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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 in January 1977 and terminated in March 1979. The tabulations in this factbook represent the first fifteen months of the program covering the period January 1977 through March 1978.

Accidents were investigated in seven geographical 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 (and their occupants) in crashes severe enough to require that the vehicles be towed from the scene.

The combined investigations presented here account for 6,626 crashes, 8,616 towed vehicles, 14,491 vehicle occupants, and 485 fatalities. The tables and figures in this factbook were generated using a computer file of the NCSS data and represent only a very broad treatment of the data. The reader is referred to NHTSA and the computer data files for more detailed analyses.

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NCSS STATISTICS

Report Number UM-HSRI-79-80

Edited by

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Department of Transportation
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PREFACE

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). The study collects a set of detailed information on passenger cars (and their occupants) in crashes which were severe enough to disable a car. Pedestrian accidents, and other accidents in which vehicles did not have to be towed away, are thus excluded from this study. The NCSS data base contains information on the instantaneous change of velocity during the impact phase of a crash (called "Delta V"), vehicle damage descriptions in a codified form, and detailed descriptions of occupant injuries. Information on other vehicles involved in these accidents (such as trucks, or non-towed passenger cars) is included in the data base, but is used only to describe the crash conditions surrounding the vehicle of interest. Data collection began in January, 1977. This factbook presents tabulations of the data for the first fifteen months of the study, thus covering the period January, 1977, through March, 1978.

The NCSS data base serves two general purposes: to describe, and to model. The descriptions are of important statistics and distributions on crash conditions and consequences: the proportion of occupants using restraints, for example, or the proportion of serious injuries occurring in passenger cars with frontal damage. This factbook contains mainly such descriptive results. The NCSS data may be used in modeling the relationships between crash conditions and occupant injury. Simple models have been developed to achieve a better understanding of crash-injury relationships, and the majority of the future analytic effort using NCSS data will involve such model development.

Accidents are studied in seven 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 established quickly in them. The seven areas and their contractors are:

1. Erie County, New York (minus the City of Buffalo)
   Calspan Field Services
2. Washtenaw and Lenawee Counties, Michigan
   University of Michigan, Highway Safety Research Institute (HSRI)
3. Sixteen counties in Southwest Indiana
   Indiana University
4. Miami, Florida
   University of Miami
5. Lexington, Kentucky, and surrounding counties
   University of Kentucky
6. Bexar, Guadalupe, and thirteen other counties in South Texas
   Southwest Research Institute (SwRI)

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

The aggregate of the seven areas has an urbanization distribution close to that of the entire United States (as given in the 1970 census), and the areas are intentionally distributed widely throughout the nation. This sample is best defined as purposive rather than random; the data from NCSS cannot be extrapolated objectively to national rates or totals.

Within each data collection area accidents are selected for investigation by strict adherence to a stratified sampling plan. Accidents eligible for investigation (the sampling frame) are all police-reported accidents within the defined geographical areas in which at least one occupied passenger automobile was towed from the scene due to collision damage. The police report form typically indicates whether a vehicle was towed, but if subsequent investigation reveals that the towing was not the result of collision damage, the case is dropped. A towed passenger car is referred to as a "case" vehicle, and each eligible accident has at least one case vehicle and may have more than one.

Each eligible accident is assigned to one of three strata:

Stratum 1 (sampled at 100%): An eligible accident in which at least one case vehicle occupant was hospitalized overnight or fatally injured.

Stratum 2 (sampled at 25%): 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.

Stratum 3 (sampled at 10%): All other eligible accidents.

Within each stratum the accident selection methods differ. Two of the teams, HSRI and SwRI, selected accidents using a randomization technique. The other teams looked at accidents on a systematic sample of days. All teams investigated every appropriate accident on the selected days except in Los Angeles, where a subsample of appropriate accidents was chosen before investigation.

For analysis, each case is assigned a case weight equal to the inverse of its sampling fraction: 1 in stratum 1, 4 in stratum 2, and 10 in stratum 3. In tabulating data from the file, each observation may be multiplied by its case weight in order to produce an estimate of the total towaway accident population for the NCSS areas. The NCSS file used for the statistics presented in this factbook contains 39,867 weighted cases (6,628 actual crashes investigated), 39,444 towed passenger cars (8,616 actual towed cars investigated), and 62,026 occupants of towed passenger cars (14,491 actual). Since fatal accidents were always sampled at the 100% fraction, there are an equal number of fatalities (485) in both the weighted and the actual populations. Unless there is an indication to the contrary, the data presented in this factbook are weighted and are aggregated over all seven data collection areas.

These data, therefore, describe distributions for all police-reported towaway passenger car accidents in the purposive sample.

The body of this factbook is organized into five major sections. The first, beginning on page 1, contains general tables describing the entire NCSS data set. The second section concerns accident distributions, and begins on page 5. The third provides distributions of factors centered on the case vehicles in the NCSS study, and begins on page 25. The fourth section is centered on vehicle occupants, and includes tabulations of both occupant characteristics, and at the end of that section, some injury distributions. These occupant tables begin on page 51. Finally, there is a section devoted to crash severity (Delta V) distributions, showing how various vehicle and occupant factors are distributed by this measure of crash severity. These tables begin on page 79.

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 shown the corresponding injury rates. In each case the columns of these tables show the number of occupants in each of several injury categories. A more complete description of the injury categories may be found on page 5.

A rather comprehensive index to the tables begins on page 99. The reader interested in a specific topic should be able to identify the pertinent tables by reference to this index.

All of the tables in this factbook were derived from the computerized NCSS files, and represent mainly interrelationships between occupant injury and the major variables available. Those interested in more detailed analysis of these data may use this book as a guide, and may access the data in their original form through the National Center for Statistics and Analysis.

In many of the line graphs the data have been smoothed, usually by a moving mean method over three or five points. As a result, readers may note some differences between the tabular and graphed values. The graphs are presented only to demonstrate trends.

The figures and tables in this factbook should be studied and used while keeping in mind this caveat: for many variables--in particular those relating to crash severity and to injury--there are substantial proportions of missing data. If these (missing) data were present it is possible, and even likely, that the distributions presented would change appreciably. Future analyses will attempt to make estimates of the uncertainty that arises from this source.

This publication was produced by the efforts of many people at the Highway Safety Research Institute. James O'Day and Richard Kaplan were responsible for content and organization. Joseph Andary developed computer programs to produce the tables in this book. Richard Kaplan and Oliver Carsten produced the graphic material in the text.

Kathleen Jackson designed the cover, and Sue Roberts and Mehdi Khodadad performed keylining. Michelle Shepherd helped with typing. James Hedlund, NHTSA, and Phyllis Gimotty made suggestions and comments as the publication evolved.

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CRASH SEVERITY (DELTA V) TABLES--Continued

1 GENERAL

This section presents information about both the unweighted (actual) counts of cases and the reconstructed or weighted counts. It provides an overview of the entire data set.

Unweighted counts presented in this section are of value to those interested in the consequences of the sampling procedures and in understanding the statistical properties of the data. The weighted distributions in this section, and in the remainder of this report, are intended to represent the total population of accidents that occurred in the NCSS sampling areas.

Weighted and Actual Crashes, Vehicles, All Vehicles, and Case Vehicle Occupants: NCSS First Fifteen Months

SAMPLING FRACTION	CRASHES		ALL VEHICLES		CASE VEHICLES		CASE VEHICLE OCCUPANTS		CASE VEHICLE FATALITIES	
	ACTUAL	WEIGHTED	ACTUAL	WEIGHTED	ACTUAL	WEIGHTED	ACTUAL	WEIGHTED	ACTUAL	WEIGHTED
100%	2669	2669	4568	4568	3614	3614	6480	6480	485	485
25%	1732	6928	3202	12808	2365	9460	4094	16376		
10%	2227	22270	4123	41230	2637	26370	3917	39170		
TOTAL	6628	31867	11893	58606	8616	39444	14491	62026	485	485

The ACTUAL *columns of this table display the number of crashes, vehicles, etc., actually investigated by the NCSS field teams. In order to make some of the major analysis categories 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 treated and released at a hospital, and 10% of those in which the vehicle was towed but no occupant was taken to a hospital, were selected. To restore the true distribution, weights may be applied--the 25% group being multiplied by a factor of four, and the 10% group by a factor of ten. Such counts are called "Weighted" in this book.*

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 *are all passenger cars and 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 about 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	4758	3105	3439	3531	5873	7862	3299	31867
Actual	942	651	913	765	1118	1643	596	6628
ALL VEHICLES								
Weighted	8577	5389	5769	5974	11944	14223	6730	58606
Actual	1686	1093	1503	1273	2260	2880	1198	11893
CASE VEHICLES								
Weighted	5905	3884	4104	4195	7474	9727	4155	39444
Actual	1231	839	1119	958	1549	2131	789	8616
ALL OCCUPANTS								
Weighted	12820	7656	8334	9370	16822	21391	9140	85533
Actual	2632	1632	2304	2110	3388	4606	1730	18402
CASE VEH. OCCUPANTS								
Weighted	9359	5843	6427	7051	11365	15784	6197	62026
Actual	2060	1334	1879	1714	2530	3712	1262	14491
FATALITIES	64	54	108	56	23	157	23	485

This table shows both the actual and the weighted numbers of crashes, 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.

This section presents several tables and graphs describing the characteristics of the accidents investigated in the NCSS program. To be included in the NCSS study, an accident must have involved at least one occupied passenger car that was towed from the scene of the accident because of damage. The tables in this section show only the weighted (or reconstructed) populations, and thus represent the total number of such (towaway) accidents that occurred in the NCSS regions over the fifteen-month period from January 1, 1977, to March 31, 1978. Represented are 31,867 accidents, 62,026 occupants of case vehicles, and 485 fatalities.

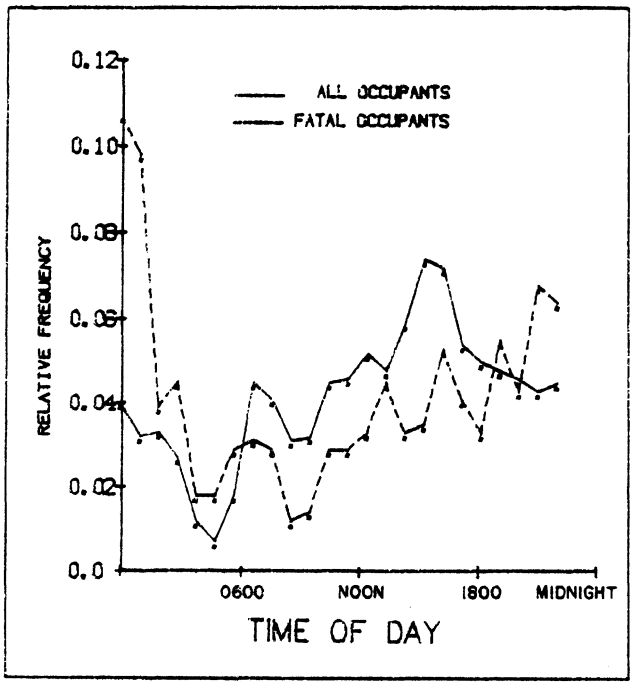
In each of the following tables the number of accidents and the number of occupants in various injury categories are shown in the columns. To allow a better understanding of the distribution of injuries across the various accident characteristics, injuries are shown as "AIS 2+," "AIS 3+," and "Fatal." AIS 2+ refers to AIS levels 2 through 6, and AIS 3+ refers to AIS levels 3 through 6. Within these levels, there are 3,627 occupants in the AIS 2+ category and 1,775 occupants in the AIS 3+ group. An additional 9,515 occupants have been reported as "Injured," but severity (on the AIS scale) is unknown. The majority of these are probably at the AIS-1 level, but some may be in the AIS-2 or AIS-3 categories. In particular the AIS-2 counts in the tables are probably somewhat underestimated.

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 69.

NCSS Crash Distributions by Time of Day

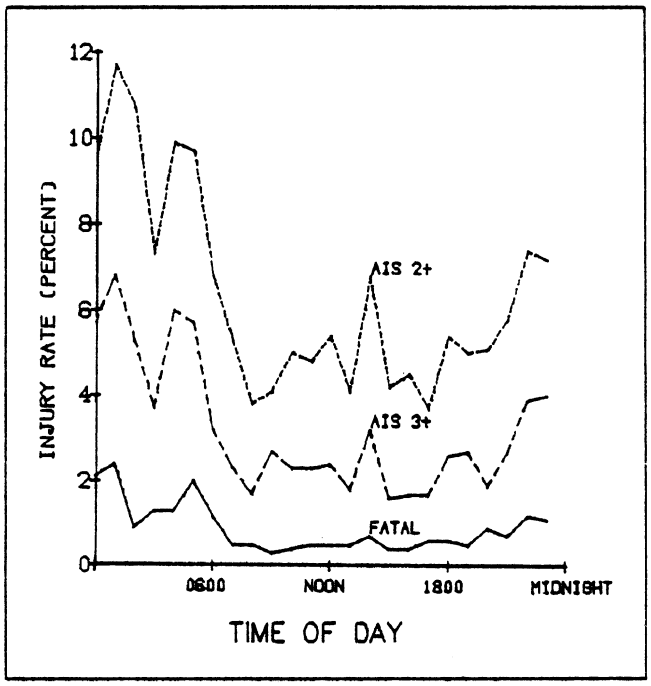
TIME OF DAY	ACCIDENTS		OCCUPANTS							
			TOTAL		AIS 2+		AIS 3+		FATAL	
	N	%	N	%	N	%	N	%	N	%
MIDNIGHT	1330	4.2	2487	4.0	237	6.5	143	8.1	52	10.7
1 AM	1033	3.2	1983	3.2	233	6.4	134	7.5	48	9.8
2 AM	1191	3.7	2041	3.3	219	6.0	108	6.1	19	3.9
3 AM	930	2.9	1640	2.6	119	3.3	61	3.4	22	4.5
4 AM	471	1.5	716	1.2	71	2.0	43	2.4	9	1.8
5 AM	301	0.9	455	0.7	44	1.2	26	1.5	9	1.8
6 AM	680	2.1	1137	1.8	77	2.1	36	2.0	14	2.9
7 AM	1517	4.8	2815	4.5	150	4.1	65	3.7	15	3.1
8 AM	1524	4.8	2553	4.1	98	2.7	44	2.5	14	2.9
9 AM	1040	3.3	1923	3.1	79	2.2	51	2.9	6	1.2
10 AM	1024	3.2	1953	3.1	97	2.7	44	2.5	7	1.4
11 AM	1408	4.4	2811	4.5	135	3.7	66	3.7	14	2.9
NOON	1392	4.4	2860	4.6	154	4.2	70	3.9	14	2.9
1 PM	1502	4.7	3215	5.2	132	3.6	57	3.2	16	3.3
2 PM	1443	4.5	2953	4.8	202	5.6	95	5.4	21	4.5
3 PM	1930	6.1	3630	5.9	152	4.2	59	3.3	16	3.3
4 PM	2348	7.4	4582	7.4	208	5.7	79	4.5	17	3.5
5 PM	2212	6.9	4435	7.2	164	4.5	77	4.3	26	5.3
6 PM	1744	5.5	3368	5.4	182	5.0	86	4.8	20	4.1
7 PM	1376	4.3	3101	5.0	156	4.3	83	4.7	16	3.3
8 PM	1386	4.3	2970	4.8	152	4.2	56	3.2	27	5.5
9 PM	1268	4.0	2817	4.5	164	4.5	75	4.2	21	4.3
10 PM	1286	4.0	2665	4.3	196	5.4	104	5.9	33	6.8
11 PM	1446	4.5	2775	4.5	199	5.5	111	6.3	29	6.4
UNKNOWN	35	0.3	141	0.2	7	0.2	2	0.1	0	0.0
TOTAL	31867	100.0	62026	100.0	3627	100.0	1775	100.0	485	100.0



In the table the time periods begin at the hour shown, so that midnight would include accidents which occured between then and 12:59 A.M. The highest hour for accident occurrence is between 4:00 and 5:00 P.M., and the lowest is between 5:00 and 6:00 in the morning. Fatal accidents show a strong peak just after midnight.

NCSS Injury Rates by Time of Day

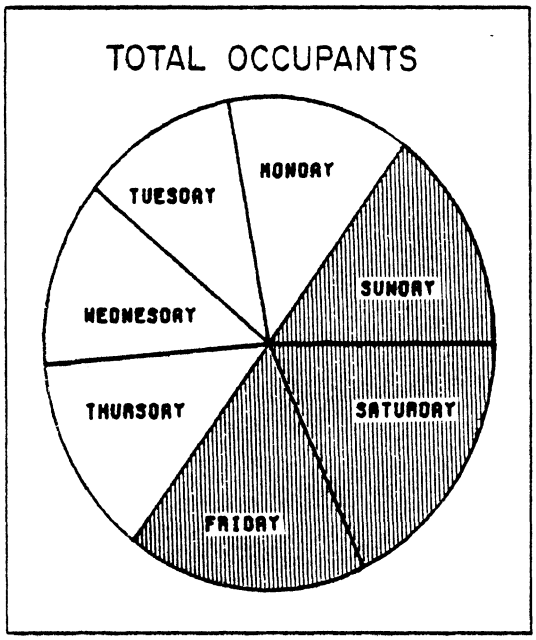
TIME OF DAY	ACCIDENTS	OCCUPANTS							
		TOTAL	AIS 2+		AIS 3+		FATAL	
			N	%	N	%	N	%
MIDNIGHT	1330	2487	237	9.5	143	5.7	52	2.1
1 AM	1033	1983	233	11.7	134	6.8	48	2.4
2 AM	1191	2041	219	10.7	108	5.3	19	0.9
3 AM	930	1640	119	7.3	61	3.7	22	1.3
4 AM	471	716	71	9.9	43	6.0	9	1.3
5 AM	301	455	44	9.7	26	5.7	9	2.0
6 AM	680	1137	77	6.8	36	3.2	14	1.2
7 AM	1517	2815	150	5.3	65	2.3	15	0.5
8 AM	1524	2553	98	3.8	44	1.7	14	0.5
9 AM	1040	1923	79	4.1	51	2.7	6	0.3
10 AM	1024	1953	97	5.0	44	2.3	7	0.4
11 AM	1408	2811	135	4.8	66	2.3	14	0.5
NOON	1392	2860	154	5.4	70	2.4	14	0.5
1 PM	1502	3215	132	4.1	57	1.8	16	0.5
2 PM	1443	2953	202	6.8	95	3.2	21	0.7
3 PM	1930	3630	152	4.2	59	1.6	16	0.4
4 PM	2348	4582	208	4.5	79	1.7	17	0.4
5 PM	2212	4435	164	3.7	77	1.7	26	0.6
6 PM	1744	3368	182	5.4	86	2.6	20	0.6
7 PM	1376	3101	156	5.0	83	2.7	16	0.5
8 PM	1386	2970	152	5.1	56	1.9	27	0.9
9 PM	1268	2817	164	5.8	75	2.7	21	0.7
10 PM	1286	2665	196	7.4	104	3.9	33	1.2
11 PM	1446	2775	199	7.2	111	4.0	29	1.1
UNKNOWN	85	141	7	5.0	2	1.4	0	0.0
TOTAL	31867	62026	3627	5.8	1775	2.9	485	0.8

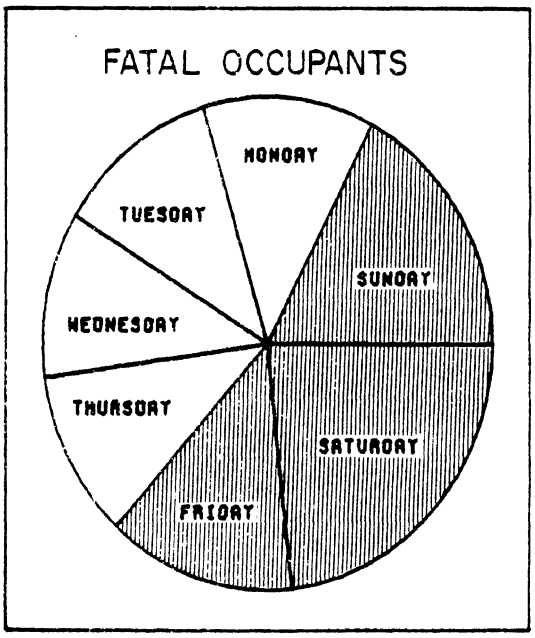


On the average, one's chance of being killed in a towaway accident at 1:00 A.M. is about 2.4%--about six times the chance of being killed in an accident between 3:00 and 5:00 in the afternoon.

NCSS Crash Distributions by Day of the Week

DAY OF WEEK	ACCIDENTS		OCCUPANTS							
			TOTAL		AIS 2+		AIS 3+		FATAL	
	N	%	N	%	N	%	N	%	N	%
SUNDAY	4113	12.9	9203	14.8	624	17.2	338	19.0	83	17.4
MONDAY	4411	13.8	8110	13.1	370	10.2	192	10.8	60	12.3
TUESDAY	3696	11.6	6933	11.2	353	9.7	163	9.2	57	11.7
WEDNESDAY	4141	13.0	7558	12.2	430	11.9	197	11.1	53	10.9
THURSDAY	4640	14.6	8322	13.4	431	11.9	226	12.7	54	11.1
FRIDAY	5531	17.4	10672	17.2	581	16.0	239	13.5	66	13.5
SATURDAY	5335	16.7	11228	18.1	838	23.1	420	23.7	112	23.2
TOTAL	31867	100.0	62026	100.0	3627	100.0	1775	100.0	485	100.0

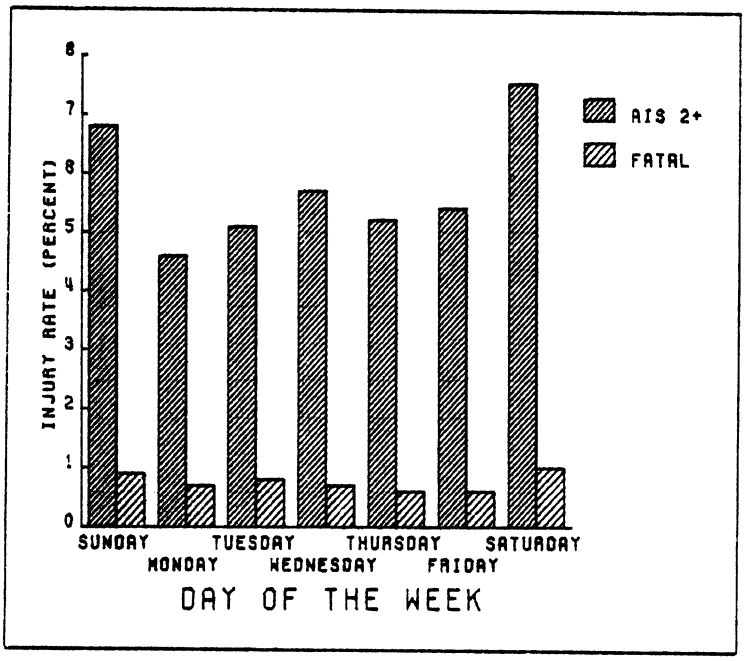




Weekends (Friday, Saturday, and Sunday combined) produce just about half of the crashes, but more than half of the fatalities. Days are defined conventionally as twenty-four hour periods beginning at midnight.

NCSS Injury Rates by Day of the Week

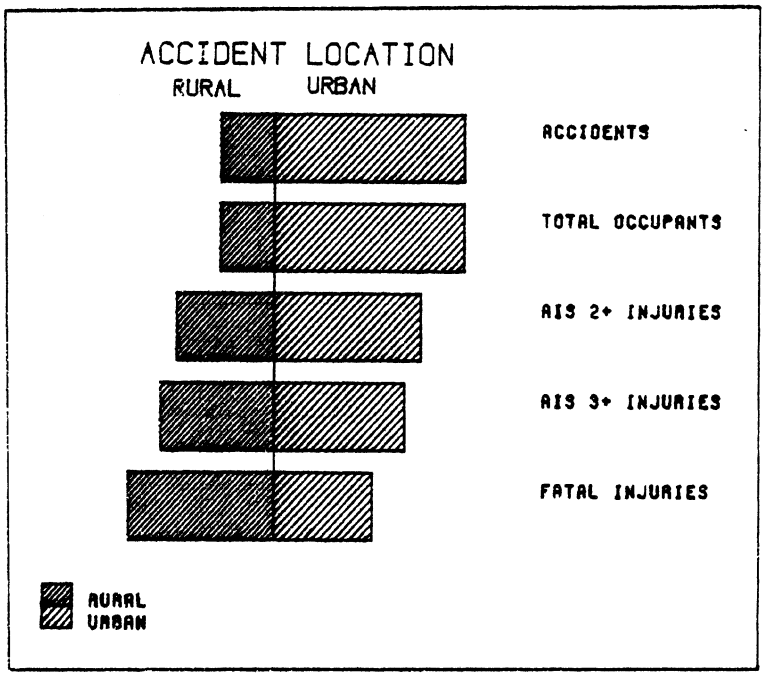
DAY OF WEEK	ACCIDENTS	OCCUPANTS						
		TOTAL	AIS 2+		AIS 3+		FATAL	
			N	%	N	%	N	%
SUNDAY	4113	9203	624	6.8	338	3.7	83	0.9
MONDAY	4411	8110	370	4.6	192	2.4	60	0.7
TUESDAY	3696	6933	353	5.1	163	2.4	57	0.8
WEDNESDAY	4141	7558	430	5.7	197	2.6	53	0.7
THURSDAY	4640	8322	431	5.2	226	2.7	54	0.6
FRIDAY	5531	10672	581	5.4	239	2.2	66	0.6
SATURDAY	5335	11228	838	7.5	420	3.7	112	1.0
TOTAL	31867	62026	3627	5.8	1775	2.9	485	0.8



The probability of a fatal injury, given a towaway crash, on a weekend is estimated to be a little less than 1%, about one and a half times the midweek value.

NCSS Crash Distributions by Rural/Urban Accident Location

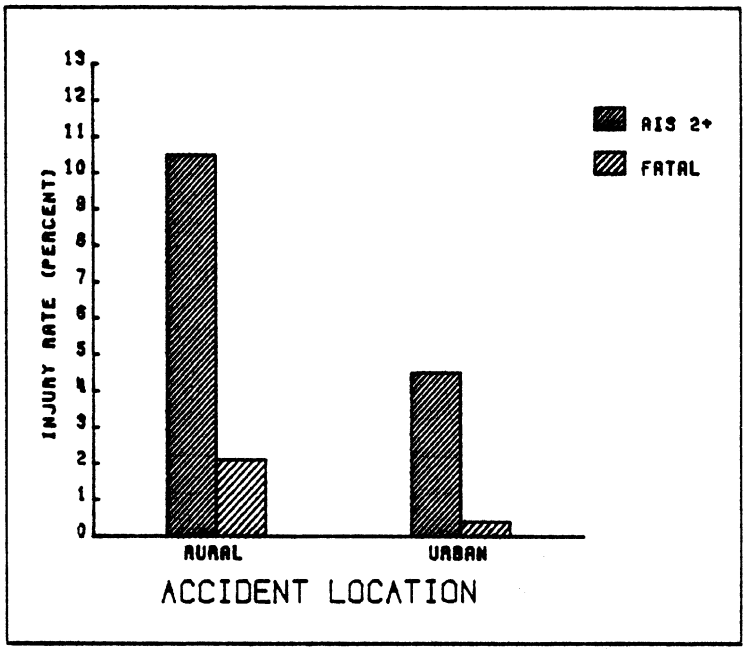
RURAL/URBAN	ACCIDENTS		OCCUPANTS							
			TOTAL		AIS 2+		AIS 3+		FATAL	
	N	%	N	%	N	%	N	%	N	%
RURAL	7043	22.1	13787	22.2	1450	40.0	828	46.6	290	59.8
URBAN	24823	77.9	48238	77.8	2177	60.0	947	53.4	195	40.2
UNKNOWN	1	0.0	1	0.0	0	0.0	0	0.0	0	0.0
TOTAL	31867	100.0	62026	100.0	3627	100.0	1775	100.0	485	100.0



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

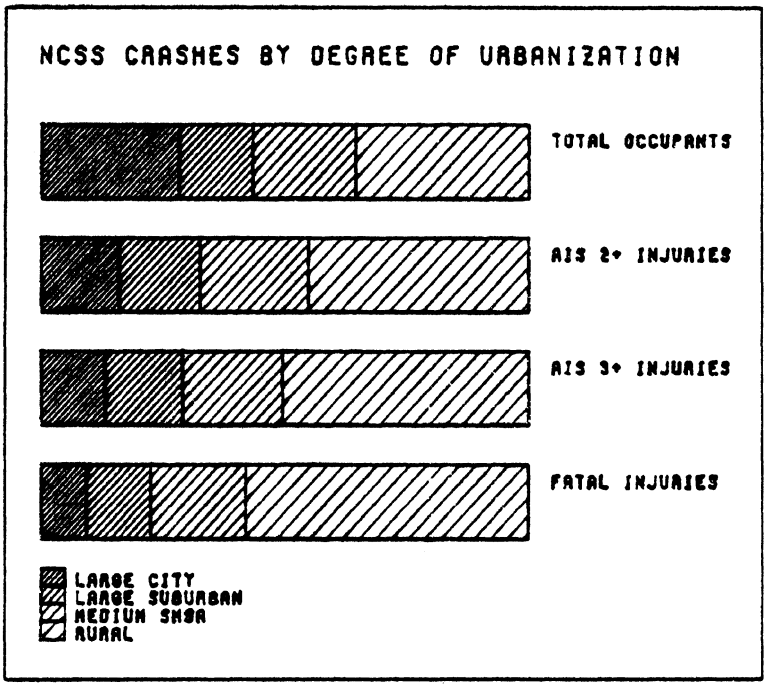
RURAL/URBAN	ACCIDENTS	OCCUPANTS							
		TOTAL	AIS 2+		AIS 3+		FATAL	
			N	%	N	%	N	%
RURAL	7043	13787	1450	10.5	828	6.0	290	2.1
URBAN	24823	48238	2177	4.5	947	2.0	195	0.4
UNKNOWN	1	1	0	0.0	0	0.0	0	0.0
TOTAL	31867	62026	3627	5.8	1775	2.9	485	0.8



Given a towaway collision in a rural area, one's chances of a fatal injury are about five times as high as in an urban crash. The probability of an AIS 2 injury is estimated to be about twice as large.

NCSS Crash Distributions by Degree of Urbanization

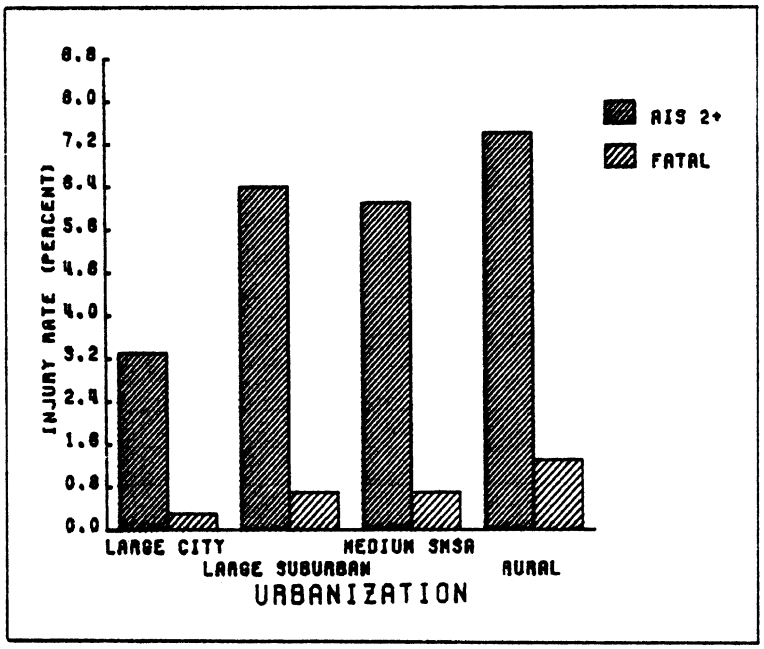
URBANIZATION	ACCIDENTS		OCCUPANTS							
			TOTAL		AIS 2+		AIS 3+		FATAL	
	N	%	N	%	N	%	N	%	N	%
LARGE CITY	9172	28.8	17562	28.3	582	16.0	234	13.2	46	9.4
LARGE SUBURB	4758	14.9	9359	15.1	602	16.6	282	15.9	64	13.1
MEDIUM SMSA	6521	20.5	13078	21.1	804	22.2	363	20.5	95	19.5
RURAL	11416	35.8	22027	35.5	1639	45.2	896	50.5	280	58.0
TOTAL	31867	100.0	62026	100.0	3627	100.0	1775	100.0	485	100.0



The Degree of Urbanization codes are assigned for the general character of each site. The large city group includes all of the city of Miami and the three police districts in Central Los Angeles. The large suburban group contains only Erie County, New York (minus the city of Buffalo). The medium SMSA group contains the urban area covered by the Southwest Research Institute team in Texas. All other areas--the remainder of the Texas region, and all of Indiana, Kentucky, and Michigan areas--are in the rural category. Neither the Degree of Urbanization nor the Rural/Urban Accident Location on the previous tables is directly comparable to the notation used in the NHTSA Fatal Accident Reporting System (FARS).

