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FACT BOOK: A SUMMARY OF INFORMATION ABOUT TOWAWAY ACCIDENTS INVOLVING 1973-1975 MODEL CARS

Volume II

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Final Report

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None

16. Abstract

Standardized injury rates and seat belt effectiveness measures are derived from a probability sample of towaway accidents involving 1973-1975 model cars. The data were collected by NHTSA-sponsored teams in five different geographic regions. Weighted sample size available for the analysis is 15,818 occupants for which there is complete information on belt usage, AIS injury level, age, crash configuration, vehicle weight, and damage severity.

In order to obtain the standardized injury rates and effectiveness measures as well as estimates of their precision, several alternative procedures utilizing techniques for analysis of complex categorical data were examined. In Volume I, these techniques and their application to the data are described in detail. Results are presented for various injury levels for both the overall population as well as various subsets of interest (e.g., by model year, impact site or vehicle damage severity). A sensitivity analysis is carried out to determine the effect on the estimates of including various subsets of the control variables. Finally, the estimates are reworked using direct injury costs derived largely from insurance data.

Volume II contains a variety of tables detailing who was involved in the accident investigated, where and when they occurred, and what make and model car was involved. This volume also serves as a "Fact Book" of information describing belt usage by various sub-populations; occupant injuries (including fatalities and belt-caused injuries); malfunction, defeat or maladjustment of belts; ejection; and problems encountered by unusual occupants.

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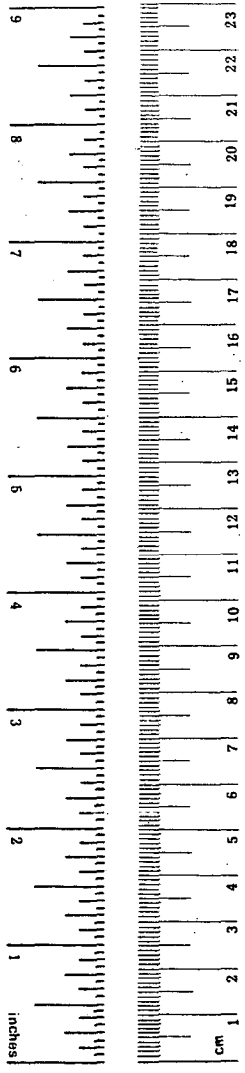
METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures

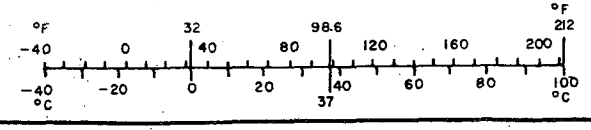
Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
in	inches	*2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
		AREA		
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
	acres	0.4	hectares	ha
		MASS (weight)		
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
		VOLUME		
tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
		TEMPERATURE (exact)		
°F	Fahrenheit temperature	5.9 (after subtracting 32)	Celsius temperature	°C

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



Approximate Conversions from Metric Measures

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



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I would like to also thank Charles J. Kahane at NHTSA for providing guidance and suggesting tables and figures that might be included in this report.

Of course, any errors and inconsistencies in this report must be attributed to the author.

TABLE OF CONTENTS

I. Introduction

The issue of restraint systems for passenger car occupants is currently the focus of much discussion. The problem is complex and cannot be resolved by any single project. The project reported in this volume and its companion examines in some detail the restraint system that is presently widely used in the U. S.: seat belts. The first volume of this report is concerned with the effectiveness of seat belts in reducing injuries and cost of injuries. This volume presents a large number of tables reflecting the effectiveness of seat belts, usage rates, injury information, ejection data along with a wide range of other variables of interest.

The data from which the tables were derived was collected by five experienced teams of accident investigators. A wide range of information sources was employed, including police reports, subject and witness interviews, hospital information and investigation of the vehicles. The concept behind the development of this type data base was that it should contain more indepth information than the usual police report (which implies a smaller data base), but represents a less extensive data collection effort than MDAI team reports. This "intermediate" type of data file is called a "Level 2" file.

The investigative teams limited their efforts to obtaining data for towaway accidents involving 1973-75 model year passenger vehicles. In order to maximize the likelihood of obtaining detailed information on injured occupants, a stratified probability sampling plan was used. In general, if at least one occupant of a vehicle was taken to a treatment facility, then all occupants of that vehicle were sampled. Otherwise, the occupants of the vehicle were sampled according to the even-odd status of the last digit of their license plate (50% chance of being included). Minor variations on this procedure were employed by some of the investigative teams. These are detailed in Appendix B of Volume 1 to this report.

The five teams were located in different geographic areas of the country. One team, Calspan, operated in Erie, Niagara, Genesee, Orleans, Wyoming, Chautaugua, Cattaraugus and Allegany counties in western New York state. HSRI included accidents in Washtenaw and Oakland counties in southern Michigan. Another team, SWRI, obtained data from Bexar, Guadalupe, Travis, Comal, and Hays counties (which include San Antonio and Austin) in Texas. Two teams, USC and Miami, restricted their involvement to one urban county: Los Angeles and Dade, respectively. The bias towards urban areas was necessary in order to insure that a large number of accidents would be investigated within a reasonable period of time. Both the national representativeness and the quality of the data are addressed in some detail in Volume 1 of this report.

The tables and figures included as the major part of this volume have a two-fold purpose. First, it is hoped that they will answer many questions about seat belts: Who uses them? How effective are they? When do people wear them? Who gets injured? What injuries are associated with compacts? What about unusual occupants? etc.

A second purpose of this volume is to suggest new hypotheses. Thus, the tables might suggest special populations to which belt usage campaigns should be addressed, or vehicle systems which should be modified to reduce risk of injury.

The tables are predominantly two and three-dimensional cross-tabulations. For ease of comparison across alternatives, the actual numbers have been converted to either row or column percentages (depending upon which variable was more interesting). The marginal sums have also been converted to percentages. Note, however, that one can always work backward from the grand totals to reconstruct actual numbers. In addition to the tables, there are numerous figures of interest that are self explanatory.

The organization of the tables corresponds to the primary purpose of the volume: question answering. Each section of this volume is organized to answer a particular "wh" question. "Who wears seat belts?" "What are they driving?" "Where are they wearing them?" "When are they wearing them?" The final "wh" question - "Why are belts worn?" - is the primary subject of the first volume of this report. Additional tables that are of interest are included at the end of each section.

The emphasis of this volume is on data. While some summary discussion is included at the start of each section, this has been kept to a minimum. It is hoped that the reader will take the time to look at the tables of interest and make an evaluation based on the data.

II. Occupant Sample

In order to be able to make any conclusions about the tables presented later in this report, it is necessary to make it clear to the reader the nature of the sample in terms of what occupants have been included, what type of vehicle was involved, where these accidents took place and when they occurred. Without this information the estimates of seat belt effectiveness will have no real meaning. Questions concerning the quality of the data and the national representativeness of these data are considered in the first volume of this report.

For example, one must know what occupants are included in the current sample. If the sample included only older drivers or younger drivers then very different conclusions might be reached in terms of the effectiveness of seat belts in preventing injury. In this sample, almost three quarters of the occupants reported are drivers. The great majority of these drivers are between 10 and 55 years old. The pasengers did have a greater number of very young or elderly individuals. The male dominance in the driver role remains consistent with age, but there is an increasing percentage of women passengers with age.

Table 1. Sex by occupant role.

	Driver	Passenger	Row Total
Male	81.3	18.7	58.0
Female	63.8	36.2	42.0
Column Total	73.9	26.1	21611

Table 2. Age by occupant role.

	Driver	Passenger	Row Total
≤ 9	0.0	9.8	2.5
10-25	42.5	53.8	45.4
26-55	47.6	27.9	42.5
56 & up	9.9	8.5	9.5
Column Total	74.1	25.9	21526

Table 3. Age by sex by role.

	Driver			Passenger		
	Male	Female	Row Total	Male	Female	Row Total
≤9	0.0	0.0	0.0	52.5	47.5	9.8
10-25	62.5	37.5	42.5	45.3	54.7	53.8
26-55	63.5	36.5	47.6	35.3	64.7	27.9
56 & up	70.0	30.0	9.9	25.2	74.8	8.5
Column Total	63.7	36.3	15942	41.5	58.5	5564

Table 4. Vehicle model year by sex.

	Male	Female	Row Total
1973	56.6	43.4	45.7
1974	58.6	41.4	43.1
1975	60.6	39.4	11.1
Column Total	58.0	42.0	21611

The fact that different types of occupants will be in different types of cars must also be a matter of concern. For example, males show a great propensity to be occupants in newer cars. Similarly, occupants in the age category 26-55 are overrepresented in the newer cars, and occupants 10-25 are more likely to be in 1974 vehicles. Elderly occupants are in 1973 model year cars more often than might be expected. Further, when one looks at a combination of all three variables, one can see that it is indeed the 26-55 males which have a tendency to be in new cars.

Table 5. Age by model year.

	1973	1974	1975	Row Total
≤ 9	50.2	40.7	9.1	2.5
10-25	44.3	45.6	10.1	45.4
26-55	46.4	41.2	12.3	42.5
56 & up	49.2	39.8	10.9	9.5
Column Total	45.8	43.0	11.1	21526

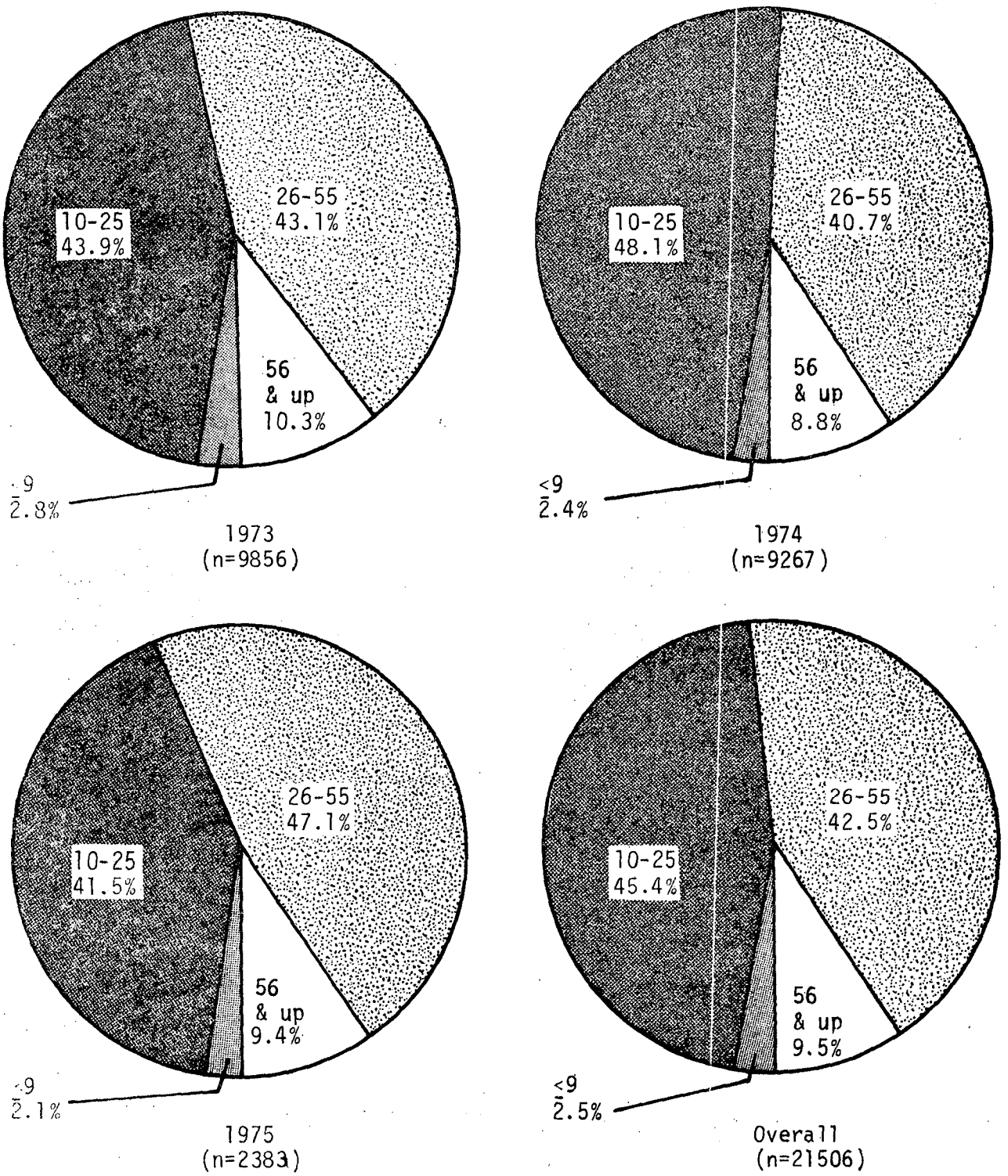


Figure 1. Age distribution by model year.

Table 6. Age by sex by vehicle model year.

	1973			1974			1975		
	Male	Female	Row Total	Male	Female	Row Total	Male	Female	Row Total
≤9	54.9	45.1	2.8	50.3	49.7	2.4	48.0	52.0	2.1
10-25	56.9	43.1	43.9	57.7	42.3	48.1	56.2	43.8	41.5
26-55	56.1	43.9	43.0	59.8	40.2	40.7	64.5	35.5	47.1
56 & up	57.9	42.1	10.2	60.7	39.3	8.8	63.7	36.3	9.4
Column Total	56.6	43.4	9842	58.6	41.4	9260	60.6	39.4	2382

In addition, females were shown to be more likely in subcompacts and compacts. The weight of the vehicle and the age of the occupant show a positive relationship. The 1973 model cars were overrepresented in the full-sized category. The 1974 models showed more subcompacts and compacts, whereas most 1975 vehicles were the middle weight groups.

Some specific makes of cars such as AMCs, Toyotas and Mazdas seemed to be occupied more often by females, while occupants in other makes such as Cadillacs and Chryslers were primarily males. The distribution of vehicle makes by age of occupant and by vehicle weight are interesting and show some similarities.

The different sexes seem not to show a preference for type of seat, but persons in the 10-25 age group primarily use bucket seats, while the older occupants show a marked preference for bench seats, especially older females. Except for a tendency for males to be driving cars with more than 20,000 miles, there seem to be no sex differences by odometer reading. Surprisingly, the elerly driver is much more likely to be driving a low mileage vehicle.

Table 7. Vehicle weight by sex.

	Male	Female	Row Total
Subcompact	29.4	33.7	31.2
Compact	24.2	26.0	25.0
Intermediate	23.5	20.6	22.3
Full-sized	22.9	19.8	21.5
Column Total	57.6	42.4	20628

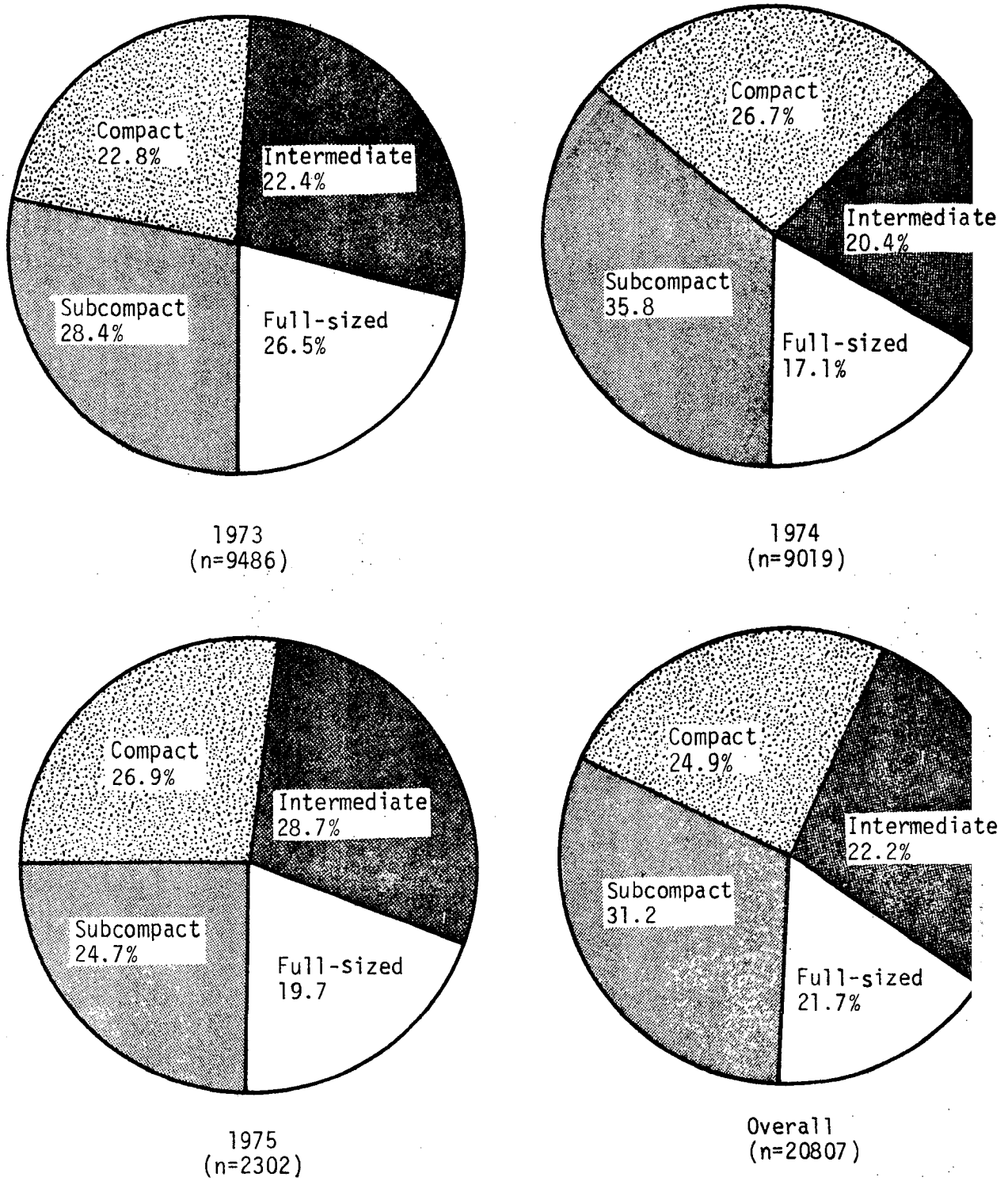


Figure 2. Vehicle weight distribution by model year.

Table 8. Age by vehicle weight.

	Subcompact	Compact	Intermediate	Full-sized	Row Total
≤9	3.0	1.9	2.9	2.6	2.6
10-25	58.5	51.6	40.8	24.8	45.6
26-55	34.1	37.6	46.5	55.3	42.3
56 & up	4.4	8.9	9.7	17.2	9.5
Column Total	31.3	24.9	22.3	21.5	20548

Table 9. Vehicle weight by model year.

	1973	1974	1975	Row Total
Subcompact	41.5	49.8	8.8	31.2
Compact	41.6	46.4	11.9	24.9
Intermediate	45.8	39.7	14.3	22.3
Full-sized	55.7	34.2	10.0	21.6
Column Total	45.5	43.3	11.0	20807

Table 10. Vehicle make by sex.

	Male	Female	Row Total
Chevrolet	58.8	41.2	21.9
Oldsmobile	55.1	44.9	5.5
Pontiac	59.0	41.0	6.8
Buick	55.8	44.2	3.9
Cadillac	61.1	38.9	1.9
GM Total	58.2	41.8	40.0
Plymouth	62.0	38.0	5.6
Dodge	61.1	38.9	3.6
Chrysler Total	61.6	38.4	9.2
Ford	57.9	42.1	20.6
Mercury	59.7	40.3	4.5
Capri	60.8	39.2	1.5
Ford Total	58.4	41.6	26.6
AMC	54.6	45.4	5.2
VW	56.3	43.7	4.4
Datsun	57.0	43.0	2.5
Toyota	48.7	51.3	3.7
Mazda	54.9	45.1	1.3
Japanese Total	52.5	47.5	7.5
Other	59.7	40.3	6.9
Column Total	58.0	42.0	21357

Table 11. Vehicle make by age.

