NCSS STATISTICS: PASSENGER CARS

Leda L. Ricci

Highway Safety Research Institute
The University of Michigan
Ann Arbor, Michigan 48109

Contract No. DOT HS-8-01944
Contract Amt. $385,960

JUNE 1980
FINAL REPORT

Prepared For
U.S. DEPARTMENT OF TRANSPORTATION
National Highway Traffic Safety Administration
Washington, D.C. 20590

Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-HS-805-531		

4. Title and Subtitle	5. Report Date
NCSS Statistics: Passenger Cars	June 1980
	6. Performing Organization Code
	8. Performing Organization Report No.
7. Author(s)	UM-HSRI-80-36
Leda L. Ricci, editor	
9. Performing Organization Name and Address	10. Work Unit No. (TRAIS)
Highway Safety Research Institute The University of Michigan Ann Arbor, Michigan 48109	11. Contract or Grant No. DOT-HS-8-01944
	13. Type of Report and Period Covered
12. Sponsoring Agency Name and Address	Special Report January 1977-March 1979
National Highway Traffic Safety Administration Department of Transportation Washington, D.C. 20590	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

The National Crash Severity Study (NCSS) is a major accident data collection program of the National Center for Statistics and Analysis (NCSA) of the National Highway Traffic Safety Administration (NHTSA). Data collection began on January 1, 1977 and terminated on March 31, 1979. This report presents tabulations of accidents involving towed passenger cars for the entire twenty-seven month period. A supplement to this publication, NCSS Statistics: Light Trucks and Vans, presents comparable tabulations for accidents involving towed light trucks and vans for the last twelve months of the study.

Accidents were investigated in seven geographic areas within the continental United States selected so that the aggregate of the areas closely resembles the urbanization distribution of the entire country. Within each area, a stratified sampling plan was used to gather detailed information on passenger cars, light trucks, and vans (and their occupants) in accidents severe enough to require that the vehicles be towed from the scene.

The combined investigations presented here total 11,386 accidents, 14,805 towed vehicles, 24,976 vehicle occupants, and 917 fatalities. The tables and figures in this report were generated using computer files for a passenger car subset of the NCSS data, and represent only a very broad treatment of the data.

17. Key Words	18. Distribution Statement
NCSS, highway statistics, injury rates, accidents, injuries, passenger cars	Document is available to the public through the National Technical Information Service, Springfield, Virginia 22161

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	102	

METRIC CONVERSION FACTORS

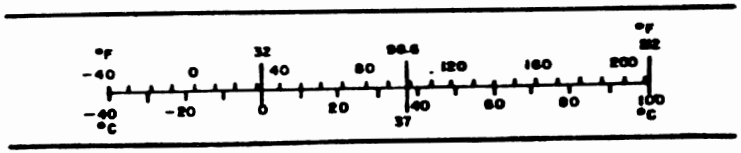
Approximate Conversions to Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
in	inches	*2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
		AREA		
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
	acres	0.4	hectares	ha
		MASS (weight)		
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
		VOLUME		
tsp	teaspoons	5	milliliters	ml
tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
		TEMPERATURE (exact)		
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

*1 in = 2.54 (exactly). For other exact conversions and more detailed tables, see NBS Misc. Publ. 286, Units of Weights and Measures, Price $2.25, SD Catalog No. C13.10:286.

Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
		AREA		
cm^2	square centimeters	0.16	square inches	in^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
	hectares (10,000 m^2)	2.5	acres	
		MASS (weight)		
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
		VOLUME		
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m^3	cubic meters	35	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
		TEMPERATURE (exact)		
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F



PREFACE

This document has been prepared from a subset of the National Crash Severity Study data restricted to accidents in which the most severe injury in the accident occurred to an occupant of a towed passenger car. During the first phase of the study (January 1977 through March 1978), only accidents that met the above criteria were sampled. During the second phase (April 1978 through March 1979), accidents in which the most severe injury occurred to the occupant of a light truck or van were also included. Such accidents have been excluded from this subset, but they and any other accidents involving a towed light truck or van are described in a supplementary report, NCSS Statistics: Light Trucks and Vans, June 1980.[1]

This report is limited, then, to descriptive statistics on all the accidents, vehicles, and occupants in the passenger car subset and covers the twenty-seven months from January 1977 through March 1979. All tables in this report were prepared from computerized NCSS files.

The National Crash Severity Study (NCSS) is a major data collection program of the National Center for Statistics and Analysis (NCSA) of the National Highway Traffic Safety Administration (NHTSA). This study collects a common set of detailed information on passenger cars, light trucks, and vans (and their occupants) involved in accidents which were severe enough to require an eligible vehicle to be towed from the scene. Pedestrian accidents, and other accidents in which the eligible vehicle did not have to be towed away, are excluded from this study. The NCSS data set includes descriptive information on the accident, the vehicles, the occupants and their injuries, and a computed estimate of the instantaneous change in velocity of the vehicle during the impact phase of the crash (called "Delta V"). Some information on other vehicles involved in these accidents (such as heavy trucks, or non-towed passenger cars) is also included in the data set.

Accident investigations are conducted in seven geographic areas of the continental United States. These areas were not selected at random, but rather were chosen because the NCSA judged that high-quality accident investigation teams could be readily established in them. The seven areas and their contractors are:

1. Erie County, New York (minus the City of Buffalo)
   Calspan Field Services

2. Sixteen Counties in Southwest Indiana
   Indiana University

---

[1] Leda Ricci, ed., NCSS Statistics: Light Trucks and Vans. Sponsored by the National Highway Traffic Safety Administration, Department of Transportation, Washington, D.C., under Contract No. DOT-HS-8-01944. Ann Arbor: Highway Safety Research Institute, The University of Michigan, June 1980. Report No. UM-HSRI-80-37.

3. Washtenaw and Lenawee Counties, Michigan
   The University of Michigan
   Highway Safety Research Institute (HSRI)

4. Miami, Florida
   University of Miami

5. Lexington, Kentucky, and seven surrounding counties
   University of Kentucky

6. Fifteen counties in South Texas
   Southwest Research Institute (SWRI)

7. Los Angeles, California (three police districts only)
   Dynamic Science Incorporated

Within each data collection area, accidents were selected for investigation by strict adherence to a stratified sampling plan. Accidents eligible for investigation are all police-reported accidents within the defined geographic areas in which at least one occupied passenger car, light truck, or van was towed from the scene due to collision damage. A towed passenger car, light truck, or van is referred to as a "case" vehicle. Each eligible accident has one or more case vehicles.

Each eligible accident is assigned to one of three strata according to the highest treatment category in a case vehicle. Definitions of the three strata and the sampling rates used are as follows:

Stratum 1. An eligible accident in which at least one case vehicle occupant was hospitalized overnight or fatally injured. This stratum was sampled at a rate of 100% (all accidents in this stratum are investigated).

Stratum 2. An eligible accident not in Stratum 1, but in which at least one case vehicle occupant was transported from the accident scene to a hospital or other treatment facility in a police, fire, or other emergency vehicle. This stratum was sampled at a 25% rate.

Stratum 3. All other eligible accidents are in this stratum. These accidents were sampled at a 10% rate, except in Texas, where they were sampled at a 5% rate during the last twelve months of the study.

Within each area, the accident selection methods differ. Two of the teams, HSRI and SWRI, selected accidents using a randomization technique. The other teams used a systematic sample of days. These teams investigated all eligible accidents on every fourth day in Stratum 2 and all eligible accidents on every tenth day in Stratum 3, except in Los Angeles, where half of the eligible accidents on every fifth day were investigated in Stratum 3.

For analysis, each case is assigned a weight equal to the inverse of its sampling fraction: 1 in Stratum 1, 4 in Stratum 2, and 10 or 20 in Stratum 3. In tabulating data from the file, each observation was multiplied by its case weight in order to produce an estimate of the total towaway population for the aggregate of the seven NCSS areas. For example, the NCSS passenger car subset file used to compile these statistics contains information on 11,386 accidents. Multiplication of each of these accidents by its appropriate weight produces an estimated total for the aggregate of the seven areas of 54,318 accidents involving a towed passenger car (with the most severe injury in the accidents occurring in the passenger car). Similarly, 14,805 towed passenger cars were involved in the 11,386 accidents producing a weighted total of 67,284 towed passenger cars involved in accidents for the aggregate; 24,976 occupants of towed passenger cars were investigated, producing a weighted total of 106,121 occupants of towed passenger cars. Since accidents involving a fatality were always sampled at a 100% rate, the investigated and weighted number of fatalities are equal (917). Unless otherwise indicated, the statistics presented in this report are weighted and are aggregated over all seven data collection areas.

Tabulations labeled "case vehicles" include only towed passenger cars. Similarly tabulations labeled "case vehicle occupants" include only occupants of those towed passenger cars. Tabulations which are labeled "all vehicles" include the case vehicles (towed passenger cars), plus any other vehicles (non-towed passenger cars, light trucks, vans, heavy trucks, etc.) which were involved in accidents in the subset. Tabulations labeled "all occupants" include the case vehicle occupants (in passenger cars), plus the occupants of the other vehicles in the accident subset.

The resulting statistics are not national estimates because the areas for data collection were not selected randomly. The areas were deliberately selected to be geographically diverse and to have an overall proportion of the population located in urban areas which is close to that of the entire United States (as given in the 1970 census). Statistical methods have been developed to generate "national projections" based on the data from the selected areas and demographic information on all areas in the United States.[2] These methods are complex and are not suitable for all data elements. Also, there is less assurance that the national projections generated are free from bias than if probability-based selection procedures had been used in the selection of the areas. The statistics presented in this report describe the police-reported accidents involving towed passenger cars for the aggregate of the seven areas.

It is also the case that sampling errors are associated with almost all the statistics published in this report. The size of these sampling

---

[2]Phyllis A. Gimotty, National Projections from NCSS Statistics. Presented at the Society of Automotive Engineering Congress and Exposition, Detroit, Michigan, 25-29 February 1980. SAE Paper No. 800097.

errors is unknown, but, given the sampling procedures used, they have the potential of being considerable for at least some of the statistics.

The body of this report is organized into five major sections. The first presents a general overview of the passenger car subset of the NCSS data. In the second section, descriptive statistics on the accidents are presented. The third and fourth sections provide information on the vehicles and occupants, respectively, with the fourth section including a group of tables on injury distribution. The last section presents various collision severity (Delta V) distributions.

For the most part, tables are presented in two complementary forms. The left-hand page provides a frequency distribution of the factor under consideration; the right-hand page shows the corresponding injury rates. In each case the columns of these tables show the number of occupants in each of several injury categories. Injury information is categorized using the Abbreviated Injury Scale.[3] This scale is used to define injuries which are equal to or greater than a given severity level as indicated by the column headings "AIS 2+," "AIS 3+," and "Fatal." These tabulations were produced from two variables (NEWOAIS2 and NEWOAIS3) computed using an NCSA algorithm. This algorithm seeks to use other injury information in the file, where possible, to code the computed variables when the AIS code was missing. A more complete description of the injury categories may be found on page 5. The injury rates presented are row percentages, and are computed by taking the number of occupants injured at the indicated injury level or higher (AIS 2+) and dividing by the total number of occupants in the row.

One important caveat should be kept in mind when interpreting the statistics presented in this report. For many variables--in particular those relating to crash severity and to injury--there are substantial proportions of missing data. Missing data counts and percentages are shown for all row variables, and have not been excluded in the computation of column percentages for the complete data. Consequently, the percentages shown may be underestimated somewhat.

This publication was produced by the efforts of many people at the Highway Safety Research Institute. James O'Day and Richard Kaplan developed the scope and organization of the report. Kenneth L. Campbell and Oliver Carsten are responsible for the content of this final version. Kathleen Jackson designed the cover and made layout and design suggestions. Joseph Andary developed programs to produce the tables in this book. Brian Wolf produced the graphics. James Hedlund, NHTSA, and Phyllis Gimotty made suggestions and comments as the publication evolved.

---

[3] The Abbreviated Injury Scale. Morton Grove, Ill.: American Association for Automotive Medicine, 1976.

CONTENTS

VEHICLE TABLES--Continued

OCCUPANT TABLES--Continued

CRASH SEVERITY (DELTA V) TABLES--Continued

* * * *

1 GENERAL

This section presents information about both the unweighted (investigated) counts of cases and the reconstructed, or weighted, counts. It provides an overview of the passenger car subset of the NCSS data.

Unweighted counts presented in this section are of value to those interested in the consequences of the sampling procedures. They indicate the actual number of investigated cases used to calculate the reconstructed totals in each sampling situation and for each data collection team. The weighted distributions in this section, and in the remainder of this report, describe the accident experience in the aggregate of the seven NCSS areas.

WEIGHTED AND ACTUAL ACCIDENTS, ALL VEHICLES, CASE VEHICLES, AND CASE VEHICLE OCCUPANTS: JANUARY 1977 TO MARCH 1979

SAMPLING FRACTION	ACCIDENTS		ALL VEHICLES		CASE VEHICLES		CASE VEHICLE OCCUPANTS		CASE VEHICLE FATALITIES	
	ACTUAL	WEIGHTED	ACTUAL	WEIGHTED	ACTUAL	WEIGHTED	ACTUAL	WEIGHTED	ACTUAL	WEIGHTED
100%	4868	4868	8320	8320	6558	6558	11775	11775	917	917
25%	2985	11940	5533	22132	4069	16276	6994	27976		
10%	3315	33150	6163	61630	3911	39110	5777	57770		
5%	218	4360	384	7680	267	5340	430	8600		
TOTAL	11386	54318	20400	99762	14805	67284	24976	106121	917	917

The ACTUAL *columns of this table display the number of accidents, vehicles, etc., actually investigated by the NCSS field teams. In order to make some of the major analysis categories more equal in size, lower-severity accidents were sampled at a rate less than 100%. All cases which resulted in overnight hospitalization or a fatality were selected (100% fraction), while only 25% of cases in which an occupant was transported to a hospital were selected. Finally, 10% of those cases in which the vehicle was towed but no occupant was taken to a hospital were sampled--the exception being SWRI (Texas) where they sampled at a 5% rate during the last twelve months of the study. To estimate the total population, weights may be applied--the 25% group being multiplied by a factor of four, the 10% group by a factor of ten, and the 5% group by a factor of twenty. Such counts are called* WEIGHTED *in this report.*

ELIGIBLE ACCIDENTS *are those in which the most severe injuries of the accident occur in a passenger car which has been towed from the scene.*

CASE VEHICLES *include all passenger cars which have been towed from the scene of an eligible accident.*

CASE VEHICLE OCCUPANTS *are the occupants of all passenger cars towed from the scene of an eligible accident.*

The columns in this table headed ALL VEHICLES *include counts of vehicles other than passenger cars (and non-towed passenger cars) which were involved in an eligible accident.*

NCSS DATA BY DATA COLLECTION TEAM

GROUP	CALSPAN	HSRI	U OF IND	U OF KEN	U MIAMI	SWRI	DYN.SCI.	TOTAL
ACCIDENTS								
Weighted	7276	4962	5344	6658	11018	13597	5463	54318
Actual	1627	1113	1528	1468	2075	2579	996	11386
ALL VEHICLES								
Weighted	13011	8506	8805	11487	22300	24248	11405	99762
Actual	2883	1870	2478	2490	4186	4451	2042	20400
CASE VEHICLES								
Weighted	9108	6192	6451	7909	13918	16807	6899	67284
Actual	2139	1440	1903	1843	2848	3307	1325	14805
ALL OCCUPANTS								
Weighted	17663	11503	11494	17097	29195	34018	13971	134941
Actual	4148	2716	3532	3906	5822	6701	2718	29543
CASE VEH. OCCUPANTS								
Weighted	14310	9419	9974	13482	21077	27543	10316	106121
Actual	3546	2357	3206	3276	4604	5813	2174	24976
FATALITIES	122	115	198	99	49	283	51	917

This table shows both the actual (investigated) and the weighted number of accidents, all vehicles, case vehicles, case vehicle occupants, and fatalities in each of the seven NCSS team areas. The Southwest Research Institute (SWRI) team actually conducted investigations at two sites (one rural and one urban), and this accounts for the relatively large numbers shown for that team. Note that fatal accidents are treated as a census, i.e., sampled at 100%, so that the weighted and unweighted totals of fatal occupants are identical.

This section presents various tables and graphs describing the characteristics of passenger car accidents in NCSS. To be included in the passenger car subset, an accident must have involved at least one occupied passenger car that was towed from the scene of the accident due to collision damage. In addition, the occupant of the passenger car must have sustained the most serious injury. The tables in this section show only the weighted (or reconstructed) populations, and thus describe the aggregate of the seven NCSS areas over the twenty-seven month period from January 1977 through March 1979. The weighted totals are 54,318 accidents, 106,121 occupants of case vehicles, and 917 fatalities in case vehicles.

In each of the following tables the number of accidents and the number of occupants in various injury categories are shown in the columns. To allow a better understanding of the distribution of injuries across the various accident characteristics, injuries are shown as "AIS 2+," "AIS 3+," and "Fatal." AIS 2+ refers to AIS Levels 2 through 6, and AIS 3+ refers to AIS Levels 3 through 6. AIS levels used here are derived levels. They are calculated according to an NCSA-designed algorithm which is intended to eliminate some of the missing data in the original AIS coded by the investigator. The algorithm uses other injury information in the file where possible to code the generated variables. Within these levels, there are 7,227 case vehicle occupants in the AIS 2+ category, and 3,397 case vehicle occupants in the AIS 3+ group. Originally, 15,089 case vehicle occupants were coded as injured but with severity, on the AIS scale, unknown. Use of the algorithm assigned 610 of these 15,089 to the AIS 2+ category, 592 of them to the AIS 3+ category, and 489 of them to the fatal group.

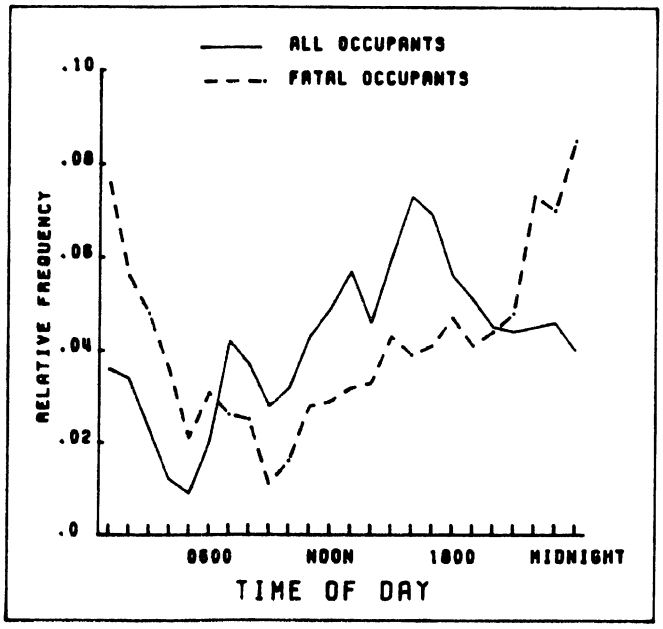
Not shown in these tabulations are missing data of 17.3% on the "derived" AIS variables (18,306 occupants for NEWOAIS2 and 18,379 for NEWOAIS3). Review of a sample of missing data cases indicates that these cases have about the same proportion of "moderate" and "severe" injuries as in the complete data. This finding implies that the AIS 2+ and AIS 3+ counts are underestimated by approximately 17% in these tables.

Overall AIS 2 refers to "moderate" injuries. These include extensive cuts to the head and face, simple fractures to arms, legs, or ribs, or concussion with brief unconsciousness; these injuries usually require medical treatment. Fewer than half of those persons injured at the AIS 2 Level are hospitalized overnight or longer. Overall AIS 3 refers to "severe" injuries. Among these are compound or multiple fractures to arms, legs, or ribs, or simple skull fractures; these injuries usually require hospitalization but are not often life-threatening.

A more complete discussion of injury detail is given at the end of the occupant section of this book on page 67.

NCSS ACCIDENT DISTRIBUTIONS BY TIME OF DAY

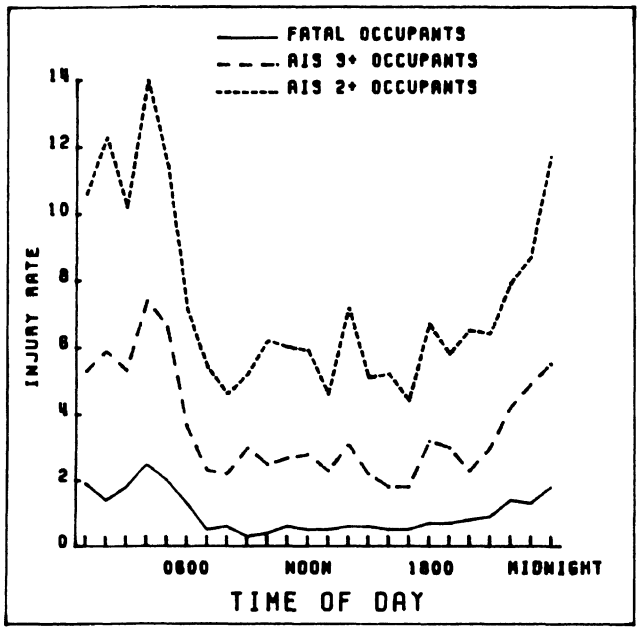
TIME OF DAY	ACCIDENTS		OCCUPANTS							
			TOTAL		AIS 2+		AIS 3+		FATAL	
	N	%	N	%	N	%	N	%	N	%
MIDNIGHT	2164	4.0	4244	4.0	495	6.8	233	6.9	78	8.5
1 AM	1951	3.6	3781	3.6	399	5.5	201	5.9	70	7.6
2 AM	1964	3.6	3608	3.4	445	6.2	213	6.3	51	5.6
3 AM	1481	2.7	2444	2.3	250	3.5	129	3.8	44	4.8
4 AM	817	1.5	1305	1.2	183	2.5	97	2.9	33	3.6
5 AM	642	1.2	956	0.9	109	1.5	63	1.9	19	2.1
6 AM	1256	2.3	2077	2.0	148	2.0	74	2.2	28	3.1
7 AM	2596	4.8	4448	4.2	240	3.3	102	3.0	24	2.6
8 AM	2420	4.5	3961	3.7	184	2.5	89	2.6	23	2.5
9 AM	1615	3.0	2977	2.8	155	2.1	89	2.6	10	1.1
10 AM	1734	3.2	3419	3.2	211	2.9	85	2.5	15	1.6
11 AM	2284	4.2	4565	4.3	275	3.8	121	3.6	26	2.8
NOON	2652	4.9	5204	4.9	309	4.3	144	4.2	27	2.9
1 PM	2804	5.2	6058	5.7	281	3.9	140	4.1	29	3.2
2 PM	2406	4.4	4903	4.6	353	4.9	154	4.5	30	3.3
3 PM	3221	5.9	6395	6.0	324	4.5	140	4.1	39	4.3
4 PM	3869	7.1	7697	7.3	397	5.5	141	4.2	36	3.9
5 PM	3650	6.7	7347	6.9	326	4.5	134	3.9	38	4.1
6 PM	2868	5.3	5917	5.6	394	5.5	187	5.5	43	4.7
7 PM	2472	4.6	5373	5.1	311	4.3	163	4.8	38	4.1
8 PM	2392	4.4	4812	4.5	311	4.3	113	3.3	40	4.4
9 PM	2147	4.0	4718	4.4	303	4.2	140	4.1	44	4.8
10 PM	2261	4.2	4767	4.5	378	5.2	199	5.9	67	7.3
11 PM	2517	4.6	4882	4.6	427	5.9	240	7.1	64	7.0
UNKNOWN	135	0.2	263	0.2	19	0.3	6	0.2	1	0.1
TOTAL	54318	100.0	106121	100.0	7227	100.0	3397	100.0	917	100.0



In the table the time periods begin at the hour shown, so that midnight would include accidents which occurred between then and 12:59 A.M. The hour between 4:00 and 5:00 P.M. has the largest proportion of accident occurrence. The smallest proportion occurs in the hour between 5:00 and 6:00 in the morning. Fatalities show a strong peak just after midnight.

NCSS INJURY RATES BY TIME OF DAY

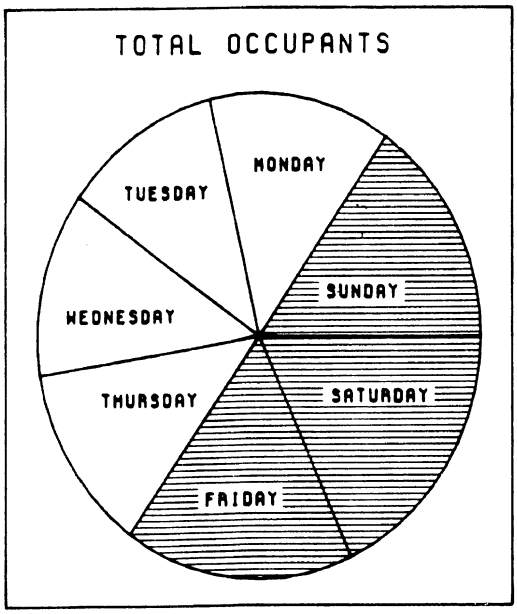
TIME OF DAY	ACCIDENTS	OCCUPANTS							
		TOTAL	AIS 2+		AIS 3+		FATAL	
			N	RATE	N	RATE	N	RATE
MIDNIGHT	2164	4244	495	11.7	233	5.5	78	1.8
1 AM	1951	3781	399	10.6	201	5.3	70	1.9
2 AM	1964	3608	445	12.3	213	5.9	51	1.4
3 AM	1481	2444	250	10.2	129	5.3	44	1.8
4 AM	817	1305	183	14.0	97	7.4	33	2.5
5 AM	642	956	109	11.4	63	6.6	19	2.0
6 AM	1256	2077	148	7.1	74	3.6	28	1.3
7 AM	2596	4448	240	5.4	102	2.3	24	0.5
8 AM	2420	3961	184	4.6	89	2.2	23	0.6
9 AM	1615	2977	155	5.2	89	3.0	10	0.3
10 AM	1734	3419	211	6.2	85	2.5	15	0.4
11 AM	2284	4565	275	6.0	121	2.7	26	0.6
NOON	2652	5204	309	5.9	144	2.8	27	0.5
1 PM	2804	6058	281	4.6	140	2.3	29	0.5
2 PM	2406	4903	353	7.2	154	3.1	30	0.6
3 PM	3221	6395	324	5.1	140	2.2	39	0.6
4 PM	3869	7697	397	5.2	141	1.8	36	0.5
5 PM	3650	7347	326	4.4	134	1.8	38	0.5
6 PM	2868	5917	394	6.7	187	3.2	43	0.7
7 PM	2472	5373	311	5.8	163	3.0	38	0.7
8 PM	2392	4812	311	6.5	113	2.3	40	0.8
9 PM	2147	4718	303	6.4	140	3.0	44	0.9
10 PM	2261	4767	378	7.9	199	4.2	67	1.4
11 PM	2517	4882	427	8.7	240	4.9	64	1.3
UNKNOWN	135	263	19	7.2	6	2.3	1	0.4
OVERALL	54318	106121	7227	6.8	3397	3.2	917	0.9

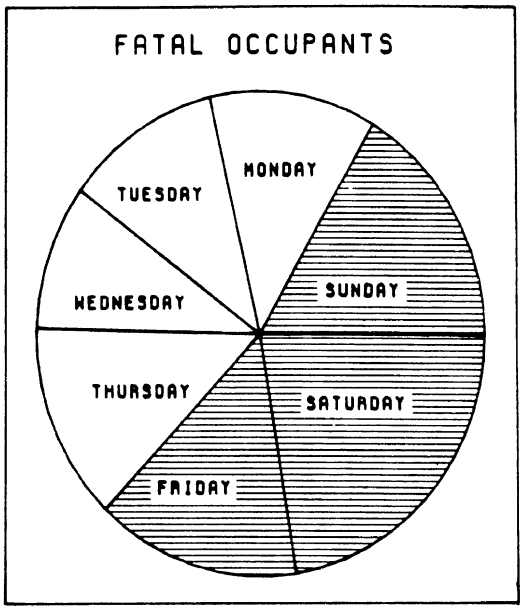


On the average, one's chance of being killed given a towaway accident between 4:00 and 5:00 A.M. is about 2.5%--about seven times the chance of being killed given an accident between 9:00 and 11:00 A.M.

NCSS ACCIDENT DISTRIBUTIONS BY DAY OF THE WEEK

DAY OF WEEK	ACCIDENTS		OCCUPANTS							
			TOTAL		AIS 2+		AIS 3+		FATAL	
	N	%	N	%	N	%	N	%	N	%
SUNDAY	7265	13.4	16249	15.3	1243	17.2	643	18.9	152	16.6
MONDAY	7422	13.7	14070	13.3	775	10.7	383	11.3	110	12.0
TUESDAY	6723	12.4	12301	11.6	755	10.4	340	10.0	104	11.3
WEDNESDAY	7379	13.6	13031	12.3	815	11.3	346	10.2	89	9.7
THURSDAY	7188	13.2	13357	12.6	900	12.5	447	13.2	122	13.3
FRIDAY	9356	17.2	17867	16.8	1144	15.8	486	14.3	135	14.7
SATURDAY	8985	16.5	19246	18.1	1595	22.1	752	22.1	205	22.4
TOTAL	54318	100.0	106121	100.0	7227	100.0	3397	100.0	917	100.0

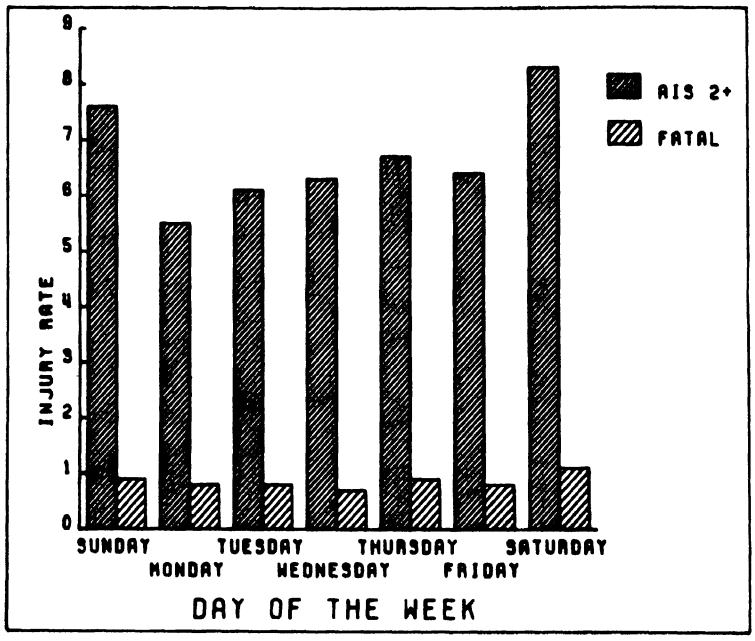




Fridays have a higher proportion of accidents than any other day of the week, perhaps because of greater traffic. The highest percentage of fatalities occurs on Saturdays and Sundays. It should be noted that the Saturday figures include accidents occurring after midnight on Friday night.

NCSS INJURY RATES BY DAY OF THE WEEK

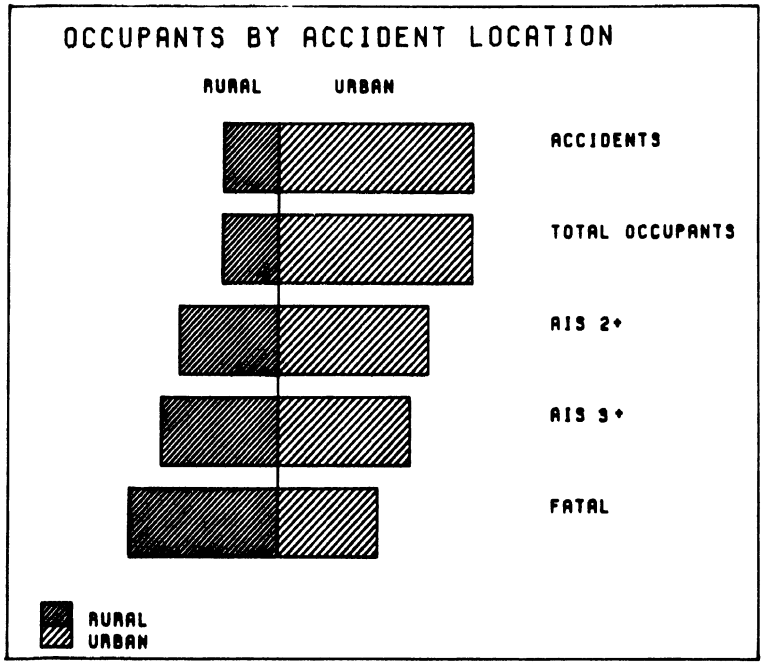
DAY OF WEEK	ACCIDENTS	OCCUPANTS							
		TOTAL	AIS 2+		AIS 3+		FATAL	
			N	RATE	N	RATE	N	RATE
SUNDAY	7265	16249	1243	7.6	643	4.0	152	0.9
MONDAY	7422	14070	775	5.5	383	2.7	110	0.8
TUESDAY	6723	12301	755	6.1	340	2.8	104	0.8
WEDNESDAY	7379	13031	815	6.3	346	2.7	89	0.7
THURSDAY	7188	13357	900	6.7	447	3.3	122	0.9
FRIDAY	9356	17867	1144	6.4	486	2.7	135	0.8
SATURDAY	8985	19246	1595	8.3	752	3.9	205	1.1
OVERALL	54318	106121	7227	6.8	3397	3.2	917	0.9



The estimated probability of a serious injury, given a towaway accident, is greater on Saturday than on any other day, although Sunday is nearly as high.

