



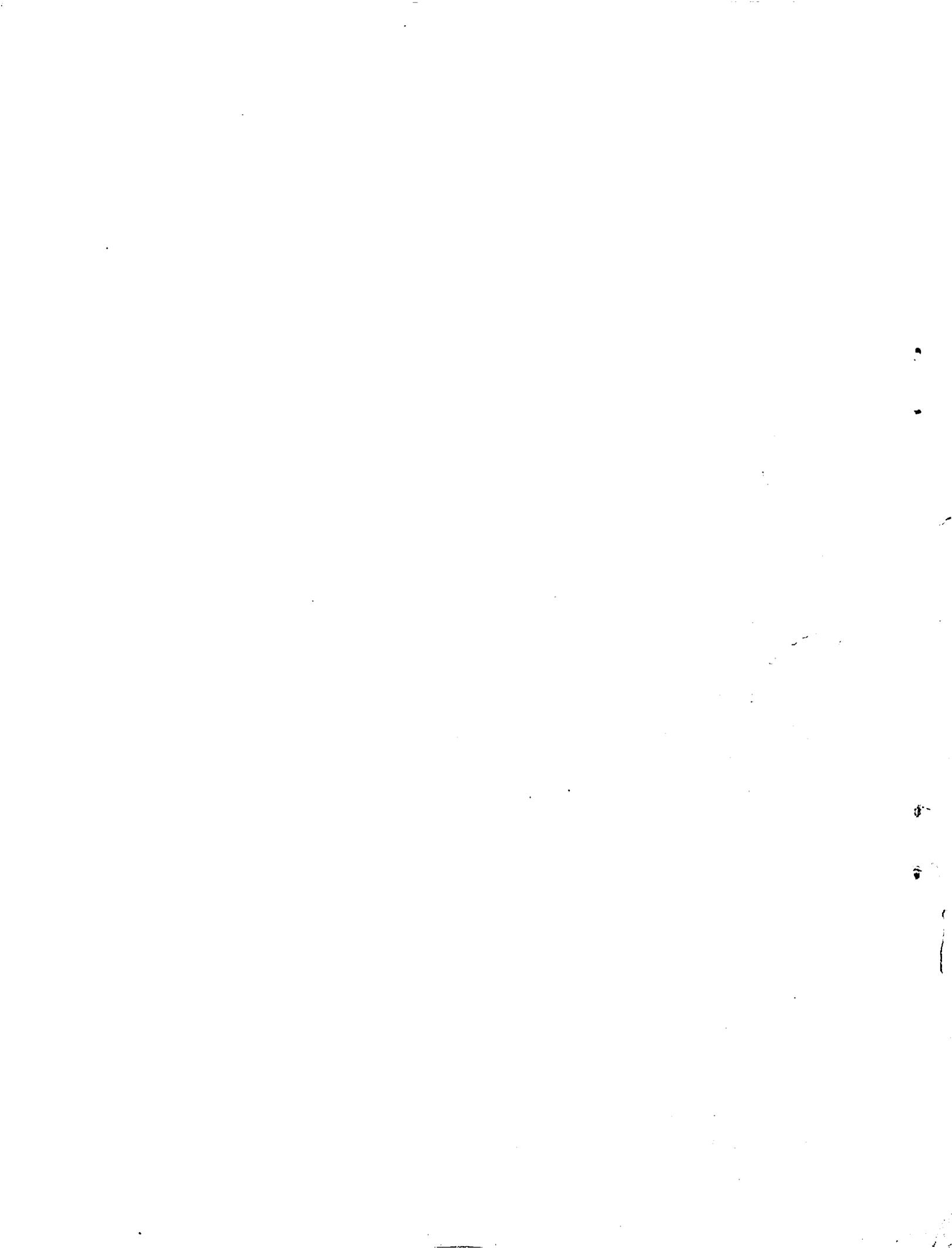
US Department  
of Transportation  
**National Highway  
Traffic Safety  
Administration**

---

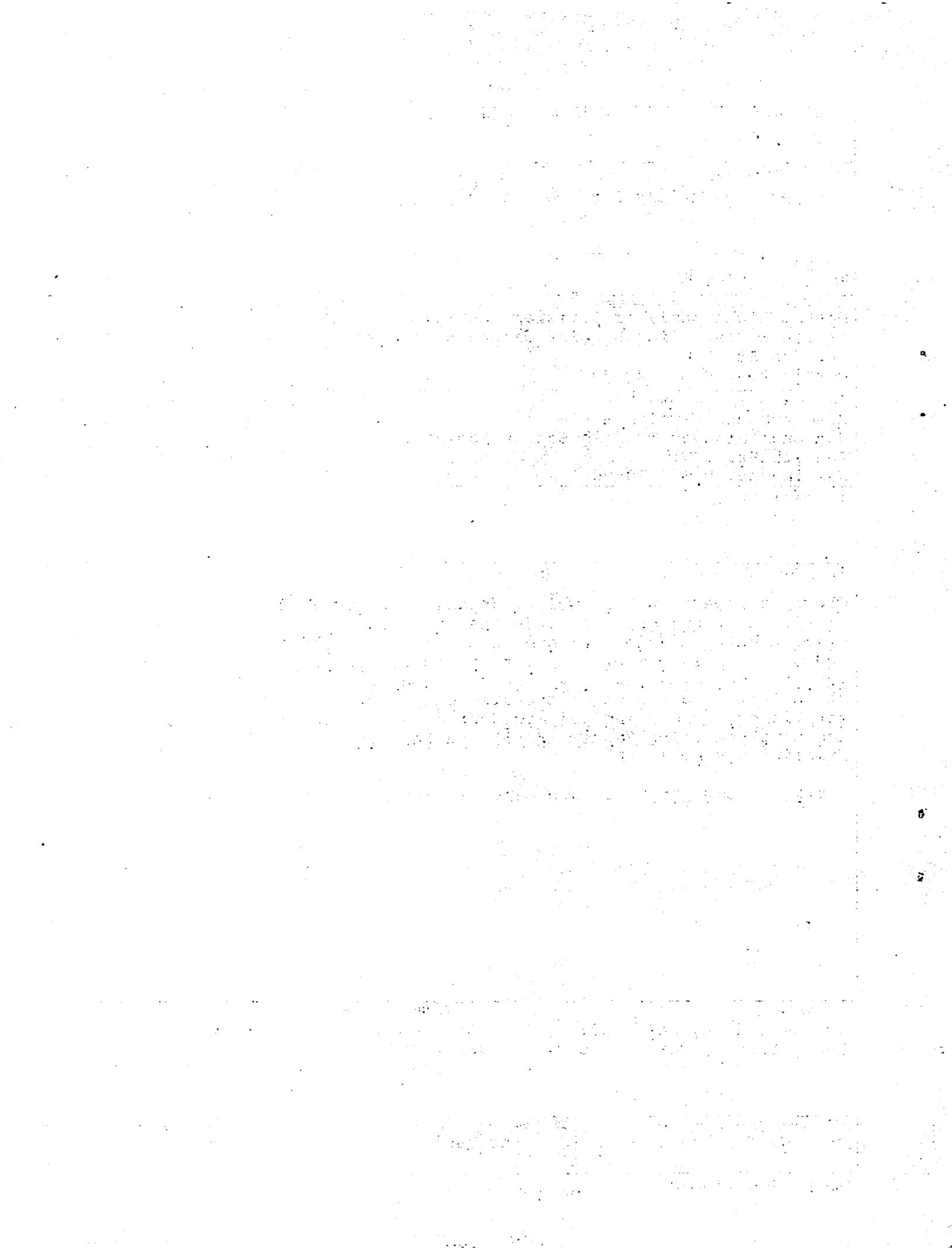
**DOT HS 807 294  
NHTSA Technical Report**

**June 1988**

# **Papers on Vehicle Size--Cars and Trucks**



1. Report No. DOT HS 807 294		2. Government Accession No.		3. Recipient's Catalog No.	
4. Title and Subtitle Papers on Vehicle Size -- Cars and Trucks				5. Report Date June 1988	
				6. Performing Organization Code	
				8. Performing Organization Report No.	
7. Author(s) Susan C. Partyka				10. Work Unit No. (TRAI5)	
9. Performing Organization Name and Address Mathematical Analysis Division, NRD-31 National Center for Statistics and Analysis 400 7th St. S.W. Washington, D.C. 20590				11. Contract or Grant No.	
				13. Type of Report and Period Covered NHTSA Technical Report June 85 - December 87	
12. Sponsoring Agency Name and Address Research and Development National Highway Traffic Safety Administration 400 7th St. S.W. Washington, D.C. 20590				14. Sponsoring Agency Code	
15. Supplementary Notes					
16. Abstract  The four papers in this volume describe analyses of car size trends and truck occupant injuries and fatalities. All four were written between June 1985 and December 1987. The topics addressed include where heavy truck accidents occur, injury and fatality outcomes for heavy truck occupants, car size trends, and the effect of car size on the frequency of rear-impact fatalities. The principal accident data sources are the Fatal Accident Reporting System (FARS) and the National Accident Sampling System (NASS).  A brief description of each paper is given in the Foreword.					
17. Key Words accident data, car size, heavy trucks, rear imoacts, trends			18. Distribution Statement Document is available to the public through the National Technical Information Service, Springfield, Virginia, 22161		
19. Security Classif. (of this report) Unclassified		20. Security Classif. (of this page) Unclassified		21. No. of Pages 146	22. Price



## FOREWORD

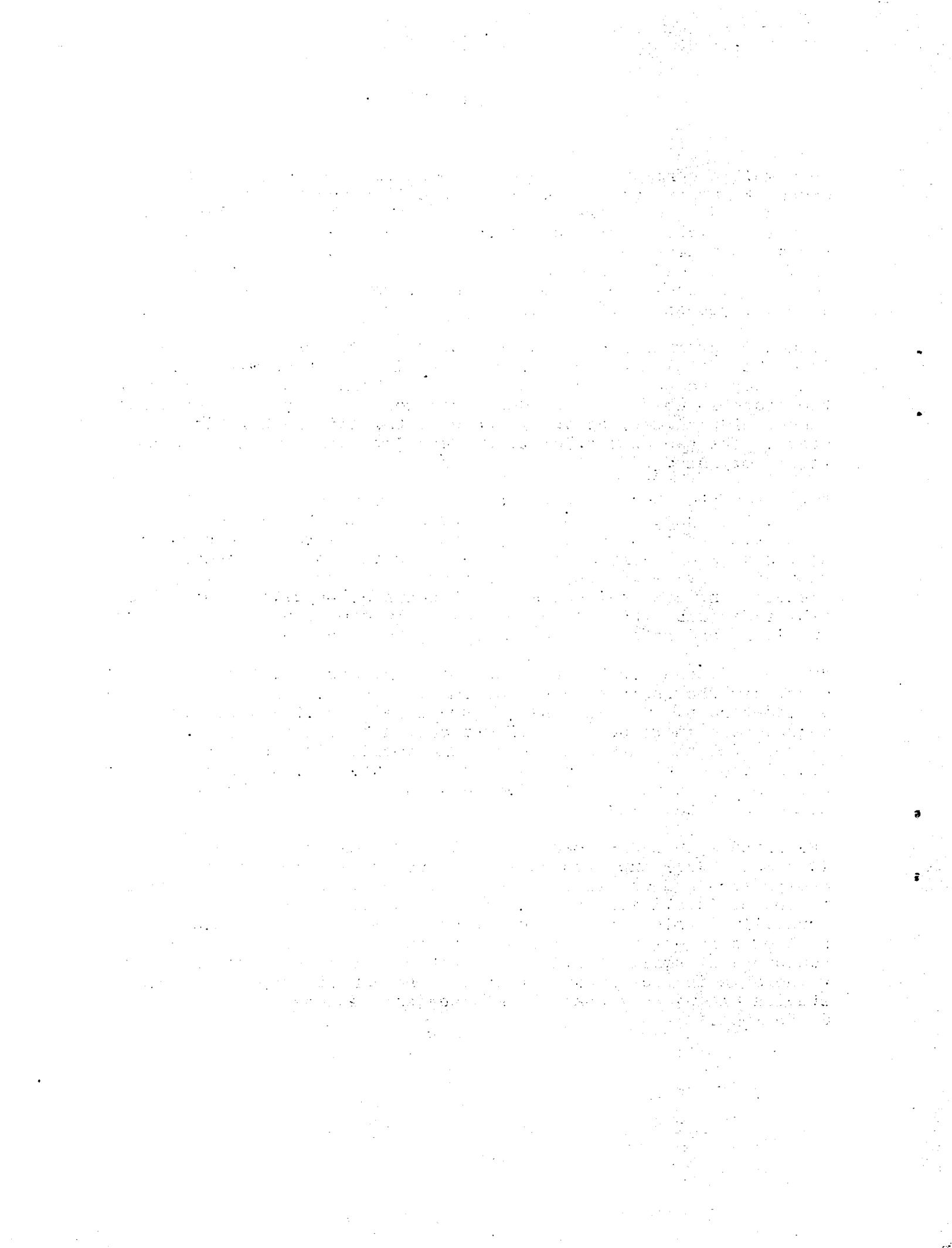
This volume contains four papers about car and heavy truck occupant safety, written between June 1985 and December 1987. Over the past ten years the average car has become smaller, the number of light trucks has increased, and the average commercial truck has become larger. The vehicle mix has changed, with greater size differences between vehicles involved together in accidents. These four papers describe some effects of vehicle size changes and differences.

"Truck-Tractor Accident Statistics: State Issues" (June 1985) describes fatal truck accidents in terms of issues within the regulatory scope of individual states. These factors include (by the state in which the accident occurred) road type, speed limit, number of trailers, driver license state, and truck registration state. The tables provide trend data for identifying changing regulatory needs.

"Truck-Tractor Accident Statistics: Occupant Factors and Injury Outcome" (August 1985) describes truck occupant injuries and fatalities. Included are comparisons of drivers and passengers by age, sex, and injury severity; descriptions of occupancy, restraint use, ejection, and entrapment; occupant fatality trends; and national estimates of nonfatal injuries. Detailed tables describe the available medical information on hospitalized survivors and fatally-injured heavy truck occupants.

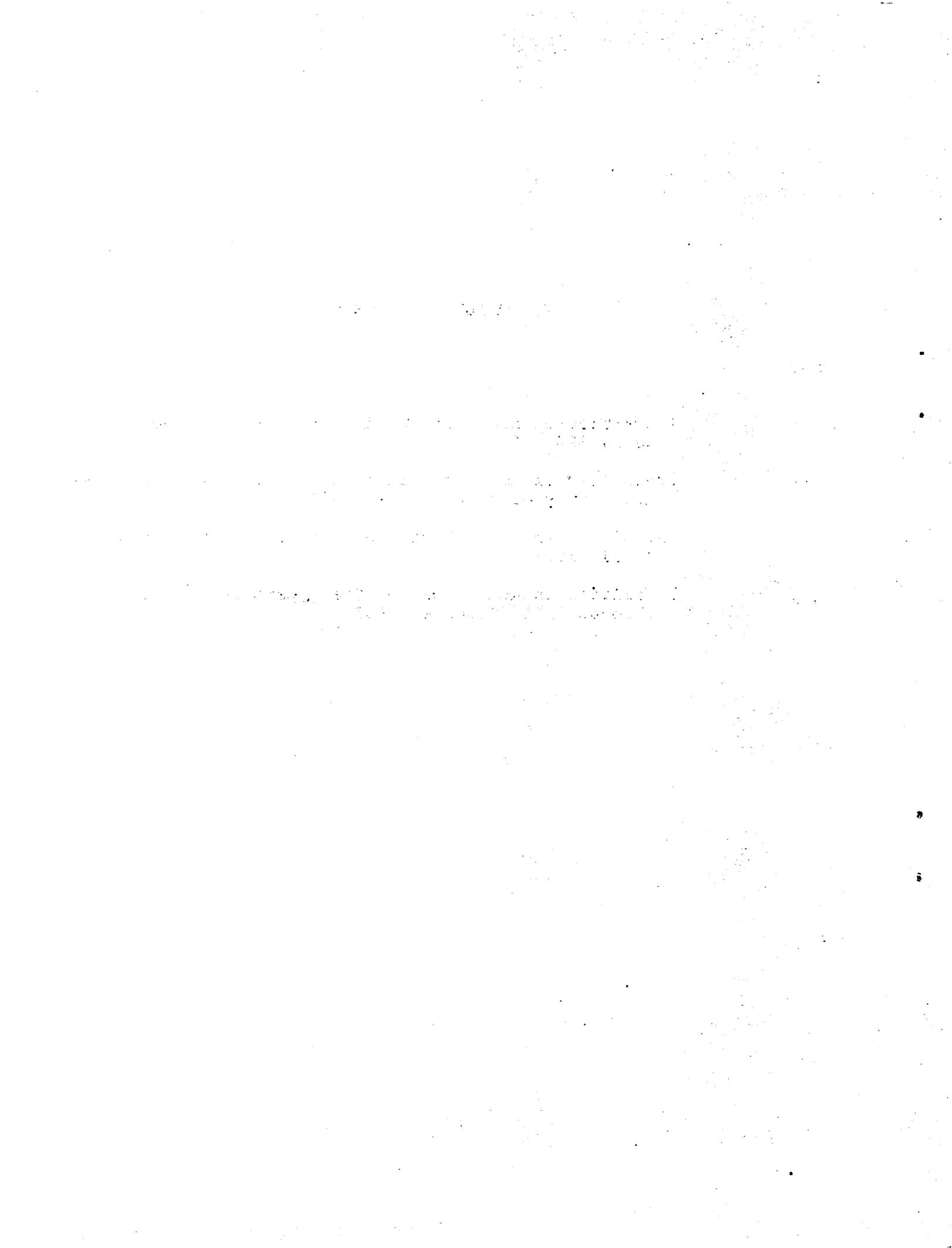
"Car Size Trends in Eleven Years of Fatal Accidents" (April 1987) describes the increasing use of small cars, as reflected in fatal accident data. The increase in small car registrations closely matched the increase in small car occupant fatalities, but the reasons for this are not clear. The implication is that vehicle downsizing changed the car size mix in fatal accidents (more cars were small, so more fatalities were in small cars), but not the number of fatalities.

"Fatalities in Rear-Impacted Small Cars from 1982 through 1986" (December 1987) explores fatalities per registered vehicle by damage area and car size. There were two reasons for the large number of fatalities in rear-impacted small cars: rear impacts generally involved two vehicles, so the weight disadvantage of smaller cars was particularly important in rear impacts; and occupants of small cars in multi-vehicle accidents appeared more vulnerable in rear impacts than in other impact types. Clinical studies of injury mechanisms may suggest reasons for this difference.



## TABLE OF CONTENTS

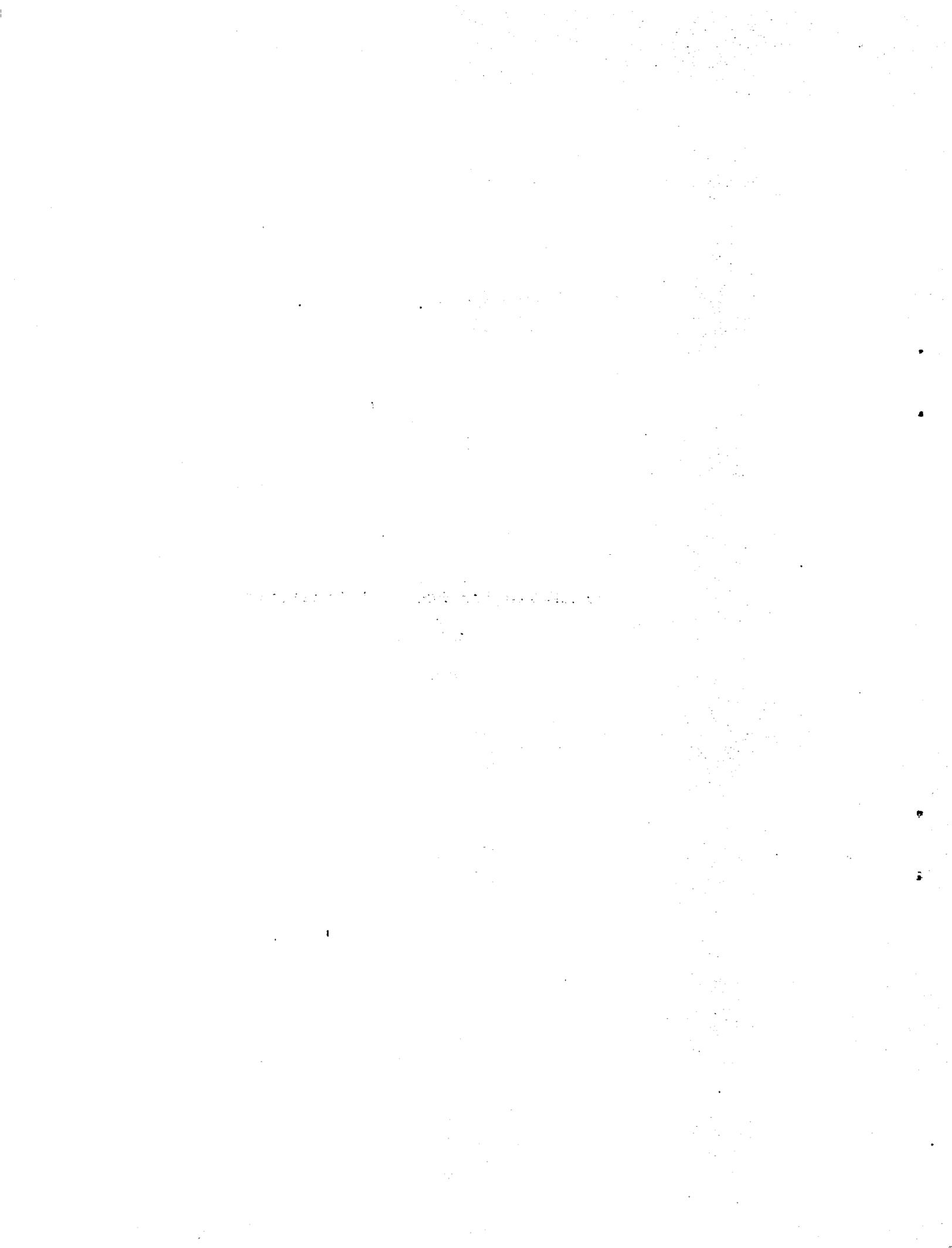
Page	
1	Truck-Tractor Accident Statistics: State Issues (June 1985)
41	Truck-Tractor Accident Statistics: Occupant Factors and Injury Outcome (August 1985)
73	Car Size Trends in Eleven Years of Fatal Accidents (April 1987)
125	Fatalities in Rear-Impacted Small Cars from 1982 through 1986 (December 1987)



**Truck-Tractor Accident Statistics:**

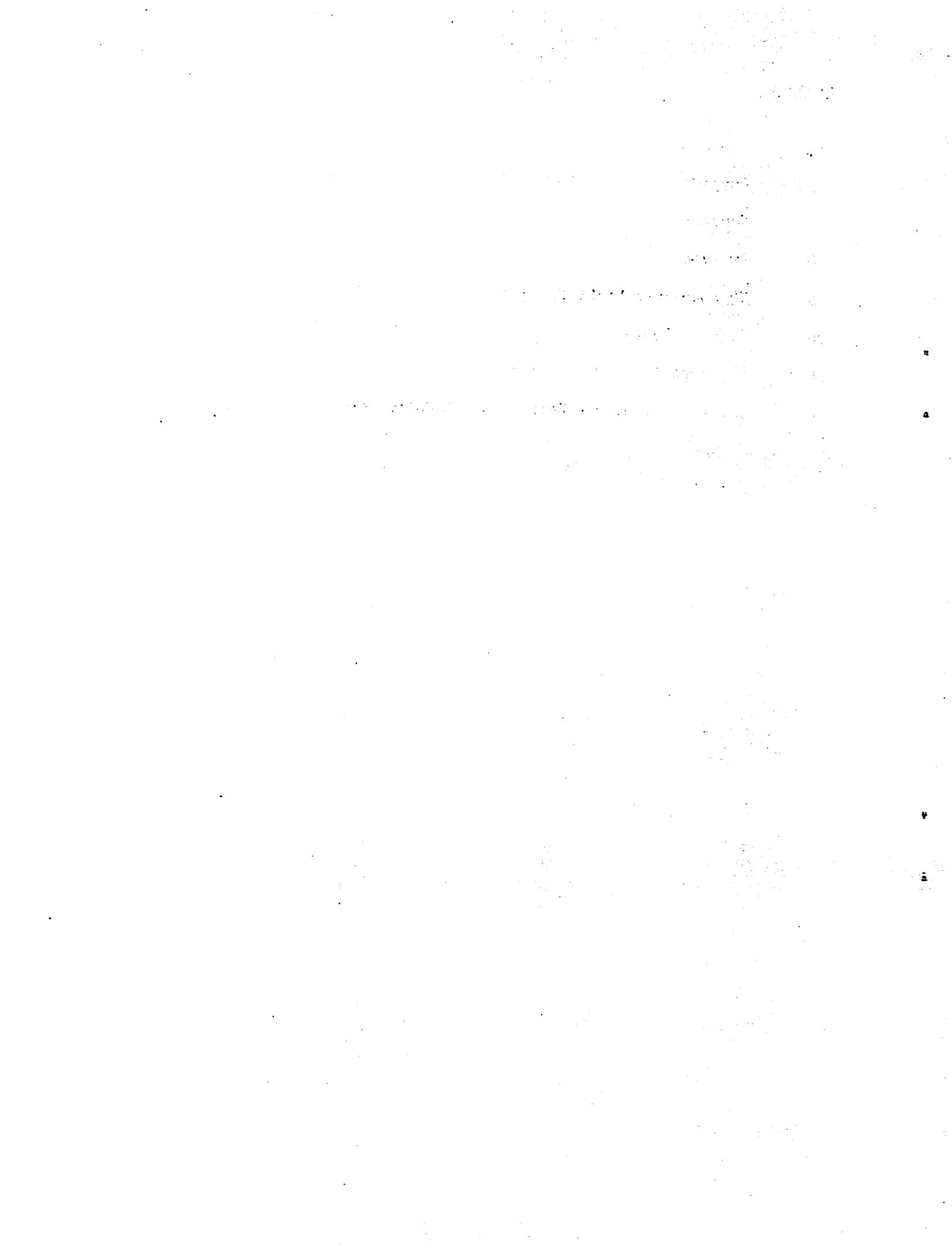
**State Issues**

**(June 1985)**



## Contents

<u>Page</u>	<u>Topic</u>
5	Purpose
5	Source
5	Overview
8	Changes over Eight Years
20	Roadway Types
28	Registration and Licensing
36	Other Vehicles and Pedestrians/Pedalcyclists



## Purpose

This report is a collection of tables that describe state issues in fatal accidents involving a truck-tractor. Throughout this report, the term "truck-tractor" is used to refer to all vehicles which include a truck-tractor as the power unit -- both trailerless truck-tractors and truck-tractors pulling one or more trailers.

The text is provided to help the reader understand the tables, but it is not an analysis of the issues. It is hoped that the tables will be useful to analysts of truck safety issues, by providing recent data and by suggesting research topics. Subsequent related reports will focus on other aspects of truck safety as revealed in national accident data.

## Source

All tables in this report are derived from the Fatal Accident Reporting System (FARS), with updates through May 1985. FARS is operated and maintained by the National Center for Statistics and Analysis, an office of the National Highway Traffic Safety Administration (United States Department of Transportation).

## Overview

In 1984 there were 3,997 truck-tractors involved in 3,794 fatal accidents. That year, truck-tractors were 7 percent of all vehicles involved in fatal accidents; 10 percent of all fatal accidents included at least one truck-tractor. Table 1 shows that these national averages are based on a wide range of state experiences. For example, Alaska, the District of Columbia, Hawaii, and Rhode Island had relatively few truck-tractor involvements in fatal accidents. In contrast, 17 percent of all fatal accidents in Utah involved a truck-tractor.

Table 2 shows that most (93 percent) of the truck-tractors were pulling at least one trailer. There were 186 trucks with two or more trailers; 100 of these (54 percent) were involved in accidents in California. There were also 289 truck-tractors without trailers reported; 80 of these (28 percent) were in accidents in Mississippi. In fact, Mississippi reported only one truck-tractor pulling a trailer in 1984.

Table 1: Truck-Tractors in the Perspective of 1984 Fatal Accidents

State	Total Vehicles	Truck-Tractors	Percent of Vehicles	Total Accidents	Truck-Tractor Accidents	Percent of Accidents
Alabama	1,222	123	10	819	119	15
Alaska	171	3	2	120	3	3
Arizona	1,142	77	7	787	74	9
Arkansas	689	73	11	472	69	15
California	6,680	345	5	4,517	325	7
Colorado	779	45	6	543	42	8
Connecticut	639	27	4	433	26	6
Delaware	176	12	7	118	12	10
District of Columbia	80	0	0	56	0	0
Florida	3,879	232	6	2,547	222	9
Georgia	1,833	151	8	1,260	145	12
Hawaii	188	3	2	129	3	2
Idaho	303	25	8	215	24	11
Illinois	2,034	109	5	1,384	104	8
Indiana	1,252	152	11	638	120	14
Iowa	565	51	9	376	49	13
Kansas	661	70	11	451	69	15
Kentucky	989	82	8	674	76	11
Louisiana	1,207	112	9	844	101	12
Maine	289	17	6	211	17	8
Maryland	847	53	6	588	49	8
Massachusetts	865	39	5	608	38	6
Michigan	2,082	96	5	1,366	95	7
Minnesota	786	60	8	517	59	11
Mississippi	860	81	9	594	74	12
Missouri	1,257	88	7	841	86	10
Montana	269	30	11	204	30	15
Nebraska	373	34	9	250	32	13
Nevada	303	13	4	215	13	6
New Hampshire	241	6	2	171	6	4
New Jersey	1,259	91	7	864	82	9
New Mexico	571	51	9	426	50	12
New York	2,713	117	4	1,881	110	6
North Carolina	1,883	143	8	1,291	136	11
North Dakota	127	11	9	88	11	13
Ohio	2,180	143	7	1,479	128	9
Oklahoma	1,080	116	11	691	106	15
Oregon	741	43	6	512	42	8
Pennsylvania	2,306	180	8	1,562	170	11
Rhode Island	97	2	2	75	2	3
South Carolina	1,172	76	6	820	73	9
South Dakota	183	14	8	132	12	9
Tennessee	1,457	87	6	990	84	8
Texas	4,889	389	8	3,465	377	11
Utah	404	50	12	274	46	17
Vermont	133	9	7	98	9	9
Virginia	1,332	107	8	921	104	11
Washington	966	47	5	674	45	7
West Virginia	570	50	9	387	49	13
Wisconsin	1,032	65	6	704	61	9
Wyoming	202	17	8	140	15	11
National Totals	57,958	3,997	7	39,622	3,794	10

Table 2: Number of Trailers in Truck-Tractor Fatal Accidents in 1984

State	Number of Trailers					Vehicle Total	Accident Total
	None	One	Two	More	Unknown		
Alabama	5	117	0	0	1	123	119
Alaska	0	3	0	0	0	3	3
Arizona	1	67	9	0	0	77	74
Arkansas	4	68	1	0	0	73	69
California	16	229	96	4	0	345	325
Colorado	2	43	0	0	0	45	42
Connecticut	0	27	0	0	0	27	26
Delaware	1	11	0	0	0	12	12
Florida	9	218	5	0	0	232	222
Georgia	11	140	0	0	0	151	145
Hawaii	0	2	1	0	0	3	3
Idaho	0	21	4	0	0	25	24
Illinois	8	100	1	0	0	109	104
Indiana	3	128	1	0	0	132	120
Iowa	1	50	0	0	0	51	49
Kansas	4	62	4	0	0	70	69
Kentucky	1	80	1	0	0	82	76
Louisiana	4	108	0	0	0	112	101
Maine	1	16	0	0	0	17	17
Maryland	5	48	0	0	0	53	49
Massachusetts	1	38	0	0	0	39	38
Michigan	8	78	10	0	0	96	95
Minnesota	11	49	0	0	0	60	59
Mississippi	80	1	0	0	0	81	74
Missouri	3	84	1	0	0	88	86
Montana	3	21	6	0	0	30	30
Nebraska	1	33	0	0	0	34	32
Nevada	1	11	1	0	0	13	13
New Hampshire	0	6	0	0	0	6	6
New Jersey	6	79	1	0	5	91	82
New Mexico	7	38	6	0	0	51	50
New York	3	113	1	0	0	117	110
North Carolina	2	140	0	0	1	143	136
North Dakota	0	11	0	0	0	11	11
Ohio	37	104	2	0	0	143	128
Oklahoma	4	107	5	0	0	116	106
Oregon	5	35	3	0	0	43	42
Pennsylvania	0	169	5	0	6	180	170
Rhode Island	0	2	0	0	0	2	2
South Carolina	5	71	0	0	0	76	73
South Dakota	1	13	0	0	0	14	12
Tennessee	4	82	1	0	0	87	84
Texas	19	366	4	0	0	389	377
Utah	2	44	4	0	0	50	46
Vermont	0	9	0	0	0	9	9
Virginia	6	101	0	0	0	107	104
Washington	2	38	7	0	0	47	45
West Virginia	0	50	0	0	0	50	49
Wisconsin	1	61	2	0	1	65	61
Wyoming	1	16	0	0	0	17	15
National Totals	289	3,508	182	4	14	3,997	3,794

## Changes over Eight Years

Table 3 (national summary) and Table 4 (state-level details) present tractor-trailer accident counts for 1977 through 1984.

Table 3: National Trends in Truck-Tractor Fatal Accidents

Year	Number of Trailers				Vehicle Total	Accident Total
	None	One	More	Unknown		
1977	63	3,573	149	0	3,785	3,574
1978	117	3,970	152	0	4,239	4,006
1979	139	4,192	186	0	4,517	4,254
1980	152	3,594	154	0	3,900	3,679
1981	105	3,738	154	0	3,997	3,795
1982	212	3,226	131	19	3,588	3,409
1983	238	3,299	179	12	3,728	3,541
1984	289	3,508	186	14	3,997	3,794

Table 4 shows some unusual trends in number of trailing units. Florida reported that most truck-tractors were pulling one trailing unit, except for 1982 when there were a large (60) number of trailerless truck-tractors reported. For Mississippi, there was a shift from reporting "one trailing unit" to reporting "no trailing unit" that appears to have occurred in 1983. Pennsylvania had a large number of trailerless truck-tractors in 1978 through 1981, but reported none of these for 1977 or for 1982 through 1984. Texas began reporting more trailerless truck-tractors beginning in 1982.

There have been several changes in the coding of truck types over the years. These changes reduce the cross-year comparability somewhat.

In 1975 and 1976, the following coding scheme was used:

- Body Type code 57 = Two-unit truck-tractor with semi-trailer or truck with cargo trailer
- Body Type code 58 = Multi-unit: truck or truck-tractor with two or more trailers

From 1977 through 1981, the coding scheme was as follows:

- Body Type code 57 = Two-unit truck-tractor with semi-trailer or truck with cargo trailer
- Body Type code 58 = Multi-unit: truck or truck-tractor with two or more trailers
- Body Type code 59 = Truck-tractor pulling no trailers

In 1982, the coding scheme was changed to two variables:

- Body Type code 74 = Truck-tractor, plus an indication of the number of trailing units:
  - Vehicle Trailering code 0 = No trailing units
  - Vehicle Trailering code 1 = Yes, one trailing unit
  - Vehicle Trailering code 2 = Yes, two or more trailing units
  - Vehicle Trailering code 3 = Yes, unknown number of trailing units
  - Vehicle Trailering code 9 = Unknown if trailing units

In 1983, the coding of the number of trailing units was expanded:

Body Type code 74 = Truck-tractor, plus an indication of the number of trailing units:

Vehicle Trailering code 0 = No trailing units

Vehicle Trailering code 1 = Yes, one trailing unit

Vehicle Trailering code 2 = Yes, two trailing units

Vehicle Trailering code 3 = Yes, three or more trailing units

Vehicle Trailering code 4 = Yes, unknown number of trailing units

Vehicle Trailering code 9 = Unknown if trailing units

The implications of these changes in the coding schemes include several difficulties in cross-year comparisons and the detection of trends.

First, it was not possible to identify trailerless tractors in 1975 and 1976 because these vehicles were classified as single unit heavy trucks until 1977. It is suspected that there were other problems in coding heavy trucks in the first year of FARS. For these reasons, Tables 3 and 4 begin with 1977.

Second, tractors and trailers were identified through a single variable (Body Type) until 1982. This coding did not distinguish a tractor pulling a trailer from a straight truck pulling a trailer. However, most articulated vehicles are tractor-trailer combinations. Tables 3 and 4 include all two-unit and multi-unit heavy trucks reported before 1982.

Third, since it was not possible to indicate an articulated truck with an unknown number of trailing units before 1982, these vehicles would have been reported as being of unknown truck type. These trucks are not included in Tables 3 and 4. Review of the 1982 through 1984 data (for example, in Table 3) shows that the number of trailers is usually known.

Fourth, multiple trailers were included in the category "2 or more trailers" in both the 1975 through 1981 coding of the Body Type variable and in the 1982 coding of the Vehicle Trailering variable. Beginning in 1983, this category has been subdivided into "2 trailers" and "3 or more trailers." The later years can be made compatible with the earlier years by collapsing the two multi-unit categories into one.

Finally, the amounts of unknown truck type data have varied with differences in the amount of detail required for coding and with temporary state-level FARS operational difficulties. The statistics in this report have not been adjusted to account for missing data.

Some of the apparent changes in Tables 3 and 4 may be artifacts of these changes in state and FARS coding practices.

