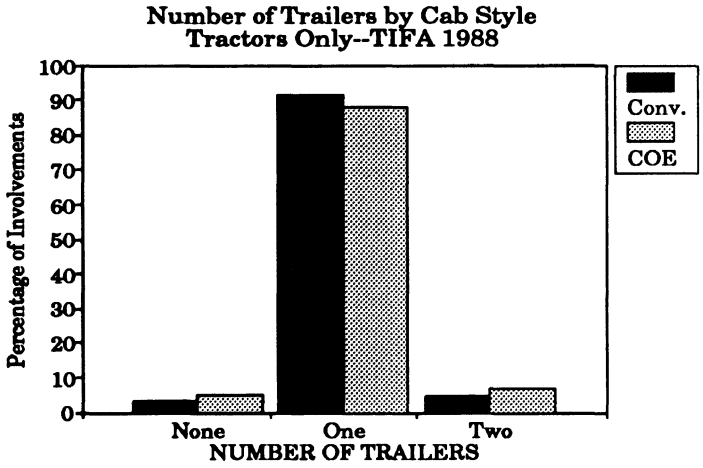


Figure 5-1

TABLE 5-1
Number of Trailers by Cab Style
Tractors Only
TIFA 1988

Number of Trailers	Conventional		Cabover/ Cab-forward		Unknown		TOTAL	
	No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.
No trailers	72	3.61%	87	5.08%	9	4.33%	168	4.29%
One trailer	1,822	91.42	1,505	87.81	97	46.63	3,424	87.46
Two trailers	97	4.87	120	7.00	13	6.25	230	5.87
Three trailers	2	0.10	1	0.06	0	0.00	3	0.08
Unknown	0	0.00	1	0.06	89	42.79	90	2.30
TOTAL	1,993	100.00%	1,714	100.00%	208	100.00%	3,915	100.00%

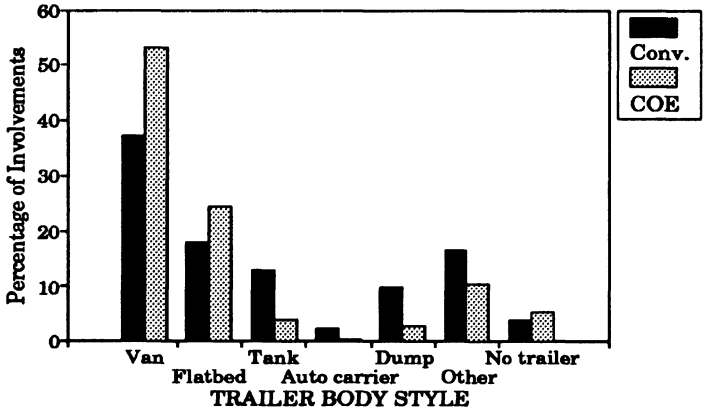


Figure 5-2

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, 53% of the cabovers were hauling a van as the first trailer. This compares to only 37% of the conventional cabs. Cabovers also were more likely to be hauling a flatbed 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 1988

First Trailer Body Style	Conventional		Cabover/ Cab-forward		Unknown		TOTAL	
	No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.
Van	729	36.58%	889	51.87%	52	25.00%	1,670	42.66%
Flatbed	353	17.71	406	23.69	22	10.58	781	19.95
Tank	250	12.54	66	3.85	7	3.37	323	8.25
Auto carrier	45	2.26	6	0.35	1	0.48	52	1.33
Dump	190	9.53	48	2.80	2	0.96	240	6.13
Other	320	16.06	170	9.92	5	2.40	495	12.64
No first trailer	72	3.61	87	5.08	9	4.33	168	4.29
Unknown	34	1.71	42	2.45	110	52.88	186	4.75
TOTAL	1,993	100.00%	1,714	100.00%	208	100.00%	3,915	100.00%

Table 5-2 above indicates the relative proportions of the different first trailer body styles for the TIFA 1988 tractors. If the cases are restricted to those where there was a first trailer and its body style was known, then 46.9% of the involved tractors were hauling a van as the first trailer, 21.9% a flatbed, 9.1% a tank, 1.5% an auto carrier, 6.7% a dump, and the remaining 14% 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 1988 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 1988 were class 8 (over 33,000 lbs.). An even higher proportion of tractors hauling flatbeds, tanks, or dumps as the first trailer were class 8 vehicles. On the other hand, somewhat lower percentages of the vans (92%) and auto carriers (88%) were hauled by class 8 tractors.

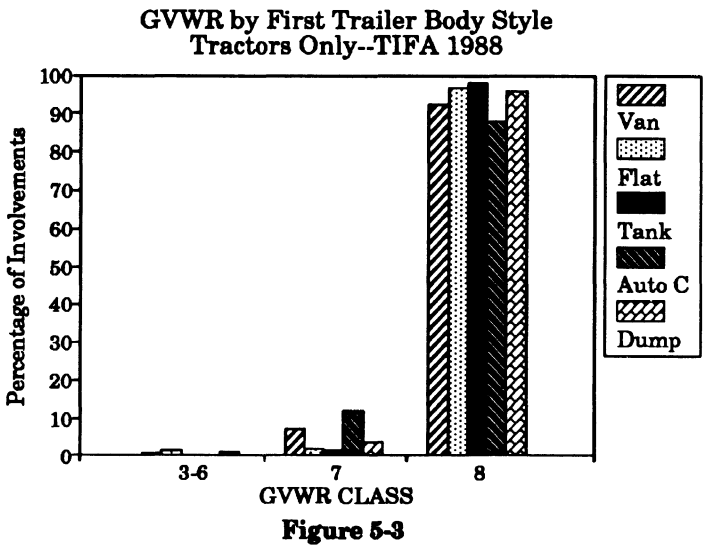


Figure 5-3

TABLE 5-3
GVWR by First Trailer Body Style
Tractors Only
TIFA 1988

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	2 0.26	0 0.00	0 0.00	0 0.00	1 0.20	1 0.28	4 0.10
4 14,001–16,000	0 0.00	1 0.13	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	1 0.03
6 19,501–26,000	7 0.42	6 0.77	1 0.31	0 0.00	2 0.83	1 0.20	4 1.13	21 0.5
7 26,001–33,000	120 7.19	15 1.92	5 1.55	6 11.54	8 3.33	11 2.22	28 7.91	193 4.93
8 33,001+	1,513 90.60	176 92.96	314 97.21	45 86.54	224 93.33	474 95.76	260 73.45	3,556 90.83
Unknown	30 1.80	31 3.97	3 0.93	1 1.92	6 2.50	8 1.62	61 17.23	140 3.58
TOTAL	1,670 100.00	781 100.00	323 100.00	52 100.00	240 100.00	495 100.00	354 100.00	3,915 100.00

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 48% of tanks (of all known cases), 45% of flatbeds, 47% of dumps, 28% of vans, and just 8% of auto carriers.

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

TABLE 5-4
Gross Combination Weight by First Trailer Body Style
Tractors Only
TIFA 1988

Gross Weight (Frequencies and Col. Pcts.)	Van	Flatbed	Tank	Auto Carrier	Dump	Other	Unknown/ No Trailer	TOTAL
< 20,000	5 0.30	3 0.38	0 0.00	0 0.00	0 0.00	3 0.61	135 38.14	146 3.73
20,000	245 14.67	123 15.75	74 22.91	1 1.92	41 17.08	103 20.81	26 7.34	613 15.66
30,000	315 18.8	76 9.73	43 13.31	20 38.46	44 18.33	75 15.15	5 1.41	578 14.76
40,000	168 10.0	48 6.15	7 2.17	9 17.31	5 2.08	13 2.63	2 0.56	252 6.44
50,000	169 10.1	57 7.30	8 2.48	7 13.46	3 1.25	13 2.63	2 0.56	259 6.62
60,000	208 12.4	82 10.50	23 7.12	9 17.31	20 8.33	23 4.65	4 1.13	369 9.43
70,000	403 24.1	252 32.27	100 30.96	4 7.69	73 30.42	162 32.73	3 0.85	997 25.47
80,000+	36 2.1	62 7.94	44 13.62	0 0.00	29 12.08	58 11.72	3 0.85	232 5.93
Unknown	121 7.2	78 9.99	24 7.43	2 3.85	25 10.42	45 9.09	174 49.15	469 11.98
TOTAL	1,670 100.0	781 100.00	323 100.00	52 100.00	240 100.00	495 100.00	354 100.00	3,915 100.00

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

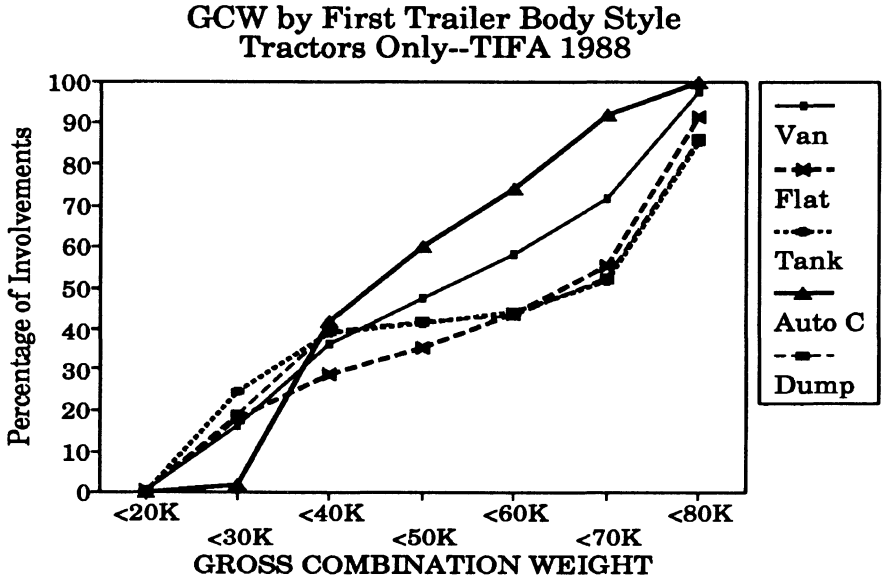


Figure 5-4

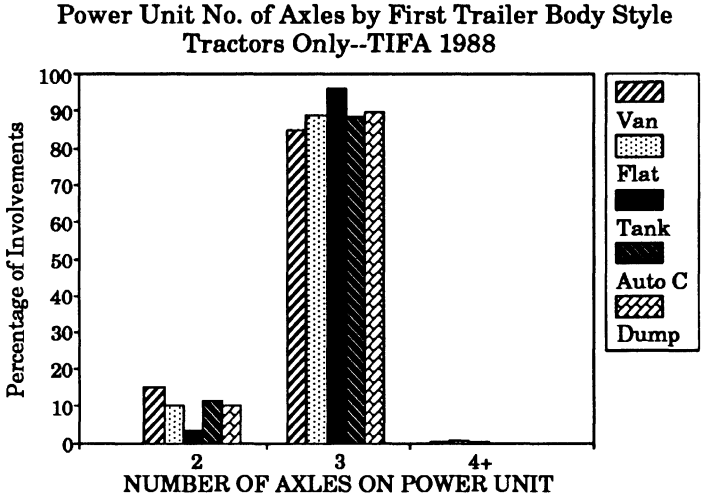


Figure 5-5

The graph at left depicts the number of axles on the tractor according to the first trailer body style. The vast majority of the five trailer body categories were hauled by 3-axle tractors. The highest percentage of 2-axle tractors was found among the van (15%) trailers.