NCSS ACCIDENT DISTRIBUTIONS BY RURAL/URBAN ACCIDENT LOCATION

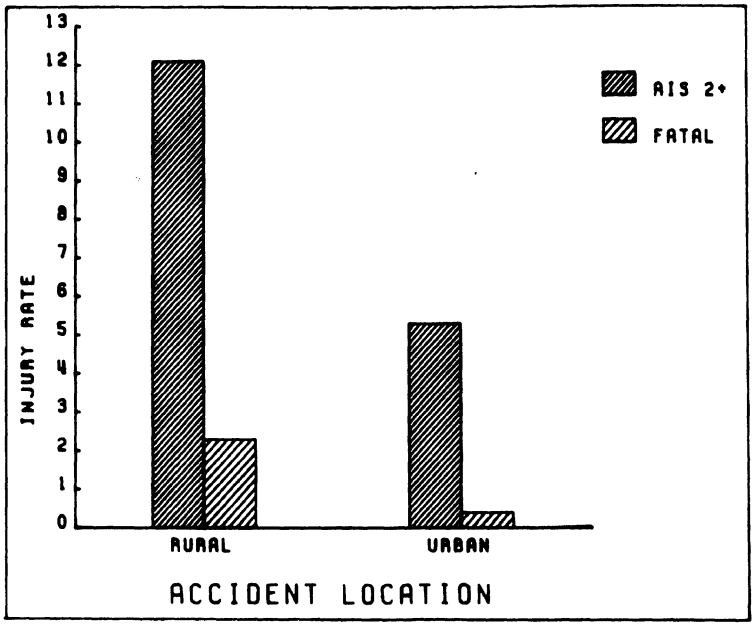
RURAL/URBAN	ACCIDENTS		OCCUPANTS							
			TOTAL		AIS 2+		AIS 3+		FATAL	
	N	%	N	%	N	%	N	%	N	%
RURAL	12057	22.2	23859	22.5	2887	39.9	1602	47.2	551	60.1
URBAN	42260	77.8	82261	77.5	4340	60.1	1795	52.8	366	39.9
UNKNOWN	1	0.0	1	0.0	0	0.0	0	0.0	0	0.0
TOTAL	54318	100.0	106121	100.0	7227	100.0	3397	100.0	917	100.0



Approximately 60% of the fatalities occur in rural areas, although only 22% of all accidents occur there. This rural/urban designation was assigned by the investigator and is not directly related to city boundaries. Generally an urban area is coded if the accident location is in or near a populated area, perhaps with buildings in sight. Rural would be coded for farmland, a slightly populated area outside the city limits, or an area outside of city limits with few buildings or homes.

NCSS INJURY RATES BY RURAL/URBAN
ACCIDENT LOCATION

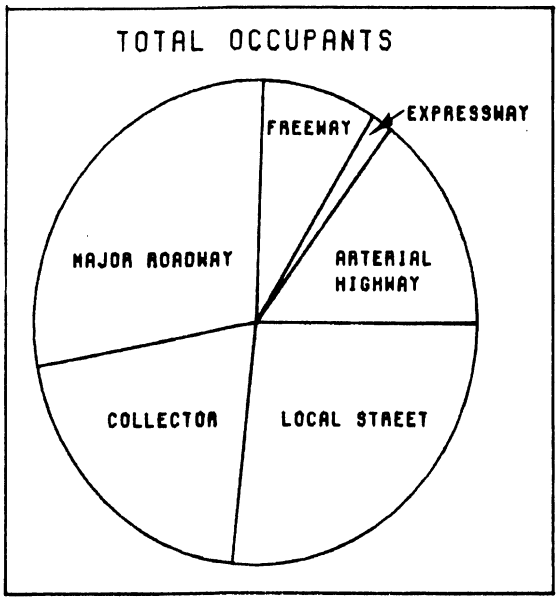
RURAL/URBAN	ACCIDENTS	OCCUPANTS							
		TOTAL	AIS 2+		AIS 3+		FATAL	
			N	RATE	N	RATE	N	RATE
RURAL	12057	23859	2887	12.1	1602	6.7	551	2.3
URBAN	42260	82261	4340	5.3	1795	2.2	366	0.4
UNKNOWN	1	1	0	0.0	0	0.0	0	0.0
OVERALL	54318	106121	7227	6.8	3397	3.2	917	0.9

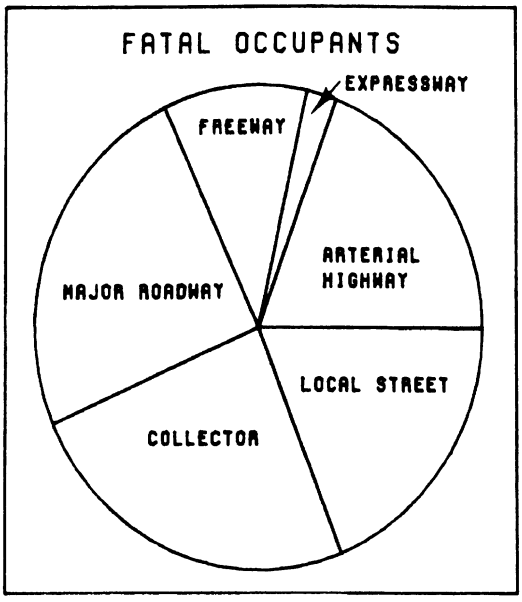


Given a towaway collision in a rural area, one's chances of a fatal injury are about six times as high as in an urban accident. The estimated probability of an injury with AIS 2 or more is about twice as large.

NCSS ACCIDENT DISTRIBUTIONS BY ROADWAY TYPE

ROADWAY TYPE	ACCIDENTS		OCCUPANTS							
			TOTAL		AIS 2+		AIS 3+		FATAL	
	N	%	N	%	N	%	N	%	N	%
ARTERIAL HWY.	7461	13.7	15275	14.4	1171	16.2	585	17.2	173	18.9
EXPRESSWAY	846	1.6	1599	1.5	105	1.5	52	1.5	19	2.1
FREEWAY	4694	8.6	8653	8.2	570	7.9	264	7.8	93	10.1
MAJOR ROADWAY	14576	26.8	29374	27.7	1843	25.5	856	25.2	220	24.0
COLLECTOR	10948	20.2	21337	20.1	1594	22.1	806	23.7	219	23.9
LOCAL STREET	14572	26.8	27671	26.1	1788	24.7	751	22.1	170	18.5
UNKNOWN	1221	2.2	2212	2.1	156	2.2	83	2.4	23	2.5
TOTAL	54318	100.0	106121	100.0	7227	100.0	3397	100.0	917	100.0

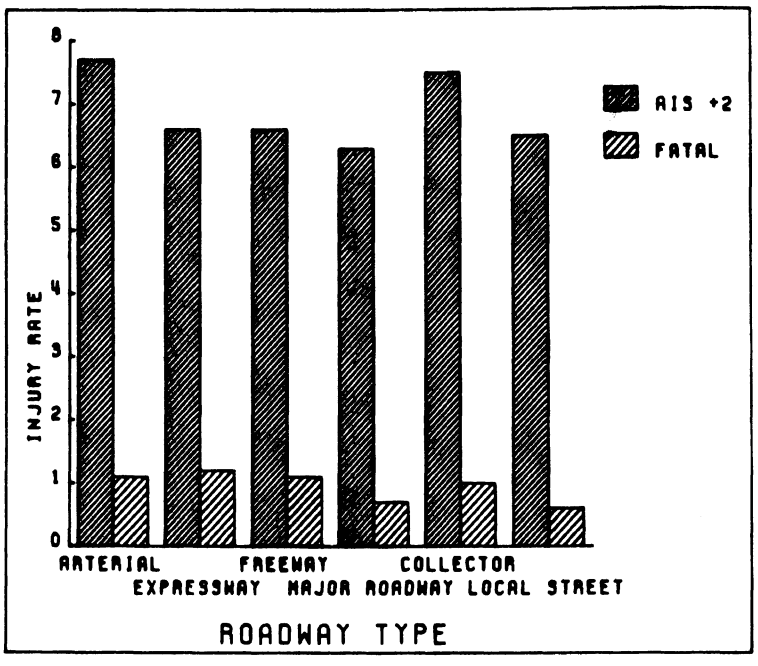




Roadway type is reported by the investigator according to the following guidelines. An ARTERIAL HIGHWAY is a roadway which provides a continuous route, has no control of access, and is primarily for through traffic. An EXPRESSWAY is a divided highway with partial control of access. A FREEWAY is a divided highway with complete control of access and no cross streets. A MAJOR ROADWAY has no control of access, can be entered by driveways, and is primarily for through traffic. A COLLECTOR takes traffic onto major roadways. A LOCAL STREET is a street or road primarily for access to residence, business, or other properties.

NCSS INJURY RATES BY ROADWAY TYPE

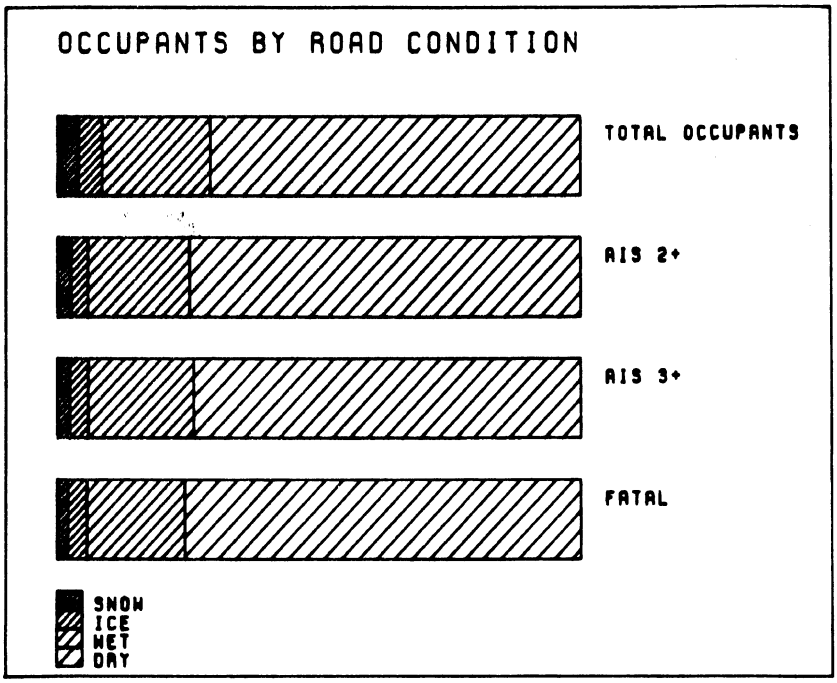
ROADWAY TYPE	ACCIDENTS	OCCUPANTS							
		TOTAL	AIS 2+		AIS 3+		FATAL	
			N	RATE	N	RATE	N	RATE
ARTERIAL HWY.	7461	15275	1171	7.7	585	3.8	173	1.1
EXPRESSWAY	846	1599	105	6.6	52	3.3	19	1.2
FREEWAY	4694	8653	570	6.6	264	3.1	93	1.1
MAJOR ROADWAY	14576	29374	1843	6.3	856	2.9	220	0.7
COLLECTOR	10948	21337	1594	7.5	806	3.8	219	1.0
LOCAL STREET	14572	27671	1788	6.5	751	2.7	170	0.6
UNKNOWN	1221	2212	156	7.1	83	3.8	23	1.0
OVERALL	54318	106121	7227	6.8	3397	3.2	917	0.9



The injury rate (at AIS 2 and above) is relatively constant across roadway types, but is highest for arterials. The higher speed roads--arterials, expressways, and freeways--have a somewhat higher rate of fatalities, given a towaway accident, than the lower speed roads.

NCSS ACCIDENT DISTRIBUTIONS BY ROAD CONDITION

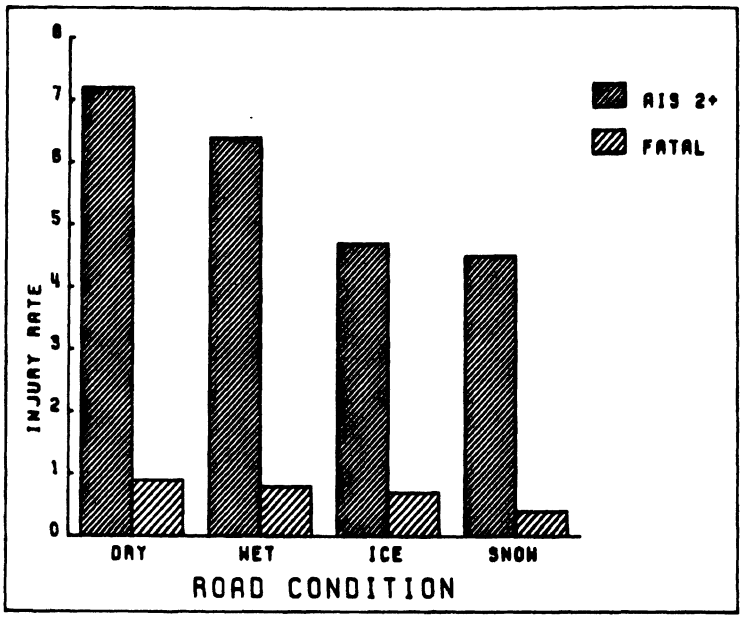
ROAD CONDITION	ACCIDENTS		OCCUPANTS							
			TOTAL		AIS 2+		AIS 3+		FATAL	
	N	%	N	%	N	%	N	%	N	%
DRY	38127	70.2	74827	70.5	5368	74.3	2500	73.6	685	74.7
WET	11095	20.4	21808	20.6	1395	19.3	682	20.1	170	18.5
ICE	2682	4.9	4814	4.5	228	3.2	118	3.5	33	3.6
SNOW	2150	4.0	4232	4.0	191	2.6	82	2.4	19	2.1
OTHER	202	0.4	371	0.3	42	0.6	13	0.4	8	0.9
UNKNOWN	62	0.1	69	0.1	3	0.0	2	0.1	2	0.2
TOTAL	54318	100.0	106121	100.0	7227	100.0	3397	100.0	917	100.0



Seventy percent of all towaway accidents in the aggregate of the seven NCSS areas are estimated to occur on dry roads. Similarly, 75% of all fatalities occur on dry roads.

NCSS INJURY RATES BY ROAD CONDITION

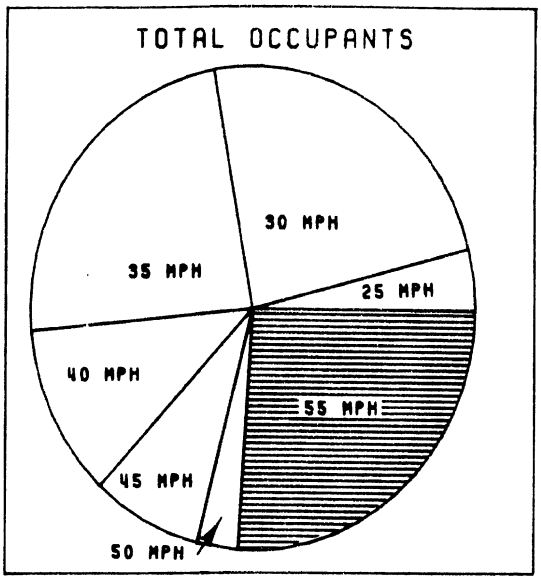
ROAD CONDITION	ACCIDENTS	OCCUPANTS						
		TOTAL	AIS 2+		AIS 3+		FATAL	
			N	RATE	N	RATE	N	RATE
DRY	38127	74827	5368	7.2	2500	3.3	685	0.9
WET	11095	21808	1395	6.4	682	3.1	170	0.8
ICE	2682	4814	228	4.7	118	2.5	33	0.7
SNOW	2150	4232	191	4.5	82	1.9	19	0.4
OTHER	202	371	42	11.3	13	3.5	8	2.2
UNKNOWN	62	69	3	4.3	2	2.9	2	2.9
OVERALL	54318	106121	7227	6.8	3397	3.2	917	0.9

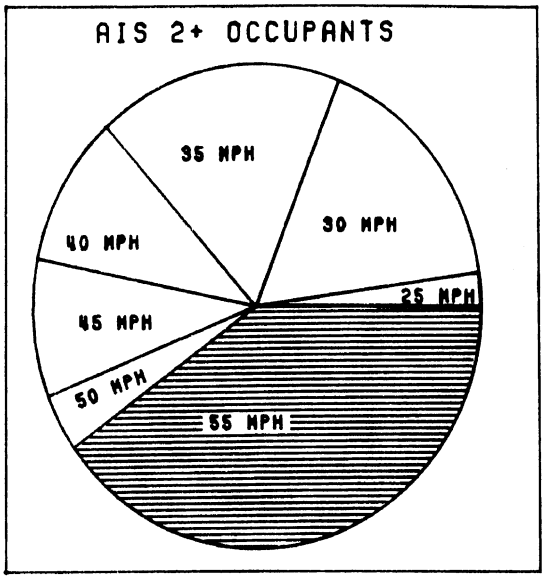


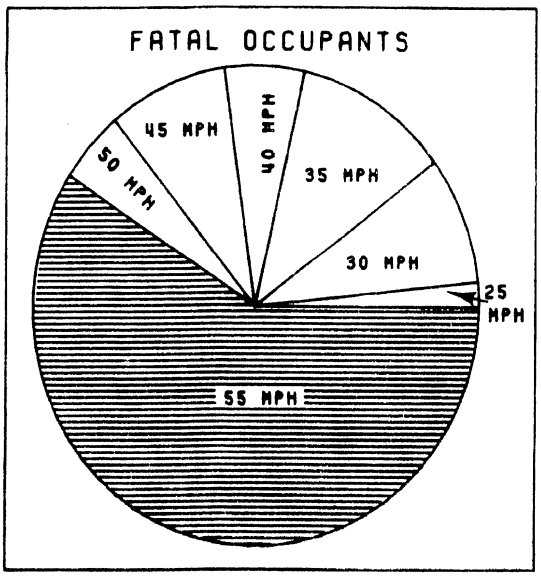
Although accidents may become more likely as road conditions worsen, the estimated probability of an injury, given a towaway accident, declines as the road condition becomes more hazardous.

NCSS ACCIDENT DISTRIBUTIONS BY SPEED LIMIT

SPEED LIMIT	ACCIDENTS		OCCUPANTS							
			TOTAL		AIS 2+		AIS 3+		FATAL	
	N	%	N	%	N	%	N	%	N	%
NONE	253	0.5	495	0.5	34	0.5	11	0.3	1	0.1
UNDER 20 MPH	449	0.8	867	0.8	60	0.8	20	0.6	2	0.2
25 MPH	2364	4.4	4178	3.9	157	2.2	71	2.1	15	1.6
30 MPH	12767	23.5	24693	23.3	1178	16.3	439	12.9	78	8.5
35 MPH	12540	23.1	24348	22.9	1249	17.3	507	14.9	101	11.0
40 MPH	5820	10.7	12001	11.3	713	9.9	310	9.1	52	5.7
45 MPH	4089	7.5	8267	7.8	649	9.0	307	9.0	78	8.5
50 MPH	1638	3.0	3059	2.9	271	3.7	131	3.9	44	4.8
55 MPH	13600	25.0	26752	25.2	2825	39.1	1560	45.9	534	58.2
UNKNOWN	798	1.5	1461	1.4	91	1.3	41	1.2	12	1.3
TOTAL	54318	100.0	106121	100.0	7227	100.0	3397	100.0	917	100.0



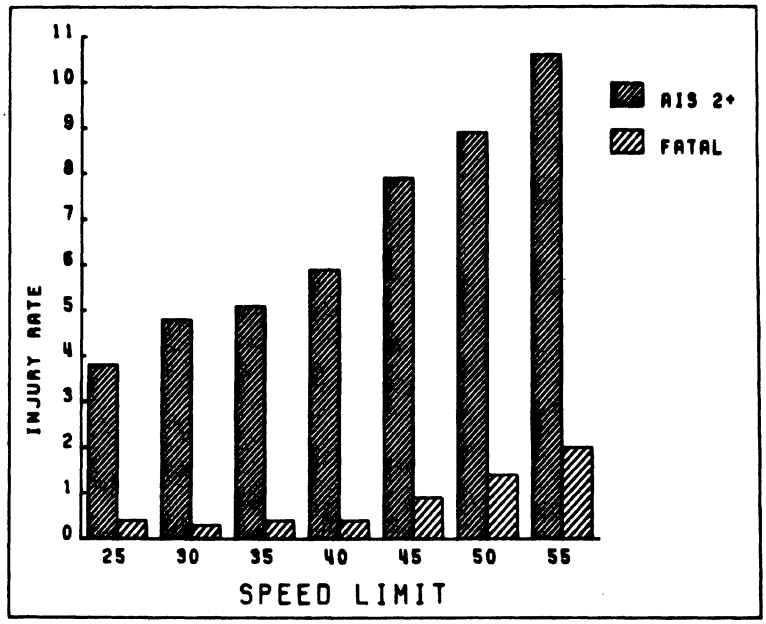




Only 25% of the accidents occurred on roadways with the maximum (55 MPH) speed limit. By contrast almost 60% of the fatalities occurred on such roadways.

NCSS INJURY RATES BY SPEED LIMIT

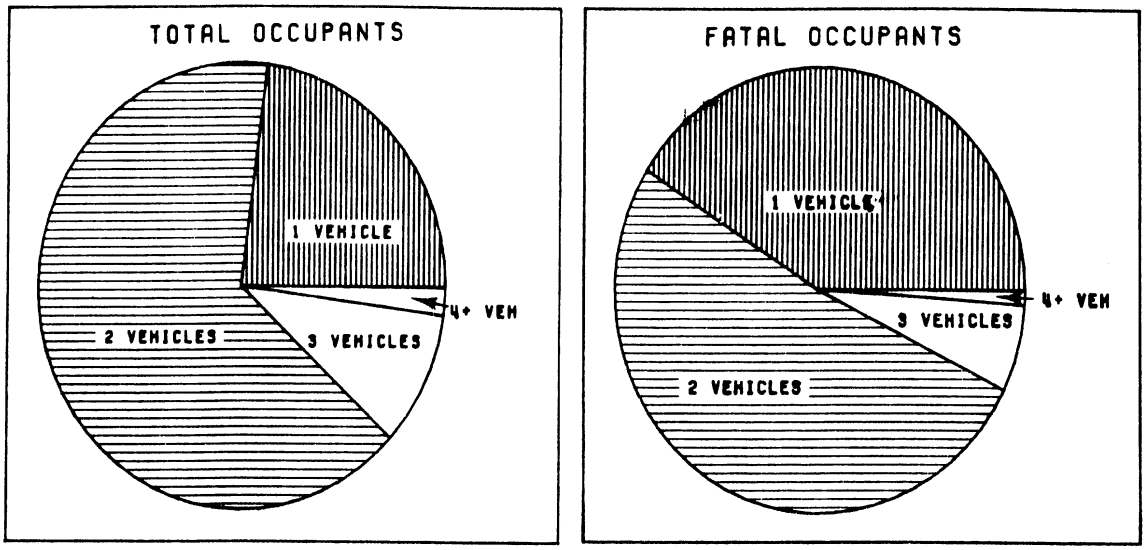
SPEED LIMIT	ACCIDENTS	OCCUPANTS						
		TOTAL	AIS 2+		AIS 3+		FATAL	
			N	RATE	N	RATE	N	RATE
NONE	253	495	34	6.9	11	2.2	1	0.2
UNDER 20 MPH	449	867	60	6.9	20	2.3	2	0.2
25 MPH	2364	4178	157	3.8	71	1.7	15	0.4
30 MPH	12767	24693	1178	4.8	439	1.8	78	0.3
35 MPH	12540	24348	1249	5.1	507	2.1	101	0.4
40 MPH	5820	12001	713	5.9	310	2.6	52	0.4
45 MPH	4089	8267	649	7.9	307	3.7	78	0.9
50 MPH	1638	3059	271	8.9	131	4.3	44	1.4
55 MPH	13600	26752	2825	10.6	1560	5.8	534	2.0
UNKNOWN	798	1461	91	6.2	41	2.8	12	0.8
OVERALL	54318	106121	7227	6.8	3397	3.2	917	0.9



Both injury and fatality rates increase steadily with increase in the speed limit. The estimated probability of injury at the AIS 2 or more level is estimated to be almost three times as high at 55 mile per hour locations as at 25 mile per hour locations--for fatalities, about five times as high.

NCSS ACCIDENT DISTRIBUTIONS BY NUMBER OF VEHICLES INVOLVED

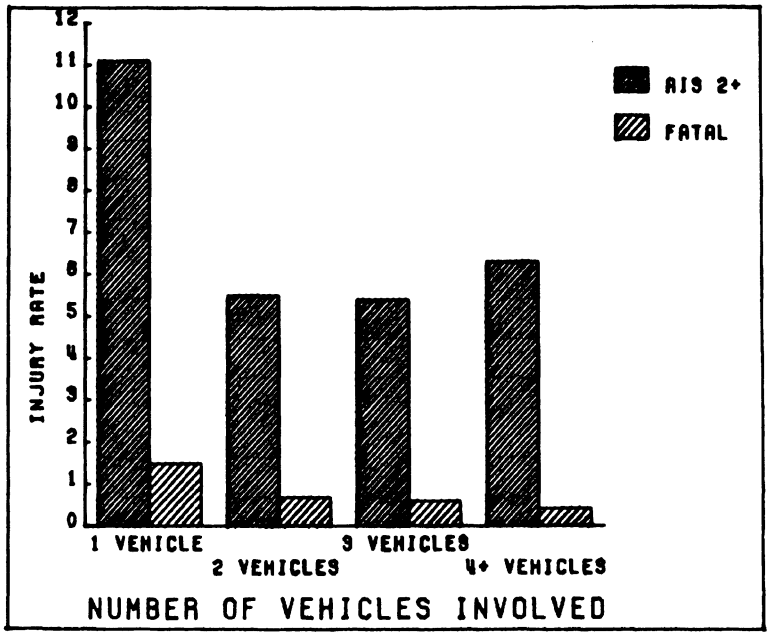
TOTAL NUMBER OF VEHICLES INVOLVED IN THE ACCIDENT	ACCIDENTS		OCCUPANTS							
			TOTAL		AIS 2+		AIS 3+		FATAL	
	N	%	N	%	N	%	N	%	N	%
1	15635	28.8	24467	23.1	2717	37.6	1347	39.7	376	41.0
2	33043	60.8	69059	65.1	3814	52.8	1754	51.6	474	51.7
3	4693	8.6	10452	9.8	561	7.8	227	6.7	58	6.3
4	788	1.5	1680	1.6	112	1.5	63	1.9	7	0.8
5	124	0.2	363	0.3	17	0.2	2	0.1	0	0.0
6 OR MORE	30	0.1	100	0.1	6	0.1	4	0.1	2	0.2
TOTAL	54318	100.0	106121	100.0	7227	100.0	3397	100.0	917	100.0



Forty-one percent of the passenger car fatalities occurred in single-vehicle accidents, although this category represented only 28.8% of the accidents.

NCSS INJURY RATES BY NUMBER OF VEHICLES INVOLVED

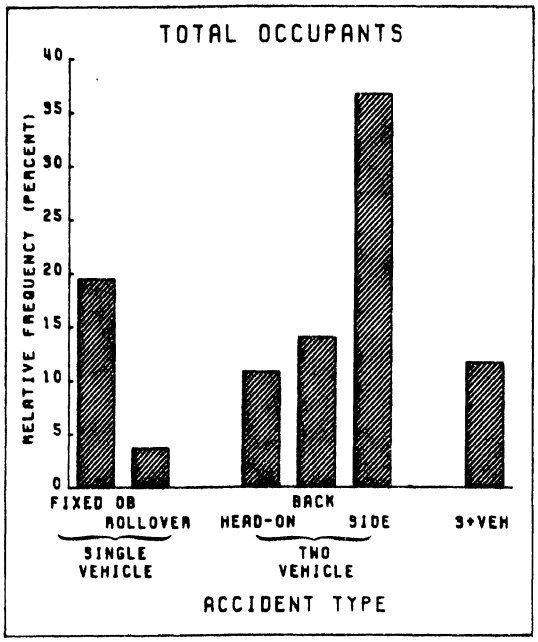
TOTAL NUMBER OF VEHICLES INVOLVED IN THE ACCIDENT	ACCIDENTS	OCCUPANTS							
		TOTAL	AIS 2+		AIS 3+		FATAL	
			N	RATE	N	RATE	N	RATE
1	15635	24467	2717	11.1	1347	5.5	376	1.5
2	33048	69059	3814	5.5	1754	2.5	474	0.7
3	4693	10452	561	5.4	227	2.2	58	0.6
4	788	1680	112	6.7	63	3.8	7	0.4
5	124	363	17	4.7	2	0.6	0	0.0
6 OR MORE	30	100	6	6.0	4	4.0	2	2.0
OVERALL	54318	106121	7227	6.8	3397	3.2	917	0.9

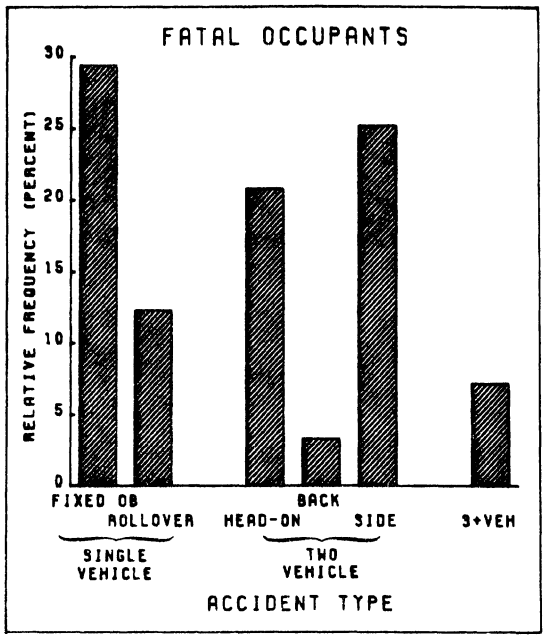


The graph shows that a car occupant is more than twice as likely to be killed in a single-vehicle crash as in a multiple-vehicle crash. About the same ratio holds true for AIS 2 and greater injuries.