Table 4: State Trends in Truck-Tractor Fatal Accidents

State	Year	Number of Trailers				Vehicle Total	Accident Total
		None	One	More	Unknown		
Alabama	1977	1	146	0	0	147	141
	1978	2	129	0	0	131	124
	1979	1	136	0	0	137	125
	1980	0	83	0	0	83	75
	1981	2	89	0	0	91	90
	1982	1	96	0	0	97	94
	1983	3	81	1	0	85	84
	1984	5	117	0	1	123	119
Alaska	1977	0	4	0	0	4	4
	1978	0	4	0	0	4	4
	1979	0	4	0	0	4	4
	1980	0	4	0	0	4	4
	1981	0	5	0	0	5	5
	1982	0	6	0	0	6	6
	1983	1	5	0	0	6	5
	1984	0	3	0	0	3	3
Arizona	1977	0	48	5	0	53	51
	1978	0	51	13	0	64	61
	1979	3	81	5	0	89	86
	1980	0	55	8	0	63	60
	1981	0	57	7	0	64	60
	1982	2	41	9	0	52	49
	1983	0	33	7	0	40	39
	1984	1	67	9	0	77	74
Arkansas	1977	1	62	0	0	63	60
	1978	1	82	0	0	83	80
	1979	0	88	1	0	89	84
	1980	0	58	0	0	58	54
	1981	0	92	0	0	92	83
	1982	2	74	1	0	77	71
	1983	13	65	1	0	79	76
	1984	4	68	1	0	73	69
California	1977	7	168	89	0	264	234
	1978	12	175	95	0	282	264
	1979	10	181	134	0	325	292
	1980	15	213	89	0	317	279
	1981	8	191	94	0	293	280
	1982	6	163	73	1	243	227
	1983	13	177	107	0	297	271
	1984	16	229	100	0	345	325

Table 4 (continued): State Trends in Truck-Tractor Fatal Accidents

State	Year	Number of Trailers				Vehicle	Accident
		None	One	More	Unknown	Total	Total
Colorado	1977	1	58	2	0	61	59
	1978	3	54	1	0	58	53
	1979	1	67	1	0	69	61
	1980	0	49	3	0	52	50
	1981	3	47	1	0	51	49
	1982	2	46	2	0	50	50
	1983	2	43	2	0	47	45
	1984	2	43	0	0	45	42
Connecticut	1977	4	26	0	0	30	29
	1978	1	21	0	0	22	20
	1979	3	21	0	0	24	24
	1980	1	17	0	0	18	17
	1981	1	34	0	0	35	32
	1982	0	35	0	0	35	32
	1983	0	30	0	0	30	27
	1984	0	27	0	0	27	26
Delaware	1978	1	3	0	0	4	4
	1979	0	12	0	0	12	12
	1980	0	22	0	0	22	20
	1981	0	12	0	0	12	12
	1982	1	9	0	0	10	10
	1983	0	10	0	0	10	9
	1984	1	11	0	0	12	12
District of Columbia	1979	0	1	0	0	1	1
	1980	0	1	0	0	1	1
	1983	0	1	0	0	1	1
Florida	1977	0	162	0	0	162	156
	1978	4	194	1	0	199	192
	1979	5	198	0	0	203	192
	1980	9	194	1	0	204	195
	1981	5	213	0	0	218	205
	1982	60	141	0	0	201	188
	1983	7	208	0	0	215	202
	1984	9	218	5	0	232	222
Georgia	1977	2	96	0	0	98	92
	1978	2	123	0	0	125	116
	1979	1	153	0	0	154	146
	1980	4	146	0	0	150	144
	1981	5	120	0	0	125	119
	1982	2	103	2	0	107	101
	1983	10	139	0	0	149	140
	1984	11	140	0	0	151	145

Table 4 (continued): State Trends in Truck-Tractor Fatal Accidents

State	Year	Number of Trailers				Vehicle Total	Accident Total
		None	One	More	Unknown		
Hawaii	1977	0	3	1	0	4	3
	1978	0	8	0	0	8	8
	1979	0	1	0	0	1	1
	1980	1	1	0	0	2	2
	1981	0	2	0	0	2	2
	1982	0	3	1	0	4	4
	1983	0	4	0	0	4	4
	1984	0	2	1	0	3	3
Idaho	1977	0	16	1	0	17	17
	1978	0	20	4	0	24	23
	1979	0	30	12	0	42	37
	1980	0	17	4	0	21	19
	1981	4	31	6	0	41	39
	1982	0	18	4	0	22	21
	1983	1	28	0	0	29	27
	1984	0	21	4	0	25	24
Illinois	1977	0	200	0	0	200	181
	1978	0	182	0	0	182	174
	1979	2	177	1	0	180	169
	1980	1	138	1	0	140	134
	1981	0	156	0	0	156	150
	1982	5	106	0	0	111	109
	1983	4	108	2	0	114	105
	1984	8	100	1	0	109	104
Indiana	1977	2	154	0	0	156	141
	1978	0	178	0	0	178	166
	1979	1	196	0	0	197	172
	1980	0	123	0	0	123	114
	1981	0	122	0	0	122	117
	1982	7	107	0	0	114	103
	1983	4	131	1	0	136	128
	1984	3	128	1	0	132	120
Iowa	1977	2	57	0	0	59	58
	1978	3	76	0	0	79	74
	1979	2	68	0	0	70	66
	1980	3	67	0	0	70	64
	1981	2	81	1	0	84	71
	1982	1	58	0	0	59	56
	1983	2	62	0	0	64	62
	1984	1	50	0	0	51	49

Table 4 (continued): State Trends in Truck-Tractor Fatal Accidents

State	Year	Number of Trailers				Vehicle Total	Accident Total
		None	One	More	Unknown		
Kansas	1977	1	55	4	0	60	59
	1978	0	68	1	0	69	64
	1979	0	51	3	0	54	52
	1980	1	58	4	0	63	61
	1981	0	47	2	0	49	48
	1982	1	64	1	0	66	63
	1983	0	55	3	0	58	57
	1984	4	62	4	0	70	69
Kentucky	1977	2	86	0	0	88	85
	1978	1	87	1	0	89	87
	1979	3	69	0	0	72	71
	1980	6	56	0	0	62	60
	1981	5	73	0	0	78	72
	1982	2	65	0	0	67	64
	1983	0	54	0	0	54	50
	1984	1	80	1	0	82	76
Louisiana	1977	0	81	0	0	81	79
	1978	0	82	1	0	83	77
	1979	3	90	0	0	93	87
	1980	7	113	0	0	120	113
	1981	1	128	0	0	129	122
	1982	6	89	0	2	97	93
	1983	9	106	3	0	118	112
	1984	4	108	0	0	112	101
Maine	1977	0	12	0	0	12	12
	1978	1	10	0	0	11	11
	1979	0	13	0	0	13	13
	1980	0	16	0	0	16	16
	1981	0	12	0	0	12	12
	1982	2	6	0	0	8	8
	1983	0	15	0	0	15	15
	1984	1	16	0	0	17	17
Maryland	1977	2	57	0	0	59	56
	1978	1	50	0	0	51	49
	1979	0	36	0	0	36	34
	1980	1	43	0	0	44	41
	1981	1	41	0	0	42	39
	1982	8	52	0	0	60	51
	1983	10	43	0	0	53	52
	1984	5	48	0	0	53	49

Table 4 (continued): State Trends in Truck-Tractor Fatal Accidents

State	Year	Number of Trailers				Vehicle Total	Accident Total
		None	One	More	Unknown		
Massachusetts	1977	1	27	0	0	28	28
	1978	2	28	0	0	30	29
	1979	0	36	0	0	36	34
	1980	0	29	0	0	29	27
	1981	0	14	0	0	14	13
	1982	3	18	0	0	21	21
	1983	4	20	0	0	24	24
	1984	1	38	0	0	39	38
Michigan	1977	1	110	2	0	113	109
	1978	0	149	0	0	149	139
	1979	3	124	5	0	132	128
	1980	5	68	12	0	85	85
	1981	5	87	9	0	101	98
	1982	6	68	1	2	77	75
	1983	8	82	6	0	96	92
	1984	8	78	10	0	96	95
Minnesota	1977	0	72	0	0	72	67
	1978	0	71	0	0	71	69
	1979	0	82	0	0	82	79
	1980	0	59	0	0	59	57
	1981	1	39	0	0	40	39
	1982	12	37	0	0	49	49
	1983	6	40	0	0	46	46
	1984	11	49	0	0	60	59
Mississippi	1977	0	59	0	0	59	55
	1978	0	71	0	0	71	67
	1979	1	88	1	0	90	86
	1980	0	71	0	0	71	68
	1981	0	74	0	0	74	71
	1982	1	91	0	0	92	88
	1983	31	35	0	0	66	64
	1984	80	1	0	0	81	74
Missouri	1977	1	94	5	0	100	97
	1978	0	112	5	0	117	111
	1979	1	110	2	0	113	107
	1980	1	89	4	0	94	89
	1981	0	90	2	0	92	90
	1982	1	84	0	0	85	80
	1983	6	76	4	0	86	83
	1984	3	84	1	0	88	86

Table 4 (continued): State Trends in Truck-Tractor Fatal Accidents

State	Year	Number of Trailers				Vehicle	Accident
		None	One	More	Unknown	Total	Total
Montana	1977	0	34	0	0	34	33
	1978	1	29	4	0	34	32
	1979	1	35	1	0	37	34
	1980	0	35	2	0	37	36
	1981	2	33	5	0	40	40
	1982	2	38	3	0	43	36
	1983	6	31	5	0	42	40
	1984	3	21	6	0	30	30
Nebraska	1977	0	30	1	0	31	30
	1978	1	49	1	0	51	46
	1979	0	48	3	0	51	49
	1980	4	58	6	0	68	63
	1981	3	51	0	0	54	51
	1982	0	38	3	0	41	39
	1983	1	34	1	0	36	34
	1984	1	33	0	0	34	32
Nevada	1977	0	11	6	0	17	17
	1978	0	13	9	0	22	22
	1979	0	17	4	0	21	21
	1980	2	22	3	0	27	25
	1981	0	13	3	0	16	16
	1982	3	10	0	0	13	13
	1983	2	13	1	0	16	15
	1984	1	11	1	0	13	13
New Hampshire	1977	0	5	0	0	5	5
	1978	1	5	0	0	6	6
	1979	0	5	0	0	5	5
	1980	0	6	0	0	6	6
	1981	0	9	0	0	9	9
	1982	0	6	0	0	6	6
	1983	1	8	0	0	9	9
	1984	0	6	0	0	6	6
New Jersey	1977	1	95	0	0	96	91
	1978	2	90	0	0	92	84
	1979	2	94	0	0	96	88
	1980	2	83	0	0	85	79
	1981	0	80	1	0	81	79
	1982	6	60	1	0	67	64
	1983	2	56	0	0	58	53
	1984	6	79	1	5	91	82

Table 4 (continued): State Trends in Truck-Tractor Fatal Accidents

State	Year	Number of Trailers				Vehicle Total	Accident Total
		None	One	More	Unknown		
New Mexico	1977	0	66	9	0	75	70
	1978	0	65	1	0	66	64
	1979	1	45	1	0	47	45
	1980	2	58	5	0	65	63
	1981	1	58	3	0	62	60
	1982	7	51	3	1	62	59
	1983	17	40	2	0	59	54
	1984	7	38	6	0	51	50
New York	1977	2	104	2	0	108	105
	1978	1	121	1	0	123	119
	1979	3	121	0	0	124	119
	1980	0	95	0	0	95	92
	1981	1	105	0	0	106	101
	1982	4	105	2	0	111	109
	1983	2	105	1	0	108	106
	1984	3	113	1	0	117	110
North Carolina	1977	1	126	0	0	127	116
	1978	0	160	0	0	160	149
	1979	0	134	0	0	134	125
	1980	2	127	0	0	129	123
	1981	1	125	0	0	126	120
	1982	5	97	0	0	102	98
	1983	9	119	1	0	129	122
	1984	2	140	0	1	143	136
North Dakota	1977	1	9	1	0	11	10
	1978	0	13	1	0	14	11
	1979	2	13	0	0	15	15
	1980	0	12	0	0	12	11
	1981	0	17	0	0	17	16
	1982	0	9	1	0	10	10
	1983	1	6	1	0	8	8
	1984	0	11	0	0	11	11
Ohio	1977	18	145	1	0	164	150
	1978	4	195	0	0	199	187
	1979	9	217	0	0	226	212
	1980	7	139	0	0	146	138
	1981	3	164	1	0	168	155
	1982	11	123	3	1	138	130
	1983	5	131	0	0	136	130
	1984	37	104	2	0	143	128

Table 4 (continued): State Trends in Truck-Tractor Fatal Accidents

State	Year	Number of Trailers				Vehicle	Accident
		None	One	More	Unknown	Total	Total
Oklahoma	1977	1	101	1	0	103	94
	1978	2	104	1	0	107	103
	1979	0	103	1	0	104	102
	1980	1	99	2	0	102	99
	1981	1	106	0	0	107	101
	1982	1	125	1	0	127	116
	1983	7	105	5	0	117	109
	1984	4	107	5	0	116	106
Oregon	1977	0	47	0	0	47	45
	1978	2	36	2	0	40	34
	1979	0	52	3	0	55	55
	1980	0	55	1	0	56	50
	1981	0	55	5	0	60	58
	1982	3	27	4	0	34	33
	1983	6	49	4	0	59	59
	1984	5	35	3	0	43	42
Pennsylvania	1977	0	188	0	0	188	180
	1978	66	199	1	0	266	252
	1979	68	212	0	0	280	272
	1980	64	172	0	0	236	218
	1981	27	181	0	0	208	191
	1982	0	168	0	8	176	164
	1983	0	189	2	12	203	187
	1984	0	169	5	6	180	170
Rhode Island	1978	0	1	0	0	1	1
	1980	0	1	0	0	1	1
	1981	0	6	0	0	6	6
	1982	0	2	0	0	2	2
	1983	0	2	0	0	2	2
	1984	0	2	0	0	2	2
South Carolina	1977	1	65	1	0	67	63
	1978	0	66	1	0	67	63
	1979	2	87	0	0	89	85
	1980	1	67	0	0	68	66
	1981	0	58	0	0	58	55
	1982	2	54	0	0	56	55
	1983	2	56	0	0	58	58
	1984	5	71	0	0	76	73

Table 4 (continued): State Trends in Truck-Tractor Fatal Accidents

State	Year	Number of Trailers				Vehicle Total	Accident Total
		None	One	More	Unknown		
South Dakota	1977	0	16	0	0	16	16
	1978	0	13	0	0	13	13
	1979	2	18	2	0	22	21
	1980	0	28	0	0	28	27
	1981	0	15	0	0	15	15
	1982	1	8	0	1	10	10
	1983	2	21	4	0	27	23
	1984	1	13	0	0	14	12
Tennessee	1977	7	111	0	0	118	108
	1978	0	112	0	0	112	107
	1979	3	76	0	0	79	73
	1980	3	78	0	0	81	73
	1981	5	76	0	0	81	78
	1982	7	91	0	0	98	95
	1983	2	89	2	0	93	91
	1984	4	82	1	0	87	84
Texas	1977	0	312	1	0	313	303
	1978	1	384	4	0	389	367
	1979	0	453	2	0	455	436
	1980	1	428	2	0	431	412
	1981	4	492	4	0	500	479
	1982	14	415	4	0	433	418
	1983	23	354	3	0	380	368
	1984	19	366	4	0	389	377
Utah	1977	1	34	0	0	35	34
	1978	0	39	0	0	39	38
	1979	0	46	0	0	46	40
	1980	0	29	5	0	34	34
	1981	0	28	3	0	31	28
	1982	2	26	4	1	33	30
	1983	1	31	4	0	36	34
	1984	2	44	4	0	50	46
Vermont	1977	0	2	0	0	2	2
	1978	0	7	0	0	7	6
	1979	0	9	0	0	9	9
	1980	0	3	0	0	3	3
	1981	0	4	0	0	4	4
	1982	0	7	0	0	7	7
	1983	1	6	0	0	7	7
	1984	0	9	0	0	9	9

Table 4 (continued): State Trends in Truck-Tractor Fatal Accidents

State	Year	Number of Trailers				Vehicle Total	Accident Total
		None	One	More	Unknown		
Virginia	1977	1	70	0	0	71	68
	1978	0	76	0	0	76	75
	1979	4	84	0	0	88	84
	1980	8	66	0	0	74	72
	1981	13	56	0	0	69	65
	1982	10	39	0	0	49	47
	1983	10	66	0	0	76	71
	1984	6	101	0	0	107	104
Washington	1977	0	36	16	0	52	52
	1978	0	53	1	0	54	50
	1979	0	70	0	0	70	66
	1980	0	46	0	0	46	44
	1981	0	42	5	0	47	46
	1982	0	35	4	2	41	39
	1983	0	29	5	0	34	33
	1984	2	38	7	0	47	45
West Virginia	1977	0	11	0	0	11	11
	1978	0	10	0	0	10	10
	1979	0	10	0	0	10	9
	1982	0	28	0	0	28	28
	1983	0	38	0	0	38	38
	1984	0	50	0	0	50	49
Wisconsin	1977	0	70	0	0	70	67
	1978	0	52	0	0	52	51
	1979	0	86	1	0	87	82
	1980	0	70	0	0	70	66
	1981	1	71	1	0	73	70
	1982	3	63	0	0	66	65
	1983	4	44	1	0	49	46
	1984	1	61	2	1	65	61
Wyoming	1977	1	32	1	0	34	31
	1978	2	50	3	0	55	50
	1979	2	44	3	0	49	44
	1980	0	27	2	0	29	29
	1981	0	36	1	0	37	34
	1982	0	21	4	0	25	23
	1983	0	26	0	0	26	24
	1984	1	16	0	0	17	15

## Roadway Types

Of the 3,794 fatal accidents involving a truck-tractor that occurred in 1984,

- 947 (25 percent) were on an Interstate road,
- 1,106 (29 percent) were on a U.S. route,
- 1,225 (32 percent) were on a state road, and
- 511 (13 percent) were on another class of trafficway.

The breakout by state is shown as Table 5.

Connecticut had the highest proportion of accidents on the Interstate system in 1984: 19 of the 26 truck-tractor fatal accidents in Connecticut (73 percent) were on an Interstate road. Hawaii, Rhode Island, and Vermont had no fatal truck-tractor accidents on their Interstate roads in 1984. Table 6 shows the data for all states, sorted by the percentage of accidents that occurred on the Interstate system. Only accidents with known trafficway classification were used in the percentage calculations.

All of Hawaii's fatal truck-tractor accidents in 1984 occurred on state roads; at least half of the truck-tractor fatal accidents in Pennsylvania, New Hampshire, Georgia, Vermont, and Rhode Island were on state roads in 1984. In contrast, relatively few truck-tractor fatal accidents occurred on state roads in Delaware, Colorado, Nevada, and Arizona. The details are included as Table 7. The list is ordered by the proportion of truck-tractor accidents that occurred on state roads, computed from accidents with known class trafficway.

Fatal truck-tractor accidents occurred more frequently on undivided roads (2,138, or 57 percent) than on divided roads (1,646, or 43 percent). The actual occurrences are shown by state in Table 8. The percentage of accidents that occurred on divided roadways was used to sort the state list, and the results are shown in Table 9. Roads with unknown roadway flow were excluded from the percentage calculations. Most truck-tractor fatal accidents in Delaware and Connecticut (but none in Vermont or Rhode Island) were on divided roads.

Fatal truck-tractor accidents in 1984 occurred more frequently on 55 mile-per-hour posted roads (2,698, or 72 percent) than on lower speed roads. The counts are shown in Table 10. The percentage data are shown, sorted by the proportion of accidents on 55 mile-per-hour roads, in Table 11. The percentages shown were computed based on the accidents with known speed limits. Only eight states had fewer than half of their truck-tractor fatal accidents on roads posted below the national maximum speed limit in 1984: Vermont, Rhode Island, Hawaii, Maine, New Hampshire, Massachusetts, New Jersey, and Tennessee.

Table 5: Class Trafficway for Truck-Tractor Fatal Accidents in 1984

State	Class Trafficway					Total
	Inter- state	US Route	State Road	Other Road	Unknown Road	
Alabama	29	39	36	15	0	119
Alaska	1	0	1	1	0	3
Arizona	32	16	6	20	0	74
Arkansas	14	35	17	3	0	69
California	94	23	112	96	0	325
Colorado	12	23	3	4	0	42
Connecticut	19	1	3	3	0	26
Delaware	1	10	0	1	0	12
Florida	41	43	102	36	0	222
Georgia	35	3	94	13	0	145
Hawaii	0	0	3	0	0	3
Idaho	3	13	6	2	0	24
Illinois	23	22	43	16	0	104
Indiana	29	53	34	4	0	120
Iowa	10	19	12	8	0	49
Kansas	6	39	16	8	0	69
Kentucky	29	30	17	0	0	76
Louisiana	24	30	39	7	1	101
Maine	3	8	4	2	0	17
Maryland	16	16	11	5	1	49
Massachusetts	12	8	14	4	0	38
Michigan	22	23	28	22	0	95
Minnesota	7	21	23	8	0	59
Mississippi	9	35	25	2	3	74
Missouri	27	35	20	4	0	86
Montana	7	12	8	3	0	30
Nebraska	6	11	11	4	0	32
Nevada	7	4	1	1	0	13
New Hampshire	2	0	4	0	0	6
New Jersey	18	16	22	26	0	82
New Mexico	18	22	9	1	0	50
New York	33	9	43	25	0	110
North Carolina	24	58	43	11	0	136
North Dakota	3	4	3	1	0	11
Ohio	36	34	45	13	0	128
Oklahoma	32	34	25	15	0	106
Oregon	7	12	15	8	0	42
Pennsylvania	50	0	114	6	0	170
Rhode Island	0	0	1	1	0	2
South Carolina	13	34	25	1	0	73
South Dakota	2	7	2	1	0	12
Tennessee	30	24	18	12	0	84
Texas	95	141	70	71	0	377
Utah	15	13	14	4	0	46
Vermont	0	2	5	2	0	9
Virginia	20	57	19	8	0	104
Washington	11	10	21	3	0	45
West Virginia	6	28	13	2	0	49
Wisconsin	10	23	22	6	0	61
Wyoming	4	6	3	2	0	15
National Totals	947	1,106	1,225	511	5	3,794

**Table 6: Truck-Tractor Fatal Accidents on Interstate Roads in 1984  
by Decreasing Relative Frequency**

<u>State</u>	<u>Interstate</u>	<u>Total</u>	<u>Percent Interstate</u>
Connecticut	19	26	73
Nevada	7	13	54
Arizona	32	74	43
Kentucky	29	76	38
New Mexico	18	50	36
Tennessee	30	84	36
Alaska	1	3	33
Maryland	16	49	33
New Hampshire	2	6	33
Utah	15	46	33
Massachusetts	12	38	32
Missouri	27	86	31
Oklahoma	32	106	30
New York	33	110	30
Pennsylvania	50	170	29
California	94	325	29
Colorado	12	42	29
Ohio	36	128	28
North Dakota	3	11	27
Wyoming	4	15	27
Texas	95	377	25
Washington	11	45	24
Alabama	29	119	24
Indiana	29	120	24
Georgia	35	145	24
Louisiana	24	101	24
Montana	7	30	23
Michigan	22	95	23
Illinois	23	104	22
New Jersey	18	82	22
Iowa	10	49	20
Arkansas	14	69	20
Virginia	20	104	19
Nebraska	6	32	19
Florida	41	222	18
South Carolina	13	73	18
Maine	3	17	18
North Carolina	24	136	18
Oregon	7	42	17
South Dakota	2	12	17
Wisconsin	10	61	16
Mississippi	9	74	13
Idaho	3	24	13
West Virginia	6	49	12
Minnesota	7	59	12
Kansas	6	69	9
Delaware	1	12	8
Hawaii	0	3	0
Rhode Island	0	2	0
<u>Vermont</u>	<u>0</u>	<u>9</u>	<u>0</u>
<b>National Totals</b>	<b>947</b>	<b>3,794</b>	<b>25</b>

Table 7: Truck-Tractor Fatal Accidents on State Roads in 1984  
by Decreasing Relative Frequency

<u>State</u>	<u>State Road</u>	<u>Total</u>	<u>Percent State Road</u>
Hawaii	3	3	100
Pennsylvania	114	170	67
New Hampshire	4	6	67
Georgia	94	145	65
Vermont	5	9	56
Rhode Island	1	2	50
Washington	21	45	47
Florida	102	222	46
Illinois	43	104	41
New York	43	110	39
Louisiana	39	101	39
Minnesota	23	59	39
Massachusetts	14	38	37
Wisconsin	22	61	36
Oregon	15	42	36
Mississippi	25	74	35
Ohio	45	128	35
California	112	325	34
Nebraska	11	32	34
South Carolina	25	73	34
Alaska	1	3	33
North Carolina	43	136	32
Utah	14	46	30
Alabama	36	119	30
Michigan	28	95	29
Indiana	34	120	28
North Dakota	3	11	27
New Jersey	22	82	27
Montana	8	30	27
West Virginia	13	49	27
Idaho	6	24	25
Arkansas	17	69	25
Iowa	12	49	24
Oklahoma	25	106	24
Maine	4	17	24
Missouri	20	86	23
Kansas	16	69	23
Maryland	11	49	23
Kentucky	17	76	22
Tennessee	18	84	21
Wyoming	3	15	20
Texas	70	377	19
Virginia	19	104	18
New Mexico	9	50	18
South Dakota	2	12	17
Connecticut	3	26	12
Arizona	6	74	8
Nevada	1	13	8
Colorado	3	42	7
<u>Delaware</u>	<u>0</u>	<u>12</u>	<u>0</u>
National Totals	1,225	3,794	30

Table 8: Roadway Flow for Truck-Tractor Fatal Accidents in 1984

<u>State</u>	<u>Not Divided</u>	<u>Divided</u>	<u>Unknown</u>	<u>Total</u>
Alabama	67	52	0	119
Alaska	2	1	0	3
Arizona	31	43	0	74
Arkansas	51	18	0	69
California	150	173	2	325
Colorado	24	18	0	42
Connecticut	5	21	0	26
Delaware	2	10	0	12
Florida	103	119	0	222
Georgia	95	50	0	145
Hawaii	2	1	0	3
Idaho	18	6	0	24
Illinois	63	41	0	104
Indiana	62	58	0	120
Iowa	39	10	0	49
Kansas	58	11	0	69
Kentucky	37	37	2	76
Louisiana	61	40	0	101
Maine	14	3	0	17
Maryland	17	32	0	49
Massachusetts	21	17	0	38
Michigan	49	46	0	95
Minnesota	40	19	0	59
Mississippi	35	39	0	74
Missouri	47	39	0	86
Montana	23	7	0	30
Nebraska	25	7	0	32
Nevada	4	9	0	13
New Hampshire	4	2	0	6
New Jersey	40	42	0	82
New Mexico	20	30	0	50
New York	57	51	2	110
North Carolina	95	41	0	136
North Dakota	6	5	0	11
Ohio	75	50	3	128
Oklahoma	64	42	0	106
Oregon	33	9	0	42
Pennsylvania	105	64	1	170
Rhode Island	2	0	0	2
South Carolina	42	31	0	73
South Dakota	8	4	0	12
Tennessee	37	47	0	84
Texas	193	184	0	377
Utah	29	17	0	46
Vermont	9	0	0	9
Virginia	56	48	0	104
Washington	33	12	0	45
West Virginia	34	15	0	49
Wisconsin	40	21	0	61
<u>Wyoming</u>	<u>11</u>	<u>4</u>	<u>0</u>	<u>15</u>
National Totals	2,138	1,646	10	3,794

Table 9: Truck-Tractor Fatal Accidents on Divided Roadways in 1984  
by Decreasing Relative Frequency

<u>State</u>	<u>Divided</u>	<u>Total</u>	<u>Percent Divided</u>
Delaware	10	12	83
Connecticut	21	26	81
Nevada	9	13	69
Maryland	32	49	65
New Mexico	30	50	60
Arizona	43	74	58
Tennessee	47	84	56
Florida	119	222	54
California	173	325	54
Mississippi	39	74	53
New Jersey	42	82	51
Kentucky	37	76	50
Texas	184	377	49
Michigan	46	95	48
Indiana	58	120	48
New York	51	110	47
Virginia	48	104	46
North Dakota	5	11	45
Missouri	39	86	45
Massachusetts	17	38	45
Alabama	52	119	44
Colorado	18	42	43
South Carolina	31	73	42
Ohio	50	128	40
Oklahoma	42	106	40
Louisiana	40	101	40
Illinois	41	104	39
Pennsylvania	64	170	38
Utah	17	46	37
Georgia	50	145	34
Wisconsin	21	61	34
Alaska	1	3	33
Hawaii	1	3	33
New Hampshire	2	6	33
South Dakota	4	12	33
Minnesota	19	59	32
West Virginia	15	49	31
North Carolina	41	136	30
Washington	12	45	27
Wyoming	4	15	27
Arkansas	18	69	26
Idaho	6	24	25
Montana	7	30	23
Nebraska	7	32	22
Oregon	9	42	21
Iowa	10	49	20
Maine	3	17	18
Kansas	11	69	16
Rhode Island	0	2	0
<u>Vermont</u>	<u>0</u>	<u>9</u>	<u>0</u>
National Totals	1,646	3,794	43

Table 10: Speed Limit for Truck-Tractor Fatal Accidents in 1984

State	Speed Limit			Total
	Under 55	At 55	Unknown	
Alabama	15	104	0	119
Alaska	1	1	1	3
Arizona	29	45	0	74
Arkansas	14	53	2	69
California	69	254	2	325
Colorado	8	34	0	42
Connecticut	11	15	0	26
Delaware	6	6	0	12
Florida	85	134	3	222
Georgia	43	99	3	145
Hawaii	3	0	0	3
Idaho	11	13	0	24
Illinois	40	64	0	104
Indiana	36	83	1	120
Iowa	6	43	0	49
Kansas	12	56	1	69
Kentucky	11	65	0	76
Louisiana	30	70	1	101
Maine	13	4	0	17
Maryland	22	24	3	49
Massachusetts	23	14	1	38
Michigan	32	56	7	95
Minnesota	10	46	3	59
Mississippi	19	55	0	74
Missouri	17	69	0	86
Montana	3	27	0	30
Nebraska	7	25	0	32
Nevada	2	11	0	13
New Hampshire	4	2	0	6
New Jersey	49	33	0	82
New Mexico	6	43	1	50
New York	34	64	12	110
North Carolina	36	98	2	136
North Dakota	2	9	0	11
Ohio	29	96	3	128
Oklahoma	19	87	0	106
Oregon	8	34	0	42
Pennsylvania	59	109	2	170
Rhode Island	1	0	1	2
South Carolina	25	48	0	73
South Dakota	2	10	0	12
Tennessee	46	37	1	84
Texas	68	309	0	377
Utah	6	38	2	46
Vermont	9	0	0	9
Virginia	24	78	2	104
Washington	12	33	0	45
West Virginia	8	41	0	49
Wisconsin	13	47	1	61
Wyoming	3	12	0	15
National Totals	1,041	2,698	55	3,794

Table 12: Registration State of Truck-Tractors in Fatal Accidents in 1984

Registration Type and Number

Table 11: Truck-Tractor Fatal Accidents on 55 mph Roads in 1984  
by Decreasing Relative Frequency

<u>State</u>	<u>At 55</u>	<u>Total</u>	<u>Percent At 55</u>
Montana	27	30	90
Iowa	43	49	88
New Mexico	43	50	88
Alabama	104	119	87
Utah	38	46	86
Kentucky	65	76	86
Nevada	11	13	85
West Virginia	41	49	84
South Dakota	10	12	83
Kansas	56	69	82
Minnesota	46	59	82
Oklahoma	87	106	82
Texas	309	377	82
North Dakota	9	11	82
Colorado	34	42	81
Oregon	34	42	81
Missouri	69	86	80
Wyoming	12	15	80
Arkansas	53	69	79
California	254	325	79
Wisconsin	47	61	78
Nebraska	25	32	78
Ohio	96	128	77
Virginia	78	104	76
Mississippi	55	74	74
Washington	33	45	73
North Carolina	98	136	73
Louisiana	70	101	70
Indiana	83	120	70
Georgia	99	145	70
South Carolina	48	73	66
New York	64	110	65
Pennsylvania	109	170	65
Michigan	56	95	64
Illinois	64	104	62
Florida	134	222	61
Arizona	45	74	61
Connecticut	15	26	58
Idaho	13	24	54
Maryland	24	49	52
Alaska	1	3	50
Delaware	6	12	50
Tennessee	37	84	45
New Jersey	33	82	40
Massachusetts	14	38	38
New Hampshire	2	6	33
Maine	4	17	24
Hawaii	0	3	0
Rhode Island	0	2	0
<u>Vermont</u>	<u>0</u>	<u>9</u>	<u>0</u>
National Totals	2,698	3,794	71

Table 13: Truck-Tractors with a Single State of Registration  
in Fatal Accidents in 1984  
by Decreasing Odds of In-State to Other-State Registration

State	Registration Type		In-State / Other State
	In-State	Other State	
Alaska	3	0	.
Hawaii	3	0	.
Minnesota	46	9	5.11
Nebraska	24	5	4.80
Florida	171	51	3.35
California	191	63	3.03
Texas	287	97	2.96
Wisconsin	38	13	2.92
Oregon	32	11	2.91
North Carolina	102	38	2.68
North Dakota	5	2	2.50
Washington	29	12	2.42
Nevada	7	3	2.33
Georgia	92	44	2.09
Ohio	84	44	1.91
Michigan	56	30	1.87
Maine	9	5	1.80
Mississippi	43	28	1.54
New Hampshire	3	2	1.50
Vermont	3	2	1.50
Indiana	67	47	1.43
Louisiana	63	45	1.40
Massachusetts	20	15	1.33
Alabama	62	52	1.19
South Carolina	41	35	1.17
Oklahoma	60	53	1.13
Kansas	27	24	1.13
Colorado	23	21	1.10
Montana	14	13	1.08
New Jersey	41	41	1.00
South Dakota	6	6	1.00
Utah	24	24	1.00
Arizona	32	34	0.94
Illinois	35	38	0.92
Arkansas	23	26	0.88
Pennsylvania	76	87	0.87
Virginia	49	57	0.86
New York	45	60	0.75
Iowa	7	11	0.64
Idaho	9	15	0.60
Tennessee	18	33	0.55
Missouri	20	40	0.50
Maryland	17	35	0.49
New Mexico	14	31	0.45
Wyoming	5	12	0.42
West Virginia	13	36	0.36
Delaware	3	9	0.33
Kentucky	13	42	0.31
Connecticut	5	19	0.26
<u>Rhode Island</u>	<u>0</u>	<u>2</u>	<u>0.00</u>
National Totals	2,060	1,422	1.45

Alabama, Connecticut, West Virginia, and Delaware, the drivers held other-state licenses more frequently than they held in-state licenses. The results are shown in Table 17.

Table 14: Other-State Truck-Tractor Fatal Accidents in 1984  
Most Common Combinations of Accident State and Registration State

<u>Registration State</u>	<u>Accident State</u>	<u>Occurrences</u>
North Carolina	Virginia	22
New Jersey	New York	21
North Carolina	South Carolina	19
Texas	Oklahoma	18
Oklahoma	Texas	16
Texas	Louisiana	14
Indiana	Ohio	14
Florida	Alabama	13
New Jersey	Pennsylvania	13
Alabama	Georgia	12
Pennsylvania	New Jersey	12
California	Arizona	11
Illinois	Indiana	11
Oregon	California	10
Texas	New Mexico	10
Georgia	Florida	9
Mississippi	Louisiana	9
Ohio	Michigan	9
Pennsylvania	New York	9
South Carolina	North Carolina	9
Michigan	Ohio	9
Ohio	Pennsylvania	9
Texas	California	8
Washington	California	8
North Carolina	Florida	8
Ohio	Kentucky	8
Virginia	North Carolina	8
Georgia	Alabama	7
Texas	Arizona	7
Alabama	Florida	7
Oklahoma	Kansas	7
Alabama	Louisiana	7
Virginia	Maryland	7
Indiana	Michigan	7
Alabama	Mississippi	7
Kansas	Missouri	7
Ohio	New York	7
Alabama	Texas	7
Indiana	Texas	7
Kansas	Texas	7
Ohio	West Virginia	7
Mississippi	Alabama	6
North Carolina	Alabama	6
North Carolina	Georgia	6
Montana	Idaho	6
Ohio	Indiana	6
New York	New Jersey	6
California	New Mexico	6
New York	Pennsylvania	6
Missouri	Texas	6
Oregon	Washington	6

**Table 14 (continued): Other-State Truck-Tractor Fatal Accidents in 1984  
Most Common Combinations of Accident State and Registration State**

<u>Registration State</u>	<u>Accident State</u>	<u>Occurrences</u>
Florida	Georgia	5
Indiana	Illinois	5
Michigan	Illinois	5
Wisconsin	Illinois	5
Indiana	Kentucky	5
Tennessee	Kentucky	5
Kansas	Oklahoma	5
Washington	Oregon	5
Georgia	South Carolina	5
Iowa	Texas	5
Louisiana	Texas	5
Tennessee	Texas	5
Maryland	Virginia	5
Tennessee	Alabama	4
Texas	Arkansas	4
Nevada	California	4
Utah	California	4
Michigan	Indiana	4
Nebraska	Kansas	4
Florida	Maryland	4
Pennsylvania	Maryland	4
Georgia	Mississippi	4
Illinois	Missouri	4
Idaho	Montana	4
Maryland	New Jersey	4
Indiana	New York	4
Florida	North Carolina	4
Illinois	Ohio	4
Pennsylvania	Ohio	4
Arkansas	Oklahoma	4
Missouri	Oklahoma	4
California	Pennsylvania	4
Illinois	Pennsylvania	4
Indiana	Pennsylvania	4
Kansas	Pennsylvania	4
Maryland	Pennsylvania	4
North Carolina	Pennsylvania	4
Georgia	Tennessee	4
Illinois	Texas	4
Nebraska	Texas	4
California	Utah	4
Indiana	West Virginia	4

Table 15: Ratio of Registration State to Accident State  
for Truck-Tractor Fatal Accidents in 1984

<u>State</u>	<u>Registrations</u>	<u>Accidents</u>	<u>Registrations / Accidents</u>
District of Columbia	2	0	.
Rhode Island	5	2	2.50
Nevada	22	10	2.20
Nebraska	62	29	2.14
North Dakota	13	7	1.86
South Dakota	22	12	1.83
Vermont	9	5	1.80
New Hampshire	8	5	1.60
Delaware	19	12	1.58
North Carolina	211	140	1.51
Oregon	60	43	1.40
Minnesota	75	55	1.36
Hawaii	4	3	1.33
Indiana	151	114	1.32
Wisconsin	67	51	1.31
Kansas	66	51	1.29
Iowa	23	18	1.28
New Jersey	104	82	1.27
Washington	51	41	1.24
Montana	33	27	1.22
Illinois	86	73	1.18
Tennessee	59	51	1.16
Ohio	148	128	1.16
Alabama	125	114	1.10
Georgia	145	136	1.07
Michigan	90	86	1.05
Mississippi	72	71	1.01
Alaska	3	3	1.00
Florida	220	222	0.99
Texas	376	384	0.98
California	248	254	0.98
Arkansas	47	49	0.96
Utah	45	48	0.94
Oklahoma	105	113	0.93
Maine	13	14	0.93
South Carolina	69	76	0.91
Idaho	21	24	0.88
Massachusetts	29	35	0.83
Colorado	36	44	0.82
Virginia	80	106	0.75
Louisiana	79	108	0.73
Maryland	38	52	0.73
Pennsylvania	118	163	0.72
New York	64	105	0.61
Missouri	36	60	0.60
Wyoming	10	17	0.59
Arizona	36	66	0.55
Kentucky	27	55	0.49
New Mexico	21	45	0.47
West Virginia	21	49	0.43
Connecticut	8	24	0.33
<u>National Totals</u>	<u>3,482</u>	<u>3,482</u>	<u>1.00</u>

Table 16: Driver License State  
for Truck-Tractors in Fatal Accidents in 1984

State	Driver License State Type				Total
	In- State	Other State	Other Type	Unknown Type	
Alabama	53	61	0	9	123
Alaska	3	0	0	0	3
Arizona	34	39	0	3	77
Arkansas	33	39	0	1	73
California	254	82	1	8	345
Colorado	24	20	0	1	45
Connecticut	6	21	0	0	27
Delaware	4	8	0	0	12
Florida	172	57	0	2	232
Georgia	91	58	0	2	151
Hawaii	3	0	0	0	3
Idaho	9	15	1	0	25
Illinois	60	48	0	1	109
Indiana	71	58	0	3	132
Iowa	32	19	0	0	51
Kansas	28	42	0	0	70
Kentucky	32	48	1	1	82
Louisiana	68	41	0	3	112
Maine	11	4	2	0	17
Maryland	20	32	1	0	53
Massachusetts	20	17	1	1	39
Michigan	64	29	2	1	96
Minnesota	45	14	1	0	60
Mississippi	49	32	0	0	81
Missouri	36	51	0	1	88
Montana	15	13	2	0	30
Nebraska	21	13	0	0	34
Nevada	7	5	0	1	13
New Hampshire	2	2	2	0	6
New Jersey	41	46	2	2	91
New Mexico	20	29	1	1	51
New York	51	54	10	2	117
North Carolina	103	39	0	1	143
North Dakota	5	3	3	0	11
Ohio	83	57	0	3	143
Oklahoma	58	56	0	2	116
Oregon	32	10	0	1	43
Pennsylvania	101	72	2	5	180
Rhode Island	0	2	0	0	2
South Carolina	39	36	0	1	76
South Dakota	6	8	0	0	14
Tennessee	43	41	0	3	87
Texas	296	83	0	10	389
Utah	25	25	0	0	50
Vermont	3	2	4	0	9
Virginia	52	55	0	0	107
Washington	33	7	5	2	47
West Virginia	14	35	1	0	50
Wisconsin	47	18	0	0	65
Wyoming	6	11	0	0	17
National Totals	2,325	1,557	42	71	3,997

Table 17: Ratio of In-State to Other-State Driver Licenses  
for Truck-Tractor Fatal Accidents in 1984  
by Decreasing Odds of In-State to Other-State Licenses

<u>Accident State</u>	<u>Driver License State</u>		<u>In-State / Other State</u>
	<u>In-State</u>	<u>Other State</u>	
Alaska	3	0	.
Hawaii	3	0	.
Washington	33	7	4.71
Texas	296	83	3.57
Minnesota	45	14	3.21
Oregon	32	10	3.20
California	254	82	3.10
Florida	172	57	3.02
Maine	11	4	2.75
North Carolina	103	39	2.64
Wisconsin	47	18	2.61
Michigan	64	29	2.21
Iowa	32	19	1.68
North Dakota	5	3	1.67
Louisiana	68	41	1.66
Nebraska	21	13	1.62
Georgia	91	58	1.57
Mississippi	49	32	1.53
Vermont	3	2	1.50
Ohio	83	57	1.46
Pennsylvania	101	72	1.40
Nevada	7	5	1.40
Illinois	60	48	1.25
Indiana	71	58	1.22
Colorado	24	20	1.20
Massachusetts	20	17	1.18
Montana	15	13	1.15
South Carolina	39	36	1.08
Tennessee	43	41	1.05
Oklahoma	58	56	1.04
New Hampshire	2	2	1.00
Utah	25	25	1.00
Virginia	52	55	0.95
New York	51	54	0.94
New Jersey	41	46	0.89
Arizona	34	39	0.87
Alabama	53	61	0.87
Arkansas	33	39	0.85
South Dakota	6	8	0.75
Missouri	36	51	0.71
New Mexico	20	29	0.69
Kansas	28	42	0.67
Kentucky	32	48	0.67
Maryland	20	32	0.63
Idaho	9	15	0.60
Wyoming	6	11	0.55
Delaware	4	8	0.50
West Virginia	14	35	0.40
Connecticut	6	21	0.29
<u>Rhode Island</u>	<u>0</u>	<u>2</u>	<u>0.00</u>
National Totals	2,325	1,557	1.49

## Other Vehicles and Pedestrians/Pedalcyclists

In 1984, 23 percent of the truck-tractor fatal accidents involved no other vehicle; 65 percent involved one other vehicle; the remainder, 12 percent, involved at least two other vehicles. The 1984 state data are shown in Table 18.