NCSS Injury Rates by Degree of Urbanization

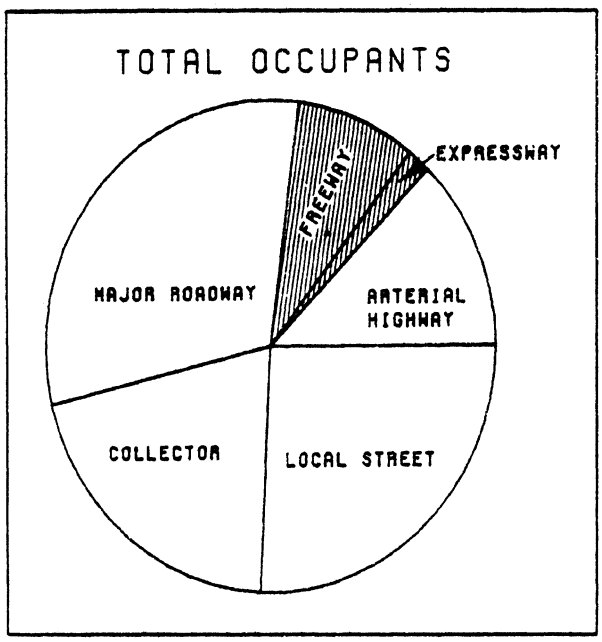
URBANIZATION	ACCIDENTS	OCCUPANTS							
		TOTAL	AIS 2+		AIS 3+		FATAL	
			N	%	N	%	N	%
LARGE CITY	9172	17562	582	3.3	234	1.3	46	0.3
LARGE SUBURB	4758	9359	602	6.4	282	3.0	64	0.7
MEDIUM SMSA	6521	13078	804	6.1	363	2.8	95	0.7
RURAL	11416	22027	1639	7.4	896	4.1	280	1.3
TOTAL	31867	62026	3627	5.8	1775	2.9	485	0.8

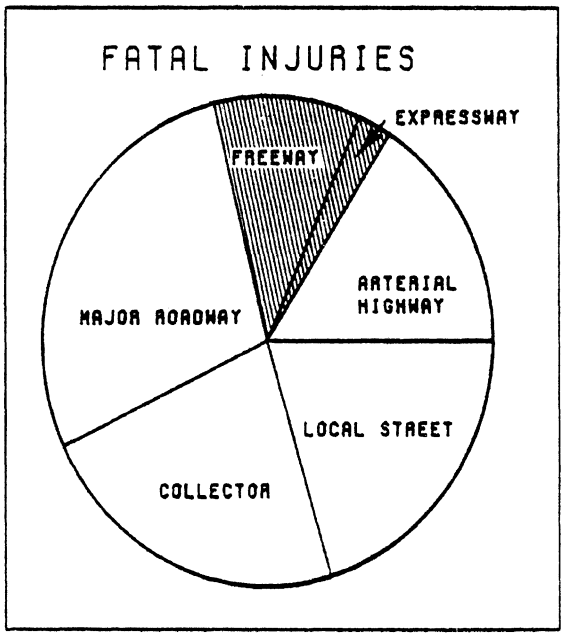


Both injury and fatality rates are noticeably lower in the large city areas. The probability of a fatality, given a towaway crash, is estimated to be about four times as high in the NCSS-defined rural areas as in the large cities.

NCSS Crash Distributions by Roadway Type

ROADWAY TYPE	ACCIDENTS		OCCUPANTS							
			TOTAL		AIS 2+		AIS 3+		FATAL	
	N	%	N	%	N	%	N	%	N	%
ARTERIAL HWY.	3744	11.7	7548	12.2	504	13.9	253	14.3	75	15.4
EXPRESSWAY	535	1.7	994	1.6	54	1.5	27	1.5	11	2.3
FREEWAY	3144	9.9	5777	9.3	291	8.0	145	8.2	49	10.2
MAJOR ROADWAY	9112	28.6	18448	29.7	972	26.8	478	26.9	133	27.3
COLLECTOR	6352	19.9	12304	19.8	755	20.8	419	23.6	106	21.9
LOCAL STREET	8102	25.4	15363	24.8	942	26.0	391	22.0	95	19.7
UNKNOWN	878	2.8	1592	2.6	109	3.0	62	3.5	16	3.3
TOTAL	31867	100.0	62026	100.0	3627	100.0	1775	100.0	485	100.0

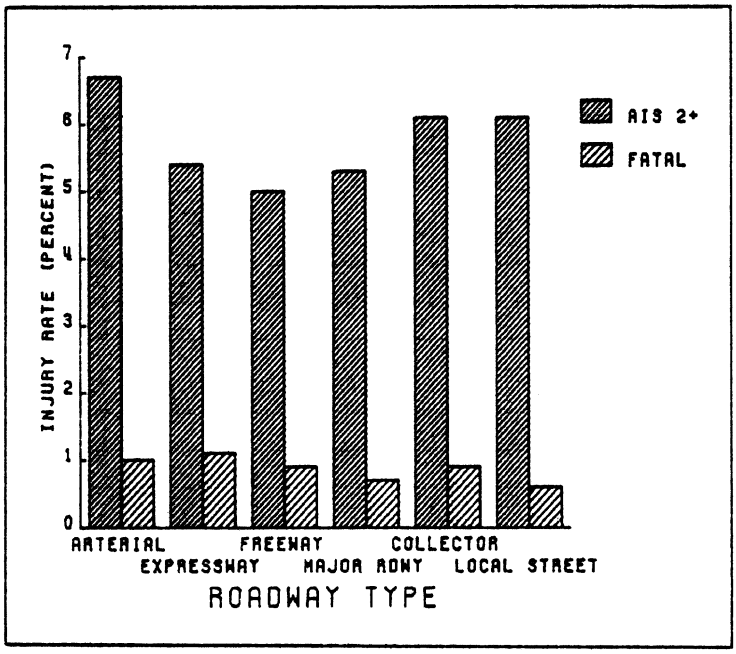




Roadway type is reported by the investigator according to the following guidelines. An arterial highway is a roadway which provides a continuous route, has no control of access, and is primarily for through traffic. An expressway is a divided highway with partial control of access. A freeway is a divided 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

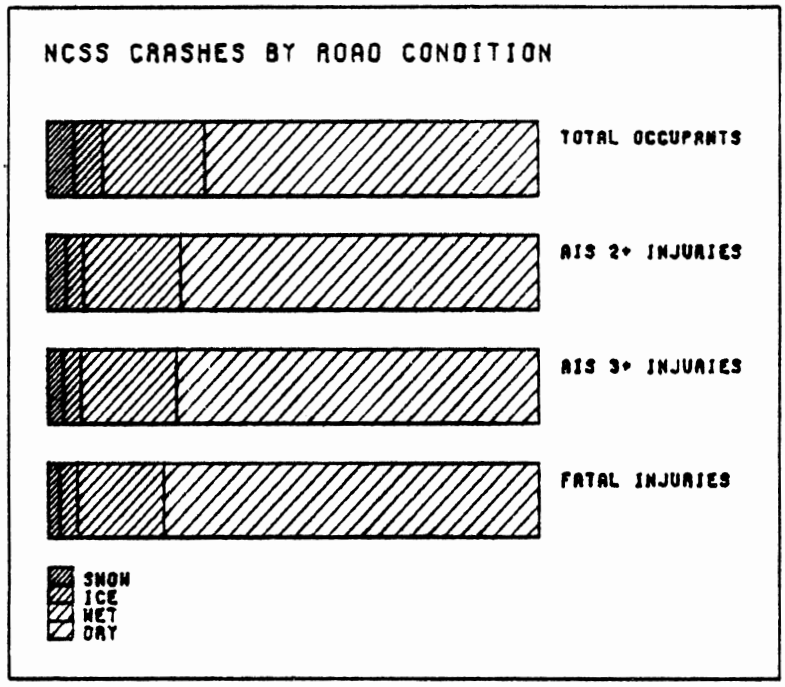
ROADWAY TYPE	ACCIDENTS	OCCUPANTS							
		TOTAL	AIS 2+		AIS 3+		FATAL	
			N	%	N	%	N	%
ARTERIAL HWY.	3744	7548	504	6.7	253	3.4	75	1.0
EXPRESSWAY	535	994	54	5.4	27	2.7	11	1.1
FREEWAY	3144	5777	291	5.0	145	2.5	49	0.9
MAJOR ROADWAY	9112	18448	972	5.3	478	2.6	133	0.7
COLLECTOR	6352	12304	755	6.1	419	3.4	106	0.9
LOCAL STREET	8102	15363	942	6.1	391	2.5	95	0.6
UNKNOWN	878	1592	109	6.8	62	3.9	16	1.0
TOTAL	31867	62026	3627	5.8	1775	2.9	485	0.8



The injury rate (at AIS 2 and above) is relatively constant across roadway types, but is highest for arterials. Fatalities are observed to have a lower rate on collectors and local roads (presumably lower speed roadways). Freeways and expressways, presumably the highest speed roads, show a slightly higher incidence for fatalities in the graphs on the previous page.

NCSS Crash Distributions by Road Condition

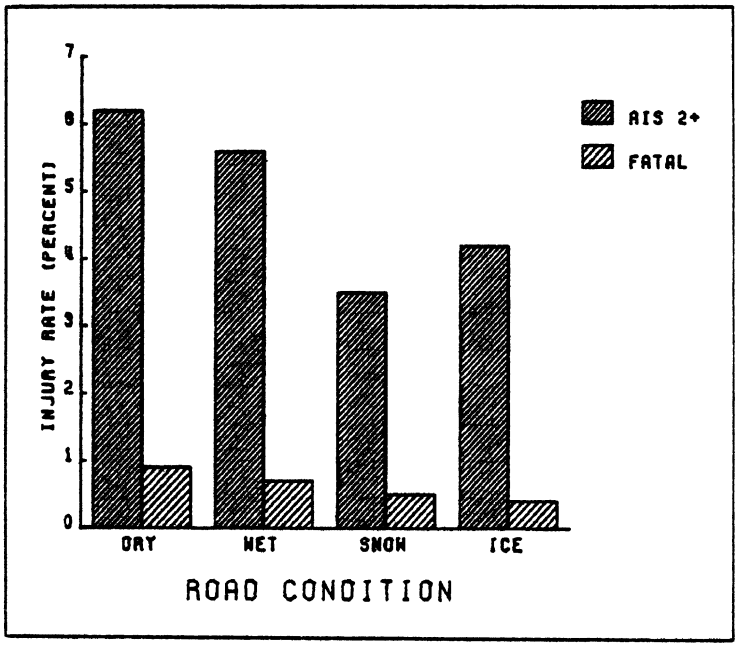
ROAD CONDITION	ACCIDENTS		OCCUPANTS							
			TOTAL		AIS 2+		AIS 3+		FATAL	
	N	%	N	%	N	%	N	%	N	%
DRY	21369	67.1	41885	67.5	2617	72.2	1304	73.5	362	74.8
WET	6620	20.8	12809	20.7	713	19.7	345	19.4	89	18.2
ICE	2008	6.3	3664	5.9	128	3.5	65	3.7	18	3.7
SNOW	1649	5.2	3342	5.4	139	3.8	55	3.1	12	2.5
OTHER	173	0.5	271	0.4	27	0.7	4	0.2	2	0.4
UNKNOWN	48	0.2	55	0.1	3	0.1	2	0.1	2	0.4
TOTAL	31867	100.0	62026	100.0	3627	100.0	1775	100.0	485	100.0



About two-thirds of all towaway crashes occur on dry roads, and dry roads account for three-quarters of the fatal accidents.

NCSS Injury Rates by Road Condition

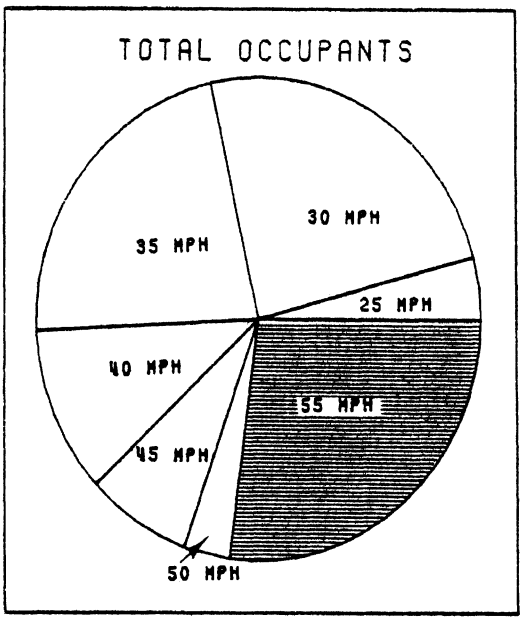
ROAD CONDITION	ACCIDENTS	OCCUPANTS							
		TOTAL	AIS 2+		AIS 3+		FATAL	
			N	%	N	%	N	%
DRY	21369	41885	2617	6.2	1304	3.1	362	0.9
WET	6620	12809	713	5.6	345	2.7	89	0.7
ICE	2008	3664	128	3.5	65	1.8	18	0.5
SNOW	1649	3342	139	4.2	55	1.6	12	0.4
OTHER	173	271	27	10.0	4	1.5	2	0.7
UNKNOWN	48	55	3	5.5	2	3.6	2	3.6
TOTAL	31867	62026	3627	5.8	1775	2.9	485	0.8

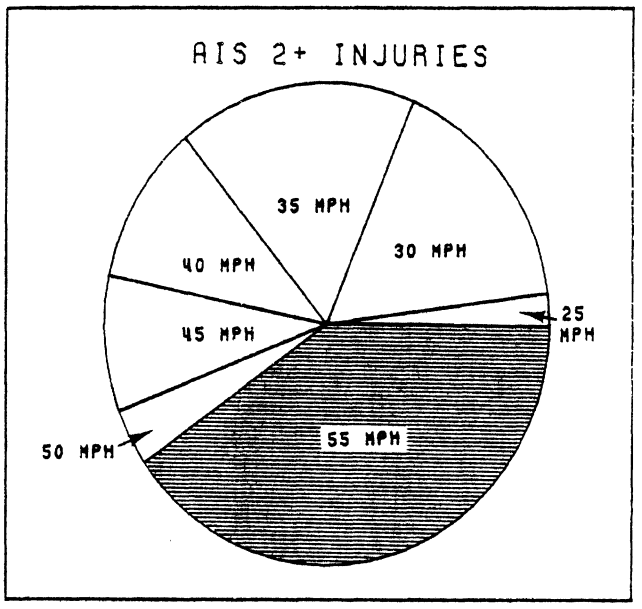


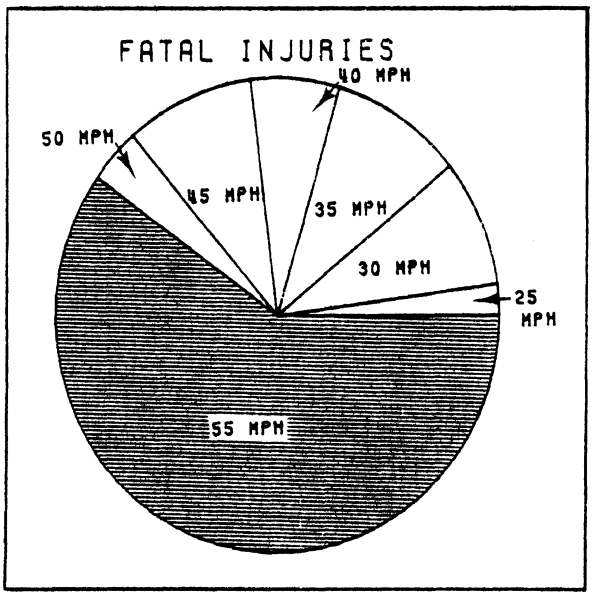
The average injury severity clearly decreases as road conditions become more "hazardous."

NCSS Crash Distributions by Speed Limit

SPEED LIMIT	ACCIDENTS		OCCUPANTS							
			TOTAL		AIS 2+		AIS 3+		FATAL	
	N	%	N	%	N	%	N	%	N	%
NONE	146	0.5	295	0.5	20	0.6	6	0.3	1	0.2
UNDER 20 MPH	229	0.7	439	0.7	27	0.7	6	0.3	1	0.2
25 MPH	1501	4.7	2522	4.1	77	2.1	33	1.9	10	2.0
30 MPH	7415	23.3	14676	23.7	587	16.2	225	12.7	42	8.6
35 MPH	6977	21.9	13439	21.7	613	16.9	267	15.0	46	9.4
40 MPH	3358	10.5	6775	10.9	381	10.5	168	9.5	31	6.4
45 MPH	2188	6.9	4585	7.4	320	8.8	172	9.7	45	9.2
50 MPH	1097	3.4	1998	3.2	137	3.8	64	3.6	17	3.7
55 MPH	8403	26.4	16307	26.3	1415	39.0	811	45.7	286	59.0
UNKNOWN	553	1.7	990	1.6	50	1.4	23	1.3	6	1.2
TOTAL	31867	100.0	62026	100.0	3627	100.0	1775	100.0	485	100.0



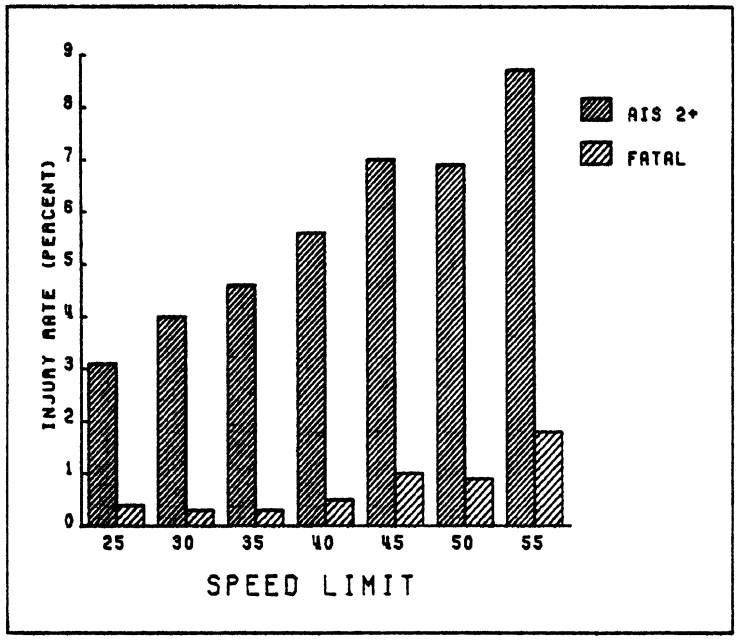




Almost three-quarters of all accidents in the NCSS sample occurred on roadways with a speed limit lower than 55 miles per hour. By contrast, almost 60% of the fatalities occurred at locations with the maximum (55 miles per hour) speed limit.

NCSS Injury Rates by Speed Limit

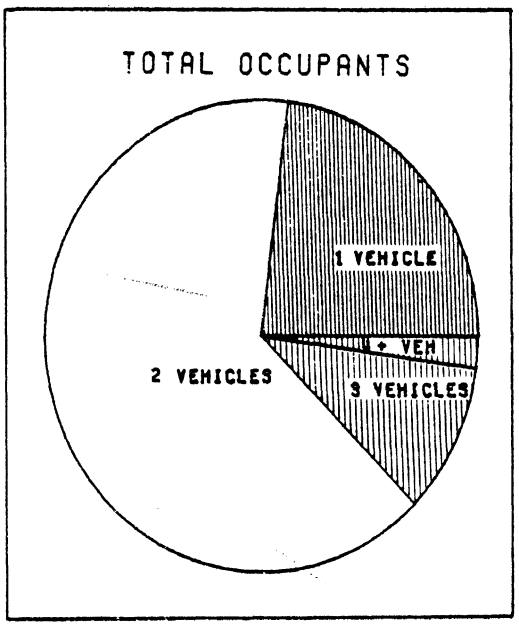
SPEED LIMIT	ACCIDENTS	OCCUPANTS						
		TOTAL	AIS 2+		AIS 3+		FATAL	
			N	%	N	%	N	%
NONE	146	295	20	6.8	6	2.0	1	0.3
UNDER 20 MPH	229	439	27	6.2	6	1.4	1	0.2
25 MPH	1501	2522	77	3.1	33	1.3	10	0.4
30 MPH	7415	14676	587	4.0	225	1.5	42	0.3
35 MPH	6977	13439	613	4.6	267	2.0	46	0.3
40 MPH	3358	6775	381	5.6	168	2.5	31	0.5
45 MPH	2188	4585	320	7.0	172	3.8	45	1.0
50 MPH	1097	1998	137	6.9	64	3.2	17	0.9
55 MPH	8403	16307	1415	8.7	811	5.0	286	1.8
UNKNOWN	553	990	50	5.1	23	2.3	6	0.6
TOTAL	31867	62026	3627	5.8	1775	2.9	485	0.8

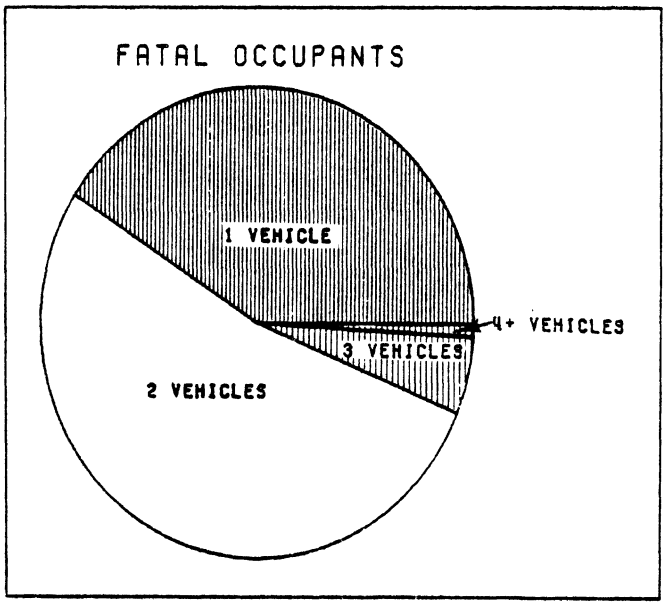


Both injury and fatality rates increase steadily with increase in the speed limit. The probability of injury at the AIS 2 level is estimated to be about three times as high at 55 mile per hour locations as at 25 mile per hour locations--for fatalities, about six times as high.

NCSS Crash Distributions by Number of Vehicles Involved

NUMBER OF VEHICLES	ACCIDENTS		OCCUPANTS							
			TOTAL		AIS 2+		AIS 3+		FATAL	
	N	%	N	%	N	%	N	%	N	%
1	9331	29.3	14295	23.0	1381	38.1	688	38.8	198	41.0
2	19069	59.8	39983	64.5	1901	52.4	932	52.5	257	52.9
3	2857	9.0	6410	10.3	276	7.6	114	6.4	26	5.3
4	506	1.6	1049	1.7	58	1.6	41	2.3	4	0.8
5	82	0.3	235	0.4	11	0.3	0	0.0	0	0.0
6	22	0.1	54	0.1	0	0.0	0	0.0	0	0.0
TOTAL	31867	100.0	62026	100.0	3627	100.0	1775	100.0	485	100.0

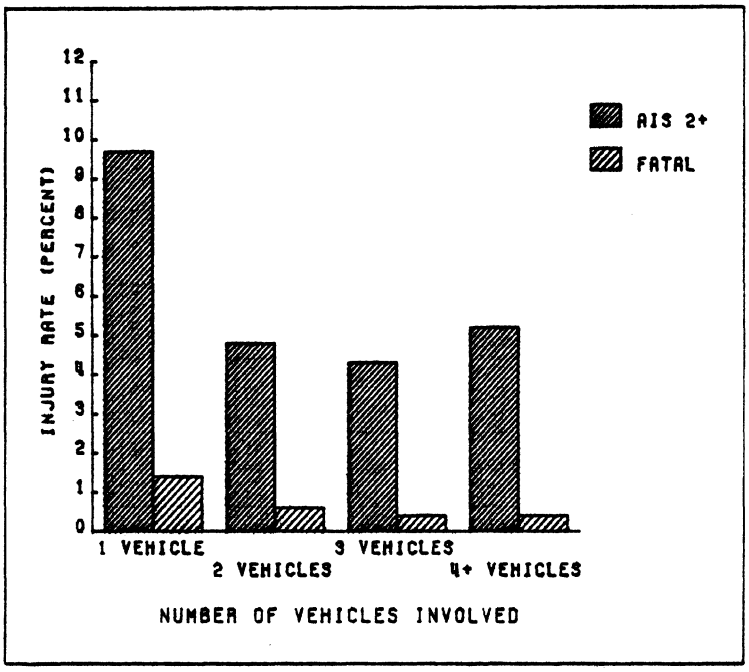




Forty-one percent of the passenger car fatalities occur in single vehicle accidents, although this category represents only 29.3% of all accidents. In the NCSS sample, 11% of all accidents involve more than two vehicles, but these account for only 6.1% of the fatalities.

NCSS Injury Rates by Number of Vehicles Involved

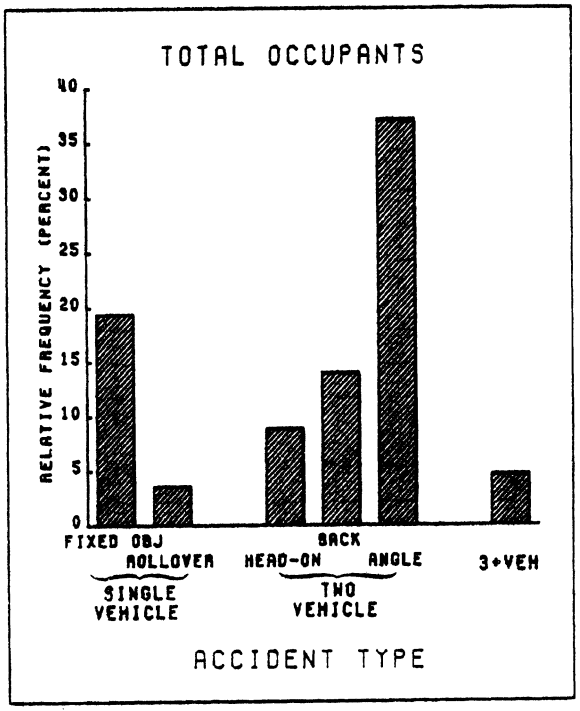
NUMBER OF VEHICLES	ACCIDENTS	OCCUPANTS						
		TOTAL	AIS 2+		AIS 3+		FATAL	
			N	%	N	%	N	%
1	9331	14295	1381	9.7	688	4.8	198	1.4
2	19069	39983	1901	4.8	932	2.3	257	0.6
3	2857	6410	276	4.3	114	1.8	26	0.4
4	506	1049	58	5.5	41	3.9	4	0.4
5	82	235	11	4.7	0	0.0	0	0.0
6	22	54	0	0.0	0	0.0	0	0.0
TOTAL	31867	62026	3627	5.8	1775	2.9	485	0.8

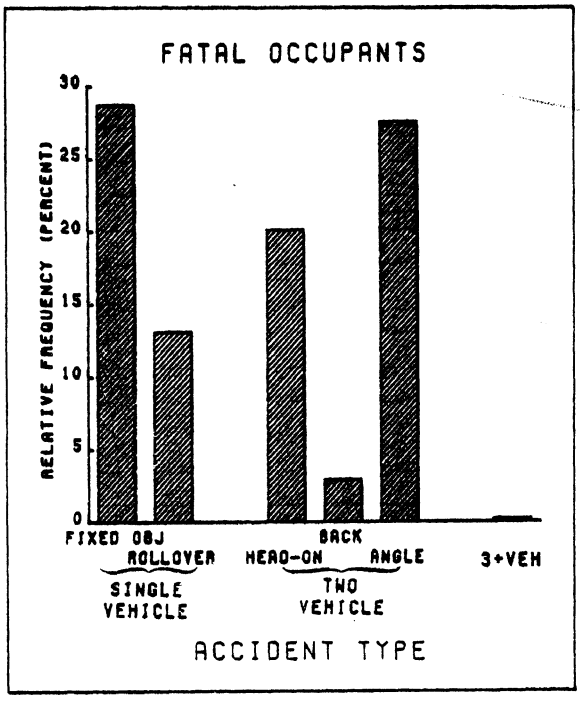


A car occupant is more than twice as likely to be killed in a single vehicle crash as in a multiple vehicle crash. About the same ratio holds true for AIS 2 and greater injuries.

NCSS Crash Distributions by Accident Type

TYPE OF IMPACT	ACCIDENTS		OCCUPANTS							
			TOTAL		AIS 2+		AIS 3+		FATAL	
	N	%	N	%	N	%	N	%	N	%
1 VEH. CRASHES										
Fixed Object	7925	24.9	12037	19.4	1133	31.2	539	30.4	138	28.7
Rollover	1330	4.2	2238	3.6	271	7.5	164	9.2	64	13.1
Undercarriage	500	1.6	765	1.2	32	0.9	13	0.7	3	0.6
2 VEH. CRASHES										
Head-On	2389	7.5	5520	8.9	564	15.6	303	17.1	97	20.1
Rear-End	4897	15.4	8702	14.0	174	4.8	67	3.8	14	2.9
Angle	10330	32.4	23046	37.2	1060	29.2	520	29.3	134	27.5
Sideswipe	484	1.5	1180	1.9	17	0.5	4	0.2	0	0.0
3+ VEH. CRASHES	1458	4.6	2895	4.7	52	1.4	11	0.6	1	0.2
UNKNOWN	2554	8.0	5643	9.1	324	8.9	154	8.7	34	7.0
TOTAL	31867	100.0	62026	100.0	3627	100.0	1775	100.0	485	100.0

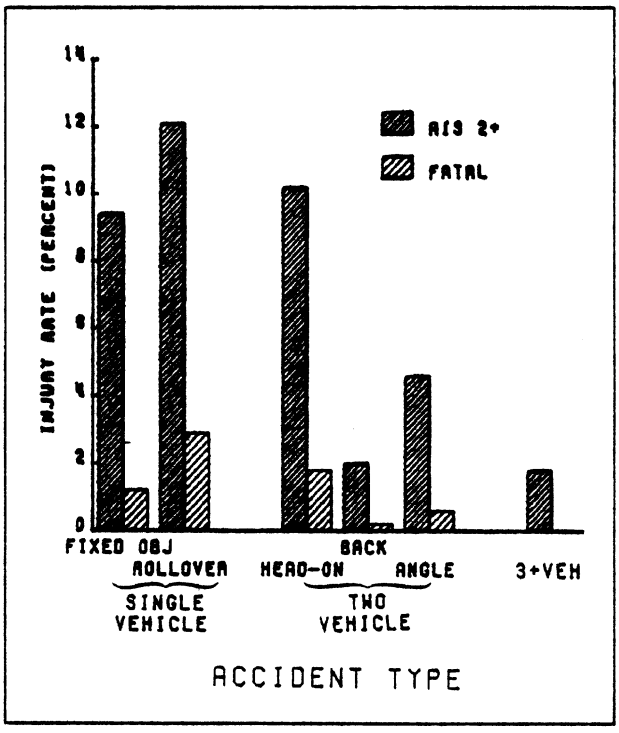




The most common accident type in this data set is a two-vehicle crash at an angle. Crashes involving three or more vehicles account for about 5% of the total, but only 0.2% (actually only one fatality) of the fatal injuries occur in these multiple vehicle accidents.

NCSS Injury Rates by Accident Type

TYPE OF IMPACT	ACCIDENTS	OCCUPANTS							
		TOTAL	AIS 2+		AIS 3+		FATAL	
			N	%	N	%	N	%
1 VEH. CRASHES								
Fixed Object	7925	12037	1133	9.4	539	4.5	138	1.2
Rollover	1330	2238	271	12.1	164	7.3	64	2.9
Undercarriage	500	765	32	4.2	13	1.7	3	0.4
2 VEH. CRASHES								
Head-On	2389	5520	564	10.2	303	5.5	97	1.8
Rear-End	4897	8702	174	2.0	67	0.8	14	0.2
Angle	10330	23046	1060	4.6	520	2.3	134	0.6
Sideswipe	484	1180	17	1.4	4	0.3	0	0.0
3+ VEH. CRASHES	1458	2895	52	1.8	11	0.4	1	0.0
UNKNOWN	2554	5643	324	5.7	154	2.7	34	0.6
TOTAL	31867	62026	3627	5.8	1775	2.9	485	0.8



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 1.8%.