NCSS ACCIDENT DISTRIBUTIONS BY ACCIDENT TYPE

TYPE OF IMPACT	ACCIDENTS		OCCUPANTS							
			TOTAL		AIS 2+		AIS 3+		FATAL	
	N	%	N	%	N	%	N	%	N	%
SINGLE VEHICLE										
Fixed Object	13294	24.5	20738	19.5	2284	31.6	1079	31.8	270	29.4
Rollover	2382	4.4	3903	3.7	496	6.9	304	8.9	113	12.3
Undercarriage	797	1.5	1280	1.2	50	0.7	18	0.5	4	0.4
TWO VEHICLE										
Head-On	4899	9.0	11507	10.8	1170	16.2	604	17.8	191	20.8
Side	17639	32.5	38895	36.7	1996	27.6	924	27.2	231	25.2
Rear	8424	15.5	14873	14.0	474	6.6	149	4.4	30	3.3
Sideswipe	625	1.2	1381	1.3	17	0.2	4	0.1	0	0.0
THREE OR MORE	5582	10.3	12435	11.7	687	9.5	288	8.5	66	7.2
UNKNOWN	676	1.2	1109	1.0	53	0.7	27	0.8	12	1.3
TOTAL	54318	100.0	106121	100.0	7227	100.0	3397	100.0	917	100.0

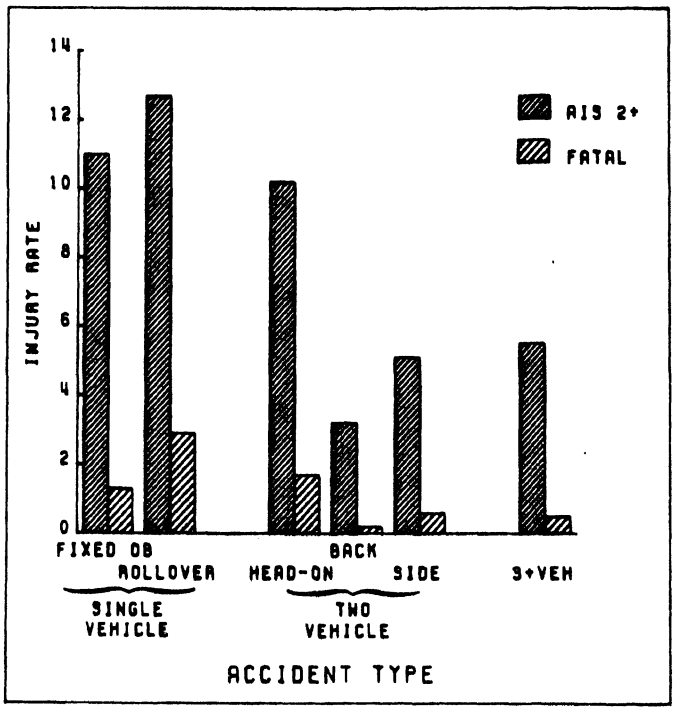




The most common type of accident in this data set was a two-vehicle accident in which one vehicle struck the other in the side. The most common type of fatality, however, involves a single-vehicle collision into a fixed object.

NCSS INJURY RATES BY ACCIDENT TYPE

TYPE OF IMPACT	ACCIDENTS	OCCUPANTS						
		TOTAL	AIS 2+		AIS 3+		FATAL	
			N	RATE	N	RATE	N	RATE
SINGLE VEHICLE								
Fixed Object	13294	20738	2284	11.0	1079	5.2	270	1.3
Rollover	2382	3903	496	12.7	304	7.8	113	2.9
Undercarriage	797	1280	50	3.9	18	1.4	4	0.3
TWO VEHICLE								
Head-On	4899	11507	1170	10.2	604	5.2	191	1.7
Side	17639	38895	1996	5.1	924	2.4	231	0.6
Rear	8424	14873	474	3.2	149	1.0	30	0.2
Sideswipe	625	1381	17	1.2	4	0.3	0	0.0
THREE OR MORE	5582	12435	687	5.5	288	2.3	66	0.5
UNKNOWN	676	1109	53	4.8	27	2.4	12	1.1
OVERALL	54318	106121	7227	6.8	3397	3.2	917	0.9



Given a rollover, the probability of a fatality is estimated at 2.9%, the highest of any of the accident classes shown. Head-on collisions follow with a rate of 1.4%. The distribution at the AIS 2 or more level is similar.

3 VEHICLES

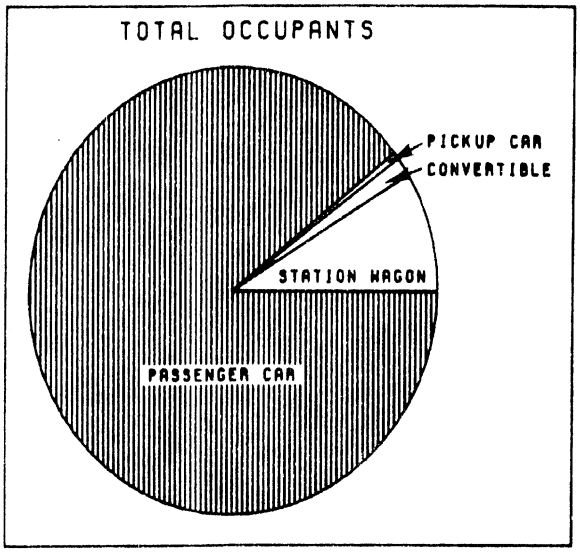
This section presents several tables and graphs describing the characteristics of the case vehicles involved in the NCSS passenger car accidents. Case vehicles in this subset are always towed (and occupied) passenger cars. The tables in this section show only weighted counts and thus describe the total number of towed passenger cars involved in the appropriate accidents in the aggregate of the seven NCSS areas during the twenty-seven months from January 1977 through March 1979.

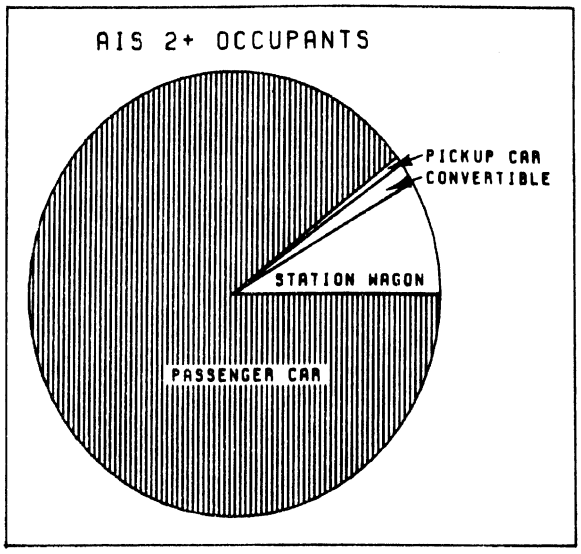
For each vehicle category shown, the total number of occupants, and the number of occupants injured at the AIS 2+, AIS 3+, and Fatal Levels, are tabulated as in the previous section. Caution with regard to the effect of missing injury data (as discussed on page 5) should also be observed in interpreting information in this section.

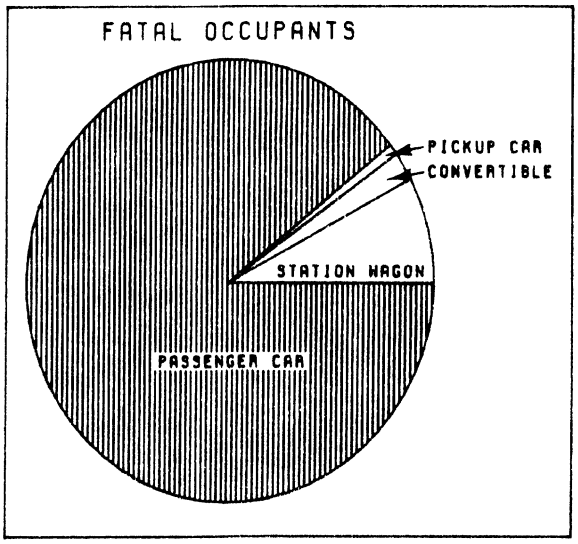
The early tables show distributions by the descriptive characteristics of the damaged vehicles (type, model year, weight, and number of occupants); these are followed by tables showing a variety of damage characteristics (direction of force, general area of damage, etc.). In addition to the information provided in this section, the last section of this report (beginning on page 77) presents several crash severity distributions (in terms of Delta V), and many of these tables are also centered on vehicle characteristics.

NCSS CASE VEHICLE DISTRIBUTIONS BY BODY STYLE

BODY STYLE	VEHICLES		OCCUPANTS							
			TOTAL		AIS 2+		AIS 3+		FATAL	
	N	%	N	%	N	%	N	%	N	%
PASSENGER CAR	60505	89.9	94935	89.5	6467	89.5	3035	89.3	820	89.4
STATION WAGON	5419	8.1	9227	8.7	602	8.3	274	8.1	71	7.7
CONVERTIBLE	988	1.5	1452	1.4	114	1.6	66	1.9	19	2.1
PICKUP CAR	372	0.6	507	0.5	44	0.6	22	0.6	7	0.8
TOTAL	67284	100.0	106121	100.0	7227	100.0	3397	100.0	917	100.0



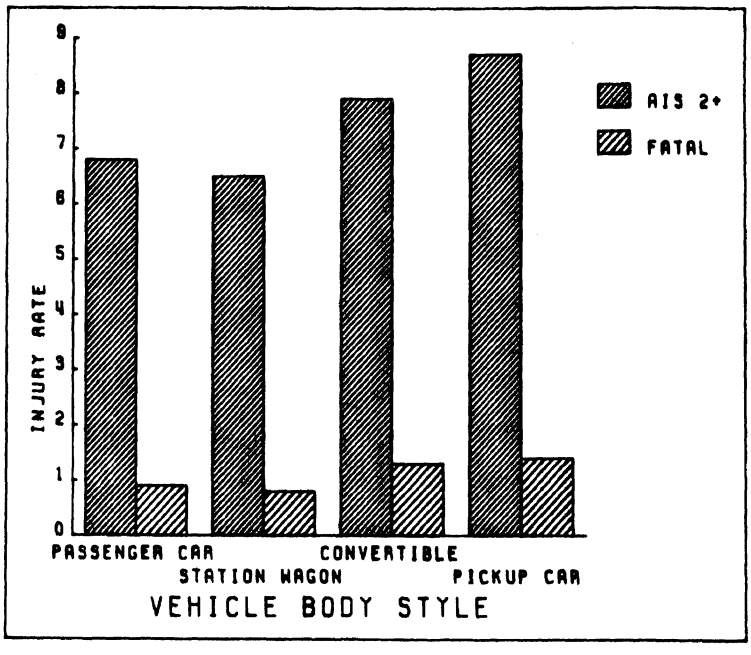




Nine out of ten case vehicles in the data set are conventional passenger cars, and most of the rest are station wagons. A small number of convertibles and pickup cars are included.

NCSS INJURY RATES BY CASE VEHICLE BODY STYLE

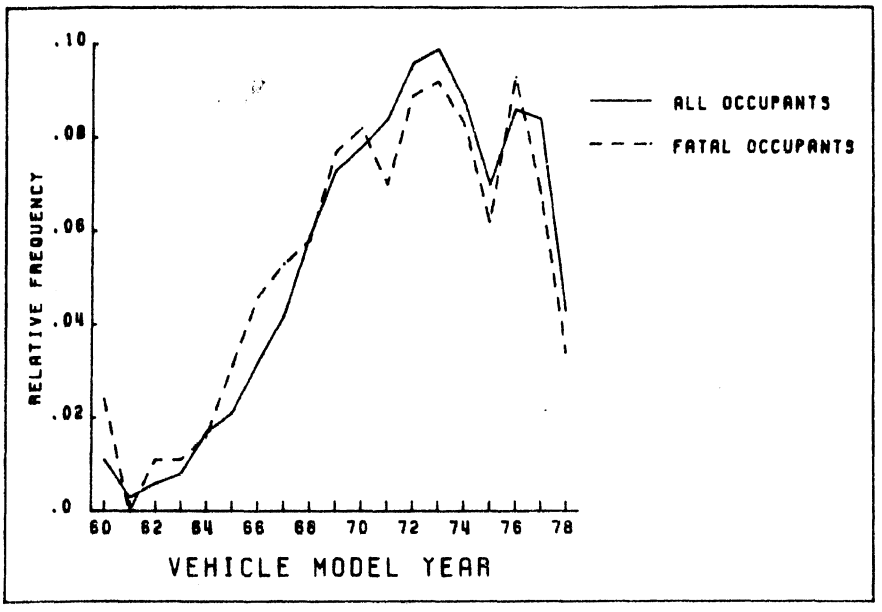
BODY STYLE	VEHICLES	OCCUPANTS						
		TOTAL	AIS 2+		AIS 3+		FATAL	
			N	RATE	N	RATE	N	RATE
PASSENGER CAR	60505	94935	6467	6.8	3035	3.2	820	0.9
STATION WAGON	5419	9227	602	6.5	274	3.0	71	0.8
CONVERTIBLE	988	1452	114	7.9	66	4.5	19	1.3
PICKUP CAR	372	507	44	8.7	22	4.3	7	1.4
OVERALL	67284	106121	7227	6.8	3397	3.2	917	0.9



The rate of fatalities is estimated to be substantially higher for occupants of convertibles and pickup cars than for occupants of conventional cars and station wagons.

NCSS CASE VEHICLE DISTRIBUTIONS BY MODEL YEAR

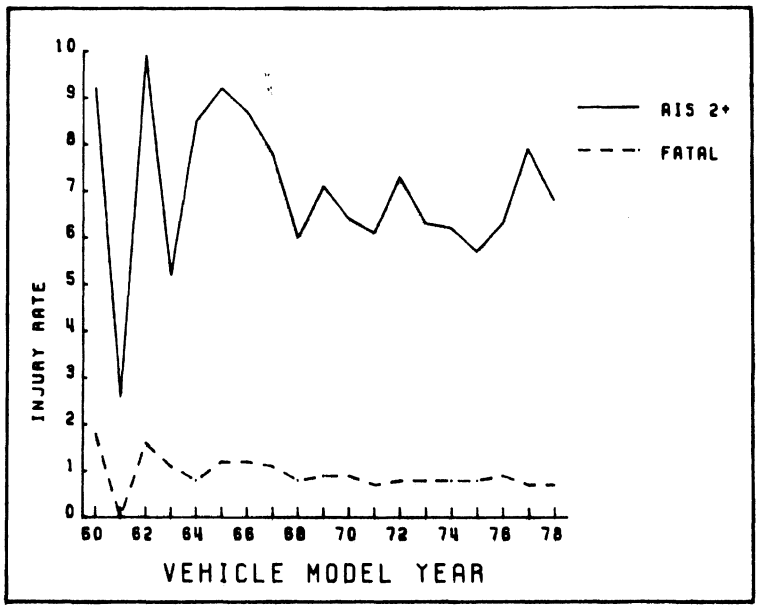
MODEL YEAR	VEHICLES		OCCUPANTS							
	N	%	TOTAL		AIS 2+		AIS 3+		FATAL	
			N	%	N	%	N	%	N	%
1960 AND OLDER	847	1.3	1201	1.1	110	1.5	45	1.3	22	2.4
1961	176	0.3	305	0.3	8	0.1	2	0.1	0	0.0
1962	402	0.6	614	0.6	61	0.8	25	0.7	10	1.1
1963	541	0.8	881	0.8	46	0.6	34	1.0	10	1.1
1964	1186	1.8	1791	1.7	153	2.1	79	2.3	15	1.6
1965	1458	2.2	2241	2.1	206	2.9	102	3.0	28	3.1
1966	2142	3.2	3416	3.2	297	4.1	176	5.2	42	4.6
1967	2706	4.0	4434	4.2	345	4.8	148	4.4	49	5.3
1968	3884	5.8	6299	5.9	380	5.3	185	5.4	53	5.8
1969	4803	7.1	7741	7.3	546	7.6	247	7.3	71	7.7
1970	5146	7.6	8267	7.8	525	7.3	265	7.8	75	8.2
1971	5506	8.2	8866	8.4	543	7.5	240	7.1	64	7.0
1972	6481	9.6	10227	9.6	748	10.4	361	10.6	82	8.9
1973	6560	9.7	10541	9.9	665	9.2	304	8.9	84	9.2
1974	6216	9.2	9324	8.8	576	8.0	265	7.8	76	8.3
1975	4778	7.1	7420	7.0	424	5.9	216	6.4	57	6.2
1976	5890	8.8	9076	8.6	574	7.9	281	8.3	85	9.3
1977	5605	8.3	8892	8.4	705	9.8	282	8.3	62	6.8
1978	2933	4.4	4545	4.3	311	4.3	138	4.1	31	3.4
UNKNOWN	24	0.0	40	0.0	4	0.1	2	0.1	1	0.1
TOTAL	67284	100.0	106121	100.0	7227	100.0	3397	100.0	917	100.0



The crossover in the graph at about 1970 indicates that occupants of newer cars in towaway accidents are less likely to sustain fatal injuries than occupants of older vehicles.

NCSS INJURY RATES BY CASE VEHICLE MODEL YEAR

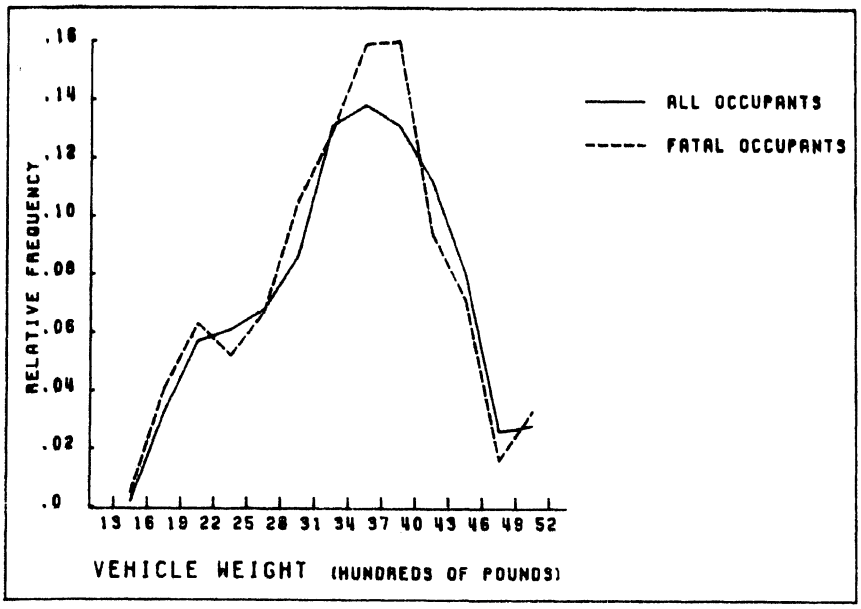
MODEL YEAR	VEHICLES	OCCUPANTS						
		TOTAL	AIS 2+		AIS 3+		FATAL	
			N	RATE	N	RATE	N	RATE
1960 AND OLDER	847	1201	110	9.2	45	3.7	22	1.8
1961	176	305	8	2.6	2	0.7	0	0.0
1962	402	614	61	9.9	25	4.1	10	1.6
1963	541	881	46	5.2	34	3.9	10	1.1
1964	1186	1791	153	8.5	79	4.4	15	0.8
1965	1458	2241	206	9.2	102	4.6	28	1.2
1966	2142	3416	297	8.7	176	5.2	42	1.2
1967	2706	4434	345	7.8	148	3.3	49	1.1
1968	3884	6299	380	6.0	185	2.9	53	0.8
1969	4803	7741	546	7.1	247	3.2	71	0.9
1970	5146	8267	525	6.4	265	3.2	75	0.9
1971	5506	8866	543	6.1	240	2.7	64	0.7
1972	6481	10227	748	7.3	361	3.5	82	0.8
1973	6560	10541	665	6.3	304	2.9	84	0.8
1974	6216	9324	576	6.2	265	2.8	76	0.8
1975	4778	7420	424	5.7	216	2.9	57	0.8
1976	5890	9076	574	6.3	281	3.1	85	0.9
1977	5605	8892	705	7.9	282	3.2	62	0.7
1978	2933	4545	311	6.8	138	3.0	31	0.7
UNKNOWN	24	40	4	10.0	2	5.0	1	2.5
OVERALL	67284	106121	7227	6.8	3397	3.2	917	0.9



Generally the injury rates, both at the AIS 2 or more and at the Fatal level, are estimated to be higher for occupants of pre-1966 vehicles.

NCSS CASE VEHICLE DISTRIBUTIONS BY VEHICLE WEIGHT

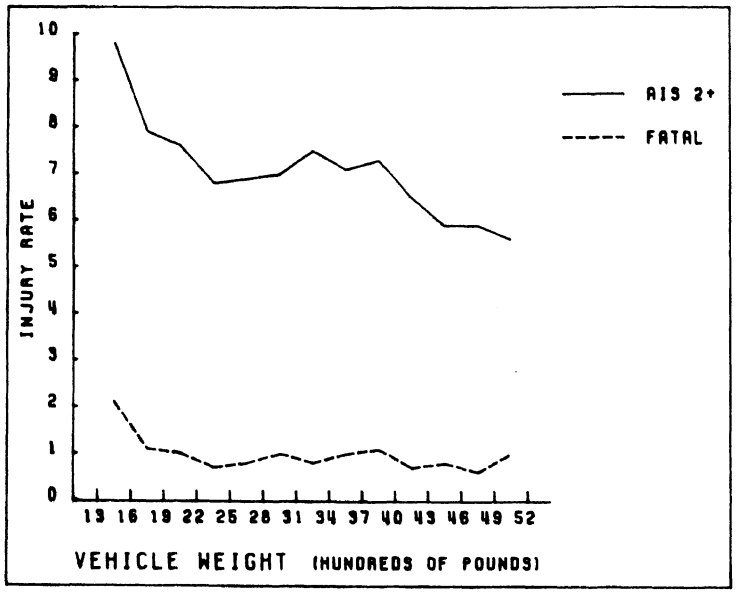
VEHICLE WEIGHT (IN POUNDS)	VEHICLES		OCCUPANTS							
			TOTAL		AIS 2+		AIS 3+		FATAL	
	N	%	N	%	N	%	N	%	N	%
1300-1599	142	0.2	234	0.2	23	0.3	20	0.6	5	0.5
1600-1899	2301	3.4	3546	3.3	279	3.9	156	4.6	38	4.1
1900-2199	4009	6.0	6058	5.7	459	6.4	213	6.3	58	6.3
2200-2499	4238	6.3	6500	6.1	439	6.1	190	5.6	48	5.2
2500-2799	4847	7.2	7210	6.8	496	6.9	216	6.4	61	6.7
2800-3099	6020	8.9	9175	8.6	644	8.9	294	8.7	96	10.5
3100-3399	8681	12.9	13885	13.1	1043	14.4	466	13.7	118	12.9
3400-3699	9254	13.8	14669	13.8	1042	14.4	525	15.5	146	15.9
3700-3999	8454	12.6	13903	13.1	1008	13.9	489	14.4	147	16.0
4000-4299	7162	10.6	11890	11.2	778	10.8	340	10.0	86	9.4
4300-4599	5446	8.1	8507	8.0	505	7.0	249	7.3	65	7.1
4600-4899	1694	2.5	2717	2.6	159	2.2	88	2.6	15	1.6
OVER 4900	1773	2.6	3021	2.8	169	2.3	94	2.8	30	3.3
UNKNOWN	3263	4.8	4806	4.5	183	2.5	57	1.7	4	0.4
TOTAL	67284	100.0	106121	100.0	7227	100.0	3397	100.0	917	100.0



As might be expected, the fatal group is somewhat underrepresented among occupants of heavier vehicles (over 4000 pounds). It is not clear, however, why they are so heavily overrepresented in the 3400 to 4000 pound range or underrepresented between 2200 and 2800 pounds. It is likely that other factors--such as occupant age, speed of travel, urbanization, etc.--are at work here.

NCSS INJURY RATES BY CASE VEHICLE WEIGHT

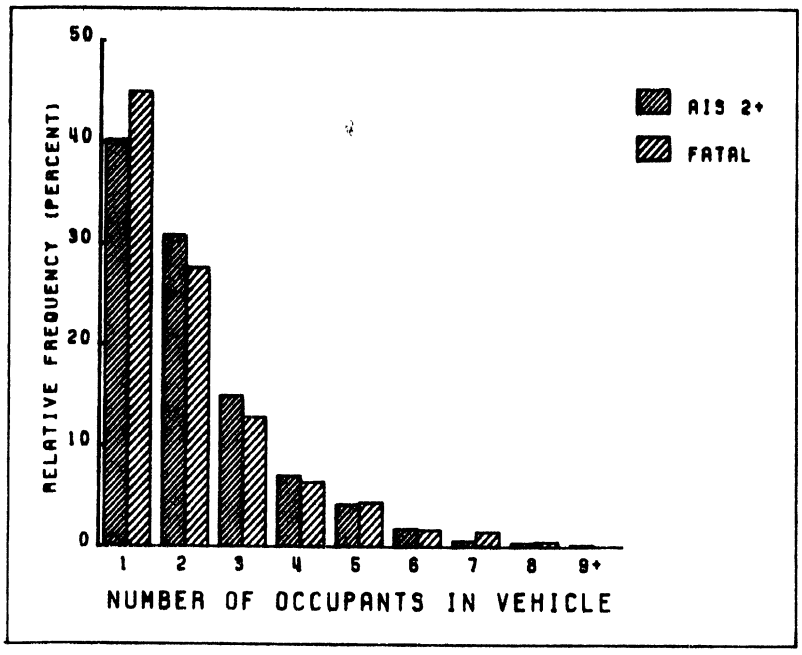
VEHICLE WEIGHT (IN POUNDS)	VEHICLES	OCCUPANTS							
		TOTAL	AIS 2+		AIS 3+		FATAL	
			N	RATE	N	RATE	N	RATE
1300-1599	142	234	23	9.8	20	8.5	5	2.1
1600-1899	2301	3546	279	7.9	156	4.4	38	1.1
1900-2199	4009	6058	459	7.6	213	3.5	58	1.0
2200-2499	4238	6500	439	6.8	190	2.9	48	0.7
2500-2799	4847	7210	496	6.9	216	3.0	61	0.8
2800-3099	6020	9175	644	7.0	294	3.2	96	1.0
3100-3399	8681	13885	1043	7.5	466	3.4	118	0.8
3400-3699	9254	14669	1042	7.1	525	3.6	146	1.0
3700-3999	8454	13903	1008	7.3	489	3.5	147	1.1
4000-4299	7162	11890	778	6.5	340	2.9	86	0.7
4300-4599	5446	8507	505	5.9	249	2.9	65	0.8
4600-4899	1694	2717	159	5.9	88	3.2	15	0.6
OVER 4900	1773	3021	169	5.6	94	3.1	30	1.0
UNKNOWN	3263	4806	183	3.8	57	1.2	4	0.1
OVERALL	67284	106121	7227	6.8	3397	3.2	917	0.9



Injury rates at the AIS 2 or more level decline steadily as vehicle weight increases. Fatality rates are high for very light cars, but above that level fluctuate without any consistent direction.

NCSS CASE VEHICLE DISTRIBUTIONS BY NUMBER OF OCCUPANTS IN VEHICLE

NUMBER OF OCCUPANTS IN VEHICLE	VEHICLES		OCCUPANTS							
			TOTAL		AIS 2+		AIS 3+		FATAL	
	N	%	N	%	N	%	N	%	N	%
1	42966	63.9	42966	40.5	2904	40.2	1401	41.2	413	45.0
2	15632	23.2	31264	29.5	2229	30.8	1025	30.2	253	27.6
3	5003	7.4	15009	14.1	1075	14.9	480	14.1	117	12.8
4	2370	3.5	9480	8.9	505	7.0	249	7.3	59	6.4
5	806	1.2	4030	3.8	301	4.2	153	4.5	40	4.4
6	307	0.5	1842	1.7	131	1.8	46	1.4	16	1.7
7	121	0.2	847	0.8	44	0.6	27	0.8	14	1.5
8	57	0.1	456	0.4	26	0.4	14	0.4	5	0.5
9 OR MORE	22	0.0	227	0.2	12	0.2	2	0.1	0	0.0
TOTAL	67284	100.0	106121	100.0	7227	100.0	3397	100.0	917	100.0



Single-occupant vehicles account for almost two-thirds of the case vehicles. However, vehicles with higher occupancy have more persons exposed to injury, so that well under half of all injuries at the various levels occur to occupants of single-occupant cars.

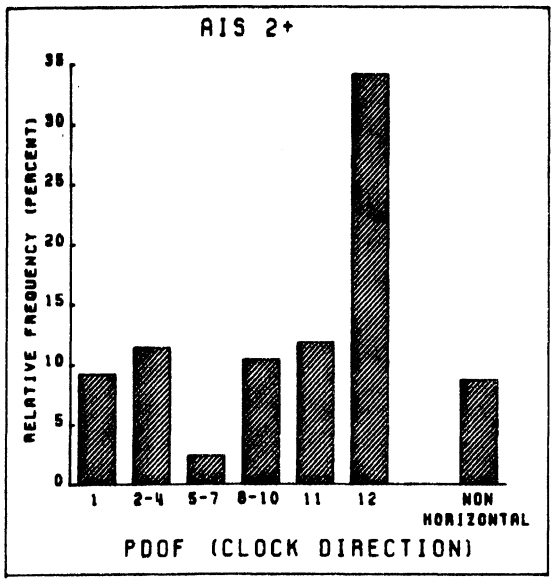
NCSS INJURY RATES BY NUMBER OF OCCUPANTS IN CASE VEHICLE

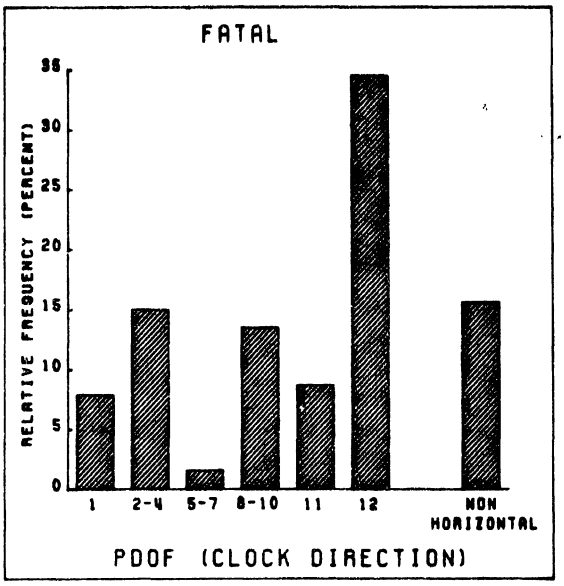
NUMBER OF OCCUPANTS IN VEHICLE	VEHICLES	OCCUPANTS						
		TOTAL	AIS 2+		AIS 3+		FATAL	
			N	RATE	N	RATE	N	RATE
1	42966	42966	2904	6.8	1401	3.3	413	1.0
2	15632	31264	2229	7.1	1025	3.3	253	0.8
3	5003	15009	1075	7.2	480	3.2	117	0.8
4	2370	9480	505	5.3	249	2.6	59	0.6
5	806	4030	301	7.5	153	3.8	40	1.0
6	307	1842	131	7.1	46	2.5	16	0.9
7	121	847	44	5.2	27	3.2	14	1.7
8	57	456	26	5.7	14	3.1	5	1.1
9 OR MORE	22	227	12	5.3	2	0.9	0	0.0
OVERALL	67284	106121	7227	6.8	3397	3.2	917	0.9

Injury rates at all levels are relatively independent of the number of occupants in the vehicles.

NCSS CASE VEHICLE DISTRIBUTIONS
BY PRINCIPAL DIRECTION OF FORCE (PDOF)

CDC DIRECTION	VEHICLES		OCCUPANTS							
			TOTAL		AIS 2+		AIS 3+		FATAL	
	N	%	N	%	N	%	N	%	N	%
1 O'CLOCK	6620	9.8	10331	9.7	662	9.2	325	9.6	72	7.9
2 O'CLOCK	5033	7.5	8144	7.7	658	9.1	354	10.4	93	10.1
3 O'CLOCK	661	1.0	1027	1.0	119	1.6	63	1.9	29	3.2
4 O'CLOCK	504	0.7	802	0.8	51	0.7	38	1.1	16	1.7
5 O'CLOCK	452	0.7	703	0.7	29	0.4	15	0.4	3	0.3
6 O'CLOCK	2490	3.7	4379	4.1	109	1.5	35	1.0	10	1.1
7 O'CLOCK	616	0.9	1006	0.9	34	0.5	15	0.4	2	0.2
8 O'CLOCK	825	1.2	1376	1.3	56	0.8	41	1.2	14	1.5
9 O'CLOCK	995	1.5	1504	1.4	119	1.6	58	1.7	27	2.9
10 O'CLOCK	4643	6.9	7583	7.1	578	8.0	333	9.8	83	9.1
11 O'CLOCK	8628	12.8	13632	12.8	856	11.8	353	10.4	80	8.7
12 O'CLOCK	18812	28.0	28960	27.3	2468	34.1	1112	32.7	315	34.4
NON-HORIZONTAL	2991	4.4	4913	4.6	626	8.7	375	11.0	143	15.6
UNKNOWN	14014	20.8	21761	20.5	862	11.9	280	8.2	30	3.3
TOTAL	67284	100.0	106121	100.0	7227	100.0	3397	100.0	917	100.0



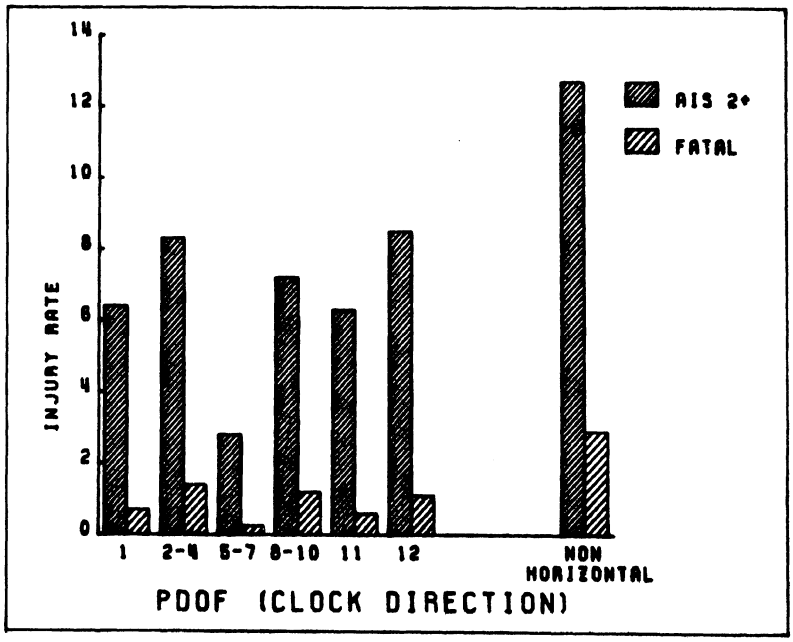


The principal direction of force is not necessarily directly related to the area of the vehicle damaged--e.g., it is possible to have an 11:00 vector into the side or the front of a car. This "clock direction" is taken from the first element of the Collision Deformation Classification code, as detailed in SAE J224a.