Table 19 shows that the number of vehicles involved in a truck-tractor fatal accident varied by state. Half of the truck-tractor fatal accidents in Montana and Rhode Island were single-vehicle accidents. Most of the truck-tractor fatal accidents in Mississippi, Michigan, Wisconsin, and Nevada involved two or more vehicles.

In two-vehicle truck-tractor fatal accidents, the most common other vehicle was a car. Table 20 shows that in 1984 there were 1,656 cars involved in a fatal crash with a truck-tractor; there were also 492 pickups and vans involved with truck-tractors. In 79 accidents there were two truck-tractors involved together (2,557 truck-tractors minus 2,478 truck-tractor accidents).

There were also 336 truck-tractor collisions which resulted in the death of a pedestrian or a pedalcyclist in 1984. Table 21 shows that these 336 accidents represented 9 percent of all truck-tractor fatal accidents and 4 percent of all accidents with a pedestrian or pedalcyclist fatality. The results vary somewhat by state, in part because of small numbers of cases.

Table 18: Number of Vehicles in Truck-Tractor Fatal Accidents in 1984

State	Number of Vehicles			Total
	One	Two	More	
Alabama	33	75	11	119
Alaska	1	1	1	3
Arizona	25	44	5	74
Arkansas	15	45	9	69
California	71	198	56	325
Colorado	15	25	2	42
Connecticut	8	14	4	26
Delaware	2	10	0	12
Florida	40	157	25	222
Georgia	29	105	11	145
Hawaii	1	2	0	3
Idaho	8	14	2	24
Illinois	19	74	11	104
Indiana	26	81	13	120
Iowa	8	31	10	49
Kansas	15	48	6	69
Kentucky	16	47	13	76
Louisiana	24	62	15	101
Maine	6	11	0	17
Maryland	11	33	5	49
Massachusetts	13	22	3	38
Michigan	11	69	15	95
Minnesota	11	43	5	59
Mississippi	6	60	8	74
Missouri	18	56	12	86
Montana	15	15	0	30
Nebraska	6	23	3	32
Nevada	2	11	0	13
New Hampshire	1	3	2	6
New Jersey	17	52	13	82
New Mexico	17	31	2	50
New York	34	64	12	110
North Carolina	24	92	20	136
North Dakota	2	5	4	11
Ohio	26	77	25	128
Oklahoma	21	74	11	106
Oregon	12	24	6	42
Pennsylvania	44	104	22	170
Rhode Island	1	1	0	2
South Carolina	17	51	5	73
South Dakota	3	7	2	12
Tennessee	24	47	13	84
Texas	99	263	15	377
Utah	19	21	6	46
Vermont	2	5	2	9
Virginia	25	62	17	104
Washington	15	26	4	45
West Virginia	8	37	4	49
Wisconsin	8	48	5	61
Wyoming	3	8	4	15
National Totals	877	2,478	439	3,794

**Table 19: Percent Single-Vehicle Truck-Tractor Fatal Accidents in 1984  
by Decreasing Relative Frequency**

<u>State</u>	<u>Percent of Accidents:</u>			<u>Count of Total Accidents</u>
	<u>Single- Vehicle</u>	<u>Two- Vehicle</u>	<u>Multi- Vehicle</u>	
Montana	50	50	0	30
Rhode Island	50	50	0	2
Utah	41	46	13	46
Colorado	36	60	5	42
Maine	35	65	0	17
Massachusetts	34	58	8	38
New Mexico	34	62	4	50
Arizona	34	59	7	74
Alaska	33	33	33	3
Hawaii	33	67	0	3
Idaho	33	58	8	24
Washington	33	58	9	45
New York	31	58	11	110
Connecticut	31	54	15	26
Oregon	29	57	14	42
Tennessee	29	56	15	84
Alabama	28	63	9	119
Texas	26	70	4	377
Pennsylvania	26	61	13	170
South Dakota	25	58	17	12
Virginia	24	60	16	104
Louisiana	24	61	15	101
South Carolina	23	70	7	73
Maryland	22	67	10	49
Vermont	22	56	22	9
California	22	61	17	325
Arkansas	22	65	13	69
Kansas	22	70	9	69
Indiana	22	68	11	120
Kentucky	21	62	17	76
Missouri	21	65	14	86
New Jersey	21	63	16	82
Ohio	20	60	20	128
Georgia	20	72	8	145
Wyoming	20	53	27	15
Oklahoma	20	70	10	106
Nebraska	19	72	9	32
Minnesota	19	73	8	59
Illinois	18	71	11	104
North Dakota	18	45	36	11
Florida	18	71	11	222
North Carolina	18	68	15	136
Delaware	17	83	0	12
New Hampshire	17	50	33	6
Iowa	16	63	20	49
West Virginia	16	76	8	49
Nevada	15	85	0	13
Wisconsin	13	79	8	61
Michigan	12	73	16	95
<u>Mississippi</u>	<u>8</u>	<u>81</u>	<u>11</u>	<u>74</u>
National Totals	23	65	12	3,794

Table 20: Body Types in Two-Vehicle Truck-Tractor Fatal Accidents in 1984

<u>State</u>	<u>Car</u>	<u>Pickup or Van</u>	<u>Truck- Tractor</u>	<u>Other Truck</u>	<u>Other</u>	<u>Vehicle Total</u>	<u>Accident Total</u>
Alabama	48	18	77	1	6	150	75
Alaska	1	0	1	0	0	2	1
Arizona	25	7	47	0	9	88	44
Arkansas	26	14	48	1	1	90	45
California	113	51	206	1	25	396	198
Colorado	16	4	26	1	3	50	25
Connecticut	10	0	15	0	3	28	14
Delaware	8	0	10	0	2	20	10
Florida	99	32	160	3	20	314	157
Georgia	79	18	107	2	4	210	105
Hawaii	2	0	2	0	0	4	2
Idaho	7	4	14	0	3	28	14
Illinois	58	6	76	0	8	148	74
Indiana	64	9	84	1	4	162	81
Iowa	16	6	33	0	7	62	31
Kansas	31	12	49	1	3	96	48
Kentucky	31	9	50	1	3	94	47
Louisiana	34	23	65	0	2	124	62
Maine	6	3	11	1	1	22	11
Maryland	21	4	34	1	6	66	33
Massachusetts	19	1	23	0	1	44	22
Michigan	51	13	70	0	4	138	69
Minnesota	33	6	43	0	4	86	43
Mississippi	35	15	66	0	4	120	60
Missouri	42	8	56	2	4	112	56
Montana	6	6	15	0	3	30	15
Nebraska	14	4	24	0	4	46	23
Nevada	4	6	11	0	1	22	11
New Hampshire	3	0	3	0	0	6	3
New Jersey	40	8	52	0	4	104	52
New Mexico	20	9	32	0	1	62	31
New York	50	9	65	2	2	128	64
North Carolina	67	16	96	0	5	184	92
North Dakota	3	1	5	0	1	10	5
Ohio	54	11	79	5	5	154	77
Oklahoma	47	20	76	3	2	148	74
Oregon	14	6	24	0	4	48	24
Pennsylvania	74	11	109	5	9	208	104
Rhode Island	1	0	1	0	0	2	1
South Carolina	37	10	52	1	2	102	51
South Dakota	7	0	7	0	0	14	7
Tennessee	29	12	47	3	3	94	47
Texas	164	70	271	3	18	526	263
Utah	12	6	22	0	2	42	21
Vermont	3	1	5	1	0	10	5
Virginia	47	10	63	0	4	124	62
Washington	17	4	28	0	3	52	26
West Virginia	27	4	38	1	4	74	37
Wisconsin	36	4	51	3	2	96	48
<u>Wyoming</u>	<u>5</u>	<u>1</u>	<u>8</u>	<u>0</u>	<u>2</u>	<u>16</u>	<u>8</u>
National Totals	1,656	492	2,557	43	208	4,956	2,478

Table 21: Truck-Tractor:Pedestrian/Pedalcyclist Fatal Accidents in 1984

State	Counts of Accidents with			"Both" - Percent of	
	Truck-Tractor	Pedestrian	Both	Truck-Tractors	Pedestrians
Alabama	119	109	3	3	3
Alaska	3	26	0	0	0
Arizona	74	199	10	14	5
Arkansas	69	70	5	7	7
California	325	921	40	12	4
Colorado	42	76	3	7	4
Connecticut	26	79	3	12	4
Delaware	12	26	2	17	8
District of Columbia	0	27	0	.	0
Florida	222	724	23	10	3
Georgia	145	212	8	6	4
Hawaii	3	28	1	33	4
Idaho	24	20	0	0	0
Illinois	104	336	14	13	4
Indiana	120	121	11	9	9
Iowa	49	51	2	4	4
Kansas	69	49	4	6	8
Kentucky	76	91	1	1	1
Louisiana	101	183	10	10	5
Maine	17	30	3	18	10
Maryland	49	141	4	8	3
Massachusetts	38	130	4	11	3
Michigan	95	284	5	5	2
Minnesota	59	70	3	5	4
Mississippi	74	79	3	4	4
Missouri	86	115	2	2	2
Montana	30	11	1	3	9
Nebraska	32	33	3	9	9
Nevada	13	39	2	15	5
New Hampshire	6	24	0	0	0
New Jersey	82	275	11	13	4
New Mexico	50	109	8	16	7
New York	110	597	23	21	4
North Carolina	136	280	8	6	3
North Dakota	11	11	1	9	9
Ohio	128	220	11	9	5
Oklahoma	106	93	6	6	6
Oregon	42	83	4	10	5
Pennsylvania	170	321	18	11	6
Rhode Island	2	17	1	50	6
South Carolina	73	150	7	10	3
South Dakota	12	18	1	8	6
Tennessee	84	129	14	17	11
Texas	377	673	31	8	5
Utah	46	52	2	4	4
Vermont	9	12	0	0	0
Virginia	104	165	9	9	5
Washington	45	103	7	16	7
West Virginia	49	44	1	2	2
Wisconsin	61	100	3	5	3
Wyoming	15	5	0	0	0
National Totals	3,794	7,761	336	9	4

**Truck-Tractor Accident Statistics:  
Occupant Factors and Injury Outcome  
(August 1985)**

11/11/2020 10:11:11 AM  
11/11/2020 10:11:11 AM

**Contents**

<b><u>Page</u></b>	<b><u>Topic</u></b>
44	<b>Purpose</b>
44	<b>Source</b>
44	<b>Eight-Year Fatality Comparison</b>
47	<b>Comparison of Fatalities by Vehicle Type</b>
50	<b>Vehicle Occupancy</b>
57	<b>Maximum Injury Severity</b>
63	<b>Individual Injuries</b>

## Purpose

This report is a collection of tables that describe truck-tractor occupant injuries and fatalities. Throughout this report, the term "truck-tractor" is used to refer to all vehicles which include a truck-tractor as the power unit -- both trailerless truck-tractors and truck-tractors pulling one or more trailers.

The text is provided to help the reader understand the tables and to point out interesting results, but it is not an analysis of truck-tractor occupant injuries. It is hoped that the tables will be useful to analysts of truck safety issues, by providing recent data and by suggesting research topics. This is the second in a continuing series of reports which focus on aspects of truck safety as revealed in national accident data.

## Source

All tables in this report are derived from either the Fatal Accident Reporting System (FARS), with updates through May 1985, or the National Accident Sampling System (NASS), with updates through June 1985. Both FARS and NASS are operated and maintained by the National Center for Statistics and Analysis (NCSA), an office of the National Highway Traffic Safety Administration (United States Department of Transportation).

## Eight-Year Fatality Comparison

Over the past eight years (1977 through 1984) there have been an average of 871 truck-tractor occupant fatalities per year. In contrast, there were an average of 25,844 car occupant fatalities and 306 straight truck occupant fatalities per year during this time. Car and straight truck occupant fatalities declined for five of the seven annual changes; truck-tractor occupant fatalities declined for only three of the seven annual changes. The data are shown in Table 1.

Table 1: Number of Fatalities  
Eight-Year Comparison by Vehicle Type

<u>Year</u>	<u>Automobile</u>	<u>Straight Truck</u>	<u>Truck-Tractor</u>
1977	26,782	365	920
1978	28,153	418	975
1979	27,808	404	1,027
1980	27,449	374	887
1981	26,645	292	840
1982	23,330	197	728
1983	22,979	225	735
1984	23,609	176	853

Truck-tractor body type coding changes are discussed in a previous related report ("Truck-Tractor Accident Statistics: State Issues," Susan C. Partyka,

NLSA, June 1985). "Automobiles" includes all cars plus all car-based vehicles: body type codes 01-09 for 1977 through 1981, body type codes 01-11 plus 67 for 1982 through 1984. "Straight trucks" are those with a gross vehicle weight rating over 10,000 pounds or of unknown weight: body type codes 53-56 for 1977 through 1981, body type codes 70-72 plus 78 for 1982 through 1984. The number of cases with unknown vehicle type, and in particular unknown truck type (which are not included in these tables), varies from year to year. This complicates the analysis of truck trends.

The median age for occupant fatalities (the age for which as many fatalities were younger as were older) has been rising gradually over the eight-year period 1977 through 1984. In 1977 the median age of truck-tractor fatalities was 35; in 1984 the corresponding median was 37. Similar increases occurred for car and straight truck occupants, as shown in Table 2. The changes in the age of fatalities probably largely reflect changes in the age composition of the general population.

Table 2: Median Age of Fatalities  
Eight-Year Comparison by Vehicle Type

<u>Year</u>	<u>Automobile</u>	<u>Straight Truck</u>	<u>Truck-Tractor</u>
1977	26	31	35
1978	26	30	35
1979	26	29	34
1980	27	32	35
1981	28	30	35
1982	28	31	35
1983	28	33	38
1984	29	34	37

Table 3 shows that about 6 percent of all truck-tractor occupant fatalities were female. There have been small differences from year to year over the past eight years, but no noticeable trend towards more (or less) female involvement.

Table 3: Gender of Fatalities  
Eight-Year Comparison of the Proportion of Female Involvement

<u>Year</u>	<u>Total Fatalities</u>	<u>Known Gender</u>	<u>Known Female</u>	<u>Percent Female</u>
1977	920	920	51	5.5 %
1978	975	975	65	6.7 %
1979	1,027	1,027	54	5.3 %
1980	887	887	59	6.7 %
1981	840	840	56	6.7 %
1982	728	728	50	6.9 %
1983	735	735	39	5.3 %
1984	853	852	57	6.7 %

All percentages in this report are based upon cases with known data -- for example, percent female involvement is computed as a percentage of people whose gender is known. The number of cases with unknown data for a particular data element is shown for each table to allow additional computations from the data, to allow verification of the results, and to indicate possible difficulties in data acquisition that may lead to reporting biases.

About one-sixth of all truck-tractor occupant fatalities in accidents that occurred during 1977 through 1984 were passengers (rather than drivers). There is no apparent trend towards more (or fewer) passenger fatalities. The data are shown in Table 4.

Table 4: Role of Fatalities  
Eight-Year Comparison of the Proportion of Passenger Involvement

<u>Year</u>	<u>Total Fatalities</u>	<u>Known Role</u>	<u>Known Passenger</u>	<u>Percent Passenger</u>
1977	920	920	148	16.1 x
1978	975	970	151	15.6 x
1979	1,027	1,027	186	18.1 x
1980	887	886	150	16.9 x
1981	840	838	140	16.7 x
1982	728	726	121	16.7 x
1983	735	733	116	15.8 x
1984	853	849	129	15.2 x

Table 5 shows that restraint use by truck-tractor occupant fatalities has been uniformly low during the past eight years -- fewer than three percent of these fatalities were belted. There is no apparent improvement in restraint use from 1977 through 1984.

Table 5: Restraint Use by Fatalities  
Eight-Year Comparison of the Proportion of Belted Involvement

<u>Year</u>	<u>Total Fatalities</u>	<u>Known Status</u>	<u>Known Belted</u>	<u>Percent Belted</u>
1977	920	676	26	3.8 x
1978	975	772	29	3.8 x
1979	1,027	813	24	3.0 x
1980	887	724	15	2.1 x
1981	840	698	11	1.6 x
1982	728	605	9	1.5 x
1983	735	600	15	2.5 x
1984	853	683	19	2.8 x

Restraint use is unknown for about 20 percent of these fatalities. The missing restraint use information is largely accounted for by states that do not routinely report restraint use. For example, California, Illinois, and Massachusetts did not report restraint use for more than two-thirds of the truck-tractor occupant fatalities that occurred in 1984. In California, 65 of the 71 fatalities had unknown restraint use; none of the 14 fatalities in Illinois had known restraint use; and 7 of the 10 fatalities in Massachusetts had restraint use unreported on the 1984 FARS file. Of the 170 truck-tractor occupant fatalities with unknown restraint status that year, more than half (86 fatalities) were in accidents in one of these three states.

Comparison of Fatalities by Vehicle Type

In 1984, 93 percent of truck-tractor occupant fatalities were between the ages of 20 and 59. This is a much tighter age grouping than that observed for either car occupant fatalities (only 61 percent in this age range) or straight truck occupant fatalities (73 percent in this age range). The data are shown in Table 6.

Table 6: Age of Fatalities in 1984  
Comparison by Vehicle Type

<u>Age</u>	<u>Automobile</u>		<u>Straight Truck</u>		<u>Truck-Tractor</u>	
	<u>Number</u>	<u>Percent</u>	<u>Number</u>	<u>Percent</u>	<u>Number</u>	<u>Percent</u>
Under 10	701	3 %	2	1 %	7	1 %
10 - 19	4,203	18 %	20	11 %	19	2 %
20 - 29	7,250	31 %	49	28 %	225	26 %
30 - 39	3,548	15 %	39	22 %	235	28 %
40 - 49	1,957	8 %	22	13 %	201	24 %
50 - 59	1,716	7 %	17	10 %	129	15 %
60 - 69	1,757	7 %	19	11 %	34	4 %
70 - 79	1,628	7 %	6	3 %	2	0 %
80 - 89	720	3 %	1	1 %	0	0 %
<u>90 and over</u>	<u>61</u>	<u>0 %</u>	<u>0</u>	<u>0 %</u>	<u>0</u>	<u>0 %</u>
Total known	23,541	100 %	175	100 %	852	100 %
<u>Unknown</u>	<u>68</u>		<u>1</u>		<u>1</u>	
Total	23,609		176		853	

Table 7 shows that only 7 percent of truck-tractor occupant fatalities in 1984 were female. This is low compared to 37 percent of car occupant fatalities, but is similar to the prevalence of female straight truck occupant fatalities (8 percent).

Table 7: Gender of Fatalities in 1984  
Comparison by Vehicle Type

<u>Gender</u>	<u>Automobile</u>		<u>Straight Truck</u>		<u>Truck-Tractor</u>	
	<u>Number</u>	<u>Percent</u>	<u>Number</u>	<u>Percent</u>	<u>Number</u>	<u>Percent</u>
Female	8,720	37 %	14	8 %	57	7 %
Male	14,889	63 %	162	92 %	795	93 %
Total known	23,609	100 %	176	100 %	852	100 %
<u>Unknown</u>	<u>0</u>		<u>0</u>		<u>1</u>	
Total	23,609		176		853	

As shown in Table 8, truck-tractor occupant fatalities in 1984 were less frequently passengers (15 percent) than was the case for either straight truck occupant fatalities (27 percent were passengers) or car occupant fatalities (33 percent).

Table 8: Role of Fatalities in 1984  
Comparison by Vehicle Type

Role	Automobile		Straight Truck		Truck-Tractor	
	Number	Percent	Number	Percent	Number	Percent
Driver	15,878	67 %	129	73 %	720	85 %
Passenger	7,655	33 %	47	27 %	129	15 %
Total known	23,533	100 %	176	100 %	849	100 %
Unknown	76		0		4	
Total	23,609		176		853	

Twice as many car occupant fatalities (6 percent) as truck-tractor occupant fatalities (3 percent) were belted in 1984. Straight truck occupant fatalities were even less frequently belted (2 percent) than were truck-tractor occupant fatalities. The data are presented as Table 9.

Table 9: Restraint Use by Fatalities in 1984  
Comparison by Vehicle Type

Restraint	Automobile		Straight Truck		Truck-Tractor	
	Number	Percent	Number	Percent	Number	Percent
None	18,003	94 %	154	98 %	664	97 %
Yes, type:						
Shoulder only	47	0 %	0	0 %	0	0 %
Lap only	190	1 %	2	1 %	11	2 %
Lap-shoulder	590	3 %	1	1 %	6	1 %
Child seat	61	0 %	0	0 %	0	0 %
Helmet	1	0 %	0	0 %	0	0 %
Other/unknown	167	1 %	0	0 %	2	0 %
Total known	19,059	100 %	157	100 %	683	100 %
Unknown	4,550		19		170	
Total	23,609		176		853	

Ejection was associated with a higher proportion of truck-tractor (39 percent) and straight truck (38 percent) fatalities than with car fatalities (25 percent), as shown in Table 10 using 1984 data.

Table 10: Ejection Status of Fatalities in 1984  
Comparison by Vehicle Type

Ejection	Automobile		Straight Truck		Truck-Tractor	
	Number	Percent	Number	Percent	Number	Percent
None	17,202	75 %	106	62 %	512	61 %
Yes, type:						
Complete	4,694	20 %	48	28 %	263	31 %
Partial	1,051	5 %	17	10 %	61	7 %
Total known	22,947	100 %	171	100 %	836	100 %
Unknown	662		5		17	
Total	23,609		176		853	

Extrication was required for 22 percent of the truck-tractor occupant fatalities in 1984, as contrasted with 14 percent of car occupant fatalities and 12 percent of straight truck occupant fatalities. The data are shown in Table 11.

Table 11: Extrication Status of Fatalities in 1984  
Comparison by Vehicle Type

Extrication	<u>Automobile</u>		<u>Straight Truck</u>		<u>Truck-Tractor</u>	
	<u>Number</u>	<u>Percent</u>	<u>Number</u>	<u>Percent</u>	<u>Number</u>	<u>Percent</u>
None	20,029	86 %	152	88 %	656	78 %
<u>Extricated</u>	<u>3,181</u>	<u>14 %</u>	<u>21</u>	<u>12 %</u>	<u>181</u>	<u>22 %</u>
Total known	23,210	100 %	173	100 %	837	100 %
<u>Unknown</u>	<u>399</u>		<u>3</u>		<u>16</u>	
Total	23,609		176		853	

## Vehicle Occupancy

There were a total of 3,997 truck-tractors involved in fatal accidents in 1984. For 3,848 (96 percent) of these, the number of occupants in the truck-tractor was known. For 132 vehicles, only the number of injured occupants was known. Most of these are accounted for by state coding practices: 73 were in accidents in Tennessee, 56 were in Virginia, and the other 3 were in all other states combined.

Most truck-tractors with known occupancy had only one occupant present, as shown in Table 12. The method of deriving the Ockham estimates of all accidents is described elsewhere ("A Method for Analyzing NASS Data Based on Ockham's Razor," Susan C. Partyka, NCSA, September 1982). Basically, all NASS cases collected from 1979 through 1984 by the Continuous Sampling Subsystem were weighted just enough to compensate for differential sampling by accident severity. These Ockham estimates are not national totals, but are estimates of national relative occurrences. After computing percentages, the results were rounded to integer values for the table. The actual number of cases included in the estimate is indicated as "N" throughout this report, and is provided to give an idea of the reliability of the individual estimates.

Table 12: Occupancy in Fatal Accidents in 1984  
and All Accidents in 1979-1984 NASS (Ockham-Weighted)

<u>Occupants</u>	<u>Fatal Accidents</u>		<u>Ockham Estimate</u> <u>All Accidents</u>	
	<u>Number</u>	<u>Percent</u>	<u>Number</u>	<u>Percent</u>
None	39	1.0	97	1.1
One	3,226	83.8	8,112	89.9
Two	536	13.9	749	8.3
Three	37	1.0	58	0.6
<u>Four or more</u>	<u>10</u>	<u>0.3</u>	<u>11</u>	<u>0.1</u>
Total known	3,848	100.0	9,028	100.0
Injured only	132		0	
<u>Unknown number</u>	<u>17</u>		<u>0</u>	
Total	3,997		9,028	

(N=3,167)

Of the 536 truck-tractors with two occupants in fatal accidents, 482 had one driver identified, one passenger identified, and the gender of each known. The other 54 cases had missing data on one or both occupants, or there was no driver present (only two passengers). The comparison of gender by occupant role (driver versus passenger) is shown in Table 13. Most drivers were male. But over one-quarter of the passengers were female.

Table 13: Role and Gender  
in Two-Occupant Truck-Tractors Involved in Fatal Accidents in 1984

<u>Driver</u>	<u>Passenger</u>		<u>Total</u>
	<u>Female</u>	<u>Male</u>	
Female	2	14	16
<u>Male</u>	<u>135</u>	<u>331</u>	<u>466</u>
Total	137	345	482

Comparable data are presented in Table 14 for relative (Ockham-weighted) occurrences in all police-reported truck-tractor accidents, nationwide. The results are based on the 308 NASS cases (749 weighted) with two occupants, of which 283 (705 weighted) had one driver, one passenger, and the gender of each known. Gender combinations in two-occupant truck-tractors in all accidents are estimated to have occurred in proportions which were very similar to those found in fatal accidents.

Table 14: Role and Gender  
in Two-Occupant Truck-Tractors Involved in Accidents  
(Ockham-Weighted Data from 1979-1984 NASS)

<u>Driver</u>	<u>Passenger</u>		<u>Total</u>
	<u>Female</u>	<u>Male</u>	
Female	0	13	13
<u>Male</u>	<u>186</u>	<u>506</u>	<u>692</u>
<u>Total</u>	<u>186</u>	<u>519</u>	<u>705</u>

(N=283)

Table 15 shows the same data as Table 13, but categorized by the survival of the driver and the passenger. The four subtables of Table 15 sum to Table 13.

Table 15: Role, Gender, and Survival  
in Two-Occupant Truck-Tractors Involved in Fatal Accidents in 1984

		<u>Passenger Alive</u>			<u>Passenger Killed</u>			
<u>Driver Alive</u>	<u>Driver</u>	<u>Passenger</u>		<u>Total</u>	<u>Driver</u>	<u>Passenger</u>		<u>Total</u>
		<u>Female</u>	<u>Male</u>			<u>Female</u>	<u>Male</u>	
Female		1	8	9	Female	0	2	2
<u>Male</u>	<u>Male</u>	<u>86</u>	<u>203</u>	<u>289</u>	<u>Male</u>	<u>25</u>	<u>40</u>	<u>65</u>
<u>Total</u>	<u>Total</u>	<u>87</u>	<u>211</u>	<u>298</u>	<u>Total</u>	<u>25</u>	<u>42</u>	<u>67</u>
<u>Driver Killed</u>	<u>Driver</u>	<u>Passenger</u>		<u>Total</u>	<u>Driver</u>	<u>Passenger</u>		<u>Total</u>
		<u>Female</u>	<u>Male</u>			<u>Female</u>	<u>Male</u>	
Female		1	4	5	Female	0	0	0
<u>Male</u>	<u>Male</u>	<u>15</u>	<u>59</u>	<u>74</u>	<u>Male</u>	<u>9</u>	<u>29</u>	<u>38</u>
<u>Total</u>	<u>Total</u>	<u>16</u>	<u>63</u>	<u>79</u>	<u>Total</u>	<u>9</u>	<u>29</u>	<u>38</u>

These two-occupant truck-tractors accounted for 39 female fatalities in 1984. This was two-thirds of all female fatalities in truck-tractors in 1984 (57 total, from Table 3). In contrast, fewer than one-quarter (183 of 795) of male truck-tractor occupant fatalities occurred in a two-occupant vehicle in 1984.

Table 16 compares the treatment received by the driver and the passenger, from the cases of Table 14. The treatment is categorized as "hospitalized or killed" versus all lesser treatment.

Table 16: Role, Gender, and Hospitalization Status  
in Two-Occupant Truck-Tractors Involved in Accidents  
(Ockham-Weighted Data from 1979-1984 NASS)

<u>Passenger</u> <u>Not Kept in Hospital</u>				<u>Passenger</u> <u>Kept in Hospital</u>			
<u>Driver</u> <u>Not Kept</u>	<u>Passenger</u>			<u>Driver</u>	<u>Passenger</u>		
	<u>Female</u>	<u>Male</u>	<u>Total</u>		<u>Female</u>	<u>Male</u>	<u>Total</u>
Female	0	13	13	Female	0	0	0
<u>Male</u>	<u>185</u>	<u>500</u>	<u>685</u>	<u>Male</u>	<u>0</u>	<u>2</u>	<u>2</u>
Total	185	513	698	Total	0	2	2
			(N=276)				(N=2)

<u>Driver</u> <u>Kept</u>				<u>Driver</u> <u>Kept</u>			
<u>Driver</u>	<u>Passenger</u>			<u>Driver</u>	<u>Passenger</u>		
	<u>Female</u>	<u>Male</u>	<u>Total</u>		<u>Female</u>	<u>Male</u>	<u>Total</u>
Female	0	0	0	Female	0	0	0
<u>Male</u>	<u>1</u>	<u>3</u>	<u>4</u>	<u>Male</u>	<u>0</u>	<u>1</u>	<u>1</u>
Total	1	3	4	Total	0	1	1
			(N=4)				(N=1)

Table 17 (fatal accidents) and Table 18 (relative occurrences of all accidents) summarize Tables 13 and 14, respectively. They show good agreement on the prevalence of the three gender combinations.

Table 17: Occurrences of Occupant Gender Pairs  
in Two-Occupant Truck-Tractors Involved in Fatal Accidents in 1984

<u>Gender Pairs</u>	<u>Fatal Accidents</u>		<u>Fatal Vehicles</u>	
	<u>Number</u>	<u>Percent</u>	<u>Number</u>	<u>Percent</u>
Female-Female	2	0.4 %	1	0.5 %
Female-Male	149	30.9 %	55	29.9 %
<u>Male-Male</u>	<u>331</u>	<u>68.7 %</u>	<u>128</u>	<u>69.6 %</u>
Total	482	100.0 %	184	100.0 %

Table 18: Occurrences of Occupant Gender Pairs  
in Two-Occupant Truck-Tractors Involved in Accidents  
(Ockham-Weighted Data from 1979-1984 NASS)

<u>Gender Pairs</u>	<u>All Accidents</u>	
	<u>Number</u>	<u>Percent</u>
Female-Female	0	0.0 %
Female-Male	199	28.2 %
<u>Male-Male</u>	<u>506</u>	<u>71.8 %</u>
Total	705	100.0 %
	(N=283)	

Table 19 (fatal accidents) and Table 20 (relative occurrences of all accidents) show that male-female occupancy combinations tend to be closer in age than male-male combinations. When a male was driving a female passenger in a fatal accident, 43 percent were the same age or no more than 5 years older than the passenger; the estimated rate was 44 percent in all accidents. In contrast, only 24 percent of the male-male combinations had this age relationship in fatal accidents; the estimated rate was 28 percent in all accidents.

Table 19: Relative Ages of Occupant Gender Pairs  
in Two-Occupant Truck-Tractors Involved in Fatal Accidents in 1984

Relative Ages	Driver-Passenger Gender Combinations			
	Female-Female	Female-Male	Male-Female	Male-Male
Driver Older:				
11 or more years		1 7 %	30 23 %	85 26 %
6 to 10 years	1 50 %		19 15 %	45 14 %
1 to 5 years	1 50 %	3 21 %	46 35 %	62 19 %
Driver Same Age			12 9 %	15 5 %
Driver Younger:				
1 to 5 years		3 21 %	15 11 %	39 12 %
6 to 10 years		2 14 %	6 5 %	32 10 %
11 or more years		5 36 %	3 2 %	44 14 %
Total known	2 100 %	14 100 %	131 100 %	322 100 %
Unknown age	0	0	4	9
Total	2	14	135	331

Table 20: Relative Ages of Occupant Gender Pairs  
in Two-Occupant Truck-Tractors Involved in Accidents  
(Ockham-Weighted Data from 1979-1984 NASS)

Relative Ages	Driver-Passenger Gender Combinations			
	Female-Female	Female-Male	Male-Female	Male-Male
Driver Older:				
11 or more years			39 24 %	98 21 %
6 to 10 years			27 16 %	61 13 %
1 to 5 years			67 40 %	99 21 %
Driver Same Age			6 3 %	33 7 %
Driver Younger:				
1 to 5 years		6 50 %	22 13 %	53 11 %
6 to 10 years			5 3 %	38 8 %
11 or more years		6 50 %	1 1 %	88 19 %
Total known	0	12 100 %	167 100 %	470 100 %
Unknown age	0	1	19	36
Total	0	13 (N=11)	186 (N=79)	506 (N=193)

Table 21 summarizes the people in 46 multiple-occupant (three or more people) truck-tractors involved in fatal accidents in 1984. Many of these truck-tractors appear to be occupied by family groups (a male driver, a female passenger about the same age, and one or more very young children). This is consistent with the age/gender/role patterns for two-occupant truck-tractors. Fatalities are indicated by an asterisk (\*).

Table 22 presents comparable data for the 31 NASS cases with three or more occupants that were investigated from 1979 through 1984.