3 VEHICLES

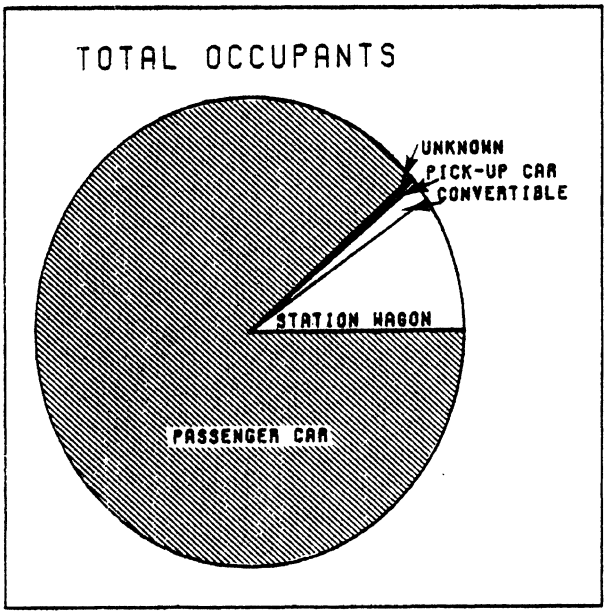
This section presents several tables and graphs describing the characteristics of the case vehicles involved in the NCSS crashes. Case vehicles are always passenger vehicles, including conventional cars, station wagons, convertibles, and a small number of pick-up cars. In the weighted tables shown, there are 39,444 vehicles represented. Other vehicle types, such as trucks, motorcycles, etc., that were involved in these accidents are not included in the following tables.

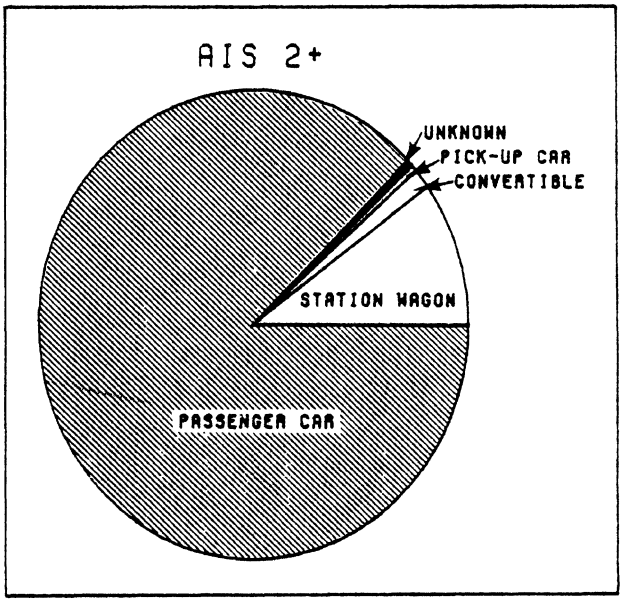
For each vehicle category shown, the total number of occupants, and the number of occupants injured at the AIS 2+, 3+, and Fatal level, are tabulated. The total number of vehicle occupants in the reconstructed population is 62,026, with 3,627 injured to AIS 2 or greater, 1,775 to AIS 3 or greater, and 485 fatalities. 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.

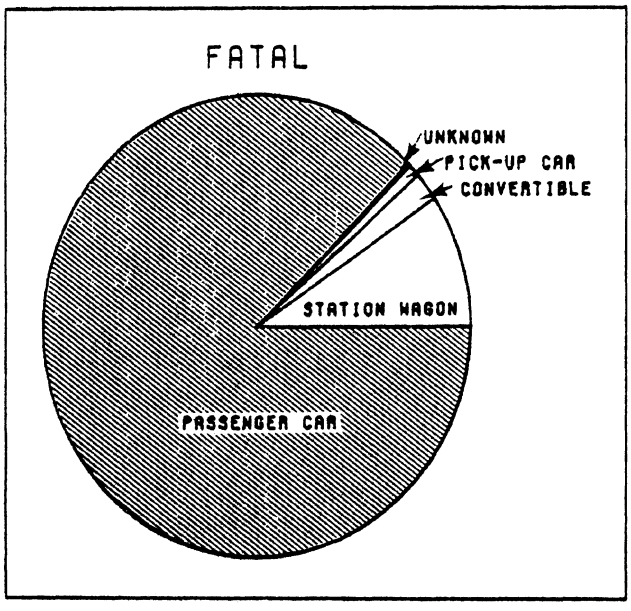
The early tables show distributions by the descriptive characteristics of the damaged vehicles (type, model year, weight, and number of occupants); these are followed by tables showing a variety of damage characteristics (direction of force, general area of damage, etc.). In addition to the information provided in this section, the last section of this factbook (beginning on page 79) 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	35274	89.4	55006	88.7	3183	87.8	1561	87.9	424	87.5
STATION WAGON	3352	8.5	5803	9.4	364	10.0	163	9.2	46	9.4
CONVERTIBLE	529	1.3	831	1.3	49	1.4	36	2.0	10	2.0
PICK-UP CAR	166	0.4	216	0.3	14	0.4	9	0.5	4	0.8
UNKNOWN	123	0.3	170	0.3	17	0.5	6	0.3	1	0.2
TOTAL	39444	100.0	62026	100.0	3627	100.0	1775	100.0	485	100.0



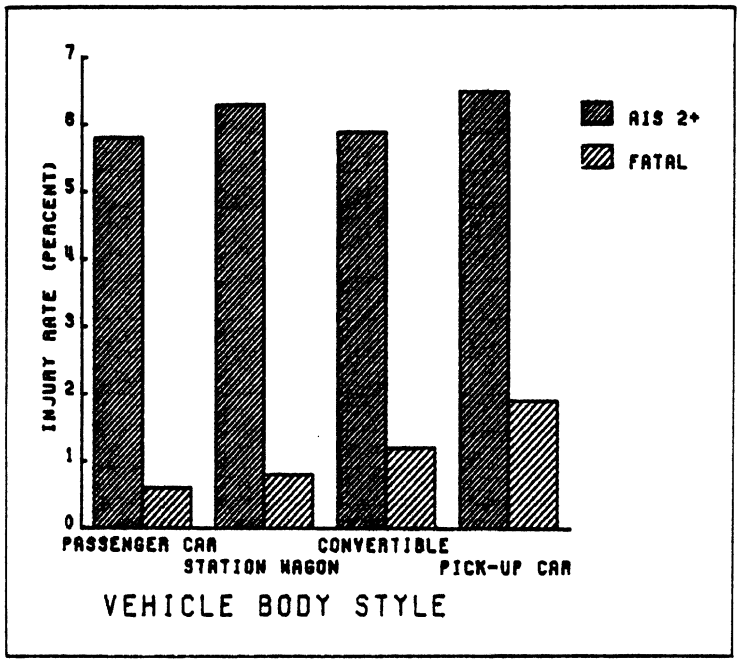




Nearly nine out of ten case vehicles in the study are conventional passenger cars, and most of the rest are station wagons. A small number of convertibles and pick-up cars are included.

NCSS Injury Rates by Case Vehicle Body Style

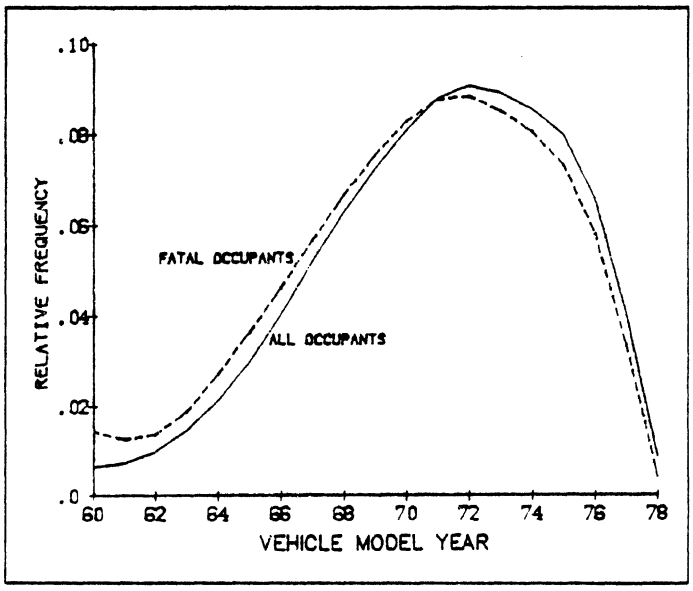
BODY STYLE	VEHICLES	OCCUPANTS						
		TOTAL	AIS 2+		AIS 3+		FATAL	
			N	%	N	%	N	%
PASSENGER CAR	35274	55006	3183	5.8	1561	2.8	424	0.8
STATION WAGON	3352	5803	364	6.3	163	2.8	46	0.8
CONVERTIBLE	529	831	49	5.9	36	4.3	10	1.2
PICK-UP CAR	166	216	14	6.5	9	4.2	4	1.9
UNKNOWN	123	170	17	10.0	6	3.5	1	0.6
TOTAL	39444	62026	3627	5.8	1775	2.9	485	0.8



The AIS 3+ injury rate is somewhat higher for the convertibles and pick-up cars. The fatality rate is higher too, but both of these involve a relatively small sample.

NCSS Case Vehicle Distributions by Model Year

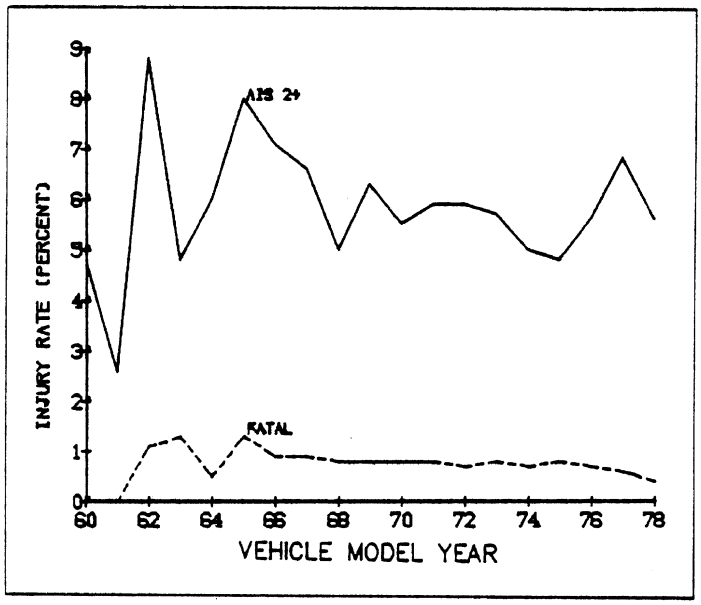
MODEL YEAR	VEHICLES		OCCUPANTS							
			TOTAL		AIS 2+		AIS 3+		FATAL	
	N	%	N	%	N	%	N	%	N	%
1960 AND OLDER	332	0.8	398	0.6	35	1.0	14	0.8	7	1.4
1961	153	0.4	272	0.4	7	0.2	1	0.1	0	0.0
1962	290	0.7	465	0.7	41	1.1	17	1.0	5	1.0
1963	345	0.9	626	1.0	30	0.8	25	1.4	8	1.6
1964	812	2.1	1174	1.9	71	2.0	38	2.1	6	1.2
1965	1094	2.8	1654	2.7	132	3.6	71	4.0	22	4.5
1966	1432	3.6	2323	3.7	166	4.6	101	5.7	22	4.5
1967	1841	4.7	2998	4.8	198	5.5	86	4.8	26	5.3
1968	2468	6.3	4172	6.7	209	5.8	118	6.6	33	6.8
1969	2846	7.2	4773	7.7	301	8.3	134	7.5	39	8.0
1970	3137	8.0	5014	8.1	276	7.6	146	8.2	40	8.4
1971	3379	8.6	5326	8.6	313	8.6	147	8.3	44	9.0
1972	4074	10.3	6394	10.3	375	10.3	188	10.6	46	9.6
1973	3796	9.6	6110	9.9	347	9.6	161	9.1	46	9.6
1974	3675	9.3	5386	8.7	269	7.4	132	7.4	37	7.6
1975	2879	7.3	4491	7.2	216	6.0	105	5.9	35	7.2
1976	3631	9.2	5278	8.5	293	8.1	132	7.4	38	7.8
1977	2920	7.4	4625	7.5	316	8.7	147	8.3	28	5.7
1978	334	0.8	539	0.9	30	0.8	11	0.6	2	0.4
UNKNOWN	6	0.0	8	0.0	2	0.1	1	0.1	0	0.0
TOTAL	39444	100.0	62026	100.0	3627	100.0	1775	100.0	485	100.0



In the graph the distribution by model year for all occupants and for fatal occupants has been smoothed with a three-point moving mean. The crossover at about 1971 indicates that newer cars in towaway crashes are less likely to produce fatal injuries.

NCSS Injury Rates by Case Vehicle Model Year

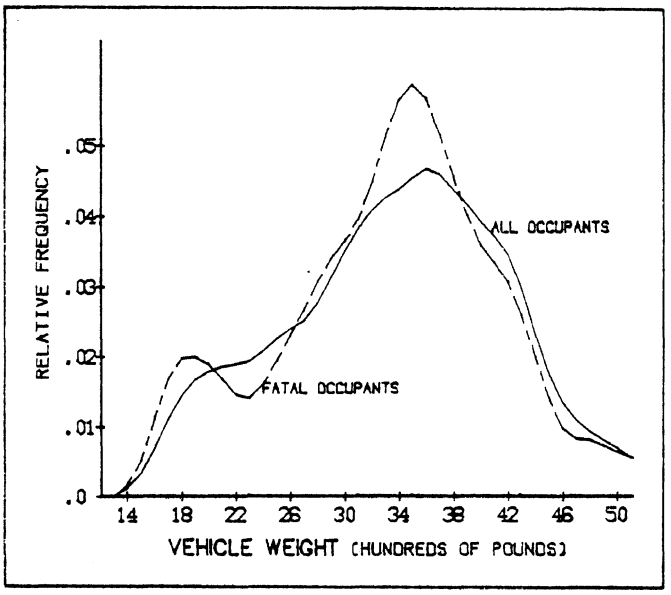
MODEL YEAR	VEHICLES	OCCUPANTS							
		TOTAL	AIS 2+		AIS 3+		FATAL	
			N	%	N	%	N	%
1960 AND OLDER	332	398	35	8.8	14	3.5	7	1.8
1961	153	272	7	2.6	1	0.4	0	0.0
1962	290	465	41	8.8	17	3.7	5	1.1
1963	345	626	30	4.8	25	4.0	8	1.3
1964	812	1174	71	6.0	38	3.2	6	0.5
1965	1094	1654	132	8.0	71	4.3	22	1.3
1966	1432	2323	166	7.1	101	4.3	22	0.9
1967	1841	2998	198	6.6	86	2.9	26	0.9
1968	2468	4172	209	5.0	118	2.8	33	0.8
1969	2846	4773	301	6.3	134	2.8	39	0.8
1970	3137	5014	276	5.5	146	2.9	40	0.8
1971	3379	5326	313	5.9	147	2.8	44	0.8
1972	4074	6394	375	5.9	188	2.9	46	0.7
1973	3796	6110	347	5.7	161	2.6	46	0.8
1974	3675	5386	269	5.0	132	2.5	37	0.7
1975	2879	4491	216	4.8	105	2.3	35	0.8
1976	3631	5278	293	5.6	132	2.5	38	0.7
1977	2920	4625	316	6.8	147	3.2	28	0.6
1978	334	539	30	5.6	11	2.0	2	0.4
UNKNOWN	6	8	2	25.0	1	12.5	0	0.0
TOTAL	39444	62026	3627	5.8	1775	2.9	485	0.8



The injury rates, in contrast to the vehicle distribution, show a peak for model years between 1965 and 1967 at all three levels of injury. For whatever reason, newer cars are safer cars.

NCSS Case Vehicle Distributions by Vehicle Weight

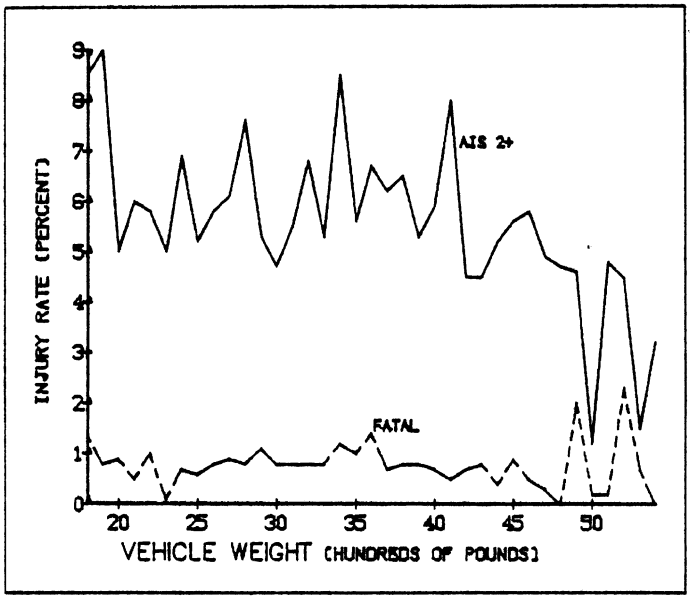
VEHICLE WEIGHT (IN POUNDS)	VEHICLES		OCCUPANTS							
			TOTAL		AIS 2+		AIS 3+		FATAL	
	N	%	N	%	N	%	N	%	N	%
1300-1599	101	0.3	172	0.3	16	0.4	14	0.8	3	0.6
1600-1899	1299	3.3	1983	3.2	151	4.2	91	5.1	26	5.3
1900-2199	2281	5.8	3433	5.5	225	6.2	107	6.0	25	5.3
2200-2499	2372	6.0	3500	5.6	204	5.6	100	5.6	20	4.1
2500-2799	3131	7.9	4770	7.7	274	7.6	124	7.0	35	7.2
2800-3099	3603	9.1	5407	8.7	303	8.4	162	9.1	49	10.0
3100-3399	4746	12.0	7760	12.5	455	12.5	211	11.9	59	12.3
3400-3699	5324	13.5	8113	13.1	563	15.5	309	17.4	94	19.5
3700-3999	5049	12.8	8456	13.6	517	14.2	239	13.5	65	13.3
4000-4299	4297	10.9	7116	11.5	434	12.0	182	10.3	47	9.6
4300-4599	3150	8.0	4928	7.9	244	6.7	120	6.8	35	7.2
4600-4899	1027	2.6	1608	2.6	82	2.3	47	2.7	4	0.8
OVER 4900	1020	2.6	1720	2.8	64	1.8	43	2.4	19	3.9
OTHER	2048	5.2	3034	4.9	96	2.7	34	1.9	4	0.8
TOTAL	39444	100.0	62026	100.0	3627	100.0	1775	100.0	485	100.0



The smoothed plots of the proportion of all and fatal occupants by weight of the case vehicle contains some unexpected crossovers. For vehicles weighing less than 2,000 pounds the "Fatals" exceed "All," but from 2,000 to 2,800 pounds the reverse is true. As might be expected, cars weighing more than 3,800 pounds are underrepresented among the fatalities, but the reason for the overrepresentation of 3,200-3,800 pound cars is not obvious. This suggests interaction in the data--perhaps among car size, occupant age, speed of travel, type of accident, etc.

NCSS Injury Rates by Case Vehicle Weight

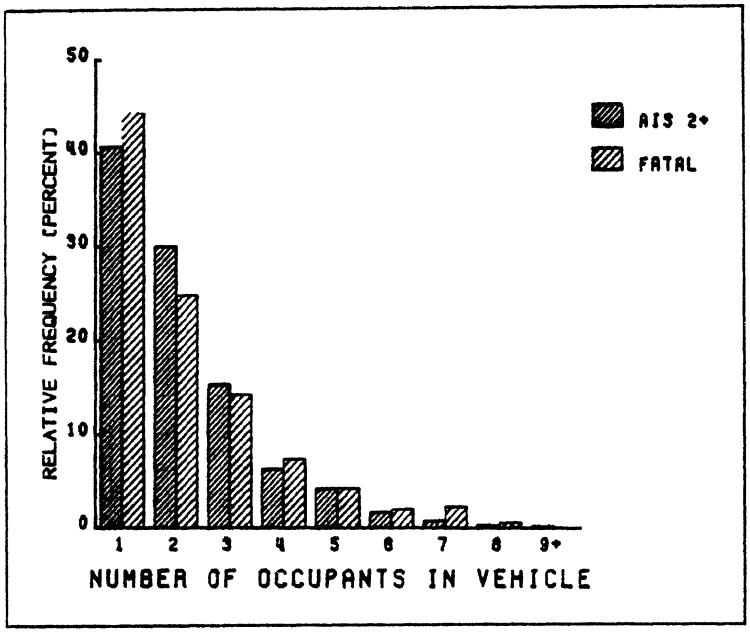
VEHICLE WEIGHT (IN POUNDS)	VEHICLES	OCCUPANTS						
		TOTAL	AIS 2+		AIS 3+		FATAL	
			N	%	N	%	N	%
1300-1599	101	172	16	9.3	14	8.1	3	1.7
1600-1899	1299	1983	151	7.6	91	4.6	26	1.3
1900-2199	2281	3433	225	6.6	107	3.1	25	0.8
2200-2499	2372	3500	204	5.8	100	2.9	20	0.6
2500-2799	3131	4770	274	5.7	124	2.6	35	0.7
2800-3099	3603	5407	303	5.6	162	3.0	49	0.9
3100-3399	4746	7760	455	5.8	211	2.7	59	0.8
3400-3699	5324	8113	563	6.9	309	3.8	94	1.2
3700-3999	5049	8456	517	6.1	239	2.8	65	0.8
4000-4299	4297	7116	434	6.1	182	2.6	47	0.6
4300-4599	3150	4928	244	4.9	120	2.4	35	0.7
4600-4899	1027	1608	82	5.1	47	2.9	4	0.3
OVER 4900	1020	1720	64	3.7	43	2.5	19	1.1
OTHER	2048	3034	96	3.2	34	1.1	4	0.1
TOTAL	39444	62026	3627	5.8	1775	2.9	485	0.8



These unsmoothed data show a lot of variation of injury rate with weight in the region from 2,000 pounds to 4,000 pounds, with relatively high and low rates for very small and very large cars, respectively.

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	25401	64.4	25401	41.0	1477	40.7	737	41.5	215	44.3
2	8986	22.8	17972	29.0	1092	30.1	518	29.2	120	24.8
3	2923	7.4	8769	14.1	559	15.4	260	14.6	70	14.3
4	1297	3.3	5188	8.4	233	6.4	124	7.0	35	7.4
5	536	1.4	2680	4.3	157	4.3	85	4.8	21	4.3
6	173	0.4	1038	1.7	62	1.7	24	1.4	10	2.0
7	79	0.2	553	0.9	30	0.8	20	1.1	11	2.3
8	34	0.1	272	0.4	10	0.3	7	0.4	3	0.6
9 OR MORE	15	0.0	153	0.2	7	0.2	0	0.0	0	0.0
TOTAL	39444	100.0	62026	100.0	3627	100.0	1775	100.0	485	100.0



The average number of occupants in a towed passenger car in a NCSS crash is 1.57 (62,026 occupants in 39,444 vehicles). Most common, in 64.4% of the crashed vehicles, is a single occupant.

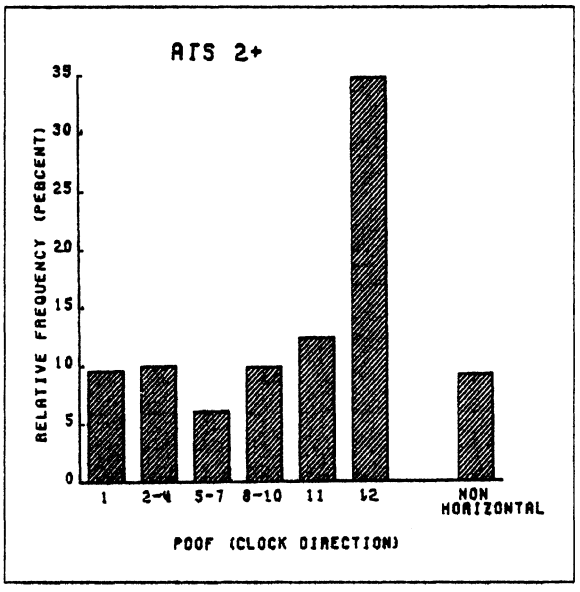
NCSS Injury Rates by Number of Occupants in Case Vehicle

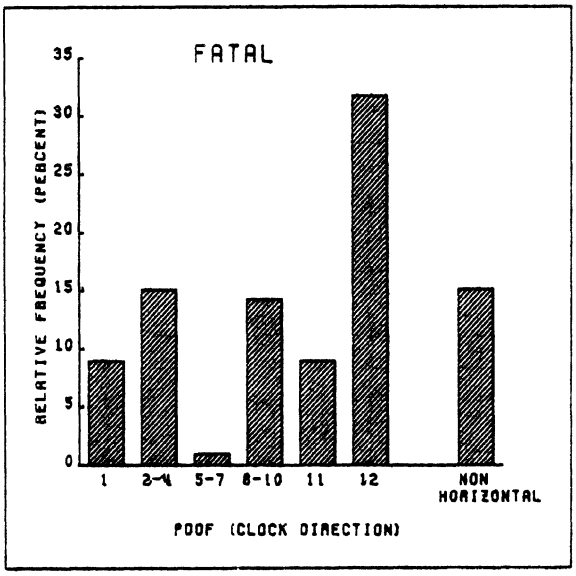
NUMBER OF OCCUPANTS IN VEHICLE	VEHICLES	OCCUPANTS							
		TOTAL	AIS 2+		AIS 3+		FATAL	
			N	%	N	%	N	%
1	25401	25401	1477	5.8	737	2.9	215	0.9
2	8986	17972	1092	6.1	518	2.9	120	0.7
3	2923	8769	559	6.4	260	3.0	70	0.8
4	1297	5188	233	4.5	124	2.4	35	0.7
5	536	2680	157	5.9	85	3.2	21	0.8
6	173	1038	62	6.0	24	2.3	10	1.0
7	79	553	30	5.4	20	3.6	11	2.0
8	34	272	10	3.7	7	2.6	3	1.1
9 OR MORE	15	153	7	4.6	0	0.0	0	0.0
TOTAL	39444	62026	3627	5.8	1775	2.9	485	0.8

Injury rates at all levels are relatively independent of the number of occupants in the vehicles. Vehicles with higher occupancy, of course, have more persons exposed to possible injury; so more than one-half of the injuries and fatalities occur in vehicles with more than one person in them.

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	%
NON-HORIZONTAL	1805	4.6	2932	4.7	334	9.2	198	11.2	74	15.2
1 O'CLOCK	3835	9.7	5943	9.6	347	9.6	183	10.3	44	9.0
2 O'CLOCK	3003	7.6	4810	7.8	318	8.8	171	9.6	47	9.6
3 O'CLOCK	459	1.2	745	1.2	58	1.6	32	1.8	18	3.7
4 O'CLOCK	376	1.0	613	1.0	26	0.7	21	1.2	9	1.8
5 O'CLOCK	325	0.8	516	0.8	17	0.5	10	0.6	2	0.4
6 O'CLOCK	1523	3.9	2686	4.3	41	1.1	10	0.6	2	0.4
7 O'CLOCK	355	0.9	627	1.0	14	0.4	7	0.4	1	0.2
8 O'CLOCK	469	1.2	842	1.4	30	0.8	24	1.4	10	2.0
9 O'CLOCK	648	1.6	972	1.6	61	1.7	33	1.9	15	3.1
10 O'CLOCK	2695	6.8	4298	6.9	315	8.7	186	10.5	45	9.2
11 O'CLOCK	4860	12.3	7708	12.4	443	12.2	182	10.3	44	9.0
12 O'CLOCK	11438	29.0	17412	28.1	1260	34.7	591	33.3	152	31.8
UNKNOWN	7653	19.4	11922	19.2	363	10.0	127	7.2	22	4.5
TOTAL	39444	100.0	62026	100.0	3627	100.0	1775	100.0	485	100.0



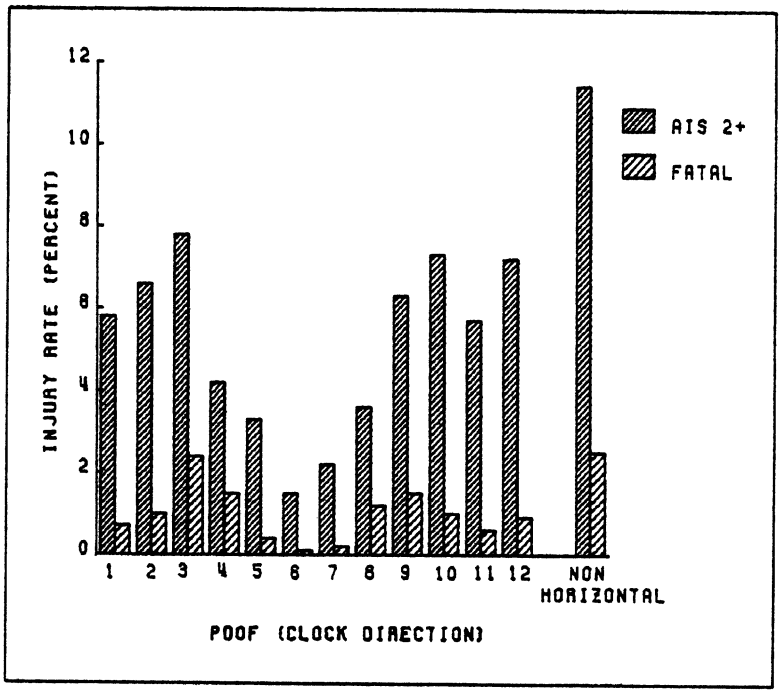


The principal direction of force to the vehicle is the vector force at the instant of impact. It is not necessarily directly related to the area of the vehicle damaged--e.g., it is possible to have an 11 o'clock vector into the side or the front of a car. This "clock direction" is taken from the first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

The "non-horizontal" category for direction of force includes the rollovers. Note that these represent only 4.6% of the vehicles, but 15.2% of the fatalities. The most common impact direction is 12 o'clock, followed by 11 o'clock and 1 o'clock. Injuries peak even more sharply at 12 o'clock.

NCSS Injury Rates by Case Vehicle
Principal Direction of Force (PDOF)

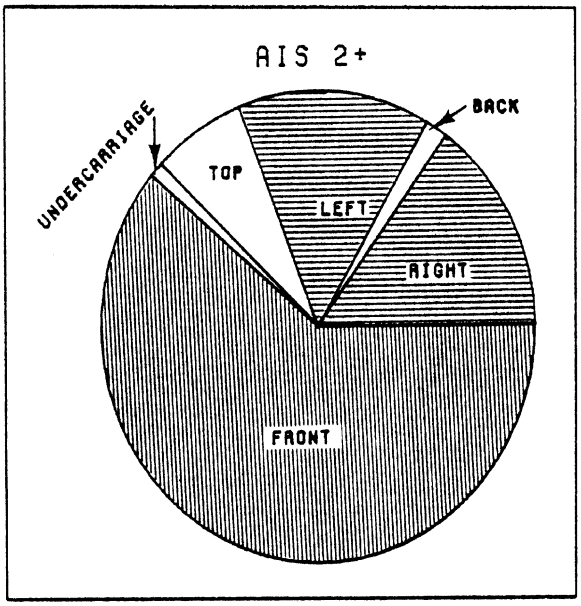
CDC DIRECTION	VEHICLES	OCCUPANTS							
		TOTAL	AIS 2+		AIS 3+		FATAL	
			N	%	N	%	N	%
NON-HORIZONTAL	1805	2932	334	11.4	198	6.8	74	2.5
1 O'CLOCK	3835	5943	347	5.8	183	3.1	44	0.7
2 O'CLOCK	3003	4810	318	6.6	171	3.6	47	1.0
3 O'CLOCK	459	745	58	7.8	32	4.3	18	2.4
4 O'CLOCK	376	613	26	4.2	21	3.4	9	1.5
5 O'CLOCK	325	516	17	3.3	10	1.9	2	0.4
6 O'CLOCK	1523	2686	41	1.5	10	0.4	2	0.1
7 O'CLOCK	355	627	14	2.2	7	1.1	1	0.2
8 O'CLOCK	469	842	30	3.6	24	2.9	10	1.2
9 O'CLOCK	648	972	61	6.3	33	3.4	15	1.5
10 O'CLOCK	2695	4298	315	7.3	186	4.3	45	1.0
11 O'CLOCK	4860	7708	443	5.7	182	2.4	44	0.6
12 O'CLOCK	11438	17412	1260	7.2	591	3.4	152	0.9
UNKNOWN	7653	11922	363	3.0	127	1.1	22	0.2
TOTAL	39444	62026	3627	5.8	1775	2.9	485	0.8

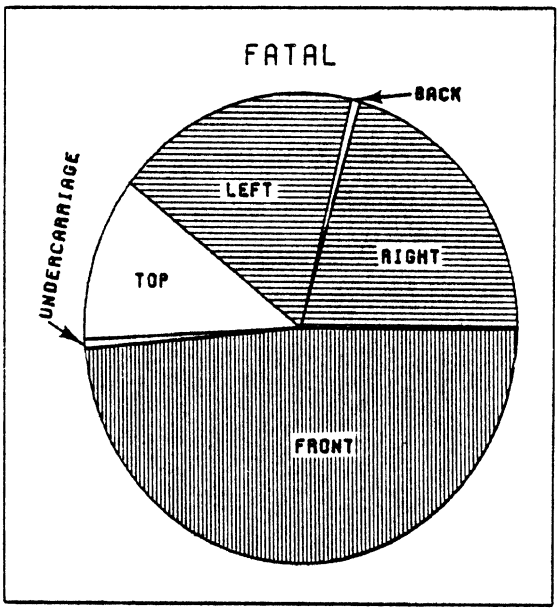


While the most common impact directions are frontal, the highest injury rates (at all levels) result from impacts toward the side.