The "Non-Horizontal" category for direction of force includes rollovers. Note that these represent only 4.4% of the vehicles, but 15.6% of the fatalities. The most common impact direction is 12:00, followed by 11:00 and 1:00. Injuries peak even more sharply at 12:00.

NCSS INJURY RATES BY CASE VEHICLE PRINCIPAL DIRECTION OF FORCE (PDOF)

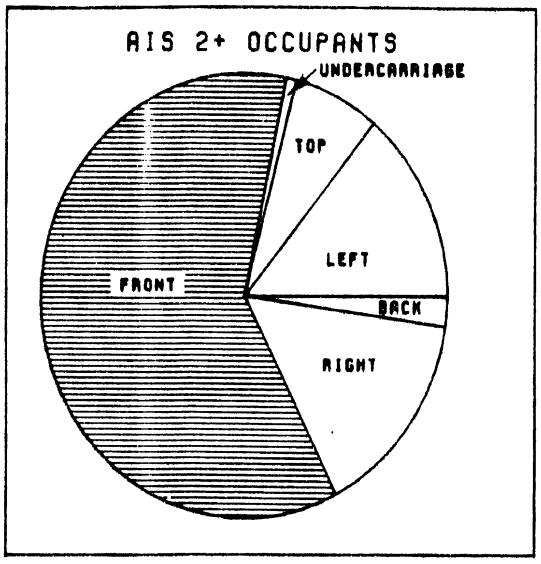
CDC DIRECTION	VEHICLES	OCCUPANTS							
		TOTAL	AIS 2+		AIS 3+		FATAL	
			N	RATE	N	RATE	N	RATE
1 O'CLOCK	6620	10331	662	6.4	325	3.1	72	0.7
2 O'CLOCK	5033	8144	658	8.1	354	4.3	93	1.1
3 O'CLOCK	661	1027	119	11.6	63	6.1	29	2.8
4 O'CLOCK	504	802	51	6.4	38	4.7	16	2.0
5 O'CLOCK	452	703	29	4.1	15	2.1	3	0.4
6 O'CLOCK	2490	4379	109	2.5	35	0.8	10	0.2
7 O'CLOCK	616	1006	34	3.4	15	1.5	2	0.2
8 O'CLOCK	825	1376	56	4.1	41	3.0	14	1.0
9 O'CLOCK	995	1504	119	7.9	58	3.9	27	1.8
10 O'CLOCK	4643	7583	578	7.6	333	4.4	83	1.1
11 O'CLOCK	8628	13632	856	6.3	353	2.6	80	0.6
12 O'CLOCK	18812	28960	2468	8.5	1112	3.8	315	1.1
NON-HORIZONTAL	2991	4913	626	12.7	375	7.6	143	2.9
UNKNOWN	14014	21761	862	4.0	280	1.3	30	0.1
OVERALL	67284	106121	7227	6.8	3397	3.2	917	0.9

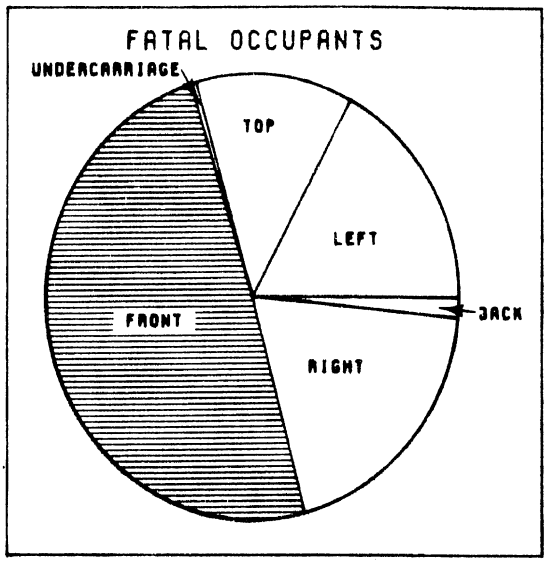


While the most common direction of force is 12:00 (head-on), the injury rate is estimated to be highest at all levels for non-horizontal impact directions. At the AIS 3 or greater level, lateral impact directions follow the non-horizontal category with the next highest estimated injury rates.

NCSS CASE VEHICLE DISTRIBUTIONS BY GENERAL AREA OF DAMAGE

DAMAGE AREA	VEHICLES		OCCUPANTS							
			TOTAL		AIS 2+		AIS 3+		FATAL	
	N	%	N	%	N	%	N	%	N	%
FRONT	33138	49.3	51192	48.2	3860	53.4	1708	50.3	437	47.7
RIGHT	7054	10.5	11457	10.8	974	13.5	553	16.3	172	18.8
BACK	2868	4.3	4937	4.7	137	1.9	50	1.5	13	1.4
LEFT	7733	11.5	12668	11.9	898	12.4	511	15.0	152	16.6
TOP	1818	2.7	3030	2.9	444	6.1	277	8.2	109	11.9
UNDERCARRIAGE	659	1.0	1076	1.0	52	0.7	18	0.5	4	0.4
UNKNOWN	14014	20.8	21761	20.5	862	11.9	280	8.2	30	3.3
TOTAL	67284	100.0	106121	100.0	7227	100.0	3397	100.0	917	100.0

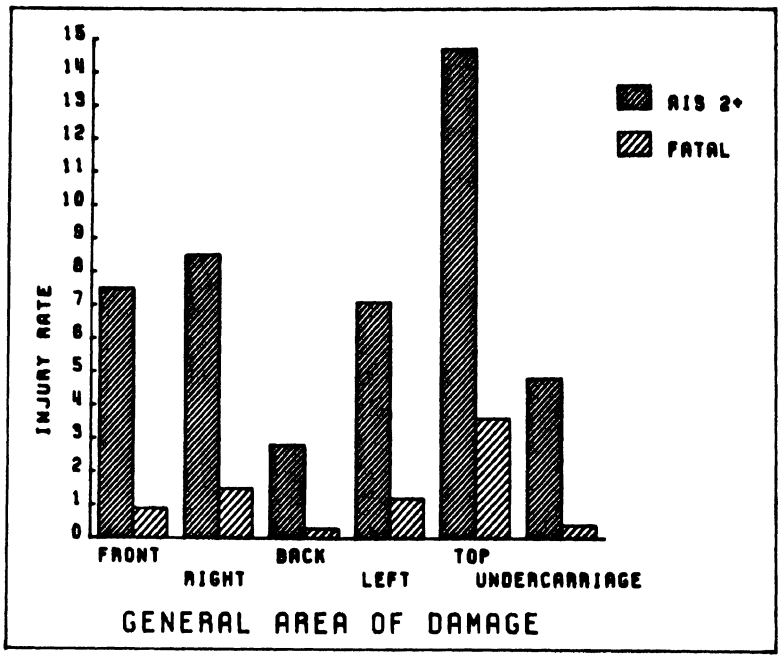




The most common area damaged in a crashed vehicle is the front, with just under half falling in this category. Right and left side impact frequencies are nearly equal, but with slightly higher injury frequencies for the right side. Unknown damage areas have been excluded from the graphs, and it is likely that many of these would also involve frontal damage.

NCSS INJURY RATES BY CASE VEHICLE GENERAL AREA OF DAMAGE

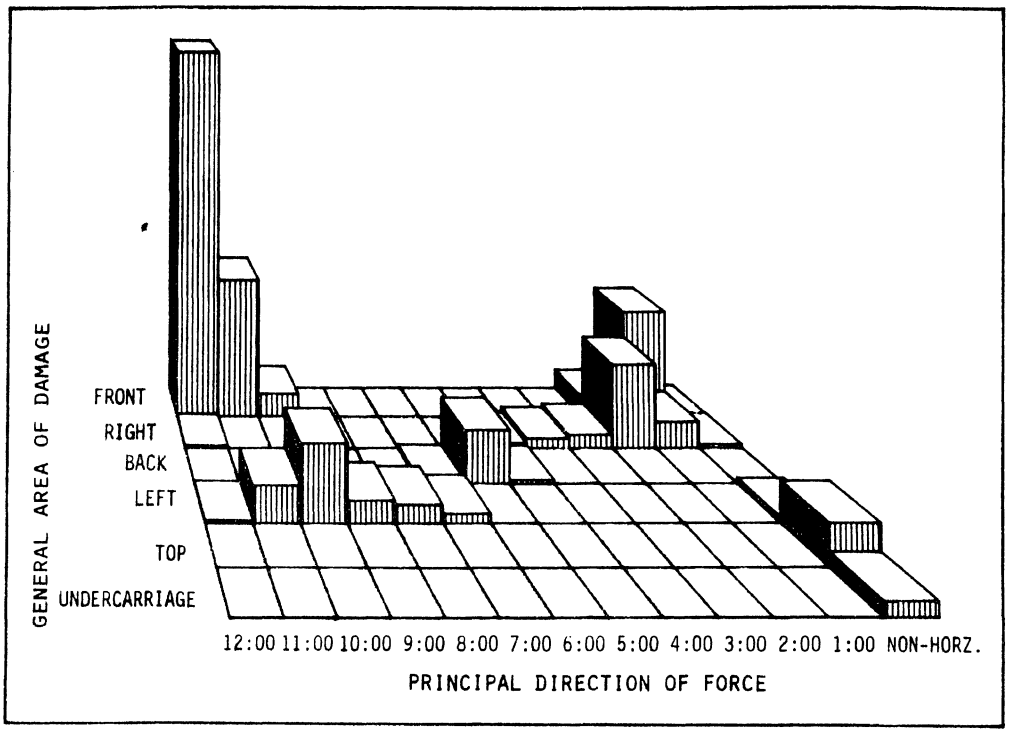
DAMAGE AREA	VEHICLES	OCCUPANTS						
		TOTAL	AIS 2+		AIS 3+		FATAL	
			N	RATE	N	RATE	N	RATE
FRONT	33138	51192	3860	7.5	1708	3.3	437	0.9
RIGHT	7054	11457	974	8.5	553	4.8	172	1.5
BACK	2868	4937	137	2.8	50	1.0	13	0.3
LEFT	7733	12668	898	7.1	511	4.0	152	1.2
TOP	1818	3030	444	14.7	277	9.1	109	3.6
UNDERCARRIAGE	659	1076	52	4.8	18	1.7	4	0.4
UNKNOWN	14014	21761	862	4.0	280	1.3	30	0.1
OVERALL	67284	106121	7227	6.8	3397	3.2	917	0.9



Injury rates are clearly highest for the top-damage code, which is a surrogate for rollover. Fatal injury is more than four times as likely in this category as compared to frontal damage. The fatality rate for side impacts is much higher than for front, while that for the back is very low. Lower-level injuries are roughly equal for front and side impacts.

NCSS CASE VEHICLES: PRINCIPAL DIRECTION OF FORCE BY GENERAL AREA OF DAMAGE

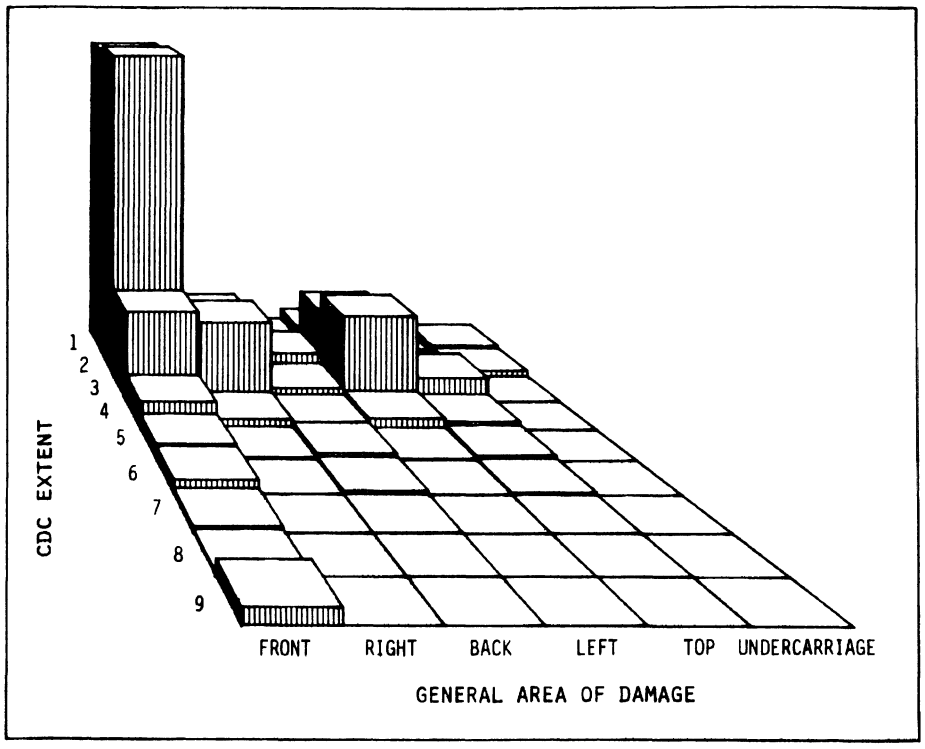
CDC DIRECTION	FRONT DAMAGE	RIGHT DAMAGE	BACK DAMAGE	LEFT DAMAGE	TOP DAMAGE	UNDER-CARRIAGE	UNKNOWN	TOTAL
1 O'CLOCK	5344	1276	0	0	0	0	0	6620
2 O'CLOCK	975	4058	0	0	0	0	0	5033
3 O'CLOCK	0	661	0	0	0	0	0	661
4 O'CLOCK	0	494	10	0	0	0	0	504
5 O'CLOCK	0	277	175	0	0	0	0	452
6 O'CLOCK	0	1	2479	10	0	0	0	2490
7 O'CLOCK	0	0	189	427	0	0	0	616
8 O'CLOCK	0	0	14	811	0	0	0	825
9 O'CLOCK	0	0	0	995	0	0	0	995
10 O'CLOCK	1156	0	0	3477	0	10	0	4643
11 O'CLOCK	6976	0	0	1642	0	10	0	8628
12 O'CLOCK	18562	121	0	124	0	5	0	18812
NON-HORIZONTAL	125	166	1	247	1818	634	0	2991
UNKNOWN	0	0	0	0	0	0	14014	14014
TOTAL	33138	7054	2868	7733	1818	659	14014	67284



The relationship between principal direction of force and area damaged is made clear here. Right-side damage, for example, while occasionally reported with a 12 o'clock vector, is most commonly associated with a 2 o'clock vector.

NCSS CASE VEHICLES: CDC (COLLISION DEFORMATION CLASS) EXTENT BY GENERAL AREA OF DAMAGE

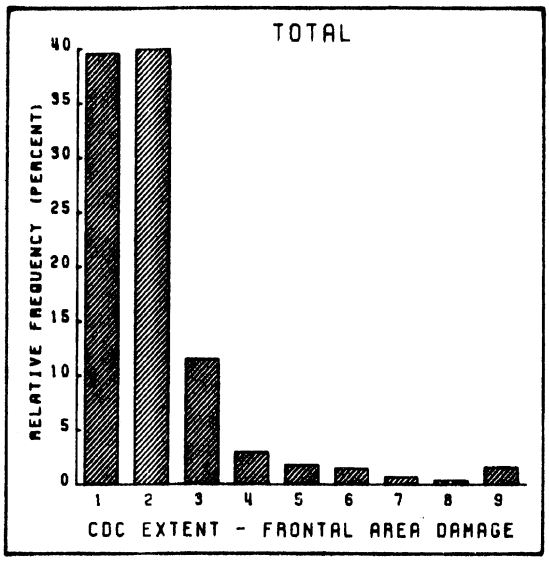
CDC EXTENT	FRONT DAMAGE	RIGHT DAMAGE	BACK DAMAGE	LEFT DAMAGE	TOP DAMAGE	UNDER-CARRIAGE	UNKNOWN	TOTAL
1	13183	805	607	1049	39	360	10	16053
2	13410	2569	955	2694	163	257	0	20048
3	3571	3148	543	3425	966	29	1	11683
4	1038	378	288	437	322	11	0	2474
5	573	100	268	82	198	1	0	1222
6	497	30	148	24	98	0	0	797
7	213	15	34	4	19	0	0	285
8	124	4	17	1	13	0	0	159
9	529	5	8	17	0	1	11	571
UNKNOWN	0	0	0	0	0	0	13992	13992
TOTAL	33138	7054	2868	7733	1818	659	14014	67284

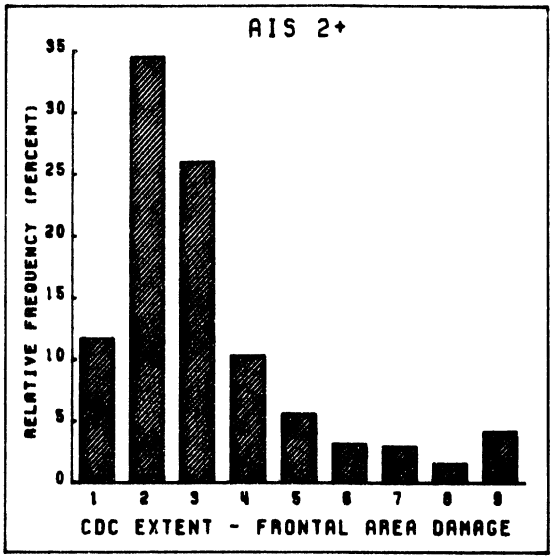


The CDC extent code measures the amount of crush sustained by the vehicle. The most common frontal damage extent is at CDC 1. Recall that these cars must have been towed for damage, and thus many cars must be towed with relatively minor front damage. The most common back-damage extent is at CDC 2, and side damage at CDC 3. However, CDC extent codes do not represent the same amount of crush when applied to different areas of damage. Other comparisons between side and frontal collisions can be seen from the Crash Severity (Delta V) section of this report on pages 84 to 89.

NCSS CASE VEHICLE CDC EXTENT DISTRIBUTIONS (FRONTAL AREA DAMAGE)

CDC EXTENT	VEHICLES		OCCUPANTS							
			TOTAL		AIS 2+		AIS 3+		FATAL	
	N	%	N	%	N	%	N	%	N	%
1	13183	39.8	20285	39.6	450	11.7	88	5.2	8	1.8
2	13410	40.5	20456	40.0	1331	34.5	394	23.1	36	8.2
3	3571	10.8	5866	11.5	1003	26.0	517	30.3	93	21.3
4	1038	3.1	1530	3.0	396	10.3	236	13.8	70	16.0
5	573	1.7	900	1.8	216	5.6	150	8.8	56	12.8
6	497	1.5	791	1.5	124	3.2	88	5.2	41	9.4
7	213	0.6	360	0.7	115	3.0	84	4.9	41	9.4
8	124	0.4	193	0.4	62	1.6	32	1.9	21	4.8
9	529	1.6	811	1.6	163	4.2	119	7.0	71	16.2
TOTAL	33138	100.0	51192	100.0	3860	100.0	1708	100.0	437	100.0

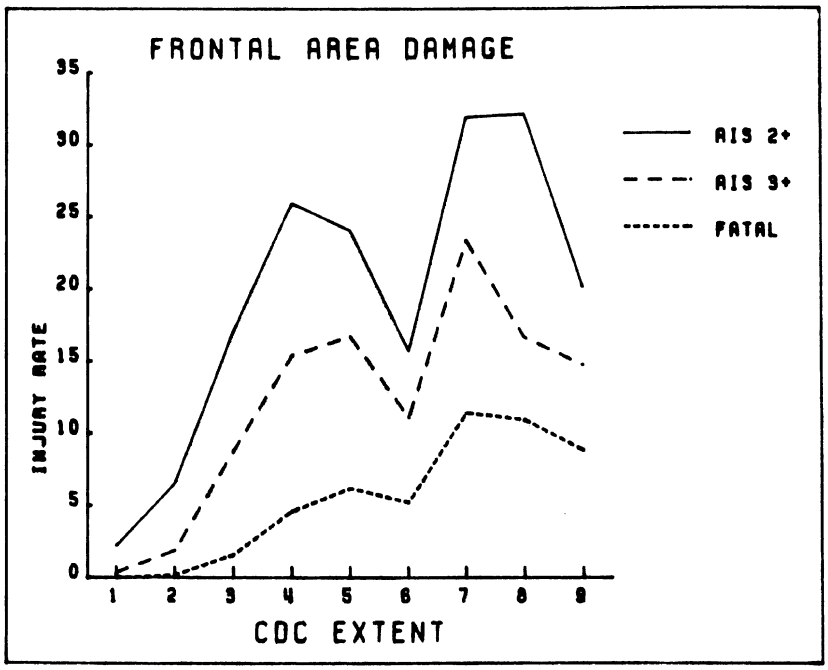




As might be expected, most fatalities occur to occupants of seriously damaged vehicles: in the frontal-damage subset, occupants of vehicles that have sustained CDC's of 4 or more account for 69% of fatalities. Lower-level injuries are more common with lower-level CDC's: 72% of injuries at the AIS 2 or more level occur with CDC's of 3 or less.

NCSS INJURY RATES BY CASE VEHICLE CDC EXTENT (FRONTAL AREA DAMAGE)

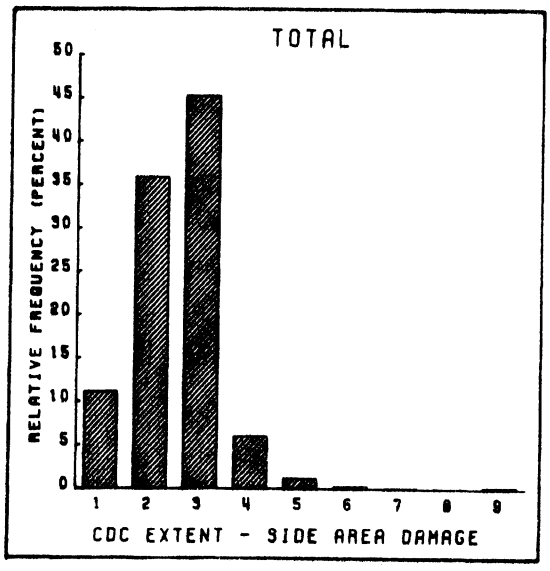
CDC EXTENT	VEHICLES	OCCUPANTS							
		TOTAL	AIS 2+		AIS 3+		FATAL	
			N	RATE	N	RATE	N	RATE
1	13183	20285	450	2.2	88	0.4	8	0.0
2	13410	20456	1331	6.5	394	1.9	36	0.2
3	3571	5866	1003	17.1	517	8.8	93	1.6
4	1038	1530	396	25.9	236	15.4	70	4.6
5	573	900	216	24.0	150	16.7	56	6.2
6	497	791	124	15.7	88	11.1	41	5.2
7	213	360	115	31.9	84	23.3	41	11.4
8	124	193	62	32.1	32	16.6	21	10.9
9	529	811	163	20.1	119	14.7	71	8.8
OVERALL	33138	51192	3860	7.5	1708	3.3	437	0.9

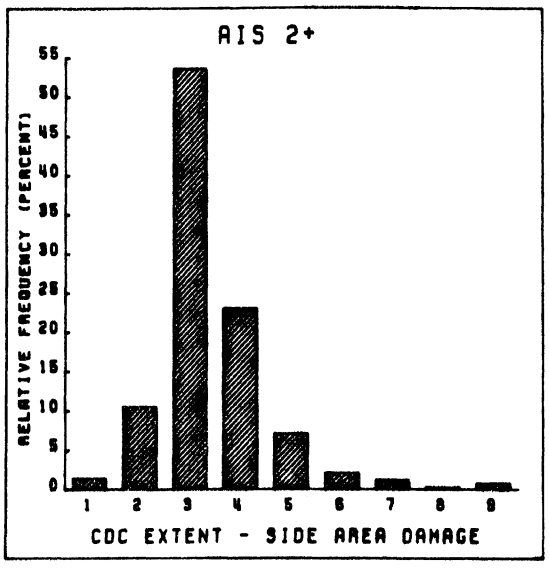


Up to CDC Extent 5, injuries for the frontal-damage subset follow the expected curve, rising with increases in CDC. Above CDC Extent 5, anomalies appear to prevail. It is highly unlikely that CDC Extent 6 and above, which involves deformation to the windshield area and beyond, would result from a widely distributed impact to the front of a car. These CDC extents are perhaps the result of sideswipes in which the front was struck first, of impacts above the beltline, or of other narrow area impacts. Other characters in the CDC code might reveal this information, but they are not included in the tabulations for this table and group.

NCSS CASE VEHICLE CDC EXTENT DISTRIBUTIONS (SIDE AREA DAMAGE)

CDC EXTENT	VEHICLES		OCCUPANTS							
	N	%	TOTAL		AIS 2+		AIS 3+		FATAL	
			N	%	N	%	N	%	N	%
1	1854	12.5	2680	11.1	26	1.4	8	0.8	3	0.9
2	5263	35.6	8663	35.9	196	10.5	74	7.0	5	1.5
3	6573	44.5	10905	45.2	1003	53.6	503	47.3	85	26.2
4	815	5.5	1440	6.0	430	23.0	297	27.9	111	34.3
5	182	1.2	282	1.2	133	7.1	106	10.0	58	17.9
6	54	0.4	68	0.3	40	2.1	34	3.2	23	7.1
7	19	0.1	34	0.1	23	1.2	21	2.0	19	5.9
8	5	0.0	7	0.0	6	0.3	6	0.6	6	1.9
9	22	0.1	46	0.2	15	0.8	15	1.4	14	4.3
TOTAL	14787	100.0	24125	100.0	1872	100.0	1064	100.0	324	100.0

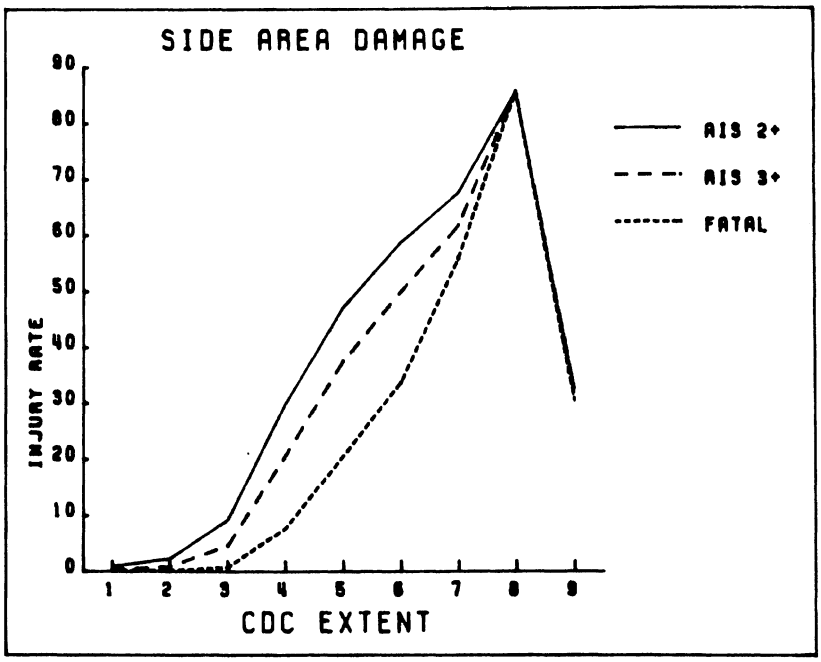




Both right- and left-damaged vehicles are combined in this table. The most frequent CDC extent for side damage is Extent 3, with 44.5% of the vehicles and 53.6% of the injuries at AIS 2 and above. However, only 26.2% of the fatalities occur at this level.

NCSS INJURY RATES BY CASE VEHICLE CDC EXTENT (SIDE AREA DAMAGE)

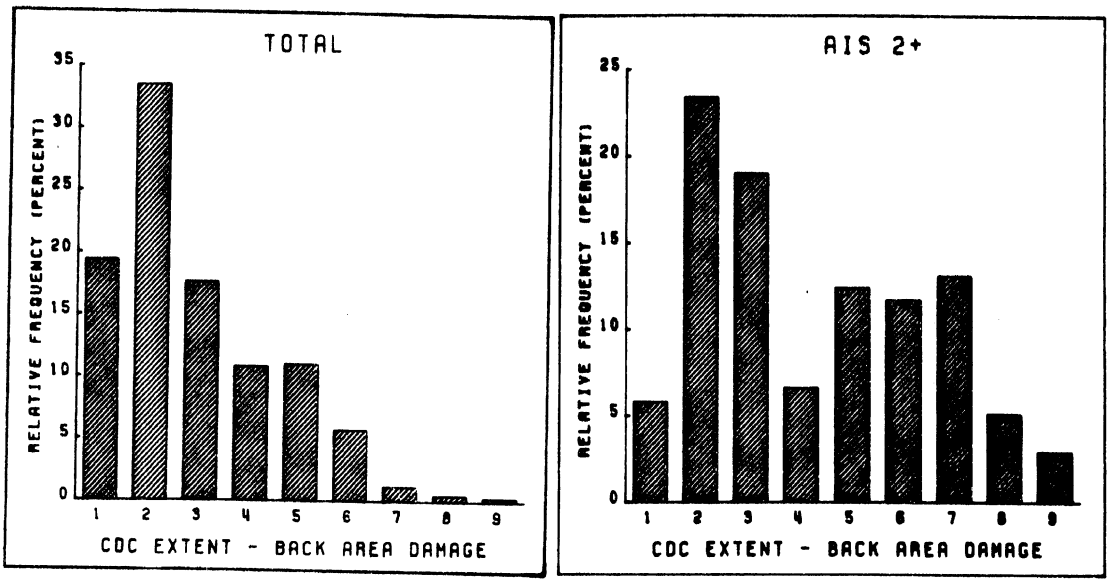
CDC EXTENT	VEHICLES	OCCUPANTS							
		TOTAL	AIS 2+		AIS 3+		FATAL	
			N	RATE	N	RATE	N	RATE
1	1854	2680	26	1.0	8	0.3	3	0.1
2	5263	8663	196	2.3	74	0.9	5	0.1
3	6573	10905	1003	9.2	503	4.6	85	0.8
4	815	1440	430	29.9	297	20.6	111	7.7
5	182	282	133	47.2	106	37.6	58	20.6
6	54	68	40	58.8	34	50.0	23	33.8
7	19	34	23	67.6	21	61.8	19	55.9
8	5	7	6	85.7	6	85.7	6	85.7
9	22	46	15	32.6	15	32.6	14	30.4
OVERALL	14787	24125	1872	7.8	1064	4.4	324	1.3



Injury rates at all levels climb with increases in CDC extent for side damage. CDC's of 7 and 8 have an estimated probability greater than half of producing a fatality. CDC 9 is out of line with much lower injury rates than CDC's 6 through 8--possibly because CDC 9 involves total penetration of the vehicle and may involve small contact areas.