Table 21: Descriptions of the Groupings of People  
in Multi-Occupant Truck-Tractors Involved in Fatal Accidents in 1984

<u>Role</u>	<u>Age</u>	<u>Gender</u>	<u>Role</u>	<u>Age</u>	<u>Gender</u>	<u>Role</u>	<u>Age</u>	<u>Gender</u>
Driver	45*	Male	Driver	25	Male	Driver	26	Male
Passenger	?	Unknown	Passenger	22	Male	Passenger	1*	Female
Passenger	18	Male	Passenger	23	Male	Passenger	27	Female
Driver	23	Male	Driver	22	Male	Driver	28	Male
Passenger	22	Male	Passenger	19	Female	Passenger	1	Male
Passenger	23	Male	Passenger	21	Male	Passenger	23	Female
Driver	23	Male	Driver	32	Male	Driver	32	Male
Passenger	3*	Female	Passenger	10	Male	Passenger	10	Male
Passenger	23	Female	Passenger	27	Female	Passenger	40	Female
Driver	29	Male	Driver	49*	Male	Driver	40	Male
Passenger	20	Male	Passenger	?	Unknown	Passenger	7	Male
Passenger	22	Male	Passenger	18	Male	Passenger	10	Male
Driver	27	Male	Driver	27	Male	Driver	21	Male
Passenger	2	Male	Passenger	?	Unknown	Passenger	1*	Male
Passenger	23	Female	Passenger	25	Female	Passenger	20*	Female
Driver	49*	Male	Driver	27	Male	Driver	39	Male
Passenger	25	Male	Passenger	3	Male	Passenger	35	Male
Passenger	45	Female	Passenger	25	Female	Passenger	36*	Male
Driver	41	Male	Driver	40	Male	Driver	60*	Male
Passenger	17	Female	Passenger	44	Male	Passenger	14*	Male
Passenger	20	Male	Passenger	45	Male	Passenger	19*	Male
Driver	23	Male	Driver	32*	Male	Driver	27	Male
Passenger	21	Male	Passenger	5	Female	Passenger	13	Female
Passenger	22*	Female	Passenger	25*	Female	Passenger	41	Male
Driver	38	Male	Driver	54*	Male	Driver	21	Male
Passenger	6	Male	Passenger	24	Male	Passenger	0*	Female
Passenger	37	Female	Passenger	38	Male	Passenger	21	Female
Driver	25	Male	Driver	35	Male	Driver	37	Female
Passenger	31	Male	Passenger	11	Female	Passenger	17	Male
Passenger	34	Female	Passenger	29	Female	Passenger	41	Male

\* indicates that the person died as a result of the accident

Table 21 (continued): Descriptions of the Groupings of People  
in Multi-Occupant Truck-Tractors Involved in Fatal Accidents in 1984

<u>Role</u>	<u>Age</u>	<u>Gender</u>	<u>Role</u>	<u>Age</u>	<u>Gender</u>	<u>Role</u>	<u>Age</u>	<u>Gender</u>
Driver	78*	Male	Driver	40	Male	Driver	41	Male
Passenger	14	Male	Passenger	21	Female	Passenger	?	Male
Passenger	20	Male	Passenger	27	Male	Passenger	?	Male
			Passenger	59	Male	Passenger	?	Male
Driver	58*	Male	Driver	37	Female	Driver	35	Male
Passenger	20	Male	Passenger	14	Male	Passenger	0	Male
Passenger	29	Male	Passenger	24	Male	Passenger	13	Female
Driver	27	Male	Passenger	31*	Male	Passenger	28*	Female
Passenger	19	Female	Driver	39*	Female	Driver	34	Male
Passenger	44	Male	Passenger	0	Female	Passenger	8*	Male
Driver	37	Male	Passenger	19	Female	Passenger	12	Male
Passenger	12*	Male	Passenger	25	Male	Passenger	38*	Male
Passenger	17*	Male				Passenger	40*	Female
Driver	39	Male	Driver	30	Male	Driver	27	Male
Passenger	12	Male	Passenger	4	Male	Passenger	11*	Female
Passenger	16	Male	Passenger	7	Female	Passenger	15	Female
Driver	23*	Male	Passenger	29	Female	Passenger	18	Male
Passenger	17*	Male	Driver	40	Male	Passenger	18	Female
Passenger	24	Male	Passenger	13	Male	Passenger	18	Female
			Passenger	17	Male	Passenger	24	Male
Driver	28	Male	Passenger	30	Female	Passenger	27*	Male
Passenger	?	Unknown						
Passenger	?	Unknown						

\* indicates that the person died as a result of the accident

**Table 22: Descriptions of the Groupings of People  
in Multi-Occupant Truck-Tractors Involved in Accidents  
(Cases Investigated during 1979-1984 NASS)**

<u>Role</u>	<u>Age</u>	<u>Gender</u>	<u>Role</u>	<u>Age</u>	<u>Gender</u>	<u>Role</u>	<u>Age</u>	<u>Gender</u>
Driver	27	Male	Driver	52	Male	Driver	45	Male
Passenger	6	Male	Passenger	16	Male	Passenger	14	Male
Passenger	30*	Female	Passenger	24	Male	Passenger	15	Male
						Passenger	18	Female
Driver	34	Male	Driver	29	Male			
Passenger	8	Male	Passenger	23	Male	Driver	35	Male
Passenger	32	Male	Passenger	47	Male	Passenger	11	Female
						Passenger	17	Female
Driver	34	Male	Driver	22	Male	Passenger	36	Female
Passenger	?	Unknown	Passenger	21	Male			
Passenger	8	Male	Passenger	30	Male	Driver	37	Male
						Passenger	11	Female
Driver	27	Male	Driver	24	Male	Passenger	13	Male
Passenger	?	Unknown	Passenger	21	Female	Passenger	22	Male
Passenger	27	Male	Passenger	24	Male			
						Driver	42	Male
Driver	26	Male	Driver	37	Male	Passenger	32	Male
Passenger	21	Male	Passenger	4	Male	Passenger	42	Male
Passenger	25	Male	Passenger	36	Female	Passenger	50	Male
Driver	40	Male	Driver	63	Male	Driver	22	Male
Passenger	6	Male	Passenger	20	Male	Passenger	1	Male
Passenger	10	Male	Passenger	24	Male	Passenger	2	Male
						Passenger	21	Female
Driver	60	Male	Driver	40	Male			
Passenger	?	Male	Passenger	18	Male	Driver	41	Male
Passenger	?	Male	Passenger	21	Male	Passenger	?	Male
						Passenger	?	Male
Driver	28	Male	Driver	38	Male	Passenger	?	Male
Passenger	9	Male	Passenger	9	Male	Passenger	40	Male
Passenger	27	Female	Passenger	35	Female			
						Driver	34	Male
Driver	46	Male	Driver	38	Male	Passenger	26	Male
Passenger	21	Female	Passenger	13	Male	Passenger	27	Male
Passenger	22	Male	Passenger	17	Male	Passenger	29	Male
						Passenger	35	Male
Driver	34	Male	Driver	61	Male	Passenger	39	Male
Passenger	19	Male	Passenger	13	Male			
Passenger	28	Male	Passenger	14	Male	Driver	33	Male
			Passenger	16	Male	Passenger	20	Male
Driver	40	Female	Driver	36	Male	Passenger	21	Male
Passenger	23	Male	Passenger	6	Male	Passenger	22	Male
Passenger	45	Male	Passenger	11	Female	Passenger	23	Male
			Passenger	36	Female	Passenger	25	Male
Driver	61	Male				Passenger	28	Male
Passenger	22	Male						
Passenger	37	Male						

\* indicates that the person died as a result of the accident

Maximum Injury Severity

In addition to the 853 truck-tractor occupant fatalities that occurred in 1984, there were an estimated 5,000 occupants who required overnight (or longer) hospitalization as the result of an accident. The estimates are shown in Table 23. They were derived by inflating the Ockham estimates to the FARS fatality count in 1984 -- each Ockham estimate was multiplied by 853/24, the ratio of FARS fatalities to NASS fatalities. The results in the table have been rounded to the nearest integer, but the percentages were computed before rounding.

Table 23: National Estimates of Treatment and Injury Severity  
(Ockham-Weighted Data from 1979-1984 NASS Inflated to 1984 FARS)

Maximum AIS	Fatality	Hospit- alized	Treated and Released	Other Treatment	No Treatment	Unknown Treatment	Total
0	0	71	353	258	301,452	8,640	310,774
1	1	1,450	9,808	2,436	13,548	3,853	31,096
2	8	1,982	1,014	247	125	1,212	4,589
3	143	1,471	259	38	42	100	2,052
4	78	181	80	0	0	10	349
5	222	171	0	0	0	11	405
6	401	0	0	0	0	0	401
<b>Total</b>	<b>853</b>	<b>5,326</b>	<b>11,514</b>	<b>2,979</b>	<b>315,167</b>	<b>13,826</b>	<b>349,666</b>
N=	24	118	199	38	2,990	147	3,516
Moderate	853	3,805	1,353	284	167	1,334	7,797
% Total	100.00 %	71.45 %	11.75 %	9.55 %	0.05 %	9.65 %	2.23 %
Serious	853	1,823	339	38	42	121	3,216
% Total	100.00 %	34.23 %	2.94 %	1.27 %	0.01 %	0.88 %	0.92 %

Up to six injuries per person are available on the NASS file. Each is coded in terms of the Occupant Injury Classification (OIC) and associated severity value of the Abbreviated Injury Scale (AIS). The coding is described in the "Injury Coding Manual" (E. Petrucelli et al, DOT-HS-805-298, February 1980). When the injury data are complete, the highest coded AIS is the Maximum AIS for the person. In cases of missing data (injury severity is unknown, including fatalities without autopsies or other medical data), the data have been estimated using the ESTMAIS scheme. The scheme is described elsewhere ("A System for Allocation of Missing AIS," Susan C. Partyka, NCSA, November 1981). Briefly, a case with unknown Maximum AIS is compared to cases with similar medical treatment and police injury severity rating; and the Ockham weighting factor for the unknown case is prorated among the Maximum AIS values, according to the observed frequency for the cases with known Maximum AIS. "Moderate" injury is Maximum AIS of 2 or greater, or fatality at any AIS; "serious" injury is Maximum AIS of 3 or greater, or fatality. Thus, "fatality" is a subset of "serious," and "serious" is a subset of "moderate."

Table 24 shows the estimated injury involvement of truck-tractor occupants in accidents by age. For comparison, the actual counts of fatalities from the 1984 FARS data are included in this (and each subsequent) table. The NASS-generated distributions agree well with the 1984 FARS data, especially considering that the NASS estimates are based on only 24 investigated fatalities. The NASS truck-tractor occupants were collected over six years: 186 cases in 1979, 146 cases in 1980, 264 cases in 1981, 975 cases in 1982, 1,327 cases in 1983, and 618 cases in 1984. However, Tables 1 through 5 indicate that occupant factors have not changed rapidly during this time.

Table 24: National Estimates of Age and Injury Severity  
(Ockham-Weighted Data from 1979-1984 NASS Inflated to 1984 FARS)

Maximum AIS	Occupant Age					Total
	Under 20	20 to 39	40 to 59	Over 59	Unknown	
0	7,732	167,611	106,698	10,553	18,180	310,774
1	514	19,253	10,577	286	466	31,096
2	98	1,916	1,563	123	889	4,589
3	120	1,123	807	3	0	2,052
4	36	46	264	3	0	349
5	19	230	140	15	0	405
6	17	287	82	14	0	401
Total	8,535	190,467	120,131	10,998	19,534	349,666
N=	90	1,925	1,219	99	183	3,516
Moderate	290	3,603	2,857	158	889	7,797
% Total	3.40 %	1.89 %	2.38 %	1.44 %	4.55 %	2.23 %
Serious	192	1,689	1,300	36	0	3,216
% Total	2.25 %	0.89 %	1.08 %	0.32 %	0.00 %	0.92 %
Killed	36	533	249	36	0	853
% Total	0.42 %	0.28 %	0.21 %	0.32 %	0.00 %	0.24 %
1984 FARS	26	460	330	36	1	853

Table 25 shows higher injury and fatality rates for female than for male truck-tractor occupants. Table 26 shows higher injury and fatality rates for truck-tractor passengers than for their drivers. Since most female occupants are passengers (rather than drivers), it is not clear from these tables whether the higher injury rates observed are a function of gender or of seating position. Table 27 shows the injury and fatality experience for female drivers, male drivers, female passengers, and male passengers separately. It appears that female and male passengers have similar rates of fatalities per accident. However, males appear to have a lower injury rate than females, after controlling for occupant role (driver versus passenger). The apparent inconsistencies in this table may reflect actual interactions between the effects of occupant role and gender on injury severity and fatality risk; they may reflect actual differences between male and female fatality risk as a function of injury severity; they may be the result of the variability of small samples; or they may result from biases in the estimation of the missing injury data.

**Table 25: National Estimates of Gender and Injury Severity  
(Ockham-Weighted Data from 1979-1984 NASS Inflated to 1984 FARS)**

Maximum <u>AIS</u>	<u>Female</u>	<u>Male</u>	<u>Gender Unknown</u>	<u>Total</u>
0	8,258	290,846	11,670	310,774
1	816	29,916	364	31,096
2	149	3,773	666	4,589
3	195	1,857	0	2,052
4	1	348	0	349
5	2	403	0	405
6	36	365	0	401
<b>Total</b>	<b>9,456</b>	<b>327,509</b>	<b>12,700</b>	<b>349,666</b>
<b>N=</b>	<b>114</b>	<b>3,284</b>	<b>118</b>	<b>3,516</b>
<b>Moderate</b>	<b>382</b>	<b>6,748</b>	<b>666</b>	<b>7,796</b>
<b>x Total</b>	<b>4.04 x</b>	<b>2.06 x</b>	<b>5.25 x</b>	<b>2.23 x</b>
<b>Serious</b>	<b>233</b>	<b>2,983</b>	<b>0</b>	<b>3,216</b>
<b>x Total</b>	<b>2.47 x</b>	<b>0.91 x</b>	<b>0.00 x</b>	<b>0.92 x</b>
<b>Killed</b>	<b>36</b>	<b>817</b>	<b>0</b>	<b>853</b>
<b>x Total</b>	<b>0.38 x</b>	<b>0.25 x</b>	<b>0.00 x</b>	<b>0.24 x</b>
<b>1984 FARS</b>	<b>57</b>	<b>795</b>	<b>1</b>	<b>853</b>

**Table 26: National Estimates of Role and Injury Severity  
(Ockham-Weighted Data from 1979-1984 NASS Inflated to 1984 FARS)**

Maximum <u>AIS</u>	<u>Driver</u>	<u>Passenger</u>	<u>Total</u>
0	282,193	28,581	310,774
1	27,592	3,504	31,096
2	4,181	408	4,589
3	1,802	250	2,052
4	310	39	349
5	383	21	405
6	313	88	401
<b>Total</b>	<b>316,775</b>	<b>32,891</b>	<b>349,666</b>
<b>N=</b>	<b>3,125</b>	<b>391</b>	<b>3,516</b>
<b>Moderate</b>	<b>6,991</b>	<b>806</b>	<b>7,796</b>
<b>x Total</b>	<b>2.21 x</b>	<b>2.45 x</b>	<b>2.23 x</b>
<b>Serious</b>	<b>2,818</b>	<b>398</b>	<b>3,216</b>
<b>x Total</b>	<b>0.89 x</b>	<b>1.21 x</b>	<b>0.92 x</b>
<b>Killed</b>	<b>711</b>	<b>142</b>	<b>853</b>
<b>x Total</b>	<b>0.22 x</b>	<b>0.43 x</b>	<b>0.24 x</b>
<b>1984 FARS</b>	<b>720</b>	<b>129</b>	<b>853</b>
		<b>Role Unknown = 4</b>	

**Table 27: National Estimates of Role, Sex, and Injury Severity  
(Ockham-Weighted Data from 1979-1984 NASS Inflated to 1984 FARS)**

Maximum AIS	Driver			Passenger			Total
	Female	Male	Unknown	Female	Male	Unknown	
0	1,533	270,579	10,081	6,725	20,267	1,588	310,774
1	95	27,140	358	721	2,776	7	31,096
2	44	3,470	666	105	303	0	4,589
3	41	1,761	0	154	96	0	2,052
4	1	310	0	0	38	0	349
5	2	382	0	0	21	0	405
6	0	313	0	36	53	0	401
<b>Total</b>	<b>1,716</b>	<b>303,954</b>	<b>11,105</b>	<b>7,741</b>	<b>23,555</b>	<b>1,595</b>	<b>349,666</b>
<b>N=</b>	<b>20</b>	<b>3,013</b>	<b>92</b>	<b>94</b>	<b>271</b>	<b>26</b>	<b>3,516</b>
Moderate	88	6,236	666	294	512	0	7,797
% Total	5.13 x	2.05 x	6.00 x	3.80 x	2.17 x	0.00 x	2.23 x
Serious	44	2,774	0	190	209	0	3,216
% Total	2.54 x	0.91 x	0.00 x	2.45 x	0.89 x	0.00 x	0.92 x
Killed	0	711	0	36	107	0	853
% Total	0.00 x	0.23 x	0.00 x	0.46 x	0.45 x	0.00 x	0.24 x
1984 FARS	14	706	0	43	85	1	853
						Role Unknown = 4	

Table 28 shows that in contrast to the low restraint use rates observed in 1984 (20 percent in all accidents), most truck-tractor occupants (87 percent) had a restraint (usually a lap belt) available to them.

**Table 28: National Estimates of Restraint Availability and Use  
(Ockham-Weighted Data from 1979-1984 NASS Inflated to 1984 FARS)**

Restraint Element	No	Lap Belt	Lap and	Other/ Unknown	Restraint	Total
	Restraint	Only	Shoulder	Type	Unknown	
Available	28,791	196,757	13,354	14,830	95,933	349,666
% Known	11 x	78 x	5 x	6 x	-	100 x
N=	295	2,076	110	116	919	3,516
Used	217,733	49,715	1,611	3,432	77,175	349,666
% Known	80 x	18 x	1 x	1 x	-	100 x
N=	2,235	477	15	28	761	3,516

Table 29 shows much lower injury and fatality rates for belted occupants than for unbelted occupants. The agreement in the number of occurrences of unknown restraint use (178 estimated from NASS; 170 observed by FARS) suggests that NASS investigators rely heavily on police-reported restraint use for fatalities.

Both ejection (Table 30) and entrapment (Table 31) are associated with very high injury and fatality rates.

Table 29: National Estimates of Restraint Use and Injury Severity  
(Ockham-Weighted Data from 1979-1984 NASS Inflated to 1984 FARS)

Maximum AIS	No Restraint	Lap Belt Only	Lap and Shoulder	Other/ Unknown Type	Restraint Unknown	Total
0	187,999	45,052	1,576	2,907	73,241	310,774
1	24,160	3,942	36	510	2,449	31,096
2	3,025	335	0	15	1,214	4,589
3	1,663	300	0	0	89	2,052
4	263	84	0	0	3	349
5	327	3	0	0	75	405
6	296	0	0	0	105	401
<b>Total</b>	<b>217,733</b>	<b>49,715</b>	<b>1,611</b>	<b>3,432</b>	<b>77,175</b>	<b>349,666</b>
<b>N=</b>	<b>2,235</b>	<b>477</b>	<b>15</b>	<b>28</b>	<b>761</b>	<b>3,516</b>
<b>Moderate</b>	<b>5,575</b>	<b>721</b>	<b>0</b>	<b>15</b>	<b>1,485</b>	<b>7,797</b>
<b>x Total</b>	<b>2.56 x</b>	<b>1.45 x</b>	<b>0.00 x</b>	<b>0.44 x</b>	<b>1.92 x</b>	<b>2.23 x</b>
<b>Serious</b>	<b>2,558</b>	<b>386</b>	<b>0</b>	<b>0</b>	<b>272</b>	<b>3,216</b>
<b>x Total</b>	<b>1.17 x</b>	<b>0.78 x</b>	<b>0.00 x</b>	<b>0.00 x</b>	<b>0.35 x</b>	<b>0.92 x</b>
<b>Killed</b>	<b>675</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>178</b>	<b>853</b>
<b>x Total</b>	<b>0.31 x</b>	<b>0.00 x</b>	<b>0.00 x</b>	<b>0.00 x</b>	<b>0.23 x</b>	<b>0.24 x</b>
<b>1984 FARS</b>	<b>664</b>	<b>11</b>	<b>6</b>	<b>2</b>	<b>170</b>	<b>853</b>

Table 30: National Estimates of Ejection and Injury Severity  
(Ockham-Weighted Data from 1979-1984 NASS Inflated to 1984 FARS)

Maximum AIS	Not Ejected	Complete Ejection	Partial Ejection	Ejection Unknown	Total
0	305,593	0	80	5,101	310,774
1	29,813	582	99	603	31,096
2	3,898	271	84	337	4,589
3	1,750	223	39	41	2,052
4	193	119	36	1	349
5	166	184	36	19	405
6	206	177	0	17	401
<b>Total</b>	<b>341,618</b>	<b>1,557</b>	<b>373</b>	<b>6,118</b>	<b>349,666</b>
<b>N=</b>	<b>3,388</b>	<b>39</b>	<b>8</b>	<b>81</b>	<b>3,516</b>
<b>Moderate</b>	<b>6,212</b>	<b>976</b>	<b>194</b>	<b>414</b>	<b>7,796</b>
<b>x Total</b>	<b>1.82 x</b>	<b>62.69 x</b>	<b>52.09 x</b>	<b>6.77 x</b>	<b>2.23 x</b>
<b>Serious</b>	<b>2,317</b>	<b>711</b>	<b>111</b>	<b>77</b>	<b>3,216</b>
<b>x Total</b>	<b>0.68 x</b>	<b>45.69 x</b>	<b>29.72 x</b>	<b>1.26 x</b>	<b>0.92 x</b>
<b>Killed</b>	<b>320</b>	<b>427</b>	<b>36</b>	<b>71</b>	<b>853</b>
<b>x Total</b>	<b>0.09 x</b>	<b>27.40 x</b>	<b>9.52 x</b>	<b>1.16 x</b>	<b>0.24 x</b>
<b>1984 FARS</b>	<b>512</b>	<b>263</b>	<b>61</b>	<b>17</b>	<b>853</b>

**Table 31: National Estimates of Entrapment and Injury Severity  
(Ockham-Weighted Data from 1979-1984 NASS Inflated to 1984 FARS)**

Maximum <u>AIS</u>	Not <u>Trapped</u>	<u>Trapped</u>	<u>Unknown</u>	<u>Total</u>
0	304,879	41	5,854	310,774
1	30,107	364	626	31,096
2	3,757	517	314	4,589
3	1,766	278	8	2,052
4	254	14	81	349
5	297	107	1	405
<u>6</u>	<u>301</u>	<u>100</u>	<u>0</u>	<u>401</u>
<b>Total</b>	<b>341,362</b>	<b>1,418</b>	<b>6,885</b>	<b>349,666</b>
<b>N=</b>	<b>3,398</b>	<b>31</b>	<b>87</b>	<b>3,516</b>
<b>Moderate</b>	<b>6,378</b>	<b>1,014</b>	<b>405</b>	<b>7,796</b>
<b>x Total</b>	<b>1.87 x</b>	<b>71.51 x</b>	<b>5.88 x</b>	<b>2.23 x</b>
<b>Serious</b>	<b>2,627</b>	<b>499</b>	<b>90</b>	<b>3,216</b>
<b>x Total</b>	<b>0.77 x</b>	<b>35.18 x</b>	<b>1.31 x</b>	<b>0.92 x</b>
<b>Killed</b>	<b>604</b>	<b>249</b>	<b>0</b>	<b>853</b>
<b>x Total</b>	<b>0.18 x</b>	<b>17.54 x</b>	<b>0.00 x</b>	<b>0.24 x</b>
<b>1984 FARS</b>	<b>656</b>	<b>181</b>	<b>16</b>	<b>853</b>

## Individual Injuries

Of the 24 fatally-injured truck-tractor occupants included in NASS during 1979 through 1984, only eight had medically-documented (official) injury data. Official injury data includes information from an autopsy, hospital medical records, emergency room records (for 1982 and later data collection), and private physician records. This is the most reliable and comprehensive medical data in NASS. Lesser sources (such as interviews with family, other involved motorists, and police) tend to describe visible injuries. They cannot provide details on, for example, internal injuries for fatalities.

Table 32 shows the injury type and severity for all injuries collected by NASS during 1979 through 1984, excluding the injuries collected for fatalities from non-medical sources. The method of collapsing the OIC into these 20 categories has been described previously ("State Injury Estimates Based upon a Synthesis of National Accident Data," Susan C. Partyka, NCSA, September 1983). There are many ways of categorizing the injury data; this method attempts to use categories that are meaningful to non-medical people.

In Table 32 the people have been ordered by their Maximum AIS -- from AIS 6 down through AIS 3. Within Maximum AIS, people have been ordered by the body region of their first-listed injury:

Whole Body,  
Head/Neck,  
Torso (back, chest, abdomen), and  
Extremities (knee, lower leg, pelvis, wrist, shoulder, thigh).

Table 33 shows the same data, but inflated using the Ockham weights and the 1984 FARS truck-tractor fatality total. (The fatalities have been weighted by 853/8 instead of the 853/24 weighting factor which was used in previous tables in this report because fatalities without medical data have been excluded.) Table 32 should be used to gauge the reliability of these estimates -- they are based on a small number of observations. Some injury type/severity combinations did not occur because they are not defined OIC-AIS combinations; others did not occur because they are rare for truck-tractor occupants; and others just did not happen to occur in this sample because of the limited number of actual cases investigated.

Overall, there were an estimated 95,500 injuries received by truck-tractor occupants in accidents in 1984. Of these, 10,613 were known to be of at least moderate (AIS 2 through 6) severity. These estimates are low because no adjustments have been made for missing or incomplete injury data for survivors, nor for injuries beyond the six that are recorded per person.

Table 34 summarizes the occupant factors and individual injuries for the eight fatalities with the most complete medical information. The accident year is shown (to help interpret the OIC-AIS data, since the coding has been revised during these six years), plus the victim age, gender, role, entrapment status, and ejection status. Up to six injuries are coded on the file, and are included in the table. In addition to the detailed OIC-AIS categorization of each injury, a brief description of the type of injury, the injury contact (when known), and the source of the medical data are provided.

Tables 35 and 36 show the same data for hospitalized survivors with a critical (AIS 5) or severe (AIS 4) injury, respectively. Tables 37 through 39 are based on hospitalized survivors with an AIS 3 torso, head/neck, or extremity injury, respectively. There is very little overlap among these three tables. Most victims suffered a single injury at their Maximum AIS; a few suffered two such injuries, but they were almost always to the same general body area.

Table 32: Individual Injuries by Type and Severity  
(Cases Investigated during 1979-1984 NASS)

Individual Injury	Individual Injury Severity							Total
	AIS=1	AIS=2	AIS=3	AIS=4	AIS=5	AIS=6	Unknown	
Burns	6	2	0	1	2	0	0	11
Amputation	0	0	2	0	0	0	0	2
Crushed Head	0	0	0	0	0	2	0	2
Concussion	8	15	5	1	0	0	0	29
Other Brain Injury	0	0	3	1	1	1	1	7
Head/Face Fracture	5	9	3	1	0	0	0	18
Vertebrae/Cord Injury	0	17	6	0	2	0	0	25
Other Head/Face/Neck	3	0	0	0	0	0	13	16
Crushed Chest	0	0	0	0	0	1	0	1
Rib/Pelvis Fracture	14	14	3	2	0	0	0	33
Other Chest Injury	8	0	1	0	0	0	1	10
Internal Injury	0	0	18	8	2	0	1	29
Extremity Fracture	2	24	13	0	0	0	0	39
Joint Injury	35	13	8	0	0	0	0	56
Muscle Injury	105	5	0	0	0	0	0	110
Other Artery/Nerve	0	0	0	0	0	0	2	2
Skin Injury	1,034	14	1	0	0	0	5	1,054
Other/Underspecified	2	0	0	0	0	0	78	80
Total	1,222	113	63	14	7	4	101	1,524

Table 33: National Estimates of Individual Injuries by Type and Severity  
(Ockham-Weighted Data from 1979-1984 NASS Inflated to 1984 FARS)

Individual Injury	Individual Injury Severity							Total
	AIS=1	AIS=2	AIS=3	AIS=4	AIS=5	AIS=6	Unknown	
Burns	884	71	0	36	71	0	0	1,062
Amputation	0	0	71	0	0	0	0	71
Crushed Head	0	0	0	0	0	213	0	213
Concussion	987	649	190	80	0	0	0	1,906
Other Brain Injury	0	0	178	46	107	107	46	482
Head/Face Fracture	188	320	188	36	0	0	0	731
Vertebrae/Cord Injury	0	1,062	444	0	81	0	0	1,588
Other Head/Face/Neck	178	0	0	0	0	0	655	833
Crushed Chest	0	0	0	0	0	107	0	107
Rib/Pelvis Fracture	1,156	824	127	71	0	0	0	2,179
Other Chest Injury	477	0	36	0	0	0	41	553
Internal Injury	0	0	1,141	508	213	0	46	1,907
Extremity Fracture	116	1,048	618	0	0	0	0	1,782
Joint Injury	2,233	798	339	0	0	0	0	3,369
Muscle Injury	7,340	178	0	0	0	0	0	7,517
Other Artery/Nerve	0	0	0	0	0	0	71	71
Skin Injury	65,352	552	107	0	0	0	282	66,293
Other/Underspecified	116	0	0	0	0	0	4,721	4,836
Total	79,026	5,503	3,437	776	472	427	5,861	95,500

**Table 34: Medically-Documented Injuries Received by Fatalities  
(Cases Investigated during 1979-1984 NASS)**

- 1980 Case: 20 year-old Male Passenger, Not Trapped, Not Ejected**  
 HWNH-6 (Crushed Head), Vehicle Exterior, Autopsy Report  
 CHNH-6 (Crushed Chest), Vehicle Exterior, Autopsy Report  
 MLRQ-4 (Internal Injury), Vehicle Exterior, Autopsy Report
- 1981 Case: 30 year-old Female Passenger, Not Trapped, Not Ejected**  
 HWNH-6 (Crushed Head), Vehicle Exterior, Autopsy Report  
 HULB-6 (Other Brain Injury), Vehicle Exterior, Autopsy Report  
 TLFS-3 (Extremity Fracture), Unknown Contact, Autopsy Report  
 YRLI-1 (Skin Injury), Unknown Contact, Autopsy Report  
 PPAI-1 (Skin Injury), Unknown Contact, Autopsy Report  
 XRAI-1 (Skin Injury), Unknown Contact, Autopsy Report
- 1984 Case: 22 year-old Male Driver, Not Trapped, Completely Ejected**  
 CCRA-5 (Internal Injury), Unknown Contact, Private Physician  
 MLRQ-4 (Internal Injury), Unknown Contact, Private Physician  
 MSRR-3 (Internal Injury), Unknown Contact, Private Physician
- 1980 Case: 24 year-old Male Driver, Entrapped, Not Ejected**  
 MRLI-5 (Internal Injury), Unknown Contact, Autopsy Report  
 HIUB-5 (Other Brain Injury), Unknown Contact, Autopsy Report  
 NPFS-3 (Vertebrae/Cord Injury), Unknown Contact, Autopsy Report  
 FLVO-3 (Skin Injury), Unknown Contact, Autopsy Report  
 CRCP-3 (Internal Injury), Unknown Contact, Autopsy Report  
 FUF3-3 (Head/Face Fracture), Unknown Contact, Autopsy Report
- 1982 Case: 55 year-old Male Driver, Not Trapped, Completely Ejected**  
 CRLP-4 (Internal Injury), Steering Assembly, Autopsy Report  
 MLLQ-3 (Internal Injury), Steering Assembly, Autopsy Report  
 CRFS-1 (Rib/Pelvis Fracture), Steering Assembly, Autopsy Report  
 FSCI-1 (Skin Injury), Unknown Contact, Autopsy Report  
 HSLI-1 (Skin Injury), Unknown Contact, Autopsy Report  
 FWCI-1 (Skin Injury), Unknown Contact, Autopsy Report
- 1982 Case: 37 year-old Male Driver, Entrapped, Not Ejected**  
 HLUB-3 (Other Brain Injury), Unknown Contact, Autopsy Report  
 CCFS-2 (Rib/Pelvis Fracture), Unknown Contact, Autopsy Report  
 ELAI-1 (Skin Injury), Unknown Contact, Autopsy Report  
 ERAI-1 (Skin Injury), Unknown Contact, Autopsy Report  
 WRLI-1 (Skin Injury), Unknown Contact, Autopsy Report  
 FRUD-1 (Other Head/Face/Neck), Unknown Contact, Autopsy Report
- 1982 Case: 37 year-old Male Passenger, Entrapped, Partially Ejected**  
 NPZV-3 (Vertebrae/Cord Injury), Non-Contact Injury, Private Physician
- 1983 Case: 50 year-old Male Driver, Not Trapped, Ejection Status Unknown**  
 MRCL-3 (Internal Injury), Unknown Contact, Autopsy Report  
 BIFS-2 (Vertebrae/Cord Injury), Unknown Contact, Autopsy Report  
 TRCI-1 (Skin Injury), Unknown Contact, Autopsy Report  
 KLLI-1 (Skin Injury), Unknown Contact, Autopsy Report  
 KRAI-1 (Skin Injury), Unknown Contact, Hospital Records  
 KLAI-1 (Skin Injury), Unknown Contact, Hospital Records

**Table 35: Critically-Injured Hospitalized Survivors  
(Cases Investigated during 1979-1984 NASS)**

- 1981 Case: 44 year-old Male Driver, Not Trapped, Not Ejected**  
 OWBI-5 (Burns), Non-Contact Injury, Non-Medical Source  
 CUBR-4 (Burns), Non-Contact Injury, Non-Medical Source  
 FLLI-1 (Skin Injury), Unknown Contact, Non-Medical Source  
 YLCI-1 (Skin Injury), Unknown Contact, Non-Medical Source  
 YRCI-1 (Skin Injury), Unknown Contact, Non-Medical Source
- 1983 Case: 58 year-old Male Driver, Not Trapped, Not Ejected**  
 OWBI-5 (Burns), Non-Contact Injury, Non-Medical Source  
 OWLI-1 (Skin Injury), Non-Contact Injury, Non-Medical Source
- 1981 Case: 29 year-old Male Driver, Entrapped, Partially Ejected**  
 BSEC-5 (Vertebrae/Cord Injury), Roof Top Contact, Hospital Records  
 MILD-4 (Internal Injury), Roof Top Contact, Hospital Records  
 CRCP-4 (Internal Injury), Roof Top Contact, Hospital Records  
 CBFS-4 (Rib/Pelvis Fracture), Roof Top Contact, Hospital Records  
 MILD-4 (Internal Injury), Roof Top Contact, Hospital Records  
 MLLQ-3 (Internal Injury), Roof Top Contact, Hospital Records
- 1984 Case: 37 year-old Male Driver, Not Trapped, Completely Ejected**  
 BSUC-5 (Vertebrae/Cord Injury), Unknown Contact, Hospital Records  
 HLUB-4 (Other Brain Injury), Unknown Contact, Hospital Records  
 HIFS-3 (Head/Face Fracture), Unknown Contact, Hospital Records  
 CRFS-3 (Rib/Pelvis Fracture), Unknown Contact, Hospital Records  
 BSFS-2 (Vertebrae/Cord Injury), Unknown Contact, Hospital Records  
 SRFS-2 (Extremity Fracture), Unknown Contact, Hospital Records

**Table 36: Severely-Injured Hospitalized Survivors  
(Cases Investigated during 1979-1984 NASS)**

- 1983 Case: 56 year-old Male Driver, Not Trapped, Not Ejected**  
 CRFS-4 (Rib/Pelvis Fracture), A-pillar Contact, Hospital Records  
 BSZV-3 (Vertebrae/Cord Injury), Roof Top Contact, Hospital Records  
 SRAI-1 (Skin Injury), A-pillar Contact, Hospital Records  
 XLAI-1 (Skin Injury), Unknown Contact, Hospital Records  
 ELAI-1 (Skin Injury), Unknown Contact, Hospital Records  
 FWAI-1 (Skin Injury), Roof Top Contact, Hospital Records
- 1984 Case: 44 year-old Male Driver, Not Trapped, Completely Ejected**  
 MLRQ-4 (Internal Injury), Unknown Contact, Hospital Records  
 HHKB-2 (Concussion), Unknown Contact, Hospital Records  
 SLDJ-2 (Joint Injury), Unknown Contact, Hospital Records  
 CLFS-2 (Rib/Pelvis Fracture), Unknown Contact, Hospital Records  
 FSLI-1 (Skin Injury), Unknown Contact, Hospital Records  
 SLAI-1 (Skin Injury), Unknown Contact, Hospital Records
- 1983 Case: 17 year-old Male Passenger, Not Trapped, Not Ejected**  
 HAFS-4 (Head/Face Fracture), Other Vehicle or Object, Hospital Records  
 FRFS-3 (Head/Face Fracture), Other Vehicle or Object, Hospital Records  
 HUCB-3 (Other Brain Injury), Other Vehicle or Object, Hospital Records  
 FLFS-2 (Head/Face Fracture), Other Vehicle or Object, Hospital Records  
 FSLI-1 (Skin Injury), Other Vehicle or Object, Hospital Records  
 FSAI-1 (Skin Injury), Other Vehicle or Object, Hospital Records

Table 37: Hospitalized Survivors with Serious Torso Injuries  
(Cases Investigated during 1979-1984 NASS)

- 1984 Case: 23 year-old Male Driver, Not Trapped, Not Ejected  
BSFS-3 (Vertebrae/Cord Injury), Unknown Contact, Hospital Records  
BSFS-3 (Vertebrae/Cord Injury), Unknown Contact, Hospital Records  
FCAI-1 (Skin Injury), Unknown Contact, Hospital Records  
ERAI-1 (Skin Injury), Unknown Contact, Hospital Records  
NPTM-1 (Muscle Injury), Unknown Contact, Hospital Records  
TLCI-1 (Skin Injury), Unknown Contact, Hospital Records
- 1979 Case: 48 year-old Male Driver, Entrapped, Not Ejected  
CBFS-3 (Rib/Pelvis Fracture), Steering Assembly, Hospital Records  
LLLI-2 (Skin Injury), Instrument Panel Contact, Hospital Records  
LRFS-2 (Extremity Fracture), Instrument Panel Contact, Hospital Records  
TRLI-2 (Skin Injury), Instrument Panel Contact, Hospital Records  
FWLI-1 (Skin Injury), Unknown Contact, Hospital Records  
MLLI-1 (Skin Injury), Unknown Contact, Hospital Records
- 1980 Case: 41 year-old Male Driver, Not Trapped, Not Ejected  
CLUU-3 (Other Chest Injury), Unknown Contact, Hospital Records  
HRLJ-2 (Joint Injury), Unknown Contact, Hospital Records  
SLFS-2 (Extremity Fracture), Unknown Contact, Hospital Records  
TLCI-1 (Skin Injury), Unknown Contact, Non-Medical Source  
TRCI-1 (Skin Injury), Unknown Contact, Non-Medical Source  
FSCI-1 (Skin Injury), Unknown Contact, Non-Medical Source
- 1981 Case: 39 year-old Male Driver, Not Trapped, Not Ejected  
CRPP-3 (Internal Injury), Floor Transmission Lever, Non-Medical Source  
BITM-1 (Muscle Injury), Non-Contact Injury, Non-Medical Source
- 1981 Case: 43 year-old Male Driver, Not Trapped, Not Ejected  
CRCP-3 (Internal Injury), Floor Transmission Lever, Hospital Records  
CRFS-2 (Rib/Pelvis Fracture), Floor Transmission Lever, Hospital Records  
FRAI-1 (Skin Injury), Roof Top Contact, Hospital Records  
RRLI-1 (Skin Injury), Non-Contact Injury, Hospital Records  
FRCO-1 (Skin Injury), Roof Top Contact, Private Physician  
FRLI-1 (Skin Injury), Roof Top Contact, Private Physician
- 1982 Case: 40 year-old Male Driver, Not Trapped, Not Ejected  
CRCP-3 (Internal Injury), Unknown Contact, Hospital Records  
CRFS-2 (Rib/Pelvis Fracture), Unknown Contact, Hospital Records  
BSCI-1 (Skin Injury), Unknown Contact, Hospital Records  
BSAI-1 (Skin Injury), Unknown Contact, Hospital Records  
FSLI-1 (Skin Injury), Unknown Contact, Hospital Records  
HRLE-1 (Skin Injury), Unknown Contact, Hospital Records
- 1983 Case: 29 year-old Male Driver, Entrapped, Not Ejected  
CLCP-3 (Internal Injury), Unknown Contact, Emergency Room Records  
FSLI-1 (Skin Injury), Unknown Contact, Emergency Room Records  
CLFS-1 (Rib/Pelvis Fracture), Unknown Contact, Emergency Room Records  
ELLI-1 (Skin Injury), Unknown Contact, Emergency Room Records  
FSLI-1 (Skin Injury), Unknown Contact, Emergency Room Records  
LLLI-1 (Skin Injury), Unknown Contact, Emergency Room Records

**Table 37 (continued): Hospitalized Survivors with Serious Torso Injuries  
(Cases Investigated during 1979-1984 NASS)**

- 1983 Case: 48 year-old Male Driver, Not Trapped, Completely Ejected**  
 CLCP-3 (Internal Injury), Steering Assembly, Emergency Room Records  
 CLFS-2 (Rib/Pelvis Fracture), Steering Assembly, Emergency Room Records  
 XRAI-1 (Skin Injury), Ground, Non-Medical Source  
 XLAI-1 (Skin Injury), Ground, Non-Medical Source
- 1983 Case: 28 year-old Male Driver, Not Trapped, Not Ejected**  
 CCCH-3 (Internal Injury), Unknown Contact, Non-Medical Source  
 NUUU-7 (Other Head/Face/Neck), Unknown Contact, Non-Medical Source  
 NUUU-7 (Other Head/Face/Neck), Unknown Contact, Non-Medical Source  
 BUUN-7 (Other Artery/Nerve), Unknown Contact, Non-Medical Source
- 1984 Case: 44 year-old Male Driver, Entrapped, Not Ejected**  
 CRLP-3 (Internal Injury), Unknown Contact, Non-Medical Source  
 CRFS-2 (Rib/Pelvis Fracture), Unknown Contact, Non-Medical Source  
 SRFS-2 (Extremity Fracture), Unknown Contact, Non-Medical Source  
 OWCI-1 (Skin Injury), Unknown Contact, Non-Medical Source  
 HUUB-7 (Other Brain Injury), Unknown Contact, Non-Medical Source
- 1984 Case: 27 year-old Male Driver, Not Trapped, Not Ejected**  
 CCCH-3 (Internal Injury), Steering Assembly, Emergency Room Records  
 CCFS-2 (Rib/Pelvis Fracture), Steering Assembly, Emergency Room Records  
 CCCI-1 (Skin Injury), Steering Assembly, Emergency Room Records  
 KLCI-1 (Skin Injury), Foot Controls, Emergency Room Records  
 KLAI-1 (Skin Injury), Foot Controls, Emergency Room Records  
 KLLI-1 (Skin Injury), Foot Controls, Non-Medical Source
- 1984 Case: 26 year-old Male Driver, Not Trapped, Not Ejected**  
 CRCP-3 (Internal Injury), Instrument Panel Contact, Hospital Records  
 CRFS-2 (Rib/Pelvis Fracture), Instrument Panel Contact, Hospital Records
- 1984 Case: 58 year-old Male Driver, Not Trapped, Completely Ejected**  
 CRFS-3 (Rib/Pelvis Fracture), Unknown Contact, Hospital Records  
 CRAI-1 (Skin Injury), Unknown Contact, Hospital Records  
 FRAI-1 (Skin Injury), Unknown Contact, Hospital Records  
 WRAI-1 (Skin Injury), Unknown Contact, Hospital Records  
 KRAI-1 (Skin Injury), Unknown Contact, Hospital Records  
 KLAI-1 (Skin Injury), Unknown Contact, Hospital Records
- 1982 Case: 29 year-old Male Driver, Not Trapped, Not Ejected**  
 MLCK-3 (Internal Injury), Unknown Contact, Hospital Records  
 ALLI-1 (Skin Injury), Unknown Contact, Hospital Records  
 FLLI-1 (Skin Injury), Unknown Contact, Hospital Records  
 ALLI-1 (Skin Injury), Unknown Contact, Hospital Records  
 HLLI-1 (Skin Injury), Unknown Contact, Hospital Records  
 TLAI-1 (Skin Injury), Unknown Contact, Hospital Records