	≤9	10-25	26-55	56 & up	Row Total
Chevrolet	3.4	47.7	40.2	8.6	21.9
Oldsmobile	1.8	37.6	49.4	11.2	5.6
Pontiac	2.6	41.9	45.2	10.4	6.8
Buick	2.3	31.1	47.9	18.7	3.9
Cadillac	3.2	16.8	60.1	20.0	1.9
GM Total	2.9	42.2	44.0	10.8	40.1
Plymouth	1.6	44.9	41.5	12.0	5.6
Dodge	1.7	39.9	42.9	15.5	3.6
Chrysler Total	1.6	42.9	42.1	13.4	9.2
Ford	2.8	46.3	41.9	9.0	20.6
Mercury	2.3	37.4	47.1	13.2	4.5
Capri	0.6	72.0	26.2	1.2	1.5
Ford Total	2.6	46.3	41.8	9.3	26.6
AMC	3.1	49.8	40.5	6.6	5.2
VW	2.2	55.4	36.5	5.9	4.4
Datsun	0.8	55.3	39.9	4.0	2.5
Toyota	2.4	57.4	37.0	3.2	3.7
Mazda	3.8	58.0	33.7	4.5	1.3
Japanese Total	2.1	56.8	37.4	3.7	7.5
Other	1.7	43.5	46.0	8.8	6.9
Column Total	2.6	45.5	42.4	9.5	21273

Table 12. Make by vehicle weight.

	Subcompact	Compact	Intermediate	Full-sized	Row Total
Chevrolet	24.1	30.0	26.0	19.9	22.2
Oldsmobile	0.7	9.5	56.3	33.5	5.6
Pontiac	1.5	19.2	43.6	35.6	6.8
Buick	1.4	9.8	44.8	44.0	3.9
Cadillac	0.0	0.0	3.7	96.3	1.9
GM Total	14.0	22.0	33.9	26.2	40.4
Plymouth	0.1	53.1	34.2	12.6	5.5
Dodge	0.4	51.7	33.4	14.6	3.6
Chrysler Total	0.2	52.6	33.9	13.4	9.1
Ford	36.6	25.7	14.3	23.5	20.6
Mercury	0.0	24.4	35.0	40.6	4.6
Capri	100.0	0.0	0.0	0.0	1.6
Ford Total	34.1	23.9	17.0	25.0	26.8
AMC	45.8	34.0	8.9	11.3	5.3
VW	89.3	10.5	0.0	0.0	4.4
Datsun	93.2	6.8	0.0	0.0	1.4
Toyota	79.8	20.2	0.0	0.0	3.6
Mazda	98.2	1.2	0.0	0.0	1.4
Japanese Total	87.4	12.6	0.0	0.0	6.4
Other	53.7	25.2	6.8	14.2	6.7
Column Total	31.2	24.9	22.3	21.6	20826

Table 13. Sex by type of seat.

	Bench	Bucket	Row Total
Male	58.0	57.2	57.6
Female	42.0	42.8	42.4
Column Total	46.8	53.2	18781

Table 14. Age by type of seat.

	Bench	Bucket	Row Total
$\leq$ 9	50.3	49.7	2.7
10-25	35.5	64.5	45.7
26-55	53.0	47.0	42.1
56 & up	72.2	27.8	9.5
Column Total	46.7	53.3	18709

Table 15. Age by sex by type of seat.

	Bench			Bucket		
	Male	Female	Row Total	Male	Female	Row Total
≤9	52.6	47.4	2.9	52.5	47.5	2.5
10-25	58.9	41.1	34.7	55.4	44.6	55.4
26-55	58.0	42.0	47.7	59.0	41.0	37.2
56 & up	57.2	42.8	14.7	66.0	34.0	4.9
Column Total	58.0	42.0	8737	57.2	42.8	9955

Table 16. Odometer reading by sex.

	Male	Female	Row Total
< 5,000	56.4	43.6	19.8
5,000 - 9,999	53.7	46.3	15.1
10,000 - 19,999	56.2	43.8	27.8
20,000 & up	61.3	38.7	37.3
Column Total	57.8	42.2	18100

Table 17. Age by odometer reading.

	<5,000	5,000 to 9,999	10,000 to 19,999	20,000 & up	Row Total
≤ 9	18.0	14.2	34.9	32.9	2.6
10 - 25	19.1	14.2	28.0	38.7	45.6
26 - 55	19.5	15.5	27.0	38.0	42.3
56 & up	24.9	17.3	28.6	29.2	9.5
Column Total	19.8	15.0	27.8	37.3	18039

Table 18. Odometer reading by vehicle model year

	1973	1974	1975	Row Total
0-4,999	18.5	49.6	31.3	19.8
5,000-9,999	12.5	67.9	19.6	15.0
10,000-19,999	40.0	54.5	5.4	27.8
20,000 & up	77.4	21.4	1.2	37.2
Column total	45.5	43.2	11.1	18249

One should also be concerned about the location of the accidents. For example, males are overrepresented in rural accidents. This pattern is repeated for occupants in the 10-25 years old category. On the other hand, accidents involving vehicles with a single occupant are much more likely to be urban. The distribution of vehicles makes by accident area is also interesting.

Further, males show a slight tendency to be overrepresented in limited access accidents; this is also true for occupants between 26 and 55 years of age. Vehicles with only one occupant and lighter vehicles are also overrepresented in accidents occurring on limited access roads.

Table 19. Area by sex.

	Male	Female	Row Total
Urban	57.5	42.5	88.7
Rural	61.2	38.5	11.3
Column Total	58.0	42.0	21611

Table 20. Age by area.

	Urban	Rural	Row Total
≤ 9	90.0	10.0	2.5
10-25	87.5	12.5	45.4
26-55	89.7	10.3	42.5
56 & up	89.0	11.0	9.5
Column Total	88.6	11.4	21526

Table 21. Vehicle make by area

	Urban	Rural	Row Total
Chevrolet	88.4	11.6	21.9
Oldsmobile	93.2	6.8	5.5
Pontiac	91.8	8.2	6.8
Buick	89.8	10.2	3.9
Cadillac	95.2	4.8	1.9
GM Total	90.1	9.9	40.0
Plymouth	83.6	16.4	5.5
Dodge	85.6	14.4	3.6
Chrysler Total	84.4	15.6	9.1
Ford	86.5	13.5	20.6
Mercury	85.4	14.6	4.6
Capri	89.4	10.6	1.5
Ford Total	86.5	13.5	26.7
AMC	83.5	16.5	5.2
VW	89.5	10.5	4.4
Datsun	94.1	5.9	2.4
Toyota	93.7	6.3	3.7
Mazda	91.0	9.0	1.3
Japanese Total	93.3	6.7	7.4
Other	92.6	7.4	2.0
Column Total	88.6	11.4	21579

Table 22. Number of front seat occupants by area.

	Urban	Rural	Row Total
One	90.5	9.5	49.1
Two	87.1	12.9	44.9
Three	86.4	13.6	6.0
Column Total	88.7	11.3	21782

Table 23. Limited access by sex.

	Male	Female	Row Total
Limited Access	59.5	40.5	14.5
Free Access	57.8	42.2	85.5
Column Total	58.1	41.9	20061

Table 24. Limited access by age.

	≤9	10-25	26-55	56 & up	Row Total
Limited Access	1.8	38.8	51.1	8.3	14.5
Free Access	2.7	46.1	41.2	10.0	85.5
Column Total	2.6	45.0	42.6	9.8	19978

Table 25. Limited access by number of front seat occupants.

	One	Two	Three	Row Total
Limited Access	53.9	40.7	5.4	14.6
Free Access	48.6	45.1	6.2	85.4
Column Total	49.4	44.5	6.1	20225

Table 26. Vehicle weight by type of road access.

	Limited Access	Free Access	Row Total
Subcompact	14.6	85.4	31.2
Compact	14.3	85.7	25.1
Intermediate	12.5	87.5	22.1
Full-sized	12.8	87.2	21.6
Column Total	13.7	86.3	19292

Males are predominant in accidents on 3, 4 and 5 lane roads. In general, the 10-25 year olds and the 26-55 show a marked decrease and increase, respectively, when the accidents occur on roads with 6 or more lanes.

Table 27. Number of lanes by sex.

	Male	Female	Row Total
1	53.4	46.6	1.7
2	57.1	42.9	33.8
3	59.4	40.6	5.2
4	58.0	42.0	39.4
5	61.4	38.6	3.8
6	55.2	44.8	9.1
7 & up	57.2	42.8	7.0
Column Total	57.5	42.5	16462

Table 28. Number of lanes by age.

	≤9	10-25	26-55	56 & up	Row Total
1	3.6	42.3	46.2	7.9	1.7
2	2.5	48.8	40.5	8.2	33.7
3	2.6	45.4	43.9	8.2	5.1
4	3.1	44.2	42.8	9.9	39.5
5	2.4	47.8	40.1	9.7	3.8
6	2.2	37.8	50.8	9.2	9.1
7 & up	2.7	35.8	50.3	11.2	7.0
Column Total	2.7	44.8	43.3	9.2	16411

The more current vehicle model years are overrepresented in urban areas. There is no consistent pattern in the distribution of vehicle weights for either urban or rural accidents.

Table 29. Vehicle model year by area

	Urban	Rural	Row Total
1973	88.1	11.9	45.6
1974	88.3	11.7	43.2
1975	92.6	7.4	11.1
Column Total	88.7	11.3	21833

Table 30. Vehicle weight by area

	Urban	Rural	Row Total
Subcompact	89.6	10.4	31.2
Compact	88.0	12.0	24.9
Intermediate	89.2	10.8	22.3
Full-sized	88.4	11.6	21.6
Column Total	88.9	11.1	20826

When the accidents occurred is also a matter of concern. We can see that the number of accidents was the highest during the day and late evening. More interestingly, we can see that male occupants were overrepresented in after midnight accidents. In terms of age groups, the 10-25 age group shows a similar pattern of overrepresentation. There is a slight change in that the overrepresentation on Sunday is reduced in magnitude. Supporting patterns of overrepresentation were also found with the light condition variable. Elderly occupants were on the road more often than expected on dry surfaces, the 10-25 year olds in the wet category, and the 26-55 year olds on the snow/ice roads.

The time of the accident also shows some interesting trends for the different vehicle weights. Subcompacts are overrepresented during rush hours. Compacts, on the other hand, show a higher than expected accident involvement rate from after midnight up until after the morning rush hour. Intermediate vehicles are more likely to be involved in accidents at night, but full-sized cars show a tendency to be in accidents during the day.

The light condition categories show a different set of trends. Here subcompacts are represented in the daylight, dawn and dark-lighted categories. Compacts are involved in accidents more often than expected at dawn and in the dark. Overrepresentation in the dusk and all the dark categories is indicated for intermediate sized vehicles. Full-sized vehicles show more than expected accidents only at dusk.

The day of the week shows little influence on the weight of vehicles that are involved in accidents.

Table 31. Time of accident by sex.

	Male	Female	Row Total
Midnight to 5:59 am	71.7	28.3	16.3
6:00 to 8:59 am	52.4	47.6	7.9
9:00 - 3:59 pm	53.4	46.6	32.6
4:00 - 5:59 pm	52.6	47.4	15.2
6:00 to 11:59 pm	59.7	40.3	28.1
Column Total	57.9	42.1	21526

Table 32. Day of week by sex.

	Male	Female	Row Total
Monday	57.4	42.6	13.0
Tuesday	54.7	45.3	12.8
Wednesday	56.6	43.4	12.9
Thursday	55.8	44.2	13.3
Friday	56.8	43.2	17.3
Saturday	61.9	38.1	17.5
Sunday	61.4	38.6	13.1
Column Total	58.0	42.0	21611

Table 33. Time of accident by age.

	≤9	10-25	26-55	56 & up	Row Total
Midnight - 5:59 am	3.7	20.7	15.0	3.7	16.2
6:00 - 8:59 am	5.8	7.1	8.9	8.3	7.9
9:00 - 3:59 pm	47.9	28.6	32.2	49.8	32.6
4:00 - 5:59 pm	18.5	14.4	15.7	15.7	15.2
6:00 - 11:59 pm	24.1	29.3	28.2	22.5	28.0
Column Total	2.6	45.4	42.5	9.6	21443

Table 34. Day of week by age.

	≤9	10-25	26-55	56 & up	Row Total
Monday	12.6	12.7	13.1	13.7	12.9
Tuesday	12.4	11.8	14.0	13.3	12.9
Wednesday	15.9	12.4	13.0	14.3	12.9
Thursday	12.2	12.4	14.3	14.0	13.4
Friday	16.6	17.4	17.2	17.5	17.3
Saturday	14.2	19.5	16.2	14.5	17.5
Sunday	16.1	13.8	12.3	12.6	13.1
Column Total	2.5	45.4	42.5	9.5	21526

Table 35. Light condition by sex.

	Male	Female	Row Total
Daylight	53.4	46.6	61.7
Dawn	57.8	42.2	0.9
Dusk	60.7	39.3	2.3
Dark	67.2	32.8	14.9
Dark-lighted	63.6	36.4	13.8
Dark-not lighted	66.7	33.3	6.4
Column Total	57.9	42.1	20709

Table 36. Age by surface condition.

	Dry	Wet	Snow/Ice	Row Total
≤9	2.6	2.1	2.5	2.5
10-25	44.8	47.6	45.9	45.4
26-55	42.5	41.5	45.4	42.5
56 & up	10.0	8.7	2.8	9.6
Column Total	77.8	17.9	4.3	20743

Table 37. Time of accident by vehicle weight.

	Subcompact	Compact	Intermediate	Full-sized	Row Total
Midnight - 5:59 am	27.2	27.1	26.2	19.5	16.5
6:00 - 8:59 am	35.3	28.4	19.3	17.0	7.9
9:00 - 3:59 pm	30.6	24.4	21.1	23.8	32.3
4:00 - 5:59 pm	33.7	22.5	21.9	21.9	15.2
6:00 - 11:59 pm	31.4	24.6	22.4	21.7	28.1
Column Total	31.1	24.9	22.3	21.7	20733

Table 38. Light condition by vehicle weight.

	Subcompact	Compact	Intermediate	Full-sized	Row Total
Daylight	33.1	24.3	20.8	21.9	61.6
Dawn	33.5	28.9	19.1	18.6	1.0
Dusk	22.4	23.3	26.2	28.1	2.3
Dark	25.1	27.6	25.4	21.9	15.0
Dark-lighted	31.8	25.2	24.2	18.8	13.8
Dark-not lighted	29.6	24.4	24.5	21.5	6.4
Column Total	31.4	25.0	22.3	21.6	19942

Table 39. Day of week by vehicle weight.

	Subcompact	Compact	Intermediate	Full-sized	Row Total
Monday	31.7	25.3	21.7	21.2	13.0
Tuesday	30.9	26.1	20.5	22.5	12.8
Wednesday	31.5	25.8	21.2	21.5	12.9
Thursday	32.9	23.9	22.3	20.8	13.3
Friday	30.4	23.9	23.7	22.0	17.4
Saturday	30.4	25.7	22.0	22.0	17.5
Sunday	30.7	24.0	23.9	21.4	13.1
Column Total	31.2	24.9	22.3	21.6	20826

The time of the accident also interacts with the locality of the accident. Urban accidents are overrepresented in the day time hours, and rural accidents occur more frequently than expected during the night, particularly after midnight. With the exception (not surprisingly) of the dark-lighted category, the same pattern of overrepresentation is found with the light condition variable. Following the established pattern, weekend accidents also show a tendency to have more than expected rural crashes.

A somewhat surprising finding is that females are more likely to be found driving on snow/ice conditions than might be expected. There is no change in the sex of the drivers when one examines dry and wet roads. Most of the snow/ice accidents occur in rural areas so one must keep in mind the possibility of a confounding with the type of drivers that have been found in rural accidents. Finally, full-sized cars have an overrepresentation in accidents on wet road surfaces.

Table 40. Time of day by area.

	Urban	Rural	Row Total
Midnight-5:59 am	85.7	14.3	16.5
6:00-8:59 am	89.5	10.5	7.9
9:00-3:59 pm	90.1	9.9	32.4
4:00-5:59 pm	90.1	9.9	15.1
6:00-11:59 pm	87.9	12.1	28.0
Column Total	88.7	11.3	21739

Table 41. Light condition by area.

	Urban	Rural	Row Total
Daylight	90.5	9.5	61.5
Dawn	87.6	12.4	0.9
Dusk	87.1	12.9	2.3
Dark	83.1	16.9	15.1
Dark-lighted	99.0	1.0	13.8
Dark-not lighted	71.6	28.4	6.3
Column Total	89.3	10.7	20924

Table 42. Day of week by area.

	Urban	Rural	Row Total
Monday	89.2	10.8	12.9
Tuesday	90.6	9.4	12.8
Wednesday	90.2	9.8	12.9
Thursday	88.2	11.8	13.3
Friday	90.9	9.1	17.3
Saturday	86.4	13.6	17.7
Sunday	85.7	14.3	13.1
Column Total	88.7	11.3	21833

Table 43. Sex by surface condition.

	Male	Female	Row Total
Dry	58.1	41.9	77.9
Wet	58.1	41.9	17.8
Snow/Ice	55.7	44.3	4.3
Column Total	58.0	42.0	20829

Table 44. Surface condition by area.

	Urban	Rural	Row Total
Dry	91.0	9.0	77.9
Wet	87.4	12.6	17.8
Snow/Ice	64.5	35.5	4.3
Column Total	89.2	10.8	21049

Table 45. Surface condition by vehicle weight.

	Subcompact	Compact	Intermediate	Full-sized	Row Total
Dry	78.8	77.6	78.2	75.9	77.7
Wet	17.6	18.0	17.1	20.0	18.1
Snow/Ice	3.6	4.4	4.7	4.1	4.2
Column Total	31.3	25.0	22.1	21.5	20068

III. Crash Sample

If we have established what the sample of occupants looks like, we must now examine what types of crashes are included in this sample. The variables involved with the description of the type of accident are some general descriptions of the accident in terms of configuration, severity of configuration, and impact site for configuration. The crash configuration variable is relatively self explanatory. Two values that might need to be noted is that the head-on collision is with another vehicle, and struck fixed object implies hitting the object.

We can first note that several types of accidents are overrepresented by male occupants: rollover and other noncollision accidents, struck fixed object and side of car into fixed object. Other crash configurations are biased toward having a female occupant: struck in rear, and struck in the side. The distribution of age by crash configurations presents a different pattern. Older occupants are overrepresented in head-on collisions, struck in rear, struck in the side and sideswipe accidents. The 26-55 age group show a more even distribution; only head-on, struck in the rear and sideswipe show overrepresentation. Both rollover and side of car into fixed object show indications of underrepresentation. With the exception of the head-on accidents, the "aggressive" collisions are all overrepresented in the 10-25 age group. The lack of occupants under 9 years of age makes it difficult to generalize about that age group. Only minor changes occur when one looks at the age by sex breakdown for crash configuration.

As might be expected, males are overrepresented in rollover and front impact site crashes. A similar pattern for age is also found, with the younger age group being overrepresented in these crash types.

Table 46. Crash configuration by sex by role.

	Driver			Passenger		
	Male	Female	Row Total	Male	Female	Row Total
Head-on	65.0	35.0	6.4	35.7	64.3	6.9
Rear striking	65.9	34.1	16.6	43.4	56.6	13.0
Struck in rear	58.4	41.6	6.6	32.3	67.7	7.6
Angle striking	64.7	35.3	22.0	38.6	61.4	21.1
Struck in left side	57.1	42.9	12.9	35.8	64.2	14.4
Struck in right side	56.4	43.6	12.5	35.3	64.7	14.5
Rollover & other	73.6	26.4	1.7	63.3	36.7	2.3
Sideswipe	65.3	34.7	3.3	32.9	67.1	3.3
Struck fixed object	71.3	28.7	13.1	57.9	42.1	12.2
Side of vehicle into fixed object	66.9	33.1	4.9	57.0	43.0	4.7
Column Total	63.6	36.4	15146	41.3	58.7	5319

Table 47. Crash configuration by age.