NCSS CASE VEHICLE CDC EXTENT DISTRIBUTIONS (BACK AREA DAMAGE)

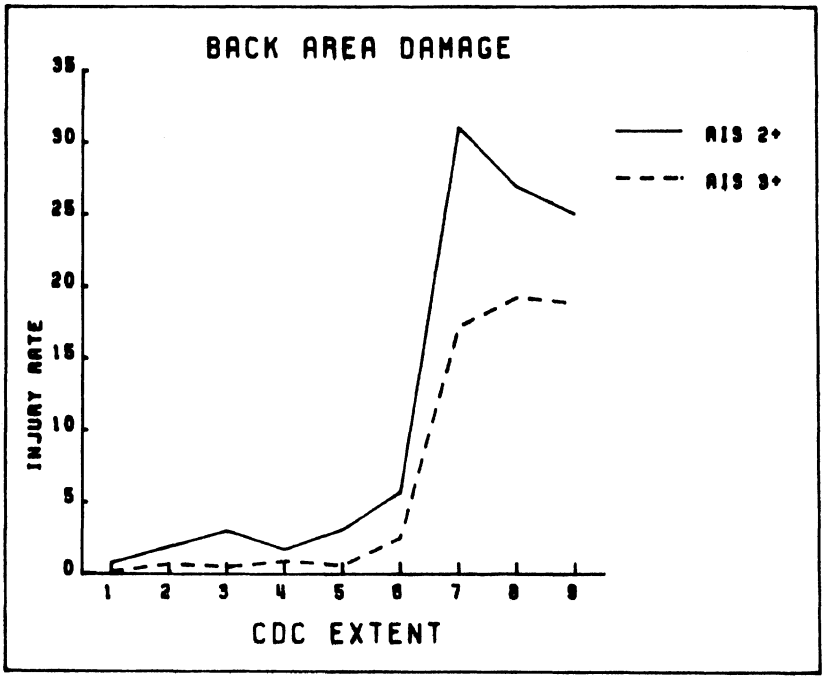
CDC EXTENT	VEHICLES		OCCUPANTS							
			TOTAL		AIS 2+		AIS 3+		FATAL	
	N	%	N	%	N	%	N	%	N	%
1	607	21.2	959	19.4	8	5.8	2	4.0	0	0.0
2	955	33.3	1653	33.5	32	23.4	11	22.0	0	0.0
3	543	18.9	868	17.6	26	19.0	4	8.0	1	7.7
4	288	10.0	533	10.8	9	6.6	5	10.0	1	7.7
5	268	9.3	545	11.0	17	12.4	3	6.0	0	0.0
6	148	5.2	279	5.7	16	11.7	7	14.0	1	7.7
7	34	1.2	58	1.2	18	13.1	10	20.0	4	30.8
8	17	0.6	26	0.5	7	5.1	5	10.0	4	30.8
9	8	0.3	16	0.3	4	2.9	3	6.0	2	15.4
TOTAL	2868	100.0	4937	100.0	137	100.0	50	100.0	13	100.0



The most common CDC extent for occupants of vehicles damaged in the rear is Level 2. Forty-two percent of injuries at the AIS 2 or greater level occur with CDC Extents of 2 or 3. There are hardly any fatalities in back-damaged vehicles.

NCSS INJURY RATES BY CASE VEHICLE CDC EXTENT
(BACK AREA DAMAGE)

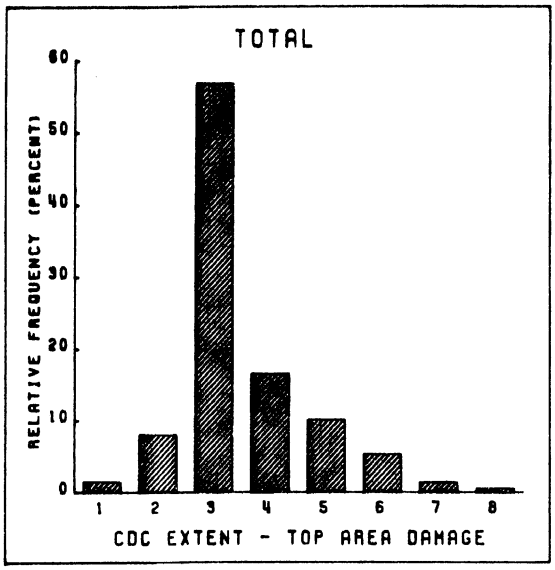
CDC EXTENT	VEHICLES	OCCUPANTS							
		TOTAL	AIS 2+		AIS 3+		FATAL	
			N	RATE	N	RATE	N	RATE
1	607	959	8	0.8	2	0.2	0	0.0
2	955	1653	32	1.9	11	0.7	0	0.0
3	543	868	26	3.0	4	0.5	1	0.1
4	288	533	9	1.7	5	0.9	1	0.2
5	268	545	17	3.1	3	0.6	0	0.0
6	148	279	16	5.7	7	2.5	1	0.4
7	34	58	18	31.0	10	17.2	4	6.9
8	17	26	7	26.9	5	19.2	4	15.4
9	8	16	4	25.0	3	18.8	2	12.5
OVERALL	2868	4937	137	2.8	50	1.0	13	0.3

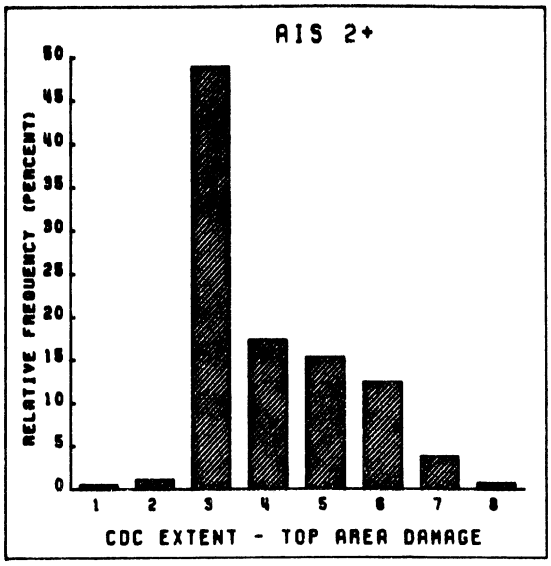


The injury rate for occupants of back-damaged vehicles is quite small. Even at Extents 7 and 8 fewer than one in three persons are injured to the AIS 2 Level and above.

NCSS CASE VEHICLE CDC EXTENT DISTRIBUTIONS (TOP AREA DAMAGE)

CDC EXTENT	VEHICLES		OCCUPANTS							
			TOTAL		AIS 2+		AIS 3+		FATAL	
	N	%	N	%	N	%	N	%	N	%
1	39	2.1	44	1.5	2	0.5	1	0.4	0	0.0
2	163	9.0	243	8.0	5	1.1	3	1.1	0	0.0
3	966	53.1	1721	56.8	217	48.9	118	42.6	48	44.0
4	322	17.7	499	16.5	77	17.3	55	19.9	22	20.2
5	198	10.9	306	10.1	68	15.3	45	16.2	13	11.9
6	98	5.4	160	5.3	55	12.4	43	15.5	19	17.4
7	19	1.0	41	1.4	17	3.8	11	4.0	7	6.4
8	13	0.7	16	0.5	3	0.7	1	0.4	0	0.0
TOTAL	1818	100.0	3030	100.0	444	100.0	277	100.0	109	100.0

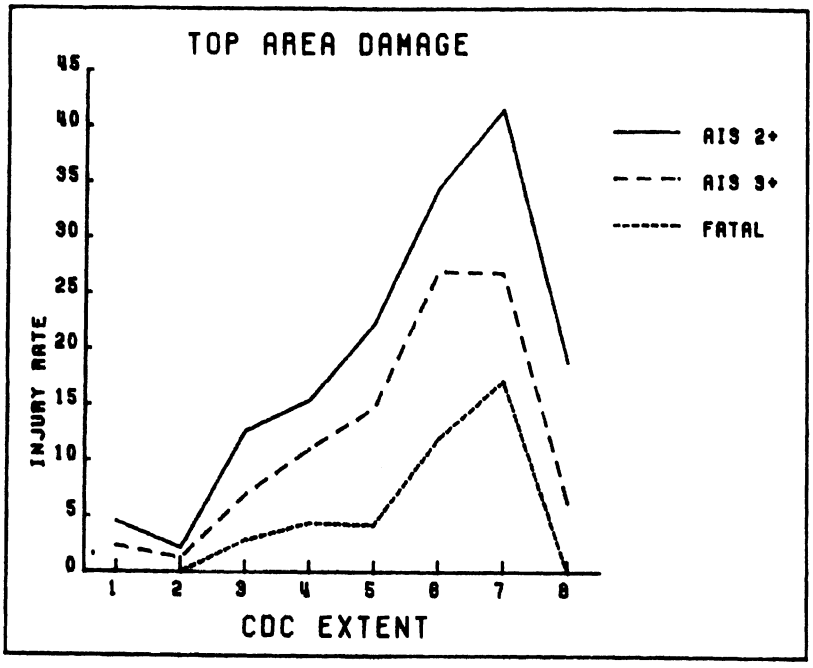




Top-area damage usually results from a rollover. More than half the occupants in this subset were in vehicles with a CDC Extent of 3, and two-thirds of the occupants were in vehicles with a CDC of 1 through 3. However, only half the injuries at the AIS 2 or greater level occurred with CDC Extents of 1 through 3.

NCSS INJURY RATES BY CASE VEHICLE CDC EXTENT (TOP AREA DAMAGE)

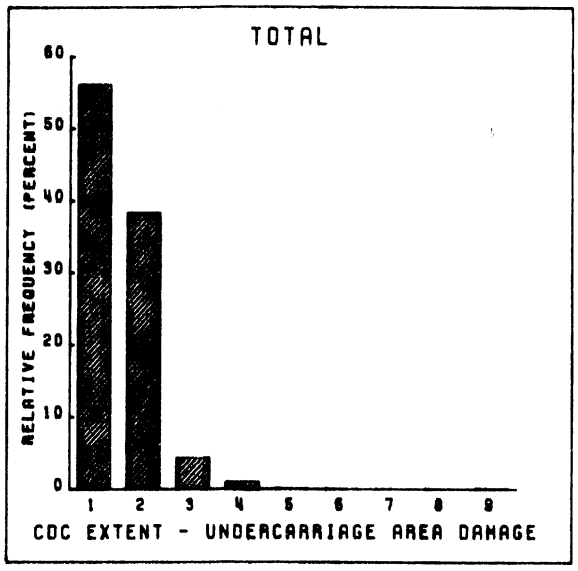
CDC EXTENT	VEHICLES	OCCUPANTS						
		TOTAL	AIS 2+		AIS 3+		FATAL	
			N	RATE	N	RATE	N	RATE
1	39	44	2	4.5	1	2.3	0	0.0
2	163	243	5	2.1	3	1.2	0	0.0
3	966	1721	217	12.6	118	6.9	48	2.8
4	322	499	77	15.4	55	11.0	22	4.4
5	198	306	68	22.2	45	14.7	13	4.2
6	98	160	55	34.4	43	26.9	19	11.9
7	19	41	17	41.5	11	26.8	7	17.1
8	13	16	3	18.8	1	6.3	0	0.0
OVERALL	1818	3030	444	14.7	277	9.1	109	3.6

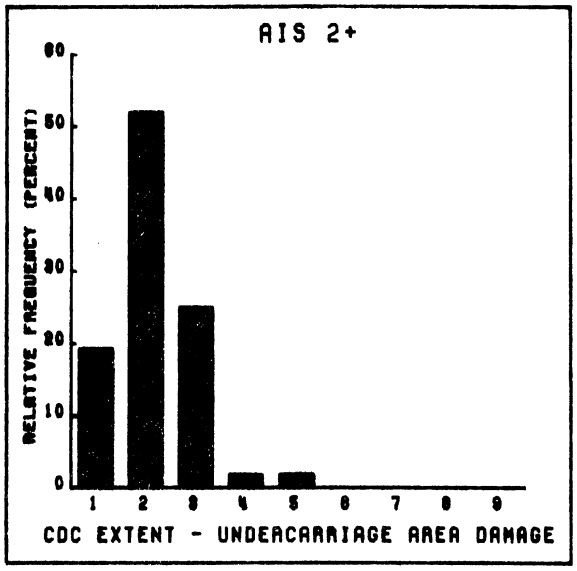


Up to CDC Extent 7, injury rates at all levels increase regularly with increase in top-damage severity. Although occupants of top-damaged vehicles represent only 2.9% of all NCSS case vehicle occupants, they account for 11.9% of the fatalities. The comparatively low injury rate at CDC Extent 8 may once again be related to the surface area of the object contacted.

NCSS CASE VEHICLE CDC EXTENT DISTRIBUTIONS (UNDERCARRIAGE AREA DAMAGE)

CDC EXTENT	VEHICLES		OCCUPANTS							
			TOTAL		AIS 2+		AIS 3+		FATAL	
	N	%	N	%	N	%	N	%	N	%
1	360	54.6	604	56.1	10	19.2	1	5.6	0	0.0
2	257	39.0	412	38.3	27	51.9	8	44.4	0	0.0
3	29	4.4	47	4.4	13	25.0	7	38.9	2	50.0
4	11	1.7	11	1.0	1	1.9	1	5.6	1	25.0
5	1	0.2	1	0.1	1	1.9	1	5.6	1	25.0
9	1	0.2	1	0.1	0	0.0	0	0.0	0	0.0
TOTAL	659	100.0	1076	100.0	52	100.0	18	100.0	4	100.0

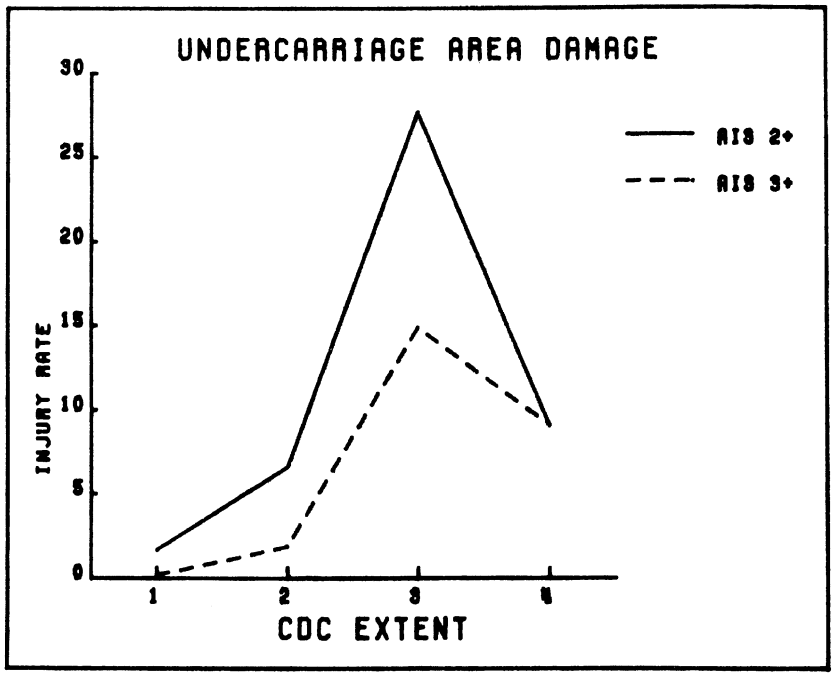




Principal damage to the undercarriage is comparatively rare: damage to the front is about 50 times more common. Undercarriage damage above Level 2 is rare.

NCSS INJURY RATES BY CASE VEHICLE CDC EXTENT
(UNDERCARRIAGE AREA DAMAGE)

CDC EXTENT	VEHICLES	OCCUPANTS						
		TOTAL	AIS 2+		AIS 3+		FATAL	
			N	RATE	N	RATE	N	RATE
1	360	604	10	1.7	1	0.2	0	0.0
2	257	412	27	6.6	8	1.9	0	0.0
3	29	47	13	27.7	7	14.9	2	4.3
4	11	11	1	9.1	1	9.1	1	9.1
5	1	1	1	100.0	1	100.0	1	100.0
9	1	1	0	0.0	0	0.0	0	0.0
OVERALL	659	1076	52	4.8	18	1.7	4	0.4



Up to CDC Extent 4 the injury rate of occupants for undercarriage-damaged vehicles is relatively low. Above CDC Extent 4 the numbers are too small to be reliable.

This section of the report is centered on the occupants of towed passenger cars in the NCSS passenger car data set. As before, tables are weighted (except in the injury data beginning on page 67), and thus describe the total number of occupants of towed passenger cars involved in NCSS accidents where the most serious injury was in a passenger car. The figures given are for the aggregate of the seven NCSS areas during the twenty-seven months from January 1977 through March 1979.

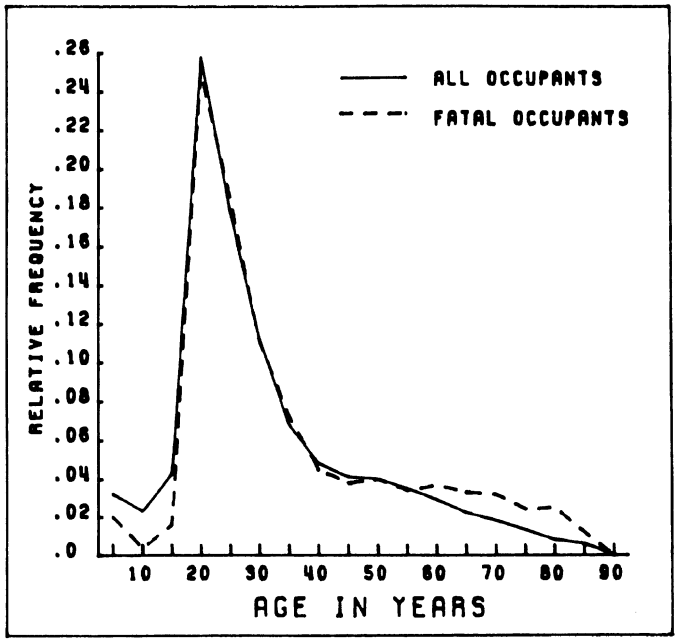
A case vehicle occupant is a person who was an occupant of any passenger car towed from the scene of the accident because of collision damage. In the following pages, distributions are shown for the reported occupant characteristics--including age, sex, seat location, restraint use, ejection and entrapment, treatment category, injury severity (Overall AIS), and the number of days spent in a hospital.

Injury information is presented in the same format as in the previous sections, and the same cautions on missing data apply. Injury details are reported at the end of the section, and have a separate introduction on page 67.

NCSS OCCUPANT DISTRIBUTIONS BY AGE

OCCUPANT AGE (5-YEAR GROUPS)	OCCUPANTS		AIS 2+		AIS 3+		FATAL	
	N	%	N	%	N	%	N	%
INFANT	403	0.4	20	0.3	13	0.4	3	0.3
01-05 YEARS	3376	3.2	90	1.2	34	1.0	18	2.0
06-10 YEARS	2474	2.3	70	1.0	26	0.8	4	0.4
11-15 YEARS	4567	4.3	276	3.8	113	3.3	15	1.6
16-20 YEARS	27338	25.8	1786	24.7	814	24.0	229	25.0
21-25 YEARS	18872	17.8	1311	18.1	568	16.7	171	18.6
26-30 YEARS	11886	11.2	816	11.3	386	11.4	102	11.1
31-35 YEARS	7170	6.8	469	6.5	217	6.4	67	7.3
36-40 YEARS	5044	4.8	354	4.9	178	5.2	41	4.5
41-45 YEARS	4306	4.1	302	4.2	141	4.2	35	3.8
46-50 YEARS	4238	4.0	372	5.1	163	4.8	37	4.0
51-55 YEARS	3723	3.5	282	3.9	146	4.3	31	3.4
56-60 YEARS	3056	2.9	310	4.3	148	4.4	34	3.7
61-65 YEARS	2321	2.2	211	2.9	120	3.5	30	3.3
66-70 YEARS	1914	1.8	205	2.8	105	3.1	29	3.2
71-75 YEARS	1398	1.3	146	2.0	85	2.5	22	2.4
76-80 YEARS	895	0.8	109	1.5	78	2.3	23	2.5
OVER 80 YEARS	592	0.6	56	0.8	39	1.1	11	1.2
UNKNOWN	2548	2.4	42	0.6	23	0.7	15	1.6
TOTAL	106121	100.0	7227	100.0	3397	100.0	917	100.0

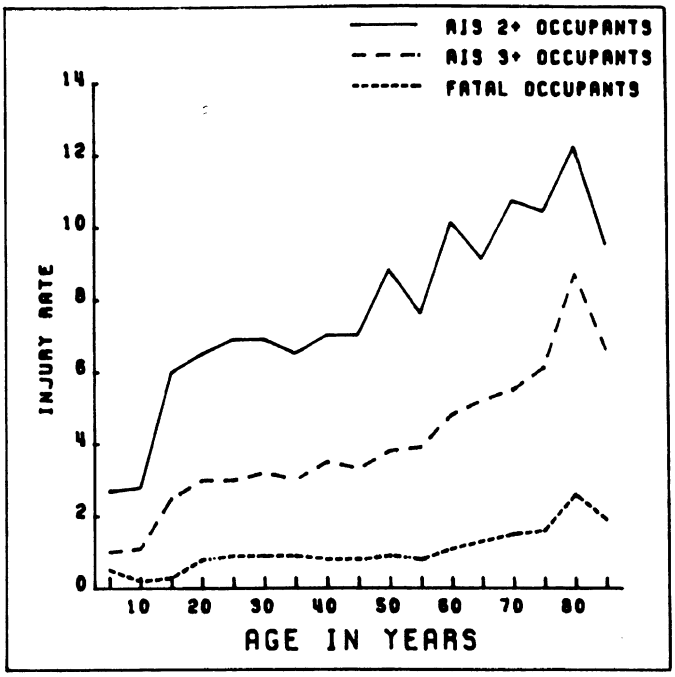
Of all case vehicle occupants in NCSS accidents, 54.8% were between 16 and 30 years of age. The same group accounts for 54.7% of the fatalities. The crossover in the graph at 55 indicates that older occupants are more likely to suffer fatal injuries.



NCSS INJURY RATES BY OCCUPANT AGE

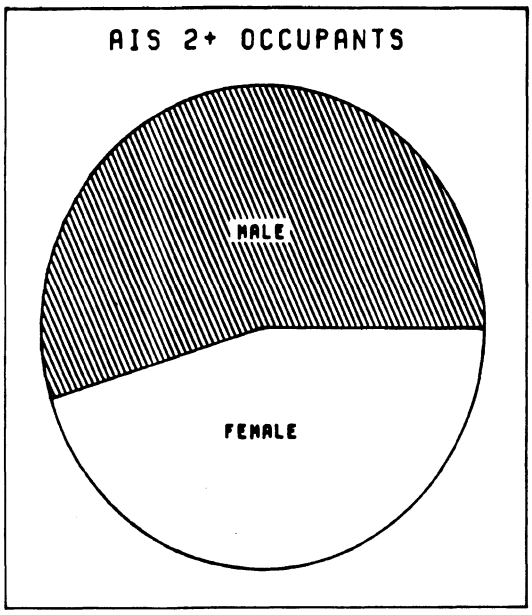
OCCUPANT AGE (5-YEAR GROUPS)	OCCUPANTS	AIS 2+		AIS 3+		FATAL	
		N	RATE	N	RATE	N	RATE
INFANT	403	20	5.0	13	3.2	3	0.7
01-05 YEARS	3376	90	2.7	34	1.0	18	0.5
06-10 YEARS	2474	70	2.8	26	1.1	4	0.2
11-15 YEARS	4567	276	6.0	113	2.5	15	0.3
16-20 YEARS	27338	1786	6.5	814	3.0	229	0.8
21-25 YEARS	18872	1311	6.9	568	3.0	171	0.9
26-30 YEARS	11886	816	6.9	386	3.2	102	0.9
31-35 YEARS	7170	469	6.5	217	3.0	67	0.9
36-40 YEARS	5044	354	7.0	178	3.5	41	0.8
41-45 YEARS	4306	302	7.0	141	3.3	35	0.8
46-50 YEARS	4238	372	8.8	163	3.8	37	0.9
51-55 YEARS	3723	282	7.6	146	3.9	31	0.8
56-60 YEARS	3056	310	10.1	148	4.8	34	1.1
61-65 YEARS	2321	211	9.1	120	5.2	30	1.3
66-70 YEARS	1914	205	10.7	105	5.5	29	1.5
71-75 YEARS	1398	146	10.4	85	6.1	22	1.6
76-80 YEARS	895	109	12.2	78	8.7	23	2.6
OVER 80 YEARS	592	56	9.5	39	6.6	11	1.9
UNKNOWN	2548	42	1.6	23	0.9	15	0.6
OVERALL	106121	7227	6.8	3397	3.2	917	0.9

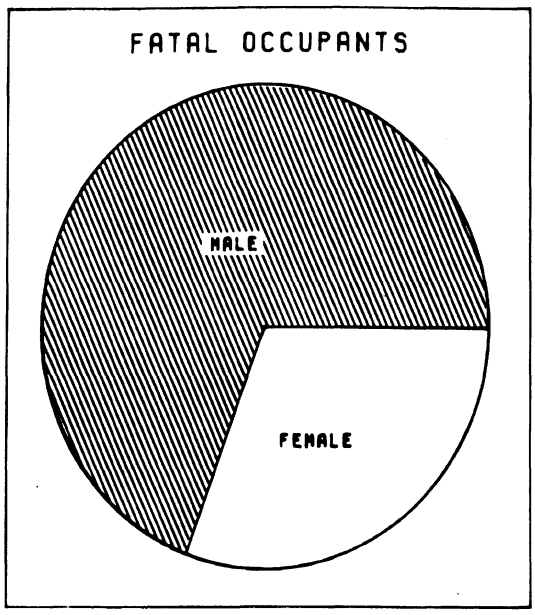
Injury rates generally rise with age, although the infant group which is omitted from the graph has a high injury rate. The fatality rate is steady for adults aged 16 through 55 at less than 1%, but then rises quickly to more than 1.5% for occupants aged 71 and over.



NCSS OCCUPANT DISTRIBUTIONS BY SEX

SEX	OCCUPANTS		AIS 2+		AIS 3+		FATAL	
	N	%	N	%	N	%	N	%
MALE	62242	58.7	3953	54.7	2023	59.6	635	69.2
FEMALE	42682	40.2	3267	45.2	1368	40.3	281	30.6
UNKNOWN	1197	1.1	7	0.1	6	0.2	1	0.1
TOTAL	106121	100.0	7227	100.0	3397	100.0	917	100.0

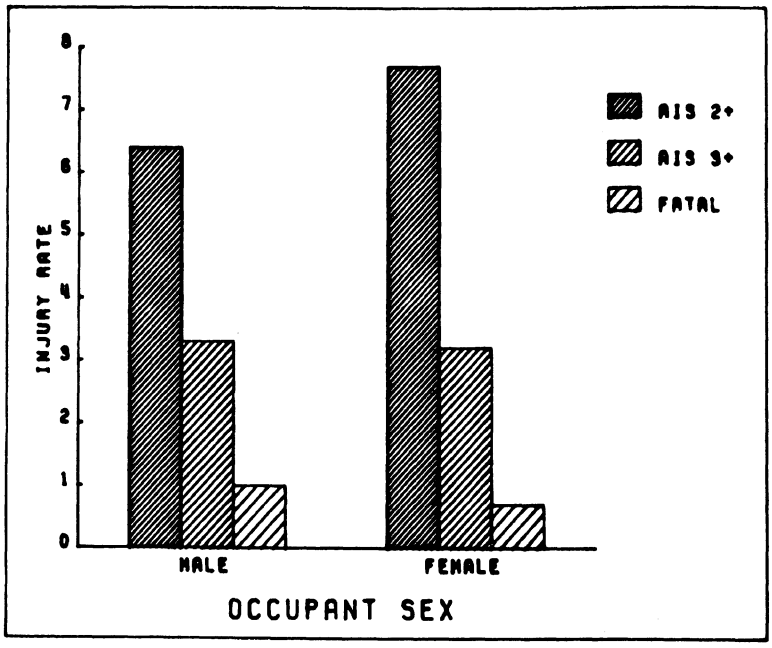




Male occupants are overrepresented slightly in all accidents, but greatly overrepresented in fatal accidents.

NCSS INJURY RATES BY OCCUPANT SEX

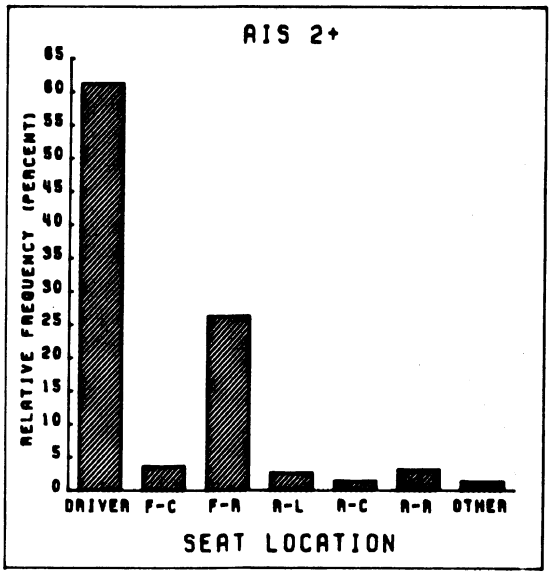
SEX	OCCUPANTS	AIS 2+		AIS 3+		FATAL	
		N	RATE	N	RATE	N	RATE
MALE	62242	3953	6.4	2023	3.3	635	1.0
FEMALE	42682	3267	7.7	1368	3.2	281	0.7
UNKNOWN	1197	7	0.6	6	0.5	1	0.1
OVERALL	106121	7227	6.8	3397	3.2	917	0.9

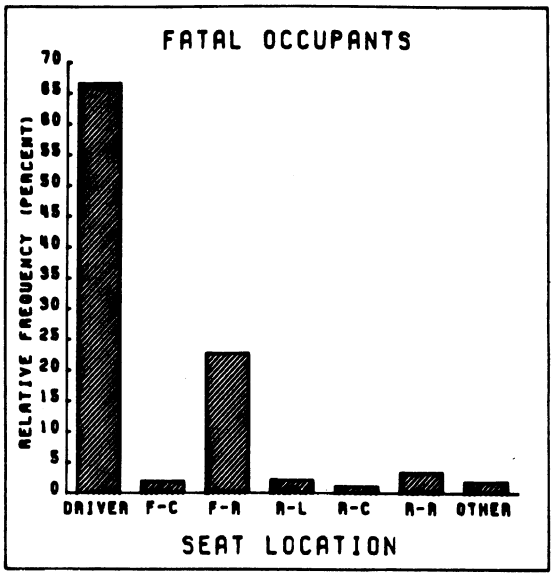


The estimated probability of an injury at the AIS 2 level and above is somewhat greater for a female than a male. However, males have a substantially greater likelihood of incurring a fatal injury.

NCSS OCCUPANT DISTRIBUTIONS BY SEAT LOCATION

SEAT POSITION	OCCUPANTS		AIS 2+		AIS 3+		FATAL	
	N	%	N	%	N	%	N	%
DRIVER	67302	63.4	4430	61.3	2093	61.6	611	66.6
FRONT CENTER	3247	3.1	266	3.7	109	3.2	18	2.0
FRONT RIGHT	22863	21.5	1899	26.3	901	26.5	209	22.8
REAR LEFT	4177	3.9	193	2.7	88	2.6	20	2.2
REAR CENTER	2086	2.0	109	1.5	42	1.2	11	1.2
REAR RIGHT	4974	4.7	229	3.2	123	3.6	31	3.4
OTHER	1472	1.4	101	1.4	41	1.2	17	1.9
TOTAL	106121	100.0	7227	100.0	3397	100.0	917	100.0

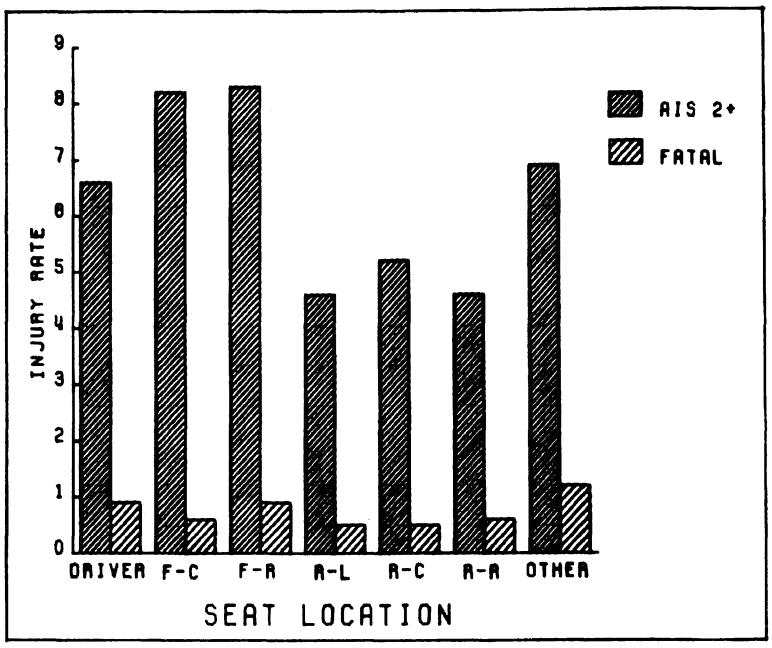




Of all injuries at the AIS 2 and above level, 61.3% of them occur to drivers. These same occupants account for 66.6% of the fatalities.