**Table 38: Hospitalized Survivors with Serious Head Injuries  
(Cases Investigated during 1979-1984 NASS)**

- 1979 Case: 39 year-old Male Driver, Not Trapped, Not Ejected**  
HSKB-3 (Concussion), Side Hardware or Armrests, Hospital Records  
HLI-1 (Skin Injury), Side Hardware or Armrests, Non-Medical Source
- 1979 Case: 26 year-old Male Driver, Not Trapped, Not Ejected**  
HNKB-3 (Concussion), Windshield Contact, Non-Medical Source  
FSCI-1 (Skin Injury), Windshield Contact, Non-Medical Source  
MCPM-1 (Muscle Injury), Windshield Contact, Non-Medical Source
- 1983 Case: 34 year-old Male Driver, Not Trapped, Not Ejected**  
HNKB-3 (Concussion), A-pillar Contact, Hospital Records  
HLAI-1 (Skin Injury), A-pillar Contact, Hospital Records  
HLAI-1 (Skin Injury), A-pillar Contact, Hospital Records  
NLAI-1 (Skin Injury), A-pillar Contact, Hospital Records  
NLAI-1 (Skin Injury), A-pillar Contact, Hospital Records  
FSCI-1 (Skin Injury), A-pillar Contact, Hospital Records
- 1983 Case: 48 year-old Female Driver, Not Trapped, Completely Ejected**  
MACB-3 (Other Brain Injury), Ground, Hospital Records  
MRAI-1 (Skin Injury), Ground, Hospital Records  
FRAI-1 (Skin Injury), Ground, Hospital Records  
HPLI-1 (Skin Injury), Ground, Hospital Records  
CRAI-1 (Skin Injury), Ground, Hospital Records  
PRCI-1 (Skin Injury), Ground, Hospital Records

**Table 39: Hospitalized Survivors with Serious Extremity Injuries  
(Cases Investigated during 1979-1984 NASS)**

- 1979 Case: 54 year-old Male Driver, Not Trapped, Not Ejected**  
KLFJ-3 (Joint Injury), Unknown Contact, Hospital Records  
FSLI-1 (Skin Injury), Windshield Contact, Hospital Records  
MLLI-1 (Skin Injury), Unknown Contact, Hospital Records  
SRSJ-3 (Joint Injury), Unknown Contact, Non-Medical Source  
LRLI-1 (Skin Injury), Unknown Contact, Non-Medical Source  
MILI-1 (Skin Injury), Unknown Contact, Non-Medical Source
- 1980 Case: 35 year-old Female Passenger, Not Trapped, Completely Ejected**  
LRMW-3 (Amputation), Unknown Contact, Hospital Records  
LLMW-3 (Amputation), Unknown Contact, Hospital Records  
TLI-1 (Skin Injury), Unknown Contact, Hospital Records  
TLAI-1 (Skin Injury), Unknown Contact, Hospital Records
- 1983 Case: 27 year-old Male Driver, Not Trapped, Not Ejected**  
LLFS-3 (Extremity Fracture), Unknown Contact, Hospital Records  
QLFS-3 (Extremity Fracture), Unknown Contact, Hospital Records  
MHKB-2 (Concussion), Unknown Contact, Hospital Records  
FSLI-1 (Skin Injury), Unknown Contact, Hospital Records  
NUUI-7 (Skin Injury), Unknown Contact, Hospital Records  
XRAI-1 (Skin Injury), Unknown Contact, Emergency Room Records
- 1984 Case: 46 year-old Male Driver, Not Trapped, Not Ejected**  
LLFS-3 (Extremity Fracture), Unknown Contact, Emergency Room Records  
DWAI-1 (Skin Injury), Unknown Contact, Emergency Room Records  
DHCI-1 (Skin Injury), Unknown Contact, Emergency Room Records
- 1979 Case: 49 year-old Male Driver, Not Trapped, Not Ejected**  
PLDJ-3 (Joint Injury), Unknown Contact, Hospital Records
- 1982 Case: 43 year-old Male Driver, Entrapped, Not Ejected**  
PRDJ-3 (Joint Injury), Unknown Contact, Hospital Records  
LRFS-3 (Extremity Fracture), Unknown Contact, Hospital Records  
FIFS-2 (Head/Face Fracture), Unknown Contact, Hospital Records  
FRLI-2 (Skin Injury), Unknown Contact, Hospital Records  
FIDS-1 (Other Head/Face/Neck), Unknown Contact, Hospital Records  
MICI-1 (Skin Injury), Unknown Contact, Hospital Records
- 1984 Case: 26 year-old Male Driver, Not Trapped, Not Ejected**  
RLFS-3 (Extremity Fracture), Unknown Contact, Hospital Records  
TRCI-1 (Skin Injury), Unknown Contact, Hospital Records  
TLAI-1 (Skin Injury), Unknown Contact, Hospital Records  
FSAI-1 (Skin Injury), Unknown Contact, Hospital Records  
SRCI-1 (Skin Injury), Unknown Contact, Hospital Records  
WLDJ-1 (Joint Injury), Unknown Contact, Hospital Records
- 1984 Case: 42 year-old Male Driver, Entrapped, Not Ejected**  
RRFS-3 (Extremity Fracture), Unknown Contact, Hospital Records  
RRFS-3 (Extremity Fracture), Unknown Contact, Hospital Records  
FUF-1 (Head/Face Fracture), Unknown Contact, Hospital Records  
CRFS-1 (Rib/Pelvis Fracture), Unknown Contact, Hospital Records  
HSLI-1 (Skin Injury), Unknown Contact, Hospital Records  
FSLI-1 (Skin Injury), Unknown Contact, Hospital Records

**Table 39 (continued): Hospitalized Survivors with Serious Extremity Injuries  
(Cases Investigated during 1979-1984 NASS)**

- 1982 Case: 53 year-old Male Driver, Not Trapped, Partially Ejected**  
SLDJ-3 (Joint Injury), Unknown Contact, Emergency Room Records  
SLFS-2 (Extremity Fracture), Unknown Contact, Emergency Room Records  
HRLI-1 (Skin Injury), Unknown Contact, Emergency Room Records  
RLLI-1 (Skin Injury), Unknown Contact, Emergency Room Records  
CLPP-4 (Internal Injury), Steering Assembly, Non-Medical Source  
BSFS-3 (Vertebrae/Cord Injury), Unknown Contact, Non-Medical Source
- 1983 Case: 59 year-old Male Driver, Not Trapped, Not Ejected**  
SLDJ-3 (Joint Injury), Side Interior Surface, Emergency Room Records  
HLAI-1 (Skin Injury), Window Glass or Frame, Emergency Room Records  
ALLI-1 (Skin Injury), Window Glass or Frame, Non-Medical Source
- 1984 Case: 28 year-old Male Driver, Not Trapped, Not Ejected**  
SLDJ-3 (Joint Injury), Unknown Contact, Non-Medical Source  
OWCI-1 (Skin Injury), Unknown Contact, Non-Medical Source  
OWLI-1 (Skin Injury), Unknown Contact, Non-Medical Source  
OWAI-1 (Skin Injury), Unknown Contact, Non-Medical Source
- 1984 Case: 19 year-old Female Passenger, Not Trapped, Not Ejected**  
TLFS-3 (Extremity Fracture), Unknown Contact, Hospital Records  
QRFS-2 (Extremity Fracture), Unknown Contact, Hospital Records  
BITM-1 (Muscle Injury), Unknown Contact, Hospital Records  
RRAI-1 (Skin Injury), Unknown Contact, Emergency Room Records  
HRAI-1 (Skin Injury), Unknown Contact, Emergency Room Records  
LRAI-1 (Skin Injury), Unknown Contact, Emergency Room Records

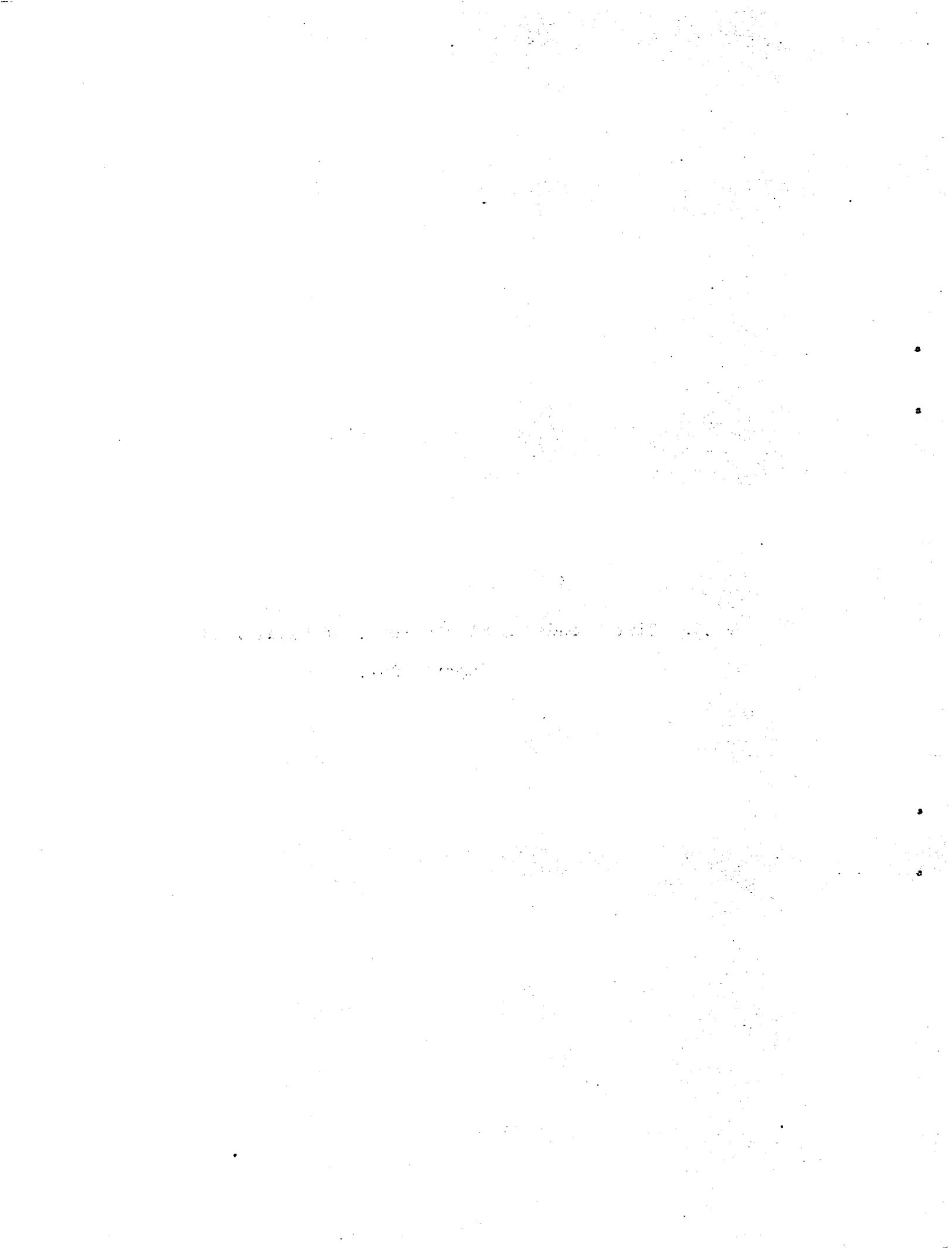
The first part of the document discusses the importance of maintaining accurate records. It emphasizes that proper record-keeping is essential for ensuring the integrity and reliability of the data collected. This section also outlines the various methods used to collect and analyze the data, highlighting the challenges faced during the process.

The second part of the document focuses on the results of the study. It presents a detailed analysis of the data, showing the trends and patterns observed. The findings indicate that there is a significant correlation between the variables studied, which supports the hypothesis of the research.

The third part of the document discusses the implications of the study. It explores the potential applications of the findings in various fields and the impact they may have on future research. The author also identifies the limitations of the study and suggests areas for further investigation.

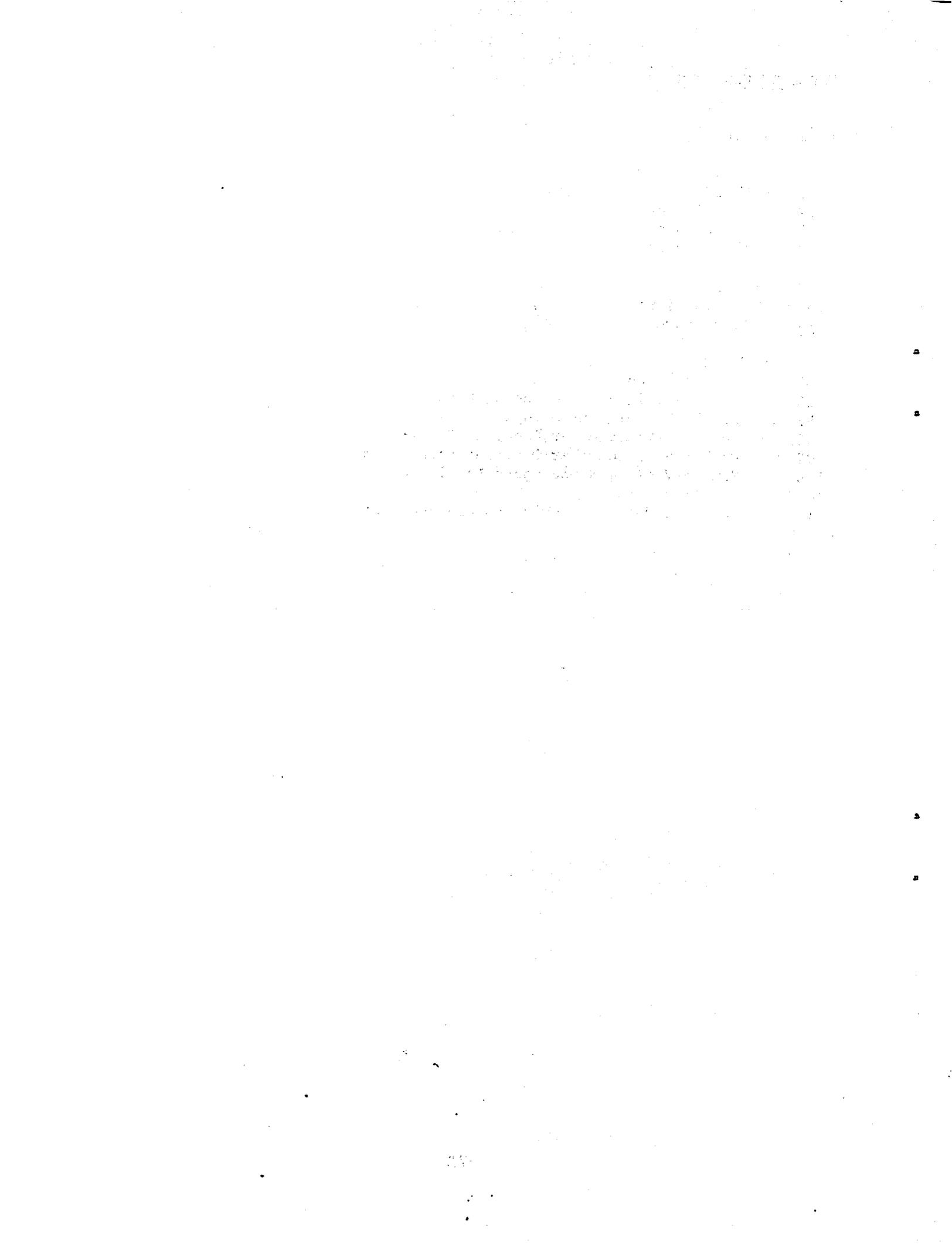
The final part of the document provides a conclusion and a summary of the key points. It reiterates the main findings and the significance of the study. The author expresses gratitude to the participants and the funding agencies that supported the research. The document ends with a list of references and a bibliography.

**Car Size Trends in Eleven Years of Fatal Accidents**  
**(April 1987)**



## TABLE OF CONTENTS

Page	Topic
77	RESULTS
77	Conclusion
78	Background
79	Discussion
82	METHOD
82	Definitions
83	Procedure
85	DETAILS
85	Presentation
85	Single-Vehicle Car Occupant Fatalities
87	Double-Vehicle Car Occupant Fatalities
95	Multiple-Vehicle Car Occupant Fatalities
99	Double-Vehicle Other Occupant Fatalities
106	Single-Vehicle Nonoccupant Fatalities
109	Fatality Rates
117	Fatality Odds in Double-Vehicle Accidents



## RESULTS

### Conclusion

In 1975, small cars (minicompact, subcompact, and compact cars -- those with curb weights under 2,950 pounds) were only 22 percent of all cars registered in this country. In 1985, the proportion of small cars had doubled -- to 43 percent of all registered cars. Fatalities in small cars rose as well -- from 8,877 in 1975 (34 percent of car occupant fatalities) to 13,014 in 1985 (56 percent of car occupant fatalities).

The increase in the proportion of small cars was 21 percentage points among registrations and 22 percentage points among fatalities. It appears that vehicle downsizing changed the car size mix in fatal accidents (more cars are small, so more fatalities occur in small cars), but not the number of fatalities. Instead, car occupant fatalities declined 11 percent (from 26,120 to 23,244) between 1975 and 1985.

Small cars do not protect as well in a crash. We do not completely understand why increased small car use has not increased fatalities. Some possible reasons include more careful driving by those who switch from large to small cars, better handling and accident avoidance in small (particularly in front-wheel drive) cars, increased restraint use (especially by young children and others covered by state belt use laws), a shift towards using light trucks and vans in place of cars, and economic changes and their social consequences.

Background

Estimates from Polk registration data show the shift to small cars in the last eleven years. The earliest two years (1975 and 1976) and the latest two years (1984 and 1985) of data were combined to improve the comparison.

Years Combined	<u>Percentage of Cars Registered in Each Size Category</u>						Total
	Mini-compact	Sub-compact	Compact	Inter-mediate	Full-size	Largest	
1975-1976	4.9 %	8.0 %	9.9 %	18.1 %	24.1 %	35.0 %	100 %
1984-1985	4.9 %	18.0 %	18.5 %	20.0 %	17.2 %	21.4 %	100 %

Small cars have increased as a proportion of registrations. They have also increased as a proportion of occupant fatalities, based on data from the Fatal Accident Reporting System.

Years Combined	<u>Percentage of Occupant Fatalities by Car Size</u>						Total
	Mini-compact	Sub-compact	Compact	Inter-mediate	Full-size	Largest	
1975-1976	7.9 %	9.6 %	17.2 %	26.2 %	22.5 %	16.7 %	100 %
1984-1985	9.5 %	23.0 %	21.7 %	22.5 %	14.3 %	9.0 %	100 %

The ratio of these two percentages (the percentage of occupant fatalities divided by the percentage of registered cars) produces a measure of fatal involvements. A value less than one means that the car size has a lower proportion of occupant fatalities than registrations; a value greater than one means that the car size has a higher proportion of fatalities than registrations. Large cars have fewer fatalities per registered vehicle (and a lower value of this measure) than do small cars.

Years Combined	<u>Ratio of Occupant Fatalities to Registered Cars</u>						Total
	Mini-compact	Sub-compact	Compact	Inter-mediate	Full-size	Largest	
1975-1976	1.6	1.2	1.7	1.4	0.9	0.5	1.0
1984-1985	2.0	1.3	1.2	1.1	0.8	0.4	1.0

## Discussion

The larger number of occupant fatalities per registered small car led to fears that fatalities would increase as small cars became more numerous. If fatalities per registered vehicle were constant within car size (not affected by changing patterns of vehicle use, nor by changes in the vehicles themselves, in the driving environment, in the economy, and in other societal influences) then certain projections could be made easily. For example, the 1975-1976 fatality experience in each size category (taking into account the vehicle size mix in two-vehicle accidents) and estimates of the future vehicle mix could be used to project a 1984-1985 fatality scenario.

The simple projections can be made from the change in the number of registered cars of each size. Subcompact cars were 8.0 percent of cars registered in 1975-1976. They were 18.0 percent in 1984-1986. If the overall number of cars did not change in the interval, there would have been 2.25 times as many (calculated as  $18.0 / 8.0$ , or 125 percent more) subcompact cars in 1984-1985 as there were in 1975-1976.

The largest cars were 35.0 percent of car registrations in 1975-1976 and 21.4 percent in 1984-1985. If the total number of registered cars had not changed, there would have been 0.61 times as many (calculated as  $21.4 / 35.0$ , or 39 percent fewer) largest cars in 1984-1985 as there were in 1975-1976.

If fatalities per registered car were constant within size category, this would mean 125 percent more single-vehicle fatalities in subcompact cars and 39 percent fewer single-vehicle fatalities in largest cars. If the number of registered motorcycles, light trucks, vans, heavy trucks, and other vehicles were also constant, this would mean the same fatality changes in accidents involving a car and another vehicle. For example, fatalities in subcompacts struck by a heavy truck would increase by 125 percent and motorcyclists killed by a largest car would decrease by 39 percent.

The situation in two-car accidents is a little more complicated because the size of each (and the changes in the registrations of each) must be considered. Fatalities in accidents involving two subcompact cars would increase by a factor of 5.06 (which is  $2.25 * 2.25$ ), a 406 percent increase. Fatalities in accidents involving two largest cars would decrease by a factor of 0.37 (which is  $0.61 * 0.61$ ), a 63 percent decrease. Fatalities in accidents involving a subcompact and a largest car would increase by a factor of 1.37 (which is  $2.25 * 0.61$ ), a 37 percent increase.

The 1975-1976 fatalities, the 1975-1976 car registrations (percent by car size), and the 1984-1985 car registrations (percent by car size) were used to make 1984-1985 projected fatalities. These projected fatalities, along with the 1975-1976 fatalities and the 1984-1985 fatalities, are shown next.

	1975-1976	1984-1985	
		Actual	Projected
<b>Car Occupant Fatalities in</b>			
Single-vehicle accidents	25,099	20,883	28,521
Car-to-car accidents	14,887	11,124	16,533
Other vehicle-to-car accidents	9,440	11,436	10,785
<u>Multiple-vehicle accidents</u>	<u>3,073</u>	<u>3,445</u>	<u>3,579</u>
Total car occupant fatalities	52,499	46,888	59,418
<b>Other Fatalities in Car Accidents</b>			
Car-to-other vehicle accidents	4,400	4,747	4,385
<u>Nonmotorists</u>	<u>11,000</u>	<u>9,007</u>	<u>11,059</u>
Total other fatalities	15,400	13,754	15,444
<b>Total Fatalities Involving Cars</b>	<b>67,899</b>	<b>60,642</b>	<b>74,862</b>

The 67,899 fatalities in car accidents in 1975-1976 produced a projection of 74,862 fatalities in car accidents in 1984-1985. In fact, there were only 60,642 fatalities in car accidents in 1984-1985. No adjustments were made in the projections for increases in registered vehicles and vehicle miles traveled. If the projections were adjusted for registered vehicles, they would increase by 28 percent. If they were adjusted for vehicle miles traveled, they would increase by 34 percent. However, historically fatalities have not increased as rapidly as either registered vehicles or vehicle miles traveled. In the past 65 years, traffic fatalities have increased in proportion to increases in population; within this overall pattern, smaller variations are associated with unemployment and employment cycles.

The simple projection based solely on the change in the car mix (assuming the number of cars, other vehicles, and people would not change) was a 10 percent increase in fatalities in car accidents.

	Percent Change in Fatalities (1975+1976) versus (1984+1985)	
	Actual	Projected
<b>Car Occupant Fatalities in</b>		
Single-vehicle accidents	- 14 %	+ 17 %
Car-to-car accidents	- 25 %	+ 11 %
Other vehicle-to-car accidents	+ 21 %	+ 14 %
<u>Multiple-vehicle accidents</u>	<u>+ 12 %</u>	<u>+ 16 %</u>
Total car occupant fatalities	- 11 %	+ 13 %
<b>Other Fatalities in Car Accidents</b>		
Car-to-other vehicle accidents	+ 8 %	- 0 %
<u>Nonmotorists</u>	<u>- 18 %</u>	<u>+ 1 %</u>
Total other fatalities	- 11 %	+ 0 %
<b>Total Fatalities Involving Cars</b>	<b>- 11 %</b>	<b>+ 10 %</b>

Fatalities to others (other occupants involved with cars in accidents and nonmotorists struck by cars) were not expected to change much. The increase was projected mainly to affect car occupant fatalities because small cars provide less crash protection. Car occupant fatalities were expected to increase by 17 percent in single-vehicle accidents, 14 percent in accidents involving another vehicle, and 11 percent in car-to-car accidents. The only one of these three projected increases to occur (and indeed to exceed the magnitude of the projected increase) was for car occupant fatalities in accidents involving another vehicle type. One reason for the larger increase was the large increase in the number of light trucks and vans in personal use, replacing some car use. Fatalities in multiple-vehicle (three or more vehicles) accidents involving at least one car also increased, but not as much as projected from 1975-1976 data.

The comparison of the 1975-1976 experience with the 1984-1985 experience shows that fatalities in single-car accidents and in car-to-car accidents have declined (by 14 percent and 25 percent, respectively), despite increases in the number of registered cars. Fatalities in cars involved with other vehicles have increased, partly as a result of the greater weight difference between smaller cars and heavier vehicles and partly as a result of the increase in the number of light trucks and vans in use. The overall change in car occupant fatalities was an 11 percent decline.

Fatalities in other vehicles involved with cars increased 8 percent. This was largely the result of an increase in motorcyclists killed by cars. As cars have gotten smaller, light truck, van, and heavy truck occupant fatalities in accidents with cars have declined despite the increased popularity of light trucks and vans for car-type travel. Nonmotorist fatalities declined 18 percent. Overall, fatalities to others involved with cars in accidents declined 11 percent.

Thus, fatalities in car accidents declined 11 percent -- an 11 percent decline among car occupant fatalities and an 11 percent decline among those involved with cars in accidents. This decline is the result of many factors whose combined effect will probably never be completely understood. It is quite different from the 10 percent increase projected from the 1975-1976 fatalities per registered car by size and the 1984-1985 car size mix.

## METHOD

### Definitions

Accidents were defined as single-vehicle, double-vehicle, or multiple-vehicle (three or more or an unknown number of vehicles) using the FARS Vehicles Involved variable. This variable did not exist in 1975. So, a combination of the FARS Vehicle Forms Submitted and First Harmful Event variables was used. If one vehicle form was submitted and the First Harmful Event was neither a collision with a motor vehicle in transport (code 12) nor a collision with a motor vehicle in another roadway (code 13), then the accident was categorized as single-vehicle. If one vehicle form was submitted and the First Harmful Event was coded 12 or 13, then the accident was categorized as double-vehicle. If two vehicle forms were submitted, the accident was categorized as double-vehicle. If three or more vehicle forms were submitted, the accident was categorized as multiple-vehicle. Single-vehicle accidents that involved a car were defined as either single-car accidents (if there was a car occupant fatality) or as nonoccupant accidents (if there was no car occupant fatality).

Vehicles were categorized into one of five groups by the FARS Body Type variable. The categories were defined differently for different accident years because of changes in the Body Type coding. The categories are as follows:

<u>Vehicle Type</u>	<u>1975-1981 Data</u>	<u>1982-1985 Data</u>
Car	1-9, 39	1-11, 67
Motorcycle	15-18	20-29
Light truck or van	50-52	40-41, 48-51, 53-55, 58-59, 69
Heavy truck	53-59	70-72, 74-76, 78
Other vehicle	all other known	all other known

Cars were categorized into one of six size groups using to the FARS Curb Weight variable. The categories are as follows:

<u>Car Size</u>	<u>Curb Weight Range</u>
Minicompact	950-1,949 pounds
Subcompact	1,950-2,449 pounds
Compact	2,450-2,949 pounds
Intermediate	2,950-3,449 pounds
Fullsize	3,450-3,949 pounds
Largest	3,950-9,049 pounds

The five vehicle type categories combined with the six subcategories of car size produced ten categories of vehicle type/size.

## Procedure

Unknown vehicle data for fatalities were distributed proportionately within relevant accident and vehicle classes to improve cross-year comparisons. Amounts of unknown data in key variables differ greatly by year. For example, 4,362 occupant fatalities in single-car accidents in 1975 (35 percent of single-car occupant fatalities) do not have curb weight coded on the FARS file. By 1985, only 1,207 (12 percent) of single-car occupant fatalities have unknown curb weight. One major reason for this improvement is that the Vehicle Identification Number (VIN) of pre-1966 model year cars cannot be interpreted by the VIN-decoding program used by FARS. As these vehicles become rarer, VIN interpretation improves. Curb weight is a product of VIN interpretation.

For all but double-vehicle accident fatalities, the distribution of unknown car size proceeded in three steps. As a first step, unknown car sizes were prorated among known sizes within accident type (single, multiple, and nonoccupant), accident year, vehicle model year (individually, except that pre-1966 model year cars were treated as if they were 1966 model year cars), and vehicle make. Some unknowns remained after this first step, so the results were collapsed over vehicle make.

As a second step, unknown car sizes were prorated among known car sizes within accident type, accident year, and vehicle model year. Fewer unknowns remained after this second step, and the results were collapsed over vehicle model year.

As a third and final step, unknown car sizes were prorated among known car sizes within accident type and accident year. After this third step, no unknown car sizes remained.

For double-vehicle accidents, the distribution of unknown data was complicated by unknown data in the subject vehicle, unknown data in the other involved vehicle, the relationship between these unknown data, and the relationship between the vehicle type/sizes of the two vehicles. As a first step, unknown subject vehicle car sizes were prorated among known sizes within accident year, other involved vehicle type/size (including unknown car size and unknown vehicle type), and subject vehicle model year (with pre-1966 model year vehicles treated as if they were 1966 model year vehicles). Some unknown subject vehicle car sizes remained after this first step, so the results were collapsed over subject vehicle model year.

As a second step, unknown subject vehicle car sizes were prorated among known sizes within categories of accident year and other involved vehicle type/size. No unknown subject vehicle car sizes remained after this second step, but there were unknown subject vehicle types.

As a third step, these unknown subject vehicle types were prorated among the ten known subject vehicle type/sizes within categories of accident year and other involved vehicle type/size. No unknown subject vehicle type/sizes remained after this third step. Now the unknown other involved vehicle type/sizes were considered.

As a fourth step, unknown other vehicle car size was prorated among the known car sizes within accident year and subject vehicle type/size (as estimated after the third step in this procedure).

In a fifth step, the simple prorating among other involved vehicle car sizes of step four was adjusted for biases in the unknown other vehicle car size data. The basis of the adjustment was the experience in the single-car procedure. The results of the detailed procedure described were compared to what would have been the result if unknown car sizes were simply prorated among known car sizes for each accident year, without consideration of vehicle model year and make. The comparison produced a ratio which was applied to the results of the fourth step in this procedure, to correct for bias in the unknown data. This left no unknown car sizes.

As a sixth and final step, unknown other vehicle types were prorated among the ten known other vehicle type/sizes within accident year and the ten subject vehicle type/sizes.

A similar procedure was used for unknown car sizes for the Polk registration data. Approximately 16 percent of the car sizes are unknown for the over 100 million vehicles represented on each of the 1983 and 1984 Polk data files. An additional complication of the Polk data is that vehicle details are available for only the 15 most recent years -- previous years are represented only by counts per manufacturer. And unknown model years are not distinguished from older vehicles. For this report, older vehicles and vehicles with unknown model year are treated as if they are the oldest model year with vehicle details (model year 1969 for 1983 registrations; model year 1970 for 1984 registrations).

As a first step, unknown car sizes were distributed within registration year, vehicle model year, and vehicle make. Some unknown car sizes remained, so the data were collapsed over vehicle make.

As a second and final step, unknown car sizes were prorated among known car sizes within registration year and vehicle model year. After this second step, no unknown car sizes remained.

## DETAILS

### Presentation

This report is organized by accident and victim type -- Single-Vehicle Car Occupant Fatalities, Double-Vehicle Car Occupant Fatalities, Multiple-Vehicle Car Occupant Fatalities, Double-Vehicle Other Occupant Fatalities, and Single-Vehicle Nonoccupant Fatalities -- and with summary sections of Fatality Rates and Fatality Odds in Double-Vehicle Accidents.

### Single-Vehicle Car Occupant Fatalities

There were 18 percent fewer single-car occupant fatalities in 1985 (10,134) than there were in 1975 (12,423). Most of this change occurred in 1981 and 1982 as a result of the economic decline; by 1985 traffic fatalities had not returned to their 1975 levels. There were large shifts within car size category. Minicompact car fatalities were essentially unchanged, although the number of fatalities has fluctuated over the years. Subcompact car fatalities doubled. Compact car fatalities increased by about one-tenth. Intermediate car fatalities declined by about one-third. Fullsize and largest car fatalities each dropped by more than one-half. The data are shown in Table 1.

The percentages in Table 2 show how steady the vehicle size changes have been. Minicompact, subcompact, and compact car single-vehicle fatalities have consistently increased as a proportion of all single-vehicle car fatalities over these eleven years. Intermediate, fullsize, and largest car single-vehicle fatalities have consistently decreased.

Table 1: Counts of Fatalities in Single-Vehicle Car Accidents

Year	Car in which Fatality Occurred						Total
	Mini-compact	Sub-compact	Compact	Inter-mediate	Full-size	Largest	
1975	792	1,056	2,058	3,531	2,981	2,007	12,423
1976	788	1,066	2,212	3,441	2,944	2,224	12,676
1977	922	1,221	1,969	3,211	3,055	2,096	12,474
1978	893	1,337	1,962	3,492	2,953	2,227	12,864
1979	901	1,647	2,051	3,346	2,878	2,106	12,929
1980	933	1,757	2,327	3,471	2,812	2,183	13,483
1981	955	1,935	2,165	3,237	2,431	1,819	12,543
1982	885	1,798	2,029	2,746	2,046	1,376	10,879
1983	939	1,827	2,107	2,583	1,874	1,273	10,604
1984	902	2,035	2,304	2,640	1,702	1,165	10,749
1985	793	2,259	2,287	2,380	1,452	962	10,134
Total	9,703	17,939	23,472	34,079	27,127	19,438	131,758

Table 2: Percentages of Fatalities in Single-Vehicle Car Accidents

Year	Car in which Fatality Occurred						Total
	Mini-compact	Sub-compact	Compact	Inter-mediate	Full-size	Largest	
1975	6	8	17	28	24	16	100
1976	6	8	17	27	23	18	100
1977	7	10	16	26	24	17	100
1978	7	10	15	27	23	17	100
1979	7	13	16	26	22	16	100
1980	7	13	17	26	21	16	100
1981	8	15	17	26	19	15	100
1982	8	17	19	25	19	13	100
1983	9	17	20	24	18	12	100
1984	8	19	21	25	16	11	100
1985	8	22	23	23	14	9	100
Total	7	14	18	26	21	15	100

## Double-Vehicle Car Occupant Fatalities

Tables 3 through 13 show car occupant fatalities in two-vehicle accidents by accident year, car size, and size of the other involved vehicle. The eleven years of data are combined to form Table 14. This shows, for example, 1,125 minicompact car occupants were killed when involved with a compact car; but only 265 compact car occupants were killed when involved with a minicompact car. Over the eleven years, 27,144 car occupants were killed by a light truck or van; 27,434 car occupants were killed by heavy trucks; but only 297 car occupants were killed by motorcycles.

Table 15 summarizes car occupant fatalities in two-vehicle accidents by accident year and car size. There were 7 percent fewer two-vehicle car occupant fatalities in 1985 (11,301) than in 1975 (12,189). This is a much smaller change than the 18 percent decline for single-car occupant fatalities. And while single-car occupant fatalities had major drops in both 1981 and 1982, two-vehicle car occupant fatalities had a major drop only in 1982.

Minicompact car fatalities were unchanged. Subcompact car fatalities more than doubled. Compact car fatalities increased by about one-quarter. Intermediate car fatalities decreased by about one-fifth. Fullsize and largest car fatalities each declined by about one-half.

Table 16 shows that minicompact, subcompact, and compact cars increased as a proportion of two-vehicle car occupant fatalities. Intermediate, fullsize, and largest car fatalities steadily declined as a proportion of two-vehicle car occupant fatalities.