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	19861	50.4	30395	49.0	1999	55.1	929	52.3	223	46.3
RIGHT	4284	10.9	6976	11.2	484	13.3	282	15.9	96	19.7
BACK	1721	4.4	2967	4.8	52	1.4	15	0.8	3	0.6
LEFT	4441	11.3	7327	11.8	469	12.9	274	15.4	85	17.4
TOP	1028	2.6	1718	2.8	226	6.2	135	7.6	53	10.9
UNDERCARRIAGE	456	1.2	721	1.2	34	0.9	13	0.7	3	0.6
UNKNOWN	7653	19.4	11922	19.2	363	10.0	127	7.2	22	4.5
TOTAL	39444	100.0	62026	100.0	3627	100.0	1775	100.0	485	100.0

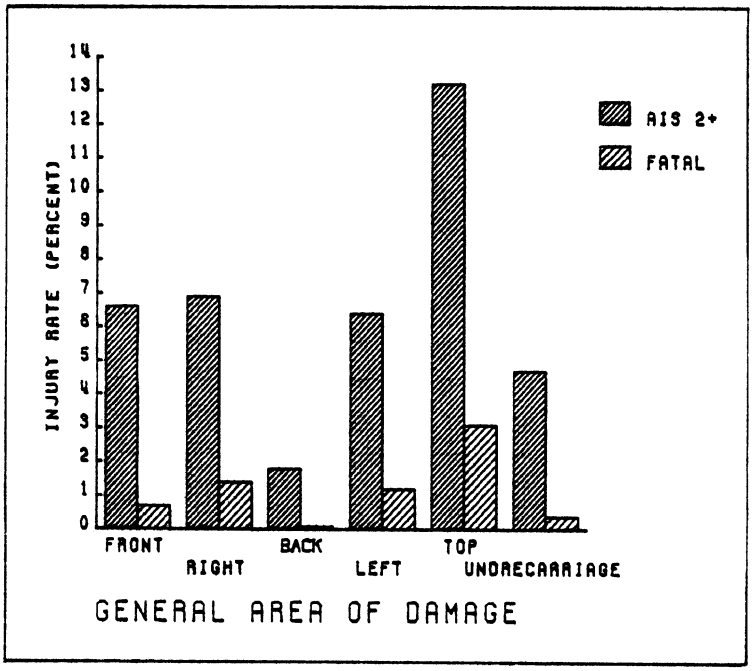




The most common area damaged in a crashed vehicle is the front, with more than half falling in this category. Right and left side impact frequencies are nearly equal, but with slightly higher injury frequencies for the right. Unknown damage areas have been excluded from the graphs, and it is likely that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

NCSS Injury Rates by Case Vehicle General Area of Damage

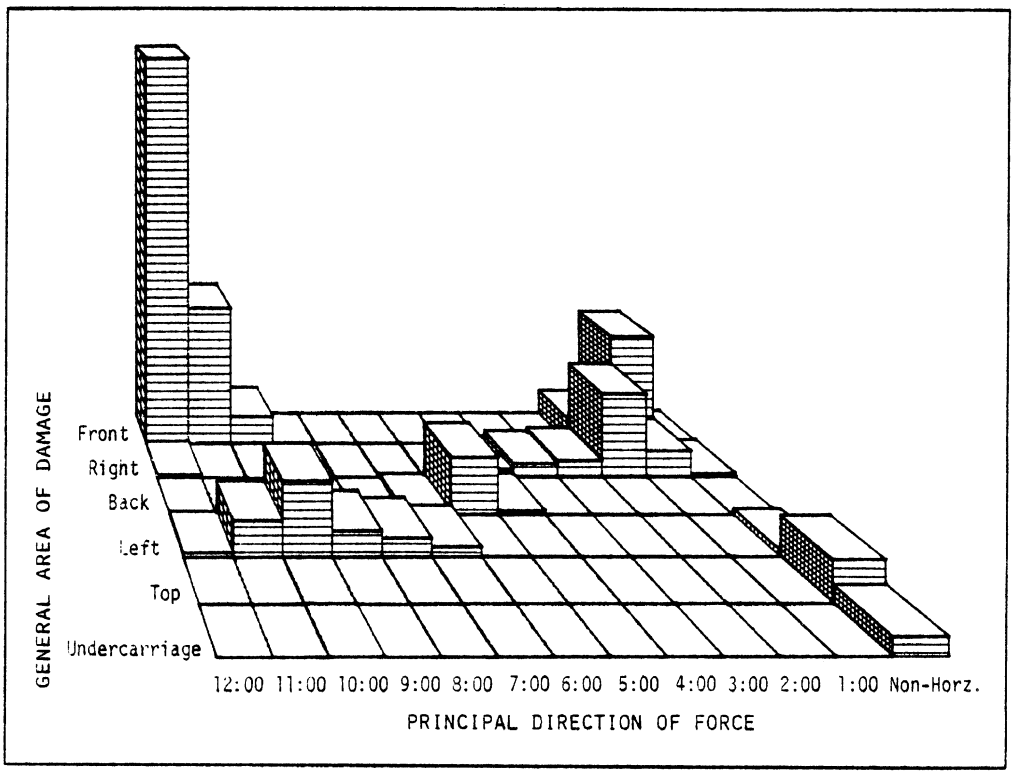
DAMAGE AREA	VEHICLES	OCCUPANTS						
		TOTAL	AIS 2+		AIS 3+		FATAL	
			N	%	N	%	N	%
FRONT	19861	30395	1999	6.6	929	3.1	223	0.7
RIGHT	4284	6976	484	6.9	282	4.0	96	1.4
BACK	1721	2967	52	1.8	15	0.5	3	0.1
LEFT	4441	7327	469	6.4	274	3.7	85	1.2
TOP	1028	1718	226	13.2	135	7.9	53	3.1
UNDERCARRIAGE	456	721	34	4.7	13	1.8	3	0.4
UNKNOWN	7653	11922	363	3.0	127	1.1	22	0.2
TOTAL	39444	62026	3627	5.8	1775	2.9	485	0.8



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 twice as high as for front, while that for the back is very low.

NCSS Case Vehicles: Principal Direction of Force
by General Area of Damage

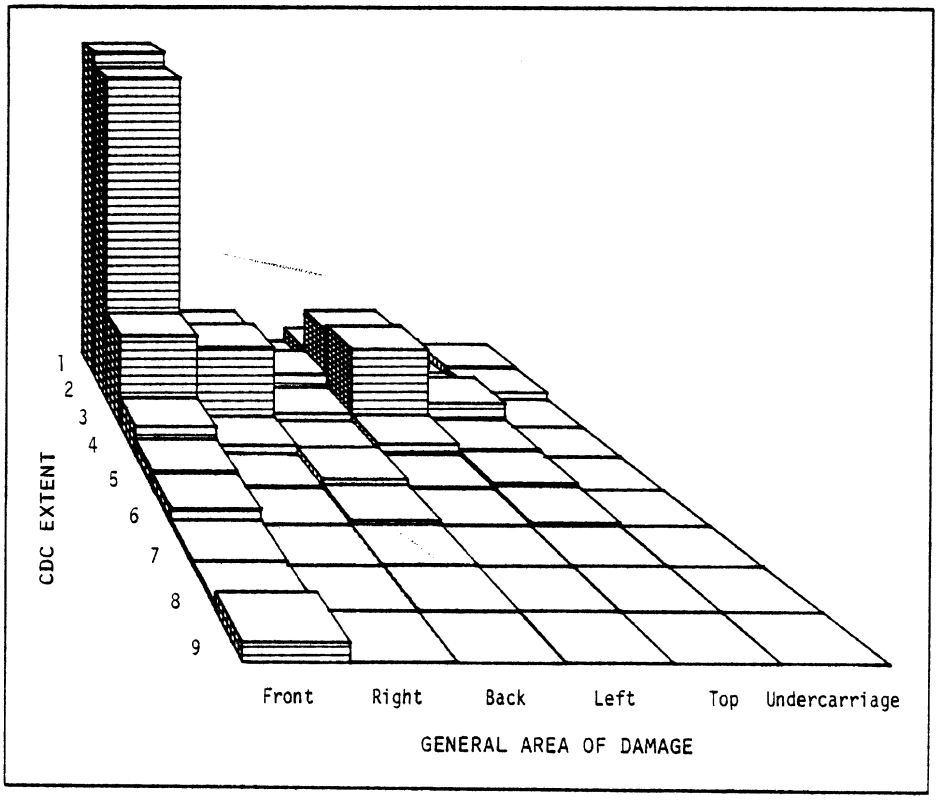
CDC DIRECTION	FRONT DAMAGE	RIGHT DAMAGE	BACK DAMAGE	LEFT DAMAGE	TOP DAMAGE	UNDER-CARRIAGE	UNKNOWN	TOTAL
NON-HORIZONTAL	63	107	0	162	1028	445	0	1805
1 O'CLOCK	3108	727	0	0	0	0	0	3835
2 O'CLOCK	689	2314	0	0	0	0	0	3003
3 O'CLOCK	0	459	0	0	0	0	0	459
4 O'CLOCK	0	376	0	0	0	0	0	376
5 O'CLOCK	0	218	107	0	0	0	0	325
6 O'CLOCK	0	1	1512	10	0	0	0	1523
7 O'CLOCK	0	0	102	253	0	0	0	355
8 O'CLOCK	0	0	0	469	0	0	0	469
9 O'CLOCK	0	0	0	648	0	0	0	648
10 O'CLOCK	798	0	0	1887	0	10	0	2695
11 O'CLOCK	3958	0	0	902	0	0	0	4860
12 O'CLOCK	11245	82	0	110	0	1	0	11438
UNKNOWN	0	0	0	0	0	0	7653	7653
TOTAL	19861	4284	1721	4441	1028	456	7653	39444



The relationship between principal direction of force and area damaged is made clear. Right and left side damage, for example, are occasionally reported with a 12 o'clock damage vector, although the most common side damage is at 2 o'clock or 10 o'clock.

NCSS Case Vehicles: CDC (Collision Deformation Class) Extent
by General Area of Damage

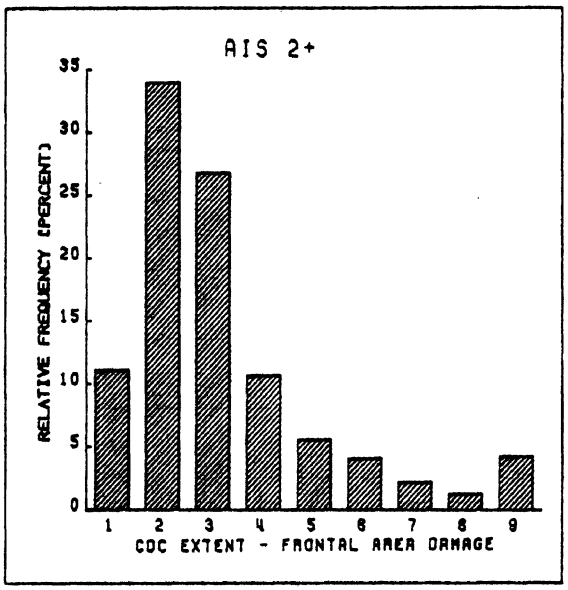
CDC EXTENT	FRONT DAMAGE	RIGHT DAMAGE	BACK DAMAGE	LEFT DAMAGE	TOP DAMAGE	UNDER-CARRIAGE	UNKNOWN	TOTAL
1	8176	517	316	651	20	232	10	9922
2	7783	1620	624	1641	74	189	0	11931
3	2086	1822	302	1786	547	22	1	6566
4	646	234	141	277	170	11	0	1479
5	363	57	202	51	134	1	0	808
6	313	20	98	17	69	0	0	517
7	91	6	24	4	3	0	0	128
8	72	4	13	1	11	0	0	101
9	331	4	1	13	0	1	11	361
UNKNOWN	0	0	0	0	0	0	7631	7631
TOTAL	19861	4284	1721	4441	1028	456	7653	39444

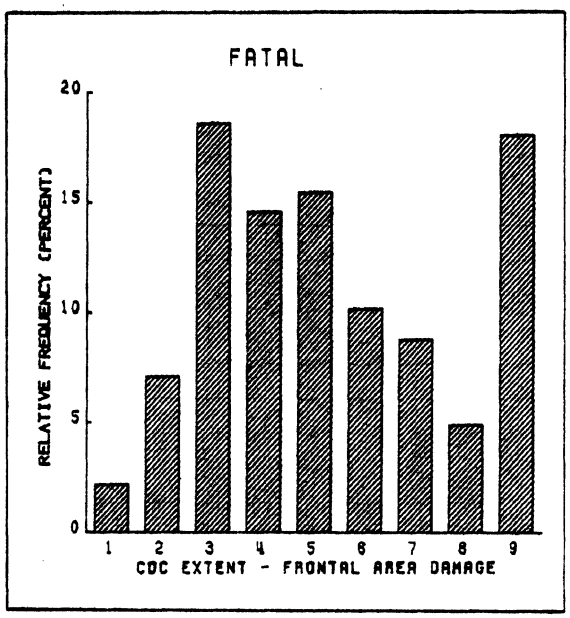


The most common frontal damage extent is at CDC 1. Recall that these cars must have been towed for damage, and thus many cars must be towed with relatively minor front damage. The most common back damage extent is at CDC 2, and side damage at CDC 3. CDC extent, of course, measures different things for frontal as compared with side damage. Other differences between side and frontal collisions can be seen from the Delta V section of this factbook on pages 88 to 93.

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	8176	41.2	12613	41.5	222	11.1	48	5.2	5	2.2
2	7783	39.2	11692	38.5	680	34.0	212	22.8	15	7.1
3	2086	10.5	3315	10.9	535	26.8	274	29.5	41	18.6
4	646	3.3	919	3.0	213	10.7	129	13.9	33	14.6
5	363	1.8	579	1.9	112	5.6	91	9.8	35	15.5
6	313	1.6	463	1.5	82	4.1	53	5.7	23	10.2
7	91	0.5	154	0.5	44	2.2	35	3.8	20	8.8
8	72	0.4	122	0.4	25	1.3	17	1.8	11	4.9
9	331	1.7	538	1.8	86	4.3	70	7.5	40	18.1
TOTAL	19861	100.0	30395	100.0	1999	100.0	929	100.0	226	100.0

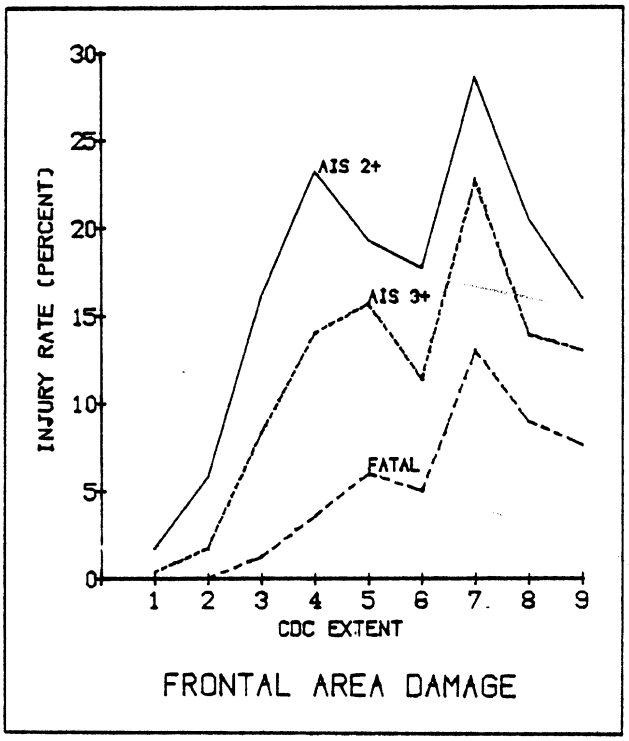




The CDC extent code indicate the amount of crush sustained by the vehicle. CDC 1 to the front indicates relatively minor damage, although the category includes five fatalities. In the frontal damage subset more than 25% of the fatalities occur with CDC extents of 3 or less.

NCSS Injury Rates by Case Vehicle CDC Extent
(Frontal Area Damage)

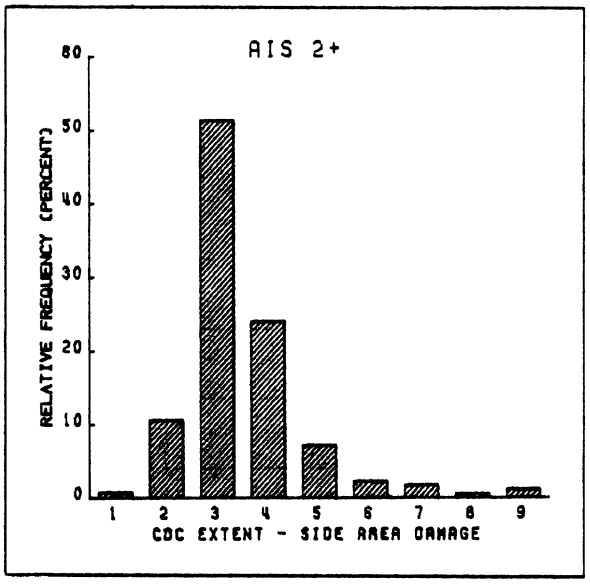
CDC EXTENT	VEHICLES	OCCUPANTS							
		TOTAL	AIS 2+		AIS 3+		FATAL	
			N	%	N	%	N	%
1	8176	12613	222	1.8	48	0.4	5	0.0
2	7783	11692	680	5.8	212	1.8	15	0.1
3	2086	3315	535	16.1	274	8.3	41	1.3
4	646	919	213	23.2	129	14.0	33	3.6
5	363	579	112	19.3	91	15.7	35	6.0
6	313	463	82	17.7	53	11.4	23	5.0
7	91	154	44	28.6	35	22.7	20	13.0
8	72	122	25	20.5	17	13.9	11	9.0
9	331	538	86	16.0	70	13.0	40	7.6
TOTAL	19861	30395	1999	6.6	929	3.1	226	0.7

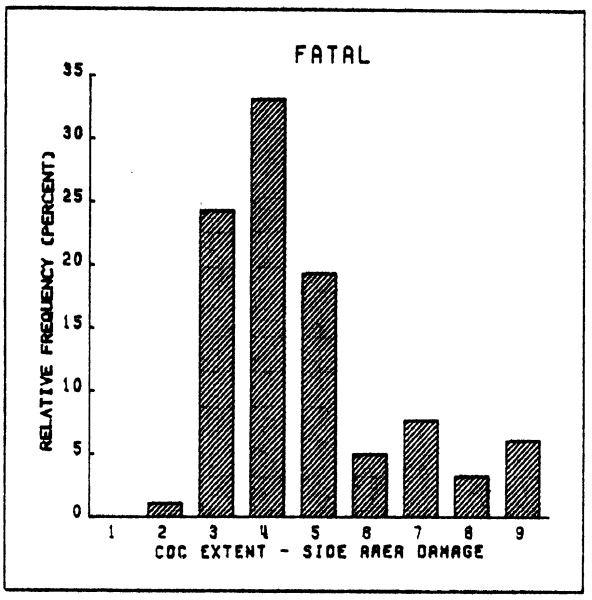


While it is apparent that injury rate generally increases with CDC extent, the CDC extent alone is not a very good predictor of injury or fatality rate. In particular, CDC 6--frontal damage extending to the base of the windshield--is more likely to be coded for a frontal collision which wipes down the side of a vehicle. All of the injury probabilities are lower for this value than for either 5 or 7. Frontal damage of CDC 8 or 9 is also most likely to be associated with an offset crash which may result from less force than a distributed frontal impact of lower extent. Further examination of details of the CDC (including wide vs. narrow objects struck, partial vs. full frontal impact, etc.), might explain these anomalies. The Delta V computation indeed takes such factors into account, and the relationship between crash and injury severity shown in the Delta V section of this report (beginning on page 79) is more regular.

NCSS Case Vehicle CDC Extent Distributions
(Side Area Damage)

CDC EXTENT	VEHICLES		OCCUPANTS							
			TOTAL		AIS 2+		AIS 3+		FATAL	
	N	%	N	%	N	%	N	%	N	%
1	1168	13.4	1768	12.4	8	0.8	1	0.2	0	0.0
2	3261	37.4	5487	38.4	101	10.6	43	7.7	2	1.1
3	3608	41.4	5957	41.6	489	51.3	252	45.3	44	24.3
4	511	5.9	802	5.6	230	24.1	150	27.0	60	33.1
5	108	1.2	179	1.3	69	7.2	60	10.8	35	19.3
6	37	0.4	47	0.3	22	2.3	18	3.2	9	5.0
7	10	0.1	20	0.1	17	1.8	15	2.7	14	7.7
8	5	0.1	7	0.0	6	0.6	6	1.1	6	3.3
9	17	0.2	36	0.3	11	1.2	11	2.0	11	6.1
TOTAL	8725	100.0	14303	100.0	953	100.0	556	100.0	181	100.0

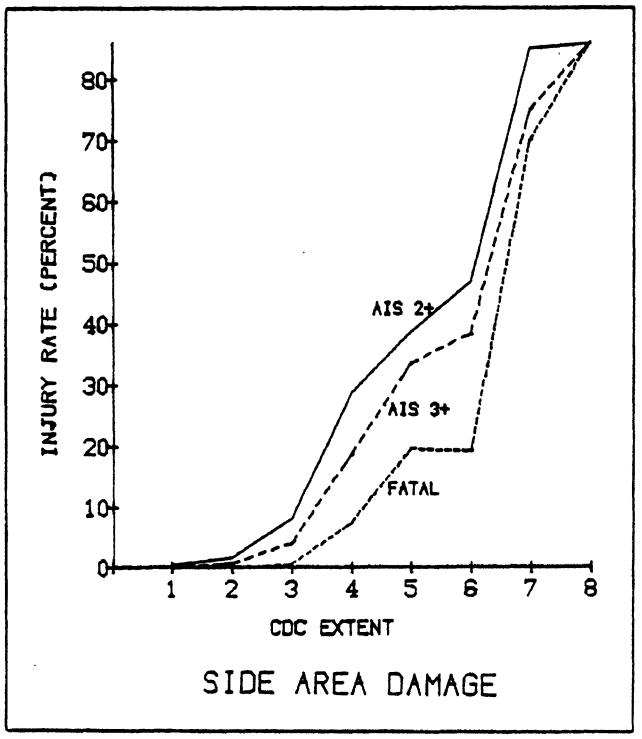




Both right- and left-side damaged vehicles are combined in this table. The most frequent CDC extent for side damage is at level 3, with 41.4% of the vehicles, and 51.3% of the injuries at AIS 2 and greater. Nearly one quarter of the side impact fatalities occur at the CDC 3 level.

NCSS Injury Rates by Case Vehicle CDC Extent
(Side Area Damage)

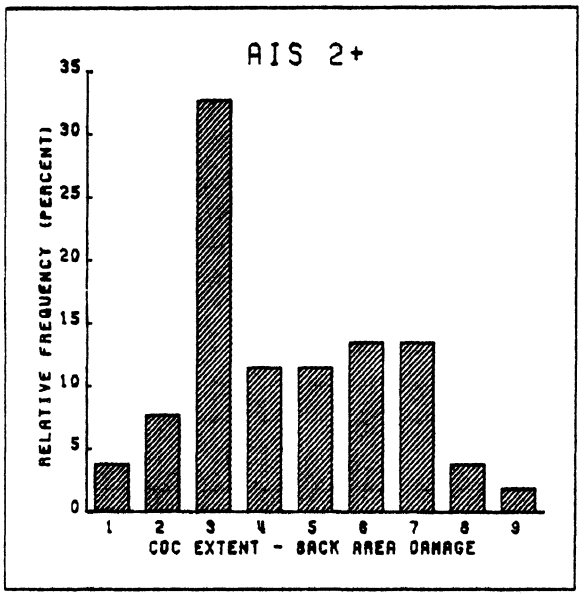
CDC EXTENT	VEHICLES	OCCUPANTS							
		TOTAL	AIS 2+		AIS 3+		FATAL	
			N	%	N	%	N	%
1	1168	1768	8	0.5	1	0.1	0	0.0
2	3261	5487	101	1.8	43	0.8	2	0.0
3	3608	5957	489	8.2	252	4.2	44	0.7
4	511	802	230	28.7	150	18.7	60	7.5
5	108	179	69	38.5	60	33.5	35	19.6
6	37	47	22	46.8	18	38.3	9	19.1
7	10	20	17	85.0	15	75.0	14	70.0
8	5	7	6	85.7	6	85.7	6	85.7
9	17	36	11	30.6	11	30.6	11	30.6
TOTAL	8725	14303	953	6.7	556	3.9	181	1.3

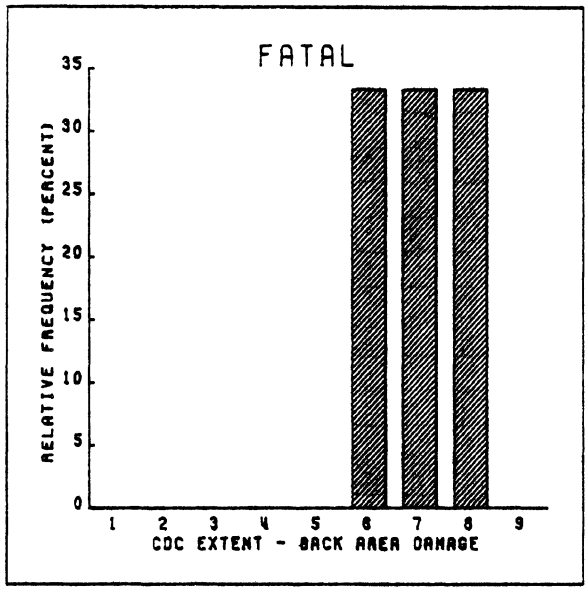


Although the fatality rate at CDC extent 3 is small (0.7%) the large number of crashes at that level makes this the second largest group among the fatalities. Severe side collisions (CDC 6, 7, and 8) are infrequent but have high injury and fatality rates. The CDC for side impact appears to be a better predictor of injury and fatality rates than does the CDC extent for frontal damage.

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	316	18.4	498	16.8	2	3.8	1	6.7	0	0.0
2	624	36.3	1098	37.0	4	7.7	0	0.0	0	0.0
3	302	17.5	520	17.5	17	32.7	2	13.3	0	0.0
4	141	8.2	259	8.7	6	11.5	3	20.0	0	0.0
5	202	11.7	348	11.7	6	11.5	1	6.7	0	0.0
6	98	5.7	193	6.5	7	13.5	4	26.7	1	33.3
7	24	1.4	36	1.2	7	13.5	2	13.3	1	33.3
8	13	0.8	14	0.5	2	3.8	1	6.7	1	33.3
9	1	0.1	1	0.0	1	1.9	1	6.7	0	0.0
TOTAL	1721	100.0	2967	100.0	52	100.0	15	100.0	3	100.0

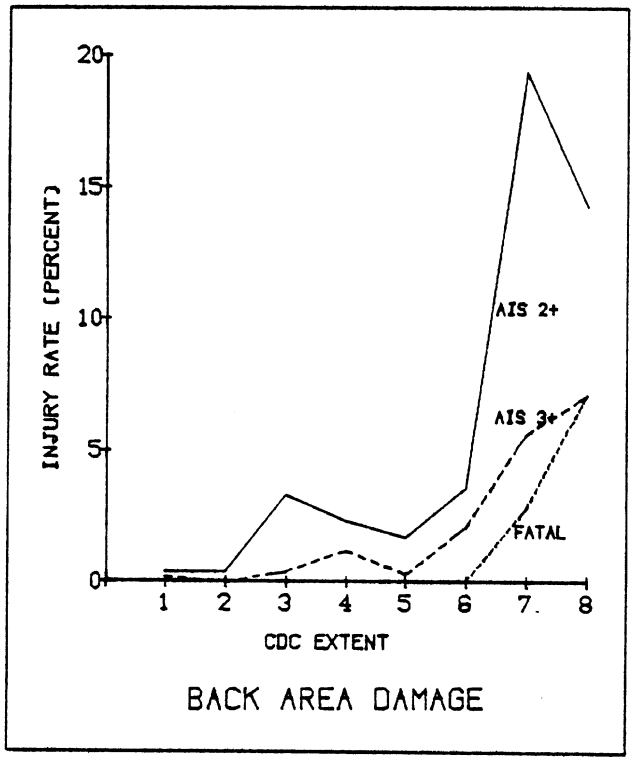




The most frequent CDC extent for back area damaged is at level 2. Only three fatalities were reported in the NCSS data for back-damaged cars, and these at levels 6 through 8.

NCSS Injury Rates by Case Vehicle CDC Extent
(Back Area Damage)

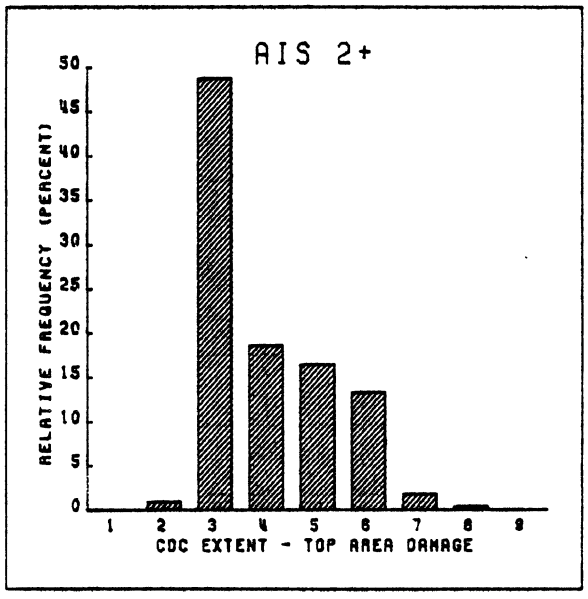
CDC EXTENT	VEHICLES	OCCUPANTS							
		TOTAL	AIS 2+		AIS 3+		FATAL	
			N	%	N	%	N	%
1	316	498	2	0.4	1	0.2	0	0.0
2	624	1098	4	0.4	0	0.0	0	0.0
3	302	520	17	3.3	2	0.4	0	0.0
4	141	259	6	2.3	3	1.2	0	0.0
5	202	348	6	1.7	1	0.3	0	0.0
6	98	193	7	3.6	4	2.1	1	0.5
7	24	36	7	19.4	2	5.6	1	2.8
8	13	14	2	14.3	1	7.1	1	7.1
9	1	1	1	100.0	1	100.0	0	0.0
TOTAL	1721	2967	52	1.8	15	0.5	3	0.1

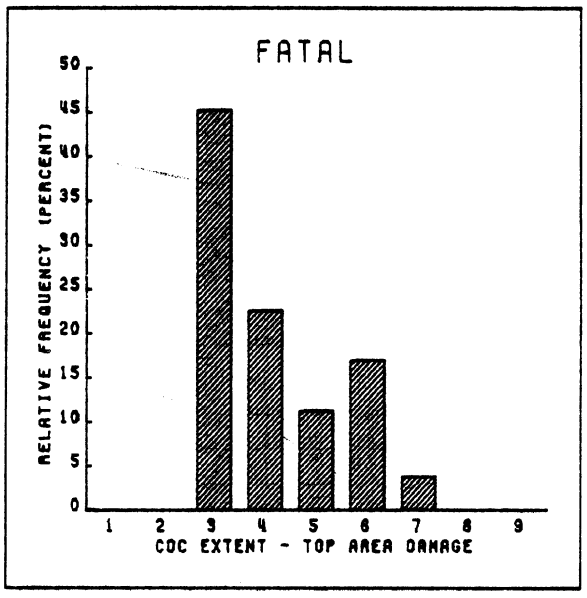


The number of injuries at all levels to occupants of back-damaged vehicles is quite small. Even at extents 7 and 8 fewer than one in five persons are injured to the AIS 2 level or greater.