NCSS INJURY RATES BY OCCUPANT SEAT LOCATION

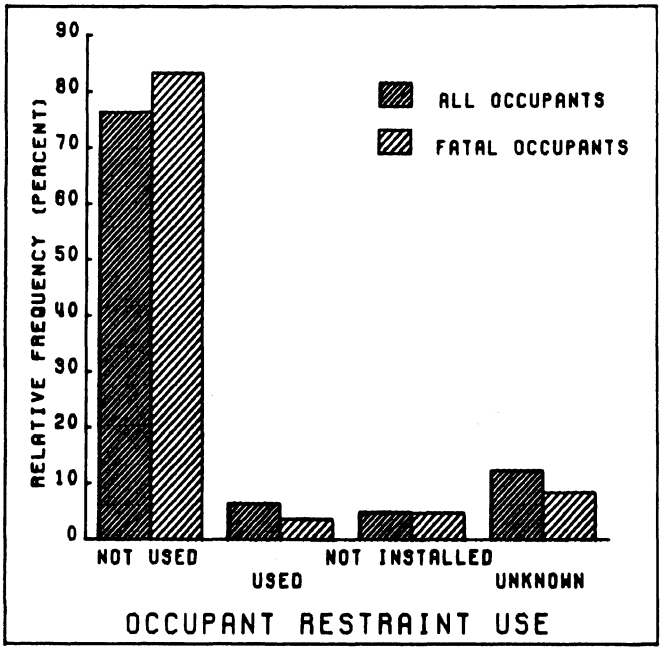
SEAT POSITION	OCCUPANTS	AIS 2+		AIS 3+		FATAL	
		N	RATE	N	RATE	N	RATE
DRIVER	67302	4430	6.6	2093	3.1	611	0.9
FRONT CENTER	3247	266	8.2	109	3.4	18	0.6
FRONT RIGHT	22863	1899	8.3	901	3.9	209	0.9
REAR LEFT	4177	193	4.6	88	2.1	20	0.5
REAR CENTER	2086	109	5.2	42	2.0	11	0.5
REAR RIGHT	4974	229	4.6	123	2.5	31	0.6
OTHER	1472	101	6.9	41	2.8	17	1.2
OVERALL	106121	7227	6.8	3397	3.2	917	0.9



Front-seat occupants have consistently higher injury and fatality rates than rear-seat occupants. The front-right occupant is more likely than the driver to be injured at the AIS 2 or greater level, but has an equal probability of being killed.

NCSS OCCUPANT DISTRIBUTIONS BY RESTRAINT USE

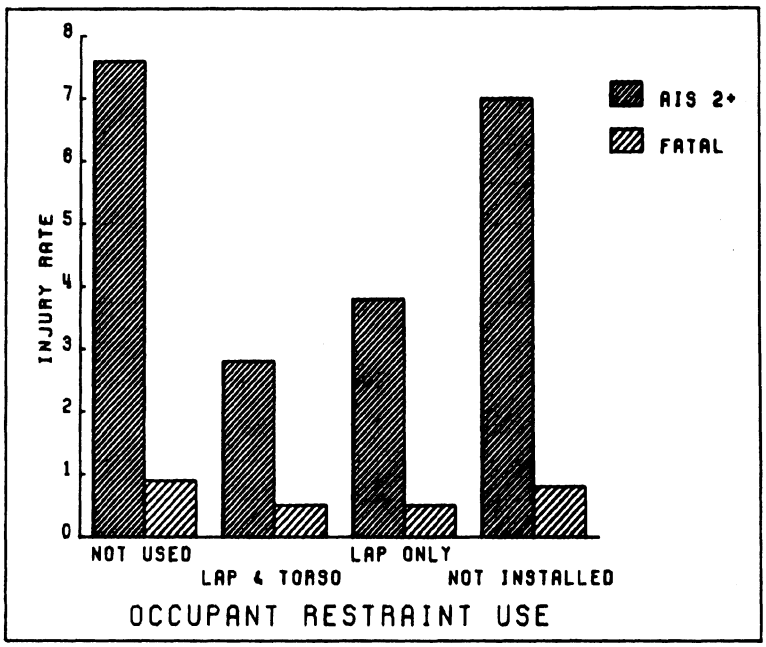
RESTRAINT USE	OCCUPANTS		AIS 2+		AIS 3+		FATAL	
	N	%	N	%	N	%	N	%
NOT USED	81031	76.4	6191	85.7	2928	86.2	764	83.3
LAP AND TORSO	3567	3.4	99	1.4	56	1.6	17	1.9
LAP ONLY	3042	2.9	116	1.6	57	1.7	15	1.6
TORSO ONLY	25	0.0	1	0.0	1	0.0	0	0.0
PASSIVE BELT	101	0.1	3	0.0	2	0.1	1	0.1
CHILD SEAT	143	0.1	4	0.1	2	0.1	0	0.0
NOT INSTALLED	5180	4.9	363	5.0	139	4.1	43	4.7
UNKNOWN	13032	12.3	450	6.2	212	6.2	77	8.4
TOTAL	106121	100.0	7227	100.0	3397	100.0	917	100.0



Only 6.5% of the NCSS case vehicle occupants were positively identified as using restraint systems. Of the fatally injured occupants, 3.6% used a restraint. The "Used" category in the graph combines all restraint types shown in the table. These percentages assume that occupants in the "Unknown" category were not wearing restraints. If this category was restrained at the same rate as the known categories, restraint use would be about 7.4%.

NCSS INJURY RATES BY OCCUPANT RESTRAINT USE

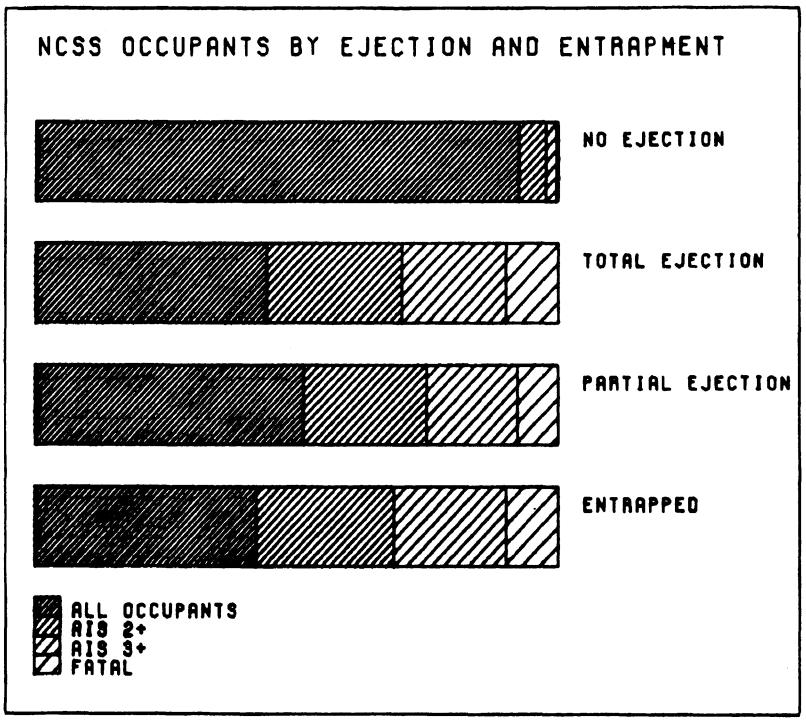
RESTRAINT USE	OCCUPANTS	AIS 2+		AIS 3+		FATAL	
		N	RATE	N	RATE	N	RATE
NOT USED	81031	6191	7.6	2928	3.6	764	0.9
LAP AND TORSO	3567	99	2.8	56	1.6	17	0.5
LAP ONLY	3042	116	3.8	57	1.9	15	0.5
TORSO ONLY	25	1	4.0	1	4.0	0	0.0
PASSIVE BELT	101	3	3.0	2	2.0	1	1.0
CHILD SEAT	143	4	2.8	2	1.4	0	0.0
NOT INSTALLED	5180	363	7.0	139	2.7	43	0.8
UNKNOWN	13032	450	3.5	212	1.6	77	0.6
OVERALL	106121	7227	6.8	3397	3.2	917	0.9



Any kind of restraint use, whether lap and torso or lap only, reduces injury and fatality rates. At the AIS 2 and above level, injury rates for belt users are estimated to be half or less of the rate for non-users. Fatality rates for belt wearers are a little over half the rate for non-wearers. The single fatality for a passive belt user and the resultant high rate should not be construed as predicting a high fatality rate with these restraints. Also see pages 80-81 for the relationship of restraint use and Delta V.

NCSS OCCUPANT DISTRIBUTIONS BY EJECTION AND ENTRAPMENT

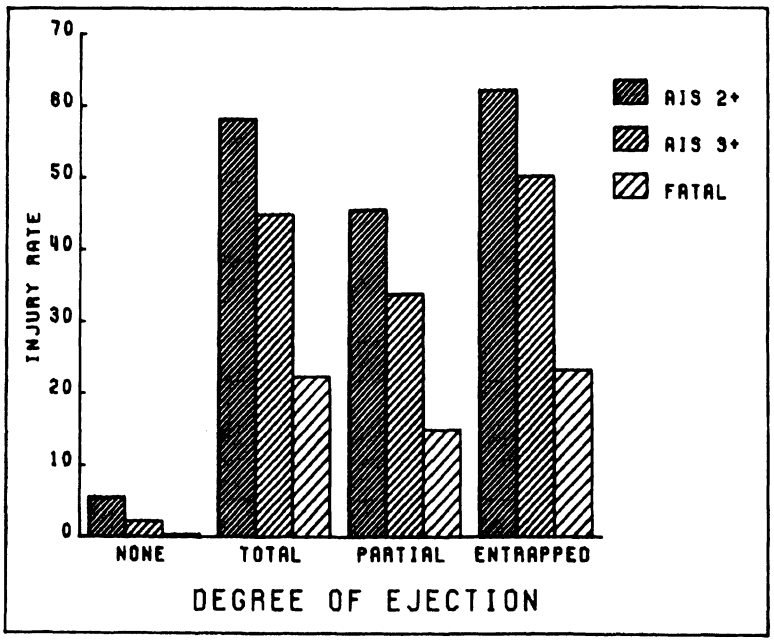
EJECTION/ENTRAPMENT	OCCUPANTS		AIS 2+		AIS 3+		FATAL	
	N	%	N	%	N	%	N	%
NONE	102479	96.6	5730	79.3	2261	66.6	366	39.9
TOTAL EJECTION	797	0.8	464	6.4	358	10.5	178	19.4
PARTIAL EJECTION	228	0.2	104	1.4	77	2.3	34	3.7
ENTRAPPED	667	0.6	415	5.7	335	9.9	155	16.9
OTHER	6	0.0	1	0.0	1	0.0	1	0.1
UNKNOWN	1944	1.8	513	7.1	365	10.7	183	20.0
TOTAL	106121	100.0	7227	100.0	3397	100.0	917	100.0



Ejection and entrapment are relatively rare occurrences, though the "Unknown" category may include some further cases of both. However, among fatally injured occupants both are relatively likely. Only 1% of occupants were ejected but this group accounts for 23.1% of the fatalities.

NCSS INJURY RATES BY OCCUPANT EJECTION AND ENTRAPMENT

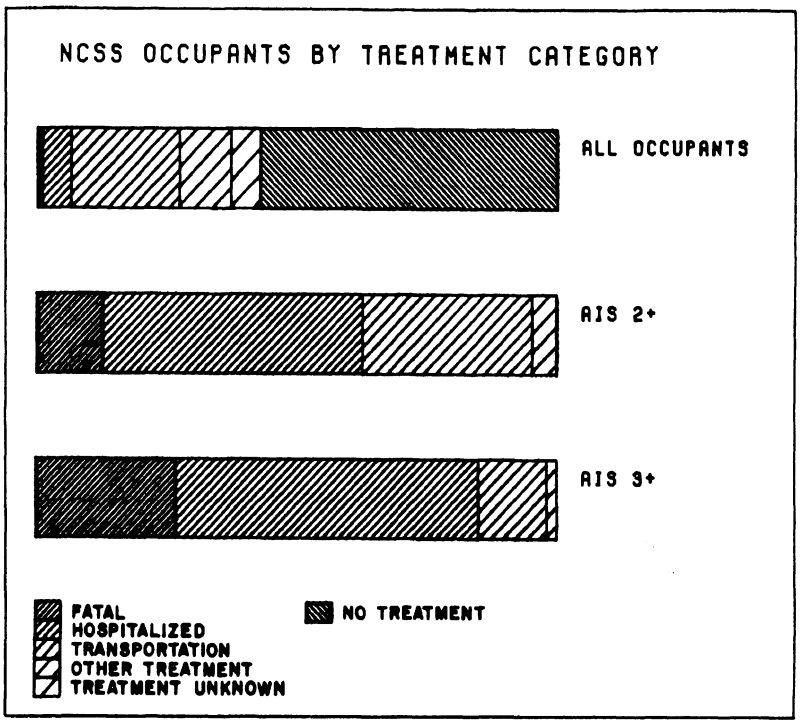
EJECTION/ENTRAPMENT	OCCUPANTS	AIS 2+		AIS 3+		FATAL	
		N	RATE	N	RATE	N	RATE
NONE	102479	5730	5.6	2261	2.2	366	0.4
TOTAL EJECTION	797	464	58.2	358	44.9	178	22.3
PARTIAL EJECTION	228	104	45.6	77	33.8	34	14.9
ENTRAPPED	667	415	62.2	335	50.2	155	23.2
OTHER	6	1	16.7	1	16.7	1	16.7
UNKNOWN	1944	513	26.4	365	18.8	183	9.4
OVERALL	106121	7227	6.8	3397	3.2	917	0.9



Both ejection and entrapment are clearly associated with high injury rates. Moreover, given an injury, that injury is more likely to be fatal for ejected and entrapped occupants than for occupants not ejected or entrapped.

NCSS OCCUPANT DISTRIBUTIONS BY TREATMENT CATEGORY

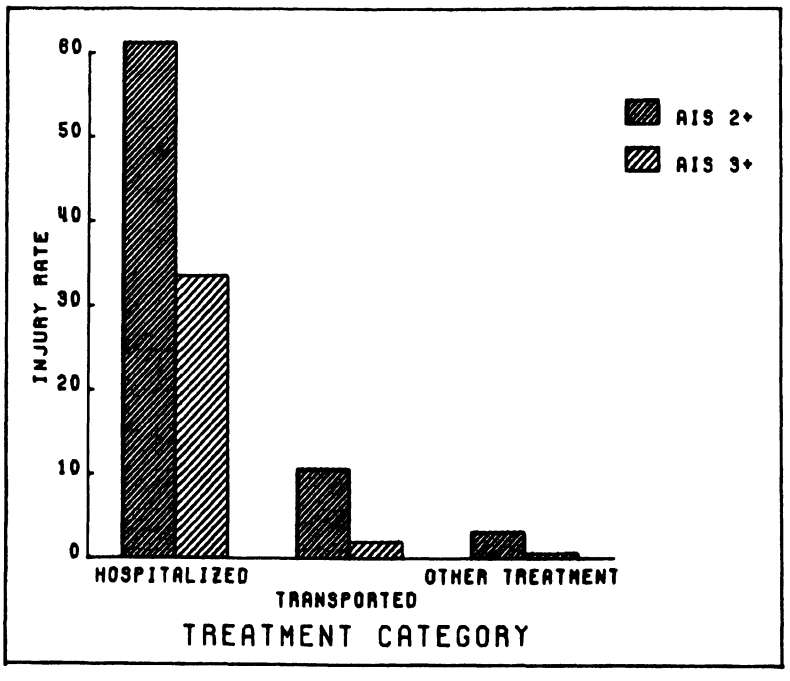
TREATMENT	OCCUPANTS		AIS 2+		AIS 3+		FATAL	
	N	%	N	%	N	%	N	%
FATAL	917	0.9	915	12.7	912	26.8	917	100.0
INJURED								
Hospitalized	5893	5.6	3606	49.9	1974	58.1	0	0.0
Transported	21976	20.7	2359	32.6	445	13.1	0	0.0
Other Treatment	10528	9.9	337	4.7	66	1.9	0	0.0
NOT TRANSPORTED								
Treatment Unknown	5932	5.6	0	0.0	0	0.0	0	0.0
No Treatment	60386	56.9	10	0.1	0	0.0	0	0.0
UNKNOWN	489	0.5	0	0.0	0	0.0	0	0.0
TOTAL	106121	100.0	7227	100.0	3397	100.0	917	100.0



The treatment category for each occupant is related to the sampling strata. The INJURED/HOSPITALIZED category includes those who were taken to a hospital and kept at least overnight. The INJURED/TRANSPORTED category includes occupants who were transported to a medical facility. INJURED/OTHER TREATMENT includes persons not transported to a medical facility, but who may have been treated privately. A small number of AIS 2's and AIS 3's may be seen in this category. The remaining categories are made up mostly of uninjured persons. The 10 persons with an injury of AIS 2 who were Not Transported and Not Treated actually represent only one person so coded with a sampling weight of 10.

NCSS INJURY RATES BY OCCUPANT TREATMENT CATEGORY

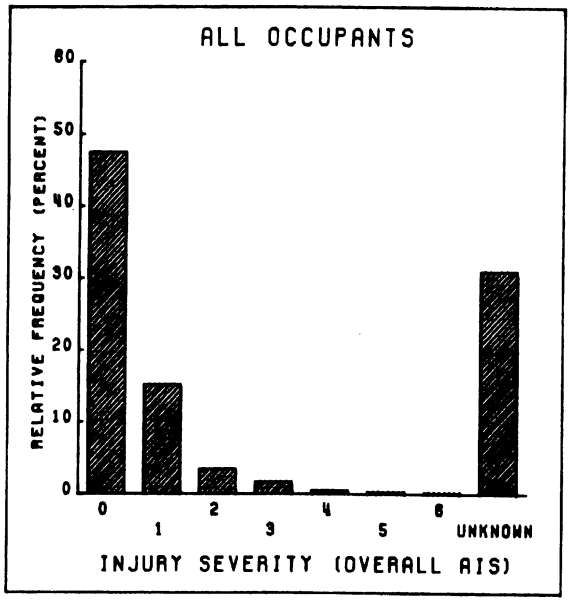
TREATMENT	OCCUPANTS	AIS 2+		AIS 3+		FATAL	
		N	RATE	N	RATE	N	RATE
FATAL	917	915	99.8	912	99.5	917	100.0
INJURED							
Hospitalized	5893	3606	61.2	1974	33.5	0	0.0
Transported	21976	2359	10.7	445	2.0	0	0.0
Other Treatment	10528	337	3.2	66	0.6	0	0.0
NOT TRANSPORTED							
Treatment Unknown	5932	0	0.0	0	0.0	0	0.0
No Treatment	60386	10	0.0	0	0.0	0	0.0
UNKNOWN	489	0	0.0	0	0.0	0	0.0
OVERALL	106121	7227	6.8	3397	3.2	917	0.9

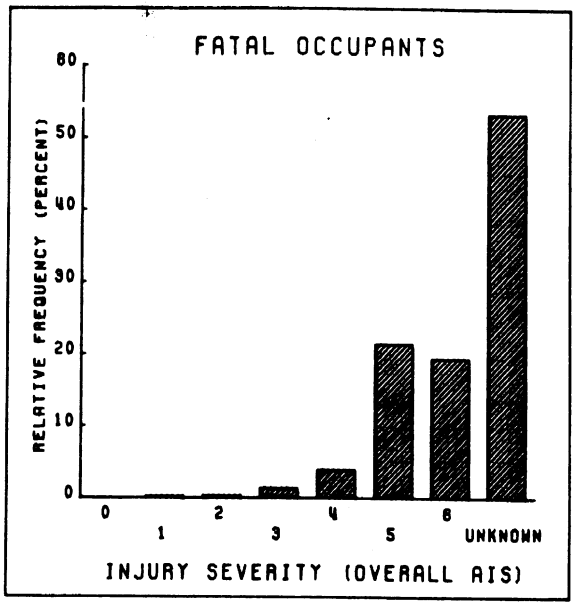


Over 60% of hospitalized occupants received injuries of AIS 2 or higher. One-third of them received AIS 3+ injuries. Of those injured but not transported, 3.2% had injuries of AIS 2 and above.

NCSS OCCUPANT DISTRIBUTIONS BY INJURY SEVERITY (OVERALL AIS)

INJURY SEVERITY	OCCUPANTS		AIS 2+		AIS 3+		FATAL	
	N	%	N	%	N	%	N	%
0 NOT INJURED	50394	47.5	0	0.0	0	0.0	0	0.0
1 MINOR	16159	15.2	0	0.0	0	0.0	2	0.2
2 MODERATE	3749	3.5	3749	51.9	0	0.0	3	0.3
3 SEVERE	1853	1.7	1853	25.6	1853	54.5	13	1.4
4 SERIOUS	488	0.5	488	6.8	488	14.4	36	3.9
5 CRITICAL	346	0.3	346	4.8	346	10.2	196	21.4
6 MAXIMUM-FATAL	178	0.2	178	2.5	178	5.2	178	19.4
7 INJURED/UNK SEV	15089	14.2	610	8.4	529	15.6	489	53.3
UNKNOWN	17865	16.8	3	0.0	3	0.1	0	0.0
TOTAL	106121	100.0	7227	100.0	3397	100.0	917	100.0

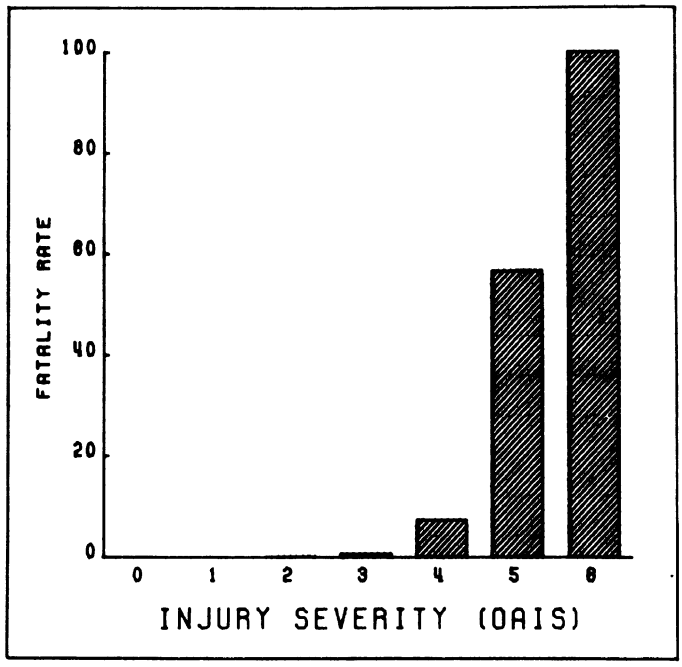




Although injuries lower than AIS 4 are generally considered non-life-threatening, 18 persons died with reported Overall AIS levels less than 4. The large group of persons coded "Injured/Unknown Severity" is made up mainly of persons with police-reported injuries unconfirmed by medical report, but also includes over half of the fatalities. For these cases, no autopsies or other medical documentation were available.

NCSS INJURY RATES BY OCCUPANT INJURY SEVERITY (OVERALL AIS)

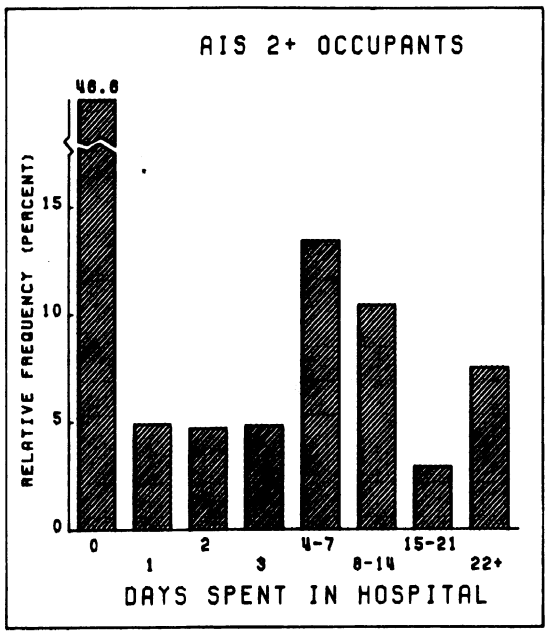
INJURY SEVERITY	OCCUPANTS	AIS 2+		AIS 3+		FATAL	
		N	RATE	N	RATE	N	RATE
0 NOT INJURED	50394	0	0.0	0	0.0	0	0.0
1 MINOR	16159	0	0.0	0	0.0	2	0.0
2 MODERATE	3749	3749	100.0	0	0.0	3	0.1
3 SEVERE	1853	1853	100.0	1853	100.0	13	0.7
4 SERIOUS	488	488	100.0	488	100.0	36	7.4
5 CRITICAL	346	346	100.0	346	100.0	196	56.6
6 MAXIMUM-FATAL	178	178	100.0	178	100.0	178	100.0
7 INJURED/UNK SEV	15089	610	4.0	529	3.5	489	3.2
UNKNOWN	17865	3	0.0	3	0.0	0	0.0
OVERALL	106121	7227	6.8	3397	3.2	917	0.9

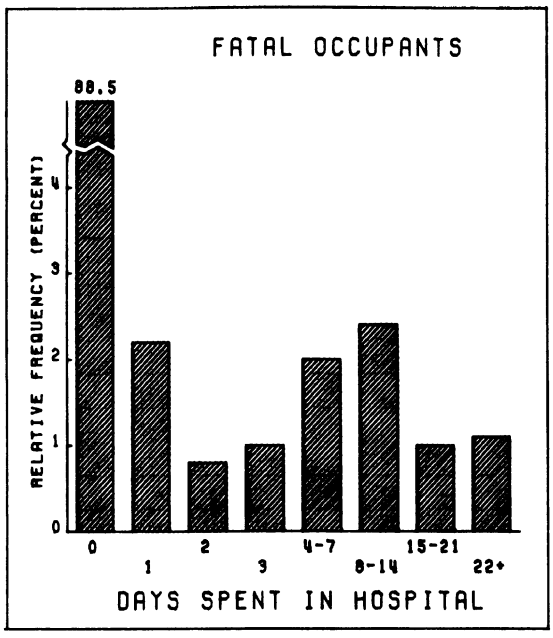


More than half of those with a reported Overall AIS of 5 died, compared with less than 10% of those at AIS 4. AIS 6, of course, is defined as an injury incompatible with life.

NCSS OCCUPANT DISTRIBUTIONS BY DAYS SPENT IN HOSPITAL

DAYS IN HOSPITAL	OCCUPANTS		AIS 2+		AIS 3+		FATAL	
	N	%	N	%	N	%	N	%
NONE	99059	93.3	3369	46.6	1268	37.3	812	88.5
1 DAY	942	0.9	351	4.9	70	2.1	20	2.2
2 DAYS	685	0.6	343	4.7	88	2.6	7	0.8
3 DAYS	655	0.6	345	4.8	132	3.9	9	1.0
4-7 DAYS	1543	1.5	966	13.4	496	14.6	18	2.0
8-14 DAYS	1010	1.0	748	10.4	534	15.7	22	2.4
15-21 DAYS	245	0.2	212	2.9	168	4.9	9	1.0
22-300 DAYS	629	0.6	541	7.5	437	12.9	10	1.1
UNKNOWN	1353	1.3	352	4.9	204	6.0	10	1.1
TOTAL	106121	100.0	7227	100.0	3397	100.0	917	100.0

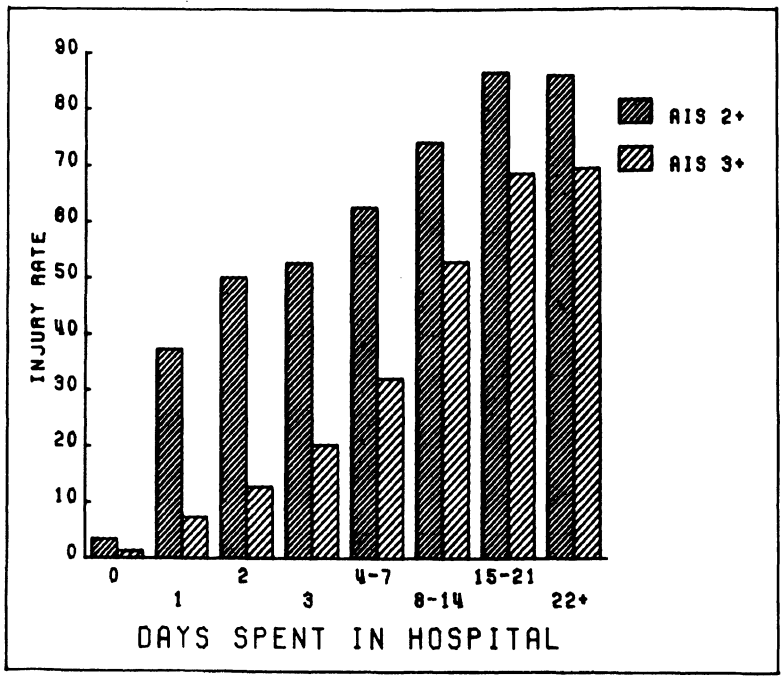




Nearly half of all persons injured at the AIS 2 or greater level were not kept in the hospital overnight. Just over 20% of them, however, spent more than a week in the hospital. Most of those fatally injured were dead at the scene or on arrival at the hospital.

NCSS INJURY RATES BY OCCUPANT DAYS SPENT IN HOSPITAL

DAYS IN HOSPITAL	OCCUPANTS	AIS 2+		AIS 3+		FATAL	
		N	RATE	N	RATE	N	RATE
NONE	99059	3369	3.4	1268	1.3	812	0.8
1 DAY	942	351	37.3	70	7.4	20	2.1
2 DAYS	685	343	50.1	88	12.8	7	1.0
3 DAYS	655	345	52.7	132	20.2	9	1.4
4-7 DAYS	1543	966	62.6	496	32.1	18	1.2
8-14 DAYS	1010	748	74.1	534	52.9	22	2.2
15-21 DAYS	245	212	86.5	168	68.6	9	3.7
22-300 DAYS	629	541	86.0	437	69.5	10	1.6
UNKNOWN	1353	352	26.0	204	15.1	10	0.7
OVERALL	106121	7227	6.8	3397	3.2	917	0.9



The relationship between injury severity and time spent in the hospital is as expected. The AIS 2+ level accounts for only 86% of those spending more than three weeks in the hospital. The remaining 14% were evidently coded with injury severity "Unknown."

Details of injuries sustained by occupants of cars in NCSS accidents are recorded in accordance with the Occupant Injury Classification System. This codification scheme provides for reporting the region of the body involved, the type of injury, the system or organ of the body injured, and the level of injury (the latter as determined by the Abbreviated Injury Scale).

While the OIC provides for considerable detail--identifying separately the thigh, knee, leg, and ankle, for example--the tables presented in this section have grouped the original data into major body regions and systems. The information on the following eight pages shows distributions of injury regions, types, and systems for: (1) all injuries taken together, (2) each AIS level from 1 (minor) to 6 (fatal--maximum), and (3) injuries for which AIS level was unreported but other information was known.

For all tables the total number of injuries vary somewhat from table to table with a given AIS level because of unreported data elements, Body Region and System/Organ tables usually having the highest counts. The lower numbers for Injury Type mean that this item was sometimes not determined even though the region was known.

As contrasted with most of the other tables in this report, the injury data are presented as actual or unweighted values. At AIS Level 3 and above, the unweighted values will not be substantially different from weighted ones.

One caution in interpreting the injury statistic is that there is a substantial amount of missing injury information. This results, in part, from the practice of requiring coded injury information to have come from qualified medical sources (hopefully ensuring good quality data), but thus missing some less qualified injury information. Injury information is missing at both ends of the injury severity range--low injuries because occupants were not available or medical records could not be obtained, and fatalities because many of the fatally injured occupants were not autopsied or otherwise reviewed by a medical examiner. Finally, the NCSS investigation protocol called for recording only three specific injuries. More severely injured persons may have had numerous lower-level injuries unreported; thus the total injury counts shown--particularly at AIS 1 and AIS 2--are probably low.