	≤9	10-25	26-55	56 & up	Row Total
Head-on	3.4	38.2	46.1	12.3	6.5
Rear striking	2.6	46.1	43.6	7.8	15.7
Struck in rear	2.7	38.3	47.8	11.2	6.9
Angle striking	3.0	45.9	42.1	9.0	21.8
Struck in left side	3.8	42.9	42.1	11.2	13.3
Struck in right side	2.7	41.2	41.4	14.6	13.0
Rollover & other	0.3	63.5	34.4	1.9	1.9
Sideswipe	0.9	39.5	47.5	12.1	3.3
Struck fixed object	0.9	51.6	40.7	6.8	12.8
Side of car into fixed object	1.8	61.3	33.3	3.6	4.8
Column Total	2.6	45.5	42.3	9.6	20387

Table 48. Crash configuration by age by sex.

	Male					Female				
	≤ 9	10-25	26-55	56 & up	Row Total	≤ 9	10-25	26-55	56 & up	Row Total
Head-on	3.7	37.5	45.5	13.3	6.4	3.0	39.2	47.0	10.8	6.7
Rear striking	2.0	42.3	46.5	9.2	16.5	3.4	52.0	39.1	5.6	14.4
Struck in rear	2.5	38.0	48.1	11.3	6.1	2.9	38.4	47.6	11.1	8.0
Angle striking	2.8	43.3	43.7	10.2	21.9	3.3	49.6	39.8	7.3	21.6
Struck in left side	3.9	41.0	42.3	12.8	11.8	3.7	45.0	41.7	9.6	15.4
Struck in right side	2.3	40.3	42.3	15.0	11.4	3.2	42.1	40.5	14.2	15.4
Rollover & other	0.4	68.4	31.2	0.0	2.3	0.0	51.8	42.0	6.3	1.3
Sideswipe	0.3	36.6	49.5	13.6	3.2	1.7	43.3	45.0	10.0	3.4
Struck fixed object	0.9	53.8	39.4	5.8	15.0	1.0	47.0	43.3	8.8	9.8
Side of car into fixed object	1.6	63.3	32.0	3.1	5.4	2.3	58.0	35.3	4.3	4.1
Column Total	2.3	44.9	42.9	10.0	11775	2.9	46.4	41.6	9.1	8592

Table 49. Impact site by sex by driver.

	Driver			Passenger		
	Male	Female	Row Total	Male	Female	Row Total
Front	66.6	33.4	58.1	43.8	56.2	53.3
Side	59.1	40.9	33.6	38.1	61.9	36.9
Rear	58.4	41.6	6.6	32.3	67.7	7.6
Rollover	73.6	26.4	1.7	63.3	36.7	2.3
Column Total	63.6	36.4	15146	41.3	58.7	5319

Table 50. Impact site by age.

	≤ 9	10-25	26-55	56 & up	Row Total
Front	2.5	46.4	42.6	8.5	56.8
Side	2.8	44.5	41.1	11.5	34.5
Rear	2.7	38.3	47.8	11.2	6.9
Rollover	0.3	63.5	34.4	1.9	1.9
Column Total	2.6	45.5	42.3	9.6	20387

There are differences in the types of crashes that different model years of cars get into. For example, 1975 cars are overrepresented in rear striking, angle striking and rollover accidents. Older cars (1973) are overrepresented in head-on, struck in rear and struck fixed object collisions. There is no apparent reason for this breakdown.

Another approach to categorizing accidents is by their severity. When the different types of crash configurations are collapsed by severity, one can determine four different "crash types." There is a tendency for the newer model cars to be in less severe accidents.

This is contradicted to some extent when one looks at the impact site by model year. Here we find that 1975 cars are overrepresented in rollover accidents. Also, 1973 model year vehicles are overrepresented in rear end crashes. When a separate damage severity variable is examined, no clear results are obtained.

Table 51. Crash configuration by model year.

	1973	1974	1975	Row Total
Head-on	48.1	43.7	8.2	6.4
Rear striking	40.2	45.8	13.9	6.5
Struck in rear	52.8	37.6	9.6	6.6
Angle Striking	44.5	43.0	12.3	21.9
Struck in left side	47.5	42.1	10.3	12.8
Struck in right side	45.9	43.3	10.6	12.5
Rollover & other	39.5	45.6	14.9	1.7
Sideswipe	41.9	45.7	12.3	3.3
Struck fixed object	49.3	39.8	11.2	13.3
Side of car into fixed object	41.9	46.9	11.2	4.9
Column Total	45.5	42.9	11.5	15215

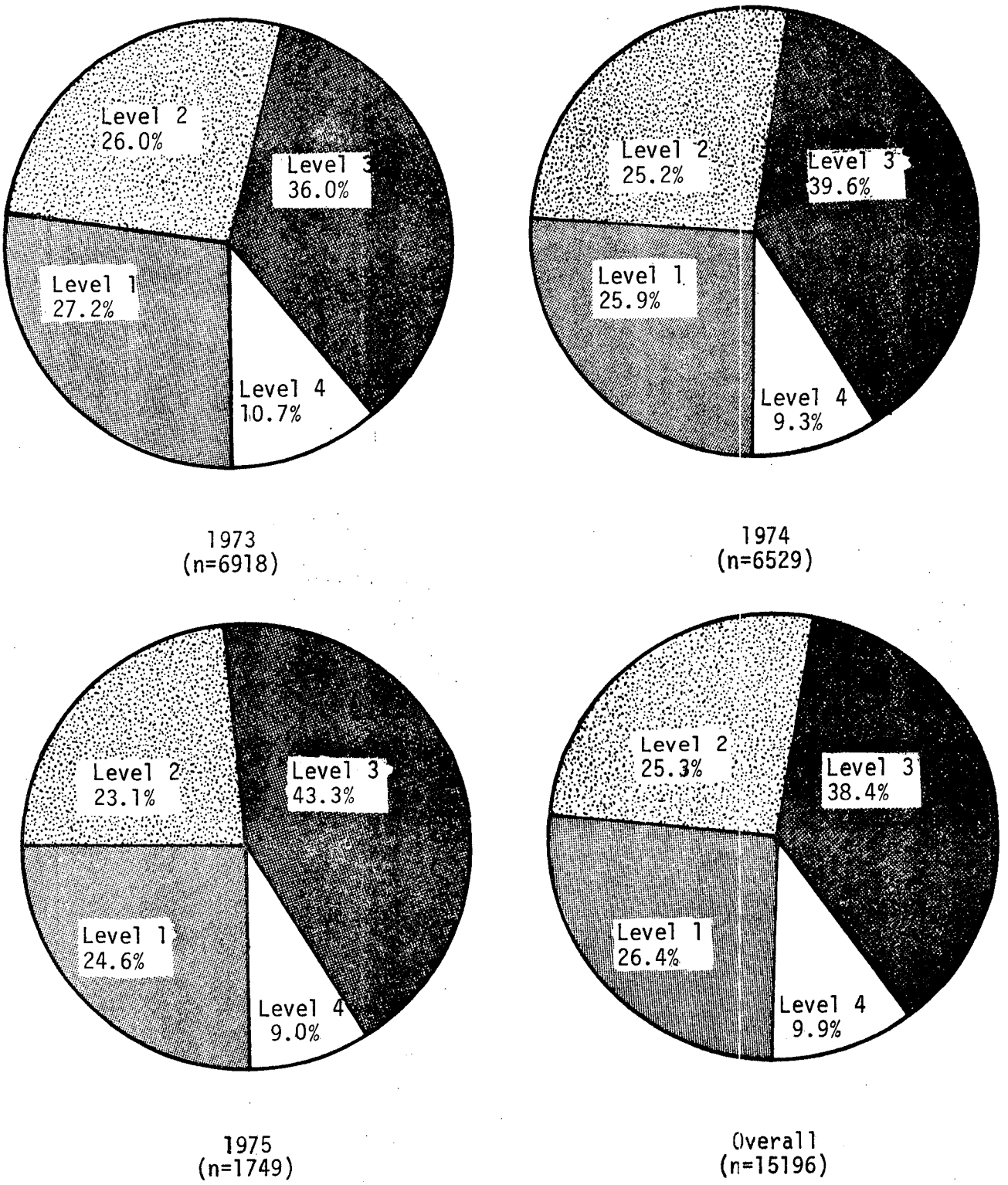


Figure 3. Crash type distribution by model year.

Table 52. Impact site by vehicle model year.

	1973	1974	1975	Row Total
Front	44.8	43.0	12.0	58.1
Side	45.6	43.6	10.8	33.6
Rear	52.8	37.6	9.6	6.8
Rollover	39.5	45.6	14.9	1.7
Column Total	45.5	42.9	11.5	15196

Table 53. Damage severity by model year.

	1973	1974	1975	Row Total
Minor	43.9	44.3	12.7	47.0
Moderate	49.1	40.7	10.0	36.5
Moderately Severe	46.3	43.4	10.2	11.7
Severe	47.0	43.7	9.3	4.8
Column Total	45.8	42.8	11.0	12723

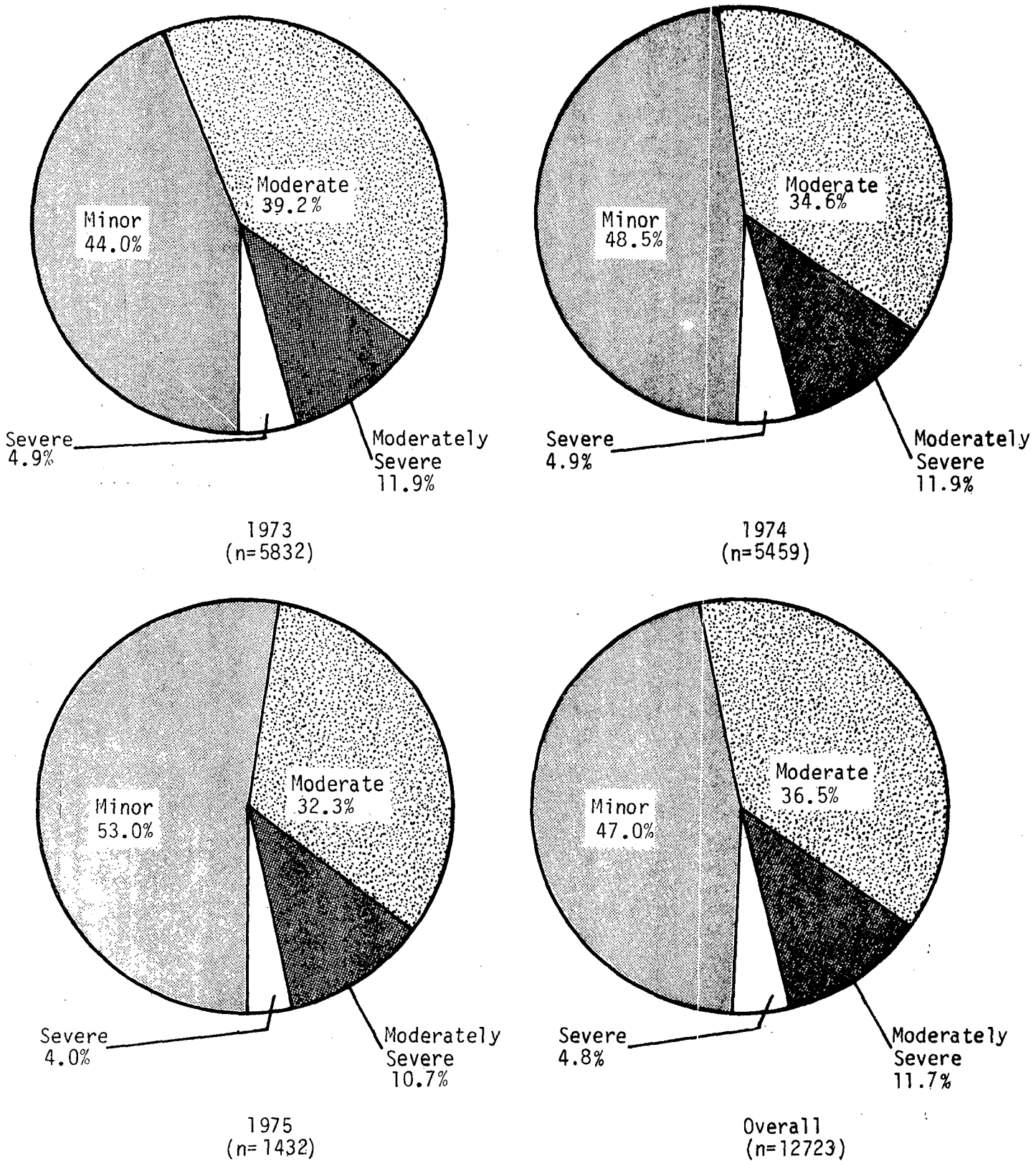


Figure 4. Damage severity distribution by model year.

One can also examine the likelihood of certain sizes of vehicles being involved in certain types of accidents. Full-sized vehicles seem to be overrepresented in head-on, struck in the side, sideswipes, and striking a fixed object. Subcompacts on the other hand, are more likely to be in rollover, angle striking, and rear end collisions.

One can also observe the different patterns of damage over the different vehicle weights. Heavier cars are damaged in the sides and undercarriage, lighter cars in the top, front and rear.

Table 54. Crash configuration by vehicle weight.

	Subcompact	Compact	Intermediate	Full-sized	Row Total
Head on	26.9	22.2	24.5	26.4	6.4
Rear striking	35.0	25.8	20.4	18.8	16.3
Struck in rear	44.9	21.6	16.2	17.3	6.6
Angle striking	34.6	24.0	20.8	20.6	22.3
Struck in left side	27.8	23.6	24.3	24.3	13.0
Struck in right side	27.6	24.7	23.6	24.1	12.7
Rollover & other	47.9	32.4	12.6	7.1	1.6
Sideswipe	29.3	24.2	21.2	25.3	3.2
Struck fixed object	24.8	27.1	25.2	23.0	12.9
Side of car into fixed object	25.8	32.0	20.2	22.0	5.0
Column Total	31.4	25.0	21.9	21.7	14657

Table 55. Impact site by vehicle weight.

	Subcompact	Compact	Intermediate	Full-sized	Row Total
Front	31.7	25.0	22.1	21.3	56.9
Side	27.6	25.3	23.2	24.0	33.9
Rear	44.9	21.6	16.2	17.3	6.6
Rollover	47.9	32.4	12.6	7.1	1.6
Column Total	31.4	25.0	21.9	21.7	14657

Table 56. O'clock direction of force of first impact by vehicle weight.

O'clock direction of force of first impact	Subcompact	Compact	Intermediate	Full-sized	Row Total
Rollover	38.9	32.1	17.3	11.7	2.2
1	29.5	26.6	20.8	23.1	10.4
2	29.8	24.5	22.3	23.4	8.2
3	27.2	28.1	22.4	22.3	4.7
4	36.2	21.4	21.9	20.5	1.5
5	32.8	20.0	26.6	20.7	1.0
6	44.6	23.1	15.7	16.5	6.8
7	32.5	14.0	32.0	21.5	1.2
8	27.3	17.0	26.9	28.8	1.8
9	24.4	26.4	27.7	21.6	4.7
10	32.6	24.5	21.5	21.4	8.0
11	31.9	25.0	20.3	22.9	12.4
12	30.5	25.1	22.4	22.0	37.1
Column total	31.4	25.0	21.8	21.8	14425

The different makes of cars show several different patterns of crash configurations, but this is probably confounded by the vehicle weight. Newer vehicles in terms of odometer readings are found to have a similar pattern to that of male drivers: overrepresentation in the rear striking, rollovers, and striking the fixed object. Cars that show a high odometer reading are overrepresented in the struck in rear and side of car into fixed object category. The impact site crash categorization tends to move from the front of the vehicle to the rear as the odometer reading increases.

Table 57. General area of damage by vehicle weight.

	Subcompact	Compact	Intermediate	Full-sized	Row Total
Undercarriage	20.3	29.4	25.4	24.9	1.3
Top	39.9	39.9	14.2	6.1	1.0
Right Side	27.5	26.2	23.1	23.2	16.8
Left Side	28.5	24.4	22.9	24.2	17.2
Front	32.1	24.7	21.8	21.3	56.5
Back	44.3	22.0	16.3	17.3	7.2
Column Total	31.5	24.9	21.8	21.7	14625

Table 58. Horizontal area of first impact by vehicle weight.

		Subcompact	Compact	Intermediate	Full-sized	Row Total
Distributed		35.9	25.4	29.7	19.0	25.5
Front or Rear	Left	32.4	23.5	22.9	21.2	12.4
	Center	37.7	22.8	23.5	16.0	2.7
	Right	28.2	24.7	23.3	23.8	12.1
Side	Front	27.5	25.6	23.8	23.1	15.1
	Center	30.0	24.1	26.9	18.9	3.3
	Rear	20.2	26.2	23.1	30.5	3.8
Front	Corner	29.2	26.8	21.7	24.0	12.8
Back	Corner	29.2	24.7	21.7	24.0	11.9
Column Total		31.2	24.9	22.3	21.6	13869

Table 59. Vehicle make by crash configuration.

	Head On	Rear Striking	Struck In Rear	Angle Striking	Struck In Left Side	Struck In Right Side	Rollover and Other	Sideswipe	Struck Fixed Object	Side of Car Into Fixed Object	Row Total
Chevrolet	6.9	17.2	6.1	19.3	12.8	11.5	1.1	4.0	16.0	5.1	21.2
Oldsmobile	6.6	16.4	4.9	21.2	15.0	15.8	0.6	3.3	12.1	4.1	5.8
Pontiac	6.8	14.6	4.3	23.5	15.9	10.0	1.3	3.1	15.5	5.0	6.8
Buick	6.2	13.4	6.2	19.4	15.3	18.2	0.8	4.8	11.2	4.5	3.9
Cadillac	10.7	12.8	4.1	24.5	10.7	14.8	0.3	3.8	10.0	8.3	1.9
GM Total	6.9	16.0	5.5	20.6	13.8	12.7	1.0	3.8	14.6	5.0	39.7
Plymouth	7.2	13.3	5.1	22.9	13.3	13.5	2.6	2.8	14.5	4.9	5.4
Dodge	8.2	11.5	4.5	21.1	17.3	15.3	2.0	3.6	11.8	4.7	3.6
Chrysler Total	7.6	12.5	4.9	22.2	14.9	14.2	2.3	3.1	13.4	4.8	9.0
Ford	6.3	17.4	6.0	22.8	11.0	12.5	1.8	2.6	13.8	6.0	20.6
Mercury	7.5	13.2	6.1	19.2	16.3	13.0	1.1	1.8	16.2	5.6	4.7
Capri	5.0	21.3	9.6	22.9	9.2	1.3	5.4	0.8	10.4	5.0	1.6
Ford Total	6.4	16.9	6.3	22.2	11.8	12.4	1.9	2.4	14.0	5.8	26.9
AMC	4.2	18.3	6.5	22.5	11.5	14.8	0.8	3.6	12.8	5.0	5.2
VW	4.9	15.7	11.9	24.1	14.8	11.8	2.8	4.2	6.2	3.5	4.5
Datsun	6.4	17.0	12.1	18.5	14.2	10.3	3.3	4.4	10.5	3.3	2.6
Toyota	2.9	22.1	9.1	24.8	12.0	12.8	4.8	1.9	7.9	1.9	3.9
Mazda	6.8	23.3	5.8	24.3	3.4	11.2	2.4	3.4	15.0	4.4	1.4
Japanese Total	4.7	20.6	9.5	22.6	11.2	11.7	3.9	3.0	10.0	2.8	7.9
Other	6.2	18.6	9.7	25.8	10.7	9.6	1.3	3.7	9.8	4.5	6.9
Column Total	6.4	16.6	6.6	21.9	12.9	12.5	1.7	3.3	13.2	4.9	15171

Table 60. Crash configuration by odometer.

	5,000	5,000 to 9,999	10,000 to 19.999	20,000 and up	Row Total
Head-on	19.2	17.2	31.0	32.6	6.2
Rear striking	21.1	15.0	26.0	37.8	15.9
Struck in rear	16.7	13.6	25.0	44.7	6.6
Angle striking	17.6	14.7	28.8	38.9	22.9
Struck in left side	17.9	15.8	28.6	37.6	13.6
Struck in right side	16.4	16.0	29.5	38.1	13.2
Rollover & other	27.1	12.9	27.6	32.4	1.7
Sideswipe	25.1	14.6	29.4	30.9	3.0
Struck fixed object	20.8	14.7	26.5	38.0	12.3
Side of car into fixed object	16.1	16.1	26.6	41.2	4.6
Column Total	18.8	15.2	27.9	38.1	12987

Table 61. Impact site by odometer reading.