TABLE 5-5
Number of Axles on Power Unit by First Trailer Body Style
Tractors Only
TIFA 1988

Power Unit No. of Axles (Frequencies and Col. Pcts.)	Van	Flatbed	Tank	Auto Carrier	Dump	Other	Unknown/ No Trailer	TOTAL
2	253 15.15	81 10.37	11 3.41	6 11.54	24 10.00	59 11.92	72 20.34	506 12.92
3	1,409 84.37	691 88.48	311 96.28	46 88.46	214 89.17	432 87.27	180 50.85	32 83.86
4+	4 0.24	6 0.77	1 0.31	0 0.00	0 0.00	2 0.40	0 0.00	13 0.33
Unknown	4 0.24	3 0.38	0 0.00	0 0.00	2 0.83	2 0.40	102 28.81	113 2.89
TOTAL	1,670 100.00	781 100.00	323 100.00	52 100.00	240 100.00	495 100.00	354 100.00	3,915 100.00

The next table indicates the unit and axle configurations of the 1988 TIFA tractors according to cab style. The tractors are split into bobtails, singles, doubles, triples, and tractors hauling an unknown number of trailers. For the purposes of this table, "single" represents a tractor hauling one trailer, which is usually, but not always, a semitrailer. Similarly "double" indicates a tractor hauling two trailers, which are usually, but not always, a semitrailer and a full trailer, and "triple" indicates a tractor hauling three trailers, 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 singles and doubles were characterized by a wide variety of axle configurations.

TABLE 5-6
Axle Configuration by Cab Style
Tractors Only
TIFA 1988

Tractor Config.	Axle Config.	Cab Style							
		Conventional		Cabover/ Cab-forward		Unknown		TOTAL	
		No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.
Bobtail	2	15	0.75%	15	0.88%	2	0.96%	32	0.82%
	3	57	2.86	72	4.20	7	3.35	136	3.47
Single	2/1	48	2.41%	35	2.04%	2	0.96%	85	2.17%
	2/2	113	5.67	68	3.97	6	2.87	187	4.78
	2/3	4	0.20	7	0.41	1	0.48	12	0.31
	3/1	3	0.15	10	0.58	0	0.00	13	0.33
	3/2	1,545	77.56	1,324	77.25	78	37.32	2,947	75.27
	3/3	61	3.06	22	1.28	0	0.00	83	2.12
	Other*	19	0.95	7	0.41	0	0.00	26	0.66
	Unknown	29	1.46	32	1.87	10	4.78	71	1.81
Double	2/1/2	60	3.01%	67	3.91%	9	4.31%	136	3.47%
	2/2/2	7	0.35	7	0.41	0	0.00	14	0.36
	3/1/2	5	0.25	16	0.93	1	0.48	22	0.56
	3/2/2	8	0.40	7	0.41	0	0.00	15	0.38
	Other**	10	0.50	9	0.53	0	0.00	19	0.49
	Unknown	7	0.35	14	0.82	3	1.44	24	0.61
Triple***		2	0.10%	1	0.06%	0	0.00%	3	0.08%
Unknown No. of Trailers		0	0.00%	1	0.06%	89	42.58%	90	2.30%
TOTAL		1,993	100.00%	1,714	100.00%	208	100.00%	3,915	100.00%

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

The table on the next page presents cargo type distributions by first trailer body style. Of all the cases of known cargo type, nearly 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 1988

Cargo Type (Frequencies and Col. Pcts.)	No Trailer	Van	Flatbed	Tank	Auto Carrier	Dump	Other	Unknown	TOTAL
General freight	0 0.00	731 43.77	69 8.83	0 0.00	0 0.00	0 0.00	8 1.62	9 4.84	817 20.87
Household goods	0 0.00	40 2.40	1 0.13	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	41 1.05
Metal	0 0.00	14 0.84	172 22.02	0 0.00	0 0.00	1 0.42	9 1.82	0 0.00	196 5.01
Heavy machinery	0 0.00	11 0.66	94 12.04	0 0.00	0 0.00	0 0.00	7 1.41	0 0.00	112 2.86
Motor vehicles	0 0.00	0 0.00	6 0.77	0 0.00	31 59.62	0 0.00	0 0.00	0 0.00	37 0.95
Driveaway/tow	14 8.33	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	14 0.36
Gases in bulk	0 0.00	0 0.00	0 0.00	13 4.02	0 0.00	0 0.00	0 0.00	0 0.00	13 0.33
Solids in bulk	0 0.00	22 1.32	22 2.82	0 0.00	0 0.00	121 50.42	85 17.17	2 1.08	252 6.44
Liquids in bulk	0 0.00	0 0.00	0 0.00	173 53.56	0 0.00	0 0.00	0 0.00	0 0.00	173 4.42
Explosives	0 0.00	0 0.00	0 0.00	1 0.31	0 0.00	0 0.00	0 0.00	0 0.00	1 0.03
Logs/lumber	0 0.00	8 0.48	102 13.06	0 0.00	0 0.00	0 0.00	86 17.37	0 0.00	196 5.01
Empty	154 91.67	370 22.16	174 22.28	123 38.08	21 40.38	87 36.25	169 34.14	10 5.38	1,108 28.30
Refrig. food	0 0.00	202 12.10	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	202 5.16
Mobile home	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	10 2.02	0 0.00	10 0.26
Farm products	0 0.00	38 2.28	47 6.02	0 0.00	0 0.00	14 5.83	70 14.14	3 1.61	172 4.39
Other	0 0.00	55 3.29	27 3.46	13 4.02	0 0.00	13 5.42	13 2.63	161 86.56	282 7.20
Unknown	0 0.00	179 10.72	67 8.58	0 0.00	0 0.00	4 1.67	38 7.68	1 0.54	289 7.38
TOTAL	168 100.00	1,670 100.00	781 100.00	323 100.00	52 100.00	240 100.00	495 100.00	186 100.00	3,915 100.00

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, or less frequently farm products. Vans and flatbeds, as illustrated in the pie graphs below, had a more varied range of cargo types.

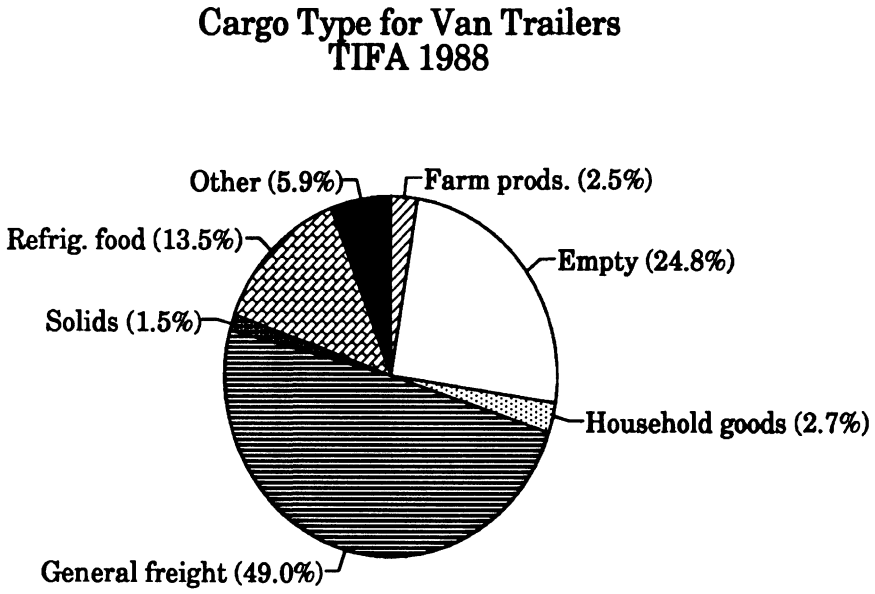


Figure 5-7a

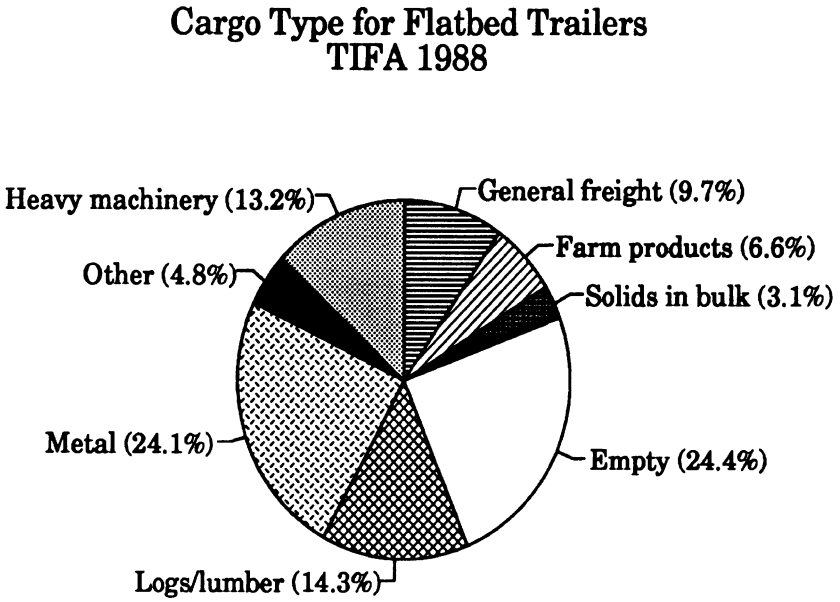


Figure 5-7b

The overwhelming majority of tractors involved in fatal accidents in 1988 used diesel fuel, as indicated in the table below. Gasoline tractors were more common among those with conventional, rather than cabover or cab-forward, cab styles.

TABLE 5-8
Fuel Type by Cab Style
Tractors Only
TIFA 1988

Fuel Type	Conventional		Cabover/ Cab-forward		Unknown		TOTAL	
	No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.
Gasoline	22	1.10%	1	0.06%	0	0.00%	23	0.59%
Diesel	1,969	98.80	1,713	99.94	93	44.71	3,775	96.42
Unknown	2	0.10	0	0.00	115	55.29	117	2.99
TOTAL	1,993	100.00%	1,714	100.00%	208	100.00%	3,915	100.00%

Use

Moving now to some of the variables that pertain to the use of the involved tractors, the graph at right shows the distributions of carrier type by first trailer body style. Intrastate private and for-hire have been combined in the graph but are listed separately in the table on the next page. One notable difference among the five trailer body styles is in the proportion of intrastate carriers. Of the known cases, 48% of the involved dumps were intrastate carriers, but this percentage was only 0-14% for each of the other four trailer body styles. Tanks had the highest proportion of interstate private carriers, with 29% of the known cases, while auto carriers had the highest proportion of interstate authorized carriers at 96%.