Table 3: Counts of Fatalities in Two-Vehicle Car Accidents, in 1975

Other Vehicle	Car in which Fatality Occurred						Total
	Mini-compact	Sub-compact	Compact	Inter-mediate	Full-size	Largest	
Motorcycle	3	2	3	5	5	6	23
Car -- minicompact	23	23	9	29	5	17	106
Car -- subcompact	52	37	49	47	40	25	251
Car -- compact	98	105	113	186	164	93	759
Car -- intermediate	169	206	303	455	353	278	1,764
Car -- full size	215	213	381	632	505	314	2,261
Car -- largest	252	252	401	654	551	367	2,477
Light truck/Van	159	216	370	481	452	290	1,967
Heavy truck	132	153	340	482	575	389	2,072
Other vehicle	31	43	74	135	121	106	509
<b>Total</b>	<b>1,134</b>	<b>1,250</b>	<b>2,043</b>	<b>3,105</b>	<b>2,773</b>	<b>1,885</b>	<b>12,189</b>

Table 4: Counts of Fatalities in Two-Vehicle Car Accidents, in 1976

Other Vehicle	Car in which Fatality Occurred						Total
	Mini-compact	Sub-compact	Compact	Inter-mediate	Full-size	Largest	
Motorcycle	0	10	0	6	3	3	22
Car -- minicompact	5	33	24	33	12	6	113
Car -- subcompact	34	30	27	45	43	18	197
Car -- compact	95	96	166	173	135	83	749
Car -- intermediate	192	177	339	351	293	238	1,591
Car -- full size	193	230	370	573	452	344	2,162
Car -- largest	247	263	433	580	488	446	2,457
Light truck/Van	204	224	465	505	389	328	2,115
Heavy truck	150	187	321	531	581	482	2,254
Other vehicle	26	46	75	134	125	71	477
<b>Total</b>	<b>1,147</b>	<b>1,296</b>	<b>2,221</b>	<b>2,930</b>	<b>2,524</b>	<b>2,020</b>	<b>12,138</b>

Table 5: Counts of Fatalities in Two-Vehicle Car Accidents, in 1977

Other Vehicle	Car in which Fatality Occurred						Total
	Mini-compact	Sub-compact	Compact	Inter-mediate	Full-size	Largest	
Motorcycle	5	2	0	6	5	2	20
Car -- minicompact	13	7	26	11	17	23	97
Car -- subcompact	38	48	37	50	34	21	228
Car -- compact	109	103	123	158	143	103	740
Car -- intermediate	178	218	275	338	341	243	1,592
Car -- full size	273	249	421	564	502	367	2,375
Car -- largest	268	258	440	573	495	409	2,443
Light truck/Van	228	290	396	475	468	346	2,202
Heavy truck	160	226	390	573	707	559	2,615
Other vehicle	69	48	89	113	129	106	555
<b>Total</b>	<b>1,342</b>	<b>1,448</b>	<b>2,196</b>	<b>2,862</b>	<b>2,840</b>	<b>2,180</b>	<b>12,868</b>

Table 6: Counts of Fatalities in Two-Vehicle Car Accidents, in 1978

Other Vehicle	Car in which Fatality Occurred						Total
	Mini-compact	Sub-compact	Compact	Inter-mediate	Full-size	Largest	
Motorcycle	7	4	9	3	3	6	31
Car -- minicompact	10	20	22	24	30	15	121
Car -- subcompact	52	31	56	54	41	39	272
Car -- compact	102	93	142	152	115	81	685
Car -- intermediate	197	236	317	390	341	270	1,751
Car -- full size	196	272	401	567	382	362	2,180
Car -- largest	235	328	437	569	522	388	2,479
Light truck/Van	314	357	460	624	510	400	2,666
Heavy truck	160	259	463	628	660	625	2,795
Other vehicle	60	50	80	130	124	86	530
<b>Total</b>	<b>1,333</b>	<b>1,652</b>	<b>2,386</b>	<b>3,141</b>	<b>2,726</b>	<b>2,272</b>	<b>13,510</b>

Table 7: Counts of Fatalities in Two-Vehicle Car Accidents, in 1979

Other Vehicle	Car in which Fatality Occurred						Total
	Mini-compact	Sub-compact	Compact	Inter-mediate	Full-size	Largest	
Motorcycle	4	1	0	11	9	1	26
Car -- minicompact	17	21	11	9	10	23	90
Car -- subcompact	24	72	61	65	47	27	295
Car -- compact	103	145	165	151	122	73	760
Car -- intermediate	220	296	293	406	256	205	1,676
Car -- full size	241	324	349	568	366	266	2,114
Car -- largest	169	318	307	500	427	348	2,069
Light truck/Van	269	419	529	683	456	410	2,766
Heavy truck	164	278	434	650	723	620	2,868
Other vehicle	35	78	94	107	80	54	449
Total	1,246	1,952	2,242	3,150	2,496	2,028	13,114

Table 8: Counts of Fatalities in Two-Vehicle Car Accidents, in 1980

Other Vehicle	Car in which Fatality Occurred						Total
	Mini-compact	Sub-compact	Compact	Inter-mediate	Full-size	Largest	
Motorcycle	1	4	6	7	5	2	25
Car -- minicompact	21	19	20	18	14	19	110
Car -- subcompact	52	87	70	75	56	41	381
Car -- compact	95	122	139	177	101	66	701
Car -- intermediate	211	314	276	378	288	176	1,643
Car -- full size	208	340	350	481	352	229	1,958
Car -- largest	223	342	339	514	372	257	2,048
Light truck/Van	286	451	491	605	520	383	2,738
Heavy truck	144	311	402	604	565	497	2,522
Other vehicle	27	68	88	98	69	62	412
Total	1,268	2,059	2,179	2,957	2,342	1,732	12,537

Table 9: Counts of Fatalities in Two-Vehicle Car Accidents, in 1981

Other Vehicle	Car in which Fatality Occurred						Total
	Mini-compact	Sub-compact	Compact	Inter-mediate	Full-size	Largest	
Motorcycle	3	4	4	7	2	2	23
Car -- minicompact	14	19	35	32	19	11	130
Car -- subcompact	61	118	69	78	51	21	397
Car -- compact	124	204	152	153	81	59	773
Car -- intermediate	224	377	338	402	246	168	1,755
Car -- full size	226	408	353	411	283	226	1,906
Car -- largest	191	314	378	427	323	221	1,854
Light truck/Van	270	501	454	628	414	296	2,564
Heavy truck	148	406	424	638	492	429	2,538
Other vehicle	64	121	82	112	83	58	519
<b>Total</b>	<b>1,326</b>	<b>2,472</b>	<b>2,290</b>	<b>2,887</b>	<b>1,993</b>	<b>1,491</b>	<b>12,459</b>

Table 10: Counts of Fatalities in Two-Vehicle Car Accidents, in 1982

Other Vehicle	Car in which Fatality Occurred						Total
	Mini-compact	Sub-compact	Compact	Inter-mediate	Full-size	Largest	
Motorcycle	3	6	2	9	2	1	23
Car -- minicompact	21	22	15	33	13	3	106
Car -- subcompact	66	112	75	80	44	21	399
Car -- compact	108	157	141	133	86	47	672
Car -- intermediate	184	379	264	358	192	122	1,499
Car -- full size	190	301	303	384	209	134	1,521
Car -- largest	203	364	268	358	237	168	1,597
Light truck/Van	248	498	519	565	369	249	2,448
Heavy truck	168	354	401	574	485	337	2,318
Other vehicle	54	75	67	100	82	54	433
<b>Total</b>	<b>1,245</b>	<b>2,268</b>	<b>2,055</b>	<b>2,594</b>	<b>1,719</b>	<b>1,136</b>	<b>11,017</b>

Table 11: Counts of Fatalities in Two-Vehicle Car Accidents, in 1983

Other Vehicle	Car in which Fatality Occurred						Total
	Mini-compact	Sub-compact	Compact	Inter-mediate	Full-size	Largest	
Motorcycle	1	14	11	5	5	5	41
Car -- minicompact	16	43	31	37	20	15	160
Car -- subcompact	63	105	73	97	29	31	399
Car -- compact	96	180	163	161	126	65	791
Car -- intermediate	206	343	259	307	199	102	1,416
Car -- full size	187	302	293	307	205	127	1,420
Car -- largest	144	280	227	287	176	133	1,247
Light truck/Van	303	571	460	560	387	206	2,486
Heavy truck	211	432	435	584	457	333	2,453
Other vehicle	48	99	55	113	85	64	464
Total	1,275	2,368	2,007	2,458	1,688	1,081	10,878

Table 12: Counts of Fatalities in Two-Vehicle Car Accidents, in 1984

Other Vehicle	Car in which Fatality Occurred						Total
	Mini-compact	Sub-compact	Compact	Inter-mediate	Full-size	Largest	
Motorcycle	3	4	9	10	5	1	32
Car -- minicompact	21	60	31	29	11	16	168
Car -- subcompact	80	121	106	109	54	23	493
Car -- compact	97	216	176	174	123	65	852
Car -- intermediate	203	416	282	268	178	105	1,452
Car -- full size	178	354	314	343	176	103	1,467
Car -- largest	139	285	280	231	138	110	1,183
Light truck/Van	279	604	537	595	384	209	2,607
Heavy truck	206	451	531	513	443	329	2,473
Other vehicle	58	116	94	117	98	49	532
Total	1,265	2,628	2,360	2,388	1,609	1,009	11,260

Table 13: Counts of Fatalities in Two-Vehicle Car Accidents, in 1985

Other Vehicle	Car in which Fatality Occurred						Total
	Mini-compact	Sub-compact	Compact	Inter-mediate	Full-size	Largest	
Motorcycle	5	10	6	2	6	0	28
Car -- minicompact	15	40	40	29	20	12	156
Car -- subcompact	82	191	133	131	51	26	614
Car -- compact	98	281	212	176	94	45	905
Car -- intermediate	149	418	330	279	166	83	1,424
Car -- full size	124	385	308	332	153	89	1,391
Car -- largest	93	257	238	232	131	68	1,019
Light truck/Van	291	663	575	526	346	182	2,584
Heavy truck	214	548	537	548	430	249	2,526
Other vehicle	63	171	141	138	88	53	653
<b>Total</b>	<b>1,134</b>	<b>2,964</b>	<b>2,518</b>	<b>2,393</b>	<b>1,483</b>	<b>808</b>	<b>11,301</b>

Table 14: Counts of Fatalities in Two-Vehicle Car Accidents Eleven Years Combined

Other Vehicle	Car in which Fatality Occurred						Total
	Mini-compact	Sub-compact	Compact	Inter-mediate	Full-size	Largest	
Motorcycle	36	61	48	69	50	31	297
Car -- minicompact	175	306	265	284	171	159	1,359
Car -- subcompact	604	953	755	831	491	294	3,927
Car -- compact	1,125	1,703	1,693	1,796	1,290	781	8,386
Car -- intermediate	2,134	3,381	3,275	3,931	2,851	1,991	17,563
Car -- full size	2,230	3,377	3,843	5,162	3,584	2,559	20,755
Car -- largest	2,166	3,261	3,746	4,925	3,861	2,914	20,873
Light truck/Van	2,853	4,795	5,255	6,248	4,694	3,299	27,144
Heavy truck	1,857	3,606	4,678	6,324	6,119	4,850	27,434
Other vehicle	535	916	938	1,295	1,084	764	5,532
<b>Total</b>	<b>13,715</b>	<b>22,358</b>	<b>24,497</b>	<b>30,865</b>	<b>24,194</b>	<b>17,641</b>	<b>133,270</b>

Table 15: Counts of Fatalities in Two-Vehicle Car Accidents

Year	Car in which Fatality Occurred						Total
	Mini-compact	Sub-compact	Compact	Inter-mediate	Full-size	Largest	
1975	1,134	1,250	2,043	3,105	2,773	1,885	12,189
1976	1,147	1,296	2,221	2,930	2,524	2,020	12,138
1977	1,342	1,448	2,196	2,862	2,840	2,180	12,868
1978	1,333	1,652	2,386	3,141	2,726	2,272	13,510
1979	1,246	1,952	2,242	3,150	2,496	2,028	13,114
1980	1,268	2,059	2,179	2,957	2,342	1,732	12,537
1981	1,326	2,472	2,290	2,887	1,993	1,491	12,459
1982	1,245	2,268	2,055	2,594	1,719	1,136	11,017
1983	1,275	2,368	2,007	2,458	1,688	1,081	10,878
1984	1,265	2,628	2,360	2,388	1,609	1,009	11,260
1985	1,134	2,964	2,518	2,393	1,483	808	11,301
Total	13,715	22,358	24,497	30,865	24,194	17,641	133,270

Table 16: Percentages of Fatalities in Two-Vehicle Car Accidents

Year	Car in which Fatality Occurred						Total
	Mini-compact	Sub-compact	Compact	Inter-mediate	Full-size	Largest	
1975	9	10	17	25	23	15	100
1976	9	11	18	24	21	17	100
1977	10	11	17	22	22	17	100
1978	10	12	18	23	20	17	100
1979	10	15	17	24	19	15	100
1980	10	16	17	24	19	14	100
1981	11	20	18	23	16	12	100
1982	11	21	19	24	16	10	100
1983	12	22	18	23	16	10	100
1984	11	23	21	21	14	9	100
1985	10	26	22	21	13	7	100
Total	10	17	18	23	18	13	100

### Multiple-Vehicle Car Occupant Fatalities

Car occupant fatalities in multiple-vehicle accidents increased 20 percent from 1975 to 1985. Minicompact, subcompact, and compact car occupant fatalities increased. Intermediate, fullsize, and largest car occupant fatalities decreased. The data are shown in Table 17.

The patterns in percentages of the various car sizes over time are not as tidy as the single-vehicle or two-vehicle car occupant fatality patterns shown in Table 18. But the same overall change occurred. There were about the same proportion of minicompact car occupant fatalities in 1985 (9 percent) as in 1975 (10 percent). There were more subcompact and compact fatalities in the later years. There were fewer intermediate, fullsize, and largest car fatalities.

Table 19 summarizes the car occupant fatalities by year, number of vehicles involved in the accident, and car size. Table 20 shows the data as the percentage of fatalities of each accident type for each year. Over all eleven years, minicompact and subcompact car occupant fatalities were a higher proportion of two-vehicle and multiple-vehicle accidents than of single-vehicle accidents. Compact car occupant fatalities were 18 percent of each of the three types of accidents. The three larger car sizes were a higher proportion of single-vehicle than of two-vehicle and multiple-vehicle accidents.

Table 17: Counts of Fatalities in Multiple-Vehicle Car Accidents

Year	Car in which Fatality Occurred						Total
	Mini-compact	Sub-compact	Compact	Inter-mediate	Full-size	Largest	
1975	145	164	235	401	281	282	1,508
1976	133	186	271	334	314	327	1,565
1977	162	202	290	345	320	307	1,626
1978	181	246	308	384	420	314	1,851
1979	190	278	302	393	404	259	1,826
1980	154	286	299	351	238	194	1,522
1981	202	343	297	419	246	194	1,701
1982	163	315	251	394	234	143	1,499
1983	155	362	312	336	225	133	1,522
1984	205	399	319	358	224	131	1,636
1985	172	489	398	374	228	149	1,809
Total	1,862	3,269	3,280	4,088	3,133	2,433	18,065

Table 18: Percentages of Fatalities in Multiple-Vehicle Car Accidents

Year	Car in which Fatality Occurred						Total
	Mini-compact	Sub-compact	Compact	Inter-mediate	Full-size	Largest	
1975	10	11	16	27	19	19	100
1976	8	12	17	21	20	21	100
1977	10	12	18	21	20	19	100
1978	10	13	17	21	23	17	100
1979	10	15	17	22	22	14	100
1980	10	19	20	23	16	13	100
1981	12	20	17	25	14	11	100
1982	11	21	17	26	16	10	100
1983	10	24	21	22	15	9	100
1984	13	24	19	22	14	8	100
1985	9	27	22	21	13	8	100
Total	10	18	18	23	17	13	100

Table 19: Counts of Fatalities by Car Accident Type

Accident Year	Type	Car in which Fatality Occurred					Largest	Total
		Mini- compact	Sub- compact	Compact	Inter- mediate	Full- size		
1975	single	792	1,056	2,058	3,531	2,981	2,007	12,423
	double	1,134	1,250	2,043	3,105	2,773	1,885	12,189
	multiple	145	164	235	401	281	282	1,508
1976	single	788	1,066	2,212	3,441	2,944	2,224	12,676
	double	1,147	1,296	2,221	2,930	2,524	2,020	12,138
	multiple	133	186	271	334	314	327	1,565
1977	single	922	1,221	1,969	3,211	3,055	2,096	12,474
	double	1,342	1,448	2,196	2,862	2,840	2,180	12,868
	multiple	162	202	290	345	320	307	1,626
1978	single	893	1,337	1,962	3,492	2,953	2,227	12,864
	double	1,333	1,652	2,386	3,141	2,726	2,272	13,510
	multiple	181	246	308	384	420	314	1,851
1979	single	901	1,647	2,051	3,346	2,878	2,106	12,929
	double	1,246	1,952	2,242	3,150	2,496	2,028	13,114
	multiple	190	278	302	393	404	259	1,826
1980	single	933	1,757	2,327	3,471	2,812	2,183	13,483
	double	1,268	2,059	2,179	2,957	2,342	1,732	12,537
	multiple	154	286	299	351	238	194	1,522
1981	single	955	1,935	2,165	3,237	2,431	1,819	12,543
	double	1,326	2,472	2,290	2,887	1,993	1,491	12,459
	multiple	202	343	297	419	246	194	1,701
1982	single	885	1,798	2,029	2,746	2,046	1,376	10,879
	double	1,245	2,268	2,055	2,594	1,719	1,136	11,017
	multiple	163	315	251	394	234	143	1,499
1983	single	939	1,827	2,107	2,583	1,874	1,273	10,604
	double	1,275	2,368	2,007	2,458	1,688	1,081	10,878
	multiple	155	362	312	336	225	133	1,522
1984	single	902	2,035	2,304	2,640	1,702	1,165	10,749
	double	1,265	2,628	2,360	2,388	1,609	1,009	11,260
	multiple	205	399	319	358	224	131	1,636
1985	single	793	2,259	2,287	2,380	1,452	962	10,134
	double	1,134	2,964	2,518	2,393	1,483	808	11,301
	multiple	172	489	398	374	228	149	1,809
Total	single	9,703	17,939	23,472	34,079	27,127	19,438	131,758
	double	13,715	22,358	24,497	30,865	24,194	17,641	133,270
	multiple	1,862	3,269	3,280	4,088	3,133	2,433	18,065

Table 20: Percentages of Fatalities by Car Accident Type

Accident Year	Type	Car in which Fatality Occurred						Total
		Mini- compact	Sub- compact	Compact	Inter- mediate	Full- size	Largest	
1975	single	6	8	17	28	24	16	100
	double	9	10	17	25	23	15	100
	multiple	10	11	16	27	19	19	100
1976	single	6	8	17	27	23	18	100
	double	9	11	18	24	21	17	100
	multiple	8	12	17	21	20	21	100
1977	single	7	10	16	26	24	17	100
	double	10	11	17	22	22	17	100
	multiple	10	12	18	21	20	19	100
1978	single	7	10	15	27	23	17	100
	double	10	12	18	23	20	17	100
	multiple	10	13	17	21	23	17	100
1979	single	7	13	16	26	22	16	100
	double	10	15	17	24	19	15	100
	multiple	10	15	17	22	22	14	100
1980	single	7	13	17	26	21	16	100
	double	10	16	17	24	19	14	100
	multiple	10	19	20	23	16	13	100
1981	single	8	15	17	26	19	15	100
	double	11	20	18	23	16	12	100
	multiple	12	20	17	25	14	11	100
1982	single	8	17	19	25	19	13	100
	double	11	21	19	24	16	10	100
	multiple	11	21	17	26	16	10	100
1983	single	9	17	20	24	18	12	100
	double	12	22	18	23	16	10	100
	multiple	10	24	21	22	15	9	100
1984	single	8	19	21	25	16	11	100
	double	11	23	21	21	14	9	100
	multiple	13	24	19	22	14	8	100
1985	single	8	22	23	23	14	9	100
	double	10	26	22	21	13	7	100
	multiple	9	27	22	21	13	8	100
Total	single	7	14	18	26	21	15	100
	double	10	17	18	23	18	13	100
	multiple	10	18	18	23	17	13	100

## Double-Vehicle Other Occupant Fatalities

Tables 21 through 31 show fatalities in other vehicles involved with a car in a two-vehicle accident. In these tables, the fatality occurred on a motorcycle, or in a light truck or van, heavy truck, or other vehicle (including buses, campers, construction equipment, and unspecified-sized trucks). The size of the car involved is shown for each accident year. The eleven-year summary is shown as Table 32.

Table 33 summarizes the data for motorcyclist fatalities by involved car size and accident year. The percentages in Table 34 show the tendencies noted for car occupant fatalities -- the small car involvement share of accidents with motorcycles has increased, and the large car involvement share has declined. However, a comparison of these data with the data of Table 20 (car occupant fatality proportions by car size) shows an important difference. Large cars are a larger proportion of involvements with motorcyclist fatalities than they are of car occupant fatalities. Large cars are more aggressive to motorcyclists because of the greater difference in their weights. These data do not indicate whether large cars are more or less likely than small cars to share the road with a motorcycle.

The eleven-year experience of light truck fatalities in accidents with cars is summarized as Table 35, with annual percentages in Table 36. The proportions of small car involvements increased. But they are lower than involvements with motorcycles and lower than the car occupant fatalities of Table 20. Small cars are relatively more likely to suffer occupant fatality than to cause fatality to others.

Table 21: Counts of Fatalities in Other Vehicles involved with Cars, in 1975

Other Vehicle	<u>Non-car in which fatality occurred</u>				Total
	Motor-cycle	Light Truck	Heavy Truck	Other Vehicle	
Car -- minicompact	41	15	0	1	57
Car -- subcompact	65	22	8	5	99
Car -- compact	149	76	11	14	250
Car -- intermediate	300	163	20	24	507
Car -- full size	341	254	24	24	644
Car -- largest	295	227	15	45	582
Car total	1,191	757	78	114	2,140

Table 22: Counts of Fatalities in Other Vehicles involved with Cars, in 1976

Other Vehicle	<u>Non-car in which fatality occurred</u>				Total
	Motor-cycle	Light Truck	Heavy Truck	Other Vehicle	
Car -- minicompact	42	11	4	3	61
Car -- subcompact	77	31	12	4	125
Car -- compact	160	127	6	13	307
Car -- intermediate	293	193	13	24	524
Car -- full size	283	229	27	39	578
Car -- largest	329	272	20	44	666
Car total	1,185	863	83	128	2,260

Table 23: Counts of Fatalities in Other Vehicles involved with Cars, in 1977

Other Vehicle	<u>Non-car in which fatality occurred</u>				Total
	Motor-cycle	Light Truck	Heavy Truck	Other Vehicle	
Car -- minicompact	45	12	4	3	64
Car -- subcompact	73	37	1	8	119
Car -- compact	147	96	11	25	279
Car -- intermediate	314	189	29	35	567
Car -- full size	453	236	36	39	763
Car -- largest	409	269	32	44	755
Car total	1,441	838	114	154	2,547

Table 24: Counts of Fatalities in Other Vehicles involved with Cars, in 1978

Other Vehicle	<u>Non-car in which fatality occurred</u>				Total
	Motor-cycle	Light Truck	Heavy Truck	Other Vehicle	
Car -- minicompact	62	22	3	0	87
Car -- subcompact	84	44	4	4	135
Car -- compact	208	77	8	17	309
Car -- intermediate	407	203	20	32	663
Car -- full size	408	269	36	39	752
Car -- largest	399	281	41	38	759
Car total	1,568	895	111	130	2,705

Table 25: Counts of Fatalities in Other Vehicles involved with Cars, in 1979

Other Vehicle	<u>Non-car in which fatality occurred</u>				Total
	Motor-cycle	Light Truck	Heavy Truck	Other Vehicle	
Car -- minicompact	69	19	0	1	88
Car -- subcompact	99	53	10	6	168
Car -- compact	203	97	10	16	326
Car -- intermediate	421	259	20	35	736
Car -- full size	427	271	29	46	772
Car -- largest	392	289	30	40	751
Car total	1,610	987	100	144	2,841

Table 26: Counts of Fatalities in Other Vehicles involved with Cars, in 1980

Other Vehicle	<u>Non-car in which fatality occurred</u>				Total
	Motor-cycle	Light Truck	Heavy Truck	Other Vehicle	
Car -- minicompact	54	28	2	3	88
Car -- subcompact	126	59	9	5	199
Car -- compact	214	81	9	20	324
Car -- intermediate	424	226	23	25	698
Car -- full size	423	297	20	31	771
Car -- largest	413	301	17	32	763
Car total	1,654	990	81	116	2,842

Table 27: Counts of Fatalities in Other Vehicles involved with Cars, in 1981

Other Vehicle	<u>Non-car in which fatality occurred</u>				Total
	Motor-cycle	Light Truck	Heavy Truck	Other Vehicle	
Car -- minicompact	67	25	5	2	100
Car -- subcompact	133	69	6	11	219
Car -- compact	231	90	17	18	357
Car -- intermediate	375	218	24	38	655
Car -- full size	405	231	10	37	683
Car -- largest	332	224	14	43	612
Car total	1,543	857	77	150	2,626

Table 28: Counts of Fatalities in Other Vehicles involved with Cars, in 1982

Other Vehicle	<u>Non-car in which fatality occurred</u>				Total
	Motor-cycle	Light Truck	Heavy Truck	Other Vehicle	
Car -- minicompact	66	23	5	5	98
Car -- subcompact	135	74	7	15	232
Car -- compact	161	89	12	21	284
Car -- intermediate	383	197	16	29	625
Car -- full size	359	234	15	37	646
Car -- largest	263	185	17	23	488
Car total	1,367	803	72	130	2,372

Table 29: Counts of Fatalities in Other Vehicles involved with Cars, in 1983

Other Vehicle	<u>Non-car in which fatality occurred</u>				Total
	Motor-cycle	Light Truck	Heavy Truck	Other Vehicle	
Car -- minicompact	76	25	3	3	107
Car -- subcompact	169	54	12	13	247
Car -- compact	206	88	14	18	325
Car -- intermediate	298	195	17	31	541
Car -- full size	302	202	9	39	552
Car -- largest	246	165	10	21	442
Car total	1,297	729	64	125	2,215

Table 30: Counts of Fatalities in Other Vehicles Involved with Cars, in 1984

Other Vehicle	<u>Non-car in which fatality occurred</u>				Total
	Motor-cycle	Light Truck	Heavy Truck	Other Vehicle	
Car -- minicompact	91	20	8	8	126
Car -- subcompact	177	77	14	15	284
Car -- compact	199	122	12	10	344
Car -- intermediate	352	185	11	44	592
Car -- full size	329	213	15	24	581
Car -- largest	238	154	12	33	436
Car total	1,386	771	71	134	2,363

Table 31: Counts of Fatalities in Other Vehicles Involved with Cars, in 1985

Other Vehicle	<u>Non-car in which fatality occurred</u>				Total
	Motor-cycle	Light Truck	Heavy Truck	Other Vehicle	
Car -- minicompact	74	19	2	15	110
Car -- subcompact	200	72	10	17	299
Car -- compact	259	128	7	29	423
Car -- intermediate	328	189	15	62	594
Car -- full size	296	207	15	42	560
Car -- largest	221	138	11	28	398
Car total	1,378	753	60	193	2,385

Table 32: Counts of Fatalities in Other Vehicles Involved with Cars  
Eleven Years Combined

Other Vehicle	<u>Non-car in which fatality occurred</u>				Total
	Motor-cycle	Light Truck	Heavy Truck	Other Vehicle	
Car -- minicompact	686	218	37	45	986
Car -- subcompact	1,340	591	93	104	2,128
Car -- compact	2,136	1,073	118	200	3,527
Car -- intermediate	3,895	2,217	207	382	6,700
Car -- full size	4,027	2,642	238	396	7,302
Car -- largest	3,537	2,505	219	391	6,652
Car total	15,620	9,244	912	1,519	27,295

Table 33: Fatalities on Motorcycles involved with a Car

Year	Size of Car involved with the Motorcyclist Fatality						Total
	Mini-compact	Sub-compact	Compact	Inter-mediate	Full-size	Largest	
1975	41	65	149	300	341	295	1,191
1976	42	77	160	293	283	329	1,185
1977	45	73	147	314	453	409	1,441
1978	62	84	208	407	408	399	1,568
1979	69	99	203	421	427	392	1,610
1980	54	126	214	424	423	413	1,654
1981	67	133	231	375	405	332	1,543
1982	66	135	161	383	359	263	1,367
1983	76	169	206	298	302	246	1,297
1984	91	177	199	352	329	238	1,386
1985	74	200	259	328	296	221	1,378
Total	686	1,340	2,136	3,895	4,027	3,537	15,620

Table 34: Percentage of Motorcyclist Fatalities by involved Car Size

Year	Size of Car involved with the Motorcyclist Fatality						Total
	Mini-compact	Sub-compact	Compact	Inter-mediate	Full-size	Largest	
1975	3	5	13	25	29	25	100
1976	4	6	14	25	24	28	100
1977	3	5	10	22	31	28	100
1978	4	5	13	26	26	25	100
1979	4	6	13	26	27	24	100
1980	3	8	13	26	26	25	100
1981	4	9	15	24	26	21	100
1982	5	10	12	28	26	19	100
1983	6	13	16	23	23	19	100
1984	7	13	14	25	24	17	100
1985	5	15	19	24	21	16	100
Total	4	9	14	25	26	23	100

Table 35: Fatalities in Light Trucks involved with a Car

Year	Size of Car involved with the Light Truck Fatality						Total
	Mini-compact	Sub-compact	Compact	Inter-mediate	Full-size	Largest	
1975	15	22	76	163	254	227	757
1976	11	31	127	193	229	272	863
1977	12	37	96	189	236	269	838
1978	22	44	77	203	269	281	895
1979	19	53	97	259	271	289	987
1980	28	59	81	226	297	301	990
1981	25	69	90	218	231	224	857
1982	23	74	89	197	234	185	803
1983	25	54	88	195	202	165	729
1984	20	77	122	185	213	154	771
1985	19	72	128	189	207	138	753
Total	218	591	1,073	2,217	2,642	2,505	9,244

Table 36: Percentage of Fatalities in Light Trucks by involved Car Size

Year	Size of Car involved with the Light Truck Fatality						Total
	Mini-compact	Sub-compact	Compact	Inter-mediate	Full-size	Largest	
1975	2	3	10	21	34	30	100
1976	1	4	15	22	27	31	100
1977	1	4	11	22	28	32	100
1978	2	5	9	23	30	31	100
1979	2	5	10	26	27	29	100
1980	3	6	8	23	30	30	100
1981	3	8	11	25	27	26	100
1982	3	9	11	25	29	23	100
1983	3	7	12	27	28	23	100
1984	3	10	16	24	28	20	100
1985	2	10	17	25	28	18	100
Total	2	6	12	24	29	27	100

Single-Vehicle Nonoccupant Fatalities

The numbers of nonmotorists killed in single-vehicle car accidents (in which no car occupant was killed) are shown in Table 37. The percentages and changes of Table 38 resemble the patterns for motorcyclist fatalities in Table 34. The motorcycle, light truck, and nonoccupant fatalities are summarized for comparison in Table 39 (counts) and Table 40 (percentages).

Table 37: Nonmotorists Killed by a Car

Year	<u>Size of Car involved with the Nonmotorist Fatality</u>						Total
	Mini-compact	Sub-compact	Compact	Inter-mediate	Full-size	Largest	
1975	202	294	707	1,458	1,549	1,467	5,677
1976	223	288	633	1,261	1,497	1,422	5,323
1977	211	307	675	1,208	1,474	1,461	5,337
1978	206	347	622	1,171	1,369	1,476	5,190
1979	209	340	680	1,279	1,401	1,343	5,251
1980	245	456	704	1,254	1,237	1,269	5,165
1981	220	495	676	1,240	1,248	1,121	5,000
1982	272	607	683	1,217	1,189	1,025	4,994
1983	310	537	682	1,152	972	858	4,510
1984	269	702	740	1,109	1,011	839	4,669
1985	274	749	743	1,080	873	618	4,338
Total	2,640	5,122	7,545	13,429	13,819	12,899	55,454

Table 38: Percentage of Nonmotorist Fatalities by involved Car Size

Year	<u>Size of Car involved with the Nonmotorist Fatality</u>						Total
	Mini-compact	Sub-compact	Compact	Inter-mediate	Full-size	Largest	
1975	4	5	12	26	27	26	100
1976	4	5	12	24	28	27	100
1977	4	6	13	23	28	27	100
1978	4	7	12	23	26	28	100
1979	4	6	13	24	27	26	100
1980	5	9	14	24	24	25	100
1981	4	10	14	25	25	22	100
1982	5	12	14	24	24	21	100
1983	7	12	15	26	22	19	100
1984	6	15	16	24	22	18	100
1985	6	17	17	25	20	14	100
Total	5	9	14	24	25	23	100

Table 39: Counts of Fatalities by Non-car Type

Accident Year	Type	Size of Car involved with the Non-car Fatality					Largest	Total
		Mini- compact	Sub- compact	Compact	Inter- mediate	Full- size		
1975	motorcycle	41	65	149	300	341	295	1,191
	light truck	15	22	76	163	254	227	757
	nonmotorist	202	294	707	1,458	1,549	1,467	5,677
1976	motorcycle	42	77	160	293	283	329	1,185
	light truck	11	31	127	193	229	272	863
	nonmotorist	223	288	633	1,261	1,497	1,422	5,323
1977	motorcycle	45	73	147	314	453	409	1,441
	light truck	12	37	96	189	236	269	838
	nonmotorist	211	307	675	1,208	1,474	1,461	5,337
1978	motorcycle	62	84	208	407	408	399	1,568
	light truck	22	44	77	203	269	281	895
	nonmotorist	206	347	622	1,171	1,369	1,476	5,190
1979	motorcycle	69	99	203	421	427	392	1,610
	light truck	19	53	97	259	271	289	987
	nonmotorist	209	340	680	1,279	1,401	1,343	5,251
1980	motorcycle	54	126	214	424	423	413	1,654
	light truck	28	59	81	226	297	301	990
	nonmotorist	245	456	704	1,254	1,237	1,269	5,165
1981	motorcycle	67	133	231	375	405	332	1,543
	light truck	25	69	90	218	231	224	857
	nonmotorist	220	495	676	1,240	1,248	1,121	5,000
1982	motorcycle	66	135	161	383	359	263	1,367
	light truck	23	74	89	197	234	185	803
	nonmotorist	272	607	683	1,217	1,189	1,025	4,994
1983	motorcycle	76	169	206	298	302	246	1,297
	light truck	25	54	88	195	202	165	729
	nonmotorist	310	537	682	1,152	972	858	4,510
1984	motorcycle	91	177	199	352	329	238	1,386
	light truck	20	77	122	185	213	154	771
	nonmotorist	269	702	740	1,109	1,011	839	4,669
1985	motorcycle	74	200	259	328	296	221	1,378
	light truck	19	72	128	189	207	138	753
	nonmotorist	274	749	743	1,080	873	618	4,338
Total	motorcycle	686	1,340	2,136	3,895	4,027	3,537	15,620
	light truck	218	591	1,073	2,217	2,642	2,505	9,244
	nonmotorist	2,640	5,122	7,545	13,429	13,819	12,899	55,454

Table 40: Percentages of Fatalities by Non-car Type

Accident Year	Type	Size of Car involved with the Non-car Fatality						Total
		Mini- compact	Sub- compact	Compact	Inter- mediate	Full- size	Largest	
1975	motorcycle	3	5	13	25	29	25	100
	light truck	2	3	10	21	34	30	100
	nonmotorist	4	5	12	26	27	26	100
1976	motorcycle	4	6	14	25	24	28	100
	light truck	1	4	15	22	27	31	100
	nonmotorist	4	5	12	24	28	27	100
1977	motorcycle	3	5	10	22	31	28	100
	light truck	1	4	11	22	28	32	100
	nonmotorist	4	6	13	23	28	27	100
1978	motorcycle	4	5	13	26	26	25	100
	light truck	2	5	9	23	30	31	100
	nonmotorist	4	7	12	23	26	28	100
1979	motorcycle	4	6	13	26	27	24	100
	light truck	2	5	10	26	27	29	100
	nonmotorist	4	6	13	24	27	26	100
1980	motorcycle	3	8	13	26	26	25	100
	light truck	3	6	8	23	30	30	100
	nonmotorist	5	9	14	24	24	25	100
1981	motorcycle	4	9	15	24	26	21	100
	light truck	3	8	11	25	27	26	100
	nonmotorist	4	10	14	25	25	22	100
1982	motorcycle	5	10	12	28	26	19	100
	light truck	3	9	11	25	29	23	100
	nonmotorist	5	12	14	24	24	21	100
1983	motorcycle	6	13	16	23	23	19	100
	light truck	3	7	12	27	28	23	100
	nonmotorist	7	12	15	26	22	19	100
1984	motorcycle	7	13	14	25	24	17	100
	light truck	3	10	16	24	28	20	100
	nonmotorist	6	15	16	24	22	18	100
1985	motorcycle	5	15	19	24	21	16	100
	light truck	2	10	17	25	28	18	100
	nonmotorist	6	17	17	25	20	14	100
Total	motorcycle	4	9	14	25	26	23	100
	light truck	2	6	12	24	29	27	100
	nonmotorist	5	9	14	24	25	23	100

## Fatality Rates

According to Polk registration data, there were 107.5 million cars registered in 1983 and 110.6 million in 1984. Even in these two years, the shift toward small cars can be seen in Table 41.

The car occupant fatality counts of Table 19 can be divided by the registration counts of Table 41, to produce car occupant fatalities per million registered vehicles by car size. These results are shown in Tables 42 and 43 for 1983 and 1984, respectively. These rates reflect differences in use (accident exposure), differences in ability to avoid crashes (crashavoidance), and differences in ability to protect occupants in a crash (crashworthiness). These three factors cannot be disentangled from these data. The tables show the amount of fatality involvement, but not why. And it seems reasonable that as people shift from large to small cars, their use patterns by car size will also shift.

Tables 44 and 45 are based on the data of the previous two tables. The fatality rates have been indexed to the largest car experience, which has been arbitrarily set to 100. This eases comparisons across years and fatality type. The highest values are for fatalities in minicompact cars involved with other vehicles; the lowest values are for light trucks involved with minicompact and subcompact cars. There is an imperfect tendency for car occupant fatality rates to decline with car size. There is no pattern for other fatalities caused by cars, by car size.

The limitation of registration-based fatality rates is that they may not reflect risk as much as use. Tables 46 and 47 show car occupant fatalities standardized by the numbers of nonmotorists and motorcyclists, respectively, killed by each size car each year. This method also has limitations -- car occupants are killed in different circumstances from the people cars kill. But this method seems to be an improvement on registration data because it at least reflects car use.

When the standardized data are indexed to the largest car experience, comparisons between years and accident types are easier. Tables 48 and 49 show these data. Using nonmotorist (Table 48) and motorcyclist (Table 49) fatalities produce similar relative results. Because nonmotorists and motorcyclists have different road use patterns, this similarity is some assurance that the method does not produce ridiculous results.

Finally, Table 50 compares the indexed fatality rates produced when registrations, nonmotorist fatalities, and motorcyclist fatalities are used as the basis for the rate. The registration-based rates produce some high indexed values for minicompact cars. They also indicate larger differences among car sizes than do the non-car fatality-based rates. If the non-car fatality-based rates could be adjusted to reflect the lower aggressivity of small cars, these rates would be even closer across car size than indicated in Table 50.