DISTRIBUTIONS OF ALL INJURIES IN THE NCSS DATA

INJURY BY BODY REGION

BODY REGION	NUMBER	PERCENT
HEAD	11.436	41.0
LEG	5,347	19.2
ARM	4,008	14.4
CHEST/THORAX	2,869	10.3
NECK	1,980	7.1
BACK	1,090	3.9
ABDOMEN	1,072	3.8
WHOLE BODY	96	0.3
TOTAL	27,898	100.0

INJURY BY TYPE

INJURY TYPE	NUMBER	PERCENT
CONTUSION	6,704	24.1
LACERATION	6,354	22.9
FRACTURE	4,346	15.7
PAIN	2,871	10.3
ABRASION	2,818	10.2
CONCUSSION	2,153	7.8
OTHER	1,963	7.1
DISLOCATION	291	1.0
SPRAIN	263	0.9
TOTAL	27,763	100.0

INJURY BY SYSTEM/ORGAN

SYSTEM/ORGAN	NUMBER	PERCENT
ALL SYSTEMS	87	0.3
SKELETAL	5459	19.6
DIGESTIVE	1117	4.0
NERVOUS	3109	11.2
CARDIOVASCULAR	351	1.3
RESPIRATORY	1309	4.7
UROGENITAL	178	0.6
MUSCULAR	3902	14.0
SKIN	12273	44.2
TOTAL	27,785	99.9

The most common injuries are contusions and lacerations, and the most common body region injured is the head. Injuries to the skin constitute the largest group in the SYSTEM/ORGAN table and these correspond to the lacerations and contusions in the INJURY BY TYPE table.

TEN MOST FREQUENT INJURIES COMMON AT ALL LEVELS

RANK	BODY REGION	INJURY TYPE	SYSTEM/ ORGAN	NUMBER OF INJURIES
1	HEAD	LACERATION	SKIN	3,008
2	HEAD	CONCUSSION	NERVOUS	2,153
3	HEAD	CONTUSION	SKIN	1,682
4	LEG	FRACTURE	SKELETAL	1,210
5	ARM	CONTUSION	SKIN	1,025
6	LEG	CONTUSION	SKIN	1,013
7	LEG	ABRASION	SKIN	920
8	ARM	FRACTURE	SKELETAL	878
9	NECK	PAIN	MUSCULAR	876
10	THORAX	FRACTURE	SKELETAL	865

The MOST FREQUENT INJURIES table shows skin lacerations to be the most common specific injury. In the same table, concussion of the brain is shown as the second-most-frequent specific injury. This category includes 281 injuries for which AIS level was unknown (see page 75). The determination of the AIS code for this condition depends on knowledge of how long the person was unconscious. Frequently this is not determined.

DISTRIBUTIONS OF AIS LEVEL 1 INJURIES IN THE NCSS DATA

INJURY BY BODY REGION

BODY REGION	NUMBER	PERCENT
HEAD	8238	43.0
LEG	3659	19.1
ARM	2905	15.2
THORAX	1298	6.8
NECK	1702	8.9
BACK	875	4.6
ABDOMEN	372	1.9
WHOLE BODY	89	.5
TOTAL	19138	100.0

INJURY BY TYPE

INJURY TYPE	NUMBER	PERCENT
CONTUSION	6111	31.7
LACERATION	4974	25.8
FRACTURE	421	2.2
PAIN	2871	14.9
ABRASION	2793	14.5
CONCUSSION	850	4.4
OTHER	1210	6.3
DISLOCATION	14	0.1
SPRAIN	23	0.1
TOTAL	19267	100.0

INJURY BY SYSTEM/ORGAN

SYSTEM/ORGAN	NUMBER	PERCENT
SKELETAL	1081	5.6
DIGESTIVE	692	3.6
NERVOUS	1428	7.4
RESPIRATORY	679	3.5
UROGENITAL	3	0.0
MUSCULAR	3882	20.1
SKIN	11506	59.7
TOTAL	19271	100.0

TEN MOST FREQUENT INJURIES COMMON AT AIS LEVEL 1

RANK	BODY REGION	INJURY TYPE	SYSTEM/ ORGAN	NUMBER OF INJURIES
1	HEAD	LACERATION	SKIN	2557
2	HEAD	CONTUSION	SKIN	1662
3	ARM	CONTUSION	SKIN	1021
4	LEG	CONTUSION	SKIN	1001
5	LEG	ABRASION	SKIN	915
6	NECK	PAIN	MUSCULAR	876
7	HEAD	CONCUSSION	NERVOUS	850
8	HEAD	ABRASION	SKIN	835
9	THORAX	CONTUSION	SKIN	775
10	LEG	CONTUSION	SKELETAL	730

The most common injury at AIS Level 1 is a cut on the head followed by a contusion to the head. Fractures are relatively rare since the only fractures coded as Level 1 are those to the fingers, toes, and teeth.

DISTRIBUTIONS OF AIS LEVEL 2 INJURIES IN THE NCSS DATA

INJURY BY BODY REGION

BODY REGION	NUMBER	PERCENT
HEAD	2053	50.1
LEG	879	21.4
ARM	707	17.2
THORAX	259	6.3
NECK	37	.9
BACK	148	3.6
ABDOMEN	16	.4
WHOLE BODY	1	0.0
TOTAL	4100	100.0

INJURY BY BODY TYPE

INJURY TYPE	NUMBER	PERCENT
CONTUSSION	104	2.5
LACERATION	841	20.5
FRACTURE	1930	47.1
ABRASION	25	.6
CONCUSSION	803	19.6
OTHER	138	3.4
DISLOCATION	37	.9
SPRAIN	220	5.4
TOTAL	4098	100.0

INJURY BY SYSTEM/ORGAN

SYSTEM/ORGAN	NUMBER	PERCENT
ALL SYSTEMS	4	.1
SKELETAL	2087	51.0
DIGESTIVE	156	3.8
NERVOUS	924	22.5
RESPIRATORY	169	4.1
UROGENITAL	1	0.0
MUSCULAR	14	.3
SKIN	744	18.2
TOTAL	4099	100.0

TEN MOST FREQUENT INJURIES COMMON AT AIS LEVEL 2

RANK	BODY REGION	INJURY TYPE	SYSTEM/ ORGAN	NUMBER OF INJURIES
1	HEAD	CONCUSSION	NERVOUS	803
2	LEG	FRACTURE	SKELETAL	601
3	ARM	FRACTURE	SKELETAL	527
4	HEAD	LACERATION	SKIN	443
5	HEAD	FRACTURE	SKELETAL	302
6	THORAX	FRACTURE	SKELETAL	236
7	HEAD	LACERATION	DIGESTIVE	143
8	LEG	SPRAIN	SKELETAL	140
9	BACK	FRACTURE	SKELETAL	139
10	HEAD	FRACTURE	RESPIRATORY	119

Fractures predominate at AIS Level 2. This is partly the result of the coding system, as the most simple fractures are assigned to this level.

DISTRIBUTIONS OF AIS LEVEL 3 INJURIES IN THE NCSS DATA

INJURY BY BODY REGION

BODY REGION	NUMBER	PERCENT
HEAD	258	10.2
LEG	661	26.1
ARM	323	12.8
THORAX	926	36.6
NECK	106	4.2
BACK	47	1.9
ABDOMEN	210	8.3
TOTAL	2531	100.0

INJURY BY TYPE

INJURY TYPE	NUMBER	PERCENT
CONTUSION	298	11.8
LACERATION	76	3.0
FRACTURE	1553	61.3
CONCUSSION	74	2.9
OTHER	294	11.6
DISLOCATION	219	8.6
SPRAIN	18	.7
TOTAL	2532	100.0

INJURY BY SYSTEM/ORGAN

SYSTEM/ORGAN	NUMBER	PERCENT
SKELETAL	1832	72.4
DIGESTIVE	21	.8
NERVOUS	100	3.9
CARDIOVASCULAR	46	1.8
RESPIRATORY	364	14.4
UROGENITAL	147	5.8
MUSCULAR	6	.2
SKIN	16	.6
TOTAL	2532	100.0

TEN MOST FREQUENT INJURIES COMMON AT AIS LEVEL 3

RANK	BODY REGION	INJURY TYPE	SYSTEM/ ORGAN	NUMBER OF INJURIES
1	THORAX	FRACTURE	SKELETAL	569
2	LEG	FRACTURE	SKELETAL	467
3	ARM	FRACTURE	SKELETAL	244
4	THORAX	OTHER	RESPIRATORY	158
5	HEAD	FRACTURE	SKELETAL	150
6	THORAX	CONTUSION	RESPIRATORY	145
7	LEG	DISLOCATION	SKELETAL	139
8	ABDOMEN	CONTUSION	UROGENITAL	133
9	NECK	FRACTURE	SKELETAL	78
10	HEAD	CONCUSSION	NERVOUS	74

Level 3 injuries, defined as severe but generally not life-threatening, are dominated by the chest and leg regions. These are most often fractures, but typically involve joints or displaced rib fractures.

DISTRIBUTIONS OF AIS LEVEL 4 INJURIES IN THE NCSS DATA

INJURY BY BODY REGION

BODY REGION	NUMBER	PERCENT
HEAD	202	24.7
LEG	135	16.5
ARM	60	7.3
THORAX	158	19.2
NECK	11	1.3
BACK	8	1.0
ABDOMEN	245	29.9
TOTAL	819	100.0

INJURY BY TYPE

INJURY TYPE	NUMBER	PERCENT
CONTUSION	92	11.2
LACERATION	149	18.1
FRACTURE	350	42.7
CONCUSSION	59	7.2
OTHER	167	20.4
DISLOCATION	2	.2
TOTAL	819	100.0

INJURY BY SYSTEM/ORGAN

SYSTEM/ORGAN	NUMBER	PERCENT
ALL SYSTEMS	6	.7
SKELETAL	346	42.2
DIGESTIVE	102	12.5
NERVOUS	114	13.9
CARDIOVASCULAR	178	21.7
RESPIRATORY	64	7.8
UROGENITAL	8	1.0
SKIN	1	.1
TOTAL	819	100.0

TEN MOST FREQUENT INJURIES COMMON AT AIS LEVEL 4

RANK	BODY REGION	INJURY TYPE	SYSTEM/ ORGAN	NUMBER OF INJURIES
1	LEG	FRACTURE	SKELETAL	128
2	ABDOMEN	RUPTURE	CARDIOVASCULAR	94
3	ABDOMEN	LACERATION	DIGESTIVE	90
4	HEAD	FRACTURE	SKELETAL	88
5	THORAX	FRACTURE	SKELETAL	60
6	HEAD	CONCUSSION	NERVOUS	59
7	ARM	FRACTURE	SKELETAL	58
8	HEAD	CONTUSION	NERVOUS	50
9	ABDOMEN	LACERATION	CARDIOVASCULAR	41
10	THORAX	CONTUSION	CARDIOVASCULAR	31

AIS Level 4 injuries are considered life-threatening. The most common body region is the abdomen, but the most common combination is a leg fracture. Rupture or laceration in the cardiovascular and digestive system are the next most frequent. Of persons whose most severe injury was at this level, 7.4% died (see page 63).

DISTRIBUTIONS OF AIS LEVEL 5 INJURIES IN THE NCSS DATA

INJURY BY BODY REGION

BODY REGION	NUMBER	PERCENT
HEAD	210	38.3
LEG	1	.2
THORAX	139	25.4
NECK	22	4.0
BACK	6	1.1
ABDOMEN	168	30.7
WHOLE BODY	2	.4
TOTAL	548	100.0

INJURY BY TYPE

INJURY TYPE	NUMBER	PERCENT
CONTUSION	99	18.1
LACERATION	279	51.0
FRACTURE	19	3.5
CONCUSSION	84	15.3
OTHER	54	9.9
DISLOCATION	9	1.6
TOTAL	548	100.0

INJURY BY SYSTEM/ORGAN

SYSTEM/ORGAN	NUMBER	PERCENT
SKELETAL	28	5.1
DIGESTIVE	143	26.0
NERVOUS	209	38.1
CARDIOVASCULAR	123	22.4
RESPIRATORY	26	4.7
UROGENITAL	17	3.1
SKIN	2	.4
TOTAL	548	100.0

TEN MOST FREQUENT INJURIES COMMON AT AIS LEVEL 5

RANK	BODY REGION	INJURY TYPE	SYSTEM/ ORGAN	NUMBER OF INJURIES
1	ABDOMEN	LACERATION	DIGESTIVE	112
2	THORAX	LACERATION	CARDIOVASCULAR	102
3	HEAD	CONTUSION	NERVOUS	96
4	HEAD	CONCUSSION	NERVOUS	84
5	ABDOMEN	RUPTURE	DIGESTIVE	29
6	HEAD	LACERATION	NERVOUS	26
7	THORAX	LACERATION	RESPIRATORY	22
8	NECK	FRACTURE	SKELETAL	11
9	THORAX	RUPTURE	CARDIOVASCULAR	9
10	NECK	DISLOCATION	SKELETAL	8

AIS Level 5 injuries are designated "critical" and are indeed life-threatening. More than half of the occupants with Level 5 injuries died (see page 63). The most common injury at this level was a laceration of the digestive system in the abdominal area, but laceration of the cardiovascular system was also frequent.

DISTRIBUTIONS OF AIS LEVEL 6 INJURIES IN THE NCSS DATA

INJURY BY BODY REGION

BODY REGION	NUMBER	PERCENT
HEAD	63	29.7
THORAX	49	23.1
NECK	92	43.4
BACK	2	.9
ABDOMEN	3	1.4
WHOLE BODY	3	1.4
TOTAL	212	100.0

INJURY BY TYPE

INJURY TYPE	NUMBER	PERCENT
LACERATION	35	16.5
FRACTURE	72	34.0
CONCUSSION	2	.9
OTHER	29	13.7
DISLOCATION	10	4.7
SPRAIN	1	.5
TOTAL	212	100.0

INJURY BY SYSTEM/ORGAN

SYSTEM/ORGAN	NUMBER	PERCENT
ALL SYSTEMS	77	36.3
SKELETAL	83	39.2
NERVOUS	48	22.6
CARDIOVASCULAR	3	1.4
SKIN	1	.5
TOTAL	212	100.0

TEN MOST FREQUENT INJURIES COMMON AT AIS LEVEL 6

RANK	BODY REGION	INJURY TYPE	SYSTEM/ ORGAN	NUMBER OF INJURIES
1	NECK	FRACTURE	SKELETAL	71
2	THORAX	CRUSH	ALL SYSTEMS	46
3	HEAD	LACERATION	NERVOUS	23
4	HEAD	CRUSH	ALL SYSTEMS	22
5	NECK	DISLOCATION	SKELETAL	10
6	NECK	LACERATION	NERVOUS	10
7	HEAD	AVULSION	NERVOUS	7
8	HEAD	HEMORRHAGE	NERVOUS	6
9	BACK	AMPUTATION	ALL SYSTEMS	2
10	ABDOMEN	CRUSH	ALL SYSTEMS	2

AIS Level 6 injuries are designated "Maximum--Currently Not Treatable." The most common of these was a fractured neck. All of the 178 persons in the NCSS study who were reported to have sustained Level 6 injuries died.

DISTRIBUTIONS OF UNKNOWN LEVEL INJURIES IN THE NCSS DATA

INJURY BY BODY REGION

BODY REGION	NUMBER	PERCENT
HEAD	412	74.9
LEG	12	2.2
ARM	13	2.4
THORAX	40	7.3
NECK	10	1.8
BACK	4	.7
ABDOMEN	58	10.5
WHOLE BODY	1	.2
TOTAL	550	100.0

INJURY BY TYPE

INJURY TYPE	NUMBER	PERCENT
FRACTURE	1	.3
CONCUSSION	281	97.9
OTHER	4	1.4
SPRAIN	1	.3
TOTAL	287	100.0

INJURY BY SYSTEM/ORGAN

SYSTEM/ORGAN	NUMBER	PERCENT
SKELETAL	2	.7
DIGESTIVE	3	1.0
NERVOUS	286	94.1
CARDIOVASCULAR	1	.3
RESPIRATORY	7	2.3
UROGENITAL	2	.7
SKIN	3	1.0
TOTAL	304	100.0

In coding injury data, the accident investigators were occasionally able to identify the body region, injury type, or system/organ involved, but could not determine the appropriate AIS level. Most frequently this uncertainty arose in connection with concussions, and it might be assumed that most of these were at either Level 2 or Level 3.

TEN MOST FREQUENT INJURIES COMMON AT UNKNOWN LEVEL

RANK	BODY REGION	INJURY TYPE	SYSTEM/ ORGAN	NUMBER OF INJURIES
1	HEAD	CONCUSSION	NERVOUS	281
2	HEAD	UNKNOWN	UNKNOWN	124
3	ABDOMEN	UNKNOWN	UNKNOWN	51
4	THORAX	UNKNOWN	UNKNOWN	38
5	ARM	UNKNOWN	UNKNOWN	12
6	LEG	UNKNOWN	UNKNOWN	11
7	UNKNOWN	UNKNOWN	UNKNOWN	8
8	NECK	UNKNOWN	UNKNOWN	5
9	NECK	ASPHYXIATION	RESPIRATORY	4
10	HEAD	UNKNOWN	NERVOUS	4

If the majority of the unknown-level concussions were at Level 2, this would leave the order of the TEN MOST FREQUENT INJURIES at that level unchanged (see page 70). But if these unknown-level concussions were at Level 3, this would probably change the ranking of the Level 3 injuries (see page 71).

A unique feature of the NCSS data set is the inclusion of a crash severity measure estimating the instantaneous change of velocity for each vehicle during the impact phase. This quantity, referred to as Delta V, is computed from a combination of information about the collision configuration (from the Collision Deformation Classification code), the crush measurements (as provided by the investigator), and certain vehicle parameters (size, weight, and stiffness). Certain crashes, such as those involving principal rollover or other non-horizontal motions, cannot have a value for Delta V computed. In other cases, the investigators were not able to gather sufficient information for the full computation. The computer algorithm which calculates Delta V is the CRASH2 program.[1]

For approximately 45% of the passenger cars investigated during the twenty-seven months of the NCSS program, a value for Delta V has been computed and recorded in the computerized file.[2] The Delta V distributions shown in this section for passenger cars may be biased because of the missing cases. Reasons for missing data include: a low-severity crash in which the "other vehicle" was so lightly damaged that it was unavailable to the investigator for inspection, or complex multiple impacts in severe crashes for which the damage dimension assignable to the initial impact could not be determined. The first of these might bias the distribution shown here toward higher Delta V's, while the second might move the Delta V distribution toward lower values. One large portion of the 55% missing data on Delta V is the 21% missing data on General Area of Damage. The footnotes to the tables on pages 82 through 91 describe missing Delta V for vehicles with known areas of damage.

Pages 78 through 81 show the frequency distribution of Delta V for rural versus urban accident locations, and for restrained and unrestrained occupants. Substantial differences in the distribution of Delta V for rural and urban accident locations can be seen. Pages 82 to 91 show the cumulative frequency distribution and injury rates for occupants of passenger cars with different damage areas. Finally, pages 92 and 93 show distributions of Delta V for various NCSS treatment categories and Overall AIS levels.

---

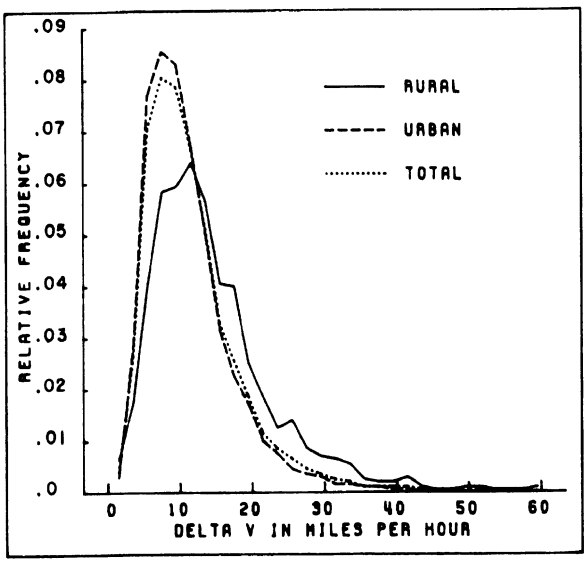
[1]For further detail, see R. R. McHenry and J. P. Lynch, CRASH2 Users Manual, DOT/HS 802-106, November 1976.

[2]All the values presented here resulted from the "damage only" runs of the CRASH2 algorithm.

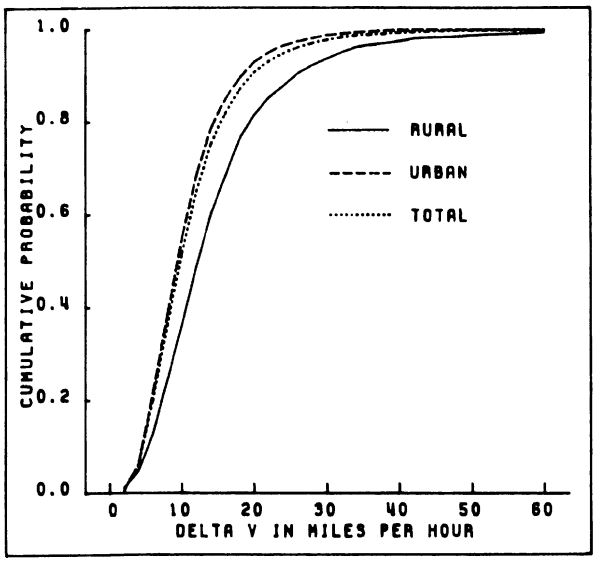
CRASH SEVERITY (DELTA V) BY RURAL/URBAN ACCIDENT LOCATION

DELTA V	RURAL	URBAN	TOTAL
1-10 MPH	2027	13799	15826
(ROW %)	12.8	87.2	100.0
(COL %)	36.5	55.4	52.0
11-20 MPH	2514	9364	11878
(ROW %)	21.2	78.8	100.0
(COL %)	45.2	37.6	39.0
21-30 MPH	673	1397	2070
(ROW %)	32.5	67.5	100.0
(COL %)	12.1	5.6	6.8
31-40 MPH	213	251	464
(ROW %)	45.9	54.1	100.0
(COL %)	3.8	1.0	1.5
41-50 MPH	71	57	128
(ROW %)	55.5	44.5	100.0
(COL %)	1.3	0.2	0.4
51-60 MPH	39	15	54
(ROW %)	72.2	27.8	100.0
(COL %)	0.7	0.1	0.2
61-70 MPH	14	7	21
(ROW %)	66.7	33.3	100.0
(COL %)	0.3	0.0	0.1
71-99 MPH	6	5	11
(ROW %)	54.5	45.5	100.0
(COL %)	0.1	0.0	0.0
TOTAL	5557	24895	30452
(ROW %)	18.2	81.8	100.0
(COL %)	100.0	100.0	100.0

The rural/urban variable is coded by the investigator at the scene of the accident and depends on such factors as the density of buildings. The graphs on the following page were plotted at increments of 2 MPH.



On the frequency graph, the rural distribution is always to the right of the urban distribution, because rural accidents have consistently higher Delta V's than urban accidents. This can be ascribed to the higher driving speeds on rural roads. In the total distribution, however, the effect of rural accidents is swamped by the far larger number of urban accidents.

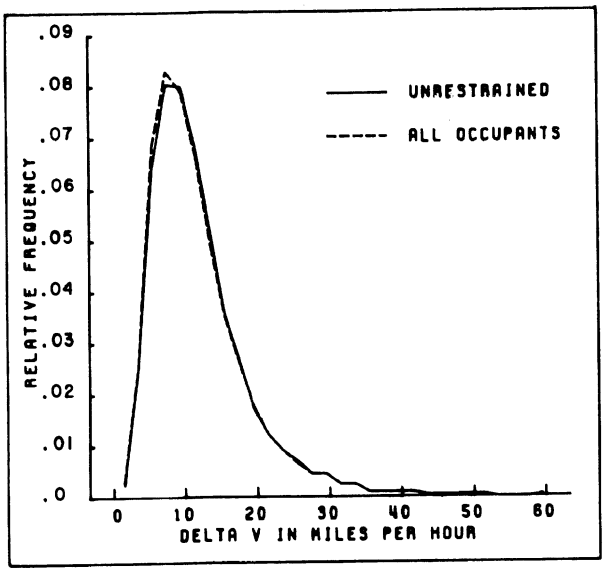


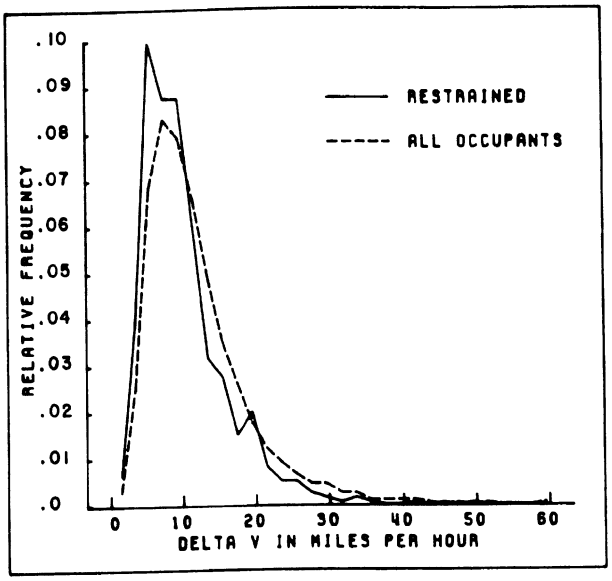
The cumulative distribution shows essentially the same effect: a larger proportion of accidents occur at higher Delta V's, and once again, the total distribution is very close to the urban.

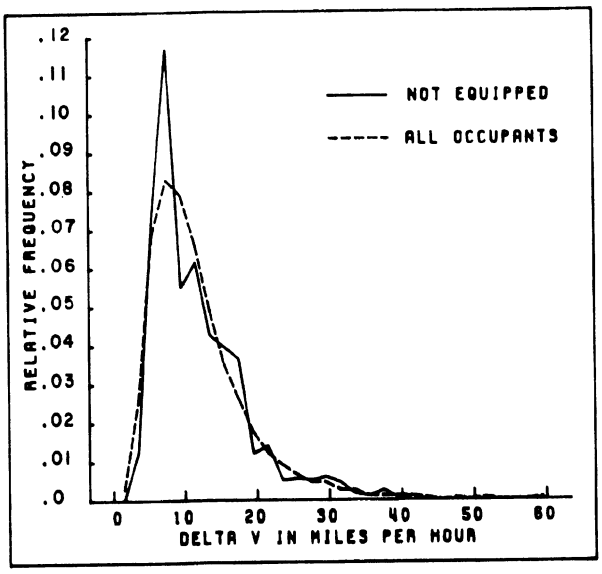
CRASH SEVERITY (DELTA V) BY RESTRAINT USAGE

DELTA V	UNRESTRAINED	RESTRAINED	NOT EQUIPPED	UNKNOWN	TOTAL
1-10 MPH	19767	2236	1467	1393	24863
(Row %)	79.5	9.0	5.9	5.6	100.0
(Col %)	50.5	61.2	52.2	53.8	51.8
11-20 MPH	15503	1067	1081	941	18592
(Row %)	83.4	5.7	5.8	5.1	100.0
(Col %)	39.6	30.6	38.5	36.4	38.7
21-30 MPH	2922	154	202	205	3483
(Row %)	83.9	4.4	5.8	5.9	100.0
(Col %)	7.5	4.4	7.2	7.9	7.3
31-40 MPH	645	18	55	29	747
(Row %)	86.3	2.4	7.4	3.9	100.0
(Col %)	1.6	0.5	2.0	1.1	1.6
41-50 MPH	172	7	5	9	193
(Row %)	89.1	3.6	2.6	4.7	100.0
(Col %)	0.4	0.2	0.2	0.3	0.4
51-60 MPH	88	1	0	8	97
(Row %)	90.7	1.0	0.0	8.2	100.0
(Col %)	0.2	0.0	0.0	0.3	0.2
61-70 MPH	38	2	1	1	42
(Row %)	90.5	4.8	2.4	2.4	100.0
(Col %)	0.1	0.1	0.0	0.0	0.1
71-99 MPH	13	0	0	1	14
(Row %)	92.9	0.0	0.0	7.1	100.0
(Col %)	0.0	0.0	0.0	0.0	0.0
TOTAL	39148	3485	2811	2587	48031
(Row %)	81.5	7.2	5.9	5.4	100.0
(Col %)	100.0	100.0	100.0	100.0	100.0

For the graphs on the following page Delta V was plotted at increments of 2 MPH.





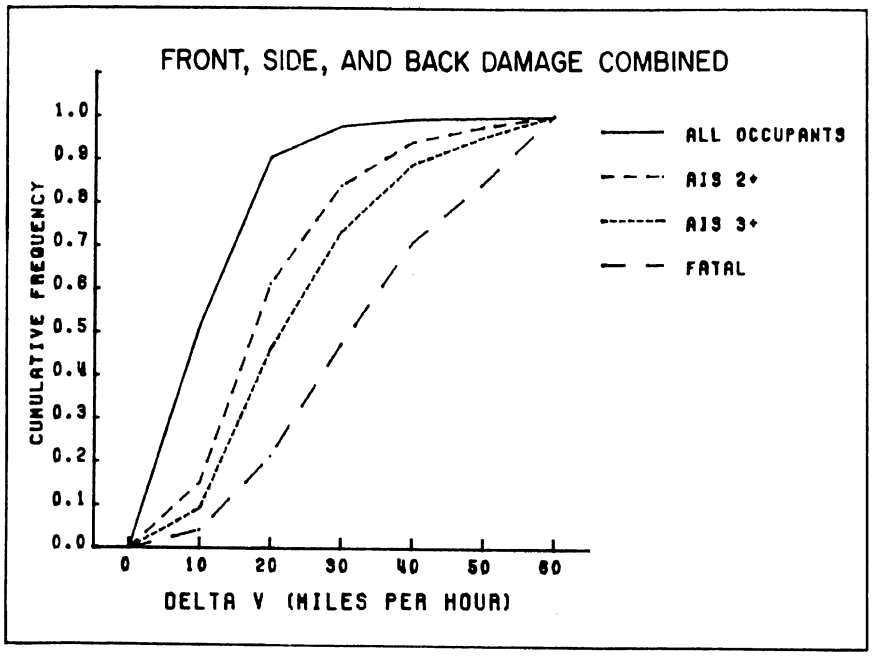


Restrained occupants are only a small proportion (less than 10%) of all occupants in this study. So the Delta V distribution for unrestrained looks essentially the same as for the total, but the restrained occupants are in a relatively lower severity group of accidents. It would be important to account for this difference in any evaluation of the effectiveness of the restraint systems. The distribution for the not-equipped subset is rather jagged, making interpretation difficult.

NCSS CASE VEHICLE CRASH SEVERITY DISTRIBUTIONS (FRONT, SIDE, AND BACK DAMAGE COMBINED)

TOTAL DELTA V IN 10 MPH GROUPS	VEHICLES		OCCUPANTS							
			TOTAL		AIS 2+		AIS 3+		FATAL	
	N	%	N	%	N	%	N	%	N	%
1-10 MPH	15685	51.9	24665	51.7	585	15.2	165	9.3	19	4.3
11-20 MPH	11836	39.1	18531	38.8	1765	46.0	656	36.9	76	17.0
21-30 MPH	2055	6.8	3454	7.2	874	22.8	481	27.1	116	26.0
31-40 MPH	459	1.5	740	1.6	383	10.0	275	15.5	105	23.5
41-50 MPH	127	0.4	192	0.4	135	3.5	112	6.3	61	13.7
OVER 50 MPH	86	0.3	153	0.3	99	2.6	87	4.9	69	15.5
TOTAL	30248	100.0	47735	100.0	3841	100.0	1776	100.0	446	100.0

*Not shown in this tabulation are 20,545 case vehicles (40%) which are missing data for Delta V because there was insufficient information for the calculation, or the CRASH program algorithm was not applicable.