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	20	1.9	20	1.2	0	0.0	0	0.0	0	0.0
2	74	7.2	142	8.3	2	0.9	1	0.7	0	0.0
3	547	53.2	957	55.7	110	48.7	53	39.3	24	45.3
4	170	16.5	272	15.8	42	18.6	28	20.7	12	22.6
5	134	13.0	196	11.4	37	16.4	27	20.0	6	11.3
6	69	6.7	113	6.6	30	13.3	23	17.0	9	17.0
7	3	0.3	7	0.4	4	1.8	2	1.5	2	3.8
8	11	1.1	11	0.6	1	0.4	1	0.7	0	0.0
TOTAL	1028	100.0	1718	100.0	226	100.0	135	100.0	53	100.0

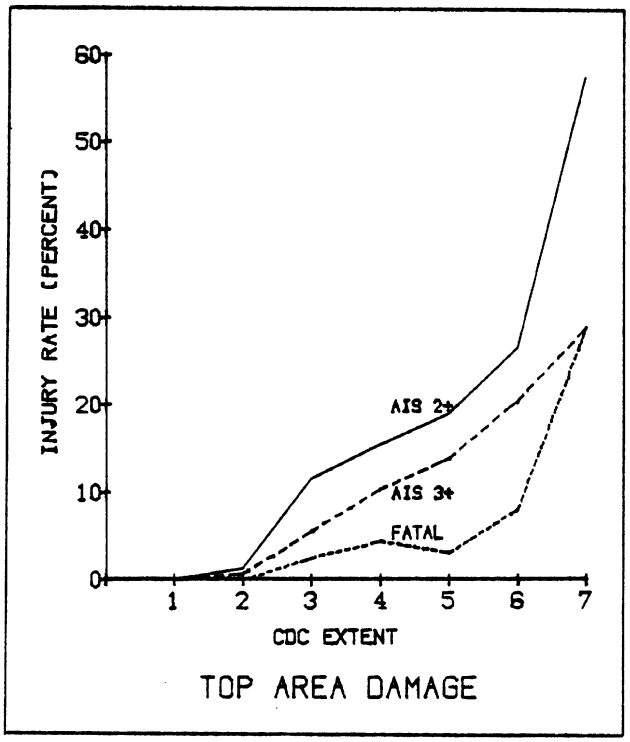




Top area damage most often indicates that the vehicle has rolled over. Ths most frequent damage extent for this category is CDC 3. No fatalities, but very few cases, appear at CDC extent 1 or 2.

NCSS Injury Rates by Case Vehicle CDC Extent
(Top Area Damage)

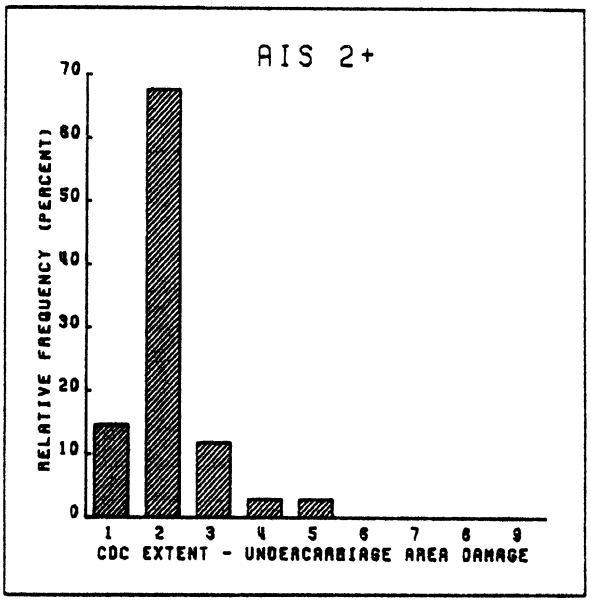
CDC EXTENT	VEHICLES	OCCUPANTS						
		TOTAL	AIS 2+		AIS 3+		FATAL	
			N	%	N	%	N	%
1	20	20	0	0.0	0	0.0	0	0.0
2	74	142	2	1.4	1	0.7	0	0.0
3	547	957	110	11.5	53	5.5	24	2.5
4	170	272	42	15.4	28	10.3	12	4.4
5	134	196	37	18.9	27	13.8	6	3.1
6	69	113	30	26.5	23	20.4	9	8.0
7	3	7	4	57.1	2	28.6	2	28.6
8	11	11	1	9.1	1	9.1	0	0.0
TOTAL	1028	1718	226	13.2	135	7.9	53	3.1

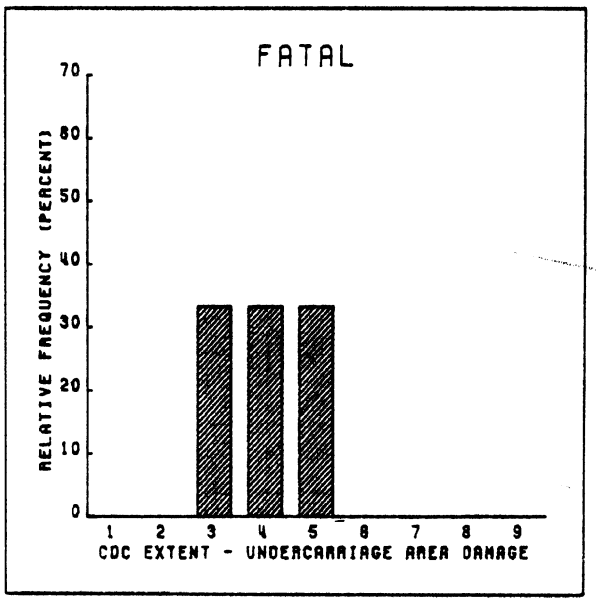


Injury rates at all levels increase regularly with the increase in top damage severity. Although occupants of top damaged vehicles represent only 2.8% of all NCSS occupants, they account for 10.9% of the fatalities. While the numbers are quite small, injury and fatality rate prediction from top area damage CDC extent appears to be quite good.

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	232	50.9	353	49.0	5	14.7	0	0.0	0	0.0
2	189	41.4	321	44.5	23	67.6	8	61.5	0	0.0
3	22	4.8	34	4.7	4	11.8	3	23.1	1	33.3
4	11	2.4	11	1.5	1	2.9	1	7.7	1	33.3
5	1	0.2	1	0.1	1	2.9	1	7.7	1	33.3
9	1	0.2	1	0.1	0	0.0	0	0.0	0	0.0
TOTAL	456	100.0	721	100.0	34	100.0	13	100.0	3	100.0

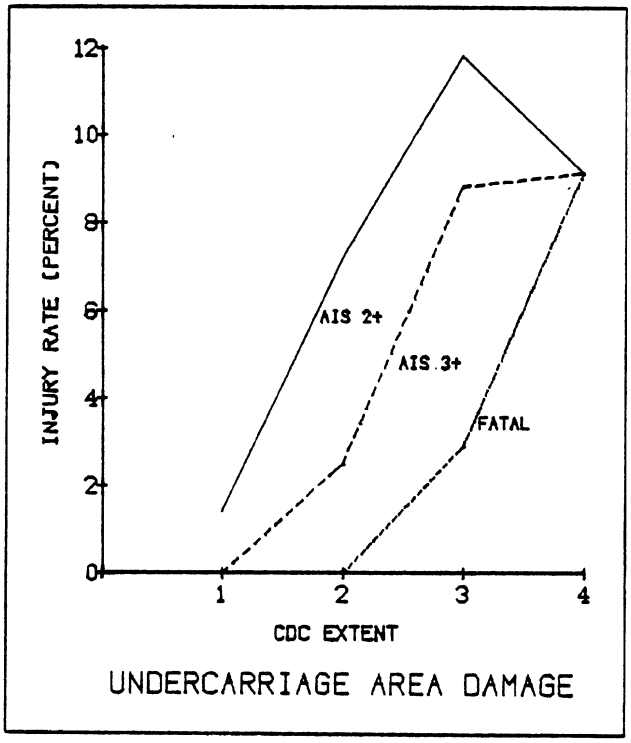




Principal damage to the undercarriage occurs only one half of 1% as often as does damage to the front of a vehicle, and undercarriage damage above level 2 is rare.

NCSS Injury Rates by Case Vehicle CDC Extent
(Undercarriage Area Damage)

CDC EXTENT	VEHICLES	OCCUPANTS						
		TOTAL	AIS 2+		AIS 3+		FATAL	
			N	%	N	%	N	%
1	232	353	5	1.4	0	0.0	0	0.0
2	189	321	23	7.2	8	2.5	0	0.0
3	22	34	4	11.8	3	8.8	1	2.9
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
TOTAL	456	721	34	4.7	13	1.8	3	0.4



The graph on this page is dominated by the three fatalities. Except for those fatalities, there were relatively few injuries in undercarriage accidents.

This section of the report is centered on the occupants of towed passenger cars in the NCSS data set. As before, tables are weighted (except in the injury data beginning on page 69), and represent the reconstructed population of the total NCSS sample for fifteen months.

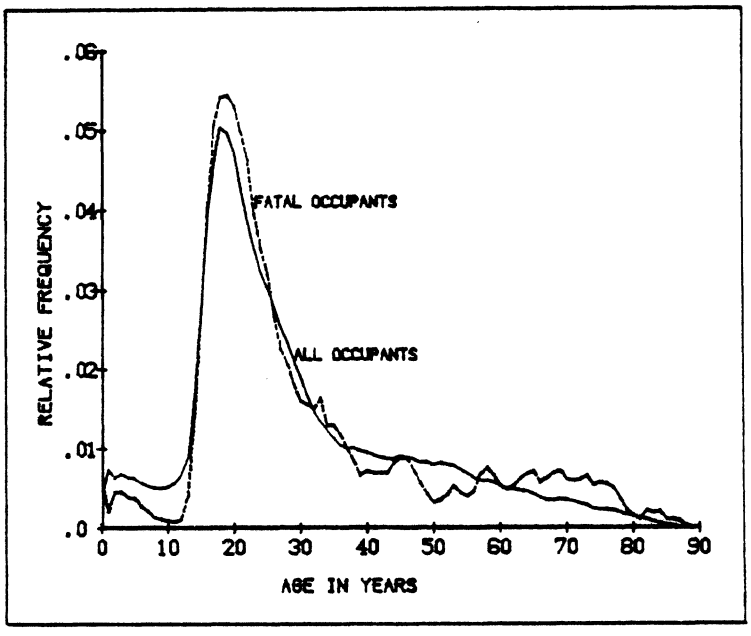
A case vehicle occupant is a person who was an occupant of any passenger vehicle towed from the scene of the crash because of damage. The total number of such persons in the reconstructed population is 62,026, of which 485 were fatally injured.

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 details are reported at the end of the section, and have a separate introduction on page 69.

NCSS Occupant Distributions by Age

OCCUPANT AGE (5-Year Groups)	OCCUPANTS		AIS 2+		AIS 3+		FATAL	
	N	%	N	%	N	%	N	%
INFANT	220	0.4	14	0.4	11	0.6	3	0.6
01-05 YEARS	2056	3.3	51	1.4	19	1.1	11	2.3
06-10 YEARS	1608	2.6	37	1.0	15	0.8	3	0.6
11-15 YEARS	2564	4.1	140	3.9	58	3.3	10	2.0
16-20 YEARS	15696	25.3	864	23.8	429	24.2	136	28.1
21-25 YEARS	10752	17.3	665	18.3	322	18.1	99	20.5
26-30 YEARS	7070	11.4	415	11.4	175	9.9	51	10.5
31-35 YEARS	4032	6.5	243	6.7	122	6.9	33	6.8
36-40 YEARS	2929	4.7	185	5.1	87	4.9	19	3.9
41-45 YEARS	2662	4.3	150	4.1	70	3.9	17	3.5
46-50 YEARS	2532	4.1	172	4.7	82	4.6	17	3.5
51-55 YEARS	2390	3.9	161	4.4	80	4.5	10	2.0
56-60 YEARS	1773	2.9	143	3.9	75	4.2	15	3.1
61-65 YEARS	1389	2.2	103	2.8	57	3.2	14	2.9
66-70 YEARS	1129	1.8	117	3.2	64	3.6	17	3.5
71-75 YEARS	855	1.4	72	2.0	45	2.5	12	2.7
76-80 YEARS	576	0.9	54	1.5	39	2.2	9	1.8
OVER 80 YEARS	336	0.5	28	0.8	19	1.1	5	1.0
UNKNOWN	1457	2.3	13	0.4	6	0.3	4	0.8
TOTAL	62026	100.0	3627	100.0	1775	100.0	485	100.0

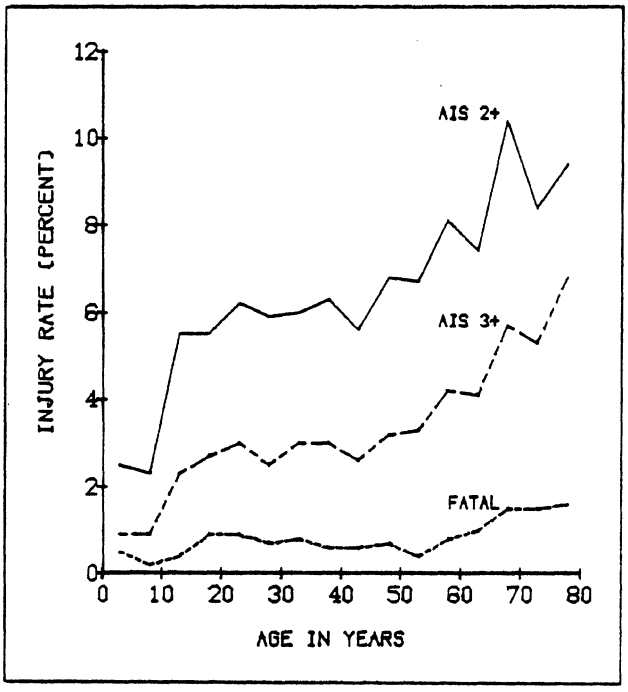
Fifty-four percent of all occupants in NCSS crashes were in the age range 16 to 30 years. Fifty-nine percent of the fatalities occurred in this same age bracket. The graph has been plotted by smoothing data over 3-years, and shows particularly that people over 60 years of age are relatively more of the time in the fatal subset.



NCSS Injury Rates by Occupant Age

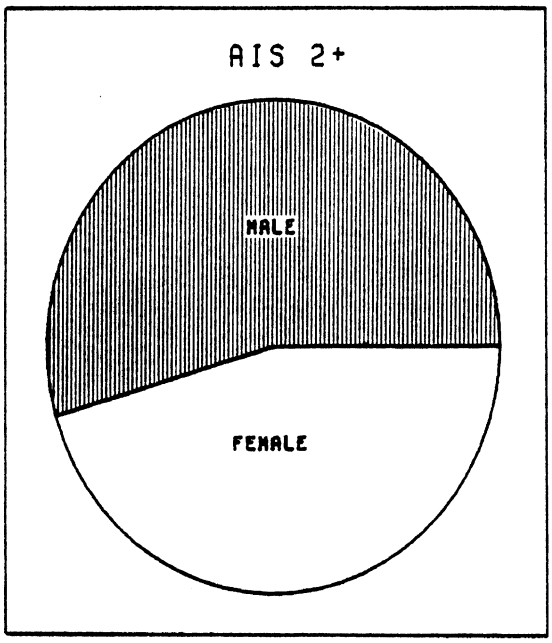
OCCUPANT AGE (5-Year Groups)	OCCUPANTS	AIS 2+		AIS 3+		FATAL	
		N	%	N	%	N	%
INFANT	220	14	6.4	11	5.0	3	1.3
01-05 YEARS	2056	51	2.5	19	0.9	11	0.5
06-10 YEARS	1608	37	2.3	15	0.9	3	0.2
11-15 YEARS	2564	140	5.5	58	2.3	10	0.4
16-20 YEARS	15696	864	5.5	429	2.7	136	0.9
21-25 YEARS	10752	665	6.2	322	3.0	100	0.9
26-30 YEARS	7070	415	5.9	175	2.5	51	0.7
31-35 YEARS	4032	243	6.0	122	3.0	33	0.8
36-40 YEARS	2929	185	6.3	87	3.0	19	0.6
41-45 YEARS	2662	150	5.6	70	2.6	17	0.6
46-50 YEARS	2532	172	6.8	82	3.2	17	0.7
51-55 YEARS	2390	161	6.7	80	3.3	10	0.4
56-60 YEARS	1773	143	8.1	75	4.2	15	0.8
61-65 YEARS	1389	103	7.4	57	4.1	14	1.0
66-70 YEARS	1129	117	10.4	64	5.7	16	1.5
71-75 YEARS	855	72	8.4	45	5.3	12	1.5
76-80 YEARS	576	54	9.4	39	6.8	9	1.6
OVER 80 YEARS	2013	55	2.7	36	1.8	12	0.6
UNKNOWN	1457	13	0.9	6	0.4	4	0.3
TOTAL	62026	3627	5.8	1775	2.9	485	0.8

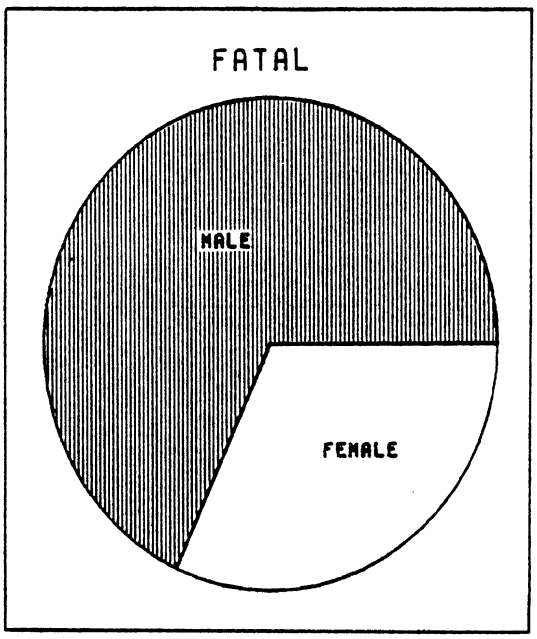
The estimated probability of a fatal injury is less than 1% for all ages up to 60 years, and then rises quickly to more than 1.5%. The same sort of pattern is true at the AIS 2+ and AIS 3+ injury levels.



NCSS Occupant Distributions by Sex

SEX	OCCUPANTS		AIS 2+		AIS 3+		FATAL	
	N	%	N	%	N	%	N	%
MALE	36079	58.2	1982	54.6	1069	60.2	332	68.2
FEMALE	25224	40.7	1644	45.3	705	39.7	152	31.3
UNKNOWN	723	1.2	1	0.0	1	0.0	1	0.2
TOTAL	62026	100.0	3627	100.0	1775	100.0	485	100.0

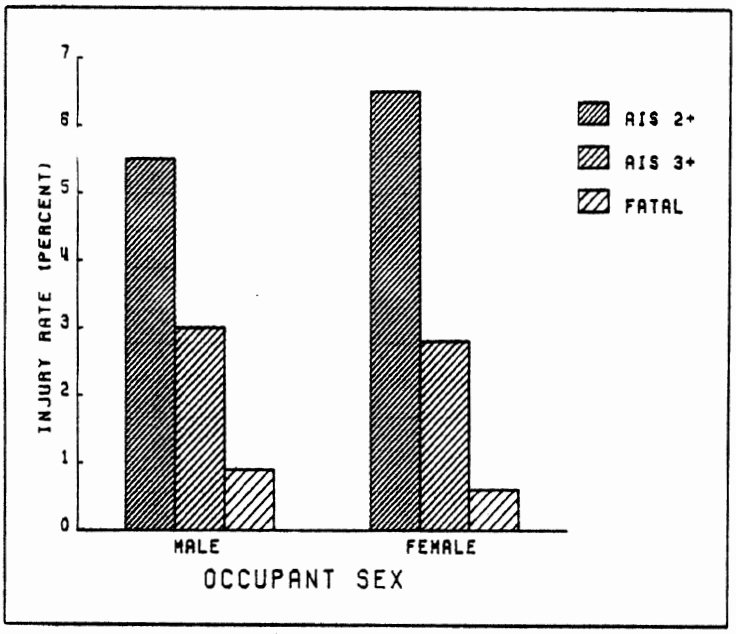




Male occupants are overrepresented slightly in all accidents, but greatly overrepresented in fatal accidents. Subtracting the AIS 3+ injuries from the AIS 2+ injuries, it can be seen that females (constituting only 40% of all occupants) have more than half of the AIS 2 (only) injuries.

NCSS Injury Rates by Occupant Sex

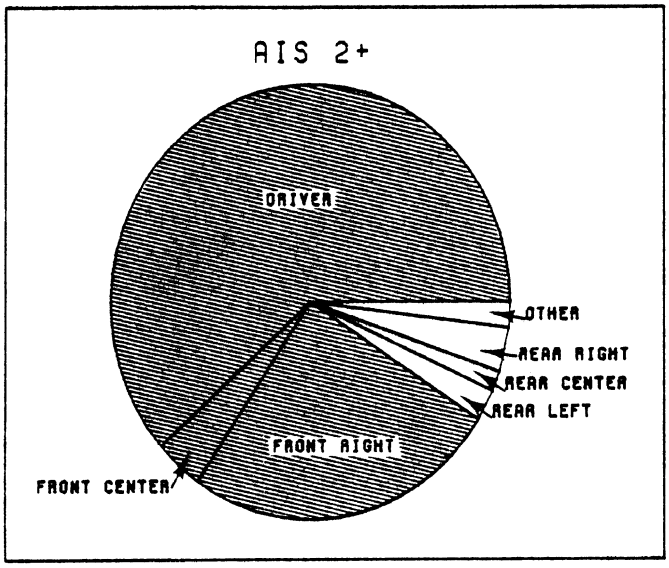
SEX	OCCUPANTS	AIS 2+		AIS 3+		FATAL	
		N	%	N	%	N	%
MALE	36079	1982	5.5	1069	3.0	332	0.9
FEMALE	25224	1644	6.5	705	2.8	152	0.6
UNKNOWN	723	1	0.1	1	0.1	1	0.1
TOTAL	62026	3627	5.8	1775	2.9	485	0.8

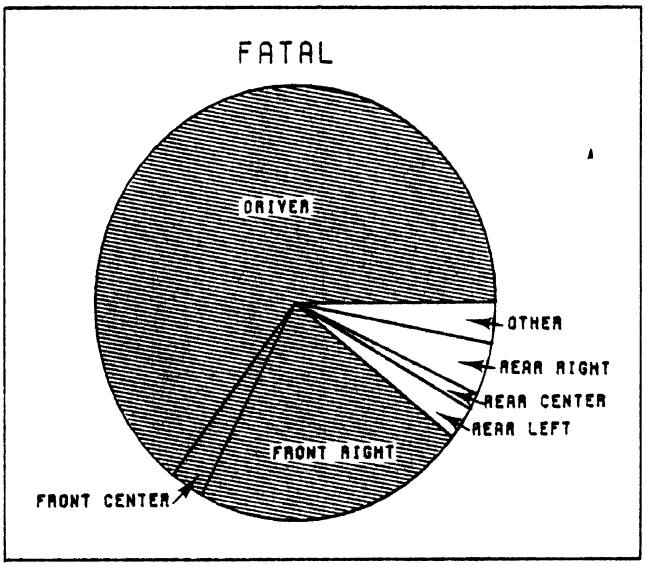


Of the male occupants, 5.5% sustained injuries at AIS 2 or above as compared with 6.5% of the females. By contrast, males are one and one-half times as likely to sustain a fatal injury.

NCSS Occupant Distributions by Seat Location

SEAT POSITION	OCCUPANTS		AIS 2+		AIS 3+		FATAL	
	N	%	N	%	N	%	N	%
DRIVER	39471	63.6	2235	61.6	1089	61.4	314	64.5
FRONT CENTER	2216	3.6	141	3.9	62	3.5	13	2.7
FRONT RIGHT	12949	20.9	925	25.5	461	26.0	106	22.1
REAR LEFT	2393	3.9	87	2.4	46	2.6	12	2.5
REAR CENTER	1251	2.0	54	1.5	22	1.2	6	1.2
REAR RIGHT	2768	4.5	118	3.3	66	3.7	19	3.9
OTHER	978	1.6	67	1.9	29	1.6	15	3.1
TOTAL	62026	100.0	3627	100.0	1775	100.0	485	100.0

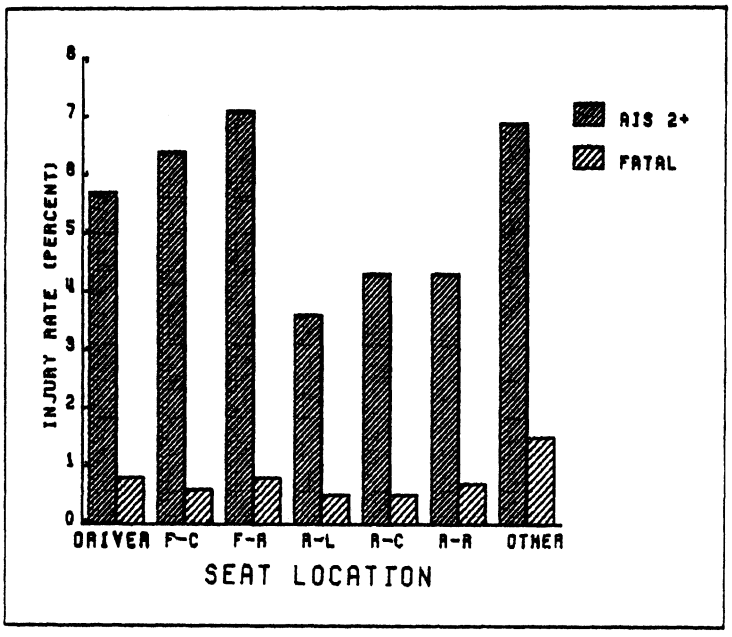




Eighty-eight percent of the NCSS occupants were in the front seats of their cars. These same seated positions accounted for 89.3% of the fatalities.

NCSS Injury Rates by Occupant Seat Location

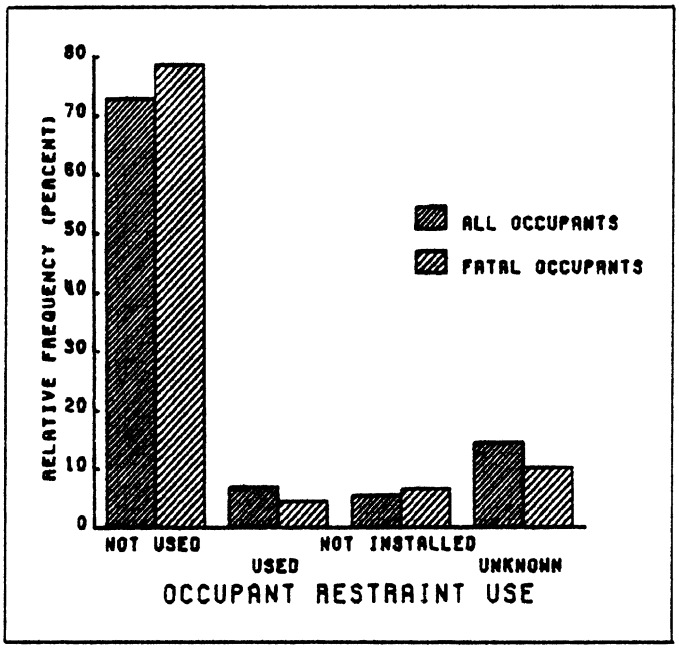
SEAT POSITION	OCCUPANTS	AIS 2+		AIS 3+		FATAL	
		N	%	N	%	N	%
DRIVER	39471	2235	5.7	1089	2.8	314	0.8
FRONT CENTER	2216	141	6.4	62	2.8	13	0.6
FRONT RIGHT	12949	925	7.1	461	3.6	106	0.8
REAR LEFT	2393	87	3.6	46	1.9	12	0.5
REAR CENTER	1251	54	4.3	22	1.8	6	0.5
REAR RIGHT	2768	118	4.3	66	2.4	19	0.7
OTHER	978	67	6.9	29	3.0	15	1.5
TOTAL	62026	3627	5.8	1775	2.9	485	0.8



The estimated probability of injury or fatality for a person in the front seat is about 1.5 times that of a rear seat passenger. Compared to the driver, the front right occupant is more likely to receive an injury at AIS 2 or above, but is about as likely to be killed.

NCSS Occupant Distributions by Restraint Use

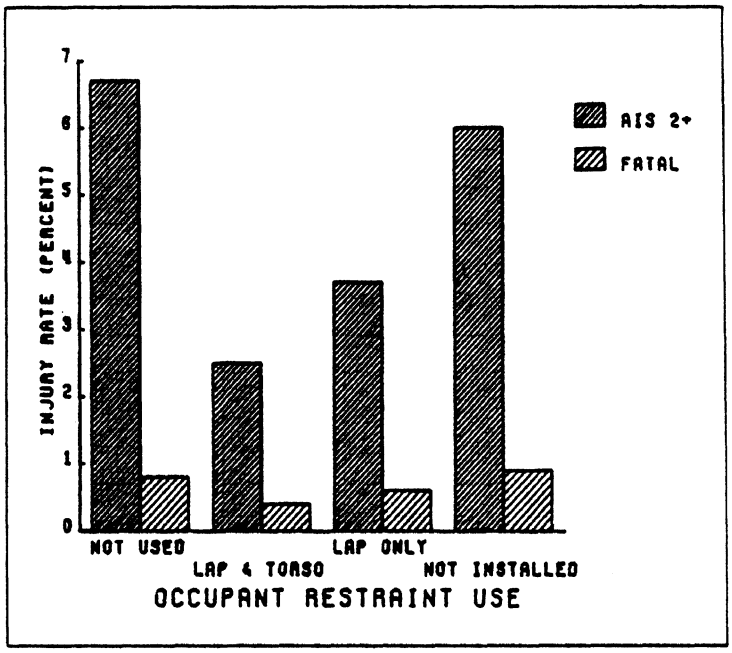
RESTRAINT USE	OCCUPANTS		AIS 2+		AIS 3+		FATAL	
	N	%	N	%	N	%	N	%
NOT USED	45210	72.9	3022	83.3	1483	83.5	381	78.7
LAP AND TORSO	2289	3.7	58	1.6	27	1.5	9	1.8
LAP ONLY	2007	3.2	74	2.0	40	2.3	13	2.7
TORSO ONLY	20	0.0	0	0.0	0	0.0	0	0.0
PASSIVE BELT	15	0.0	1	0.0	1	0.1	0	0.0
CHILD SEAT	91	0.1	1	0.0	1	0.1	0	0.0
NOT INSTALLED	3405	5.5	203	5.6	91	5.1	32	6.6
UNKNOWN	8989	14.5	268	7.4	132	7.5	50	10.2
TOTAL	62026	100.0	3627	100.0	1775	100.0	485	100.0



Only 7% of the NCSS occupants were positively identified as using restraint systems. Among the fatal occupants, only 4.5% were using any form of restraint. These percentages are computed assuming that the unknown category is not using restraints. If the unknowns are wearing restraints at the same rate as the others, the restraint usage would be estimated at about 8%. In the graph the "Used" category combines all restraint types shown in the table.

NCSS Injury Rates by Occupant Restraint Use

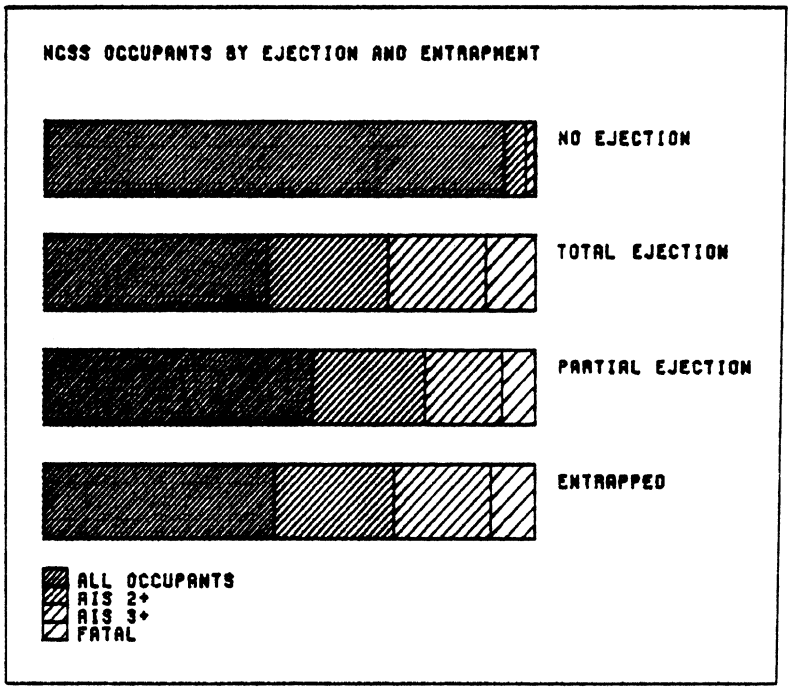
RESTRAINT USE	OCCUPANTS	AIS 2+		AIS 3+		FATAL	
		N	%	N	%	N	%
NOT USED	45210	3022	6.7	1483	3.3	381	0.8
LAP AND TORSO	2289	58	2.5	27	1.2	9	0.4
LAP ONLY	2007	74	3.7	40	2.0	13	0.6
TORSO ONLY	20	0	0.0	0	0.0	0	0.0
PASSIVE BELT	15	1	6.7	1	6.7	0	0.0
CHILD SEAT	91	1	1.1	1	1.1	0	0.0
NOT INSTALLED	3405	203	6.0	91	2.7	32	0.9
UNKNOWN	8989	268	3.0	132	1.5	50	0.6
TOTAL	62026	3627	5.8	1775	2.9	485	0.8



Both lap only and lap plus upper torso restraint wearers are less likely to sustain injury than are non-users. The highest fatality rate occurs for occupants who did not have seat belts installed, perhaps because their older cars do not offer the protection of newer models.