	5,000	5,000 to 9,999	10,000 to 19,999	20,000 and up	Row Total
Front	19.4	15.1	27.8	37.7	57.2
Side	17.7	15.8	28.8	27.7	34.4
Rear	16.7	13.6	25.0	44.7	6.6
Rollover	27.1	12.9	27.6	32.4	1.7
Column Total	18.8	15.3	27.9	38.1	12987

As might be expected, single car crashes are most common in rural areas. There also seems to be an overrepresentation of rural accidents in the more severe (by both damage severity and extent of vehicle deformation variables) accidents. Also rollover and frontal accidents occur more frequently than one might expect in rural areas.

Table 62. Crash configuration by area

	Urban	Rural	Row Total
Head-on	82.9	17.1	6.4
Rear striking	93.9	6.1	16.5
Struck in rear	92.4	7.6	6.6
Angle striking	92.9	6.9	21.7
Struck in left side	93.0	7.1	12.8
Struck in right side	94.2	5.8	12.5
Rollover & other	58.2	41.8	1.7
Sideswipe	89.1	10.9	3.3
Struck fixed object	78.7	21.3	13.3
Side of car into fixed object	77.5	22.5	4.9
Column Total	88.6	11.4	15215

Table 63. Damage severity by accident area.

	Urban	Rural	Row Total
Minor	91.5	8.5	47.0
Moderate	88.1	11.9	36.5
Moderately Severe	84.7	15.3	11.7
Severe	80.8	19.2	4.8
Column Total	88.9	11.1	12742

Table 64. Impact site by area

	Urban	Rural	Row Total
Front	88.8	11.2	58.1
Side	90.8	9.2	33.6
Rear	92.4	7.6	6.6
Rollover	58.2	41.8	1.7
Column Total	89.2	10.8	15215

Table 65. Extent of first impact by area.

		Urban	Rural	Row Total
Extent of First Impact	1	91.3	8.7	43.7
	2	88.5	11.5	33.0
	3	85.8	14.2	17.2
	4	84.4	15.6	3.6
	5	79.6	20.4	1.2
	6	86.9	13.1	0.7
	7	91.3	8.7	0.2
	8	75.0	25.0	0.1
	9	79.3	20.7	0.5
Column Total		88.9	11.1	12742

Another environmental factor is the type of access that a road allows. We can see that accidents on limited access roads are more likely to be either no injury accidents or ones that lead to serious or severe injuries.

Table 66. AIS Level by type of access

		Limited Access	Non-Limited Access	Row Total
AIS Level	0	15.8	84.2	51.5
	1	12.8	87.2	40.3
	2	10.8	89.2	6.2
	3	20.1	79.9	1.3
	4	20.5	79.5	0.2
	5	7.7	92.3	0.1
	6	15.4	84.6	0.5
	Column Total	14.3	85.7	19513

Certain types of crashes also show a tendency to occur at different times. Rollovers and fixed object accidents occur predominately at night. Sideswipe accidents occur mostly at night before midnight. Rush hour collisions are likely to be struck in rear accidents. Striking in the rear and getting struck in the side occur more often than expected during the day. Interestingly, the object struck varies considerably with time. In the early morning hours, one usually strikes either a fixed or a non-fixed object. Rush hour accidents are overrepresented as striking smaller cars. Daytime accidents strike larger vehicles and other non-car vehicles, and evening accidents seem to involve hitting other cars or non-fixed objects.

If crash configurations are classified by light conditions, then almost all of the struck in side accidents happen in the day. Rollover and striking fixed object accidents occur primarily in the dark. There is no real overrepresentation in what type of object is struck when the road is lighted, but when it is not lighted then there is a tendency to strike a fixed object.

As might be expected, the more aggressive types of accidents occur on the weekend (especially Saturday), while the more passive accidents occur during the week. Saturday is marked in particular by the striking of non-fixed objects (pedestrians, bicyclists, animals and the like).

When surface condition is examined, skidding and head-on accidents are most likely on non-dry surfaces. Further, compacts and fixed objects are overrepresented when one looks at what object was struck. But other large vehicles (intermediate and full-sized vehicles and other non-car vehicles) and fixed objects seem to be hit disproportionately often in the snow.

Other tables that might be of interest are also reported concerning the interactions among the different variables within the vehicle deformation index.

Table 67. Crash configuration by time of accident.

	Midnight to 5:59 am	6:00 am to 8:59 am	9:00 am to 3:59 pm	4:00 pm to 5:59 pm	6:00 pm to 11:59 pm	Row Total
Head-on	15.5	9.1	31.9	14.7	28.7	6.4
Rear striking	12.1	9.0	34.4	17.1	27.4	16.6
Struck in rear	9.5	12.7	31.3	19.9	26.6	6.6
Angle striking	10.1	8.6	37.2	17.1	27.0	21.9
Struck in left side	9.0	8.6	41.2	16.3	24.9	12.9
Struck in right side	8.2	8.9	36.6	18.2	28.2	12.5
Rollover & other	43.1	6.9	19.3	6.6	25.1	1.7
Sideswipe	13.8	8.4	31.1	14.6	32.1	3.3
Struck fixed object	40.1	7.9	18.3	7.3	26.4	13.3
Side of car into fixed object	40.4	8.2	19.0	8.0	24.4	4.9
Column Total	16.5	8.9	32.6	15.2	26.9	15143

Table 68. Time of accident by impact site.

	Front	Side	Rear	Rollover	Row Total
Midnight - 5:59 am	18.1	13.8	19.5	42.1	16.5
6:00 - 8:59 am	8.6	8.6	12.7	6.9	8.9
9:00 - 3:59 pm	31.5	35.2	31.3	19.3	32.6
4:00 - 5:59 pm	14.6	15.6	19.9	6.6	15.2
6:00 - 11:59 pm	27.1	26.8	26.6	25.1	26.9
Column Total	58.1	33.6	6.6	1.7	15143

Table 69. Object struck by time of day.

	Midnight to 5:59 am	6:00 am to 8:59 am	9:00 am to 3:59 pm	4:00 pm to 5:59 pm	6:00 pm to 11:59 pm	Row Total
Subcompact	10.0	9.7	31.3	19.6	29.4	7.7
Compact	8.7	10.9	31.2	18.3	30.9	9.6
Intermediate	12.1	7.0	34.3	16.8	29.8	14.9
Full-sized	10.2	9.0	38.1	16.2	26.6	33.3
Other vehicle	10.4	9.4	40.4	16.1	23.8	13.3
Non-fixed object	33.6	8.6	13.8	9.9	34.2	1.1
Fixed object	41.0	7.7	18.8	7.6	24.9	20.2
Column Total	16.8	8.7	32.5	15.0	27.0	13878

Table 70. Crash configuration by light condition.

	Daylight	Dawn	Dusk	Dark	Dark-lighted	Dark-not lighted	Row Total
Head-on	59.1	0.7	3.8	15.9	13.4	7.1	6.2
Rear striking	64.5	1.3	1.9	12.6	13.6	6.0	16.6
Struck in rear	68.2	1.5	1.9	10.0	13.6	4.9	6.6
Angle striking	71.2	0.7	2.1	9.4	12.8	3.8	22.0
Struck in left side	73.5	0.8	2.1	8.2	11.8	3.6	12.9
Struck in right side	72.3	1.0	2.9	8.4	11.3	4.1	12.6
Rollover & other	31.1	1.2	1.2	31.1	11.8	23.6	1.7
Sideswipe	62.0	0.2	2.8	16.0	11.5	7.5	3.2
Struck fixed object	36.1	1.7	1.8	30.9	17.9	11.6	13.2
Side of car into fixed object	35.5	1.8	2.2	32.6	15.5	12.4	5.0
Column total	62.2	1.1	2.2	14.7	13.5	6.4	14604

Table 71. Object struck by light condition.

	Daylight	Dawn	Dusk	Dark	Dark lighted	Dark-not lighted	Row Total
Subcompact	71.6	0.2	2.0	7.8	14.2	4.2	7.8
Compact	69.2	1.2	2.3	10.1	12.8	4.3	9.7
Intermediate	66.5	0.9	2.2	13.4	11.6	5.4	14.9
Full-sized	68.9	0.9	2.5	8.4	13.9	5.3	32.8
Other Vehicle	73.5	1.0	1.9	9.8	10.0	3.8	13.4
Non-Fixed Object	31.5	1.4	1.4	49.7	13.3	2.8	1.1
Fixed Object	35.9	1.5	1.7	30.5	17.3	13.1	20.2
Column Total	62.3	1.0	2.1	14.4	13.6	6.5	13383

Table 72. Crash configuration by day of week.

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Row Total
Head-on	12.6	11.2	13.1	15.2	20.0	16.1	11.7	6.4
Rear striking	14.7	12.8	14.6	13.2	18.0	16.5	10.2	16.5
Struck in rear	11.8	13.9	13.0	19.1	18.4	16.7	7.0	6.6
Angle striking	14.1	15.7	13.3	13.2	17.3	15.2	11.1	21.9
Struck in left side	15.1	15.9	12.5	14.4	16.7	13.8	11.6	12.8
Struck in right side	13.5	12.9	15.5	15.1	18.2	14.4	10.4	12.5
Rollover & other	11.9	11.9	12.6	8.0	18.0	19.2	18.4	1.7
Sideswipe	9.5	12.9	14.5	13.9	19.5	18.7	10.9	3.3
Struck fixed object	11.3	10.8	11.9	13.3	13.9	22.3	16.5	13.3
Side of car into fixed object	9.2	11.0	14.2	12.2	16.6	19.3	17.4	4.9
Column Total	13.2	13.4	13.5	14.0	17.3	16.6	11.9	15215

Table 73. Object struck by day of week

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Row Total
Subcompact	14.5	17.1	16.4	13.4	14.3	13.2	11.1	7.7
Compact	11.3	17.3	14.2	14.6	15.5	15.9	11.2	9.5
Intermediate	13.2	12.6	13.0	13.9	17.9	18.5	11.0	14.9
Full-sized	14.1	13.5	12.8	14.4	18.1	15.7	11.4	33.3
Other vehicle	17.1	14.8	13.1	14.5	21.0	13.4	6.3	13.3
Non-fixed object	13.8	9.9	9.9	5.9	10.5	33.6	16.4	1.1
Fixed object	10.7	10.4	12.5	12.9	15.3	20.8	17.6	20.3
Column Total	13.4	13.5	13.2	13.9	17.3	16.9	11.9	13947

Table 74. Day of week by impact site.

	Front	Side	Rear	Rollover	Row Total
Monday	13.5	13.1	11.8	11.9	13.2
Tuesday	13.3	13.8	13.9	11.9	13.4
Wednesday	13.3	14.1	13.0	12.6	13.5
Thursday	13.4	14.3	19.1	8.0	14.0
Friday	17.0	17.5	18.4	18.0	17.3
Saturday	17.3	15.3	16.7	19.2	16.6
Sunday	12.2	12.0	7.0	18.4	11.9
Column Total	58.1	33.6	6.6	1.7	15215

Table 75. Object struck by surface condition.

	Dry	Wet	Snow/Ice	Row Total
Subcompact	82.8	15.5	1.7	7.8
Compact	76.8	21.0	2.2	9.7
Intermediate	78.0	19.1	2.8	14.9
Full-sized	80.0	16.6	3.4	32.9
Other Vehicle	81.1	15.2	3.7	13.4
Non-fixed Object	86.6	13.4	0.0	1.1
Fixed Object	71.6	20.4	8.0	20.2
Column Total	78.1	17.9	4.0	13465

Table 76. Crash configuration by surface condition.

	Dry	Wet	Snow/ Ice	Row Total
Head-on	67.1	22.5	10.4	6.3
Rear striking	81.0	15.8	3.2	16.6
Struck in rear	78.1	19.5	2.4	6.6
Angle striking	79.0	18.8	2.2	22.1
Struck in left side	77.4	19.3	3.3	12.9
Struck in right side	83.3	14.4	2.3	12.5
Rollover & other	77.6	15.7	6.7	1.7
Sideswipe	79.7	14.4	5.9	3.3
Struck fixed object	75.3	18.3	6.4	13.2
Side of car into fixed object	63.3	24.7	12.1	5.0
Column Total	77.6	18.1	4.3	14685

Table 77. Crash by horizontal impact area.

		Front or Rear			Side					
	Distributed	Left	Center	Right	Front	Center	Rear	Front Corner	Back Corner	Row Total
Head-on	19.3	31.1	2.6	11.8	1.6	0.0	0.1	21.2	12.4	6.4
Rear striking	46.1	9.2	2.8	16.2	0.0	0.0	0.0	12.3	13.4	16.0
Struck in rear	50.7	11.9	4.0	9.2	0.0	0.2	0.0	10.7	13.2	6.4
Angle striking	29.4	22.3	2.0	20.2	0.2	0.0	0.0	13.5	12.4	22.4
Struck in left side	5.8	0.0	0.2	0.3	46.9	11.4	10.0	13.7	11.8	13.6
Struck in right side	6.3	0.0	0.0	0.0	40.2	9.3	11.1	16.5	16.6	13.1
Rollover & other	71.6	0.2	0.9	1.3	5.2	3.1	0.0	14.4	1.7	1.6
Sideswipe	17.9	3.4	0.2	10.9	28.6	2.9	13.6	6.7	6.0	3.2
Struck fixed object	23.1	20.9	11.0	26.7	3.5	0.2	0.0	7.0	7.2	12.0
Side of car into fixed object	17.9	0.0	0.1	0.3	38.8	13.9	12.0	10.3	6.8	5.1
Column Total	25.5	12.3	2.7	12.1	15.2	3.7	3.9	12.9	11.8	13952

Table 78. Crash configuration by extent of first impact.

	Extent of First Impact									Row Total
	1	2	3	4	5	6	7	8	9	
Head-on	34.9	39.0	15.8	4.2	2.9	1.1	0.6	0.4	1.0	6.2
Rear striking	57.6	33.0	7.1	1.0	0.8	0.3	0.1	0.1	0.1	15.4
Struck in rear	42.0	28.3	18.4	4.8	3.0	2.7	0.5	0.1	0.1	6.6
Angle striking	59.2	32.3	6.2	1.4	0.4	0.4	0.1	0.0	0.0	23.1
Struck in left side	25.0	36.9	32.4	4.5	0.5	0.4	0.1	0.1	0.1	13.8
Struck in right side	21.2	37.1	33.1	6.7	0.8	0.1	0.2	0.1	0.8	13.6
Rollover & other	27.6	22.7	32.0	13.8	2.5	0.5	0.0	0.0	1.0	1.6
Sideswipe	56.8	28.9	9.5	1.9	1.1	0.5	0.0	0.3	1.1	3.0
Struck fixed object	45.5	31.3	14.1	3.9	2.0	1.2	0.2	0.1	1.7	11.8
Side of car into fixed object	42.0	26.3	23.0	5.1	1.8	1.1	0.0	0.3	0.3	4.9
Column Total	43.4	33.2	17.3	3.6	1.2	0.7	0.2	0.1	0.5	12579

Table 79. Crash configuration by damage distribution.

	Wide Impact	Sideswipe	Rollover	Narrow Impact	Corner	Overhanging Str.	Row Total
Head-on	75.1	0.0	0.0	4.0	19.6	1.4	6.5
Rear striking	80.4	0.0	0.0	3.8	9.4	6.4	15.9
Struck in rear	86.8	0.0	0.0	6.0	5.4	1.8	6.5
Angle striking	73.2	2.0	0.0	6.0	16.2	2.5	22.5
Struck in left side	84.7	3.0	0.0	4.1	7.6	0.7	13.5
Struck in right side	84.3	3.3	0.0	3.2	8.8	0.5	13.0
Rollover & other	9.5	0.0	87.3	2.3	0.9	0.0	1.6
Sideswipe	14.7	81.5	0.0	0.2	3.5	0.0	3.3
Struck fixed object	52.1	2.8	0.5	29.5	14.4	0.7	11.9
Side of car into fixed object	39.3	30.8	0.7	23.6	4.8	0.8	5.2
Column Total	71.1	5.9	1.5	8.4	11.0	2.1	13617

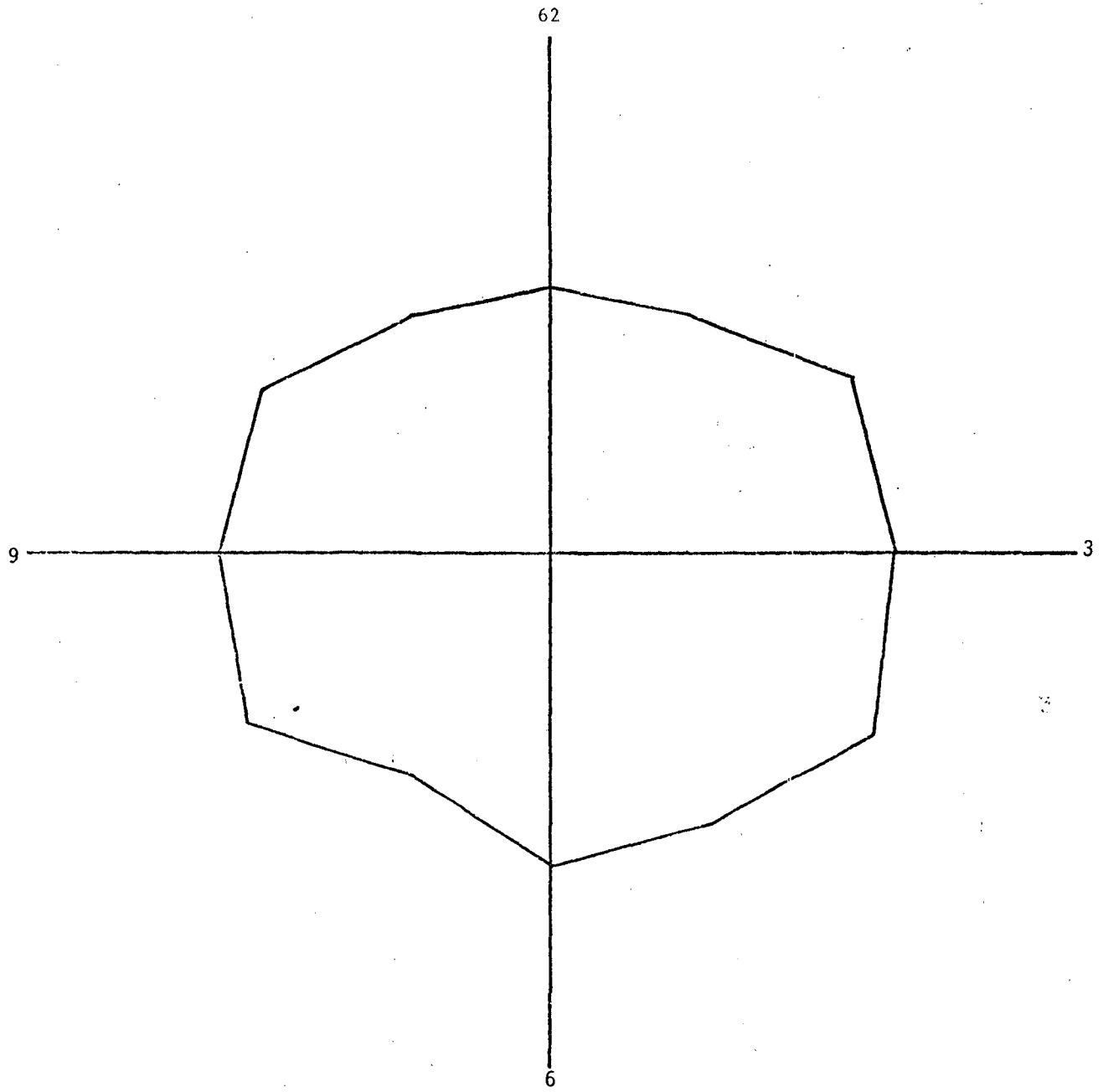


Figure 5 . Mean extent of first impact by o'clock direction of force of first impact.