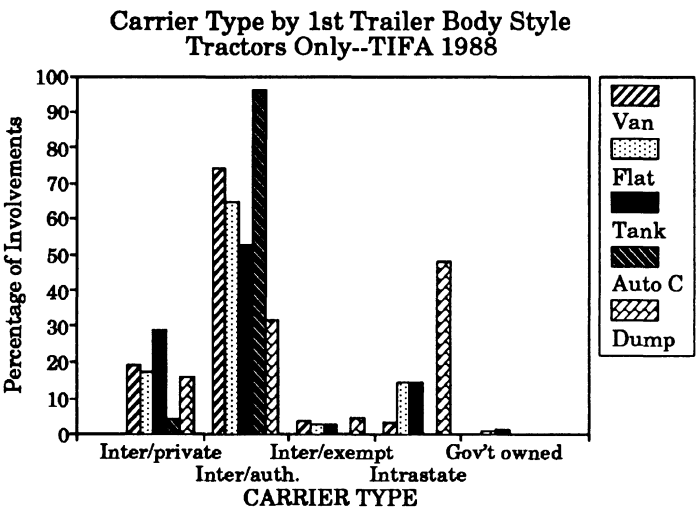


Figure 5-9

TABLE 5-9
Carrier Type by First Trailer Body Style
Tractors Only
TIFA 1988

Carrier Type (Frequencies and Col. Pcts.)	Van	Flatbed	Tank	Auto Carrier	Dump	Other	Unknown/ No Trailer	TOTAL
Interstate private	310 18.56	130 16.65	90 27.86	2 3.85	35 14.58	98 19.80	15 4.24	680 17.37
Interstate authorized	1,203 72.04	483 61.84	165 51.08	50 96.15	71 29.58	177 35.76	120 33.90	2,269 57.96
Interstate exempt	56 3.35	20 2.56	9 2.79	0 0.00	10 4.17	63 12.73	10 2.82	168 4.29
Intrastate private	34 2.04	67 8.58	26 8.05	0 0.00	41 17.08	73 14.75	13 3.67	254 6.49
Intrastate for hire	20 1.20	40 5.12	19 5.88	0 0.00	65 27.08	62 12.53	39 11.02	245 6.26
Government owned	0 0.00	6 0.77	4 1.24	0 0.00	0 0.00	2 0.40	3 0.85	15 0.38
Unknown	47 2.81	35 4.48	10 3.10	0 0.00	18 7.50	20 4.04	154 43.50	284 7.25
TOTAL	1,670 100.00	781 100.00	323 100.00	52 100.00	240 100.00	495 100.00	354 100.00	3,915 100.00

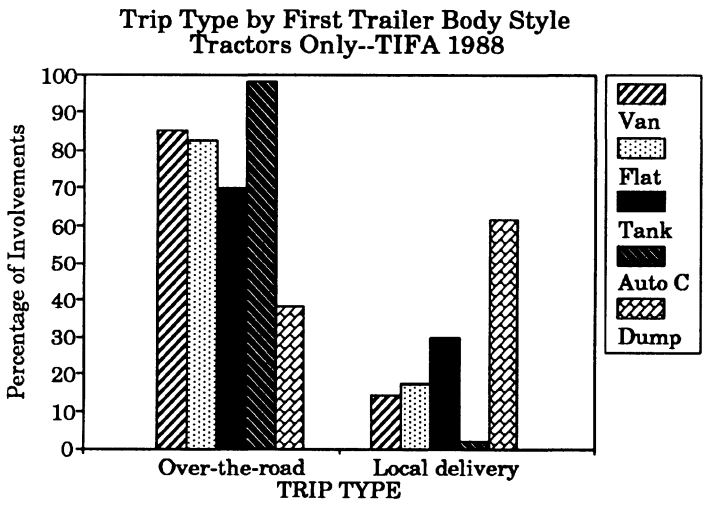


Figure 5-10

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, over 98% of the auto carriers were conducting over-the-road

trips, followed by vans (85.4%), flatbeds (82.4%), tanks (70.0%), and dumps (38.2%). 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 1988

Trip Type (Frequencies and Col. Pcts.)	Van	Flatbed	Tank	Auto Carrier	Dump	Other	Unknown/ No Trailer	TOTAL
Over-the-road	1,367 81.86	589 75.42	215 66.56	51 98.08	83 34.58	298 60.20	107 30.23	2,710 69.22
Local delivery	233 13.95	126 16.13	92 28.48	1 1.92	134 55.83	171 34.55	76 21.47	833 21.28
Unknown	70 4.19	66 8.45	16 4.95	0 0.00	23 9.58	26 5.25	171 48.31	372 9.50
TOTAL	1,670 100.00	781 100.00	323 100.00	52 100.00	240 100.00	495 100.00	354 100.00	3,915 100.00

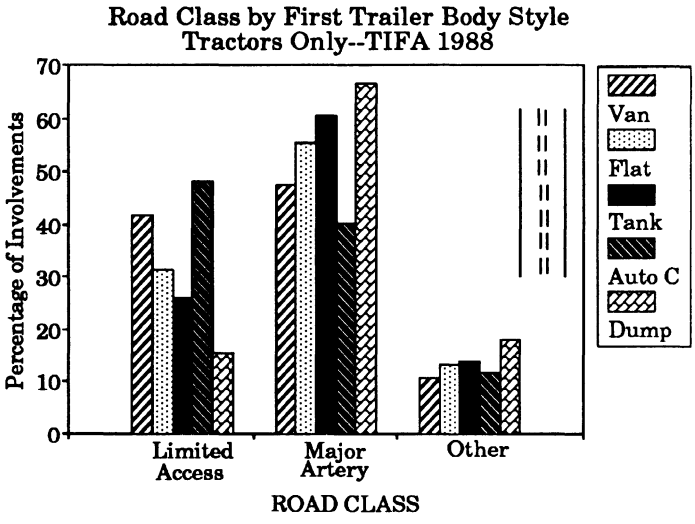


Figure 5-11

For all trailer body styles, except auto carriers, 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 48% of the auto carrier involvements occurred on limited access routes, followed by 41.5% of vans, 31% of flatbeds, 26% of tanks, and 15% of dumps. A very nearly reverse order held for "other" road class involvements, with dumps having the highest proportion, followed by tanks, flatbeds, auto carriers, and vans. In this as in other distributions, the percentages for auto carriers may be more affected by problems of sample size than the percentages for the other trailer types, since only 52 fatal accidents involving auto carriers took place in 1988.

TABLE 5-11
Road Class by First Trailer Body Style
Tractors Only
TIFA 1988

Road Class (Frequencies and Col. Pcts.)	Van	Flatbed	Tank	Auto Carrier	Dump	Other	Unknown/ No Trailer	TOTAL
Limited Access	693 41.50	241 30.86	83 25.70	25 48.08	37 15.42	82 16.57	79 22.32	1,240 31.67
Major Artery	788 47.19	427 54.67	194 60.06	21 40.38	160 66.67	332 67.07	188 53.11	2,110 53.90
Other	176 10.54	103 13.19	44 13.62	6 11.54	43 17.92	73 14.75	82 23.16	527 13.46
Unknown	13 0.78	10 1.28	2 0.62	0 0.00	0 0.00	8 1.62	5 1.41	38 0.97
TOTAL	1,670 100.00	781 100.00	323 100.00	52 100.00	240 100.00	495 100.00	354 100.00	3,915 100.00

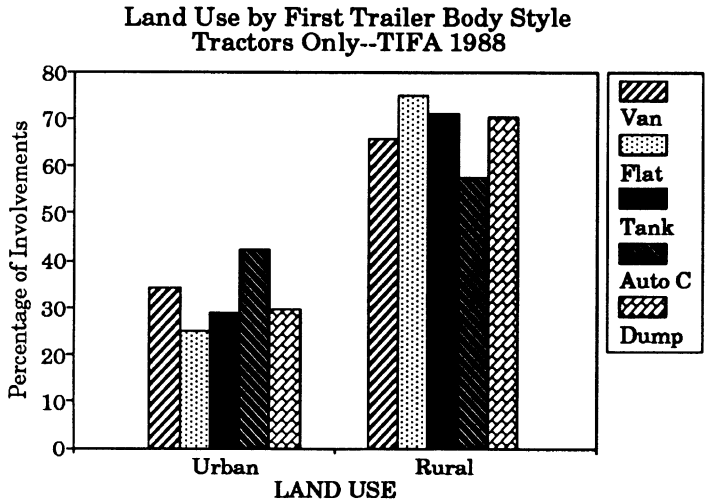


Figure 5-12

The land use distributions are very stable from one trailer body style to another. For vans, flatbeds, tanks, and dumps, the proportion of involvements in urban areas ranged from 25% to 34%, while the proportion in rural areas varied from 65% to 75%. The split for auto carrier involvements, on the other hand, was 42% in urban and 58% in rural areas.

TABLE 5-12
Land Use by First Trailer Body Style
Tractors Only
TIFA 1988

Land Use (Frequencies and Col. Pcts.)	Van	Flatbed	Tank	Auto Carrier	Dump	Other	Unknown/ No Trailer	TOTAL
Urban	567 33.95	195 24.97	93 28.79	22 42.31	62 25.83	109 22.02	118 33.33	1,166 29.78
Rural	1,088 65.15	582 74.52	228 70.59	30 57.69	178 74.17	382 77.17	232 65.54	2,720 69.48
Unknown	15 0.90	4 0.51	2 0.62	0 0.00	0 0.00	4 0.81	4 1.13	29 0.74
TOTAL	1,670 100.00	781 100.00	323 100.00	52 100.00	240 100.00	495 100.00	354 100.00	3,915 100.00

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 42% of the flatbed and tank and 40% 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.

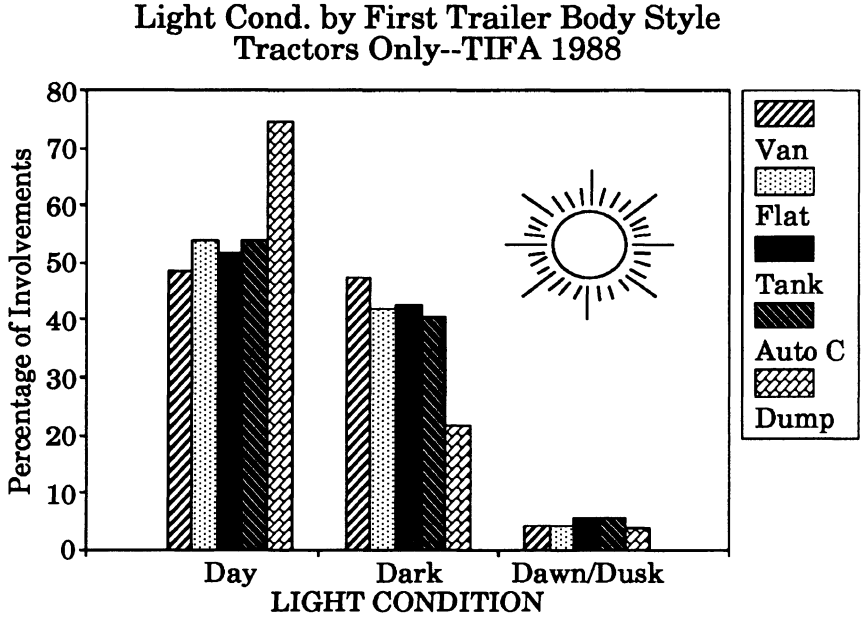


Figure 5-13

TABLE 5-13
Light Condition by First Trailer Body Style
Tractors Only
TIFA 1988

Light Condition (Frequencies and Col. Pcts.)	Van	Flatbed	Tank	Auto Carrier	Dump	Other	Unknown/ No Trailer	TOTAL
Daylight	813 48.68	419 53.65	166 51.39	28 53.85	179 74.58	305 61.62	203 57.34	2,113 53.97
Dark, not lighted	618 37.01	272 34.83	107 33.13	14 26.92	47 19.58	125 25.25	100 28.25	1,283 32.77
Dark, but lighted	171 10.24	56 7.17	30 9.29	7 13.46	5 2.08	38 7.68	36 10.17	343 8.76
Dawn	45 2.69	22 2.82	12 3.72	3 5.77	5 2.08	21 4.24	10 2.82	118 3.01
Dusk	23 1.38	10 1.28	6 1.86	0 0.00	4 1.67	6 1.21	5 1.41	54 1.38
Unknown	0 0.00	2 0.26	2 0.62	0 0.00	0 0.00	0 0.00	0 0.00	4 0.10
TOTAL	1,670 100.00	781 100.00	323 100.00	52 100.00	240 100.00	495 100.00	354 100.00	3,915 100.00