NCSS Occupant Distributions by Ejection and Entrapment

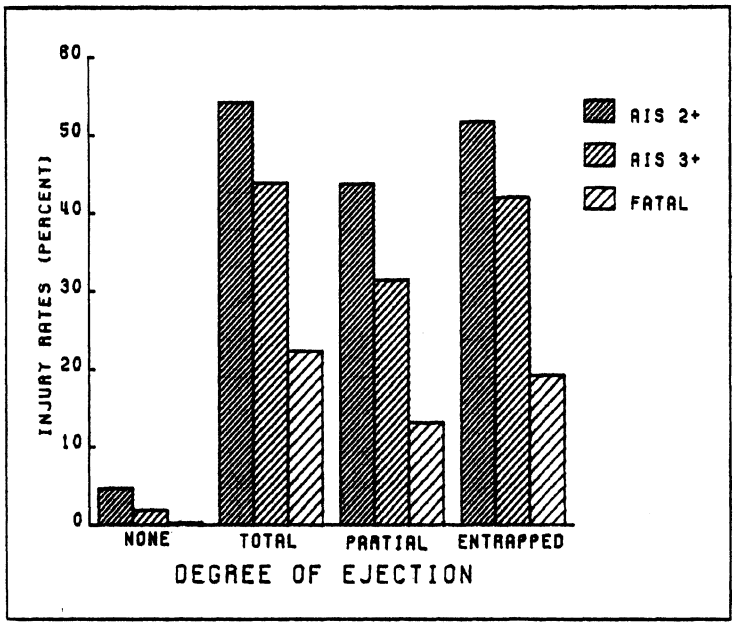
EJECTION/ENTRAPMENT	OCCUPANTS		AIS 2+		AIS 3+		FATAL	
	N	%	N	%	N	%	N	%
NONE	60222	97.1	2829	78.0	1145	64.5	172	35.7
TOTAL EJECTION	467	0.8	253	7.0	205	11.5	104	21.3
PARTIAL EJECTION	129	0.2	54	1.5	37	2.1	16	3.3
ENTRAPPED	433	0.7	224	6.2	182	10.3	82	17.0
OTHER	16	0.0	13	0.4	12	0.7	5	1.0
UNKNOWN	759	1.2	254	7.0	194	10.9	106	21.9
TOTAL	62026	100.0	3627	100.0	1775	100.0	485	100.0



Among all crashes, ejection and entrapment are relatively rare. The 1% of the occupants fully or partially ejected might be considered a lower bound on this estimate, since a major fraction of the fatalities were reported with ejection "Unknown."

NCSS Injury Rates by Occupant Ejection and Entrapment

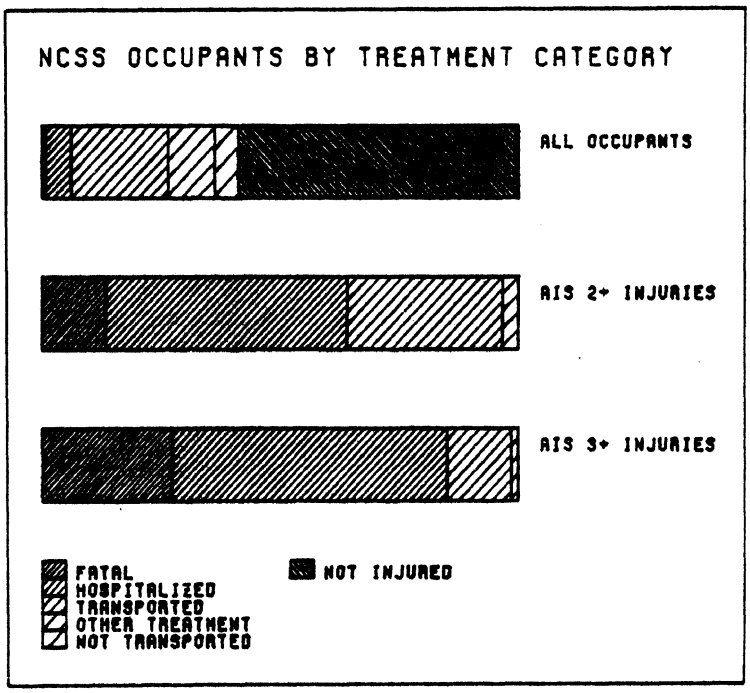
EJECTION/ENTRAPMENT	OCCUPANTS	AIS 2+		AIS 3+		FATAL	
		N	%	N	%	N	%
NONE	60222	2829	4.7	1145	1.9	172	0.3
TOTAL EJECTION	467	253	54.2	205	43.9	104	22.3
PARTIAL EJECTION	129	54	41.9	37	28.7	16	12.4
ENTRAPPED	433	224	51.7	182	42.0	82	19.2
OTHER	16	13	81.3	12	75.0	5	31.2
UNKNOWN	759	254	33.5	194	25.6	106	14.0
TOTAL	62026	3627	5.8	1775	2.9	485	0.8



Although only 1% of all NCSS occupants were ejected they account for 25% of the fatalities. Both ejection and entrapment are clearly associated with severe injury crashes. Note particularly the low ratio of AIS 2+ to Fatal injuries in the ejected and entrapped classification.

NCSS Occupant Distributions by Treatment Category

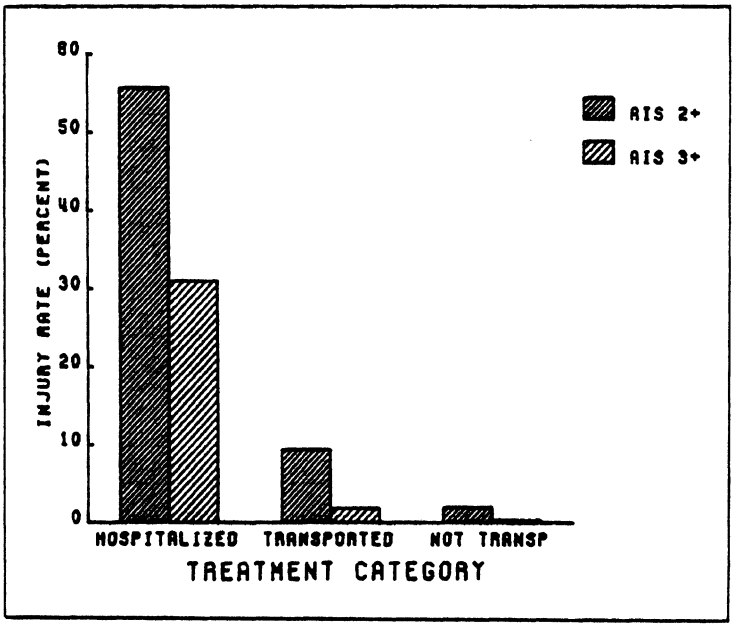
TREATMENT	OCCUPANTS		AIS 2+		AIS 3+		FATAL	
	N	%	N	%	N	%	N	%
FATAL	485	0.8	484	13.3	484	27.3	485	100.0
INJURED								
Hospitalized	3302	5.3	1838	50.7	1025	57.7	0	0.0
Transported	12529	20.2	1183	32.6	240	13.5	0	0.0
Other Treatment	6053	9.8	122	3.4	26	1.5	0	0.0
NOT TRANSPORTED	3068	4.9	0	0.0	0	0.0	0	0.0
NOT INJURED	36288	58.5	0	0.0	0	0.0	0	0.0
UNKNOWN	301	0.5	0	0.0	0	0.0	0	0.0
TOTAL	62026	100.0	3627	100.0	1775	100.0	485	100.0



The treatment class for each occupant is related to the sampling rule. The Injured/Hospitalized class includes those who were taken to a hospital and remained at least overnight. The Injured/Transported class includes occupants who were transported to a medical facility. Injured/Other Treatment includes persons who were not transported by ambulance to a medical facility, but may have been treated privately. A small number of AIS 2 and AIS 3's may be seen in this category. The remaining categories may include some occupants with relatively minor injuries, but are made up mostly of uninjured persons.

NCSS Injury Rates by Occupant Treatment Category

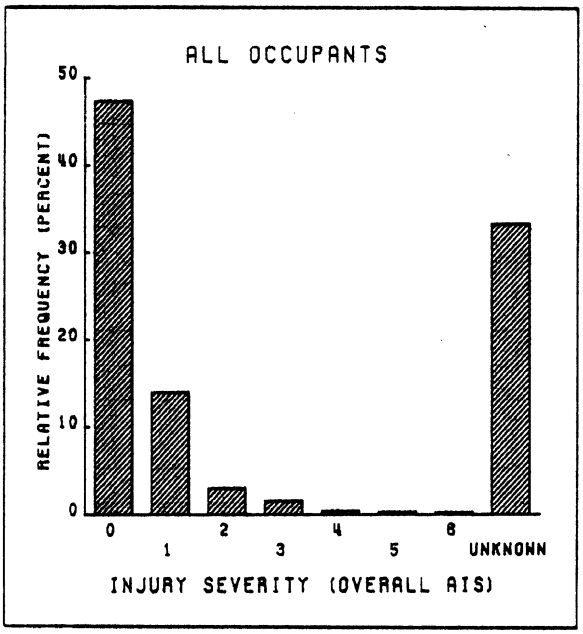
TREATMENT	OCCUPANTS	AIS 2+		AIS 3+		FATAL	
		N	%	N	%	N	%
FATAL	485	484	99.8	484	99.8	485	100.0
INJURED							
Hospitalized	3302	1838	55.7	1025	31.0	0	0.0
Transported	12529	1183	9.4	240	1.9	0	0.0
Other Treatment	6053	122	2.0	26	0.4	0	0.0
NOT TRANSPORTED	3068	0	0.0	0	0.0	0	0.0
NOT INJURED	36288	0	0.0	0	0.0	0	0.0
UNKNOWN	301	0	0.0	0	0.0	0	0.0
TOTAL	62026	3627	5.8	1775	2.9	485	0.8

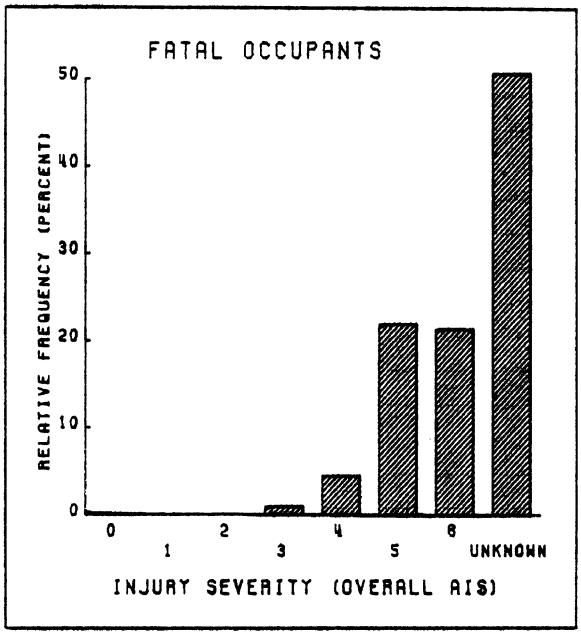


Over 50% of vehicle occupants who were hospitalized received AIS 2+ injuried and about 30% of them received AIS 3+ injuries. Of those occupants not transported to any medical facility, 2% had injuries of AIS 2 or greater.

NCSS Occupant Distributions by Injury Severity (Overall AIS)

INJURY SEVERITY	OCCUPANTS		AIS 2+		AIS 3+		FATAL	
	N	%	N	%	N	%	N	%
0 NOT INJURED	29350	47.3	0	0.0	0	0.0	0	0.0
1 MINOR	8681	14.0	0	0.0	0	0.0	1	0.2
2 MODERATE	1849	3.0	1849	51.0	0	0.0	0	0.4
3 SEVERE	969	1.6	969	26.7	969	44.6	4	1.0
4 SERIOUS	254	0.4	254	7.0	254	14.3	22	4.5
5 CRITICAL	196	0.3	196	5.4	196	11.0	107	21.9
6 MAXIMUM-FATAL	104	0.2	104	2.9	104	5.9	104	21.3
7 INJURED/UNK SEV	9515	15.3	253	7.0	250	14.1	246	50.4
UNKNOWN	11108	17.9	2	0.1	2	0.1	1	0.2
TOTAL	62026	100.0	3627	100.0	1775	100.0	485	100.0

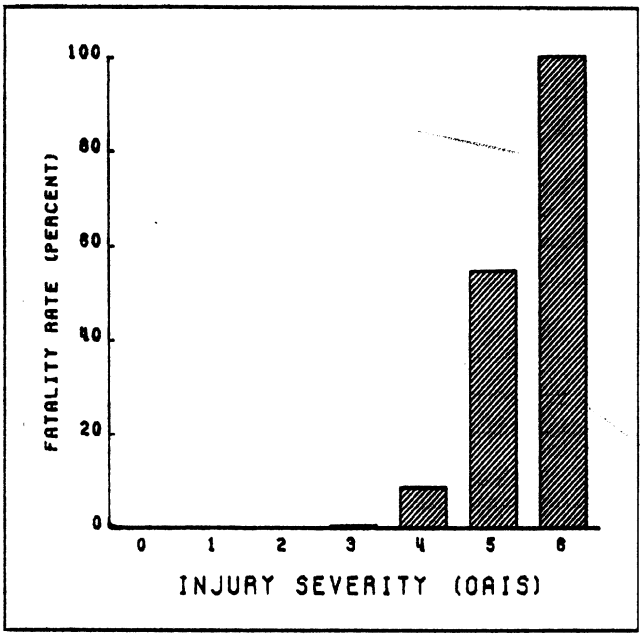




Although injuries lower than AIS 4 are usually considered non life-threatening, four persons died with an overall AIS of 3. The large group of persons coded "Injured/Unknown Severity" is made up mainly of persons with police-reported injuries unconfirmed by medical report, but also includes almost half of the fatalities, for whom no autopsies or other medical documentation were available.

NCSS Injury Rates by Occupant Injury Severity (Overall AIS)

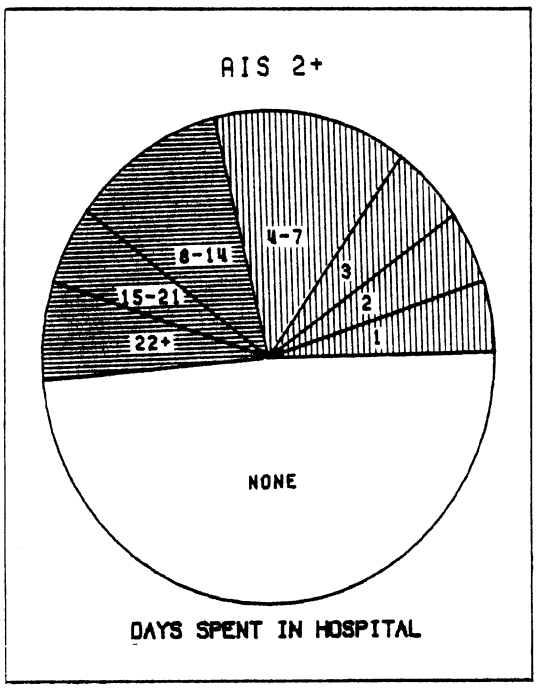
INJURY SEVERITY	OCCUPANTS	AIS 2+		AIS 3+		FATAL	
		N	%	N	%	N	%
0 NOT INJURED	29350	0	0.0	0	0.0	0	0.0
1 MINOR	8681	0	0.0	0	0.0	1	0.0
2 MODERATE	1849	1849	100.0	0	0.0	0	0.0
3 SEVERE	969	969	100.0	969	100.0	4	0.4
4 SERIOUS	254	254	100.0	254	100.0	22	8.7
5 CRITICAL	196	196	100.0	196	100.0	107	54.6
6 MAXIMUM-FATAL	104	104	100.0	104	100.0	104	100.0
7 INJURED/UNK SEV	9515	253	2.7	250	2.6	246	2.6
UNKNOWN	11108	2	0.0	2	0.0	1	0.0
TOTAL	62026	3627	5.8	1775	2.9	485	0.8

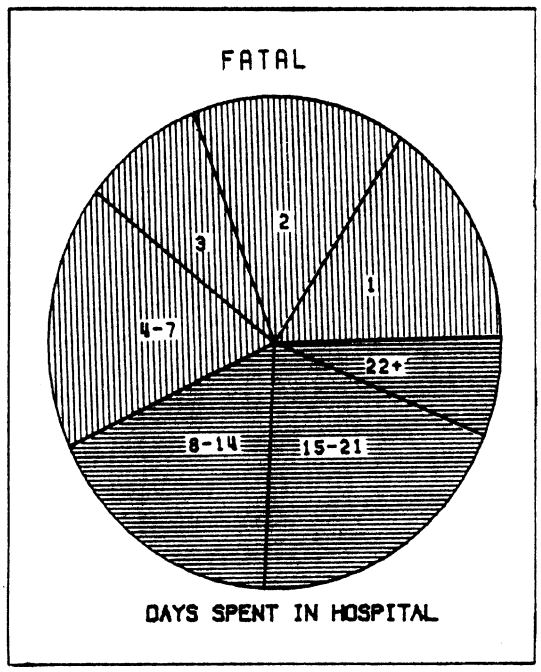


More than half of those with a reported overall AIS of 5 died, compared with less than 10% of those at AIS 4. AIS 6, of course, is defined as an injury incompatible with life.

NCSS Occupant Distributions by Days Spent in Hospital

DAYS IN HOSPITAL	OCCUPANTS		AIS 2+		AIS 3+		FATAL	
	N	%	N	%	N	%	N	%
NONE	58027	93.5	1678	46.3	678	38.2	438	90.0
1 DAY	497	0.8	161	4.4	37	2.1	7	1.4
2 DAYS	344	0.6	163	4.5	47	2.6	6	1.4
3 DAYS	370	0.6	182	5.0	73	4.1	4	0.8
4-7 DAYS	857	1.4	475	13.1	239	13.5	7	1.6
8-14 DAYS	565	0.9	376	10.4	273	15.4	8	1.6
15-21 DAYS	219	0.4	177	4.9	135	7.6	9	1.8
22-300 DAYS	256	0.4	220	6.1	180	10.1	3	0.6
UNKNOWN	891	1.4	195	5.4	113	6.4	3	0.6
TOTAL	62026	100.0	3627	100.0	1775	100.0	485	100.0

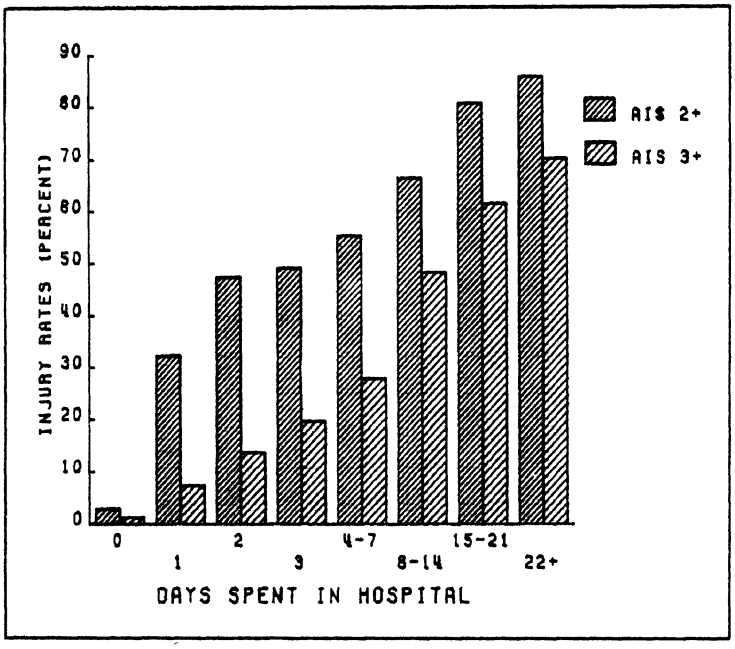




For persons injured at the AIS 2 or higher level, nearly half were not hospitalized overnight. (This includes 439 people who died on the day of the accident.) Nearly a quarter of this AIS 2+ group, however, spent more than a week in the hospital. Forty-six of 485 fatal occupants remained in the hospital for one or more days. The large number of fatalities with no days in the hospital implies that these persons were dead at the scene or on arrival at the hospital. Persons who were dead on arrival are not shown in the fatal graph.

NCSS Injury Rates by Occupant Days Spent in Hospital

DAYS IN HOSPITAL	OCCUPANTS	AIS 2+		AIS 3+		FATAL	
		N	%	N	%	N	%
NONE	58027	1678	2.9	678	1.2	438	0.8
1 DAY	497	161	32.4	37	7.4	7	1.4
2 DAYS	344	163	47.4	47	13.7	6	2.0
3 DAYS	370	182	49.2	73	19.7	4	1.1
4-7 DAYS	857	475	55.4	239	27.9	7	0.9
8-14 DAYS	565	376	66.5	273	48.3	8	1.4
15-21 DAYS	219	177	80.8	135	61.6	9	4.1
22-300 DAYS	256	220	85.9	180	70.3	3	1.2
UNKNOWN	891	195	21.9	113	12.7	3	0.3
TOTAL	62026	3627	5.8	1775	2.9	485	0.8



The relationship between injury severity and time spent in the hospital is as expected. The 15% of the people who spent more than three weeks in the hospital without a reported AIS of 2 or more evidently sustained injuries in this range which were reported as "Unknown."

Details of injuries sustained by occupants of cars in NCSS crashes 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. One of the forms of storage of the NCSS computerized data is an injury-centered file--i.e., with one entry for each injury sustained by each person. The information on the following eight pages has been taken from that file, and shows distributions of injury regions, types, and systems for (1) all injuries taken together, (2) for each AIS level from 1 (minor) to 6 (Fatal-maximum), and (3) for injuries for which AIS level was unreported but other information was known.

For all tables except those displaying the "Ten Most Frequent Injuries" the total number of injuries reported for that factor is shown in parentheses after the table heading. These numbers vary somewhat from table to table with a given AIS level because of unreported data elements, body region and system/organ 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 (N=17360)

BODY REGION	NUMBER OF INJURIES	PERCENT
HEAD	6782	39.1
NECK	1226	7.1
CHEST/THORAX	1761	10.1
ABDOMEN	735	4.2
BACK	705	4.1
LEG	3502	20.2
ARM	2552	14.7
WHOLE BODY	97	0.6

The most common injuries are contusions and lacerations, and the most common body region injured is the head.

INJURY BY TYPE (N=15917)

INJURY TYPE	NUMBER OF INJURIES	PERCENT
LACERATION	3923	24.6
CONTUSION	4210	26.4
ABRASION	1835	11.5
FRACTURE	2619	16.5
PAIN	1941	12.2
CONCUSSION	1188	7.5
HEMORRHAGE	79	0.5
AVULSION	121	0.8
RUPTURE	1	0.0

INJURY BY SYSTEM/ORGAN (N=17228)

SYSTEM/ORGAN	NUMBER OF INJURIES	PERCENT
ALL SYSTEMS	51	0.3
SKELETAL GROUP	3277	19.0
DIGESTIVE GROUP	695	4.0
NERVE GROUP	1766	10.3
CARDIO GROUP	214	1.2
RESPIRATORY GROUP	775	4.5
UROGENITAL GROUP	110	0.6
MUSCLES	2561	14.9
SKIN	7779	45.2

Injuries to the skin constitute the highest single group and these correspond to the lacerations and contusions above. Concussion of the brain listed as the second most frequent combination includes 271 injuries for which the AIS level was not reported. The determination of the AIS code for this condition depends on the knowledge of the time the person was unconscious and this was frequently not determined. See the "Most Frequent Injury" table on page 77 for the concussions with undetermined AIS level.

TEN MOST FREQUENT INJURIES COMMON AT ALL LEVELS

BODY REGION	INJURY TYPE	SYSTEM/ ORGAN	NUMBER OF INJURIES
HEAD	LACERATION	SKIN	1763
HEAD	CONCUSSION	NERVOUS SYSTEM	1188
HEAD	CONTUSION	SKIN	984
LEG	FRACTURE	SKELETAL	716
LEG	CONTUSION	SKIN	700
ARM	CONTUSION	SKIN	664
LEG	ABRASION	SKIN	616
NECK	PAIN	MUSCLE	556
THORAX	FRACTURE	SKELETAL	510
HEAD	ABRASION	SKIN	504

Distributions of AIS Level 1 Injuries in the NCSS Data

INJURY BY BODY REGION (N=12219)

BODY REGION	NUMBER OF INJURIES	PERCENT
HEAD	4932	40.4
NECK	1060	8.7
CHEST/THORAX	841	6.9
ABDOMEN	275	2.3
BACK	578	4.7
LEG	2510	20.5
ARM	1930	15.8
WHOLE BODY	93	0.8

INJURY BY TYPE (N=11554)

INJURY TYPE	NUMBER OF INJURIES	PERCENT
LACERATION	3097	26.8
CONTUSION	3870	33.5
ABRASION	1825	15.8
FRACTURE	306	2.6
PAIN	1939	16.8
CONCUSSION	469	4.1
HEMORRHAGE	10	0.1
AVULSION	38	0.3

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

INJURY BY SYSTEM/ORGAN (N=12291)

SYSTEM/ORGAN	NUMBER OF INJURIES	PERCENT
SKELETAL GROUP	721	5.9
DIGESTIVE GROUP	431	3.5
NERVE GROUP	819	6.7
CARDIO GROUP	1	0.0
RESPIRATORY GROUP	433	3.5
UROGENITAL GROUP	6	0.0
MUSCLES	2547	20.7
SKIN	7333	59.7

TEN MOST COMMON INJURIES COMMON AT AIS LEVEL 1

BODY REGION	INJURY TYPE	SYSTEM/ ORGAN	NUMBER OF INJURIES
HEAD	LACERATION	SKIN	1509
HEAD	CONTUSION	SKIN	972
LEG	CONTUSION	SKIN	692
ARM	CONTUSION	SKIN	662
LEG	ABRASION	SKIN	612
NECK	PAIN	MUSCLE	556
HEAD	ABRASION	SKIN	502
THORAX	CONTUSION	SKIN	472
HEAD	CONCUSSION	NERVOUS SYSTEM	469
LEG	CONTUSION	SKELETAL	435

Distributions of AIS Level 2 Injuries in the NCSS Data

INJURY BY BODY REGION (N=2287)

BODY REGION	NUMBER OF INJURIES	PERCENT
HEAD	1037	45.3
NECK	26	1.1
CHEST/THORAX	167	7.3
ABDOMEN	9	0.4
BACK	90	3.9
LEG	541	23.7
ARM	415	18.1
WHOLE BODY	2	0.1

INJURY BY BODY TYPE (N=2144)

INJURY TYPE	NUMBER OF INJURIES	PERCENT
LACERATION	474	22.1
CONTUSION	59	2.8
ABRASION	10	0.5
FRACTURE	1203	56.1
CONCUSSION	329	15.3
HEMORRHAGE	3	0.1
AVULSION	66	3.1

INJURY BY SYSTEM/ORGAN (N=2286)

SYSTEM/ORGAN	NUMBER OF INJURIES	PERCENT
ALL SYSTEMS	1	0.0
SKELETAL GROUP	1282	56.1
DIGESTIVE GROUP	85	3.7
NERVE GROUP	400	17.5
RESPIRATORY GROUP	81	3.5
UROGENITAL GROUP	1	0.0
MUSCLES	9	0.4
SKIN	427	18.7

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

TEN MOST FREQUENT INJURIES COMMON AT AIS LEVEL 2

BODY REGION	INJURY TYPE	SYSTEM/ ORGAN	NUMBER OF INJURIES
LEG	FRACTURE	SKELETAL	380
HEAD	CONCUSSION	NERVOUS SYSTEM	329
ARM	FRACTURE	SKELETAL	322
HEAD	LACERATION	SKIN	246
HEAD	FRACTURE	SKELETAL	198
THORAX	FRACTURE	SKELETAL	157
BACK	FRACTURE	SKELETAL	86
HEAD	LACERATION	DIGESTIVE	72
LEG	SPRAIN	SKELETAL	68
LEG	LACERATION	SKIN	60

Distributions of AIS Level 3 Injuries in the NCSS Data

INJURY BY BODY REGION (N=1417)

BODY REGION	NUMBER OF INJURIES	PERCENT
HEAD	153	10.8
NECK	60	4.2
CHEST/THORAX	510	36.0
ABDOMEN	126	8.9
BACK	24	1.7
LEG	377	26.6
ARM	167	11.8

INJURY BY TYPE (N=1184)

INJURY TYPE	NUMBER OF INJURIES	PERCENT
LACERATION	50	4.2
CONTUSION	173	14.6
FRACTURE	858	72.5
PAIN	1	0.1
CONCUSSION	42	3.5
HEMORRHAGE	48	4.1
AVULSION	12	1.0

INJURY BY SYSTEM/ORGAN (N=1419)

SYSTEM/ORGAN	NUMBER OF INJURIES	PERCENT
SKELETAL GROUP	1012	71.3
DIGESTIVE GROUP	19	1.3
NERVE GROUP	57	4.0
CARDIO GROUP	33	2.3
RESPIRATORY GROUP	202	14.2
UROGENITAL GROUP	78	5.5
MUSCLES	5	0.4
SKIN	13	0.9

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.

TEN MOST FREQUENT INJURIES COMMON AT AIS LEVEL 3

BODY REGION	INJURY TYPE	SYSTEM/ ORGAN	NUMBER OF INJURIES
THORAX	FRACTURE	SKELETAL	313
LEG	FRACTURE	SKELETAL	272
ARM	FRACTURE	SKELETAL	116
HEAD	FRACTURE	SKELETAL	85
THORAX	CONTUSION	RESPIRATORY	82
THORAX	OTHER	RESPIRATORY	82
ABDOMEN	CONTUSION	UROGENITAL	72
LEG	DISLOCATION	SKELETAL	71
NECK	FRACTURE	SKELETAL	47
HEAD	CONCUSSION	NERVOUS SYSTEM	42

Distributions of AIS Level 4 Injuries in the NCSS Data

INJURY BY BODY REGION (N=473)

BODY REGION	NUMBER OF INJURIES	PERCENT
HEAD	130	27.5
NECK	8	1.7
CHEST/THORAX	89	18.8
ABDOMEN	159	33.6
BACK	6	1.3
LEG	57	12.0
ARM	24	5.1

INJURY BY TYPE (N=391)

INJURY TYPE	NUMBER OF INJURIES	PERCENT
LACERATION	100	25.6
CONTUSION	51	13.0
FRACTURE	190	48.6
CONCUSSION	32	8.2
HEMORRHAGE	17	4.3
AVULSION	1	0.3

AIS Level 4 injuries are considered life-threatening. The most common body region is the abdomen, but the most common combination is a skull or other fracture of the head. Rupture or laceration in the cardiovascular and digestive system are the next most frequent. Of persons whose most severe injury was at this level, 8.4% died (see page 65).

INJURY BY SYSTEM/ORGAN (N=474)

SYSTEM/ORGAN	NUMBER OF INJURIES	PERCENT
ALL SYSTEMS	3	0.6
SKELETAL GROUP	187	39.5
DIGESTIVE GROUP	61	12.9
NERVE GROUP	67	14.1
CARDIO GROUP	109	23.0
RESPIRATORY GROUP	37	7.8
UROGENITAL	9	1.9
SKIN	1	0.2

TEN MOST FREQUENT INJURIES COMMON AT AIS LEVEL 4

BODY REGION	INJURY TYPE	SYSTEM/ ORGAN	NUMBER OF INJURIES
HEAD	FRACTURE	SKELETAL	62
ABDOMEN	RUPTURE	CARDIOVASCULAR	60
ABDOMEN	LACERATION	DIGESTIVE	55
LEG	FRACTURE	SKELETAL	53
THORAX	FRACTURE	SKELETAL	38
HEAD	CONCUSSION	NERVOUS SYSTEM	32
HEAD	CONTUSION	NERVOUS SYSTEM	28
ABDOMEN	LACERATION	CARDIOVASCULAR	27
ARM	FRACTURE	SKELETAL	24
THORAX	CONTUSION	CARDIOVASCULAR	16

Distributions of AIS Level 5 Injuries in the NCSS Data

INJURY BY BODY REGION (N=332)

BODY REGION	NUMBER OF INJURIES	PERCENT
HEAD	117	35.2
NECK	12	3.6
CHEST/THORAX	82	24.7
ABDOMEN	118	35.5
BACK	2	0.6
LEG	1	0.3

INJURY BY TYPE (N=287)

INJURY TYPE	NUMBER OF INJURIES	PERCENT
LACERATION	175	61.0
CONTUSION	57	19.9
FRACTURE	10	3.5
CONCUSSION	45	15.7

INJURY BY SYSTEM/ORGAN (N=332)

SYSTEM/ORGAN	NUMBER OF INJURIES	PERCENT
SKELETAL GROUP	16	4.8
DIGESTIVE GROUP	97	29.2
NERVE GROUP	116	34.9
CARDIO GROUP	68	20.5
RESPIRATORY GROUP	20	6.0
UROGENITAL GROUP	15	4.5

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 65). The most common injury at this level was a laceration of the digestive system in the abdominal area, but contusion of the brain was also frequent.