Table 41: Polk Registration Data

	Car Size						Total
	Mini-compact	Subcompact	Compact	Inter-mediate	Fullsize	Largest	
1							
9	5,311,791	17,276,200	17,416,656	20,921,384	19,213,636	27,393,252	107,532,919
8	5 %	16 %	16 %	19 %	18 %	25 %	100 %
3							
1							
9	5,388,913	19,215,742	19,588,211	21,903,729	19,295,495	25,204,987	110,597,077
8	5 %	17 %	18 %	20 %	17 %	23 %	100 %
4							

Table 42: Fatalities per Million Registered Vehicles in 1983

Fatality to:	Car Size						Total
	Mini-compact	Sub-compact	Compact	Inter-mediate	Full-size	Largest	
Car occupant							
single	176.84	105.78	120.99	123.44	97.54	46.48	98.61
double	240.08	137.09	115.21	117.51	87.83	39.47	101.16
multiple	29.10	20.95	17.92	16.06	11.70	4.84	14.15
Other person							
motorcycle	14.31	9.78	11.83	14.24	15.72	8.98	12.06
light truck	4.71	3.13	5.05	9.32	10.51	6.02	6.78
nonmotorist	58.36	31.08	39.16	55.06	50.59	31.32	41.94

Table 43: Fatalities per Million Registered Vehicles in 1984

Fatality to:	Car Size						Total
	Mini-compact	Sub-compact	Compact	Inter-mediate	Full-size	Largest	
Car occupant							
single	167.44	105.91	117.63	120.54	88.19	46.23	97.19
double	234.77	136.77	120.48	109.02	83.40	40.05	101.81
multiple	38.06	20.77	16.27	16.34	11.60	5.21	14.79
Other person							
motorcycle	16.89	9.21	10.16	16.07	17.05	9.44	12.53
light truck	3.71	4.01	6.23	8.45	11.04	6.11	6.97
nonmotorist	49.92	36.53	37.78	50.63	52.40	33.29	42.22

Table 44: Fatalities per Million Registered Vehicles in 1983  
Indexed to the Largest Car Experience

Fatality to:	Car Size						Total
	Mini-compact	Sub-compact	Compact	Inter-mediate	Full-size	Largest	
Car occupant							
single	380	228	260	266	210	100	212
double	608	347	292	298	223	100	256
multiple	601	433	370	332	242	100	292
Other person							
motorcycle	159	109	132	159	175	100	134
light truck	78	52	84	155	175	100	113
nonmotorist	186	99	125	176	162	100	134

Table 45: Fatalities per Million Registered Vehicles in 1984  
Indexed to the Largest Car Experience

Fatality to:	Car Size						Total
	Mini-compact	Sub-compact	Compact	Inter-mediate	Full-size	Largest	
Car occupant							
single	362	229	254	261	191	100	210
double	586	341	301	272	208	100	254
multiple	731	399	312	314	223	100	284
Other person							
motorcycle	179	98	108	170	181	100	133
light truck	61	66	102	138	181	100	114
nonmotorist	150	110	113	152	157	100	127

Table 46: Car Occupant Fatalities Standardized by Nonmotorists Killed

Accident Year	Type	Car Size					Largest	Total
		Mini- compact	Sub- compact	Compact	Inter- mediate	Full- size		
1975	single	3.92	3.59	2.91	2.42	1.92	1.37	2.19
	double	5.61	4.25	2.89	2.13	1.79	1.28	2.15
	multiple	0.72	0.56	0.33	0.28	0.18	0.19	0.27
1976	single	3.53	3.70	3.50	2.73	1.97	1.56	2.38
	double	5.14	4.50	3.51	2.32	1.69	1.42	2.28
	mutiple	0.60	0.65	0.43	0.27	0.21	0.23	0.29
1977	single	4.37	3.98	2.92	2.66	2.07	1.43	2.34
	double	6.36	4.72	3.25	2.37	1.93	1.49	2.41
	multiple	0.77	0.66	0.43	0.29	0.22	0.21	0.30
1978	single	4.34	3.85	3.15	2.98	2.16	1.51	2.48
	double	6.47	4.76	3.84	2.68	1.99	1.54	2.60
	multiple	0.88	0.71	0.49	0.33	0.31	0.21	0.36
1979	single	4.31	4.84	3.02	2.62	2.05	1.57	2.46
	double	5.96	5.74	3.30	2.46	1.78	1.51	2.50
	mutiple	0.91	0.82	0.44	0.31	0.29	0.19	0.35
1980	single	3.81	3.85	3.31	2.77	2.27	1.72	2.61
	double	5.17	4.52	3.10	2.36	1.89	1.36	2.43
	multiple	0.63	0.63	0.42	0.28	0.19	0.15	0.29
1981	single	4.34	3.91	3.20	2.61	1.95	1.62	2.51
	double	6.03	4.99	3.39	2.33	1.60	1.33	2.49
	multiple	0.92	0.69	0.44	0.34	0.20	0.17	0.34
1982	single	3.25	2.96	2.97	2.26	1.72	1.34	2.18
	double	4.58	3.74	3.01	2.13	1.45	1.11	2.21
	mutiple	0.60	0.52	0.37	0.32	0.20	0.14	0.30
1983	single	3.03	3.40	3.09	2.24	1.93	1.48	2.35
	double	4.11	4.41	2.94	2.13	1.74	1.26	2.41
	multiple	0.50	0.67	0.46	0.29	0.23	0.15	0.34
1984	single	3.35	2.90	3.11	2.38	1.68	1.39	2.30
	double	4.70	3.74	3.19	2.15	1.59	1.20	2.41
	multiple	0.76	0.57	0.43	0.32	0.22	0.16	0.35
1985	single	2.89	3.02	3.08	2.20	1.66	1.56	2.34
	double	4.14	3.96	3.39	2.22	1.70	1.31	2.61
	multiple	0.63	0.65	0.54	0.35	0.26	0.24	0.42
Total	single	3.68	3.50	3.11	2.54	1.96	1.51	2.38
	double	5.19	4.37	3.25	2.30	1.75	1.37	2.40
	multiple	0.71	0.64	0.43	0.30	0.23	0.19	0.33

Table 47: Car Occupant Fatalities Standardized by Motorcyclists Killed

Accident Year	Type	Car Size					Largest	Total
		Mini- compact	Sub- compact	Compact	Inter- mediate	Full- size		
1975	single	19.31	16.24	13.81	11.77	8.74	6.80	10.43
	double	27.65	19.22	13.71	10.35	8.13	6.39	10.23
	multiple	3.54	2.52	1.57	1.34	0.83	0.96	1.27
1976	single	18.75	13.84	13.83	11.75	10.40	6.76	10.70
	double	27.30	16.84	13.88	10.00	8.92	6.14	10.24
	multiple	3.16	2.41	1.69	1.14	1.11	0.99	1.32
1977	single	20.48	16.73	13.39	10.23	6.74	5.13	8.66
	double	29.83	19.83	14.94	9.11	6.27	5.33	8.93
	multiple	3.61	2.77	1.97	1.10	0.71	0.75	1.13
1978	single	14.41	15.92	9.43	8.58	7.24	5.58	8.20
	double	21.49	19.66	11.47	7.72	6.68	5.69	8.62
	multiple	2.92	2.92	1.48	0.94	1.03	0.79	1.18
1979	single	13.06	16.63	10.10	7.95	6.74	5.37	8.03
	double	18.06	19.72	11.04	7.48	5.85	5.17	8.15
	multiple	2.75	2.81	1.49	0.93	0.95	0.66	1.13
1980	single	17.28	13.95	10.87	8.19	6.65	5.28	8.15
	double	23.47	16.34	10.18	6.97	5.54	4.19	7.58
	multiple	2.85	2.27	1.40	0.83	0.56	0.47	0.92
1981	single	14.25	14.55	9.37	8.63	6.00	5.48	8.13
	double	19.79	18.59	9.91	7.70	4.92	4.49	8.07
	multiple	3.02	2.58	1.28	1.12	0.61	0.59	1.10
1982	single	13.40	13.31	12.60	7.17	5.70	5.23	7.96
	double	18.86	16.80	12.77	6.77	4.79	4.32	8.06
	multiple	2.47	2.33	1.56	1.03	0.65	0.55	1.10
1983	single	12.36	10.81	10.23	8.67	6.21	5.18	8.18
	double	16.78	14.01	9.74	8.25	5.59	4.40	8.39
	multiple	2.03	2.14	1.52	1.13	0.74	0.54	1.17
1984	single	9.92	11.50	11.58	7.50	5.17	4.90	7.76
	double	13.90	14.85	11.86	6.78	4.89	4.24	8.12
	multiple	2.25	2.25	1.60	1.02	0.68	0.55	1.18
1985	single	10.72	11.29	8.83	7.26	4.91	4.36	7.35
	double	15.33	14.82	9.72	7.30	5.01	3.65	8.20
	multiple	2.32	2.44	1.54	1.14	0.77	0.67	1.31
Total	single	14.14	13.39	10.99	8.75	6.74	5.50	8.44
	double	19.99	16.69	11.47	7.92	6.01	4.99	8.53
	multiple	2.71	2.44	1.54	1.05	0.78	0.69	1.16

Table 48: Car Occupant Fatalities Standardized by Nonmotorists Killed and Indexed to the Largest Car Experience

Accident Year	Type	Car Size					Largest	Total
		Mini- compact	Sub- compact	Compact	Inter- mediate	Full- size		
1975	single	287	263	213	177	141	100	160
	double	437	331	225	166	139	100	167
	multiple	374	289	173	143	94	100	138
1976	single	226	237	223	174	126	100	152
	double	362	317	247	164	119	100	161
	multiple	259	281	186	115	91	100	128
1977	single	304	277	203	185	144	100	163
	double	426	316	218	159	129	100	162
	multiple	366	313	204	136	103	100	145
1978	single	287	255	209	198	143	100	164
	double	420	309	249	174	129	100	169
	multiple	413	333	233	154	144	100	168
1979	single	275	309	192	167	131	100	157
	double	395	380	218	163	118	100	165
	multiple	472	424	230	160	149	100	180
1980	single	221	224	192	161	132	100	152
	double	379	331	227	173	139	100	178
	multiple	410	411	278	183	126	100	193
1981	single	267	241	197	161	120	100	155
	double	453	375	255	175	120	100	187
	multiple	531	399	253	195	113	100	196
1982	single	242	221	221	168	128	100	162
	double	413	337	272	192	131	100	199
	multiple	428	371	262	231	140	100	214
1983	single	204	229	208	151	130	100	158
	double	326	350	233	169	138	100	191
	multiple	322	436	296	189	150	100	218
1984	single	242	209	224	171	121	100	166
	double	391	311	265	179	132	100	200
	multiple	487	363	275	206	141	100	224
1985	single	186	194	198	142	107	100	150
	double	317	303	259	170	130	100	199
	multiple	260	271	222	144	109	100	173
Total	single	244	232	206	168	130	100	158
	double	380	319	237	168	128	100	176
	multiple	374	338	230	161	120	100	173

Table 49: Car Occupant Fatalities Standardized by Motorcyclists Killed and Indexed to the Largest Car Experience

Accident Year	Type	Car Size					Largest	Total
		Mini-compact	Sub-compact	Compact	Inter-mediate	Full-size		
1975	single	284	239	203	173	129	100	153
	double	433	301	215	162	127	100	160
	multiple	371	263	165	140	86	100	132
1976	single	277	205	205	174	154	100	158
	double	445	274	226	163	145	100	167
	mutiple	319	243	171	115	112	100	133
1977	single	400	326	261	200	132	100	169
	double	560	372	280	171	118	100	168
	multiple	480	368	262	146	94	100	150
1978	single	258	285	169	154	130	100	147
	double	377	345	201	136	117	100	151
	multiple	371	372	188	120	131	100	150
1979	single	243	310	188	148	125	100	149
	double	349	381	213	145	113	100	157
	mutiple	417	425	225	142	143	100	172
1980	single	327	264	206	155	126	100	154
	double	560	390	243	166	132	100	181
	multiple	606	484	297	176	120	100	196
1981	single	260	266	171	158	110	100	148
	double	441	414	221	171	110	100	180
	multiple	516	440	219	191	104	100	188
1982	single	256	255	241	137	109	100	152
	double	437	389	296	157	111	100	187
	mutiple	452	428	285	188	119	100	201
1983	single	239	209	198	167	120	100	158
	double	382	319	222	188	127	100	191
	multiple	377	397	281	209	138	100	218
1984	single	203	235	236	153	106	100	158
	double	328	350	280	160	115	100	192
	multiple	408	408	290	184	123	100	214
1985	single	246	259	203	167	113	100	169
	double	420	406	266	200	137	100	224
	multiple	344	363	228	169	114	100	195
Total	single	257	244	200	159	123	100	153
	double	401	335	230	159	120	100	171
	multiple	394	355	223	153	113	100	168

Table 50: Comparison of Car Occupant Fatality Standardization Methods Indexed to the Largest Car Experience

	Car Size					Largest	Total
	Mini-compact	Sub-compact	Compact	Inter-mediate	Full-size		
<u>1983 Fatalities</u>							
Single Vehicle							
Registrations	380	228	260	266	210	100	212
Nonmotorists	204	229	208	151	130	100	158
Motorcyclists	239	209	198	167	120	100	158
Double Vehicle							
Registrations	608	347	292	298	223	100	256
Nonmotorists	326	350	233	169	138	100	191
Motorcyclists	382	319	222	188	127	100	191
Multiple Vehicle							
Registrations	601	433	370	332	242	100	292
Nonmotorists	322	436	296	189	150	100	218
Motorcyclists	377	397	281	209	138	100	218
<u>1984 Fatalities</u>							
Single Vehicle							
Registrations	362	229	254	261	191	100	210
Nonmotorists	242	209	224	171	121	100	166
Motorcyclists	203	235	236	153	106	100	158
Double Vehicle							
Registrations	586	341	301	272	208	100	254
Nonmotorists	391	311	265	179	132	100	200
Motorcyclists	328	350	280	160	115	100	192
Multiple Vehicle							
Registrations	731	399	312	314	223	100	284
Nonmotorists	487	363	275	206	141	100	224
Motorcyclists	408	408	290	184	123	100	214

## Fatality Odds in Double-Vehicle Accidents

Table 51 shows the fatality odds in two-car accidents, based on the data in Tables 3 through 14. For example, when a fullsize car and a subcompact car were involved together in 1975, there were 213 fatalities in subcompact cars, 40 fatalities in fullsize cars, for a fatality odds ratio of 213/40, or 5.3. (Because of the distribution of unknown data, the figures in Tables 3 through 14 are rounded to integers from non-integers. Table 51, and other tables that are calculated from a previous table, are calculated based on the unrounded figures. They differ slightly from the results of calculating from rounded figures. This rounding error is small and does not affect the conclusions presented here.)

Table 53 shows fatality odds for cars involved with motorcycles, light trucks, and heavy trucks. The sorted data are shown in Table 54. Light trucks appear to be larger than the largest cars, based on the fatality odds. The difference between a motorcycle and a car seems to be greater than the difference between a car and a heavy truck, based on a comparison of fatality odds.

The eleven-year total fatality odds of Tables 51 and 53 are displayed in a two-way Table 55. Only accidents involving a car are shown. The odds increase as the difference in the sizes of the vehicles increases. This table is used to calculate Table 56 (incremental risk to the smaller vehicle as the larger vehicle size increases) and Table 57 (incremental risk to the smaller car occupant as the smaller car size decreases). Table 57 mimics decreased vehicle crashworthiness with downsizing, but does not take into account improvements in driver and vehicle crashavoidance. The fatality odds in Table 55 (based on two-vehicle accidents) indicate much larger size differences in crashworthiness than in overall safety (including crashavoidance and changes in use), as reflected in the fatality rates of Tables 48 and 49. This is consistent with such behavior as, for example, the higher belt use observed in small cars.

Table 51: Fatality Odds in Car-to-Car Accidents

Larger Car	Smaller Car	1975 Odds	1976 Odds	1977 Odds	1978 Odds	1979 Odds	1980 Odds
Minicompact	Minicompact	1.00	1.00	1.00	1.00	1.00	1.00
Subcompact	Minicompact	2.26	1.02	5.77	2.56	1.13	2.78
Subcompact	Subcompact	1.00	1.00	1.00	1.00	1.00	1.00
Compact	Minicompact	10.36	3.99	4.15	4.60	9.43	4.82
Compact	Subcompact	2.13	3.61	2.82	1.66	2.39	1.75
Compact	Compact	1.00	1.00	1.00	1.00	1.00	1.00
Intermediate	Minicompact	5.83	5.75	16.28	8.39	25.85	11.70
Intermediate	Subcompact	4.34	3.97	4.32	4.36	4.56	4.20
Intermediate	Compact	1.63	1.96	1.73	2.08	1.94	1.55
Intermediate	Intermediate	1.00	1.00	1.00	1.00	1.00	1.00
Fullsize	Minicompact	39.66	15.50	15.62	6.60	24.04	15.37
Fullsize	Subcompact	5.30	5.29	7.36	6.71	6.86	6.05
Fullsize	Compact	2.32	2.73	2.95	3.48	2.85	3.46
Fullsize	Intermediate	1.79	1.95	1.65	1.66	2.22	1.67
Fullsize	Fullsize	1.00	1.00	1.00	1.00	1.00	1.00
Largest	Minicompact	15.08	44.22	11.82	16.04	7.28	11.81
Largest	Subcompact	10.22	14.64	12.12	8.47	11.94	8.25
Largest	Compact	4.32	5.20	4.25	5.40	4.18	5.16
Largest	Intermediate	2.35	2.43	2.36	2.11	2.44	2.92
Largest	Fullsize	1.75	1.42	1.35	1.44	1.61	1.63
Largest	Largest	1.00	1.00	1.00	1.00	1.00	1.00

Larger Car	Smaller Car	1981 Odds	1982 Odds	1983 Odds	1984 Odds	1985 Odds	Total Odds
Minicompact	Minicompact	1.00	1.00	1.00	1.00	1.00	1.00
Subcompact	Minicompact	3.18	3.03	1.48	1.34	2.06	1.97
Subcompact	Subcompact	1.00	1.00	1.00	1.00	1.00	1.00
Compact	Minicompact	3.51	7.11	3.14	3.08	2.46	4.25
Compact	Subcompact	2.95	2.09	2.46	2.05	2.11	2.26
Compact	Compact	1.00	1.00	1.00	1.00	1.00	1.00
Intermediate	Minicompact	6.96	5.63	5.58	7.04	5.06	7.53
Intermediate	Subcompact	4.85	4.73	3.53	3.82	3.19	4.07
Intermediate	Compact	2.21	1.98	1.61	1.62	1.88	1.82
Intermediate	Intermediate	1.00	1.00	1.00	1.00	1.00	1.00
Fullsize	Minicompact	12.14	14.47	9.47	16.88	6.21	13.08
Fullsize	Subcompact	8.05	6.77	10.43	6.50	7.60	6.88
Fullsize	Compact	4.38	3.52	2.33	2.55	3.29	2.98
Fullsize	Intermediate	1.67	2.01	1.54	1.93	2.01	1.81
Fullsize	Fullsize	1.00	1.00	1.00	1.00	1.00	1.00
Largest	Minicompact	17.07	72.14	9.92	8.55	7.79	13.65
Largest	Subcompact	15.16	16.98	8.97	12.39	9.71	11.11
Largest	Compact	6.43	5.71	3.52	4.27	5.24	4.80
Largest	Intermediate	2.54	2.93	2.81	2.20	2.80	2.47
Largest	Fullsize	1.43	1.77	1.38	1.34	1.48	1.51
Largest	Largest	1.00	1.00	1.00	1.00	1.00	1.00

Table 52: Fatality Odds in Car-to-Car Accidents, Sorted in Descending Order

Larger Car	Smaller Car	1975 Odds	1976 Odds	1977 Odds	1978 Odds	1979 Odds	1980 Odds
Largest	Minicompact	15.08	44.22	11.82	16.04	7.28	11.81
Fullsize	Minicompact	39.66	15.50	15.62	6.60	24.04	15.37
Largest	Subcompact	10.22	14.64	12.12	8.47	11.94	8.25
Intermediate	Minicompact	5.83	5.75	16.28	8.39	25.85	11.70
Fullsize	Subcompact	5.30	5.29	7.36	6.71	6.86	6.05
Largest	Compact	4.32	5.20	4.25	5.40	4.18	5.16
Compact	Minicompact	10.36	3.99	4.15	4.60	9.43	4.82
Intermediate	Subcompact	4.34	3.97	4.32	4.36	4.56	4.20
Fullsize	Compact	2.32	2.73	2.95	3.48	2.85	3.46
Largest	Intermediate	2.35	2.43	2.36	2.11	2.44	2.92
Compact	Subcompact	2.13	3.61	2.82	1.66	2.39	1.75
Subcompact	Minicompact	2.26	1.02	5.77	2.56	1.13	2.78
Intermediate	Compact	1.63	1.96	1.73	2.08	1.94	1.55
Fullsize	Intermediate	1.79	1.95	1.65	1.66	2.22	1.67
Largest	Fullsize	1.75	1.42	1.35	1.44	1.61	1.63
Minicompact	Minicompact	1.00	1.00	1.00	1.00	1.00	1.00
Subcompact	Subcompact	1.00	1.00	1.00	1.00	1.00	1.00
Compact	Compact	1.00	1.00	1.00	1.00	1.00	1.00
Intermediate	Intermediate	1.00	1.00	1.00	1.00	1.00	1.00
Fullsize	Fullsize	1.00	1.00	1.00	1.00	1.00	1.00
Largest	Largest	1.00	1.00	1.00	1.00	1.00	1.00

Larger Car	Smaller Car	1981 Odds	1982 Odds	1983 Odds	1984 Odds	1985 Odds	Total Odds
Largest	Minicompact	17.07	72.14	9.92	8.55	7.79	13.65
Fullsize	Minicompact	12.14	14.47	9.47	16.88	6.21	13.08
Largest	Subcompact	15.16	16.98	8.97	12.39	9.71	11.11
Intermediate	Minicompact	6.96	5.63	5.58	7.04	5.06	7.53
Fullsize	Subcompact	8.05	6.77	10.43	6.50	7.60	6.88
Largest	Compact	6.43	5.71	3.52	4.27	5.24	4.80
Compact	Minicompact	3.51	7.11	3.14	3.08	2.46	4.25
Intermediate	Subcompact	4.85	4.73	3.53	3.82	3.19	4.07
Fullsize	Compact	4.38	3.52	2.33	2.55	3.29	2.98
Largest	Intermediate	2.54	2.93	2.81	2.20	2.80	2.47
Compact	Subcompact	2.95	2.09	2.46	2.05	2.11	2.26
Subcompact	Minicompact	3.18	3.03	1.48	1.34	2.06	1.97
Intermediate	Compact	2.21	1.98	1.61	1.62	1.88	1.82
Fullsize	Intermediate	1.67	2.01	1.54	1.93	2.01	1.81
Largest	Fullsize	1.43	1.77	1.38	1.34	1.48	1.51
Minicompact	Minicompact	1.00	1.00	1.00	1.00	1.00	1.00
Subcompact	Subcompact	1.00	1.00	1.00	1.00	1.00	1.00
Compact	Compact	1.00	1.00	1.00	1.00	1.00	1.00
Intermediate	Intermediate	1.00	1.00	1.00	1.00	1.00	1.00
Fullsize	Fullsize	1.00	1.00	1.00	1.00	1.00	1.00
Largest	Largest	1.00	1.00	1.00	1.00	1.00	1.00

Table 53: Fatality Odds in Car-to-Other Accidents

Larger Vehicle	Smaller Vehicle	1975 Odds	1976 Odds	1977 Odds	1978 Odds	1979 Odds	1980 Odds
Minicompact	Motorcycle	15.09	--	8.27	9.54	16.58	53.27
Subcompact	Motorcycle	36.01	7.68	34.22	21.47	71.75	31.42
Compact	Motorcycle	55.45	--	--	23.40	--	37.32
Intermediate	Motorcycle	66.69	52.19	51.76	156.45	39.82	57.16
Fullsize	Motorcycle	62.44	83.11	97.62	142.51	48.99	83.73
Largest	Motorcycle	46.57	97.59	191.69	61.51	284.47	204.01
Light Truck	Minicompact	10.60	18.50	18.49	14.50	14.43	10.37
Light Truck	Subcompact	10.02	7.13	7.90	8.10	7.89	7.68
Light Truck	Compact	4.84	3.66	4.13	6.00	5.48	6.05
Light Truck	Intermediate	2.95	2.61	2.52	3.07	2.63	2.68
Light Truck	Fullsize	1.78	1.70	1.99	1.90	1.69	1.75
Light Truck	Largest	1.27	1.21	1.28	1.43	1.42	1.27
Heavy Truck	Minicompact	--	34.45	38.34	55.87	--	62.08
Heavy Truck	Subcompact	20.10	15.05	176.28	70.65	29.04	35.59
Heavy Truck	Compact	31.34	51.67	35.57	58.16	42.44	43.10
Heavy Truck	Intermediate	23.74	41.16	19.75	31.98	31.76	26.10
Heavy Truck	Fullsize	23.67	21.71	19.38	18.57	24.59	27.56
Heavy Truck	Largest	25.49	23.73	17.35	15.21	20.69	29.30

Larger Vehicle	Smaller Vehicle	1981 Odds	1982 Odds	1983 Odds	1984 Odds	1985 Odds	Total Odds
Minicompact	Motorcycle	21.21	18.99	55.17	28.06	14.03	18.88
Subcompact	Motorcycle	31.23	23.66	11.95	41.31	20.89	21.86
Compact	Motorcycle	54.43	71.51	19.58	23.25	46.73	44.13
Intermediate	Motorcycle	50.09	44.78	62.04	36.56	162.40	56.25
Fullsize	Motorcycle	190.25	170.10	62.08	61.49	51.01	79.89
Largest	Motorcycle	155.31	250.79	44.98	222.29	--	112.46
Light Truck	Minicompact	10.80	10.62	12.14	14.29	15.67	13.10
Light Truck	Subcompact	7.32	6.73	10.66	7.82	9.21	8.11
Light Truck	Compact	5.02	5.80	5.21	4.39	4.47	4.90
Light Truck	Intermediate	2.88	2.86	2.88	3.21	2.79	2.82
Light Truck	Fullsize	1.79	1.58	1.91	1.80	1.67	1.78
Light Truck	Largest	1.32	1.35	1.24	1.35	1.32	1.32
Heavy Truck	Minicompact	28.40	37.13	62.55	26.25	94.23	50.25
Heavy Truck	Subcompact	65.01	47.37	36.15	32.21	54.36	38.74
Heavy Truck	Compact	24.51	32.86	31.84	44.13	77.41	39.75
Heavy Truck	Intermediate	26.93	36.71	35.02	47.46	36.72	30.53
Heavy Truck	Fullsize	48.39	31.69	52.34	29.50	27.98	25.75
Heavy Truck	Largest	30.69	19.80	34.46	28.03	22.80	22.13

Table 54: Fatality Odds in Car-to-Other Accidents, in Descending Order

Larger Vehicle	Smaller Vehicle	1975 Odds	1976 Odds	1977 Odds	1978 Odds	1979 Odds	1980 Odds
Largest	Motorcycle	46.57	97.59	191.69	61.51	284.47	204.01
Fullsize	Motorcycle	62.44	83.11	97.62	142.51	48.99	83.73
Intermediate	Motorcycle	66.69	52.19	51.76	156.45	39.82	57.16
Heavy Truck	Minicompact	--	34.45	38.34	55.87	--	62.08
Compact	Motorcycle	55.45	--	--	23.40	--	37.32
Heavy Truck	Compact	31.34	51.67	35.57	58.16	42.44	43.10
Heavy Truck	Subcompact	20.10	15.05	176.28	70.65	29.04	35.59
Heavy Truck	Intermediate	23.74	41.16	19.75	31.98	31.76	26.10
Heavy Truck	Fullsize	23.67	21.71	19.38	18.57	24.59	27.56
Heavy Truck	Largest	25.49	23.73	17.35	15.21	20.69	29.30
Subcompact	Motorcycle	36.01	7.68	34.22	21.47	71.75	31.42
Minicompact	Motorcycle	15.09	--	8.27	9.54	16.58	53.27
Light Truck	Minicompact	10.60	18.50	18.49	14.50	14.43	10.37
Light Truck	Subcompact	10.02	7.13	7.90	8.10	7.89	7.68
Light Truck	Compact	4.84	3.66	4.13	6.00	5.48	6.05
Light Truck	Intermediate	2.95	2.61	2.52	3.07	2.63	2.68
Light Truck	Fullsize	1.78	1.70	1.99	1.90	1.69	1.75
Light Truck	Largest	1.27	1.21	1.28	1.43	1.42	1.27

Larger Vehicle	Smaller Vehicle	1981 Odds	1982 Odds	1983 Odds	1984 Odds	1985 Odds	Total Odds
Largest	Motorcycle	155.31	250.79	44.98	222.29	--	112.46
Fullsize	Motorcycle	190.25	170.10	62.08	61.49	51.01	79.89
Intermediate	Motorcycle	50.09	44.78	62.04	36.56	162.40	56.25
Heavy Truck	Minicompact	28.40	37.13	62.55	26.25	94.23	50.25
Compact	Motorcycle	54.43	71.51	19.58	23.25	46.73	44.13
Heavy Truck	Compact	24.51	32.86	31.84	44.13	77.41	39.75
Heavy Truck	Subcompact	65.01	47.37	36.15	32.21	54.36	38.74
Heavy Truck	Intermediate	26.93	36.71	35.02	47.46	36.72	30.53
Heavy Truck	Fullsize	48.39	31.69	52.34	29.50	27.98	25.75
Heavy Truck	Largest	30.69	19.80	34.46	28.03	22.80	22.13
Subcompact	Motorcycle	31.23	23.66	11.95	41.31	20.89	21.86
Minicompact	Motorcycle	21.21	18.99	55.17	28.06	14.03	18.88
Light Truck	Minicompact	10.80	10.62	12.14	14.29	15.67	13.10
Light Truck	Subcompact	7.32	6.73	10.66	7.82	9.21	8.11
Light Truck	Compact	5.02	5.80	5.21	4.39	4.47	4.90
Light Truck	Intermediate	2.88	2.86	2.88	3.21	2.79	2.82
Light Truck	Fullsize	1.79	1.58	1.91	1.80	1.67	1.78
Light Truck	Largest	1.32	1.35	1.24	1.35	1.32	1.32

Table 55: Matrix of Fatality Odds, Eleven Years Combined  
 Fatalities in Smaller Vehicle / Fatalities in Larger Vehicle

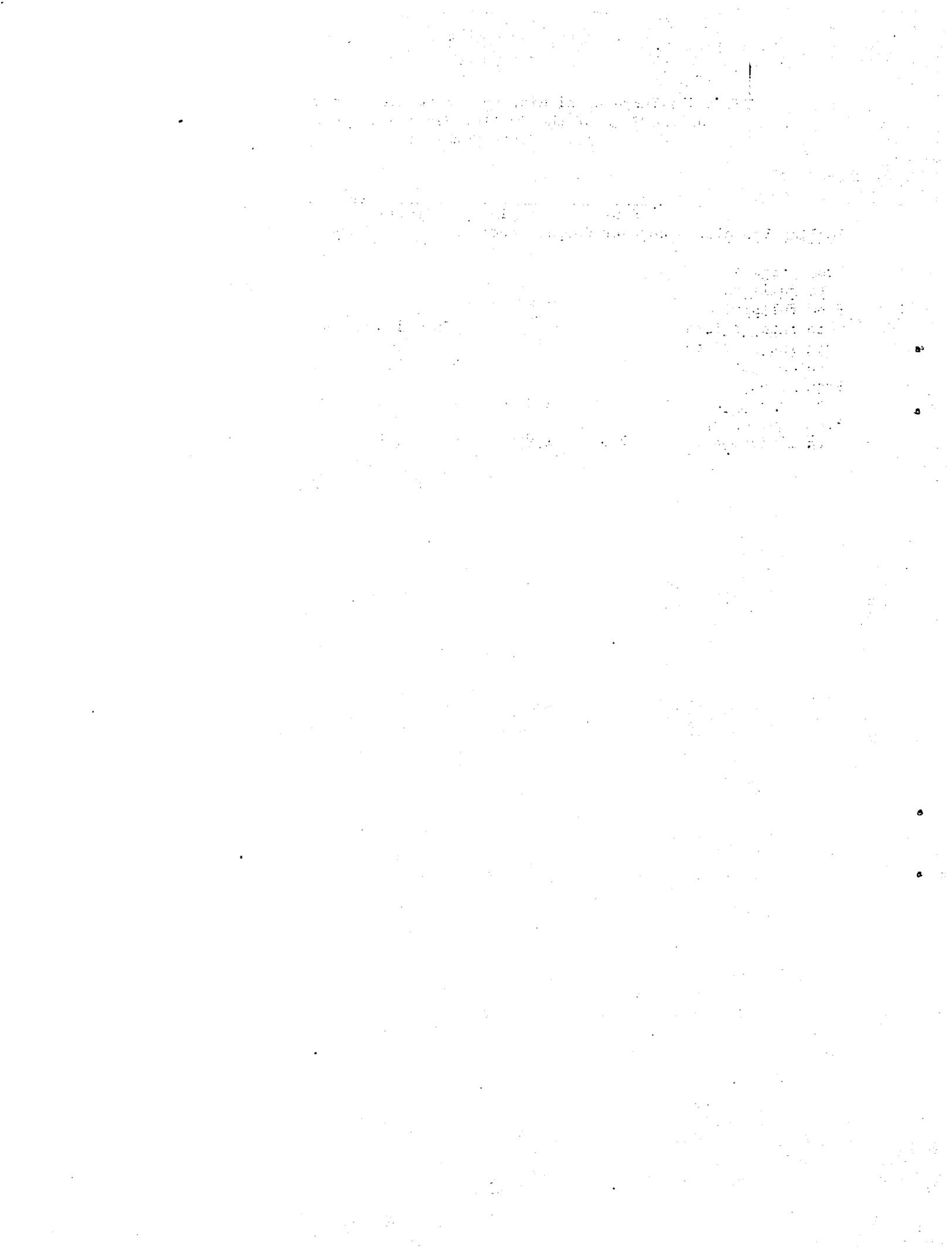
Larger Vehicle	Smaller Vehicle						
	Motor- cycle	Mini- compact	Sub- compact	Compact	Inter- mediate	Full- size	Largest
Car -- minicompact	18.88	1.00					
Car -- subcompact	21.86	1.97	1.00				
Car -- compact	44.13	4.25	2.26	1.00			
Car -- intermediate	56.25	7.53	4.07	1.82	1.00		
Car -- full size	79.89	13.08	6.88	2.98	1.81	1.00	
Car -- largest	112.46	13.65	11.11	4.80	2.47	1.51	1.00
Light truck/Van		13.10	8.11	4.90	2.82	2.82	1.32
Heavy truck		50.25	38.74	39.75	30.53	25.75	22.13

Table 56: Incremental Risk to the Smaller Car Occupant  
 as the Size of the Larger Vehicle Increases  
 Eleven Years Combined

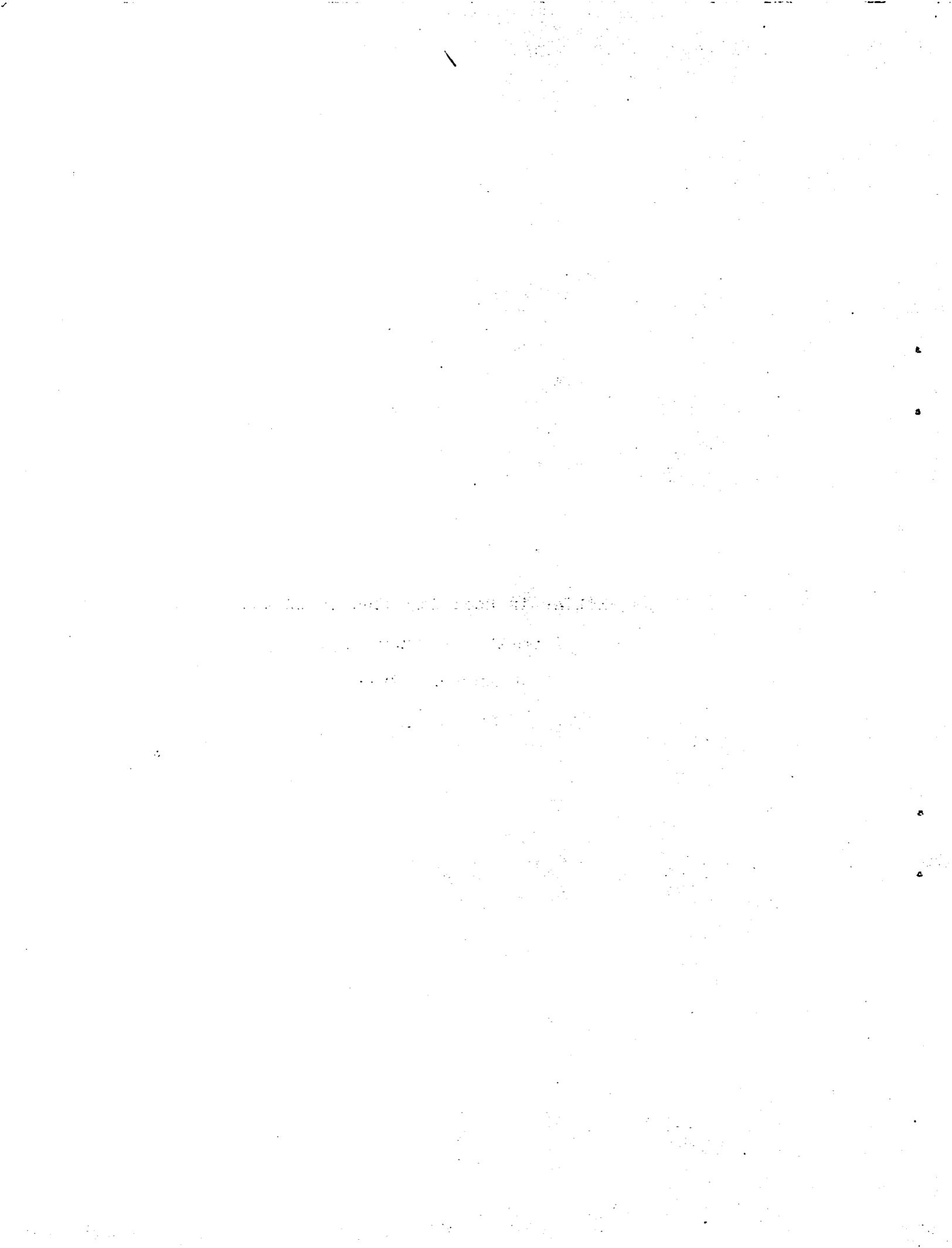
Larger Vehicle	Smaller Vehicle						
	Motor- cycle	Mini- compact	Sub- compact	Compact	Inter- mediate	Full- size	Largest
From minicompact to subcompact	1.2	2.0					
From subcompact to compact	2.0	2.0	2.3				
From compact to intermediate	1.3	1.8	1.8	1.8			
From intermediate to fullsize	1.4	1.7	1.7	1.6	1.8		
From fullsize to largest	1.4	1.0	1.6	1.6	1.4	1.5	
From largest to light truck		1.0	0.7	1.0	1.1	1.9	1.3
From light truck to heavy truck		3.8	4.8	8.1	10.8	9.1	16.8

Table 57: Incremental Risk to the Smaller Car Occupant  
as the Size of the Smaller Vehicle Decreases  
Eleven Years Combined

Smaller Vehicle	Larger Vehicle						
	Sub-compact	Compact	Inter-mediate	Full-size	Largest	Light Truck	Heavy Truck
From largest to fullsize					1.5	2.1	1.2
From fullsize to intermediate				1.8	1.6	1.0	1.2
From intermediate to compact			1.8	1.6	1.9	1.7	1.3
From compact to subcompact		2.3	2.2	2.3	2.3	1.7	1.0
From subcompact to mincompact	2.0	1.9	1.9	1.9	1.2	1.6	1.3



**Fatalities in Rear-Impacted Small Cars  
from 1982 through 1986  
(December 1987)**



## Findings

This report describes fatalities in cars struck in the rear from 1982 through 1986. It addresses the higher fatality rate of small cars in rear impacts, as illustrated by the following.

In 1984 there were

- 310 fatalities in small cars struck in the rear and 40,305,503 registered vehicles,
- 113 fatalities in medium cars struck in the rear and 18,125,415 registered vehicles, and
- 117 fatalities in large cars struck in the rear and 34,601,950 registered vehicles.

This produces fatality rates in rear impacts per million registered vehicles of

- 7.7 for small cars,
- 6.2 for medium cars, and
- 3.4 for large cars.

There appear to be two important aspects of this higher fatality rate for small cars struck in the rear.

First, rear impact fatalities occur predominately in multi-vehicle accidents. When a small car is struck in the rear, it is likely to be struck by a larger vehicle. The weight disadvantage of small cars in multi-vehicle accidents plays an important part in determining fatality outcome in rear impact collisions.