Accidents

This subsection will discuss variables pertaining to the accidents in which the tractors were involved. The graph at right illustrates the distributions for the first harmful event in the accident according to first trailer body style. The distributions are relatively stable from one type of trailer to the next. The great majority of all the fatal accidents involved a collision with another motor vehicle in transport. This event ranged from 75% of the tank involvements to 86% of the dump

First Harmful Event by 1st Trailer Body Style
Tractors Only--TIFA 1988

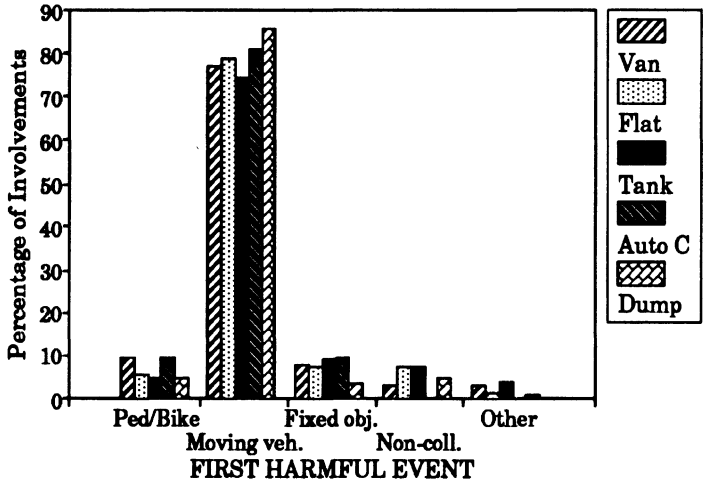


Figure 5-14

involvements. Auto carriers and vans experienced relatively more pedestrian involvements than the other trailer body styles, while auto carriers and tanks had relatively higher percentages of collisions with fixed objects.

TABLE 5-14
First Harmful Event by First Trailer Body Style
Tractors Only
TIFA 1988

First Harmful Event (Frequencies and Col. Pcts.)	Van	Flatbed	Tank	Auto Carrier	Dump	Other	Unknown/ No Trailer	TOTAL
Pedestrian	142 8.50	35 4.48	12 3.72	5 9.62	10 4.17	24 4.85	36 10.17	264 6.74
Pedalcyclist	15 0.90	8 1.02	4 1.24	0 0.00	2 0.83	4 0.81	5 1.41	38 0.97
Train	5 0.30	4 0.51	9 2.79	0 0.00	0 0.00	6 1.21	0 0.00	24 0.61
Animal	2 0.12	3 0.38	1 0.31	0 0.00	0 0.00	0 0.00	3 0.85	9 0.23
Moving vehicle	1,288 77.13	615 78.75	241 74.61	42 80.77	206 85.83	392 79.19	263 74.29	3,047 77.83
Parked vehicle	21 1.26	0 0.00	1 0.31	0 0.00	1 0.42	3 0.61	0 0.00	26 0.66
Other non-fixed object	19 1.14	2 0.26	2 0.62	0 0.00	1 0.42	9 1.82	2 0.56	35 0.89
Fixed object	130 7.78	58 7.43	29 8.98	5 9.62	8 3.33	31 6.26	30 8.47	291 7.43
Non-collision	48 2.87	56 7.17	24 7.43	0 0.00	12 5.00	26 5.25	15 4.24	181 4.62
TOTAL	1,670 100.00	781 100.00	323 100.00	52 100.00	240 100.00	495 100.00	354 100.00	3,915 100.00

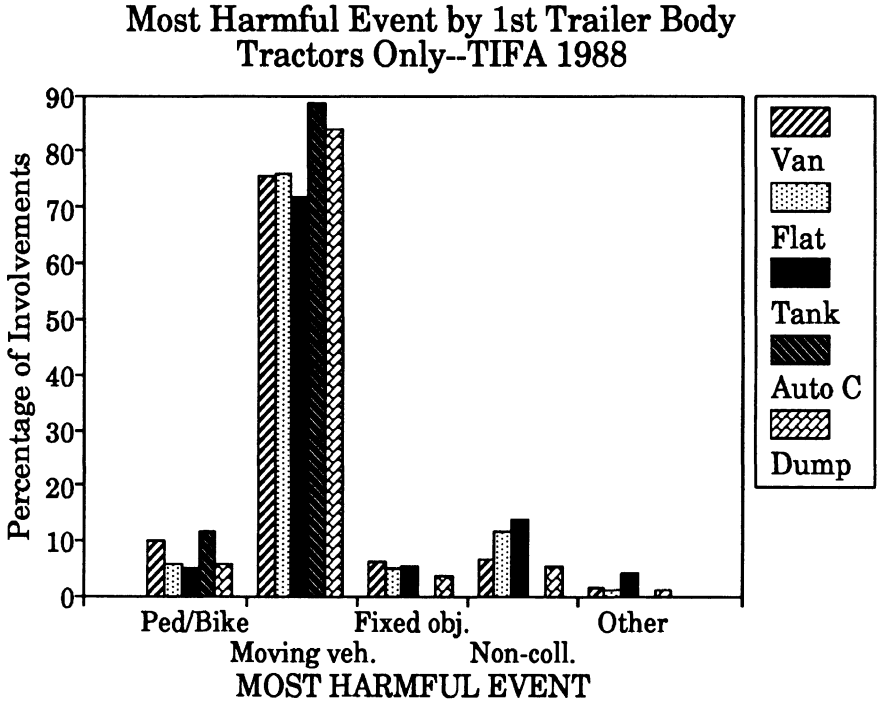


Figure 5-15

The graph above illustrates the most harmful event for 1988 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 tanks, flatbeds, and vans. The most harmful event in all of the auto carrier involvements was either collisions with another motor vehicle in transport (88.5%), or collisions with a pedestrian (11.5%). The data for this variable are presented in tabular format on the following page.

TABLE 5-15
Most Harmful Event by First Trailer Body Style
Tractors Only
TIFA 1988

Most Harmful Event (Frequencies and Col. Pcts.)	Van	Flatbed	Tank	Auto Carrier	Dump	Other	Unknown/ No Trailer	TOTAL
Pedestrian	154 9.22	38 4.87	12 3.72	6 11.54	12 5.00	27 5.45	38 10.73	287 7.33
Pedalcyclist	15 0.90	7 0.90	4 1.24	0 0.00	2 0.83	4 0.81	5 1.41	37 0.95
Train	5 0.30	4 0.51	9 2.79	0 0.00	0 0.00	6 1.21	0 0.00	24 0.61
Animal	0 0.00	2 0.26	0 0.00	0 0.00	0 0.00	0 0.00	1 0.28	3 0.08
Moving vehicle	1,260 75.45	594 76.06	232 71.83	46 88.46	201 83.75	374 75.56	260 73.45	2,967 75.79
Parked vehicle	13 0.78	2 0.26	4 1.24	0 0.00	3 1.25	3 0.61	0 0.00	25 0.64
Other non-fixed object	7 0.42	2 0.26	0 0.00	0 0.00	0 0.00	5 1.01	2 0.56	16 0.41
Fixed object	104 6.23	40 5.12	17 5.26	0 0.00	9 3.75	21 4.24	23 6.50	214 5.47
Non-collision	112 6.71	92 11.78	45 13.93	0 0.00	13 5.42	55 11.11	25 7.06	342 8.74
TOTAL	1,670 100.00	781 100.00	323 100.00	52 100.00	240 100.00	495 100.00	354 100.00	3,915 100.00

The graph and table on the following page illustrate the manner of collision for the 3,047 tractors involved in fatal accidents with another motor vehicle. There is some variation among the different first trailer body styles. For example, flatbeds and vans experienced the highest proportion of rear-end collisions, dumps the highest percentage of head-ons, and tanks the highest percentage of angle collisions. Overall, angle collisions were the most common collision type, representing over 39% of all tractor involvements, followed by head-ons (26.8%) and rear-ends (26%).

Manner of Collision by 1st Trailer Body Style
for Crashes with Another Motor Vehicle
Tractors Only--TIFA 1988

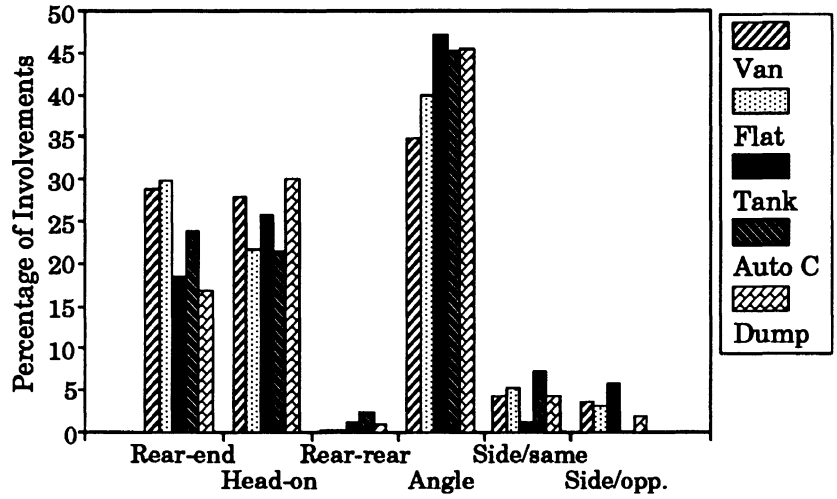


Figure 5-16

TABLE 5-16
Manner of Collision by First Trailer Body Style
for Crashes with Another Motor Vehicle
Tractors Only—TIFA 1988

Manner of Collision (Frequencies and Col. Pcts.)	Van	Flatbed	Tank	Auto Carrier	Dump	Other	Unknown/ No Trailer	TOTAL
Rear-end	371 28.80	183 29.76	45 18.67	10 23.81	35 16.99	81 20.66	68 25.86	793 26.03
Head-on	358 27.80	133 21.63	62 25.73	9 21.43	62 30.10	108 27.55	85 32.32	817 26.81
Rear-to-rear	2 0.16	2 0.33	3 1.24	1 2.38	2 0.97	3 0.77	0 0.00	13 0.43
Angle	447 34.70	245 39.84	114 47.30	19 45.24	94 45.63	180 45.92	91 34.60	1,190 39.05
Sideswipe, same dir.	55 4.27	32 5.20	3 1.24	3 7.14	9 4.37	8 2.04	9 3.42	119 3.91
Sideswipe, opp. dir.	46 3.57	19 3.09	14 5.81	0 0.00	4 1.94	10 2.55	10 3.80	103 3.38
Unknown	9 0.70	1 0.16	0 0.00	0 0.00	0 0.00	2 0.51	0 0.00	12 0.39
TOTAL	1,288 100.00	615 100.00	241 100.00	42 100.00	206 100.00	392 100.00	263 100.00	3,047 100.00

TABLE 5-18
Gross Combination Weight by Jackknife Occurrence
Tractors Only
TIFA 1988

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	58	39.73%	0	0.00%	0	0.00%	88	60.27%	146	100.00%
20,000	454	74.06	17	2.77	65	10.60	77	12.56	613	100.00
30,000	476	82.35	12	2.08	51	8.82	39	6.75	578	100.00
40,000	196	77.78	10	3.97	19	7.54	27	10.71	252	100.00
50,000	231	89.19	2	0.77	9	3.47	17	6.56	259	100.00
60,000	330	89.43	5	1.36	14	3.79	20	5.42	369	100.00
70,000	899	90.17	10	1.00	37	3.71	51	5.12	997	100.00
80,000+	205	88.36	6	2.59	5	2.16	16	6.90	232	100.00
Unknown	349	74.41	12	2.56	13	2.77	95	20.26	469	100.00
TOTAL	3,198	81.69%	74	1.89%	213	5.44%	430	10.98%	3,915	100.00%

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

On this page are the distributions of jackknife occurrence according to gross combination weight. In general, jackknifes were more common as a subsequent event in the accident (5.4% of all tractor involvements) rather than the primary event (1.9%). The tractor combinations with a GCW of 20,000-49,999 pounds had a higher incidence of jackknifes than the heavier combinations. This is particularly true for subsequent-event jackknifes. Nearly 11% of the tractors in the 20,000-29,999 pound group and 9% in the 30,000-39,999 group jackknifed as the subsequent event in the accident. This compares with 3.7% in the 70,000-79,999 pound group and 2.2% 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.