TEN MOST FREQUENT INJURIES COMMON AT AIS LEVEL 5

BODY REGION	INJURY TYPE	SYSTEM/ ORGAN	NUMBER OF INJURIES
ABDOMEN	LACERATION	DIGESTIVE	76
HEAD	CONTUSION	NERVOUS SYSTEM	56
THORAX	LACERATION	CARDIOVASCULAR	55
HEAD	CONCUSSION	NERVOUS SYSTEM	45
ABDOMEN	RUPTURE	DIGESTIVE	20
THORAX	LACERATION	RESPIRATORY	18
HEAD	LACERATION	NERVOUS SYSTEM	13
ABDOMEN	LACERATION	UROGENITAL	7
ABDOMEN	RUPTURE	UROGENITAL	7
NECK	FRACTURE	SKELETAL	6

Distributions of AIS Level 6 Injuries in the NCSS Data

INJURY BY BODY REGION (N=123)

BODY REGION	NUMBER OF INJURIES	PERCENT
HEAD	35	28.5
NECK	53	43.1
CHEST/THORAX	31	25.2
ABDOMEN	2	1.6
BACK	1	0.8
WHOLE BODY	1	0.8

INJURY BY TYPE (N=74)

INJURY TYPE	NUMBER OF INJURIES	PERCENT
LACERATION	26	35.1
FRACTURE	42	56.8
HEMORRHAGE	1	1.4
AVULSION	4	5.4
RUPTURE	1	1.4

AIS Level 6 injuries are designated "Maximum--Currently Not Treatable." The most common of these was a fractured neck. All of the 104 persons in the NCSS study who sustained Level 6 injuries died.

INJURY BY SYSTEM/ORGAN (N=123)

SYSTEM/ORGAN	NUMBER OF INJURIES	PERCENT
ALL SYSTEMS	44	35.8
SKELETAL GROUP	46	37.4
NERVE GROUP	30	24.4
CARDIO GROUP	2	1.6
SKIN	1	0.8

TEN MOST FREQUENT INJURIES COMMON AT AIS LEVEL 6

BODY REGION	INJURY TYPE	SYSTEM/ ORGAN	NUMBER OF INJURIES
NECK	FRACTURE	SKELETAL	42
THORAX	CRUSH	ALL SYSTEMS	29
HEAD	LACERATION	NERVOUS SYSTEM	18
HEAD	CRUSH	ALL SYSTEMS	11
NECK	LACERATION	NERVOUS SYSTEM	7
HEAD	AVULSION	NERVOUS SYSTEM	4
NECK	DISLOCATION	SKELETAL	4
HEAD	HEMORRHAGE	NERVOUS SYSTEM	1
HEAD	AMPUTATION	ALL SYSTEMS	1
THORAX	LACERATION	CARDIOVASCULAR	1

Distributions of Unknown Level Injuries in the NCSS Data

INJURY BY BODY REGION (N=509)

BODY REGION	NUMBER OF INJURIES	PERCENT
HEAD	378	74.3
NECK	7	1.4
CHEST/THORAX	41	8.1
ABDOMEN	46	9.0
BACK	4	0.8
LEG	16	3.1
ARM	16	3.1
WHOLE BODY	1	0.2

INJURY BY TYPE (N=283)

INJURY TYPE	NUMBER OF INJURIES	PERCENT
LACERATION	1	0.4
FRACTURE	10	3.5
PAIN	1	0.4
CONCUSSION	271	95.8

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 a concussion, and it might be assumed that most of these were at either Level 2 or Level 3. If the majority were at Level 2 this would change the order of the Ten Most Frequent Injuries at that level (see page 72).

INJURY BY SYSTEM ORGAN (N=303)

SYSTEM/ORGAN	NUMBER OF INJURIES	PERCENT
ALL SYSTEMS	3	1.0
SKELETAL GROUP	13	4.3
DIGESTIVE GROUP	2	0.7
NERVE GROUP	277	91.4
CARDIO GROUP	1	0.3
RESPIRATORY	2	0.7
UROGENITAL	1	0.3
SKIN	4	1.3

TEN MOST FREQUENT INJURIES COMMON AT UNKNOWN LEVEL

BODY REGION	INJURY TYPE	SYSTEM/ ORGAN	NUMBER OF INJURIES
HEAD	CONCUSSION	NERVOUS SYSTEM	271
NONE	UNKNOWN	UNKNOWN	230
LEG	FRACTURE	SKELETAL	5
ARM	FRACTURE	SKELETAL	3
HEAD	LACERATION	SKIN	1
HEAD	OTHER	NERVOUS SYSTEM	1
NECK	FRACTURE	SKELETAL	1
NECK	OTHER	SKELETAL	1
THORAX	FRACTURE	SKELETAL	1
LEG	SPRAIN	SKELETAL	1

A unique feature of the NCSS data set is the inclusion of a crash severity measure indicating the instantaneous change of velocity for each vehicle at the time of the crash. 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 this Delta V is the CRASH2 program.*

For approximately 50% of the passenger cars investigated during the first fifteen months of the NCSS program, a value for Delta V has been computed and recorded in the computerized file.** The Delta V distributions shown in this section 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, and thus the necessary crush measurements could not be obtained; 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 distributions shown here toward higher Delta V's, while the second might move the Delta V distribution toward lower values. Although the direction and magnitude of the bias are unknown (and thus the absolute values of Delta V somewhat questionable), the general shape of the distribution and the comparisons of this shape across such factors as crash type, road type, driver age, etc., should be useful.

The presented curves have been smoothed, usually with a five-point moving mean over two-mph groups, to eliminate the noise in the raw data. Tabular data are shown in 10-mph groups. Relative frequencies for the graphs on pages 80-85 are shown for two-mph groups. For example, about 14% of all crashes occurred in a two-mph band around 10 mph. The reader may estimate the frequency in a one-mph band by taking half of the number shown on the vertical scale--e.g., about 7% of all crashes occurred between 9 and 10 mph. Pages 80 through 85 show the frequency distribution of Delta V for investigation, degree of urbanization, and restraint usage. This suggests that the total distribution is relatively insensitive to these variables. The next ten pages show the cumulative frequency distribution and injury rates for occupants of cars with different damage areas. The final two pages show the cumulative and frequency distributions for several injury classifications.

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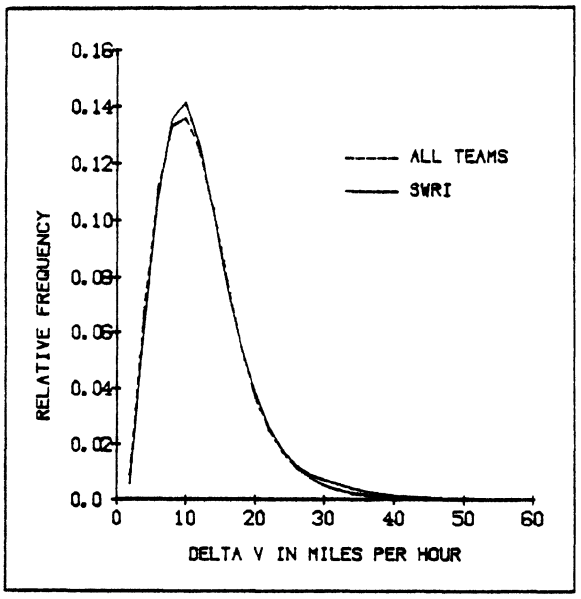
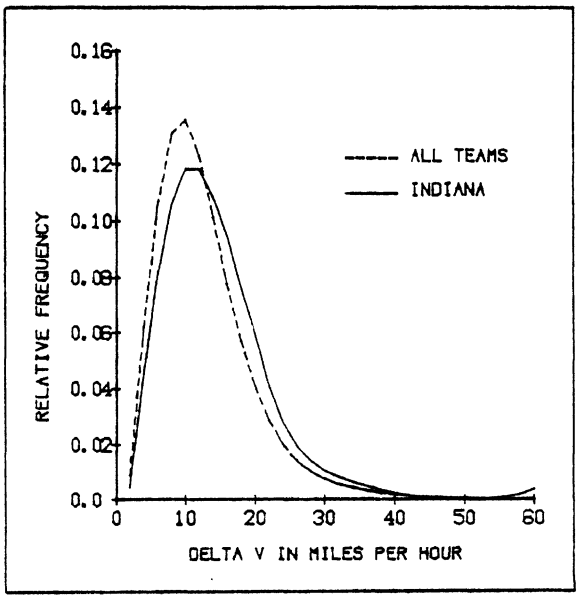
*For further detail, see McHenry, R. R. and Lynch, J. P., CRASH2 Users Manual, DOT/HS 802-106, November 1976.

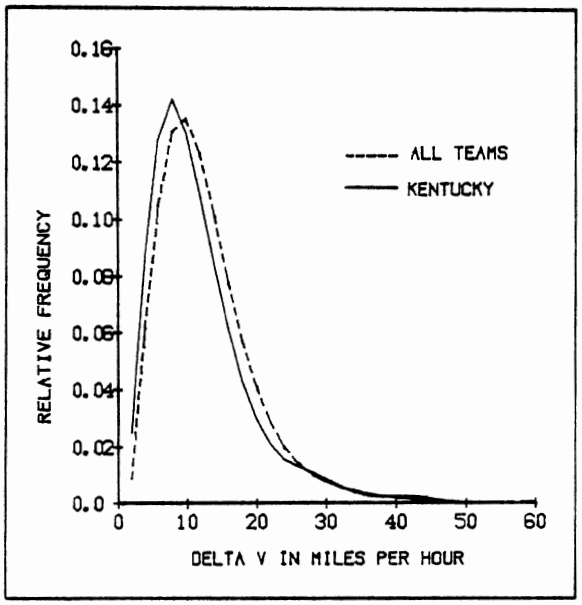
**All the values presented here resulted from the "damage only" runs of the CRASH2 algorithm. A more complex part of CRASH2 computes Delta V and other parameters from crash trajectory information. These runs were performed for a smaller fraction of the NCSS cases, and their data are not included in this section.

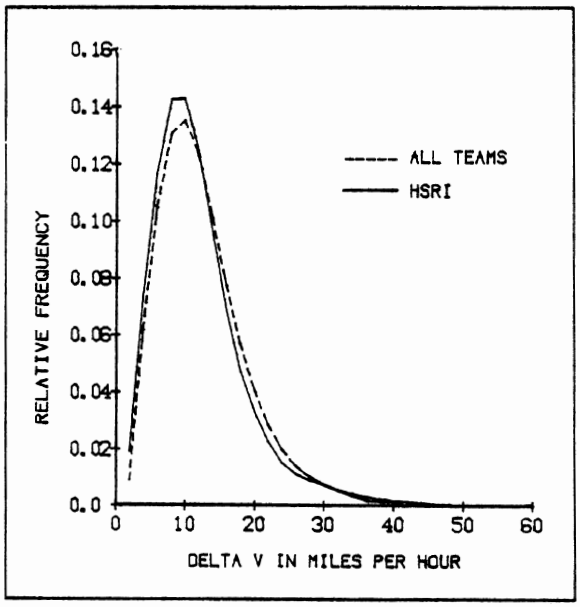
Crash Severity (Delta V) by Investigation Team

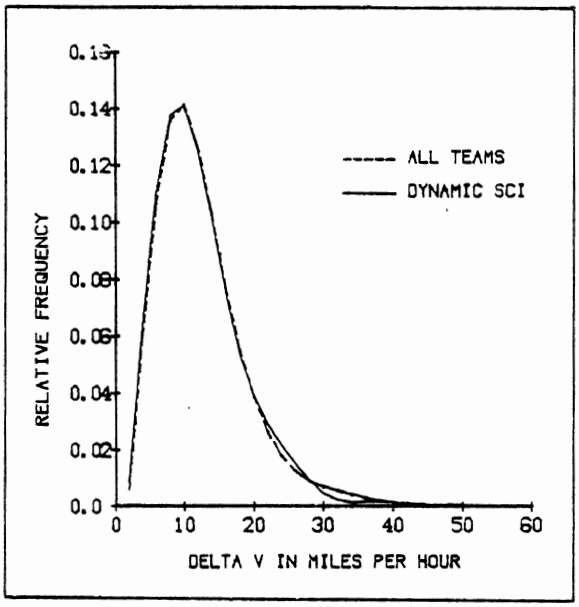
DELTA V	CALSPAN	HSRI	INDIANA UNIV.	U. OF KENTUCKY.	MIAMI UNIV.	SWRI	DYNAMIC SCIENCE	TOTAL
1-10 MPH	1539	971	1056	1234	1180	2856	648	9484
(ROW %)	16.2	10.2	11.1	13.0	12.4	30.1	6.8	100.0
(COL %)	47.0	57.5	41.2	60.5	52.9	53.0	55.0	51.6
11-20 MPH	1379	600	1177	633	881	2066	433	7169
(ROW %)	19.2	8.4	16.4	8.8	12.3	28.8	6.0	100.0
(COL %)	42.1	35.5	45.9	31.0	39.5	38.3	36.8	39.0
21-30 MPH	262	86	238	124	144	338	85	1277
(ROW %)	20.5	6.7	18.6	9.7	11.3	26.5	6.7	100.0
(COL %)	8.0	5.1	9.3	6.1	6.5	6.3	7.2	7.0
31-40 MPH	68	19	62	29	18	96	9	301
(ROW %)	22.6	6.3	20.6	9.6	6.0	31.9	3.0	100.0
(COL %)	2.1	1.1	2.4	1.4	0.8	1.8	0.8	1.6
41-50 MPH	16	9	12	18	4	18	2	79
(ROW %)	20.3	11.4	15.2	22.8	5.1	22.8	2.5	100.0
(COL %)	0.5	0.5	0.5	0.9	0.2	0.3	0.2	0.4
51-60 MPH	4	3	16	1	2	11	1	38
(ROW %)	10.5	7.9	42.1	2.6	5.3	28.9	2.6	100.0
(COL %)	0.1	0.2	0.6	0.0	0.1	0.2	0.1	0.2
61-70 MPH	6	1	4	0	0	3	0	14
(ROW %)	42.9	7.1	28.6	0.0	0.0	21.4	0.0	100.0
(COL %)	0.2	0.1	0.2	0.0	0.0	0.1	0.0	0.1
71-80 MPH	0	1	0	1	1	4	0	7
(ROW %)	0.0	14.4	0.0	14.4	14.4	57.6	0.0	100.0
(COL %)	0.0	0.1	0.0	0.1	0.1	0.1	0.0	0.1
TOTAL	3274	1690	2565	2040	2230	5392	1178	18369
(ROW %)	17.8	9.2	14.0	11.1	12.1	29.4	6.4	100.0
(COL %)	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

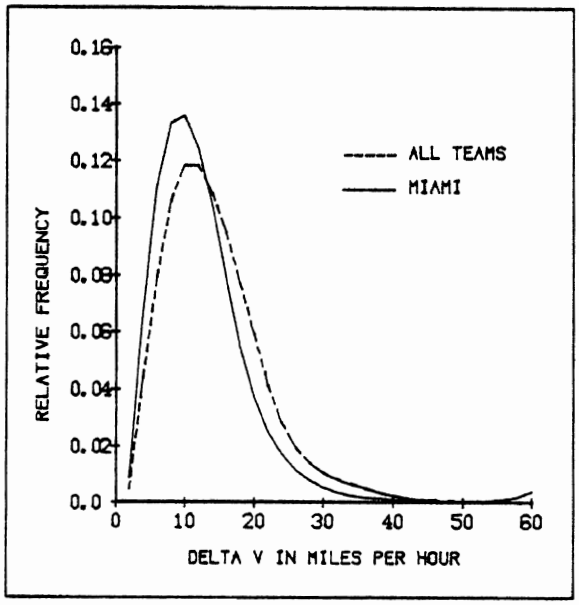


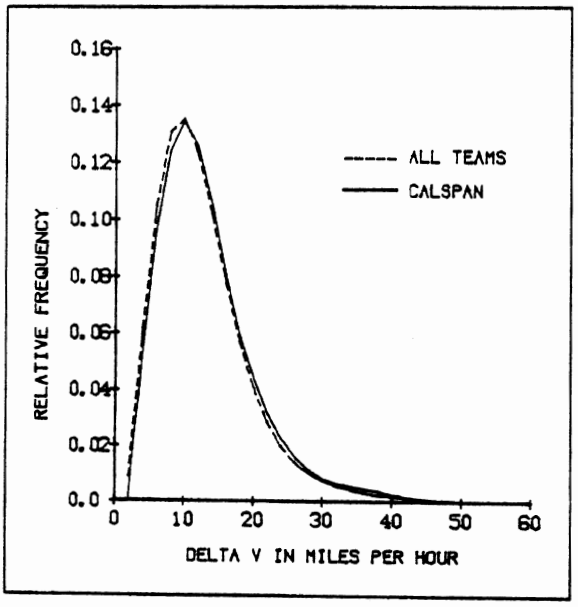








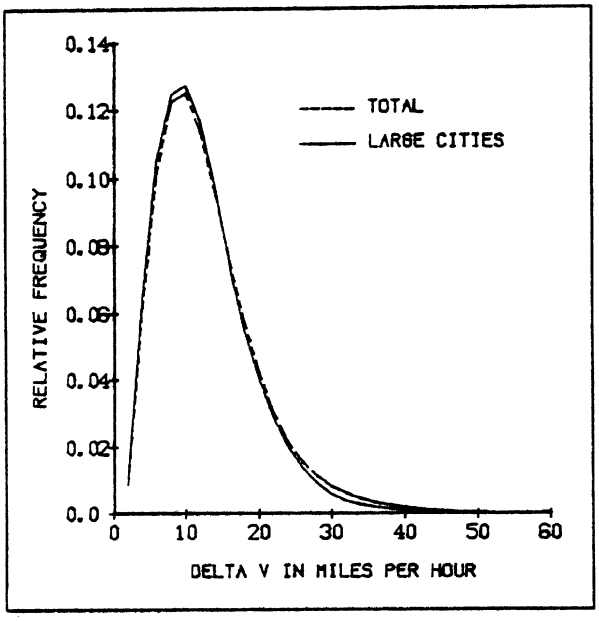


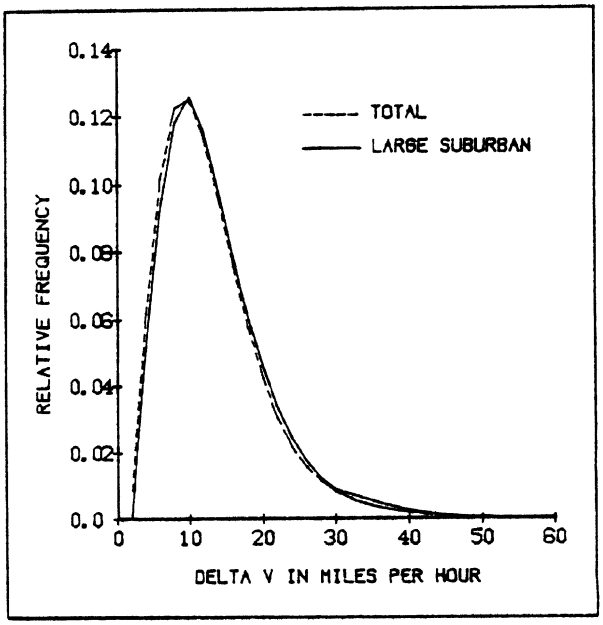


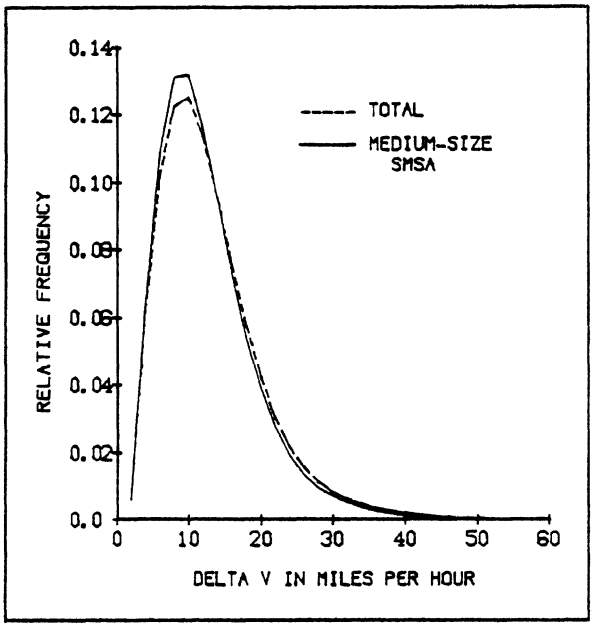
The overall shape of all the team-Delta V curves is similar, but the more rural teams show a higher proportion of high values. The Indiana University team operated in primarily rural counties in southern Indiana. Miami cases were all obtained within the city limits, and show relatively lower Delta V's.

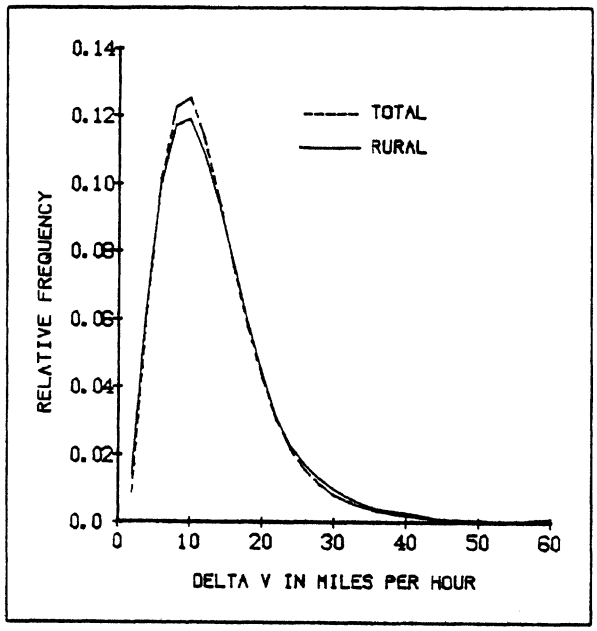
Crash Severity (Delta V) by Degree of Urbanization

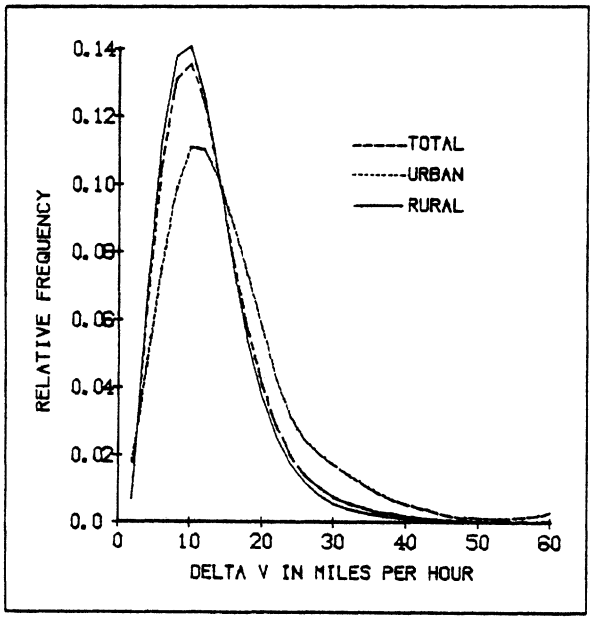
DELTA V	LARGE CITY	LARGE SUBURB	MEDIUM SMSA	RURAL	TOTAL
1-10 MPH	1828	1539	2689	3428	9484
(ROW %)	19.3	16.2	28.4	36.1	100.0
(COL %)	53.6	47.0	55.0	50.4	51.6
11-20 MPH	1314	1379	1809	2667	7169
(ROW %)	18.3	19.2	25.2	37.2	100.0
(COL %)	38.6	42.1	37.0	39.2	39.0
21-30 MPH	229	262	301	485	1277
(ROW %)	17.9	20.5	23.6	38.0	100.0
(COL %)	6.7	8.0	6.2	7.1	7.0
31-40 MPH	27	68	66	140	301
(ROW %)	9.0	22.6	21.9	46.5	100.0
(COL %)	0.8	2.1	1.3	2.1	1.6
41-50 MPH	6	16	15	42	79
(ROW %)	7.6	20.3	19.0	53.2	100.0
(COL %)	0.2	0.5	0.3	0.6	0.4
51-60 MPH	3	4	6	25	38
(ROW %)	7.9	10.5	15.8	65.8	100.0
(COL %)	0.1	0.1	0.1	0.4	0.2
61-70 MPH	0	6	1	7	14
(ROW %)	0.0	42.9	7.1	50.0	100.0
(COL %)	0.0	0.2	0.0	0.1	0.1
71-99 MPH	1	6	1	9	17
(ROW %)	5.9	35.3	5.9	52.9	100.0
(COL %)	0.0	0.2	0.0	0.1	0.1
TOTAL	3408	3274	4890	6797	18369
(ROW %)	18.6	17.8	26.6	37.0	100.0
(COL %)	100.0	100.0	100.0	100.0	100.0







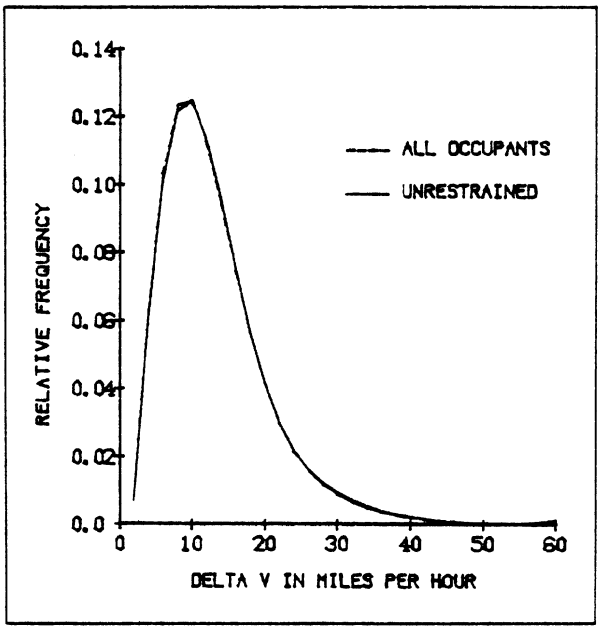


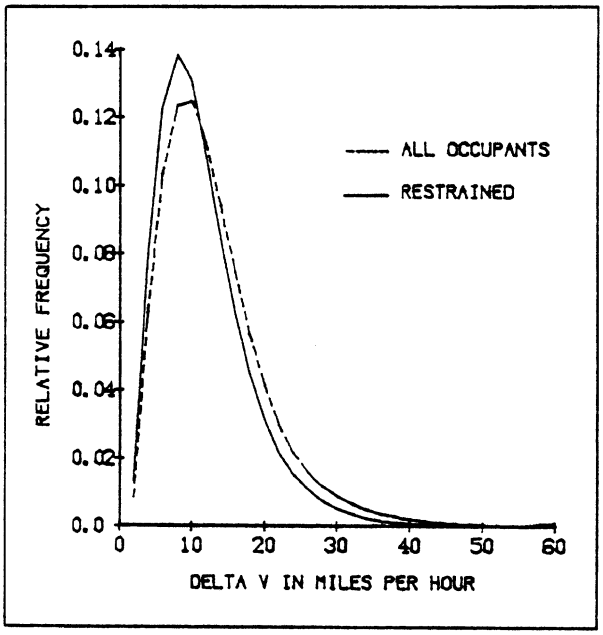


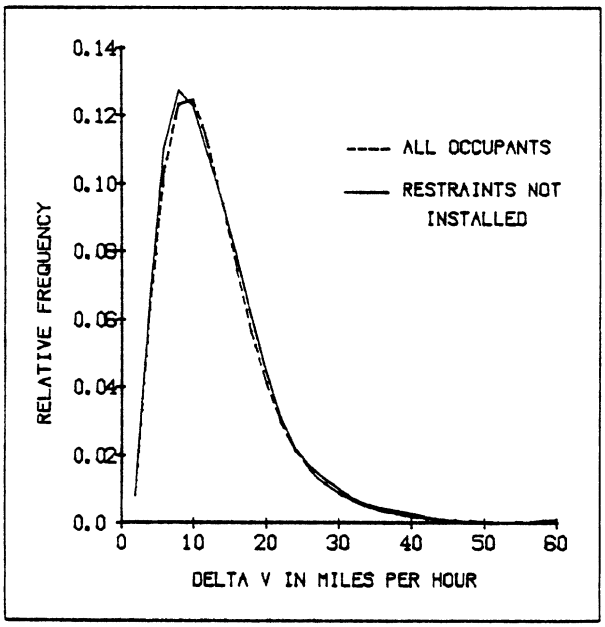
The Degree of Urbanization (defined on page 12) is a description for an entire data collection site. The The Urban/Rural Designation, by contrast, is the character of the accident location reported by the investigator. The total frequency distribution of Delta V for the four "Degree of Urbanization" categories are remarkably similar. Using the investigator-reported categories, as shown in the figure at the left, accidents in rural areas are more likely to involve higher Delta V's.

Crash Severity (Delta V) by Restraint Usage

DELTA V	NOT USED	LAP & TORSO	LAP ONLY	TORSO ONLY	PASSIVE	CHILD SEAT	NONE PRESENT	NOT KNOWN	TOTAL
1-10 MPH	11617	699	673	20	0	18	961	1040	15028
(ROW %)	77.3	4.7	4.5	0.1	0.0	0.1	6.4	6.9	100.0
(COL %)	51.3	61.9	64.3	100.0	0.0	64.3	51.4	52.6	52.3
11-20 MPH	8736	378	313	0	10	9	715	754	10915
(ROW %)	80.0	3.5	2.9	0.0	0.1	0.1	6.6	6.9	100.0
(COL %)	38.6	33.5	29.9	0.0	90.9	32.1	38.2	38.1	38.0
21-30 MPH	1682	41	52	0	1	0	149	150	2075
(ROW %)	81.1	2.0	2.5	0.0	0.0	0.0	7.2	7.2	100.0
(COL %)	7.4	3.6	5.0	0.0	9.1	0.0	8.0	7.6	7.2
31-40 MPH	411	11	4	0	0	1	40	23	490
(ROW %)	83.9	2.2	0.8	0.0	0.0	0.2	8.2	4.7	100.0
(COL %)	1.8	1.0	0.4	0.0	0.0	3.6	2.1	1.2	1.7
41-50 MPH	108	1	4	0	0	0	6	6	125
(ROW %)	86.4	0.8	3.2	0.0	0.0	0.0	4.8	4.8	100.0
(COL %)	0.5	0.1	0.4	0.0	0.0	0.0	0.3	0.3	0.4
51-60 MPH	64	0	1	0	0	0	0	4	69
(ROW %)	92.8	0.0	1.4	0.0	0.0	0.0	0.0	5.8	100.0
(COL %)	0.3	0.0	0.1	0.0	0.0	0.0	0.0	0.2	0.2
61-70 MPH	30	0	0	0	0	0	0	1	31
(ROW %)	96.8	0.0	0.0	0.0	0.0	0.0	0.0	3.2	100.0
(COL %)	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1
71-99 MPH	9	0	0	0	0	0	0	1	10
(ROW %)	90.0	0.0	0.0	0.0	0.0	0.0	0.0	10.0	100.0
(COL %)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
TOTAL	22657	1130	1047	20	11	28	1871	1979	28743
(ROW %)	78.8	3.9	3.6	0.1	0.0	0.1	6.5	6.9	100.0
(COL %)	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0



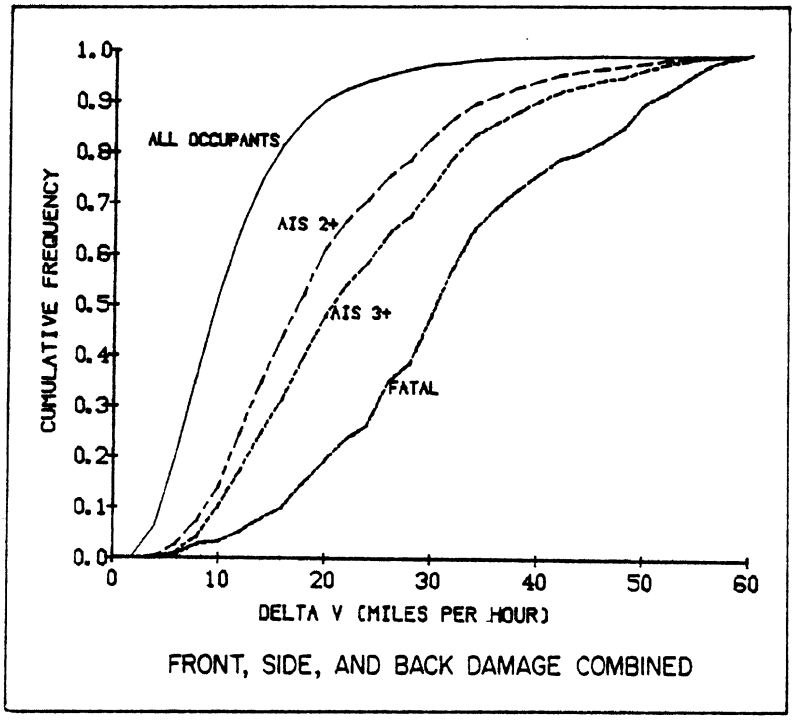




Restrained occupants, of course, are only a small proportion (less than 10%) of all occupants in this study. So the Delta V distribution for unrestrained looks essentially the same as for the total, but the restrained occupants are in a relatively lower severity group of crashes. It would be important to account for this difference in any evaluation of the effectiveness of the restraint systems.