Table 80. General area of damage by extent of first impact.

	Extent of First Impact									Row Total
	1	2	3	4	5	6	7	8	9	
Undercarriage	53.4	27.0	9.2	5.5	0.0	0.0	0.0	1.2	3.7	1.3
Top	13.5	19.5	40.6	19.5	2.3	2.3	0.8	0.0	1.5	1.0
Right Side	27.3	34.9	29.5	6.1	1.0	0.2	0.2	0.1	0.6	17.3
Left Side	30.2	34.2	30.0	4.3	0.6	0.6	0.1	0.0	0.1	17.7
Front	53.7	32.9	9.0	2.0	1.1	0.6	0.2	0.1	0.5	55.5
Rear	42.5	28.7	17.2	5.0	3.4	2.5	0.4	0.1	0.1	7.1
Column Total	43.7	33.0	17.2	3.6	1.1	0.7	0.2	0.1	0.5	12718

Table 81. Horizontal area of first impact by extent of first impact.

		Extent of First Impact									Row Total
		1	2	3	4	5	6	7	8	9	
Distributed		53.1	30.8	11.3	2.8	1.1	0.3	0.0	0.2	0.5	24.7
	Left	48.5	32.6	11.3	3.3	2.1	1.3	0.5	0.1	0.4	12.4
Front or Rear	Center	60.5	30.9	5.7	1.6	0.0	1.4	0.0	0.0	0.0	2.9
	Right	49.8	33.0	9.9	3.1	1.8	1.4	0.1	0.1	0.9	12.0
	Front	32.9	34.3	27.0	4.2	0.6	0.4	0.3	0.0	0.4	15.3
Side	Center	21.4	30.4	35.0	9.1	2.3	0.8	0.0	0.2	0.6	3.7
	Rear	42.9	33.6	19.7	2.0	0.2	0.8	0.0	0.0	0.8	3.8
Front	Corner	36.6	34.1	22.3	4.6	1.2	0.6	0.3	0.2	0.1	13.2
Back	Corner	37.8	36.4	21.3	3.4	0.6	0.2	0.3	0.1	0.1	12.0
Column Total		43.7	33.0	17.2	3.6	1.2	0.7	0.2	0.1	0.4	12726

Table 82. Damage distribution by extent of first impact.

	Extent of First Impact									Row Total
	1	2	3	4	5	6	7	8	9	
Wide Impact	41.9	34.3	18.5	3.4	1.0	0.4	0.2	0.1	0.3	70.9
Sideswipe	60.7	26.6	8.7	1.0	0.9	0.3	0.1	0.3	1.3	5.3
Rollover	22.7	23.8	34.6	15.1	2.7	0.0	0.5	0.0	0.5	1.5
Narrow Impact	53.4	27.5	13.5	2.9	0.8	1.2	0.0	0.1	0.6	8.9
Corner	40.8	34.3	15.3	4.8	2.4	1.4	0.2	0.0	0.8	11.2
Overhang. Str.	47.4	31.2	8.4	4.2	2.1	4.2	0.7	0.4	1.4	2.2
Column Total	43.6	33.1	17.2	3.6	1.2	0.7	0.2	0.1	0.4	12714

Table 83. Damage severity by first object contacted.

	Minor	Moderate	Moderately Severe	Severe	Row Total
Subcompact	8.4	7.2	5.9	4.2	7.4
Compact	10.7	9.6	8.2	5.2	9.7
Intermediate	16.2	15.6	16.0	7.5	15.4
Full-sized	34.1	36.2	27.5	31.1	33.9
Other vehicle	11.4	14.6	15.7	19.7	13.6
Non-fixed object	1.3	0.2	0.0	0.8	0.7
Fixed object	17.9	16.5	26.7	31.4	19.3
Column Total	45.6	36.1	12.1	6.2	11443

Table 84. Extent of first impact by object struck.

		Subcompact	Compact	Intermediate	Full Sized	Other Vehicles	Non-Fixed Object	Fixed Object	Row Total
Extent of First Impact	1	48.0	46.1	43.2	42.5	36.5	84.3	41.8	42.7
	2	29.7	31.9	34.0	35.8	33.4	7.2	29.2	32.9
	3	17.4	18.1	18.0	16.8	19.2	2.4	19.3	17.8
	4	3.2	2.4	3.5	2.8	6.1	3.6	5.3	3.8
	5	0.4	0.6	0.6	1.2	1.8	0.0	2.1	1.2
	6	0.1	0.5	0.3	0.6	1.5	2.4	0.9	0.7
	7	0.2	0.1	0.1	0.1	0.8	0.0	0.1	0.2
	8	0.0	0.0	0.1	0.1	0.2	0.0	0.2	0.1
	9	0.9	0.3	0.3	0.1	0.6	0.0	1.2	0.5
Column Total		7.5	9.8	15.6	33.5	13.6	0.7	19.3	11318

Table 85. Damage distribution after first impact by first object contacted.

	Wide Impact	Sideswipe	Rollover	Narrow Impact	Corner	Overhanging Str.	Row Total
Subcompact	8.1	3.5	0.0	4.1	8.7	2.5	7.3
Compact	10.4	8.7	0.0	4.3	10.4	10.2	9.6
Intermediate	16.6	13.5	0.0	6.7	16.3	20.0	15.3
Full-sized	37.6	24.1	0.5	16.3	34.1	31.2	33.8
Other vehicle	14.1	15.0	0.0	6.7	11.1	30.5	13.3
Non-fixed object	1.0	0.4	0.5	2.2	0.7	0.7	1.0
Fixed object	12.3	34.7	99.0	59.6	18.6	4.9	19.8
Column Total	69.8	6.0	1.7	8.7	11.4	2.3	12185

Table 86. Horizontal area of first impact by object struck.

		Subcompact	Compact	Intermediate	Full Sized	Other Vehicle	Non-Fixed Object	Fixed Object	Row Total
Distributed		5.8	8.3	15.4	34.8	14.7	0.7	20.4	25.2
Front or Rear	Left	7.7	9.5	16.8	31.2	11.0	0.8	23.0	12.3
	Center	6.1	5.6	7.2	19.5	9.7	3.9	47.9	2.9
	Right	7.5	7.6	13.0	29.6	11.3	1.1	29.8	12.1
Side	Front	8.7	10.9	15.4	34.8	12.4	0.5	17.3	15.1
	Center	7.1	11.1	11.3	33.6	12.5	0.6	23.7	3.8
	Rear	10.5	10.5	15.3	31.2	14.6	0.4	17.5	3.9
Front Corner		8.4	11.5	16.5	35.9	16.9	1.6	9.2	11.8
Rear Corner		7.3	10.9	18.2	36.5	13.4	16.8	12.3	12.9
Column Total		7.4	9.6	15.4	33.5	13.3	1.0	19.8	12446

IV. Injuries

Injuries constitute a vital part of an evaluation of seat belt effectiveness. In this chapter we will explore types and expense of injuries incurred in towaway accidents, who gets injured, and what types of injuries are associated with particular crash configurations.

We should first note that as the severity of the injury increases, the cost of treatment also goes up. Different body regions are more expensive to treat. The head and chest are costly, but injuries to the face and to joints are relatively inexpensive. The cost of particular types of lesions are distributed approximately as one might expect. Fractures and concussion are seen as rather severe injuries, whereas pains and contusions are overwhelmingly minor injuries.

Table 87. Cost of injury by AIS level.

		Mean	S.D.	N
AIS Level	1	130.56	211.03	8100
	2	548.30	565.54	1317
	3	1340.18	734.89	273
	4	1688.79	840.76	48
	5	2893.23	6661.71	13
	6	68516.68	29137.10	97

Table 88. Cost of injury by region of injury.

	Mean	S.D.	N
Leg	141.64	236.10	37
Arm	174.21	260.94	23
Wrist-Hand	332.80	1415.15	292
Thigh	378.83	865.95	143
Shoulder	249.24	416.85	388
Forearm	361.55	1728.26	218
Ankle-Foot	389.59	478.32	122
Hip	412.65	752.76	177
Whole Body	2318.59	14487.73	42
Neck	631.66	6258.94	1212
Abdomen	2570.51	14032.02	174
Lower Leg	363.87	3067.97	280
Knee	114.98	266.78	652
Head-Skull	2052.47	11930.42	1965
Face	261.14	2304.85	2704
Elbow	148.95	307.62	180
Chest	2854.53	13551.01	611
Back	223.80	417.55	479
Upper Arm	505.51	2626.69	142

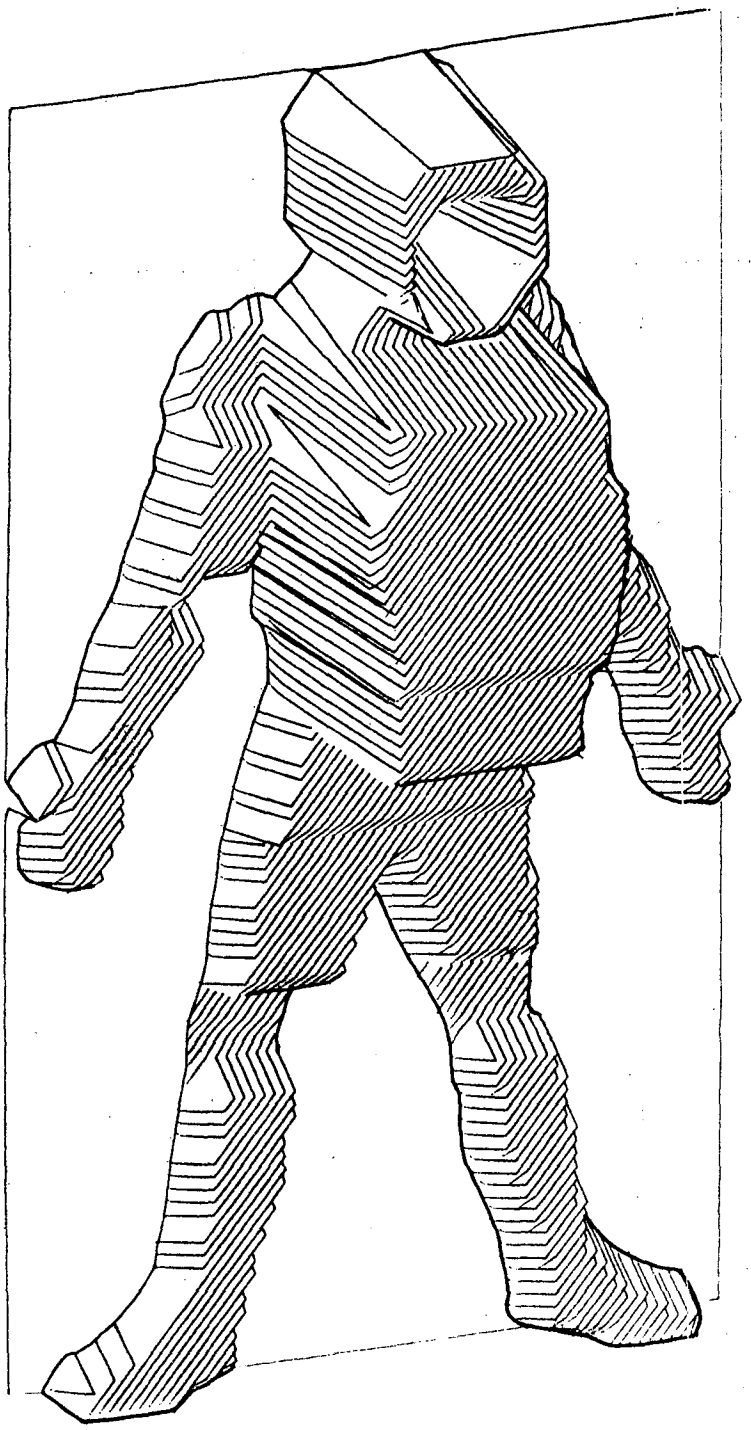


Figure 6. Distribution of mean cost of injury by body region.

Table 89. Cost of injury by lesion type.

	Mean	S.D.	N
Asphysxia	76868.62	33302.02	3
Avulsion	8258.21	25432.47	23
Sprain	244.32	226.87	185
Rupture	23036.33	36598.47	21
Pain	132.61	201.65	2251
Crushing	65909.68	36974.89	7
Laceration	619.54	5694.13	1996
Concussion	1339.48	8451.72	440
Hemorrhage	23441.70	35419.34	55
Fracture	3350.62	13675.99	703
Dislocation	740.95	619.50	24
Contusion	175.66	2127.28	3496
Burn	16182.50	38110.76	6
Abrasion	277.90	3330.67	547

Table 90. Trauma type by AIS level.

		1	2	3	4	5	6	Row Total
Avulsion, Rupture, Laceration, Hemorrhage	Lower Extremity	68.8	10.3	3.8	9.4	0.9	6.8	2.3
	Upper Extremity	87.5	12.5	0.0	0.0	0.0	0.0	0.1
	Face	63.2	36.0	0.6	0.0	0.1	0.1	13.2
	Head-Skull	74.0	20.6	0.2	0.0	0.2	4.9	4.2
Pain, Contusion, Abrasion	Lower Extremity	99.4	0.6	0.0	0.0	0.0	0.0	11.3
	Shoulder/Hip	99.4	0.6	0.0	0.0	0.0	0.0	3.1
	Back	99.3	0.7	0.0	0.0	0.0	0.0	4.1
	Abdomen	94.5	2.1	3.4	0.0	0.0	0.0	1.4
	Chest	94.8	2.0	2.3	0.9	0.0	0.0	4.4
	Upper Extremity	85.8	10.2	3.4	0.1	0.1	0.4	8.8
	Neck	98.5	1.3	0.0	0.0	0.0	0.3	11.0
	Face	98.8	1.1	0.2	0.0	0.0	0.0	11.8
	Head-Skull	98.0	1.1	0.2	0.2	0.3	0.3	11.0
Fracture, Crushing	Extremities	3.4	42.0	37.3	2.9	1.1	12.6	1.7
	Shoulder/Hip	65.9	21.4	12.7	0.0	0.0	0.0	2.6
	Chest	6.3	57.2	30.8	1.3	0.0	4.4	1.6
	Face	33.2	51.6	13.0	2.2	0.0	0.0	1.8
Sprain, Dislocation	Extremities	61.5	32.9	5.7	0.0	0.0	0.0	0.9
	Neck	78.8	20.0	1.2	0.0	0.0	0.0	0.8
Concussion	Head-Skull	42.5	47.5	6.4	1.6	0.7	1.4	4.3
Column Total		83.1	12.9	2.6	0.5	0.1	0.8	10177

The cost of an injury depends on several different demographic variables. The cost of treatment of an injury is much greater for males. This might be due to the greater number of unrestrained males and the fact that males have a higher built-in cost per injury (see Chapter 4 in Volume 1). The cost of treatment also shows a large increase between the 10-25 year old category and the 26 to 55 year old group. Lower treatment costs were also incurred for occupants in the left front seat.

Table 91. Cost of injury by sex.

	Mean	S.D.	N
Male	550.22	6294.04	11978
Female	269.34	2643.87	8712

Table 92. Cost of injury by age.

	Mean	S.D.	N
$\leq$ 9	181.58	2361.39	526
10-25	352.55	4742.92	9433
26-55	522.80	5824.06	8733
56 & up	486.54	3525.22	1952

Table 93. Cost of injury by role.

	Mean	S.D.	N
Driver	452.37	5316.37	15320
Passenger	363.03	4309.46	5533

Table 94. Cost of injury by seat position.

	Mean	S.D.	N
Left	452.02	5314.30	15332
Center	313.89	3384.00	403
Right	373.18	4419.20	5025

In terms of the type of vehicle in which the individual is an occupant, one can easily observe that the 1975 cars show a much lower treatment cost. This cost increases with the age of the vehicle.

Table 95. Cost of injury by model year.

	Mean	S.D.	N
1973	507.00	5667.23	9552
1974	392.46	4760.10	8962
1975	249.65	3338.70	2317

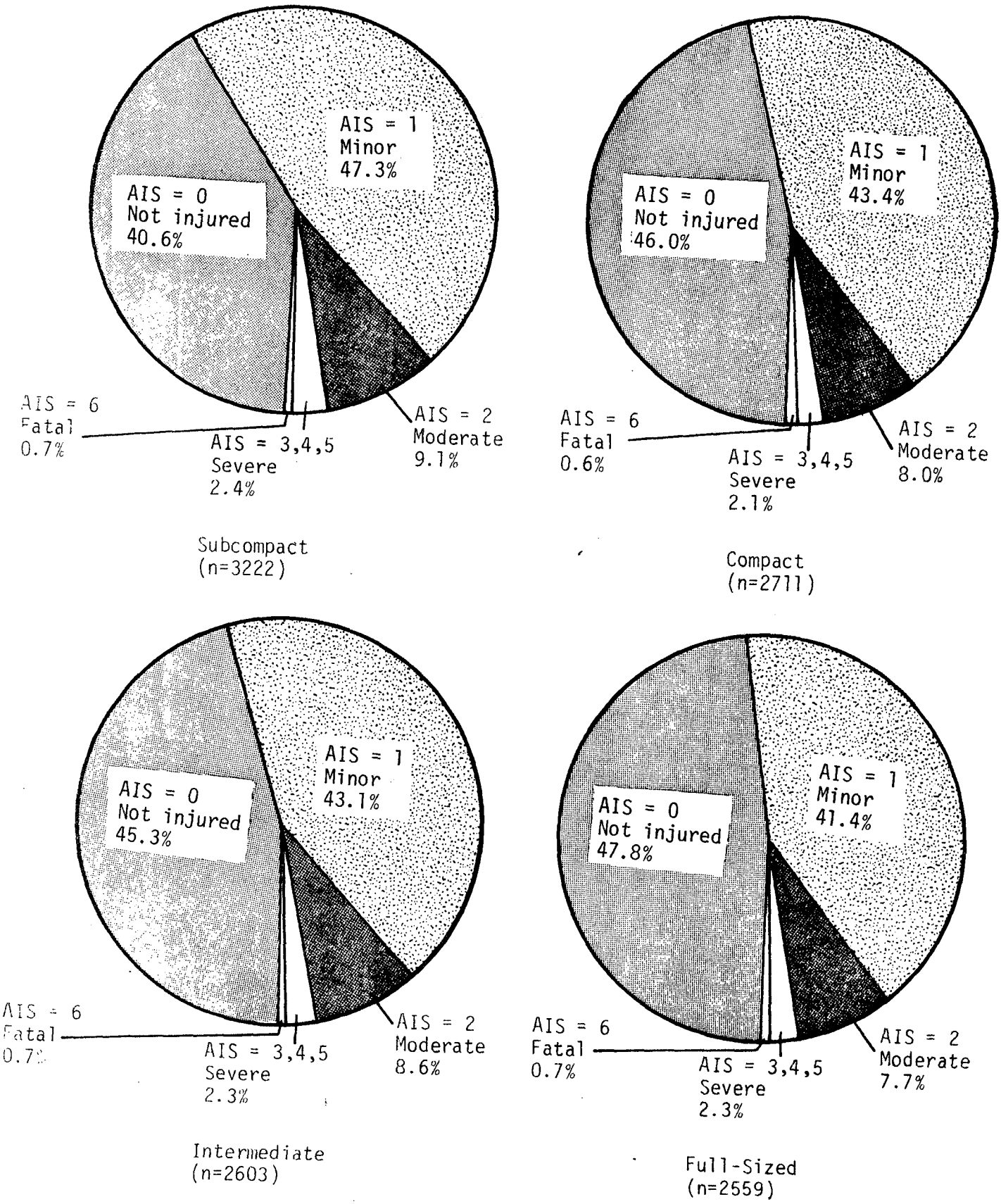


Figure 7. AIS distribution of unrestrained occupants by vehicle weight.

The distribution of injuries by vehicle weight is also interesting. Occupants in full-sized vehicles are likely to incur fractures to the body, sprained extremities, pains, contusions, and abrasions to the body and legs. Similarly one can identify injuries that seem to be vehicle weight dependent.