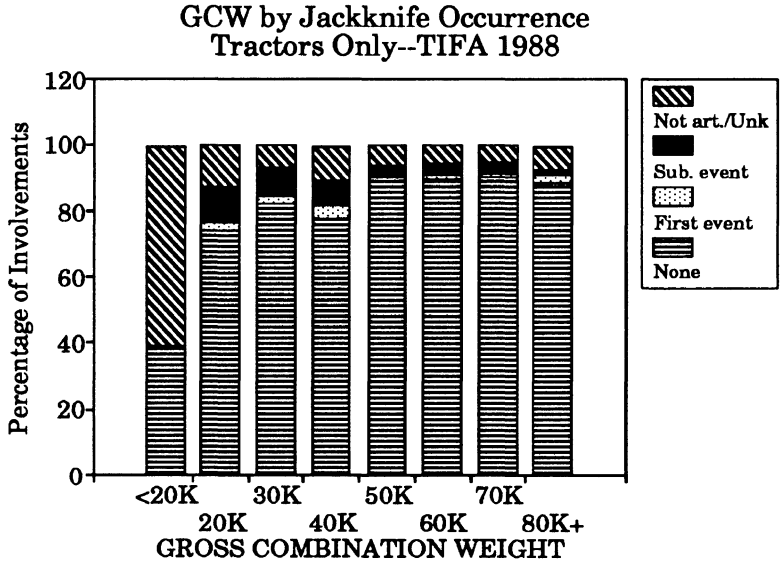


Figure 5-18

TABLE 5-18
Gross Combination Weight by Jackknife Occurrence
Tractors Only
TIFA 1988

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	58	39.73%	0	0.00%	0	0.00%	88	60.27%	146	100.00%
20,000	454	74.06	17	2.77	65	10.60	77	12.56	613	100.00
30,000	476	82.35	12	2.08	51	8.82	39	6.75	578	100.00
40,000	196	77.78	10	3.97	19	7.54	27	10.71	252	100.00
50,000	231	89.19	2	0.77	9	3.47	17	6.56	259	100.00
60,000	330	89.43	5	1.36	14	3.79	20	5.42	369	100.00
70,000	899	90.17	10	1.00	37	3.71	51	5.12	997	100.00
80,000+	205	88.36	6	2.59	5	2.16	16	6.90	232	100.00
Unknown	349	74.41	12	2.56	13	2.77	95	20.26	469	100.00
TOTAL	3,198	81.69%	74	1.89%	213	5.44%	430	10.98%	3,915	100.00%

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

On this page are the distributions of jackknife occurrence according to gross combination weight. In general, jackknifes were more common as a subsequent event in the accident (5.4% of all tractor involvements) rather than the primary event (1.9%). The tractor combinations with a GCW of 20,000-49,999 pounds had a higher incidence of jackknifes than the heavier combinations. This is particularly true for subsequent-event jackknifes. Nearly 11% of the tractors in the 20,000-29,999 pound group and 9% in the 30,000-39,999 group jackknifed as the subsequent event in the accident. This compares with 3.7% in the 70,000-79,999 pound group and 2.2% 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.

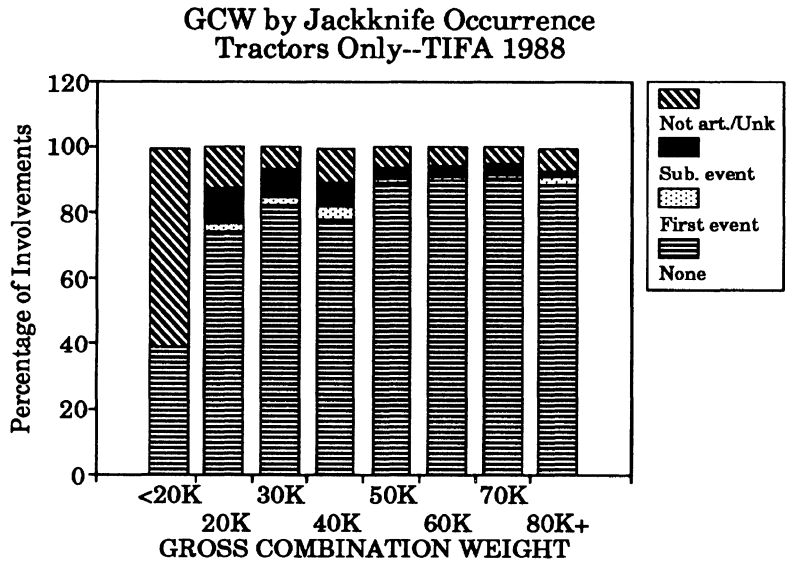


Figure 5-18

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, with 69% of the known cases compared to the overall average of 58.5%. Tank drivers experienced the lowest proportion of uninjured cases at 49.4% of the known cases, and the highest percentage of fatals with 21.1% compared to the overall average of 15%. In general, however, the injury severity distributions are similar among the different trailer body styles.

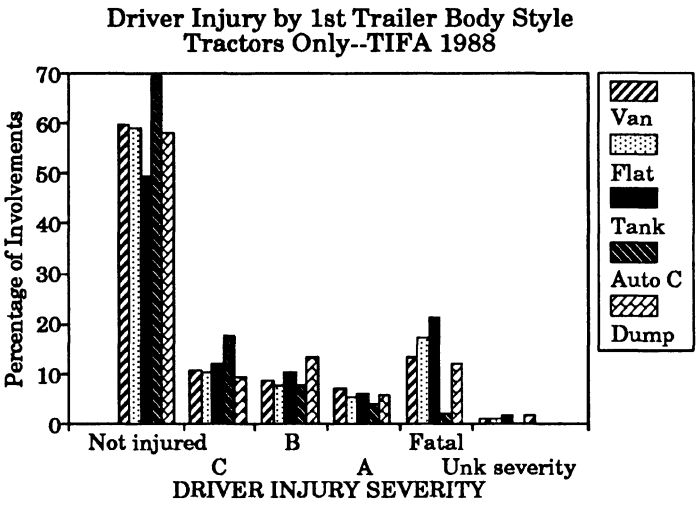


Figure 5-19

TABLE 5–19
Truck Driver Injury Severity by First Trailer Body Style
Tractors Only
TIFA 1988

Injury Severity (Frequencies and Col. Pcts.)	Van	Flatbed	Tank	Auto Carrier	Dump	Other	Unk/ No Trail	TOTAL
Not injured	974 58.32	455 58.26	157 48.61	36 69.23	136 56.67	291 58.79	204 57.63	2,253 57.55
C injury, possible	172 10.30	79 10.12	38 11.76	9 17.31	22 9.17	42 8.48	27 7.63	389 9.94
B injury, not incapacitating	142 8.50	59 7.55	32 9.91	4 7.69	31 12.92	54 10.91	36 10.17	358 9.14
A injury, incapacitating	115 6.89	41 5.25	19 5.88	2 3.85	13 5.42	24 4.85	18 5.08	232 5.93
Fatal injury	219 13.11	133 17.03	67 20.74	1 1.92	28 11.67	78 15.76	62 17.51	588 15.02
Injured, severity unknown	13 0.78	6 0.77	5 1.55	0 0.00	4 1.67	0 0.00	1 0.28	29 0.74
Unknown if injured	35 2.10	8 1.02	5 1.55	0 0.00	6 2.50	6 1.21	6 1.69	66 1.69
TOTAL	1,670 100.00	781 100.00	323 100.00	52 100.00	240 100.00	495 100.00	354 100.00	3,915 100.00

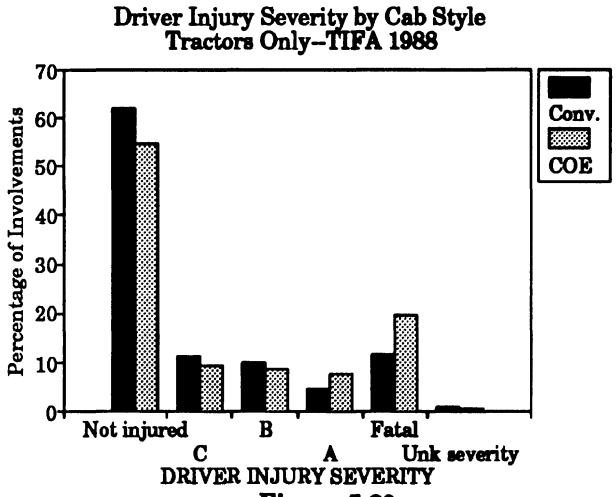


Figure 5-20

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

TABLE 5-20
Truck Driver Injury Severity by Cab Style
Tractors Only
TIFA 1988

Injury Severity	Conventional		Cabover/ Cab-forward		Unknown		TOTAL	
	No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.
Not injured	1,209	60.66%	922	53.79%	122	58.65%	2,253	57.55%
C injury	215	10.79	156	9.10	18	8.65	389	9.94
B injury	195	9.78	145	8.46	18	8.65	358	9.14
A injury	91	4.57	130	7.58	11	5.29	232	5.93
Fatal injury	226	11.34	328	19.14	34	16.35	588	15.02
Injured, severity unknown	16	0.80	12	0.70	1	0.48	29	0.74
Unknown if injured	41	2.06	21	1.23	4	1.92	66	1.69
TOTAL	1,993	100.00%	1,714	100.00%	208	100.00%	3,915	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 almost 70% of the cases. Non-collisions accounted for 3.4% of all involvements but 19% of the involvements that were fatal to the truck driver.