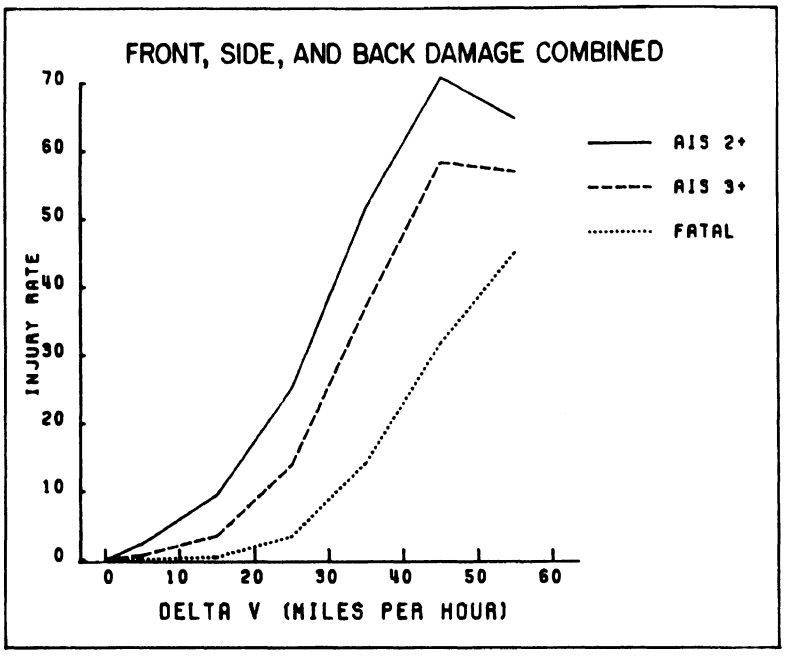


The small number of vehicles coded for other than front, side, and back damage have been deleted from this table and graph. The graph shows that about 50% of all occupants of NCSS case vehicles are subjected to Delta V's of less than 10 miles per hour. For fatally injured occupants the median point is a little over 30 miles per hour.

NCSS INJURY RATES BY CRASH SEVERITY (FRONT, SIDE, AND BACK DAMAGE COMBINED)

TOTAL DELTA V IN 10 MPH GROUPS	VEHICLES	OCCUPANTS							
		TOTAL	AIS 2+		AIS 3+		FATAL	
			N	RATE	N	RATE	N	RATE
1-10 MPH	15685	24665	585	2.4	165	0.7	19	0.1
11-20 MPH	11836	18531	1765	9.5	656	3.5	76	0.4
21-30 MPH	2055	3454	874	25.3	481	13.9	116	3.4
31-40 MPH	459	740	383	51.8	275	37.2	105	14.2
41-50 MPH	127	192	135	70.3	112	58.3	61	31.8
OVER 50 MPH	86	153	99	64.7	87	56.9	69	45.1
OVERALL	30248	47735	3841	8.0	1776	3.7	446	0.9

*Not shown in this tabulation are 20,545 case vehicles (40%) which are missing data for Delta V because there was insufficient information for the calculation, or the CRASH program algorithm was not applicable.

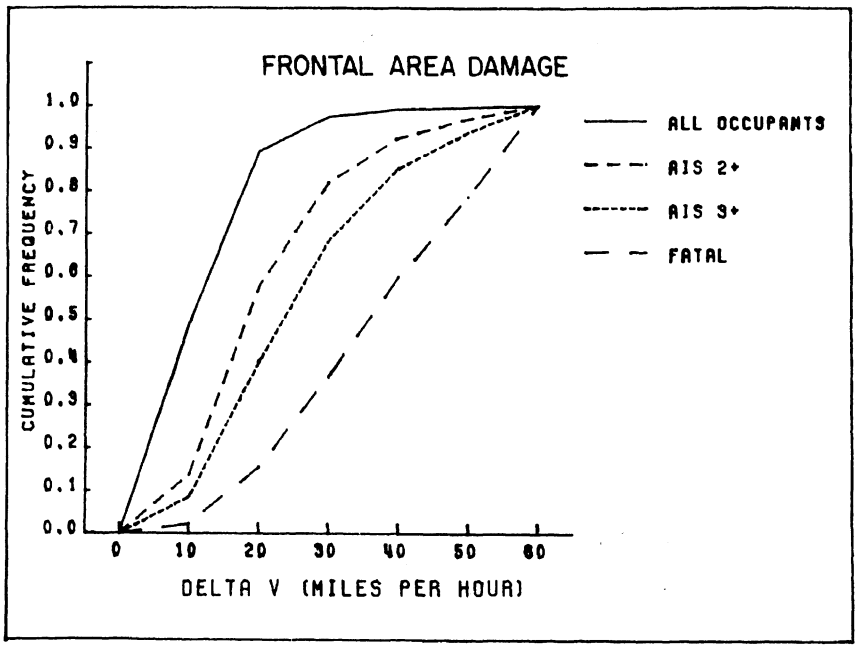


For the four damage categories combined, the probability of an AIS 2 or greater injury to an occupant of a vehicle with a 30 mile per hour Delta V is estimated at about 40%. For the same probability of a fatality, the Delta V is about 50 miles per hour.

NCSS CASE VEHICLE CRASH SEVERITY DISTRIBUTIONS (FRONTAL DAMAGE ONLY)

TOTAL DELTA V IN 10 MPH GROUPS	VEHICLES		OCCUPANTS							
			TOTAL		AIS 2+		AIS 3+		FATAL	
	N	%	N	%	N	%	N	%	N	%
1-10 MPH	10060	49.6	15431	49.1	359	13.8	95	8.5	6	2.3
11-20 MPH	8163	40.3	12620	40.2	1147	44.1	355	31.7	35	13.3
21-30 MPH	1524	7.5	2538	8.1	626	24.1	316	28.2	56	21.2
31-40 MPH	354	1.7	573	1.8	272	10.5	191	17.0	61	23.1
41-50 MPH	112	0.6	168	0.5	116	4.5	94	8.4	50	18.9
OVER 50 MPH	66	0.3	101	0.3	81	3.1	70	6.2	56	21.2
TOTAL	20279	100.0	31431	100.0	2601	100.0	1121	100.0	264	100.0

*Not shown in this tabulation are 12,859 case vehicles (39%) which are missing data for Delta V because there was insufficient information for the calculation, or the CRASH program algorithm was not applicable.

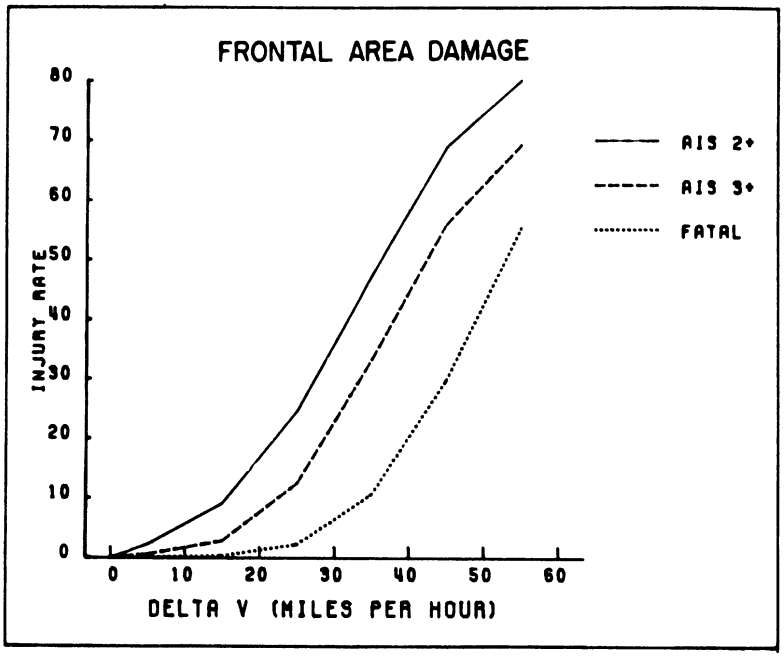


The 20,279 frontal-damage cases tabulated here represent about two-thirds of the cases shown on the previous two pages. Thus they dominate the total distribution and that shown here is little different, although the median point for fatalities is a little higher at just under 40 miles per hour.

NCSS INJURY RATES BY CRASH SEVERITY
(FRONTAL DAMAGE ONLY)

TOTAL DELTA V IN 10 MPH GROUPS	VEHICLES	OCCUPANTS							
		TOTAL	AIS 2+		AIS 3+		FATAL	
			N	RATE	N	RATE	N	RATE
1-10 MPH	10060	15431	359	2.3	95	0.6	6	0.0
11-20 MPH	8163	12620	1147	9.1	355	2.8	35	0.3
21-30 MPH	1524	2538	626	24.7	316	12.5	56	2.2
31-40 MPH	354	573	272	47.5	191	33.3	61	10.6
41-50 MPH	112	168	116	69.0	94	56.0	50	29.8
OVER 50 MPH	66	101	81	80.2	70	69.3	56	55.4
OVERALL	20279	31431	2601	8.3	1121	3.6	264	0.8

*Not shown in this tabulation are 12,859 case vehicles (39%) which are missing data for Delta V because there was insufficient information for the calculation, or the CRASH program algorithm was not applicable.

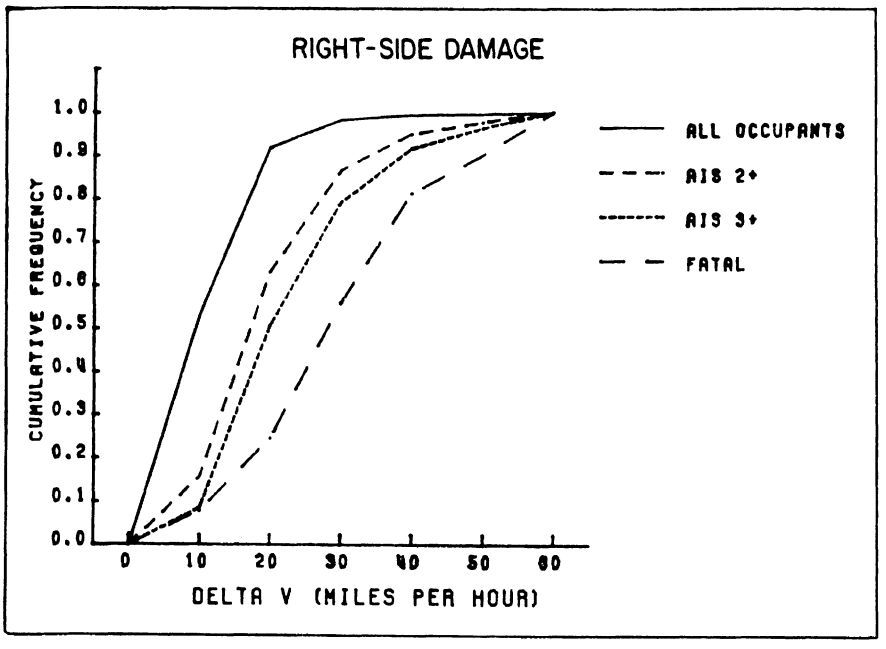


The fatality rate in frontal collisions is about 10% at a 35 mile per hour Delta V, but thereafter rises sharply to 30% at 45 miles per hour, and over 50% above 50 miles per hour.

NCSS CASE VEHICLE CRASH SEVERITY DISTRIBUTIONS (RIGHT-SIDE DAMAGE ONLY)

TOTAL DELTA V IN 10 MPH GROUPS	VEHICLES		OCCUPANTS							
			TOTAL		AIS 2+		AIS 3+		FATAL	
	N	%	N	%	N	%	N	%	N	%
1-10 MPH	2173	53.1	3520	53.2	97	15.7	29	8.6	8	7.8
11-20 MPH	1617	39.5	2561	38.7	292	47.4	142	42.1	17	16.7
21-30 MPH	232	5.7	417	6.3	145	23.5	96	28.5	32	31.4
31-40 MPH	54	1.3	81	1.2	52	8.4	42	12.5	26	25.5
41-50 MPH	13	0.3	22	0.3	17	2.8	16	4.7	9	8.8
OVER 50 MPH	7	0.2	14	0.2	13	2.1	12	3.6	10	9.8
TOTAL	4096	100.0	6615	100.0	616	100.0	337	100.0	102	100.0

*Not shown in this tabulation are 2,958 case vehicles (42%) which are missing data for Delta V because there was insufficient information for the calculation, or the CRASH program algorithm was not applicable.

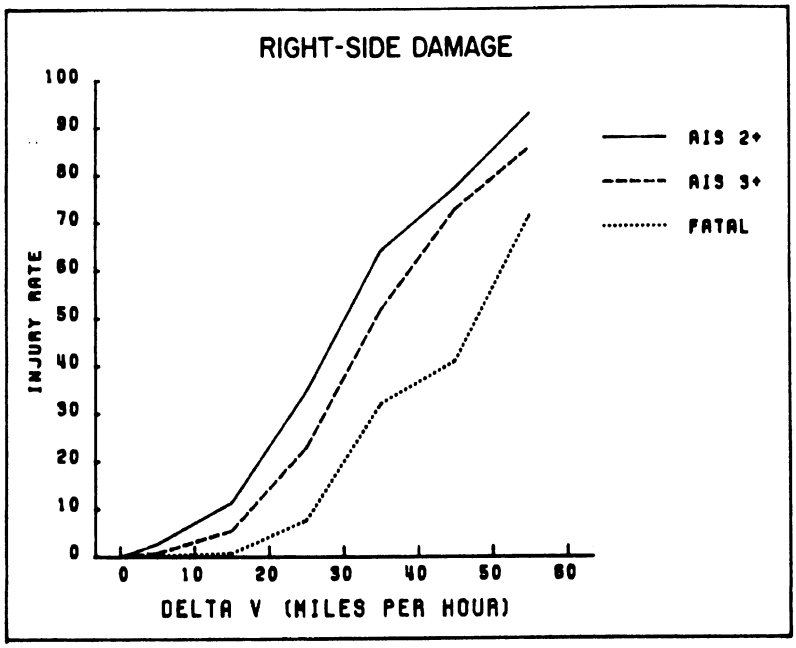


Of the 20,279 case vehicles for which Delta V was computed, 8,176 (or about 40%) had principal damage in the side. These side-damage cases were about equally distributed between right and left damage. The median Delta V for a fatality is about 30 miles per hour for right-side damage cases, as compared to about 37 miles per hour for front-damage cases. There is less collision protection for an occupant in side impacts.

NCSS INJURY RATES BY CRASH SEVERITY (RIGHT-SIDE DAMAGE ONLY)

TOTAL DELTA V IN 10 MPH GROUPS	VEHICLES	OCCUPANTS							
		TOTAL	AIS 2+		AIS 3+		FATAL	
			N	RATE	N	RATE	N	RATE
1-10 MPH	2173	3520	97	2.8	29	0.8	8	0.2
11-20 MPH	1617	2561	292	11.4	142	5.5	17	0.7
21-30 MPH	232	417	145	34.8	96	23.0	32	7.7
31-40 MPH	54	81	52	64.2	42	51.9	26	32.1
41-50 MPH	13	22	17	77.3	16	72.7	9	40.9
OVER 50 MPH	7	14	13	92.9	12	85.7	10	71.4
OVERALL	4096	6615	616	9.3	337	5.1	102	1.5

*Not shown in this tabulation are 2,958 case vehicles (42%) which are missing data for Delta V because there was insufficient information for the calculation, or the CRASH program algorithm was not applicable.

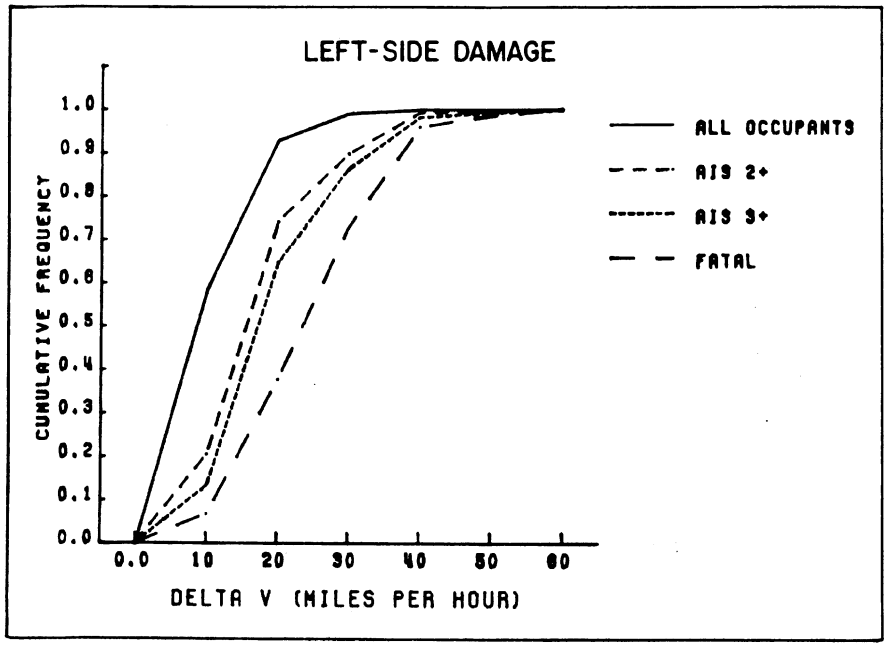


For a given Delta V the estimated probability of injury or fatality is greater for occupants of vehicles with right-side damage than for occupants of vehicles with front damage. At a Delta V of 30 miles per hour, the probability of an AIS 2 or greater injury is 50%. At a Delta V of 50 miles per hour, there is a 50% estimated probability of a fatality.

NCSS CASE VEHICLE CRASH SEVERITY DISTRIBUTIONS (LEFT-SIDE DAMAGE ONLY)

TOTAL DELTA V IN 10 MPH GROUPS	VEHICLES		OCCUPANTS							
			TOTAL		AIS 2+		AIS 3+		FATAL	
	N	%	N	%	N	%	N	%	N	%
1-10 MPH	2395	58.7	3983	58.8	112	20.6	39	13.4	5	6.8
11-20 MPH	1406	34.5	2308	34.1	291	53.6	150	51.4	23	31.1
21-30 MPH	233	5.7	417	6.2	85	15.7	63	21.6	26	35.1
31-40 MPH	42	1.0	63	0.9	51	9.4	36	12.3	17	23.0
41-50 MPH	2	0.0	2	0.0	2	0.4	2	0.7	2	2.7
OVER 50 MPH	2	0.0	2	0.0	2	0.4	2	0.7	1	1.4
TOTAL	4080	100.0	6775	100.0	543	100.0	292	100.0	74	100.0

*Now shown in this tabulation are 3,653 case vehicles (47%) which are missing data for Delta V because there was insufficient information for the calculation, or the CRASH program algorithm was not appplicable.

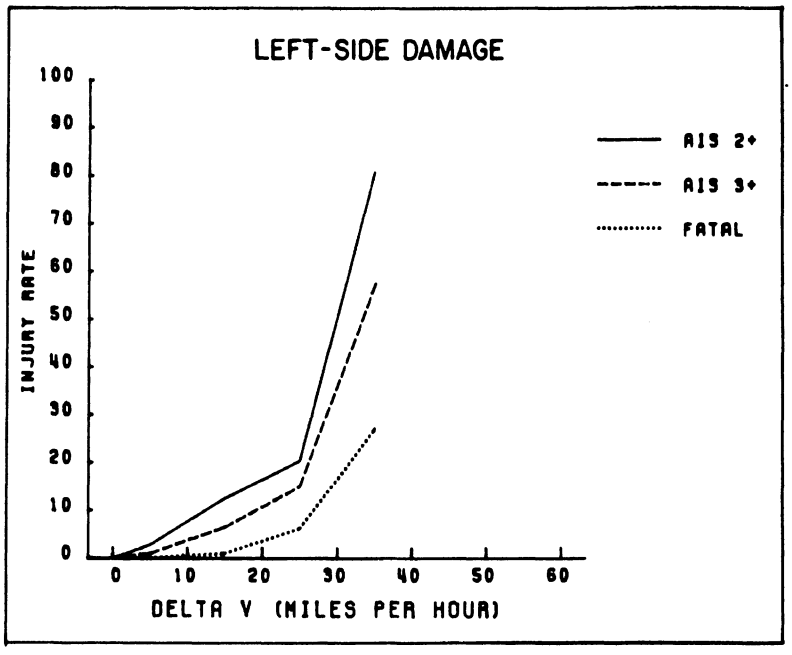


A higher proportion of injuries from left-side damage occur with low Delta V's than is the case with right-side damage. In the left-side subset about one-third of the fatalities occur with a Delta V of less than 20 miles per hour. In the right-side subset only about one-fifth of the fatalities occur with a Delta V under 20 miles per hour.

NCSS INJURY RATES BY CRASH SEVERITY
(LEFT-SIDE DAMAGE ONLY)

TOTAL DELTA V IN 10 MPH GROUPS	VEHICLES	OCCUPANTS						
		TOTAL	AIS 2+		AIS 3+		FATAL	
			N	RATE	N	RATE	N	RATE
1-10 MPH	2395	3983	112	2.8	39	1.0	5	0.1
11-20 MPH	1406	2308	291	12.6	150	6.5	23	1.0
21-30 MPH	233	417	85	20.4	63	15.1	26	6.2
31-40 MPH	42	63	51	81.0	36	57.1	17	27.0
41-50 MPH	2	2	2	100.0	2	100.0	2	100.0
OVER 50 MPH	2	2	2	100.0	2	100.0	1	50.0
OVERALL	4080	6775	543	8.0	292	4.3	74	1.1

*Not shown in this tabulation are 3,653 case vehicles (47%) which are missing data for Delta V because there was insufficient information for the calculation, or the CRASH program algorithm was not applicable.

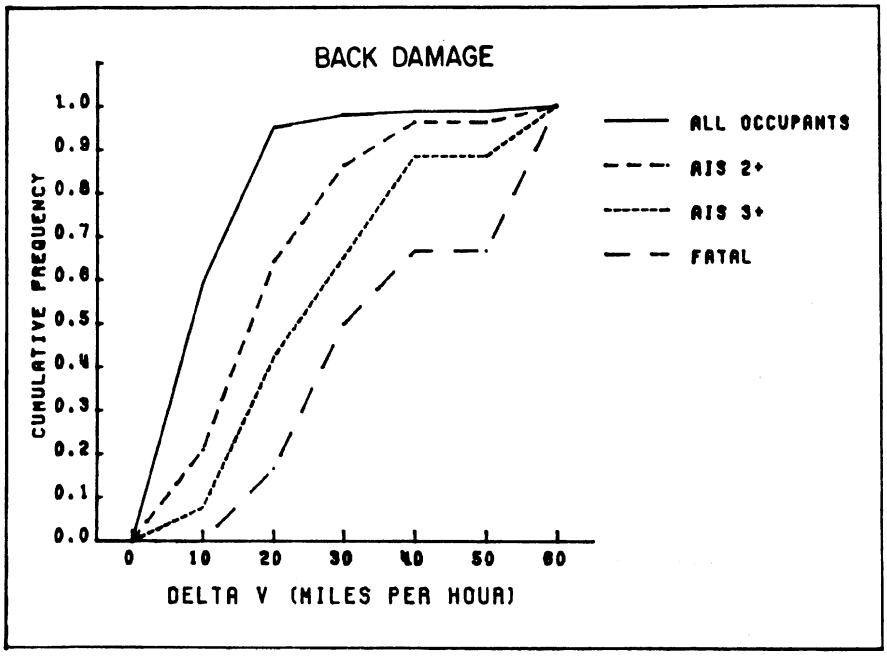


The injury rates for the left-side damage subset are similar to those for the right-side cases up to a Delta V of about 35 miles per hour. Beyond that they climb much more steeply. Because the number of cases with a high Delta V is so small, the graph only shows Delta V's up to 40 miles per hour.

NCSS CASE VEHICLE CRASH SEVERITY DISTRIBUTIONS (BACK DAMAGE ONLY)

TOTAL DELTA V IN 10 MPH GROUPS	VEHICLES		OCCUPANTS							
			TOTAL		AIS 2+		AIS 3+		FATAL	
	N	%	N	%	N	%	N	%	N	%
1-10 MPH	1057	59.0	1731	59.4	17	21.0	2	7.7	0	0.0
11-20 MPH	650	36.3	1042	35.8	35	43.2	9	34.6	1	16.7
21-30 MPH	66	3.7	82	2.8	18	22.2	6	23.1	2	33.3
31-40 MPH	9	0.5	23	0.8	8	9.9	6	23.1	1	16.7
41-50 MPH	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
OVER 50 MPH	11	0.6	36	1.2	3	3.7	3	11.5	2	33.3
TOTAL	1793	100.0	2914	100.0	81	100.0	26	100.0	6	100.0

*Not shown in this tabulation are 1,075 case vehicles (37%) which are missing data for Delta V because there was insufficient information for the calculation, or the crash program algorithm was not applicable.

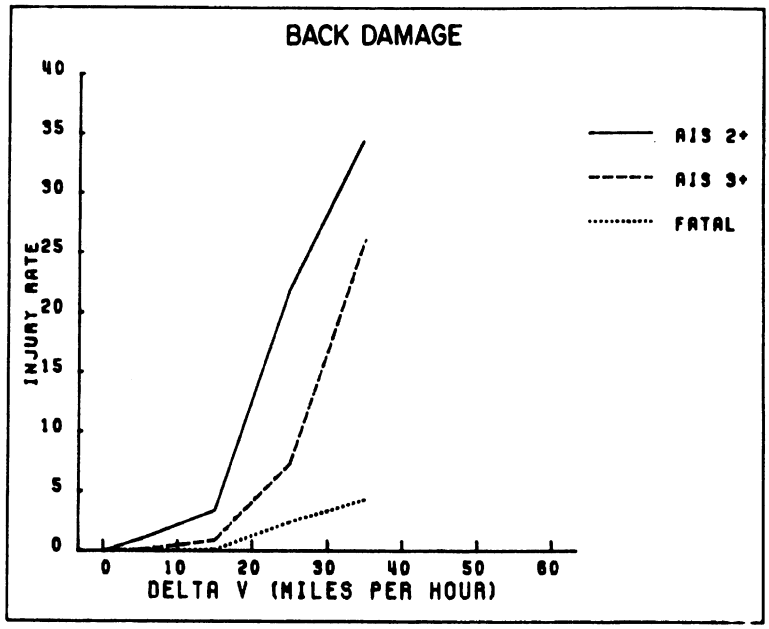


Back-damaged vehicles account for only 6% of the cases for which Delta V could be calculated. Only 6 fatalities appear in this subset and even the number of occupants with AIS 2 or greater injuries is small. The cumulative distribution is similar to that for the front-damage subset, though the proportion of the AIS 2 or greater injuries that occurred with a Delta V under 10 miles per hour is somewhat smaller.

NCSS INJURY RATES BY CRASH SEVERITY (BACK DAMAGE ONLY)

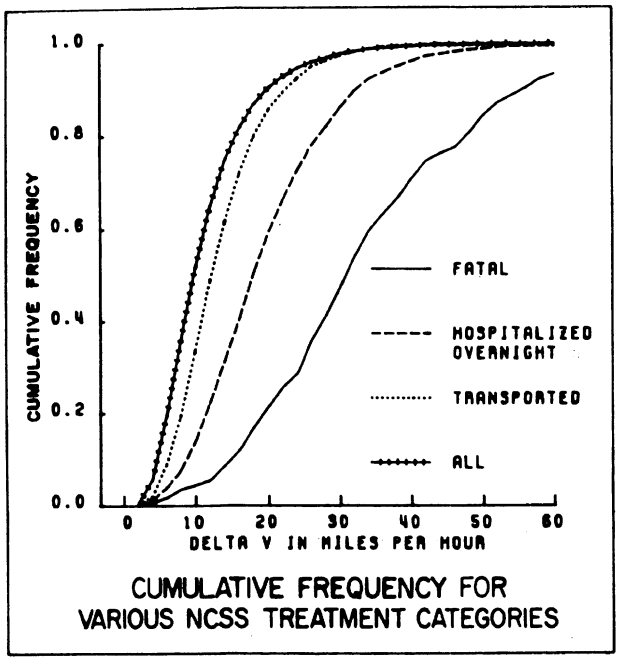
TOTAL DELTA V IN 10 MPH GROUPS	VEHICLES	OCCUPANTS						
		TOTAL	AIS 2+		AIS 3+		FATAL	
			N	RATE	N	RATE	N	RATE
1-10 MPH	1057	1731	17	1.0	2	0.1	0	0.0
11-20 MPH	650	1042	35	3.4	9	0.9	1	0.1
21-30 MPH	66	82	18	22.0	6	7.3	2	2.4
31-40 MPH	9	23	8	34.8	6	26.1	1	4.3
41-50 MPH	0	0	0	0.0	0	0.0	0	0.0
OVER 50 MPH	11	36	3	8.3	3	8.3	2	5.6
OVERALL	1793	2914	81	2.8	26	0.9	6	0.2

*Not shown in this tabulation are 1,075 case vehicles (37%) which are missing data for Delta V because there was insufficient information for the calculation, or the CRASH program algorithm was not applicable.

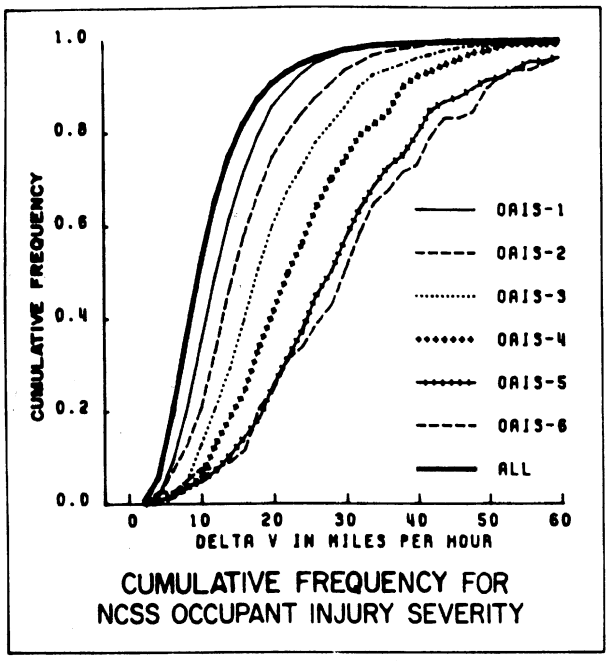


Up to a Delta V of 35 miles per hour the injury rates for the back-damage subset are estimated to be generally lower than for the front-damage subset. There are no data for Delta V's between 41 and 50 miles per hour, and above 50 miles per hour the number of cases is too small for the rates to be reliable.

CUMULATIVE FREQUENCY OF DELTA V



CUMULATIVE FREQUENCY FOR VARIOUS NCSS TREATMENT CATEGORIES

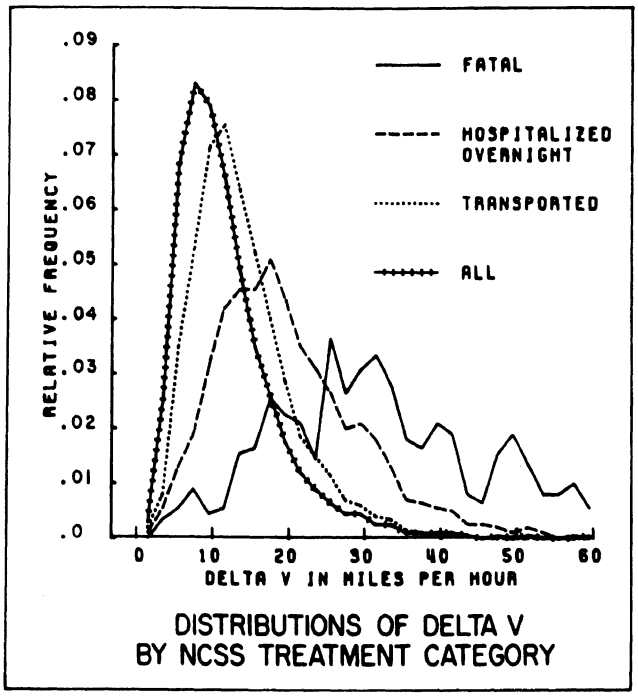


CUMULATIVE FREQUENCY FOR NCSS OCCUPANT INJURY SEVERITY

Passenger car occupants in NCSS accidents are categorized into treatment classes. The classes graphed here are those coded by the investigator, not the derived variables used for the columns in the occupant tables. Ninety percent of the occupants hospitalized overnight receive their injuries in accidents with a Delta V of 30 miles per hour or less. Only 50% of the fatalities result from such accidents.

Similarly, 90% of the AIS 2 Level injuries occur in accidents with a Delta V of 25 miles per hour or less.

CRASH SEVERITY (DELTA V) BY NCSS TREATMENT CATEGORY



DISTRIBUTIONS OF DELTA V
BY NCSS TREATMENT CATEGORY

Delta V distributions for occupants of the several NCSS treatment categories are shown. For all occupants--essentially for all towed passenger cars--the most frequent Delta V is about 10 miles per hour, with crashes over 30 miles per hour being rather rare. For fatal crashes, however, the mode of the curve is at around 30 miles per hour. Note that these distributions are developed only from those cases for which Delta V was reported, and that approximately half of the fatal cases are missing Delta V. The fluctuations in the fatal distribution are probably the result of the rather sparse data.

INDEX

B

C

D

E

F

G

H

I

K

L

M

S

T

U

V

W