One can also observe that some vehicles such as Cadillacs, Mercurys and Datsuns appear to be involved in less hostile accidents. Other vehicle makes show a tendency for their belted occupants to have a higher injury rate. Vehicle makes also vary considerably with cost. Chevrolets, Cadillacs, Dodges, Mercurys, Capris, AMCs, VWs and Toyotas all show a low mean cost of injury. Occupants sitting on bench seats have more expensive injuries.

Table 96. Trauma type by vehicle weight.

		Subcompact	Compact	Intermediate	Full-sized	Row Total
Avulsion	Lower Extremity	36.5	22.2	23.9	17.4	2.3
Rupture	Upper Extremity	14.3	14.3	57.1	14.3	0.1
Laceration	Face	34.3	22.2	23.8	19.7	13.2
Hemorrhage	Head-Skull	42.7	19.6	22.4	15.3	4.3
	Lower Extremity	32.9	23.1	20.2	24.8	11.3
	Shoulder/Hip	29.7	26.6	21.0	22.7	3.1
	Back	39.0	20.5	21.5	19.0	4.1
Pain	Abdomen	29.0	24.8	16.6	29.7	1.5
Contusion	Chest	24.5	24.9	24.3	26.3	4.4
Abrasion	Upper Extremity	34.7	26.3	20.2	18.7	8.6
	Neck	34.4	27.9	19.7	18.1	11.0
	Face	34.2	23.9	25.5	16.5	11.9
	Head-Skull	34.6	24.0	21.6	19.9	10.9
	Extremities	35.1	18.4	22.4	24.1	1.7
Fracture	Shoulder/Hip	28.9	25.0	23.7	22.4	2.3
Crushing	Chest	17.8	31.8	17.8	32.5	1.6
	Face	30.6	33.9	22.2	13.3	1.8
Sprain	Extremities	28.7	16.3	30.9	24.1	0.9
Dislocation	Neck	36.9	25.0	25.0	13.1	0.8
Concussion	Head-Skull	40.3	21.7	19.1	18.9	4.4
Column Total		33.8	24.1	22.0	20.1	9961

Table 97. Cost of injury by vehicle make.

	Mean	S.D.	N
Chevrolet	287.96	3757.30	4532
Oldsmobile	574.73	6138.69	1161
Pontiac	972.04	8805.17	1394
Buick	487.75	5388.89	796
Cadillac	330.31	3395.57	404
GM Total	464.52	-	8287
Plymouth	540.56	5695.49	1166
Dodge	248.78	1701.38	740
Chrysler Total	427.26	-	1906
Ford	468.04	5544.28	4275
Mercury	217.85	2258.04	948
Capri	109.53	286.46	318
Ford Total	404.65	-	5541
AMC	100.43	288.29	1062
VW	302.73	3887.90	903
Datsun	560.18	4645.94	509
Toyota	224.88	3605.44	780
Mazda	636.49	6387.69	274
Japanese Total	406.21	-	1563
Other	584.57	6142.78	1440

Table 98. Cost of injury by type of seat.

	Mean	S.D.	N
Bench	472.42	5298.02	8554
Bucket	417.25	4981.90	9680

The cost of injury seems to increase in accidents on wet roads and decrease in accidents on snowy or icy roads.

Table 99. Cost of injury by surface condition.

	Mean	S.D.	N
Dry	402.32	4834.20	15645
Wet	476.45	5621.16	3587
Snow/Ice	294.20	3045.48	850

The importance of locality in determining injury severity is indicated by the cost estimates for injuries in accidents in urban areas as opposed to those in rural areas. The rural injuries are much more expensive to treat.

Table 100. Cost of injury by area.

	Mean	S.D.	N
Urban	325.40	4150.60	18525
Rural	1250.62	9609.75	2328

One might also want to consider the time of the accident. The cost of injuries incurred is lowest at rush hours and markedly higher after midnight.

Table 101. Cost of injury by time of accident.

	Mean	S.D.	N
Midnight to 5:59 am	906.51	8179.13	3409
6:00 am to 8:59 am	299.16	3417.01	1627
9:00 am to 3:59 pm	383.88	4471.78	6744
4:00 am to 5:59 pm	287.35	4093.81	3160
6:00 pm to 11:59 pm	318.37	4139.20	5841

Table 102. Cost of injury by light condition.

	Mean	S.D.	N
Daylight	323.33	4121.98	12316
Dawn	449.89	4663.65	185
Dusk	100.30	292.03	456
Dark	643.43	6620.57	2984
Dark-lighted	521.45	5758.30	2760
Dark-not lighted	660.32	6683.32	1285

As might be expected, injuries happening on the weekend are much more expensive than those occuring during the week.

Table 103. Cost of injury by day of week.

	Mean	S.D.	N
Monday	442.98	4852.22	2694
Tuesday	495.22	5846.95	2692
Wednesday	292.23	3708.51	2676
Thursday	317.18	3942.57	2752
Friday	307.20	4390.18	3620
Saturday	526.38	5929.19	3689
Sunday	624.00	6088.13	2731

Interesting trends can be observed in looking at particular types of injuries that occur primarily in certain types of crashes. WHile these findings are quite interesting, they are apparent from the tables so they will not be discussed here. One can observe, as might be expected, that the rollover, head-on, and striking fixed object crashes lead to more severe injuries. What is somewhat surprising is the severity of the injuries sustained in the struck in side crashes. The cost data provide a similar pattern. The AIS (Abbreviated Injury Scale) level behaves appropriately when crash configurations are grouped by severity/crash types. These is a large increase in the cost of injuries when damage severity increases to moderately-severe and severe. Rear end collisions have a very low percentage of no injury accidents, but they are also the category with the smallest values for the higher AIS levels.

When one examines the mean AIS level by the o'clock direction of force, one can see once again that when the impact comes from the side, the injuries sustained are rather high in their overall severity. The cost data replicates this finding with particular emphasis on the left side of the vehicle. Several additional tables are reported indicating the interaction with various parts of the vehicle deformation index and injury severity.

Table 104. Trauma type by crash configuration.

		Head-on	Rear striking	Struck in rear	Angle striking	Struck in left side	Struck in right side	Rollover & other	Sideswipe	Struck fixed object	Side of car into fixed object
Avulsion Rupture Laceration Hemorrhage	Lower Extremity	14.1	9.8	3.4	19.7	12.4	14.1	4.7	1.7	13.2	6.8
	Upper Extremity	0.0	0.0	25.0	0.0	12.5	25.0	0.0	0.0	37.5	0.0
	Face	11.9	17.4	1.7	22.1	8.9	11.0	0.8	2.0	21.0	3.1
	Head-skull	11.1	9.2	3.3	15.3	14.1	15.1	3.8	3.1	16.5	8.7
Pain Contusion Abrasion	Lower Extremity	7.5	10.8	7.6	30.9	14.4	15.7	1.4	2.2	6.6	2.9
	Shoulder/Hip	3.7	5.4	9.4	23.2	24.7	14.5	4.0	6.1	5.2	3.4
	Back	8.1	7.6	19.4	21.5	15.4	16.2	2.0	1.8	4.5	3.5
	Abdomen	8.4	7.7	6.3	23.1	17.5	21.0	1.4	0.7	11.9	2.1
	Chest	8.2	11.2	4.3	20.4	21.1	11.0	1.1	1.8	15.6	5.3
	Upper Extremity	9.0	11.5	5.9	22.9	15.1	12.7	3.2	3.1	11.8	4.8
	Neck	4.9	9.4	33.5	18.8	12.1	11.0	1.0	1.1	5.7	2.5
	Face	10.0	15.8	5.6	27.7	12.1	8.9	0.8	2.2	13.2	3.7
	Head-Skull	9.0	12.6	7.5	23.6	16.0	11.9	1.2	2.7	10.7	4.2
Fracture Crushing	Extremities	14.4	5.2	2.3	17.2	9.2	8.0	3.4	3.4	23.0	13.8
	Shoulder/Hip	1.3	5.3	1.8	14.2	21.3	33.8	2.2	4.4	9.8	5.8
	Chest	7.2	11.1	0.7	7.8	26.1	20.9	3.3	3.3	16.3	3.3
	Face	8.9	14.0	2.8	19.6	8.4	4.5	2.2	2.2	28.5	8.9
Sprain Dislocation	Extremities	5.8	13.9	10.4	22.0	15.4	16.2	1.2	0.0	9.3	5.8
	Neck	3.8	6.3	38.0	12.7	22.8	5.1	1.3	2.5	7.6	0.0
Concussion	Head-Skull	7.9	11.9	8.8	18.1	14.2	16.5	2.6	1.6	11.2	7.2
Column Total		8.6	11.8	9.2	22.4	14.2	13.0	1.8	2.3	12.2	4.3

Table 105. Body region for first injury by crash configuration for left front occupant.

	Head-on	Rear striking	Struck in rear	Angle striking	Struck in left side	Struck in right side	Rollover & other	Sideswipe	Struck fixed object	Side of car into fixed object	Row Total
Not injured	4.3	20.5	4.1	22.4	10.9	13.1	1.7	4.0	13.6	5.4	50.0
Leg	3.7	0.0	0.0	37.0	7.4	11.1	14.8	3.7	22.2	0.0	0.2
Arm	13.0	4.3	8.7	21.7	21.7	8.7	0.0	0.0	21.7	0.0	.2
Wrist-Hand	12.4	11.9	4.4	22.4	11.4	14.3	2.5	4.9	11.9	4.0	1.4
Thigh	4.5	1.8	0.0	16.2	27.9	32.4	3.6	0.0	9.0	4.5	0.7
Shoulder	3.3	5.9	7.7	22.5	24.5	13.3	3.7	6.3	8.5	4.4	1.8
Forearm	6.0	12.0	3.3	29.9	10.3	13.0	3.8	2.7	13.6	5.4	1.2
Ankle-foot	6.5	22.8	2.2	28.3	7.6	13.0	0.0	6.5	9.8	3.3	.6
Hip	2.3	5.4	2.3	14.7	24.0	32.6	2.3	3.1	7.0	6.2	.9
Whole body	0.0	24.2	9.1	15.2	24.2	9.1	0.0	3.0	6.1	9.1	.2
Neck	4.9	9.5	30.8	18.6	14.5	11.2	1.4	1.3	5.5	2.4	6.2
Abdomen	13.3	5.8	6.7	16.7	15.8	20.0	1.7	0.0	14.2	5.8	.8
Lower leg	10.5	6.0	11.0	32.0	13.5	14.0	0.5	1.0	3.0	8.5	1.3
Knee	8.0	14.2	6.7	37.6	8.4	13.1	0.9	1.3	8.0	1.9	3.1
Head-Skull	8.5	11.9	7.3	18.6	17.3	13.0	2.6	2.9	11.6	6.1	9.9
Face	10.9	13.3	3.4	22.7	9.7	8.2	0.8	2.4	19.6	4.1	13.5
Elbow	15.0	10.2	4.7	22.8	15.7	3.1	4.7	2.4	12.6	8.7	.9
Chest	9.5	11.1	2.4	15.6	25.9	10.5	1.2	2.4	17.2	4.2	3.3
Back	7.2	6.9	17.9	19.0	17.1	17.1	2.2	1.9	6.3	4.4	2.4
Upper arm	7.8	14.8	14.8	20.0	15.7	9.6	0.9	4.3	10.4	1.7	.8
Column Total	6.4	16.6	6.5	22.1	12.8	12.6	1.7	3.2	13.1	4.9	14,758

One can detect differences in the distribution of injuries, particularly in the case of lap and shoulder belted individuals (who have a much greater number of neck injuries). The overall distribution of injuries for lap and shoulder belted occupants shows that almost all of them (90%) are minor in nature. It is interesting to note that the injuries to unbelted occupants were more than twice as expensive to treat as the injuries sustained by lap and shoulder belted occupants. Lap only belt injuries are apparently less expensive to treat than injuries in either of the other two classes. Lap and shoulder belts are overrepresented in neck and shoulder/hip laceration injuries. Lap only belted occupants are injured in the face (lacerations, fractures and pains), the abdomen and the neck at a disproportionate rate. The distributions for various types of lesions over the body are shown for the three usage levels.

Table 106. Trauma type by restraint system usage.

		None Used	Lap Only	Lap and Shoulder	Row Total
Avulsion, Rupture, Laceration, Hemorrhage	Lower Extremity	71.2	9.7	19.0	2.3
	Upper Extremity	33.3	16.7	50.0	0.1
	Face	71.8	16.5	11.7	13.2
	Head-Skull	74.4	10.9	14.7	4.3
Pain, Contusion, Abrasion	Lower Extremity	64.2	12.5	23.2	11.4
	Shoulder/Hip	47.3	15.2	37.6	3.1
	Back	50.9	16.5	32.6	4.1
	Abdomen	42.9	22.1	35.0	1.4
	Chest	65.1	10.5	24.4	4.4
	Upper Extremity	58.5	16.8	24.7	8.8
	Neck	42.3	18.2	39.6	11.0
	Face	70.3	18.5	11.3	11.8
	Head-Skull	68.8	14.7	16.4	10.7
Fracture, Crushing	Extremities	75.0	9.3	15.7	1.7
	Shoulder/Hip	57.1	8.0	35.0	2.3
	Chest	69.2	10.9	19.9	1.6
	Face	68.1	19.2	12.6	1.8
Sprain, Dislocation	Extremities	61.3	15.2	23.5	0.9
	Neck	40.0	17.6	42.4	0.9
Concussion	Head-Skull	71.0	13.2	15.8	4.3
Column Total		63.0	15.2	21.8	9845

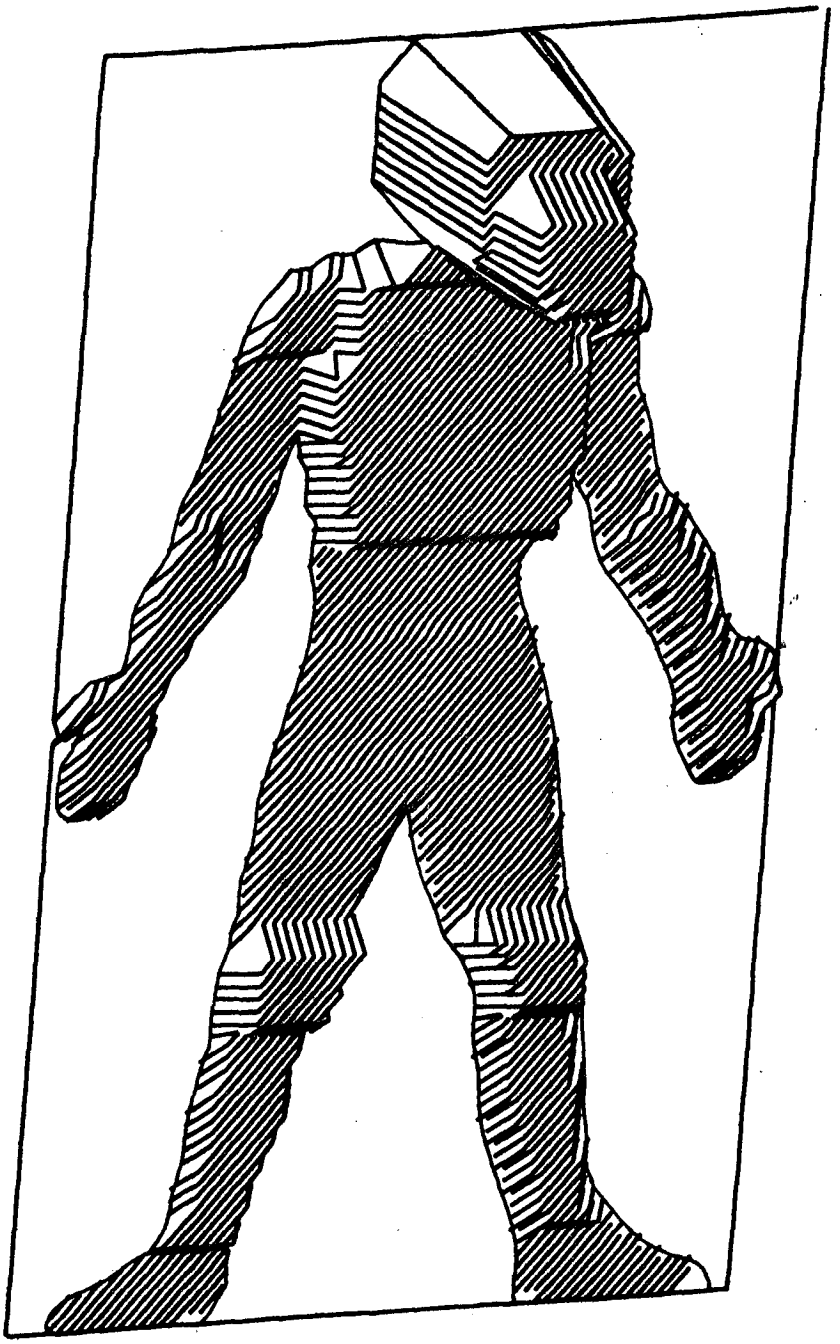


Figure 8. Distribution of injuries by body region for unrestrained occupants.

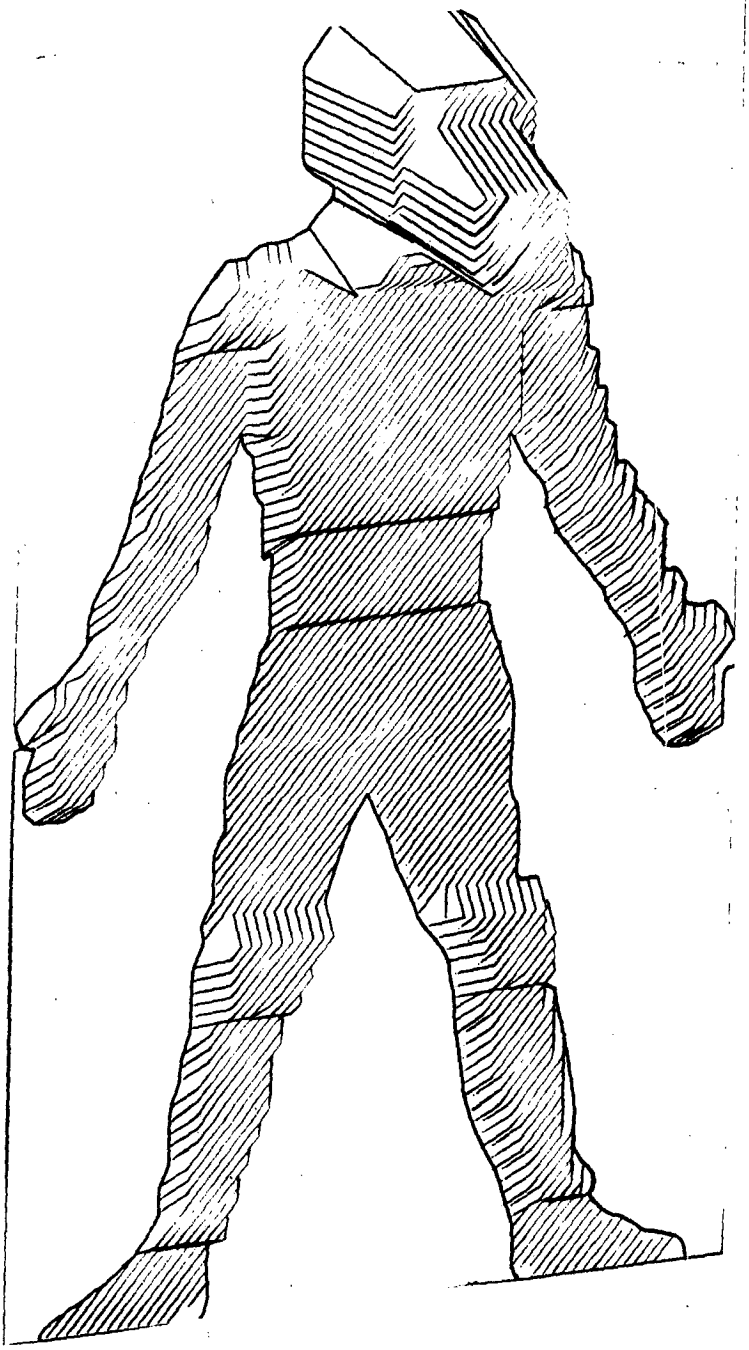


Figure 9. Distribution of injuries by body region for lap only belted occupants.