TABLE 5-21A
Driver Injury Severity by Principal Impact Point for Tractors—Frequencies
TIFA 1988

Principal Impact Point	Driver Injury Severity							
	Not Injured	C	B	A	Fatal	Injured, severity unk	Unknown if injured	TOTAL
Noncollision	13	4	3	2	112	0	0	134
Right side	237	44	37	29	52	5	2	406
Rear	403	49	31	16	17	1	29	546
Left side	307	26	18	8	25	4	11	399
Front	1,045	248	260	170	330	19	16	2,088
Top	2	4	1	3	31	0	1	42
Undercarriage	191	8	2	1	6	0	7	215
Underride	23	4	5	2	0	0	0	34
Override	30	2	1	1	15	0	0	49
Unknown	2	0	0	0	0	0	0	2
TOTAL	2,253	389	358	232	588	29	66	3,915

TABLE 5-21B
Driver Injury Severity by Principal Impact Point for Tractors—Column Percentages
TIFA 1988

Principal Impact Point	Driver Injury Severity							
	Not Injured	C	B	A	Fatal	Injured, sev unk	Unk if injured	TOTAL
Noncollision	0.58%	1.03%	0.84%	0.86%	19.05%	0.00%	0.00%	3.42%
Right side	10.52	11.31	10.34	12.50	8.84	17.24	3.03	10.37
Rear	17.89	12.60	8.66	6.90	2.89	3.45	43.94	13.95
Left side	13.63	6.68	5.03	3.45	4.25	13.79	16.67	10.19
Front	46.38	63.75	72.63	73.28	56.12	65.52	24.24	53.33
Top	0.09	1.03	0.28	1.29	5.27	0.00	1.52	1.07
Undercar.	8.48	2.06	0.56	0.43	1.02	0.00	10.61	5.49
Underride	1.02	1.03	1.40	0.86	0.00	0.00	0.00	0.87
Override	1.33	0.51	0.28	0.43	2.55	0.00	0.00	1.25
Unknown	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.05
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 almost 80% of the known cases in these categories. On the other hand, 84% of the non-collisions resulted in the death of the driver, and the driver was uninjured in only 9.7% of these cases.

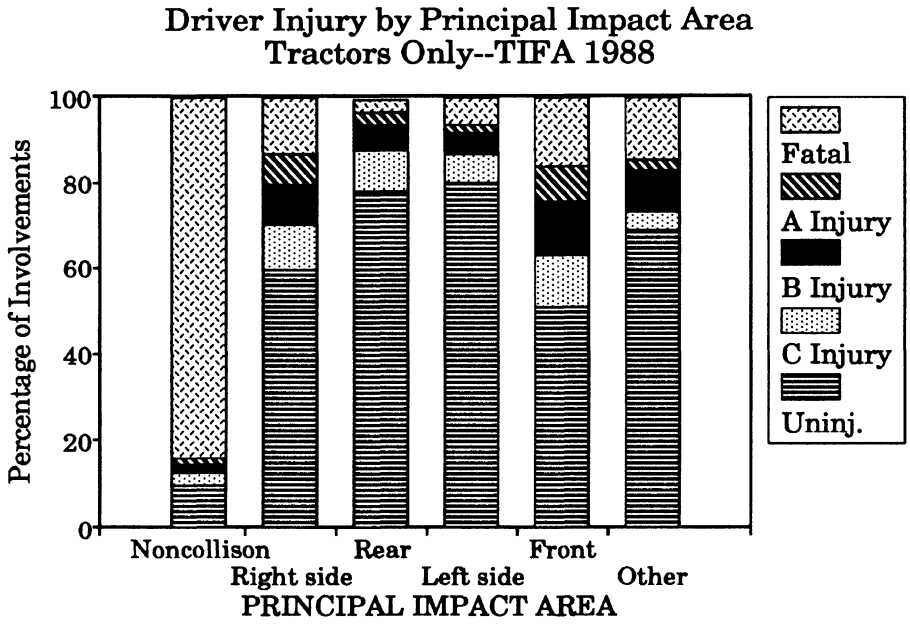


Figure 5-21

Finally, driver injury severity is compared across the levels of the variable that indicate whether or not the truck experienced a rollover or fire or whether the driver was ejected. As Tables 5-22A and 5-22B indicate, about 80% of the involvements did not include any of these events. Rollovers alone occurred in 9.5% of the involvements but accounted for 11.7% of the cases of drivers with "B" injuries, 25.0% of those with "A" injuries, and 28.7% of those with fatal injuries. Ejections alone took place in 2.5% of the involvements but represented 13.4% of the cases in which the driver was killed. Only 2.6% of the involvements included both a rollover and the ejection of the driver, but 16.8% 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 1988

Occurrence of Rollover/Fire/Ejection	Driver Injury Severity							
	Not Injured	C	B	A	Fatal	Injured, severity unk	Unknown if injured	TOTAL
None	2,151	334	280	143	157	22	15	3,102
Rollover only	57	33	42	58	169	5	0	364
Fire only	37	14	23	11	37	2	0	124
Ejection only	3	4	5	10	79	0	0	101
Rollover/Fire	3	2	5	4	31	0	0	45
Fire/Ejection	0	0	0	0	7	0	0	7
Rollover/Ejection	0	2	3	3	99	0	0	107
Rollover/Fire/Ejection	0	0	0	2	8	0	0	10
Unknown	2	0	0	1	1	0	51	55
TOTAL	2,253	389	358	232	588	29	66	3,915

TABLE 5-22B
Driver Injury Severity by Rollover/Fire/Ejection for Tractors—Column Percentages
TIFA 1988

Occurrence of Rollover/Fire/ Ejection	Driver Injury Severity							
	Not Injured	C	B	A	Fatal	Injured, sev unk	Unk if injured	TOTAL
None	95.47%	85.86%	78.21%	61.64%	26.70%	75.86%	22.73%	79.51%
Rollover only	2.53	8.48	11.73	25.00	28.74	17.24	0.00	9.54
Fire only	1.64	3.60	6.42	4.74	6.29	6.90	0.00	3.18
Ejection only	0.13	1.03	1.40	4.31	13.44	0.00	0.00	2.46
Rollover/Fire	0.13	0.51	1.40	1.72	5.27	0.00	0.00	1.04
Fire/Ejection	0.00	0.00	0.00	0.00	1.19	0.00	0.00	0.40
Roll/Eject	0.00	0.51	0.84	1.29	16.84	0.00	0.00	2.59
Roll/Fire/Eject	0.00	0.00	0.00	0.86	1.36	0.00	0.00	0.21
Unknown	0.09	0.00	0.00	0.43	0.17	0.00	77.27	1.07
TOTAL	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

The figure below illustrates the driver injury severity distributions for each category of the rollover/fire/ejection variable. The driver was uninjured in 70% of the cases where none of these events took place. This compares to 30% of the cases when a fire alone occurred, 15.9% of the cases when a rollover alone took place, and 3.0% of the cases when there was only an ejection. Combinations of these events generally proved more severe to the driver, not surprisingly. In 100% of the cases in which there was a fire and an ejection, and 92.5% of the cases in which there was a rollover and an ejection the crash resulted in the death of the driver.

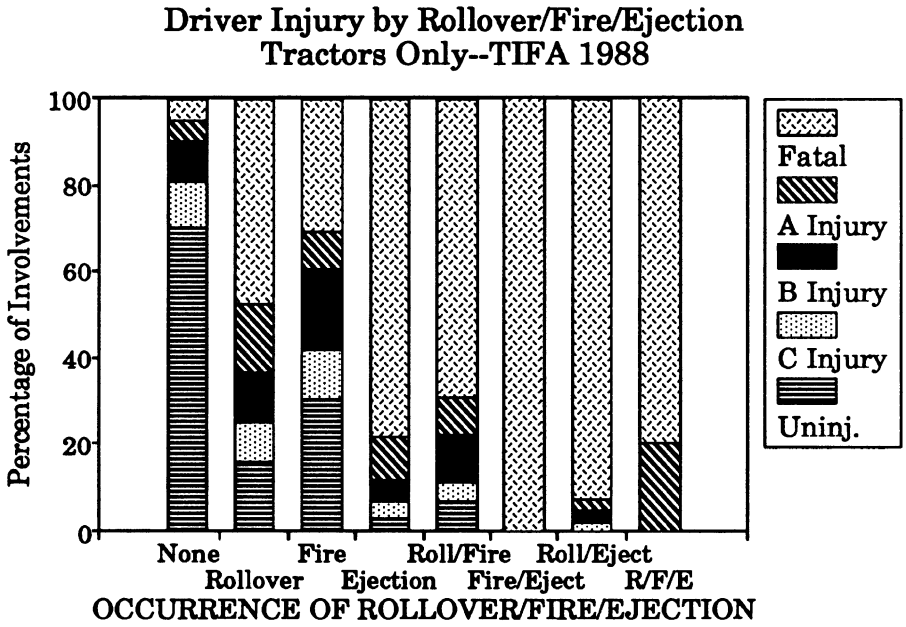
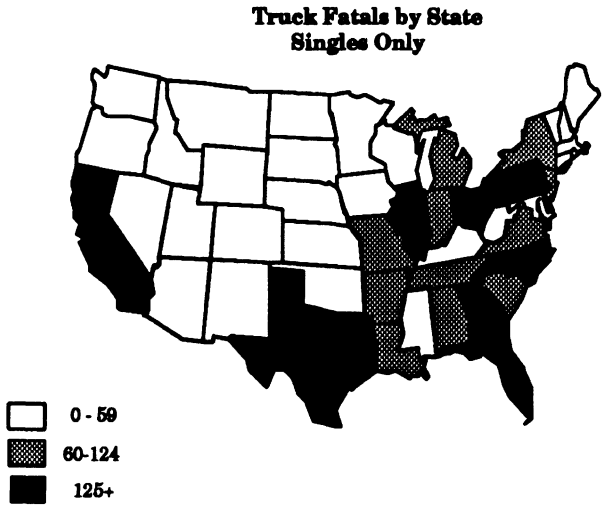


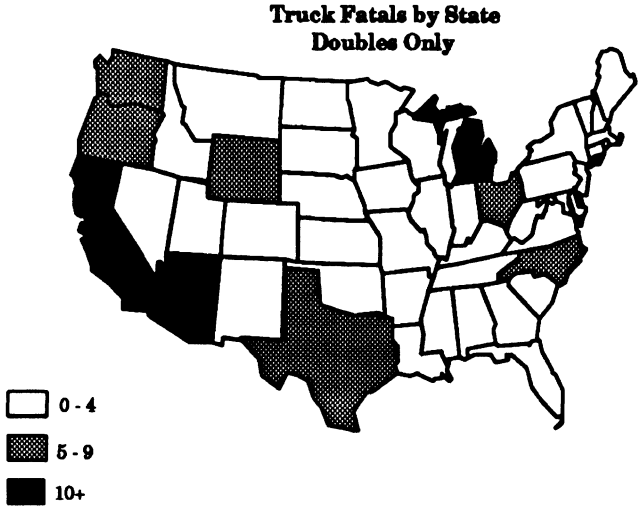
Figure 5-22

1988 FATAL ACCIDENT EXPERIENCE OF SINGLES AND DOUBLES

In this final section of the 1988 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 1988 there were 3,411 fatal accidents involving singles and 228 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 1988 and examine the similarities and differences between them. The distributions presented in this section concern variables relating to the physical characteristics and usage of the trucks. All of these variables have been discussed earlier in comparisons based on the power unit type of the involved vehicles.





The first comparison between singles and doubles concerns the cab style of the involved trucks. The singles were more likely to have a conventional cab (55% of the known cases). Conversely, the majority of the doubles were cabover engine cab styles (55% of known cases).