Second, occupants of small cars in multi-vehicle accidents appear to be particularly vulnerable to fatality in rear impacts. The weight disadvantage of small cars appears to be less critical (though still very important) in rollover, frontal, and side damage collisions than in rear impacts.

## Data

There were 3,349 fatalities to occupants of cars which were struck in the rear but did not roll over during the five years from 1982 through 1986. The data were extracted from the Fatal Accident Reporting System (FARS) computer files in mid-November 1987. At that time, the following versions of the FARS data were available as analysis files.

1982 data - version 127 (last updated February 4, 1984).  
1983 data - version 97 (last updated February 21, 1985).  
1984 data - version 65 (last updated December 31, 1985).  
1985 data - version 228 (last updated March 10, 1987).  
1986 data - version 165 (last updated May 15, 1987).

The data were tabulated using the following definitions.

Car - vehicle with FARS Body Type coded 1 through 9.  
Nonrollover - collision with FARS Rollover coded 0.  
Rear Impact - damage with FARS Principal Impact coded 5 through 7.

Car sizes were defined in terms of vehicle curb weight, using the following categories.

Small car - FARS Curb Weight under 3,000 pounds.  
Medium car - FARS Curb Weight from 3,000 to 3,500 pounds.  
Large car - FARS Curb Weight over 3,500 pounds.

The numbers of fatalities reported in each of the five accident years are shown in Table 1. These 3,349 fatalities are the basis of all tables in this report.

Table 1: Fatalities in Rear Impacts by Accident Year

<u>Accident Year</u>	<u>Car Size Defined by Curb Weight</u>				<u>Total</u>
	<u>Small</u>	<u>Medium</u>	<u>Large</u>	<u>Unknown</u>	
1982	270	111	140	57	578
1983	303	121	120	65	609
1984	310	113	117	59	599
1985	422	128	122	80	752
1986	445	183	107	76	811
<u>Total</u>	<u>1,750</u>	<u>656</u>	<u>606</u>	<u>337</u>	<u>3,349</u>

## Road Type

The land use (Federal Highway Administration definitions) where the rear-impacted car fatalities occurred is shown in Table 2 (fatality counts) and Table 3 (fatality percentages). Small car fatalities had a higher proportion of urban involvement (52 percent) than those in either medium cars (41 percent) or large cars (38 percent). One possible explanation for this difference is that smaller cars may receive more city use than do larger cars.

The roadway function class (Federal Highway Administration definitions) of these fatalities is shown in Table 4 (counts) and Table 5 (percentages). The proportion of fatality involvement on interstate highways increased with car size, from 19 percent (small cars) to 21 percent (medium cars) to 23 percent (large cars). Percentage fatality involvement on principal arterials other than interstates, urban freeways, and urban expressways decreased by car size, from 31 percent (small cars) to 27 percent (medium cars) to 23 percent (large cars).

The speed limits of the roads where the fatalities occurred are shown in Table 6 (counts) and Table 7 (percentages). The results are consistent with the land use and roadway function class data. The proportion of fatalities on 55 mile-per-hour roads increased with car size, from 53 percent (small cars) to 62 percent (medium cars) to 64 percent (large cars).

Table 2: Fatalities in Rear Impacts by Land Use

<u>Land Use</u>	<u>Car Size Defined by Curb Weight</u>				<u>Total</u>
	<u>Small</u>	<u>Medium</u>	<u>Large</u>	<u>Unknown</u>	
Urban	909	272	228	177	1,586
Rural	841	384	378	158	1,761
Unknown	0	0	0	2	2
<u>Total</u>	<u>1,750</u>	<u>656</u>	<u>606</u>	<u>337</u>	<u>3,349</u>

Table 3: Percent Fatalities in Rear Impacts by Land Use

<u>Land Use</u>	<u>Car Size Defined by Curb Weight</u>				<u>Total</u>
	<u>Small</u>	<u>Medium</u>	<u>Large</u>	<u>Unknown</u>	
Urban	51.9	41.5	37.6	52.8	47.4
Rural	48.1	58.5	62.4	47.2	52.6
Unknown	-	-	-	-	-
<u>Total</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>

Table 4: Fatalities in Rear Impacts by Roadway Function Class

<u>Roadway Function Class</u>	<u>Car Size Defined by Curb Weight</u>				<u>Total</u>
	<u>Small</u>	<u>Medium</u>	<u>Large</u>	<u>Unknown</u>	
<b>Principal Arterials:</b>					
Interstate	339	140	140	73	692
Other urban	117	28	36	24	205
Other	540	177	139	91	947
Minor arterial	332	123	109	46	610
Urban collector	63	28	13	22	126
Major rural collector	175	92	79	44	390
Minor rural collector	25	12	13	10	60
Local road or street	154	56	74	25	309
Unknown	5	0	3	2	10
<b>Total</b>	<b>1,750</b>	<b>656</b>	<b>606</b>	<b>337</b>	<b>3,349</b>

Table 5: Percent Fatalities in Rear Impacts by Roadway Function Class

<u>Roadway Function Class</u>	<u>Car Size Defined by Curb Weight</u>				<u>Total</u>
	<u>Small</u>	<u>Medium</u>	<u>Large</u>	<u>Unknown</u>	
<b>Principal Arterials:</b>					
Interstate	19.4	21.3	23.2	21.8	20.7
Other urban	6.7	4.3	6.0	7.2	6.1
Other	30.9	27.0	23.1	27.2	28.4
Minor arterial	19.0	18.8	18.1	13.7	18.3
Urban collector	3.6	4.3	2.2	6.6	3.8
Major rural collector	10.0	14.0	13.1	13.1	11.7
Minor rural collector	1.4	1.8	2.2	3.0	1.8
Local road or street	8.8	8.5	12.3	7.5	9.3
Unknown	-	-	-	-	-
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>
<b>Any principal arterial</b>	<b>57.1</b>	<b>52.6</b>	<b>52.2</b>	<b>56.1</b>	<b>55.2</b>

Table 6: Fatalities in Rear Impacts by Speed Limit

Speed Limit	Car Size Defined by Curb Weight				Total
	Small	Medium	Large	Unknown	
None	2	0	1	0	3
-10 mph	1	0	0	1	2
15 mph	1	0	1	1	3
20 mph	2	2	0	0	4
25 mph	51	17	12	12	92
30 mph	88	34	38	20	180
35 mph	178	51	47	30	306
40 mph	137	35	32	37	241
45 mph	207	68	61	28	364
50 mph	129	37	23	17	206
55 mph	912	392	380	176	1,860
Unknown	42	20	11	15	88
Total	1,750	656	606	337	3,349

Table 7: Percent Fatalities in Rear Impacts by Speed Limit

Speed Limit	Car Size Defined by Curb Weight				Total
	Small	Medium	Large	Unknown	
None	0.1	0.0	0.2	0.0	0.1
10 mph	0.1	0.0	0.0	0.3	0.1
15 mph	0.1	0.0	0.2	0.3	0.1
20 mph	0.1	0.3	0.0	0.0	0.1
25 mph	3.0	2.7	2.0	3.7	2.8
30 mph	5.2	5.3	6.4	6.2	5.5
35 mph	10.4	8.0	7.9	9.3	9.4
40 mph	8.0	5.5	5.4	11.5	7.4
45 mph	12.1	10.7	10.3	8.7	11.2
50 mph	7.6	5.8	3.9	5.3	6.3
55 mph	53.4	61.6	63.9	54.7	57.0
Unknown	-	-	-	-	-
Total	100.0	100.0	100.0	100.0	100.0
Up to 30	8.5	8.3	8.7	10.6	8.7
35 - 50	38.1	30.0	27.4	34.8	34.3
55 mph	53.4	61.6	63.9	54.7	57.0

## Ambient Conditions

Most fatalities in rear-impacted cars occurred on dry roads (Tables 8 and 9) and during dry weather conditions (Table 10 and 11). The results did not vary greatly across car size.

The proportion of fatalities that occurred during daylight hours increased with car size, from 46 percent (small cars) to 49 percent (medium cars) to 53 percent (large cars), as shown in Tables 12 and 13. The proportion of fatalities on roads that were dark-but-lighted decreased with car size: from 20 percent (small cars) to 14 percent (medium cars) to 13 percent (large cars). This seems to reflect the greater proportion of urban fatalities in small cars, since street lights are more common on city streets than on country roads.

Table 8: Fatalities in Rear Impacts by Surface Condition

<u>Surface Condition</u>	<u>Car Size Defined by Curb Weight</u>				<u>Total</u>
	<u>Small</u>	<u>Medium</u>	<u>Large</u>	<u>Unknown</u>	
Dry	1,292	506	462	258	2,518
Wet	350	111	99	66	626
Snow or slush	43	16	18	8	85
Ice	58	21	25	5	109
Sand, dirt, oil	1	0	0	0	1
Other	3	1	0	0	4
<u>Unknown</u>	<u>3</u>	<u>1</u>	<u>2</u>	<u>0</u>	<u>6</u>
Total	1,750	656	606	337	3,349

Table 9: Percent Fatalities in Rear Impacts by Surface Condition

<u>Surface Condition</u>	<u>Car Size Defined by Curb Weight</u>				<u>Total</u>
	<u>Small</u>	<u>Medium</u>	<u>Large</u>	<u>Unknown</u>	
Dry	74.0	77.3	76.5	76.6	75.3
Wet	20.0	16.9	16.4	19.6	18.7
Snow or slush	2.5	2.4	3.0	2.4	2.5
Ice	3.3	3.2	4.1	1.5	3.3
Sand, dirt, oil	0.1	0.0	0.0	0.0	0.0
Other	0.2	0.2	0.0	0.0	0.1
<u>Unknown</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>
Total	100.0	100.0	100.0	100.0	100.0

Table 10: Fatalities in Rear Impacts by Weather

<u>Weather</u>	<u>Car Size Defined by Curb Weight</u>				<u>Total</u>
	<u>Small</u>	<u>Medium</u>	<u>Large</u>	<u>Unknown</u>	
Normal	1,389	523	480	258	2,650
Rain	261	85	78	50	474
Sleet	11	0	2	2	15
Snow	52	22	19	9	102
Fog	17	20	17	11	65
Rain/fog	8	1	3	2	14
Other	7	4	5	5	21
Unknown	5	1	2	0	8
<u>Total</u>	<u>1,750</u>	<u>656</u>	<u>606</u>	<u>337</u>	<u>3,349</u>

Table 11: Percent Fatalities in Rear Impacts by Surface Condition

<u>Weather</u>	<u>Car Size Defined by Curb Weight</u>				<u>Total</u>
	<u>Small</u>	<u>Medium</u>	<u>Large</u>	<u>Unknown</u>	
Normal	79.6	79.8	79.5	76.6	79.3
Rain	15.0	13.0	12.9	14.8	14.2
Sleet	0.6	0.0	0.3	0.6	0.4
Snow	3.0	3.4	3.1	2.7	3.1
Fog	1.0	3.1	2.8	3.3	1.9
Rain/fog	0.5	0.2	0.5	0.6	0.4
Other	0.4	0.6	0.8	1.5	0.6
Unknown	-	-	-	-	-
<u>Total</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>

Table 12: Fatalities in Rear Impacts by Light Condition

<u>Light Condition</u>	<u>Car Size Defined by Curb Weight</u>				<u>Total</u>
	<u>Small</u>	<u>Medium</u>	<u>Large</u>	<u>Unknown</u>	
Daylight	811	321	319	133	1,584
Dark	524	212	187	118	1,041
Dark but lighted	343	93	76	72	584
Dawn	23	11	12	5	51
Dusk	46	18	11	8	83
Unknown	3	1	1	1	6
<u>Total</u>	<u>1,750</u>	<u>656</u>	<u>606</u>	<u>337</u>	<u>3,349</u>

Table 13: Percent Fatalities in Rear Impacts by Light Condition

<u>Light Condition</u>	<u>Car Size Defined by Curb Weight</u>				<u>Total</u>
	<u>Small</u>	<u>Medium</u>	<u>Large</u>	<u>Unknown</u>	
Daylight	46.4	49.0	52.7	39.6	47.4
Dark	30.0	32.4	30.9	35.1	31.1
Dark but lighted	19.6	14.2	12.6	21.4	17.5
Dawn	1.3	1.7	2.0	1.5	1.5
Dusk	2.6	2.7	1.8	2.4	2.5
Unknown	-	-	-	-	-
<u>Total</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>

## Collision Type

Most rear-impact occupant fatalities occurred in accidents involving two vehicles, but the proportion was higher for small cars (62 percent) than for either medium cars (54 percent) or large cars (53 percent). Thus, for rear impacts, the relative weights of the striking and struck vehicle is an important factor in fatality outcome. The data are shown as Tables 14 and 15.

About 60 percent of the rear-impacted cars whose travel speed was reported were noted as stopped (travel speed of zero miles per hour). The results did not vary greatly by car size, as shown in Tables 16 and 17.

Table 14: Fatalities in Rear Impacts by Vehicles Involved in Accident

<u>Vehicles</u>	<u>Car Size Defined by Curb Weight</u>				<u>Total</u>
	<u>Small</u>	<u>Medium</u>	<u>Large</u>	<u>Unknown</u>	
Single	277	154	152	72	655
Double	1,078	351	320	172	1,921
Multiple	395	151	134	93	773
Total	1,750	656	606	337	3,349

Table 15: Percent Fatalities in Rear Impacts by Vehicles Involved in Accident

<u>Vehicles</u>	<u>Car Size Defined by Curb Weight</u>				<u>Total</u>
	<u>Small</u>	<u>Medium</u>	<u>Large</u>	<u>Unknown</u>	
Single	15.8	23.5	25.1	21.4	19.6
Double	61.6	53.5	52.8	51.0	57.4
Multiple	22.6	23.0	22.1	27.6	23.1
Total	100.0	100.0	100.0	100.0	100.0

Table 16: Fatalities in Rear Impacts by Whether Car Was Stopped

<u>Stopped</u>	<u>Car Size Defined by Curb Weight</u>				<u>Total</u>
	<u>Small</u>	<u>Medium</u>	<u>Large</u>	<u>Unknown</u>	
No	551	206	206	137	1,100
Yes	867	346	295	147	1,655
Unknown	332	104	105	53	594
Total	1,750	656	606	337	3,349

Table 17: Percent Fatalities in Rear Impacts by Whether Car Was Stopped

<u>Stopped</u>	<u>Car Size Defined by Curb Weight</u>				<u>Total</u>
	<u>Small</u>	<u>Medium</u>	<u>Large</u>	<u>Unknown</u>	
No	38.9	37.3	41.1	48.2	39.9
Yes	61.1	62.7	58.9	51.8	60.1
Unknown	-	-	-	-	-
Total	100.0	100.0	100.0	100.0	100.0

Most of these vehicles were reported as suffering severe or disabling damage (Tables 18 and 19). The damage severity scale is not detailed enough at the high severity end to usefully describe damage in fatal accidents.

Overall, about 14 percent of the rear-impact fatalities occurred in a car which caught-fire (Tables 20 and 21).

Table 18: Fatalities in Rear Impacts by Deformation Extent

<u>Deformation Extent</u>	<u>Car Size Defined by Curb Weight</u>				<u>Total</u>
	<u>Small</u>	<u>Medium</u>	<u>Large</u>	<u>Unknown</u>	
None	7	2	4	0	13
Minor	18	4	10	3	35
Moderate/functional	93	35	32	16	176
Disabling/severe	1,623	611	558	318	3,110
Unknown	9	4	2	0	15
<u>Total</u>	<u>1,750</u>	<u>656</u>	<u>606</u>	<u>337</u>	<u>3,349</u>

Table 19: Percent Fatalities in Rear Impacts by Deformation Extent

<u>Deformation Extent</u>	<u>Car Size Defined by Curb Weight</u>				<u>Total</u>
	<u>Small</u>	<u>Medium</u>	<u>Large</u>	<u>Unknown</u>	
None	0.4	0.3	0.7	0.0	0.4
Minor	1.0	0.6	1.7	0.9	1.0
Moderate/functional	5.3	5.4	5.3	4.7	5.3
Disabling/severe	93.2	93.7	92.4	94.4	93.3
Unknown	-	-	-	-	-
<u>Total</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>

Table 20: Fatalities in Rear Impacts by Occurrence of Fire

<u>Fire</u>	<u>Car Size Defined by Curb Weight</u>				<u>Total</u>
	<u>Small</u>	<u>Medium</u>	<u>Large</u>	<u>Unknown</u>	
No	1,517	544	514	293	2,868
Yes	233	112	91	44	480
<u>Total</u>	<u>1,750</u>	<u>656</u>	<u>605</u>	<u>337</u>	<u>3,348</u>

Table 21: Percent Fatalities in Rear Impacts by Occurrence of Fire

<u>Fire</u>	<u>Car Size Defined by Curb Weight</u>				<u>Total</u>
	<u>Small</u>	<u>Medium</u>	<u>Large</u>	<u>Unknown</u>	
No	86.7	82.9	85.0	86.9	85.7
Yes	13.3	17.1	15.0	13.1	14.3
<u>Total</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>

Victim Characteristics

A higher proportion of small car fatalities were drivers (56 percent) than was the case for medium car (54 percent) or large car (50 percent) fatalities. The data are shown in Tables 22 and 23.

Table 22: Fatalities in Rear Impacts by Seat Area

<u>Seat Area</u>	<u>Car Size Defined by Curb Weight</u>				<u>Total</u>
	<u>Small</u>	<u>Medium</u>	<u>Large</u>	<u>Unknown</u>	
<b>Front:</b>					
Left	964	341	295	174	1,774
Middle	15	10	7	4	36
Right	358	154	135	63	710
Other	2	1	1	0	4
Unknown	4	2	1	0	7
<b>Second:</b>					
Left	115	47	49	23	234
Middle	46	16	26	9	97
Right	172	57	60	33	322
Other	1	1	4	2	8
Unknown	15	0	2	3	20
Other	25	4	6	12	47
<u>Unknown</u>	<u>33</u>	<u>23</u>	<u>20</u>	<u>14</u>	<u>90</u>
<b>Total</b>	<b>1,750</b>	<b>656</b>	<b>606</b>	<b>337</b>	<b>3,349</b>

Table 23: Percent Fatalities in Rear Impacts by Seat Area

<u>Seat Area</u>	<u>Car Size Defined by Curb Weight</u>				<u>Total</u>
	<u>Small</u>	<u>Medium</u>	<u>Large</u>	<u>Unknown</u>	
<b>Front:</b>					
Left	56.1	53.9	50.3	53.9	54.4
Middle	0.9	1.6	1.2	1.2	1.1
Right	20.9	24.3	23.0	19.5	21.8
Other	0.1	0.2	0.2	0.0	0.1
Unknown	0.2	0.3	0.2	0.0	0.2
<b>Second:</b>					
Left	6.7	7.4	8.4	7.1	7.2
Middle	2.7	2.5	4.4	2.8	3.0
Right	10.0	9.0	10.2	10.2	9.9
Other	0.1	0.2	0.7	0.6	0.2
Unknown	0.9	0.0	0.3	0.9	0.6
Other	1.5	0.6	1.0	3.7	1.4
<u>Unknown</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>
<b>Front:</b>					
Driver	56.1	53.9	50.3	53.9	54.4
Other	22.1	26.4	24.6	20.7	23.2
Behind	21.8	19.7	25.1	25.4	22.3

The fatalities in small cars tended to be younger than those in larger cars (Tables 24 and 25). While 69 percent of small car fatalities were under 40 years old, only 58 percent of medium car and 53 percent of large car fatalities were under 40. Only 16 percent of small car fatalities were 60 years or older, as compared to 25 percent of medium car and 27 percent of large car fatalities.

Table 24: Fatalities in Rear Impacts by Victim Age

Age Group	Car Size Defined by Curb Weight				Total
	Small	Medium	Large	Unknown	
Under 10	144	43	31	21	239
10 - 19	340	110	100	57	607
20 - 29	454	144	120	79	797
30 - 39	263	84	70	63	480
40 - 49	142	58	61	22	283
50 - 59	124	52	59	23	258
60 - 69	138	60	58	31	287
70 - 79	100	67	66	29	262
80 - 89	35	30	37	9	111
90 and up	4	4	1	3	12
Unknown	6	4	3	0	13
<b>Total</b>	<b>1,750</b>	<b>656</b>	<b>606</b>	<b>337</b>	<b>3,349</b>

Table 25: Percent Fatalities in Rear Impacts by Victim Age

Age Group	Car Size Defined by Curb Weight				Total
	Small	Medium	Large	Unknown	
Under 10	8.3	6.6	5.1	6.2	7.2
10 - 19	19.5	16.9	16.6	16.9	18.2
20 - 29	26.0	22.1	19.9	23.4	23.9
30 - 39	15.1	12.9	11.6	18.7	14.4
40 - 49	8.1	8.9	10.1	6.5	8.5
50 - 59	7.1	8.0	9.8	6.8	7.7
60 - 69	7.9	9.2	9.6	9.2	8.6
70 - 79	5.7	10.3	10.9	8.6	7.9
80 - 89	2.0	4.6	6.1	2.7	3.3
90 and up	0.2	0.6	0.2	0.9	0.4
Unknown	-	-	-	-	-
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>
<b>Under 40</b>	<b>68.9</b>	<b>58.4</b>	<b>53.2</b>	<b>65.3</b>	<b>63.6</b>
<b>40 - 59</b>	<b>15.3</b>	<b>16.9</b>	<b>19.9</b>	<b>13.4</b>	<b>16.2</b>
<b>60 and up</b>	<b>15.9</b>	<b>24.7</b>	<b>26.9</b>	<b>21.4</b>	<b>20.1</b>

Most of these fatalities were reported as unprotected by any restraint (Tables 26 and 27). However, more small car fatalities (14 percent) were reported restrained than were medium car (10 percent) or large car (6 percent) fatalities.

About one-fifth of the fatalities were ejected from their vehicles (Tables 28 and 29). Large car fatalities had more frequent ejection (24 percent) than small and medium car fatalities (20 percent).

About one-tenth of the fatalities were in cars that were sufficiently crushed that the victims had to be extricated from their vehicles (Tables 30 and 31). There was a slight pattern of greater required extrication for smaller cars: 11.0 percent for small car victims, 9.7 percent for medium car victims, and 9.5 percent for large car victims.

Table 26: Fatalities in Rear Impacts by Manual Restraint Use

<u>Manual Restraint Use</u>	<u>Car Size Defined by Curb Weight</u>				<u>Total</u>
	<u>Small</u>	<u>Medium</u>	<u>Large</u>	<u>Unknown</u>	
None used	1,175	455	453	219	2,302
Shoulder belt	5	0	1	0	6
Lap belt	31	13	5	4	53
Lap and shoulder	111	25	19	11	166
Child safety seat	14	5	0	2	21
Used, other/unknown	28	8	4	8	48
<u>Unknown if used</u>	<u>386</u>	<u>150</u>	<u>124</u>	<u>93</u>	<u>753</u>
<u>Total</u>	<u>1,750</u>	<u>656</u>	<u>606</u>	<u>337</u>	<u>3,349</u>

Table 27: Percent Fatalities in Rear Impacts by Manual Restraint Use

<u>Manual Restraint Use</u>	<u>Car Size Defined by Curb Weight</u>				<u>Total</u>
	<u>Small</u>	<u>Medium</u>	<u>Large</u>	<u>Unknown</u>	
None used	86.1	89.9	94.0	89.8	88.7
Shoulder belt	0.4	0.0	0.2	0.0	0.2
Lap belt	2.3	2.6	1.0	1.6	2.0
Lap and shoulder	8.1	4.9	3.9	4.5	6.4
Child safety seat	1.0	1.0	0.0	0.8	0.8
Used, other/unknown	2.1	1.6	0.8	3.3	1.8
<u>Unknown if used</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>
<u>Total</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>
Any used	13.9	10.1	6.0	10.2	11.3

**Table 28: Fatalities in Rear Impacts by Ejection**

<u>Ejection</u>	<u>Car Size Defined by Curb Weight</u>				<u>Total</u>
	<u>Small</u>	<u>Medium</u>	<u>Large</u>	<u>Unknown</u>	
No	1,388	521	456	261	2,626
Totally	319	117	122	67	625
Partially	35	13	21	8	77
Unknown	8	5	7	1	21
<u>Total</u>	<u>1,750</u>	<u>656</u>	<u>606</u>	<u>337</u>	<u>3,349</u>

**Table 29: Percent Fatalities in Rear Impacts by Ejection**

<u>Ejection</u>	<u>Car Size Defined by Curb Weight</u>				<u>Total</u>
	<u>Small</u>	<u>Medium</u>	<u>Large</u>	<u>Unknown</u>	
No	79.7	80.0	76.1	77.7	78.9
Totally	18.3	18.0	20.4	19.9	18.8
Partially	2.0	2.0	3.5	2.4	2.3
Unknown	-	-	-	-	-
<u>Total</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>
Any	20.3	20.0	23.9	22.3	21.1

**Table 30: Fatalities in Rear Impacts by Whether Extrication Needed**

<u>Extricated</u>	<u>Car Size Defined by Curb Weight</u>				<u>Total</u>
	<u>Small</u>	<u>Medium</u>	<u>Large</u>	<u>Unknown</u>	
No	1,542	584	546	288	2,960
Yes	191	63	57	47	358
Unknown	17	9	3	2	31
<u>Total</u>	<u>1,750</u>	<u>656</u>	<u>606</u>	<u>337</u>	<u>3,349</u>

**Table 31: Percent Fatalities in Rear Impacts by Whether Extrication Needed**

<u>Extricated</u>	<u>Car Size Defined by Curb Weight</u>				<u>Total</u>
	<u>Small</u>	<u>Medium</u>	<u>Large</u>	<u>Unknown</u>	
No	89.0	90.3	90.5	86.0	89.2
Yes	11.0	9.7	9.5	14.0	10.8
Unknown	-	-	-	-	-
<u>Total</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>

## Single-Vehicle Accidents

Of the 3,349 rear-impact car occupant fatalities that occurred during 1982 through 1986 (Table 32), only 655 were in accidents that involved only a single vehicle (Table 33). This is 20 percent (Table 34) of the rear-impact fatalities, a lower proportion than for any of the other major collision type categories -- rollover, frontal, side damage, other type, or unknown type. Thus, rear-impact fatalities were a predominately multiple-vehicle phenomenon (involving two or more vehicles).

Table 32: Fatalities by Collision Type

<u>Collision Type</u>	<u>Car Size Defined by Curb Weight</u>				<u>Total</u>
	<u>Small</u>	<u>Medium</u>	<u>Large</u>	<u>Unknown</u>	
Rollover	14,708	5,241	4,968	2,711	27,628
Nonrollover:					
Front	23,046	10,625	10,519	4,066	48,256
Side	15,578	6,955	6,647	2,612	31,792
Rear	1,750	656	606	337	3,349
Other	1,274	708	855	340	3,177
Unknown	878	484	431	1,293	3,086
<u>Total</u>	<u>52,234</u>	<u>24,669</u>	<u>24,026</u>	<u>11,359</u>	<u>117,288</u>

Table 33: Fatalities in Single-Vehicle Accidents by Collision Type

<u>Collision Type</u>	<u>Car Size Defined by Curb Weight</u>				<u>Total</u>
	<u>Small</u>	<u>Medium</u>	<u>Large</u>	<u>Unknown</u>	
Rollover	12,248	4,599	4,379	2,290	23,516
Nonrollover:					
Front	6,861	4,137	4,625	1,458	17,081
Side	3,818	2,030	2,051	817	8,716
Rear	277	154	152	72	655
Other	752	435	576	251	2,014
Unknown	338	245	231	495	1,309
<u>Total</u>	<u>24,294</u>	<u>11,600</u>	<u>12,014</u>	<u>5,383</u>	<u>53,291</u>

Table 34: Percent Fatalities in Single-Vehicle Accidents by Collision Type

<u>Collision Type</u>	<u>Car Size Defined by Curb Weight</u>				<u>Total</u>
	<u>Small</u>	<u>Medium</u>	<u>Large</u>	<u>Unknown</u>	
Rollover	88.3	87.8	88.1	84.5	85.1
Nonrollover:					
Front	29.8	38.9	44.0	35.9	35.4
Side	24.5	29.2	30.9	31.3	27.4
Rear	15.8	23.5	25.1	21.4	19.6
Other	59.0	61.4	67.4	73.8	63.4
Unknown	38.5	50.6	53.6	38.3	42.4
<u>Total</u>	<u>42.4</u>	<u>47.0</u>	<u>50.0</u>	<u>47.4</u>	<u>45.4</u>

For 10 percent of the fatalities in single-vehicle rear impacts (Tables 35 and 36) there was a fire in the car. This was lower than the 14 percent of all rear impacts (single plus multiple vehicle). In single-vehicle rear impacts, the frequency of fire involvement with fatalities increased with car size.

Table 35: Fatalities in Single-Vehicle Rear Impacts  
by Occurrence of Fire

<u>Fire</u>	<u>Car Size Defined by Curb Weight</u>				<u>Total</u>
	<u>Small</u>	<u>Medium</u>	<u>Large</u>	<u>Unknown</u>	
No	251	138	132	68	589
Yes	26	16	20	4	66
Total	277	154	152	72	655

Table 36: Percent Fatalities in Single-Vehicle Rear Impacts  
by Occurrence of Fire

<u>Fire</u>	<u>Car Size Defined by Curb Weight</u>				<u>Total</u>
	<u>Small</u>	<u>Medium</u>	<u>Large</u>	<u>Unknown</u>	
No	90.6	89.6	86.8	94.4	89.9
Yes	9.4	10.4	13.2	5.6	10.1
Total	100.0	100.0	100.0	100.0	100.0

About one-third of rear-impact single-vehicle fatalities were ejected (Tables 37 and 38). There was no clear pattern across car size. This rate was substantially higher than that observed for all rear-impact fatalities -- one in five of these were ejected. By subtracting the data in Table 37 from that in Table 28, the ejection rates in multiple-vehicle accidents can be calculated. While only 17 percent of multiple-vehicle rear-impact fatalities were ejected, twice as many (34 percent) single-vehicle rear-impact fatalities were ejected.

**Table 37: Fatalities in Single-Vehicle Rear Impacts by Ejection**

<u>Ejection</u>	<u>Car Size Defined by Curb Weight</u>				<u>Total</u>
	<u>Small</u>	<u>Medium</u>	<u>Large</u>	<u>Unknown</u>	
No	172	92	95	44	403
Totally	92	52	50	26	220
Partially	10	7	4	2	23
Unknown	3	3	3	0	9
<u>Total</u>	<u>277</u>	<u>154</u>	<u>152</u>	<u>72</u>	<u>655</u>

**Table 38: Percent Fatalities in Single-Vehicle Rear Impacts by Ejection**

<u>Ejection</u>	<u>Car Size Defined by Curb Weight</u>				<u>Total</u>
	<u>Small</u>	<u>Medium</u>	<u>Large</u>	<u>Unknown</u>	
No	62.8	60.9	63.8	61.1	62.4
Totally	33.6	34.4	33.6	36.1	34.1
Partially	3.6	4.6	2.7	2.8	3.6
Unknown	-	-	-	-	-
<u>Total</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>
Any	37.2	39.1	36.2	38.9	37.6

## Striking Vehicle Characteristics

The distribution of the striking vehicle type varied greatly with the size of the rear-impacted car (Tables 39 and 40). Rear-impacted car fatalities tended to occur in accidents with a larger vehicle. For example, while 24 percent of the fatalities in small cars were in rear impacts with a heavy truck, 36 percent of the medium car fatalities and 50 percent of the large car fatalities resulted from heavy truck collisions. Large car fatalities were less frequently caused by impacts with small and medium cars than was the case for smaller rear-impacted cars.

Table 39: Fatalities in Two-Vehicle Rear Impacts  
by Striking Vehicle Type

<u>Striking Vehicle Type</u>	<u>Car Size Defined by Curb Weight</u>				<u>Total</u>
	<u>Small</u>	<u>Medium</u>	<u>Large</u>	<u>Unknown</u>	
Small car	134	37	24	23	218
Medium car	139	24	22	28	213
Large car	247	80	45	30	402
Unknown car	39	13	8	9	69
Motorcycle	0	0	1	0	1
Van	40	10	9	6	65
Pickup	190	52	46	30	318
Large truck	251	126	156	40	573
Other vehicle	25	8	4	3	40
<u>Unknown vehicle</u>	<u>13</u>	<u>1</u>	<u>5</u>	<u>3</u>	<u>22</u>
<b>Total</b>	<b>1,078</b>	<b>351</b>	<b>320</b>	<b>172</b>	<b>1,921</b>

Table 40: Percent Fatalities in Two-Vehicle Rear Impacts  
by Striking Vehicle Type

<u>Striking Vehicle Type</u>	<u>Car Size Defined by Curb Weight</u>				<u>Total</u>
	<u>Small</u>	<u>Medium</u>	<u>Large</u>	<u>Unknown</u>	
Small car	12.6	10.6	7.6	13.6	11.5
Medium car	13.1	6.9	7.0	16.6	11.2
Large car	23.2	22.9	14.3	17.8	21.2
Unknown car	3.7	3.7	2.5	5.3	3.6
Motorcycle	0.0	0.0	0.3	0.0	0.1
Van	3.8	2.9	2.9	3.6	3.4
Pickup	17.8	14.9	14.6	17.8	16.7
Large truck	23.6	36.0	49.5	23.7	30.2
Other vehicle	2.3	2.3	1.3	1.8	2.1
<u>Unknown vehicle</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>

Table 41 shows the numbers of fatalities in two-car collisions for rear impacts and, for comparison, other major collision types. The total includes other and unknown collision types. There were substantially more fatalities in, for example, a small car involved with a large car (5,857 across all collision types) than in a large car involved with a small car (1,010 total). The ratio of these is

$$5,857 / 1,010 = 5.80.$$

This can be used as a "risk ratio" for two-car involvements. The risk ratio means that 5.80 times as many fatalities occurred in small cars involved with large cars as in large cars involved with small cars. If accidents are assumed to occur randomly across car sizes (with the numbers of cars of various sizes on the road determining collision interactions), then this risk ratio has a further interpretation.

There were 247 fatalities in small cars struck in the rear by large cars, and 24 fatalities in large cars struck in the rear by small cars. The risk ratio is the highest of any in this table,

$$247 / 24 = 10.29.$$

This ratio becomes, under the assumption just described, a composite measure of the ability of these two vehicle sizes to protect their occupants in rear impacts and their tendency to inflict life-threatening damage when striking other vehicles in the rear.

Table 41: Fatalities in Two-Vehicle Impacts  
by Car Sizes and Collision Type

Involved Car Sizes		Victim's Car Collision Type					Total
Victim's Car	Other Car	Rollover	Front	Side	Rear		
Small	Medium	341	1,969	1,327	139	3,827	
Medium	Small	91	705	520	37	1,370	
Medium	Large	128	1,234	861	80	2,342	
Large	Medium	83	587	402	22	1,108	
Small	Large	441	3,012	2,069	247	5,857	
Large	Small	92	495	386	24	1,010	

Table 42: Fatality Ratios in Two-Vehicle Impacts  
By Car Sizes and Collision Type

Involved Car Sizes		Victim's Car Collision Type					Total
Smaller Car	Larger Car	Rollover	Front	Side	Rear		
Small	Medium	3.75	2.79	2.55	3.76	2.79	
Medium	Large	1.54	2.10	2.14	3.64	2.11	
Small	Large	4.79	6.08	5.36	10.29	5.80	

The striking vehicle speed was most frequently reported in the range 50-to-59 miles per hour (Tables 43 and 44). The proportion in this speed range increased with car size, from 33 percent (small cars) to 42 percent (medium cars) to 47 percent (large cars). This is consistent with the pattern of car size and speed limit, with large cars more frequently rear-impacted on 55 mile-per-hour roads than was the case for smaller cars.

Table 43: Fatalities in Two-Vehicle Rear Impacts by Striking Vehicle Speed

<u>Striking Vehicle Speed</u>	<u>Car Size Defined by Curb Weight</u>				<u>Total</u>
	<u>Small</u>	<u>Medium</u>	<u>Large</u>	<u>Unknown</u>	
Under 10 mph	9	2	3	2	16
10 - 19 mph	10	0	3	2	15
20 - 29 mph	13	5	6	4	28
30 - 39 mph	55	11	9	10	85
40 - 49 mph	102	34	24	24	184
50 - 59 mph	152	65	76	30	323
60 - 69 mph	54	14	25	14	107
70 - 79 mph	40	7	11	7	65
80 - 89 mph	10	8	2	4	24
90 mph and up	11	7	2	4	24
<u>Unknown</u>	<u>622</u>	<u>198</u>	<u>159</u>	<u>71</u>	<u>1,050</u>
<b>Total</b>	<b>1,078</b>	<b>351</b>	<b>320</b>	<b>172</b>	<b>1,921</b>

Table 44: Percent Fatalities in Two-Vehicle Rear Impacts by Striking Vehicle Speed

<u>Striking Vehicle Speed</u>	<u>Car Size Defined by Curb Weight</u>				<u>Total</u>
	<u>Small</u>	<u>Medium</u>	<u>Large</u>	<u>Unknown</u>	
Under 10 mph	2.0	1.3	1.9	2.0	1.8
10 - 19 mph	2.2	0.0	1.9	2.0	1.7
20 - 29 mph	2.9	3.3	3.7	4.0	3.2
30 - 39 mph	12.1	7.2	5.6	9.9	9.8
40 - 49 mph	22.4	22.2	14.9	23.8	21.1
50 - 59 mph	33.3	42.5	47.2	29.7	37.1
60 - 69 mph	11.8	9.2	15.5	13.9	12.3
70 - 79 mph	8.8	4.6	6.8	6.9	7.5
80 - 89 mph	2.2	5.2	1.2	4.0	2.8
90 mph and up	2.4	4.6	1.2	4.0	2.8
<u>Unknown</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>

There was an indication that the striking vehicle driver had been drinking for more small car rear-impact fatalities (29 percent) than was the case for medium car fatalities (21 percent) or large car fatalities (18 percent). The data are shown in Tables 45 and 46.

Table 45: Fatalities in Two-Vehicle Rear Impacts  
by Whether Striking Vehicle Driver Was Drinking

<u>Striking Driver Drinking</u>	<u>Car Size Defined by Curb Weight</u>				<u>Total</u>
	<u>Small</u>	<u>Medium</u>	<u>Large</u>	<u>Unknown</u>	
No indication	764	277	263	130	1,434
<u>Yes, some indication</u>	<u>314</u>	<u>74</u>	<u>57</u>	<u>42</u>	<u>487</u>
<u>Total</u>	<u>1,078</u>	<u>351</u>	<u>320</u>	<u>172</u>	<u>1,921</u>

Table 46: Percent Fatalities in Two-Vehicle Rear Impacts  
by Whether Striking Vehicle Driver Was Drinking

<u>Striking Driver Drinking</u>	<u>Car Size Defined by Curb Weight</u>				<u>Total</u>
	<u>Small</u>	<u>Medium</u>	<u>Large</u>	<u>Unknown</u>	
No indication	70.9	78.9	82.2	75.6	74.6
<u>Yes, some indication</u>	<u>29.1</u>	<u>21.1</u>	<u>17.8</u>	<u>24.4</u>	<u>25.4</u>
<u>Total</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>

4

2

8

9

4

U.S. Department  
of Transportation

**National Highway  
Traffic Safety  
Administration**

400 Seventh St., S.W.  
Washington, D.C. 20590

**FOURTH CLASS BOOK RATE  
POSTAGE & FEES PAID  
NATIONAL HIGHWAY TRAFFIC  
SAFETY ADMINISTRATION  
PERMIT NO. G-90**

**RETURN POSTAGE GUARANTEED**

Official Business  
Penalty for Private Use \$300