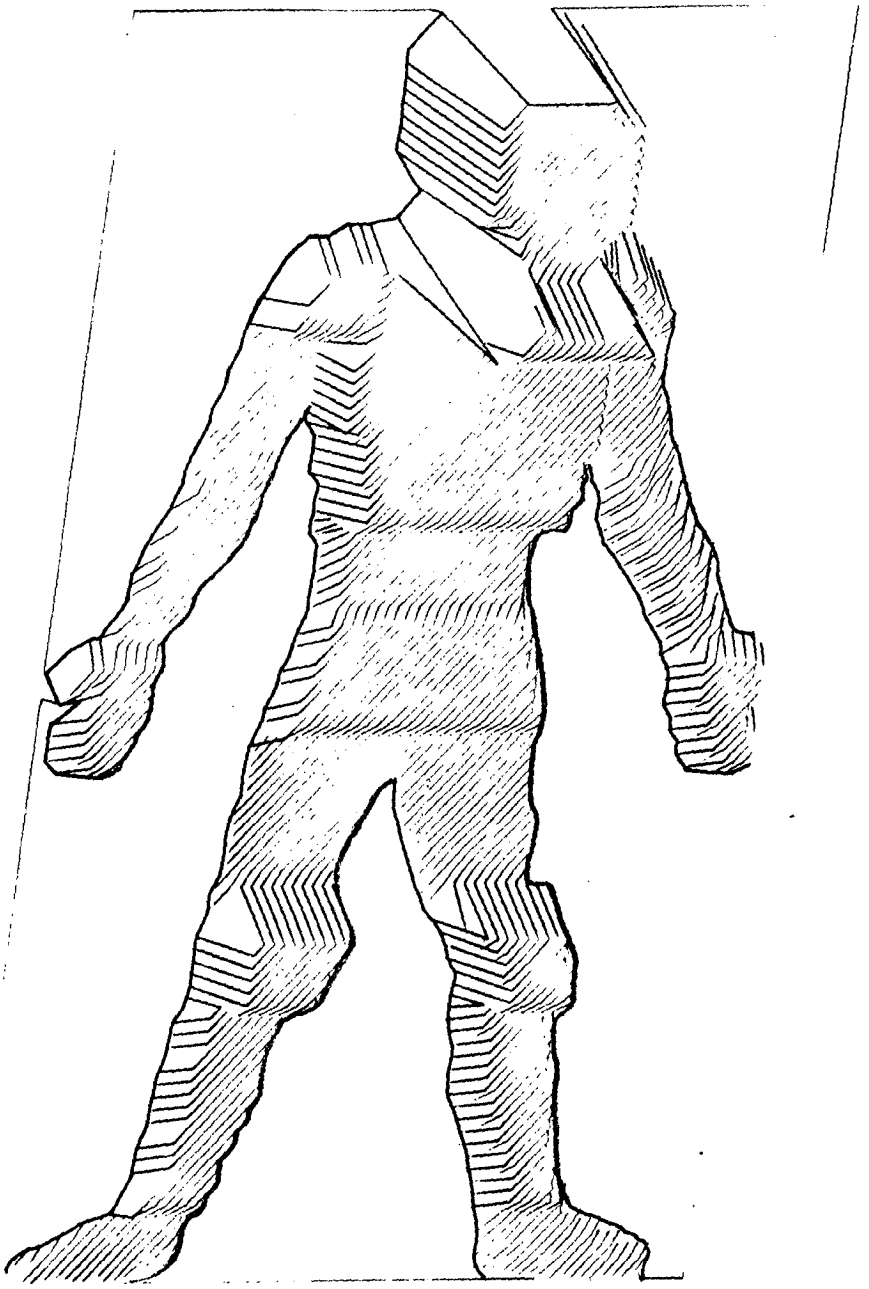


Figure 10. Distribution of injuries by body region for lap and shoulder belted occupants.

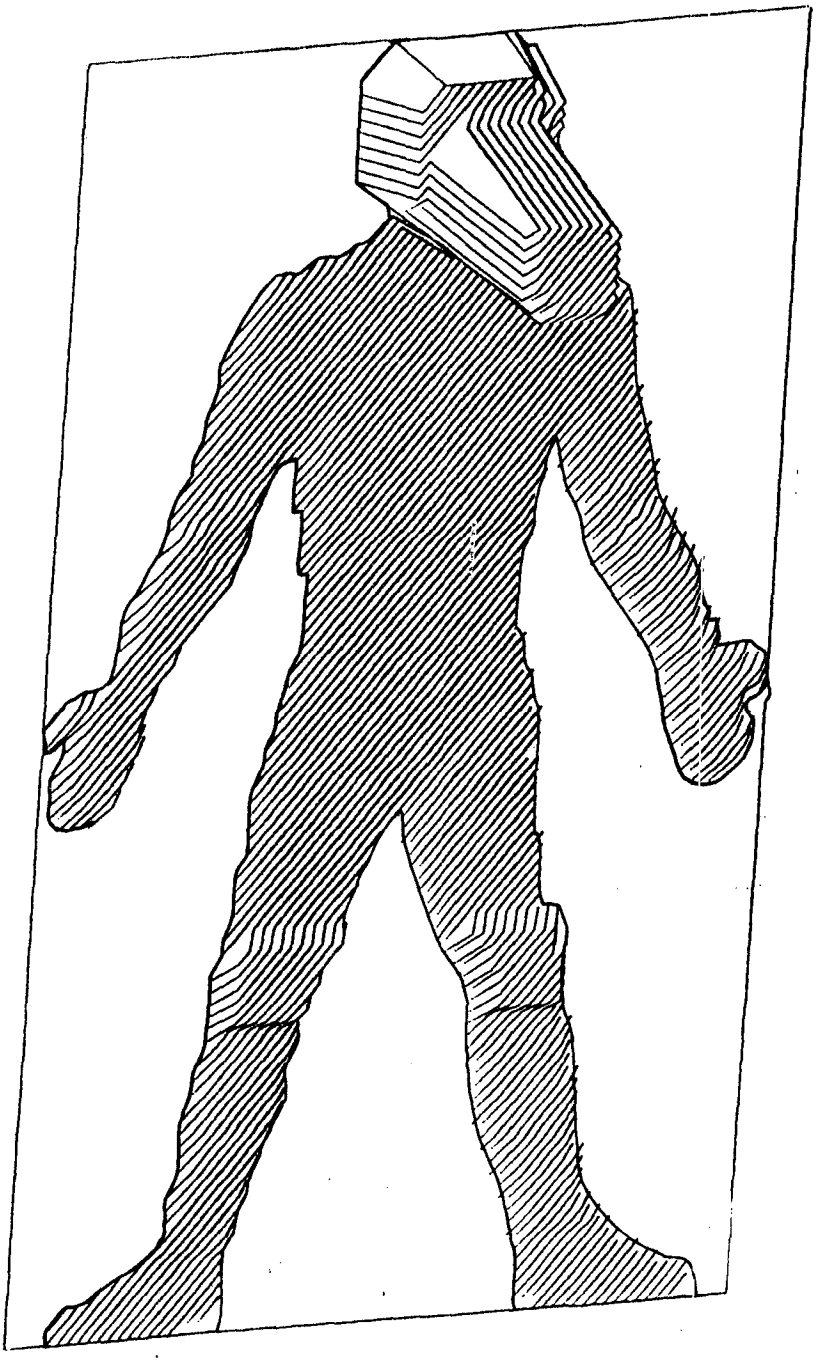


Figure 11. Distribution of lacerations by body region for unrestrained occupants.

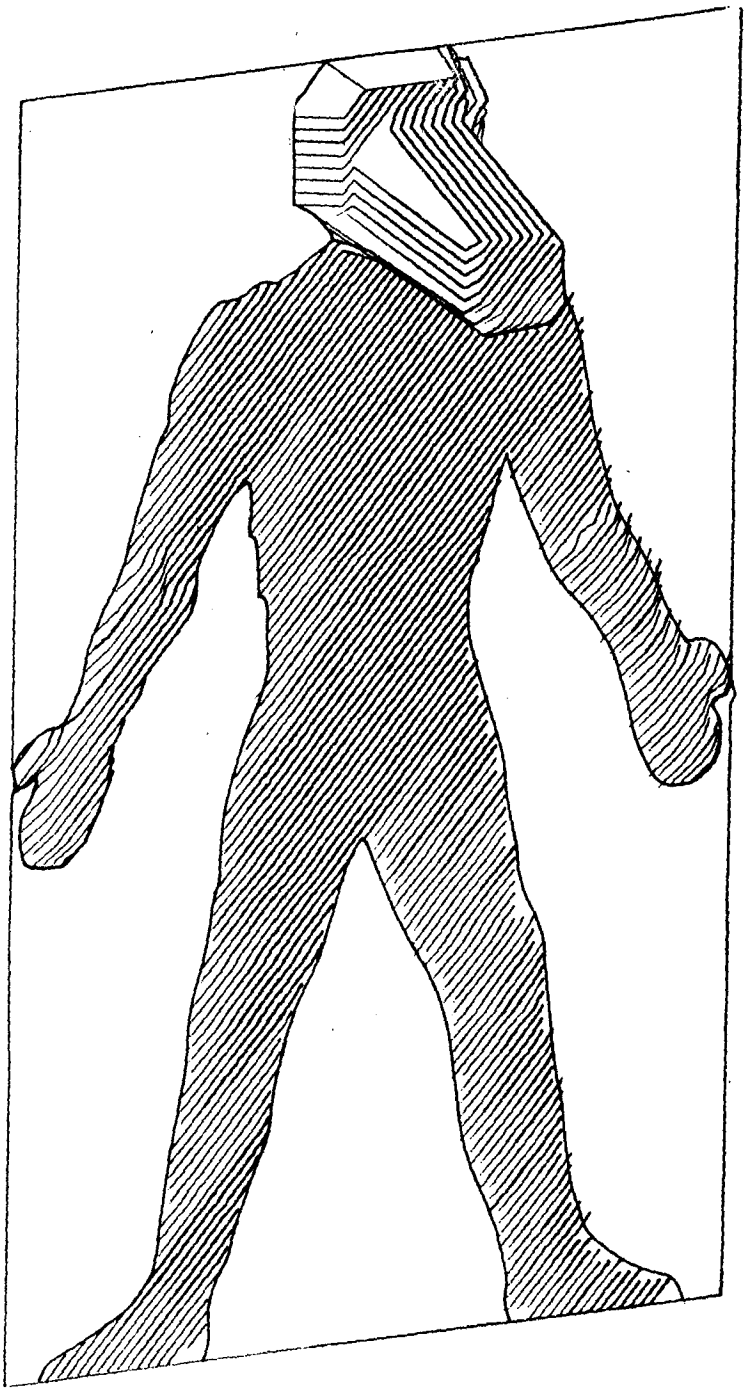


Figure 12. Distribution of lacerations by body region for lap only belted occupants.

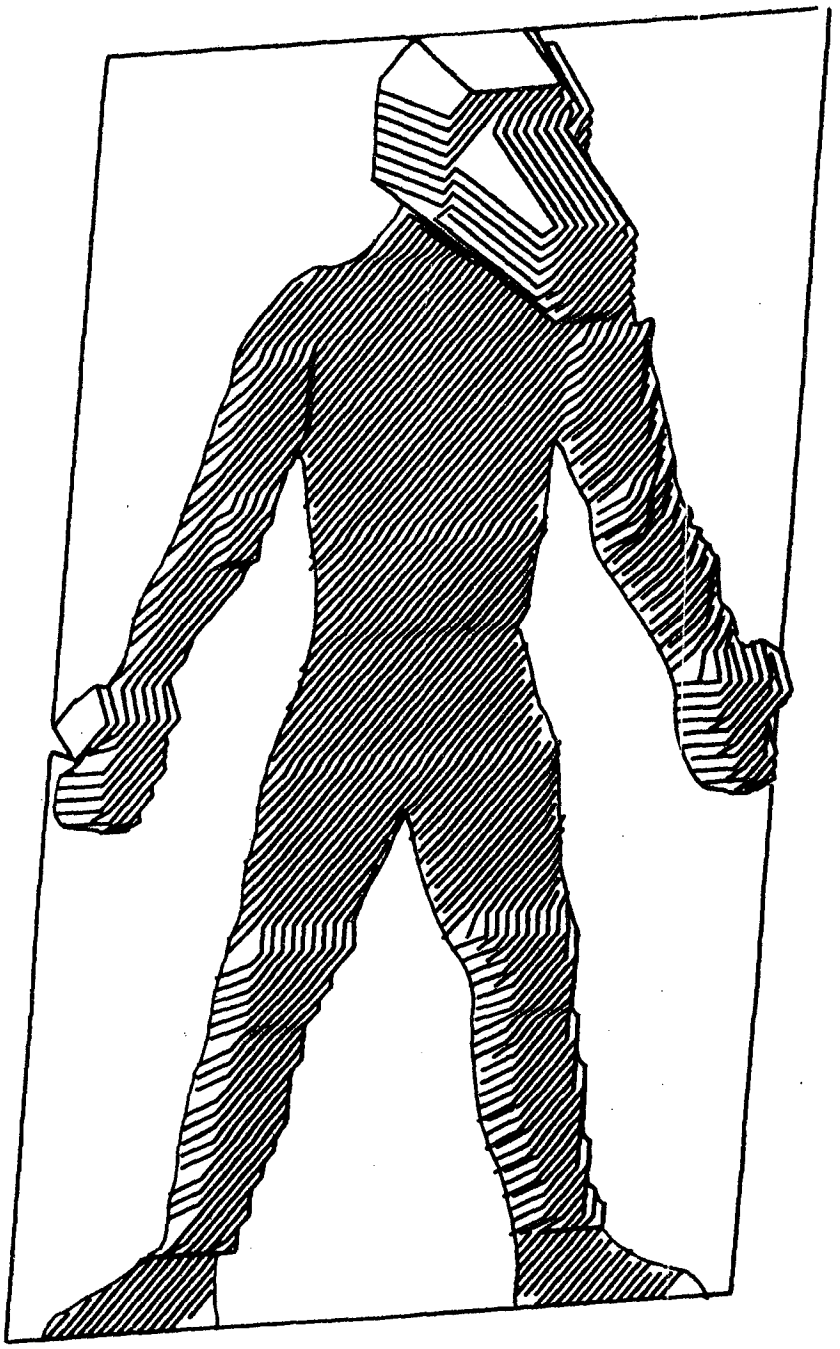


Figure 13. Distribution of lacerations by body region for lap and shoulder belted occupants.

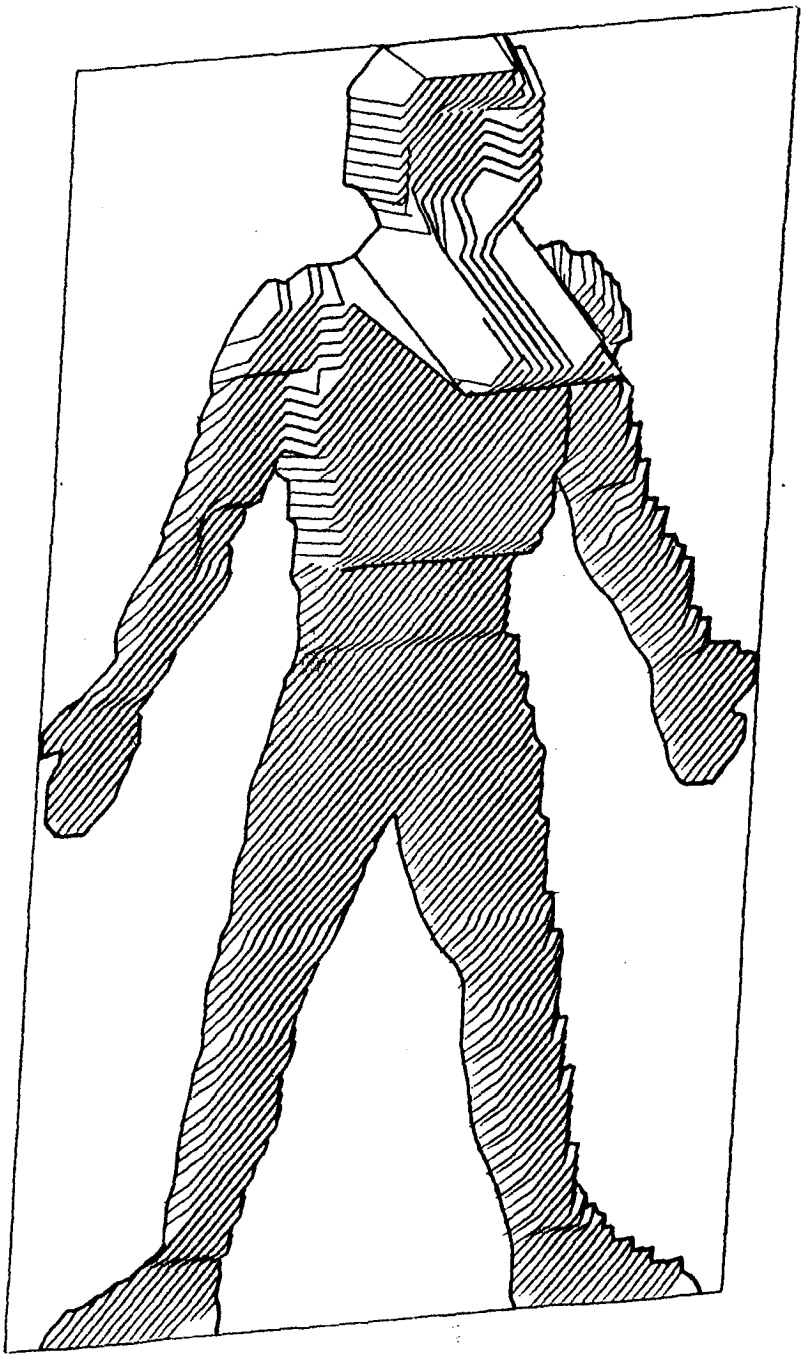


Figure 14. Distribution of pain injuries by body region for unrestrained occupants.

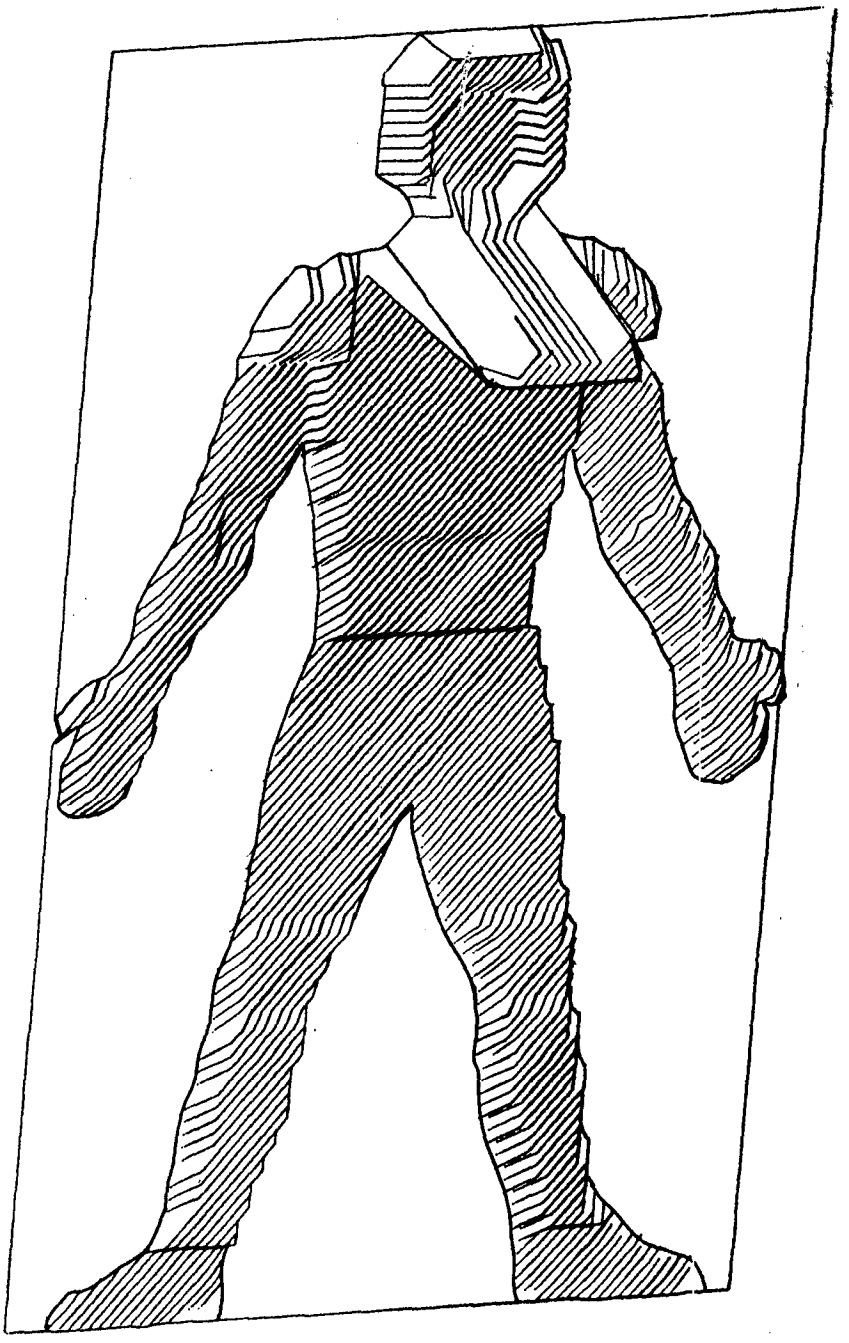


Figure 15. Distribution of pain injuries by body region for lap only belted occupants.