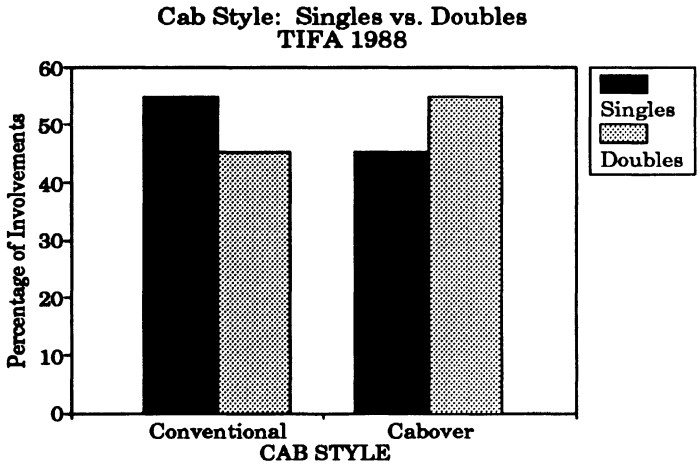


Figure 6-1

TABLE 6-1
Cab Style: Singles vs. Doubles
TIFA 1988

Cab Style	Singles		Doubles		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
Conventional	1,817	53.27%	97	42.54%	1,914	52.60%
Cabover/Cab-forward	1,498	43.92	118	51.75	1,616	44.41
Unknown	96	2.81	13	5.70	109	3.00
TOTAL	3,411	100.00%	228	100.00%	3,639	100.00%

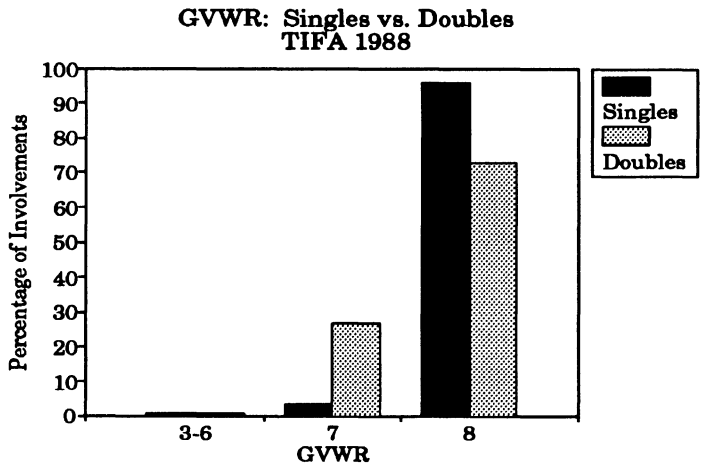


Figure 6-2

The graph at left shows the distributions for the gross vehicle weight ratings of the involved singles and doubles. Again there is a difference in the distributions. Almost 96% of the singles with a known GVWR were class 8 (over 33,000 lbs.). Only 73% of the known cases of doubles were class 8.

TABLE 6-2
GVWR: Singles vs. Doubles
TIFA 1988

GVWR Class	Singles		Doubles		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
3	4	0.12%	0	0.00%	4	0.11%
4	1	0.03	0	0.00	1	0.03
6	16	0.47	1	0.44	17	0.47
7	118	3.46	49	21.49	167	4.59
8	3,213	94.20	133	58.33	3,346	91.95
Unknown	59	1.73	45	19.74	104	2.86
TOTAL	3,411	100.00%	228	100.00%	3,639	100.00%

Next are the distributions for gross combination weight—the total combined weight of the tractor, trailer(s), and cargo at the time of the accident. The graph at right indicates that the GCWs of the involved doubles were more evenly spread out over the spectrum than the GCWs of the singles. The GCW distribution for singles is bimodal, presumably representing empty and loaded vehicles. Nearly 19% of the known cases are included in the peak in the 20,000-29,999 pound weight range, while another 31% of the cases fall into a peak representing the 70,000-79,999 pound category. In contrast, only 8.4% of the involved doubles had a GCW of 20,000-29,999 pounds. There is a general rise in the percentage of doubles represented under each 10,000 pound increment of GCW. Most of the known cases (58%) fall into the three heaviest GCW categories, indicating weights of 60,000 pounds and above.

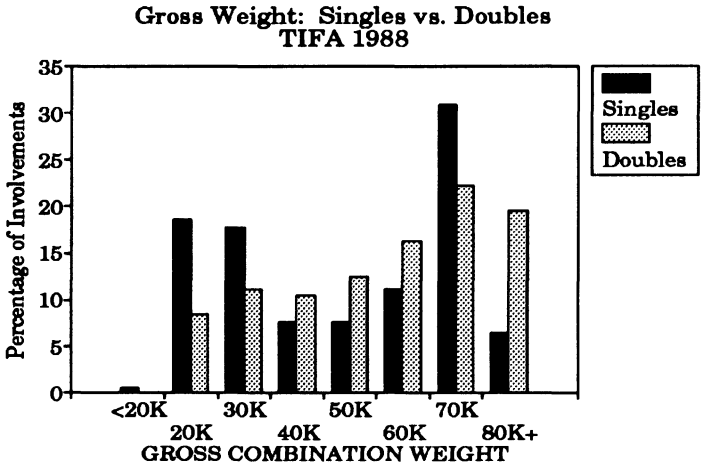


Figure 6-3

TABLE 6-3
Gross Combination Weight: Singles vs. Doubles
TIFA 1988

Gross Weight	Singles		Doubles		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
< 20,000	12	0.35%	0	0.00%	12	0.33%
20,000	577	16.92	13	5.70	590	16.21
30,000	552	16.18	17	7.46	569	15.64
40,000	235	6.89	16	7.02	251	6.90
50,000	239	7.01	19	8.33	258	7.09
60,000	343	10.06	25	10.96	368	10.11
70,000	960	28.14	34	14.91	994	27.32
80,000+	199	5.83	30	13.16	229	6.29
Unknown	294	8.62	74	32.46	368	10.11
TOTAL	3,411	100.00%	228	100.00%	3,639	100.00%

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

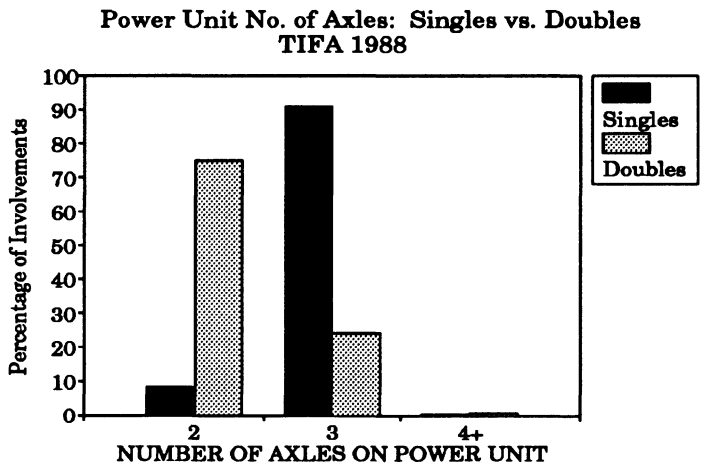


Figure 6-4

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

TABLE 6-4
Power Unit Number of Axles: Singles vs. Doubles
TIFA 1988

Power Unit No. of Axles	Singles		Doubles		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
2	289	8.47%	171	75.00%	460	12.64%
3	3,087	90.50	55	24.12	3,142	86.34
4+	12	0.35	1	0.44	13	0.36
Unknown	23	0.67	1	0.44	24	0.66
TOTAL	3,411	100.00%	228	100.00%	3,639	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, 86.6% of the involved singles and 69.7% of the doubles were interstate carriers. Conversely, 12.7% of the involved singles and 29.8% of the doubles were intrastate carriers.

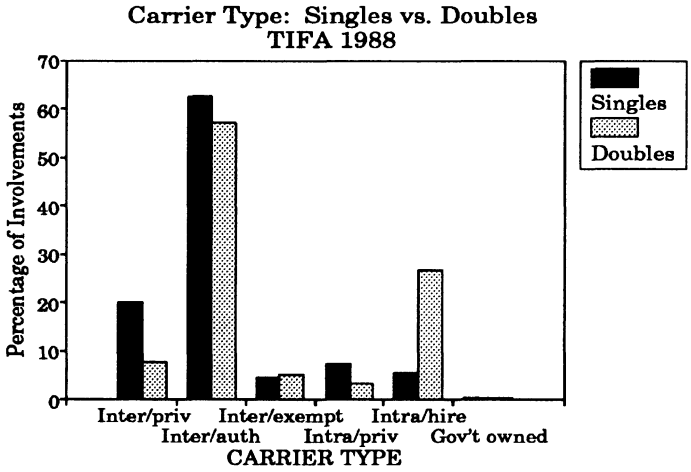


Figure 6-5

TABLE 6-5
Carrier Type: Singles vs. Doubles
TIFA 1988

Carrier Type	Singles		Doubles		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
Interstate private	649	19.03%	15	6.58%	642	18.35%
Interstate authorized	2,041	59.84	113	49.56	1,984	56.72
Interstate exempt	150	4.40	10	4.39	119	3.40
Intrastate private	237	6.95	6	2.63	266	7.60
Intrastate for hire	178	5.22	53	23.25	188	5.37
Government owned	12	0.35	1	0.44	12	0.34
Unknown	144	4.22	30	13.16	6	0.17
TOTAL	3,411	100.00%	228	100.00%	3,498	100.00%

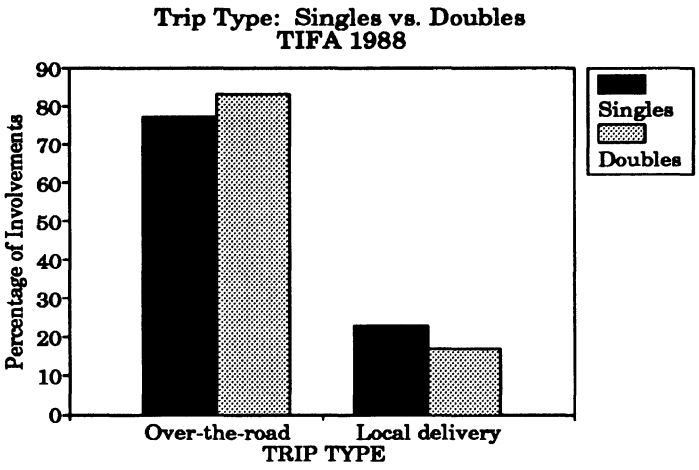


Figure 6-6

In terms of the type of trip being conducted when the accident occurred, the majority of singles and doubles were making over-the-road trips. However, of the known cases, 83% of the doubles were conducting over-the-road trips, compared to only 77% of the singles. This probably reflects the tendency for doubles to be used even more than singles in long-haul operations.

TABLE 6-6
Trip Type: Singles vs. Doubles
TIFA 1988

Trip Type	Singles		Doubles		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
Over-the-road	2,480	72.71%	134	58.77%	2,614	71.83%
Local delivery	739	21.67	27	11.84	766	21.05
Unknown	192	5.63	67	29.39	259	7.12
TOTAL	3,411	100.00%	228	100.00%	3,639	100.00%

Consistent with the differences in the trip type distributions are the differences in the road class distributions shown in the graph at right. Relatively more doubles involvements took place on limited access routes and fewer on major arteries compared to singles involvements. Of the known cases, 46% of the doubles accidents occurred on limited access roads and 35% occurred on major arteries. The respective figures for singles were 36% and 51%.