NCSS Case Vehicle Crash Severity Distributions
(Front, Side, and Back Damage Combined)

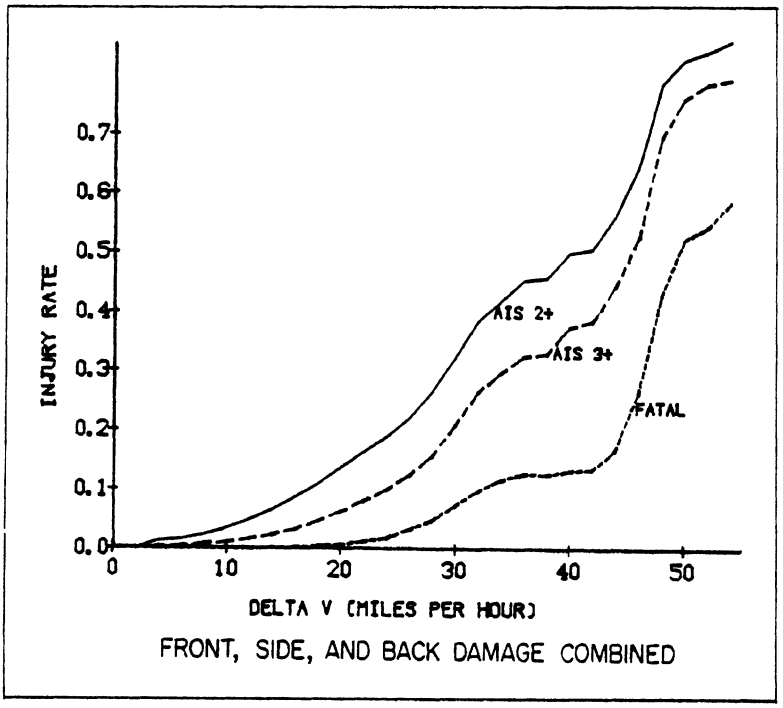
TOTAL DELTA V IN 10 MPH GROUPS	VEHICLES		OCCUPANTS							
			TOTAL		AIS 2+		AIS 3+		FATAL	
	N	%	N	%	N	%	N	%	N	%
1-10 MPH	9340	51.5	15093	52.1	284	13.9	100	10.0	8	3.3
11-20 MPH	7134	39.3	11101	38.3	949	46.5	369	36.9	36	14.6
21-30 MPH	1243	6.8	2037	7.0	443	21.7	251	25.1	65	26.4
31-40 MPH	295	1.6	483	1.7	227	11.1	167	16.7	64	26.0
41-50 MPH	79	0.4	126	0.4	76	3.7	62	6.2	32	13.0
OVER 50 MPH	59	0.3	109	0.4	63	3.1	52	5.2	41	16.7
TOTAL	18150	100.0	28949	100.0	2042	100.0	1001	100.0	246	100.0



The small number of crashes coded for other than front, side, and back damage have been deleted from this table. One can read from the graph that about 50% of all crashes (strictly speaking all occupants in towaway crashes) have a Delta V of less than 10 miles per hour. For fatal occupants, the 50% point is slightly greater than 30 miles per hour.

NCSS Injury Rates by Crash Severity
(Front, Side, and Back Damage Combined)

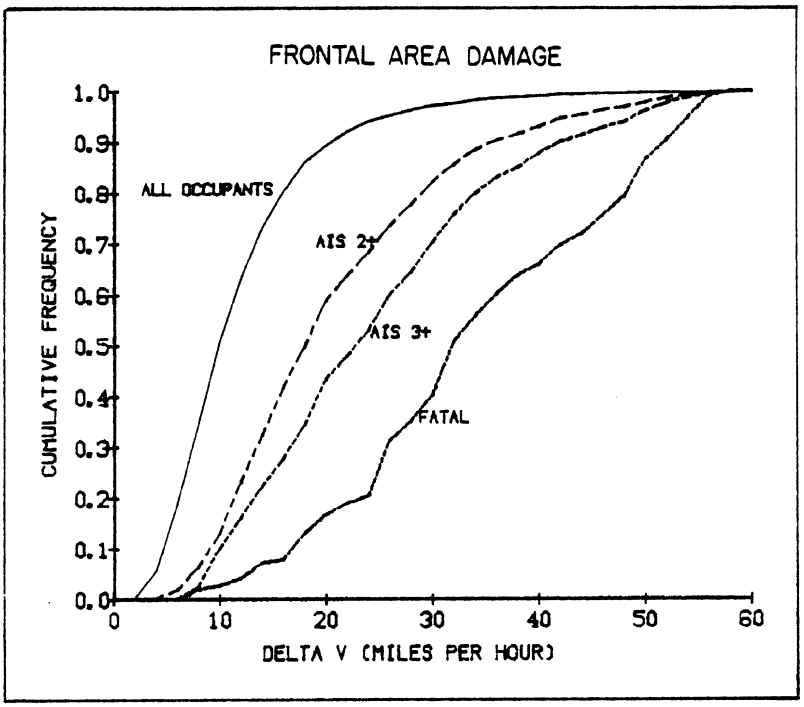
TOTAL DELTA V IN 10 MPH GROUPS	VEHICLES	OCCUPANTS							
		TOTAL	AIS 2+		AIS 3+		FATAL	
			N	%	N	%	N	%
1-10 MPH	9340	15093	284	1.9	100	0.7	8	0.1
11-20 MPH	7134	11101	949	8.5	369	3.3	36	0.3
21-30 MPH	1243	2037	443	21.7	251	12.3	65	3.2
31-40 MPH	295	483	227	47.0	167	34.6	64	13.3
41-50 MPH	79	126	76	60.3	62	49.2	32	25.4
OVER 50 MPH	59	109	63	57.8	52	47.7	41	37.6
TOTAL	18150	28949	2042	7.1	1001	3.5	246	0.8



For the four damage categories (front, right, back, and left) combined, the probability of an AIS 2 or greater injury in a 30 mile per hour crash is estimated at slightly more than 0.3. The original data have been smoothed over five 2-mile per hour points.

NCSS Case Vehicle Crash Severity Distributions
(Frontal Damage Only)

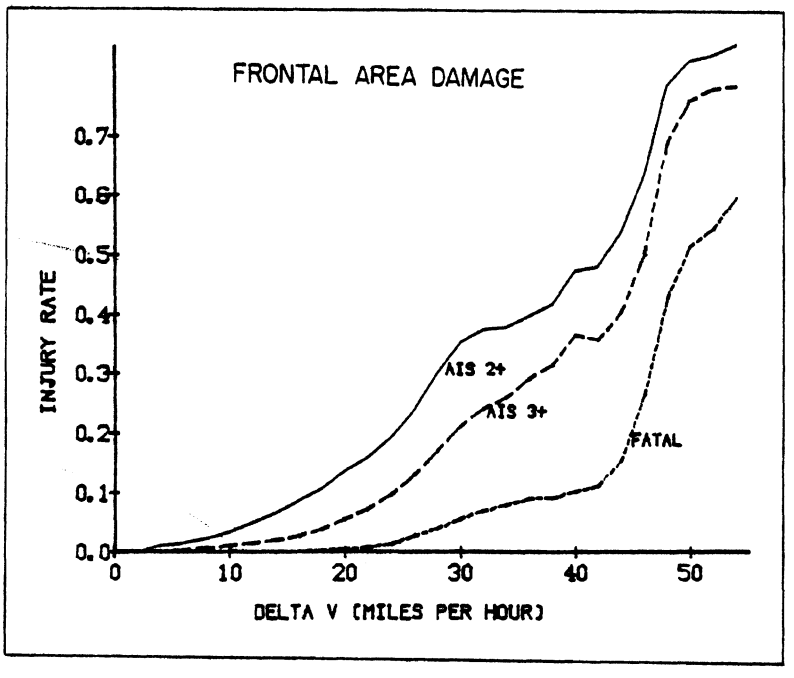
TOTAL DELTA V IN 10 MPH GROUPS	VEHICLES		OCCUPANTS							
			TOTAL		AIS 2+		AIS 3+		FATAL	
	N	%	N	%	N	%	N	%	N	%
1-10 MPH	6121	50.7	9606	50.9	183	13.1	65	10.0	4	2.7
11-20 MPH	4712	39.1	7268	38.5	633	45.1	211	32.6	19	12.8
21-30 MPH	901	7.5	1441	7.6	321	22.9	170	26.3	32	21.6
31-40 MPH	217	1.8	364	1.9	151	10.8	111	17.2	35	23.6
41-50 MPH	74	0.6	114	0.6	66	4.7	52	8.0	28	18.9
OVER 50 MPH	41	0.3	64	0.3	48	3.4	38	5.9	30	20.3
TOTAL	12066	100.0	18857	100.0	1402	100.0	647	100.0	148	100.0



The 12,066 frontal damage cases represent about two-thirds of the cases shown on the previous two pages, and thus dominate the total distribution. There are only minor differences between "All" and "Frontal" distributions.

NCSS Injury Rates by Crash Severity
(Frontal Damage Only)

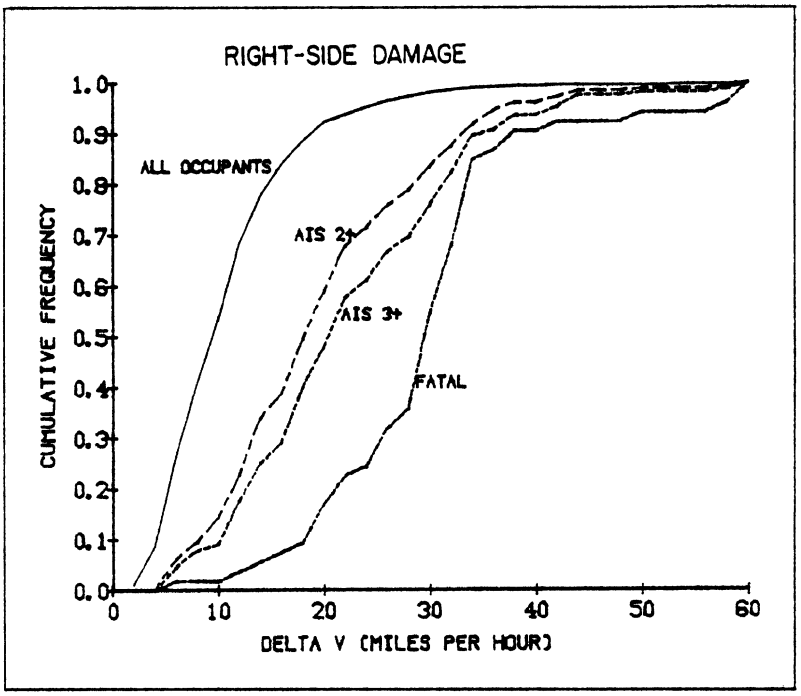
TOTAL DELTA V IN 10 MPH GROUPS	VEHICLES	OCCUPANTS							
		TOTAL	AIS 2+		AIS 3+		FATAL	
			N	%	N	%	N	%
1-10 MPH	6121	9606	183	1.9	65	0.7	4	0.0
11-20 MPH	4712	7268	633	8.7	211	2.9	19	0.3
21-30 MPH	901	1441	321	22.3	170	11.8	32	2.2
31-40 MPH	217	364	151	41.5	111	30.5	35	9.6
41-50 MPH	74	114	66	57.9	52	45.6	28	24.6
OVER 50 MPH	41	64	48	75.0	38	59.4	30	46.9
TOTAL	12066	18857	1402	7.4	647	3.4	148	0.8



Although the fatality rate for a 40 mile per hour frontal collision is only about 0.1, this rate rises sharply for higher speeds. Although these data have been smoothed for plotting, the number of cases above 40 miles per hour is so small that inferences from that portion of the graph should be made with caution.

NCSS Case Vehicle Crash Severity Distributions
(Right-Side Damage Only)

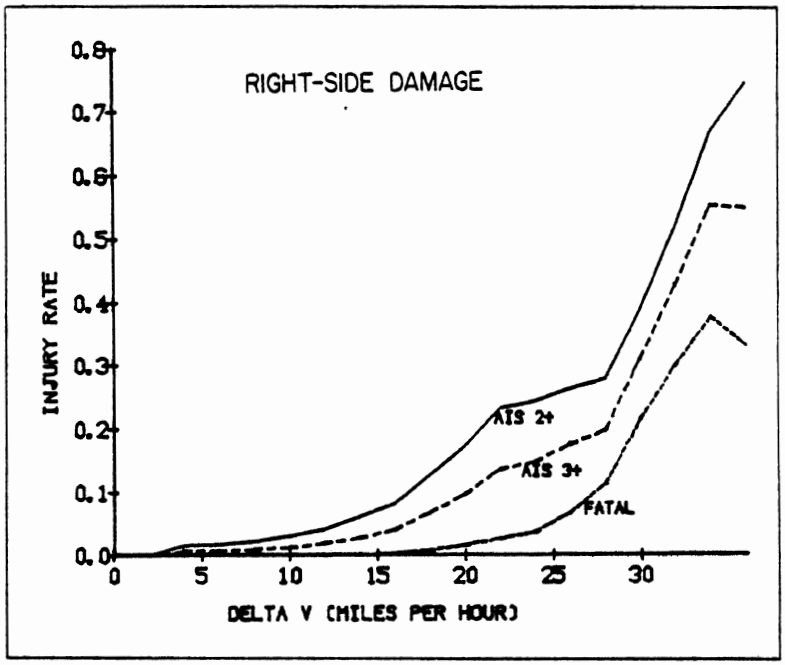
TOTAL DELTA V IN 10 MPH GROUPS	VEHICLES		OCCUPANTS							
			TOTAL		AIS 2+		AIS 3+		FATAL	
	N	%	N	%	N	%	N	%	N	%
1-10 MPH	1302	50.7	2273	53.4	43	13.9	16	8.7	1	1.7
11-20 MPH	1067	41.5	1656	38.9	133	43.0	68	37.0	8	13.3
21-30 MPH	150	5.8	247	5.8	74	23.9	49	26.6	20	33.3
31-40 MPH	40	1.6	56	1.3	38	12.3	31	16.8	19	31.7
41-50 MPH	3	0.1	10	0.2	8	2.6	8	4.3	2	3.3
OVER 50 MPH	6	0.2	13	0.3	13	4.2	12	6.5	10	16.7
TOTAL	2568	100.0	4255	100.0	309	100.0	184	100.0	60	100.0



On the following four pages cumulative frequency and injury rate distributions are shown for right- and left-side damage separately. Of the total 18,150 crashed vehicles, about five thousand had principal damage in the side, and these are about equally distributed between right and left damage. Note that only 15% of the fatalities occur below 20 miles per hour for right-side impacts.

NCSS Injury Rates by Crash Severity
(Right-Side Damage Only)

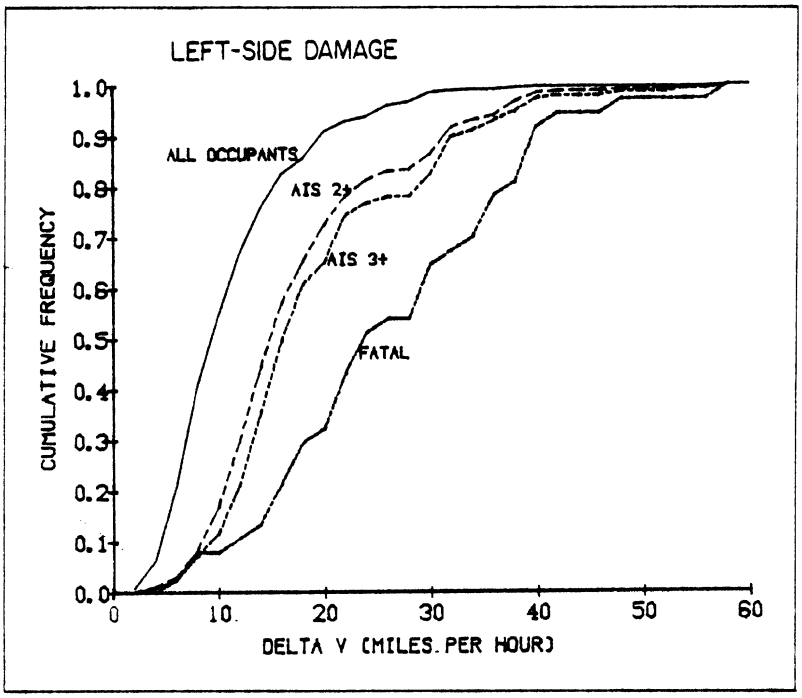
TOTAL DELTA V IN 10 MPH GROUPS	VEHICLES	OCCUPANTS							
		TOTAL	AIS 2+		AIS 3+		FATAL	
			N	%	N	%	N	%
1-10 MPH	1302	2273	43	1.9	16	0.7	1	0.0
11-20 MPH	1067	1656	133	8.0	68	4.1	8	0.5
21-30 MPH	150	247	74	30.0	49	19.8	20	8.1
31-40 MPH	40	56	38	67.9	31	55.4	19	33.9
41-50 MPH	3	10	8	80.0	8	80.0	2	20.0
OVER 50 MPH	6	13	13	100.0	12	92.3	10	76.9
TOTAL	2568	4255	309	7.3	184	4.3	60	1.4



The injury rates may be compared with those of frontal-damaged cars. At 30 miles per hour the fatality rate for right-side damage is about 0.2, whereas in the frontal cases the rate at 30 miles per hour was less than 0.1.

NCSS Case Vehicle Crash Severity Distributions
(Left-Side Damage Only)

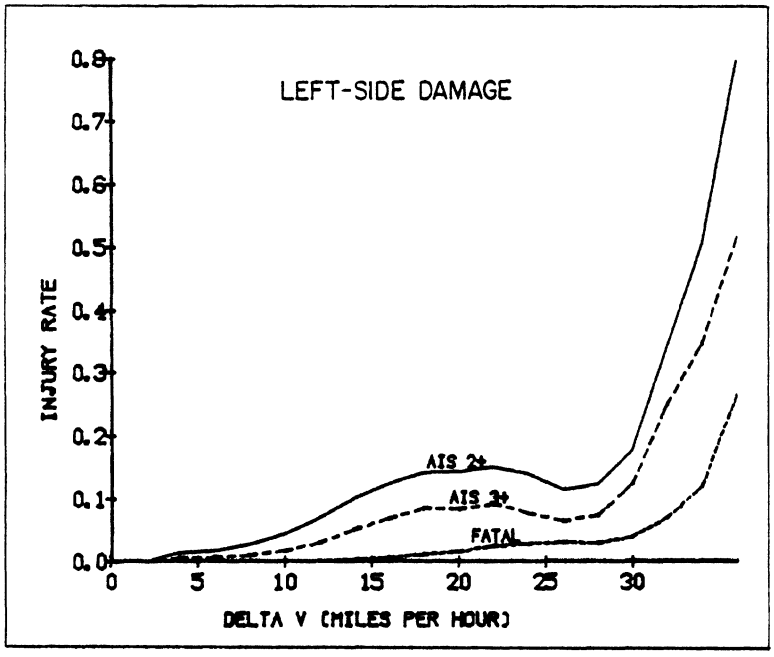
TOTAL DELTA V IN 10 MPH GROUPS	VEHICLES		OCCUPANTS							
			TOTAL		AIS 2+		AIS 3+		FATAL	
	N	%	N	%	N	%	N	%	N	%
1-10 MPH	1339	54.5	2216	54.9	51	17.1	19	11.8	3	8.1
11-20 MPH	928	37.7	1467	36.3	166	55.5	86	53.4	9	24.3
21-30 MPH	160	6.5	305	7.6	42	14.0	28	17.4	12	32.4
31-40 MPH	28	1.1	45	1.1	36	12.0	24	14.9	10	27.0
41-50 MPH	2	0.1	2	0.0	2	0.7	2	1.2	2	5.4
OVER 50 MPH	2	0.1	2	0.0	2	0.7	2	1.2	1	2.7
TOTAL	2459	100.0	4037	100.0	299	100.0	161	100.0	37	100.0



For left-side impacts, about one-third of the fatalities occurred at speeds less than 20 miles per hour. Compare this with the data on page 90.

NCSS Injury Rates by Crash Severity
(Left-Side Damage Only)

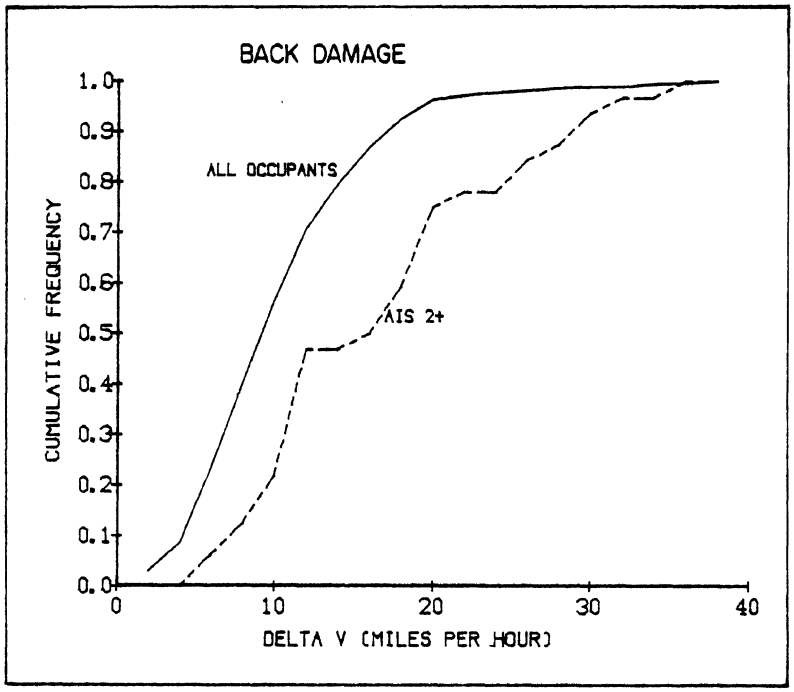
TOTAL DELTA V IN 10 MPH GROUPS	VEHICLES	OCCUPANTS							
		TOTAL	AIS 2+		AIS 3+		FATAL	
			N	%	N	%	N	%
1-10 MPH	1339	2216	51	2.3	19	0.9	3	0.1
11-20 MPH	928	1467	166	11.3	86	5.9	9	0.6
21-30 MPH	160	305	42	13.8	28	9.2	12	3.9
31-40 MPH	28	45	36	80.0	24	53.3	10	22.2
41-50 MPH	2	2	2	100.0	2	100.0	2	100.0
OVER 50 MPH	2	2	2	100.0	2	100.0	1	50.0
TOTAL	2459	4037	299	7.4	161	4.0	37	0.9



The fatality rate for left side damage at 30 miles per hour is low compared with either frontal- or right-side damage. The number of cases in the higher speed ranges is small, but this suggests that left- and right-side crashes are not symmetrical.

NCSS Case Vehicle Crash Severity Distributions
(Back Damage Only)

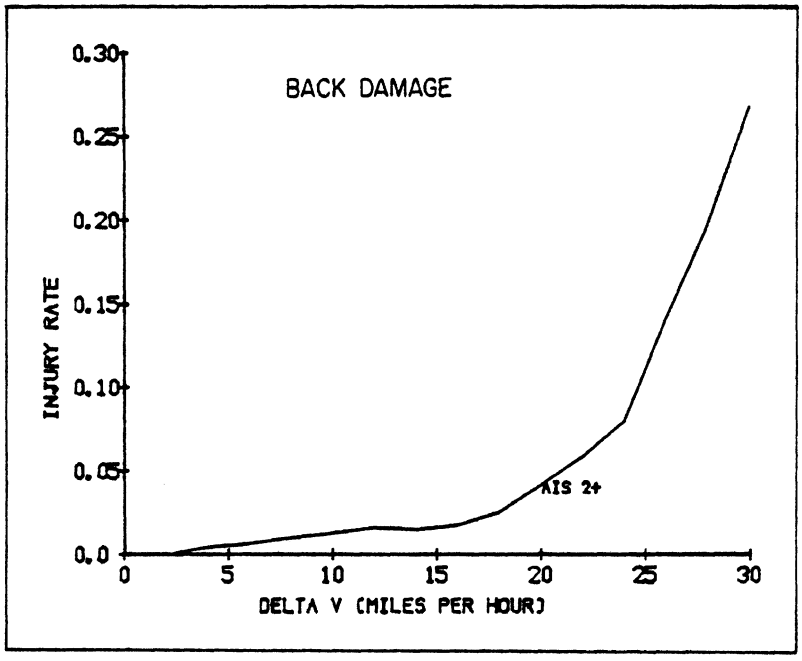
TOTAL DELTA V IN 10 MPH GROUPS	VEHICLES		OCCUPANTS							
			TOTAL		AIS 2+		AIS 3+		FATAL	
	N	%	N	%	N	%	N	%	N	%
1-10 MPH	578	54.7	998	55.4	7	21.9	0	0.0	0	0.0
11-20 MPH	427	40.4	710	39.4	17	53.1	4	44.4	0	0.0
21-30 MPH	32	3.0	44	2.4	6	18.8	4	44.4	1	100.0
31-40 MPH	10	0.9	18	1.0	2	6.3	1	11.1	0	0.0
41-50 MPH	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
OVER 50 MPH	10	0.9	30	1.7	0	0.0	0	0.0	0	0.0
TOTAL	1057	100.0	1800	100.0	32	100.0	9	100.0	1	100.0



Back-damaged cars in the NCSS reconstructed population (and for which Delta V is reported) account for only about 6% of the totals shown on page 86. Only three fatalities appear in this subset, and injury data about AIS 2 is too sparse to plot.

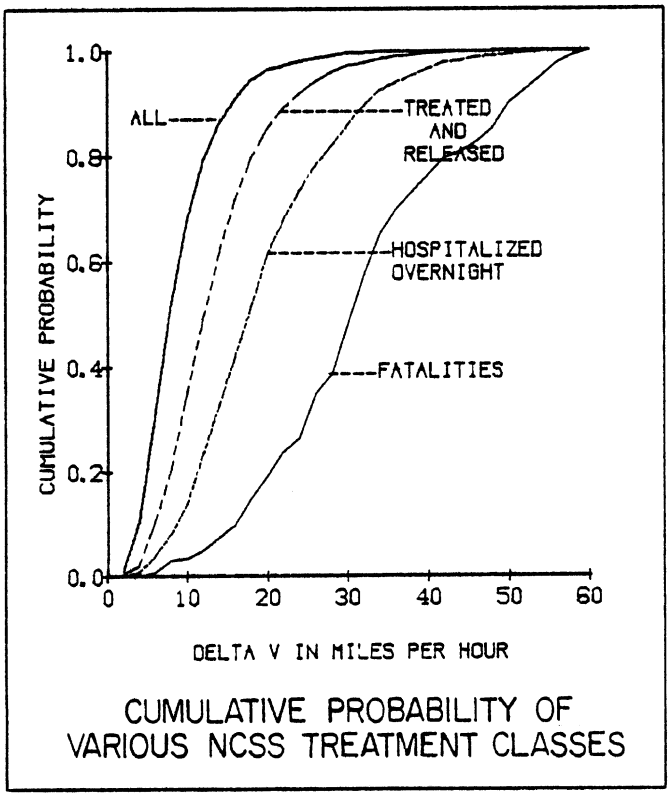
NCSS Injury Rates by Crash Severity
(Back Damage Only)

TOTAL DELTA V IN 10 MPH GROUPS	VEHICLES	OCCUPANTS							
		TOTAL	AIS 2+		AIS 3+		FATAL	
			N	%	N	%	N	%
1-10 MPH	578	998	7	0.7	0	0.0	0	0.0
11-20 MPH	427	710	17	2.4	4	0.6	0	0.0
21-30 MPH	32	44	6	13.6	4	9.1	1	2.3
31-40 MPH	10	18	2	11.1	1	5.6	0	0.0
41-50 MPH	0	0	0	0.0	0	0.0	0	0.0
OVER 50 MPH	10	30	0	0.0	0	0.0	0	0.0
TOTAL	1057	1800	32	1.8	9	0.5	1	0.1

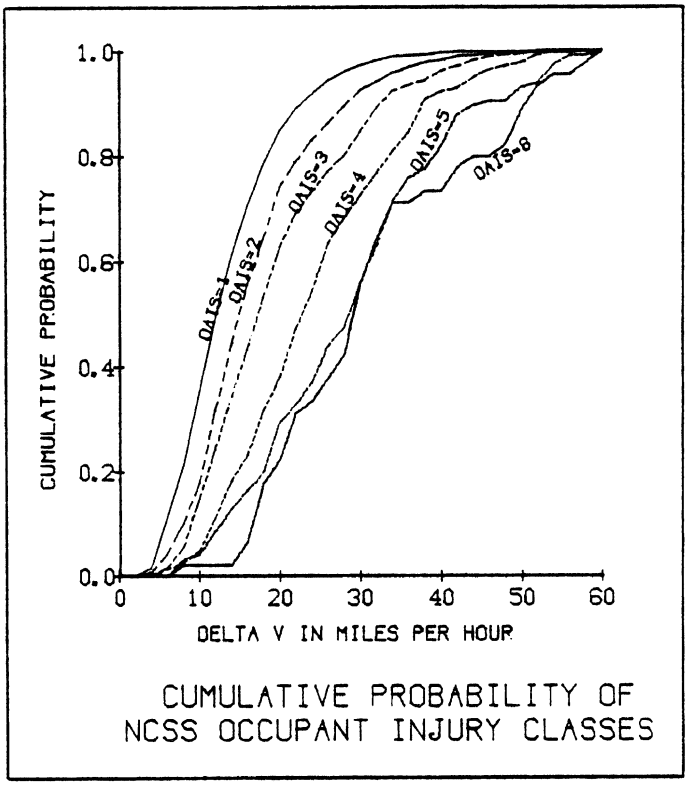


The AIS 2+ injury rate alone is plotted, as the number of cases with greater injury is quite small. Injury rates (for a given Delta V) are substantially lower than for other (side and front) damage classes.

CUMULATIVE INJURY PROBABILITIES



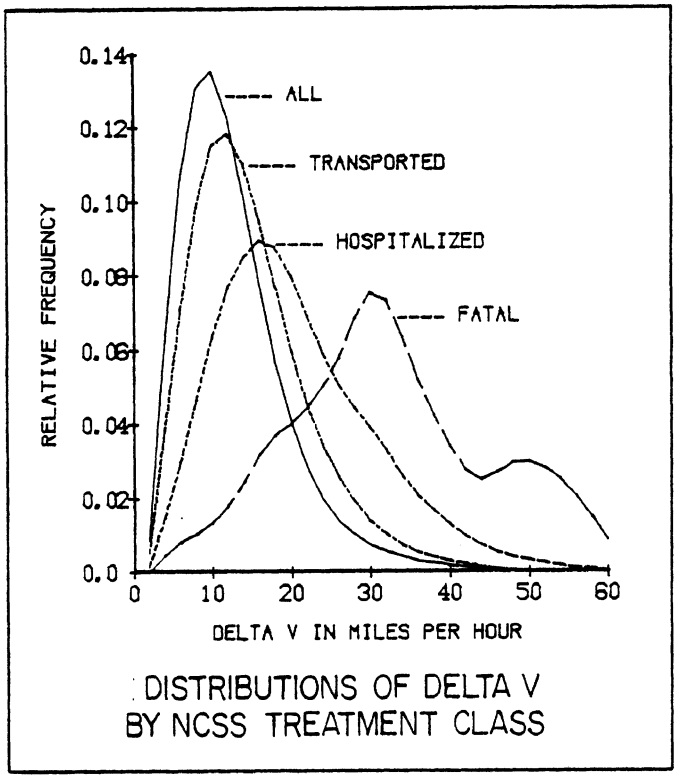
CUMULATIVE PROBABILITY OF VARIOUS NCSS TREATMENT CLASSES



CUMULATIVE PROBABILITY OF NCSS OCCUPANT INJURY CLASSES

Passenger car occupants in NCSS-reported crashes are categorized into treatment classes. The left-most figure above shows the estimated cumulative probabilities of being in each of several classes. In crashes with a 30 mile per hour Delta V, the chance of an occupant being hospitalized at least overnight (or killed) is about 0.85. In the right-hand figure the cumulative distribution of the various AIS injury classes are shown. Again, given a thirty mile per hour Delta V, the chance of at least an AIS 2 injury is about 0.9.

CRASH SEVERITY (DELTA V) BY NCSS TREATMENT CLASS



Delta V distributions for occupants of the several NCSS treatment classes 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 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. The dip in the fatality curve in the 45 mile per hour region is likely to be the result of sparsity of data.

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