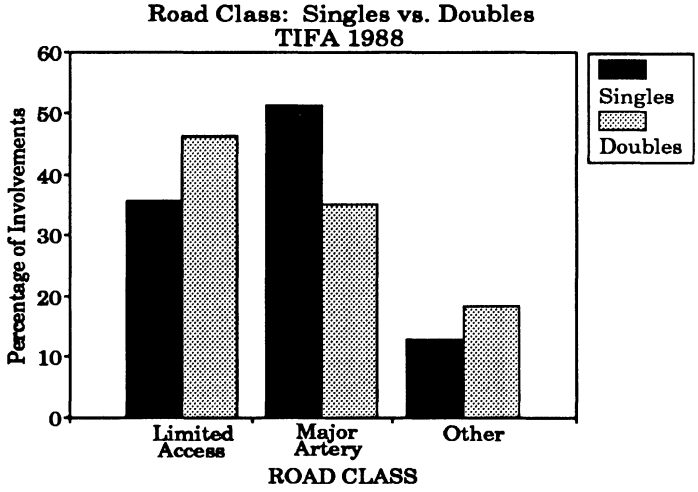


Figure 6-7

TABLE 6-7
Road Class: Singles vs. Doubles
TIFA 1988

Road Class	Singles		Doubles		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
Limited Access	1,209	35.44%	105	46.05%	1,314	36.11%
Major Artery	1,735	50.86	80	35.09	1,815	49.88
Other	432	12.66	42	18.42	474	13.03
Unknown	35	1.03	1	0.44	36	0.99
TOTAL	3,411	100.00%	228	100.00%	3,639	100.00%

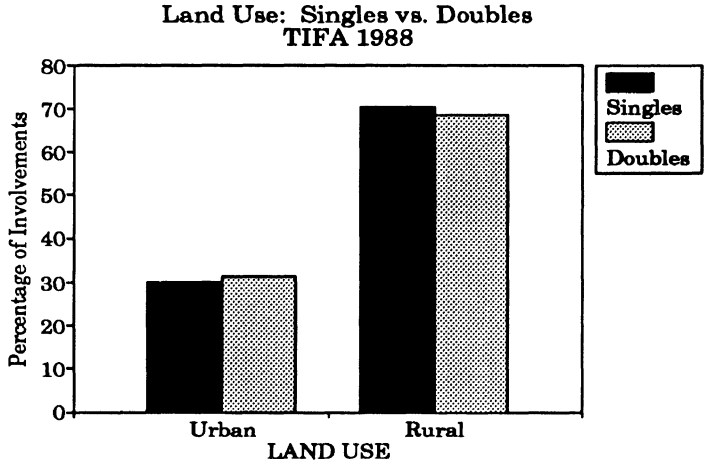


Figure 6-8

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

TABLE 6-8
Land Use: Singles vs. Doubles
TIFA 1988

Land Use	Singles		Doubles		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
Urban	1,013	29.70%	71	31.14%	1,084	29.79%
Rural	2,376	69.66	155	67.98	2,531	69.55
Unknown	22	0.64	2	0.88	24	0.66
TOTAL	3,411	100.00%	228	100.00%	3,639	100.00%

The final comparison concerns the light condition at the time of the accident. The main difference is the higher incidence of nighttime accidents and lower incidence of daytime involvements for doubles compared to singles. Over 54% of the singles involvements occurred during daylight, compared to 43% of the doubles involvements. On the other hand, 54% of 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.

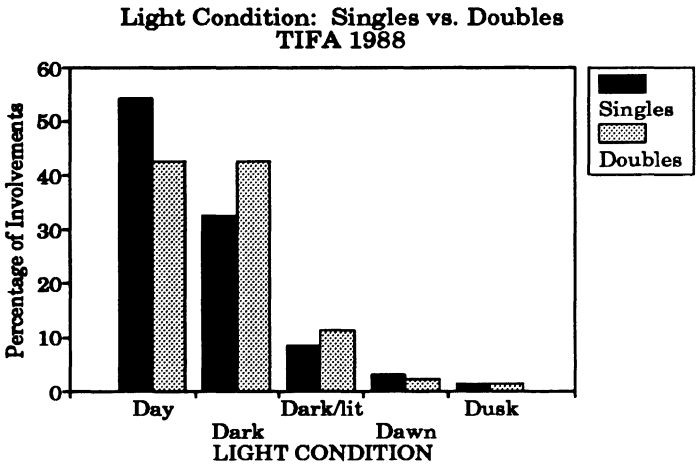


Figure 6-9

TABLE 6-9
Light Condition: Singles vs. Doubles
TIFA 1988

Light Condition	Singles		Doubles		TOTAL	
	Number	Percent	Number	Percent	Number	Percent
Daylight	1,847	54.15%	97	42.54%	1,944	53.42%
Dark, not lighted	1,117	32.75	97	42.54	1,214	33.36
Dark, but lighted	290	8.50	26	11.40	316	8.68
Dawn	105	3.08	5	2.19	110	3.02
Dusk	48	1.41	3	1.32	51	1.40
Unknown	4	0.12	0	0.00	4	0.11
TOTAL	3,411	100.00%	228	100.00%	3,639	100.00%

INDEX

Alcohol use 15, 39, 40
Ambulances 3
Angle collisions 33, 34, 66, 89
Arizona 17
Auto carriers 75-79, 81-92, 95
Axles, axle configuration 53, 55, 57, 58, 73, 76, 79, 80, 103, 105
Bobtails 5-8, 10, 13, 19-21, 79, 80, 97
Buses 3
Cabs 49, 73, 75, 76, 80, 83, 95, 103
  Cabover engine 49, 75, 76, 80, 83, 95, 101
  Cab-forward 49, 75, 83, 103
  Conventional 49, 75, 76, 80, 83, 95, 103
California 17, 18
Cargo type 3, 4, 47-49, 59, 60, 73, 80-82
Cargo weight 4, 56, 77, 104
Carrier type 45, 46, 53, 61, 73, 83-85, 106
  Authorized 45, 46, 61, 83-85, 106
  Exempt 45, 46, 61, 83, 84, 106
  Interstate 3, 45, 46, 61, 83-85, 106
  Intrastate 45, 46, 61, 83, 84, 85, 106
  Private 45, 46, 61, 83, 84, 106
Collision type 15, 33-35, 64-66, 73, 88-92
Daily rental trucks 45, 46, 61, 83-84, 106
Dark, nighttime 1, 15, 23-25, 87, 88, 109
Dawn 1, 24, 25, 88
Day, daytime 1, 15, 23-25, 87, 88, 109
Doubles 1, 3, 7, 9, 11, 14, 17-21, 73, 75, 79, 80, 101, 103-109
Driver age 15, 37, 38
Driver fatalities 1, 12-14, 42, 67-71, 95-99
Driver injuries 15, 42, 53, 68-71,73, 95-99
Driveway 29, 30
Dumps 53, 55-67, 75-79, 82-92
Dusk 1, 24, 25, 88
Ejection 69-71, 97-99
Explosion 65, 90
Extrication 41
Farm products 48, 49, 59, 60, 81, 82
FARS (Fatal Accident Reporting System) 3-6, 21, 24, 26, 32, 40, 42, 44, 45, 53, 65, 69, 73
Fatal involvements 1, 3, 7-9, 11-12, 15, 17-53, 55-71, 73, 75-99, 101-109
Fatalities 1, 7, 9-14, 42, 67, 69-70
Female 38
Fire 5, 65, 69-71, 90, 98-99
Fire trucks 3
First harmful event 32, 33, 36, 64-66, 88, 90, 92, 93
Fixed object 32, 33, 64, 88-91
Flatbeds 53, 55-67, 75-79, 81, 82, 84-92, 95
Florida 18
For-hire carriers 45, 46, 61, 83, 84, 106
Fuel 51, 73, 83
  Diesel 51, 83
  Gasoline 51, 83
  Liquid petroleum gas 51, 83
Full trailer 1, 6, 7, 21, 79, 101, 105
Gases in bulk 48, 59, 60, 81, 82
General freight 47, 48-49, 59-60, 81, 82
Government owned trucks 45, 46, 61, 83, 84, 106
Gross combination weight (GCW) 77, 78, 93, 94, 104
Gross vehicle weight 3, 56, 57
Gross vehicle weight rating (GVWR) 3, 55, 76, 77, 103, 104
Head-on collisions 33-35, 66, 91-92
Heavy machinery 47, 48, 59, 60, 81, 82
Ice 1, 26
Impact areas 68, 69, 96, 97
Injury 3, 32
  Incapacitating ("A") 42, 67, 68, 69-71, 95-99
  Nonincapacitating ("B") 42, 67-71, 95-99
  Possible ("C") 42, 67-71, 95-99
Interchange 29, 30
Intersection 29-31
Interstate highway system 26-28
Jackknife 93
Junction 29, 30
Land use 24, 27, 73, 86, 87, 108
Light condition 24, 25, 73, 87, 88, 109
Limited access roads 1, 26-29, 63, 85, 86, 107, 108
Liquids in bulk 47-49, 59, 60, 81, 82
Local delivery 47, 62, 84, 85, 107
Long-haul 27, 43, 107
Lumber 47-49, 59, 60, 81, 82
Major arteries 1, 26-29, 63, 85, 86, 107, 108
Male 38
Michigan 17
Model year 3, 51, 52
NHTSA (National Highway Traffic Safety Administration) 3

Non-collision 32, 33, 35, 64-65, 68-69, 88, 89, 96-98
OMC (Office of Motor Carriers) 3-5, 42, 45, 66
Over-the-road 47, 62, 84, 85, 107
Parked truck 42
Parked vehicle 33, 64, 89
Pedalcyclist/bicyclist 32, 33, 35, 64, 88, 89
Pedestrian 32, 33, 35, 64, 88, 89
Pennsylvania 18
Pickup truck 3
Piggyback 6, 50
Property damage 3, 32
Rear-end collisions 33, 34, 65, 66, 89-91
Refrigerated food 47-49, 59, 60, 81, 82
Refuse trucks 53, 55-67
Restraint use 15, 38, 39
Right-of-way violations 44
Road surface condition 1, 25, 26
Rollovers 32, 36, 65, 69-71, 90, 93, 98, 99
Rural areas 1, 15, 24, 28, 29, 86, 87, 108
Sampling in TIFA 5
Semitrailer 1, 5-8, 12, 13, 17, 21, 79, 101, 105
Short-haul 43
Sideswipe collisions 34, 66, 92
Singles 7, 11, 13, 17-21, 73, 79, 80, 101-109
Snow 1, 26
Solids in bulk 47-49, 59, 60, 81, 82
Speed limit 31, 32
Speeding 44
Straight trucks 1, 6-8, 10, 12, 13, 15, 19, 20-53, 55-71, 73, 82
Striking vehicle 35
Struck vehicle 35
Tanks 53, 55-67, 75-79, 81-92, 95
Texas 18
Towing 4, 6, 48, 50, 59, 81
Tractors 1, 5-15, 17-52, 73, 75-99, 101-107
Traffic control 30, 31, 44
Trip type 47, 53, 62, 73, 84, 85, 105
Triples 1, 3, 6
Urban areas 1, 5, 15, 24, 26, 27-28, 86, 87, 106
Utility vehicles 3
Vans (passenger) 3
Vans (body style) 53, 55-67, 75-79, 81-92, 95
VIN (Vehicle Identification Number) 4, 55