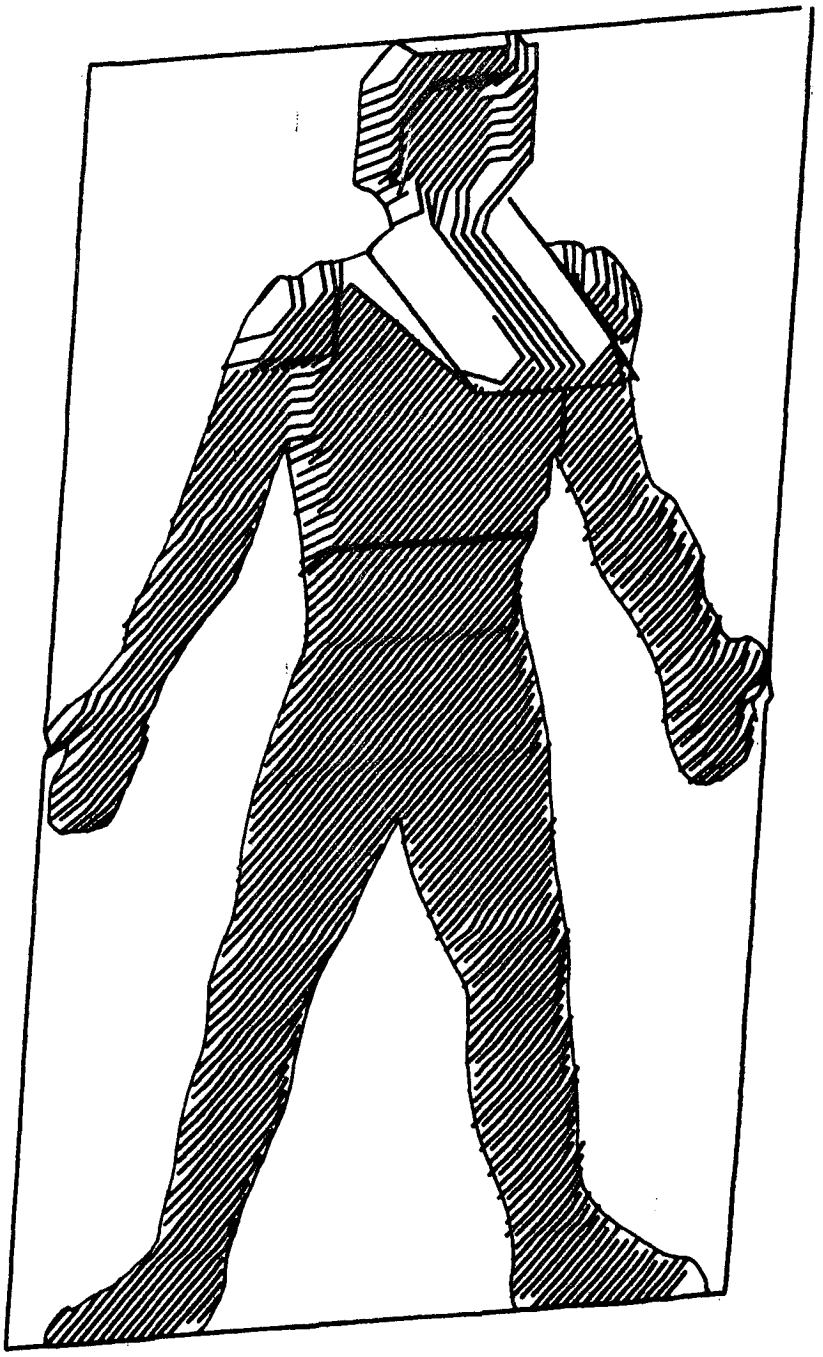


Figure 16. Distribution of pain injuries by body region for lap and shoulder belted occupants.

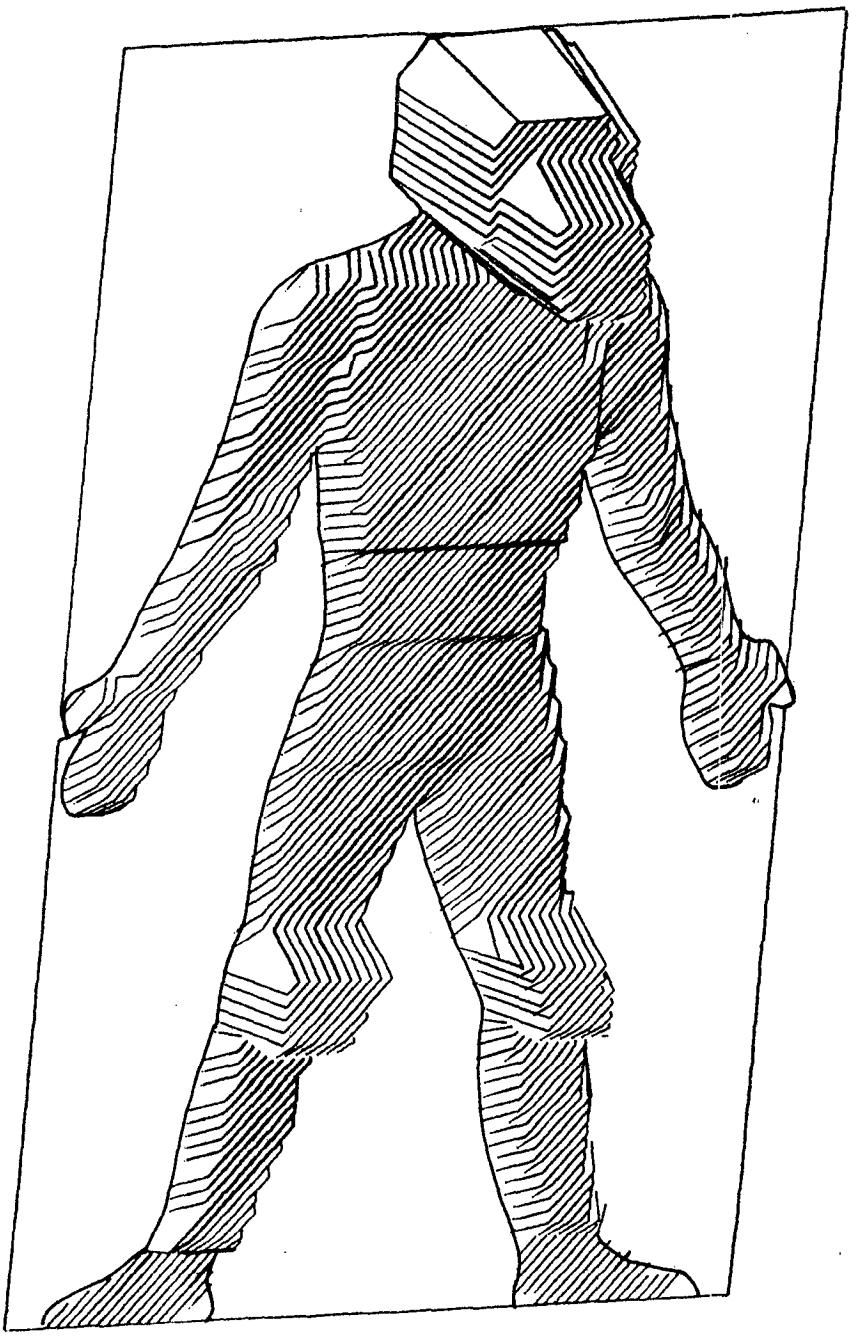


Figure 17. Distribution of contusions by body region for unrestrained occupants.

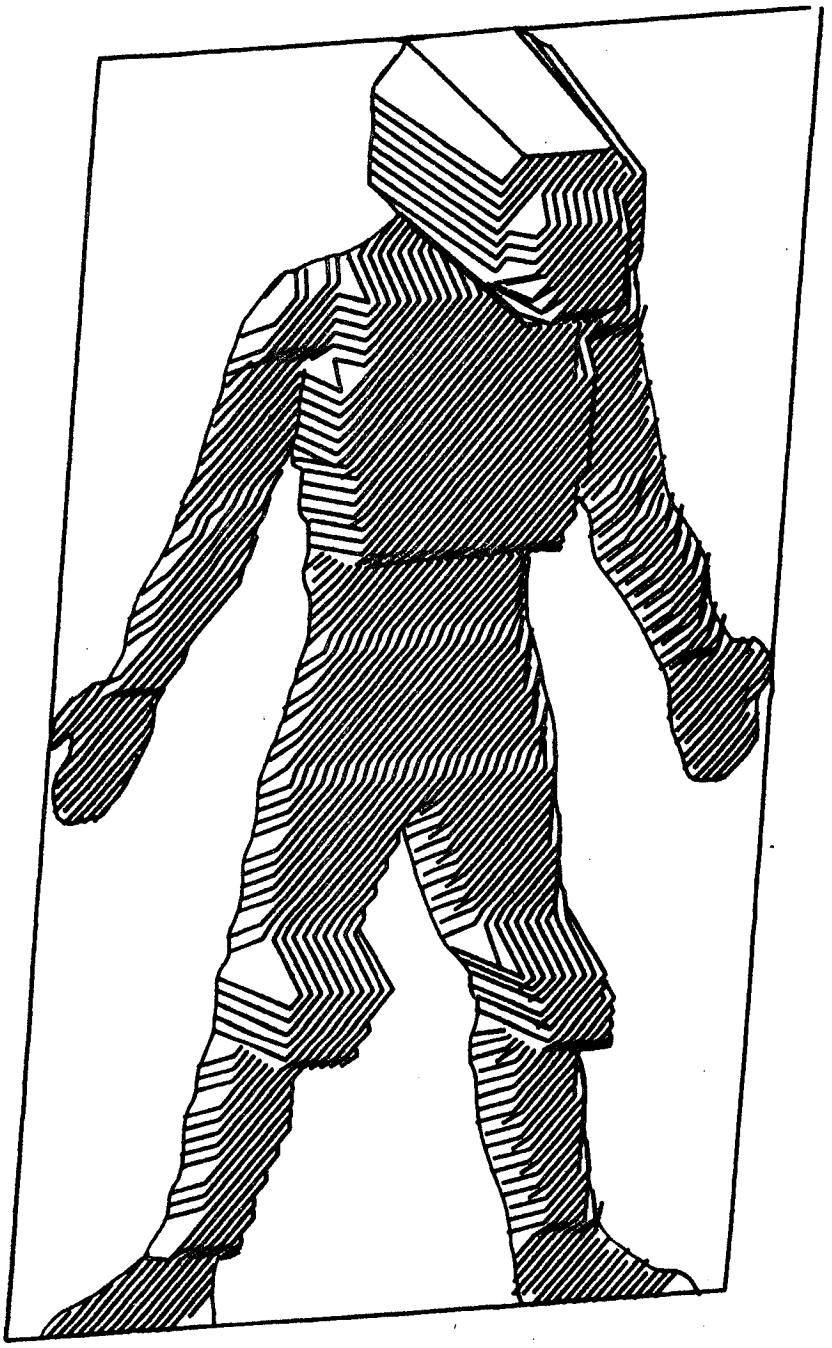


Figure 18. Distribution of contusions by body region for lap only belted occupants.

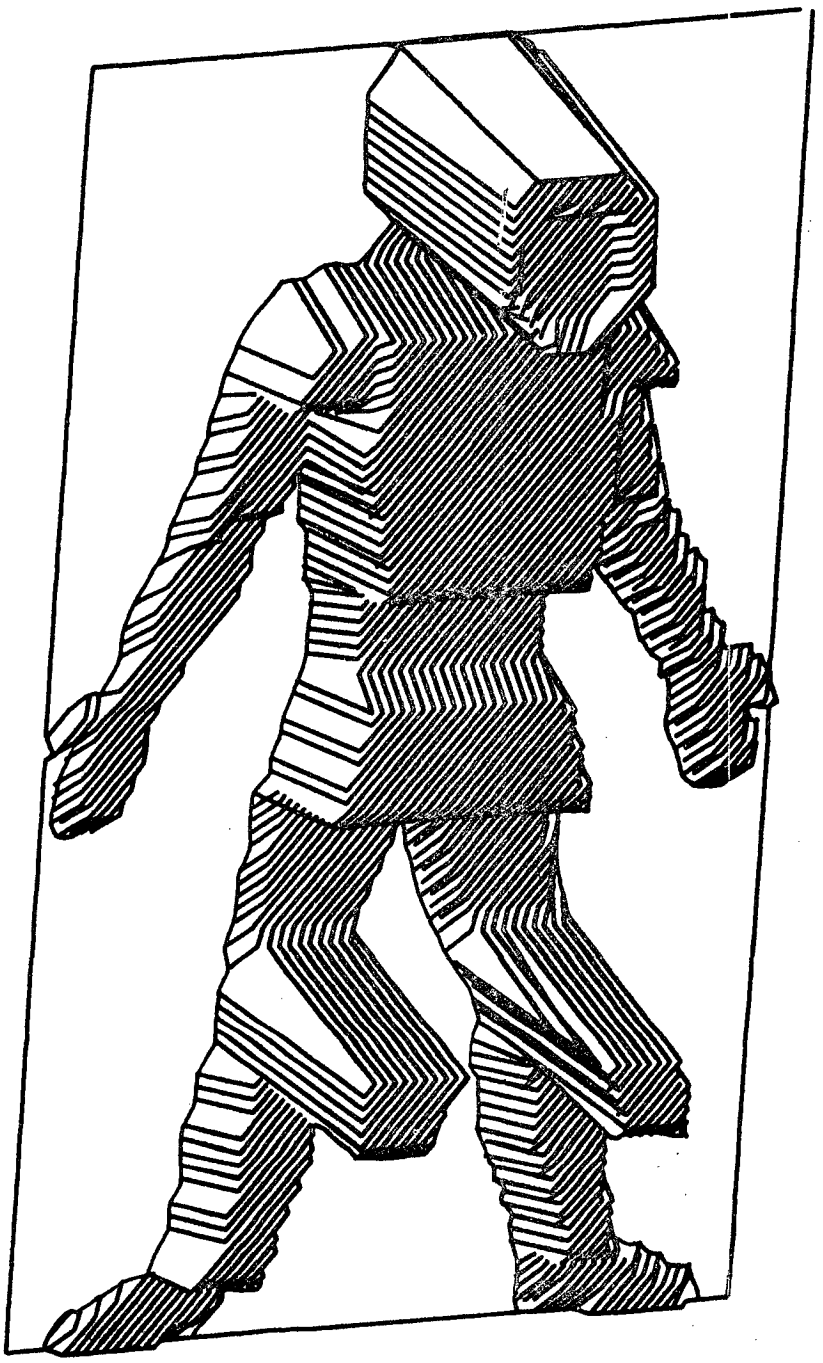


Figure 19. Distribution of contusions by body region for lap and shoulder belted occupants.

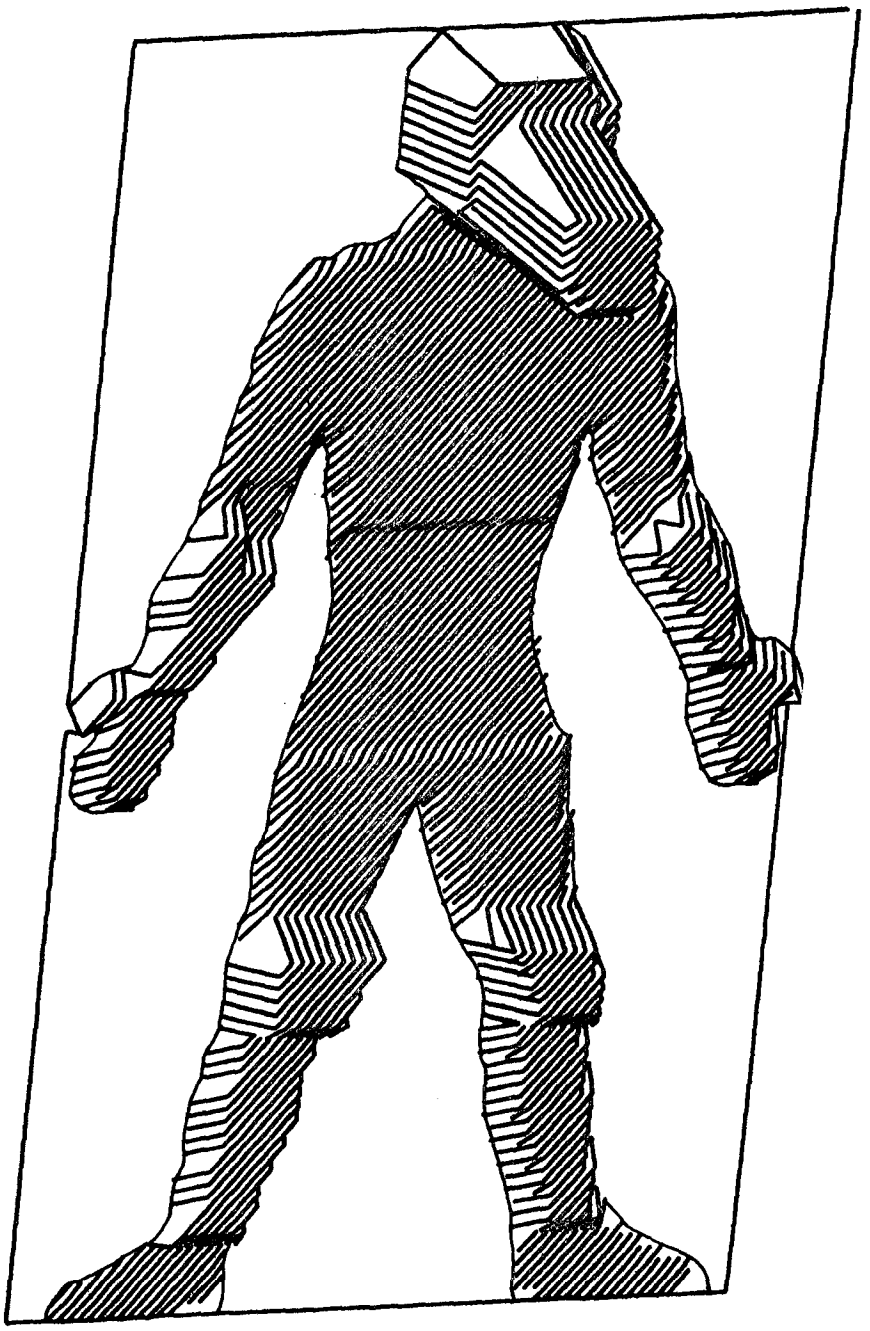


Figure 20. Distribution of abrasions by body regions for unrestrained occupants.

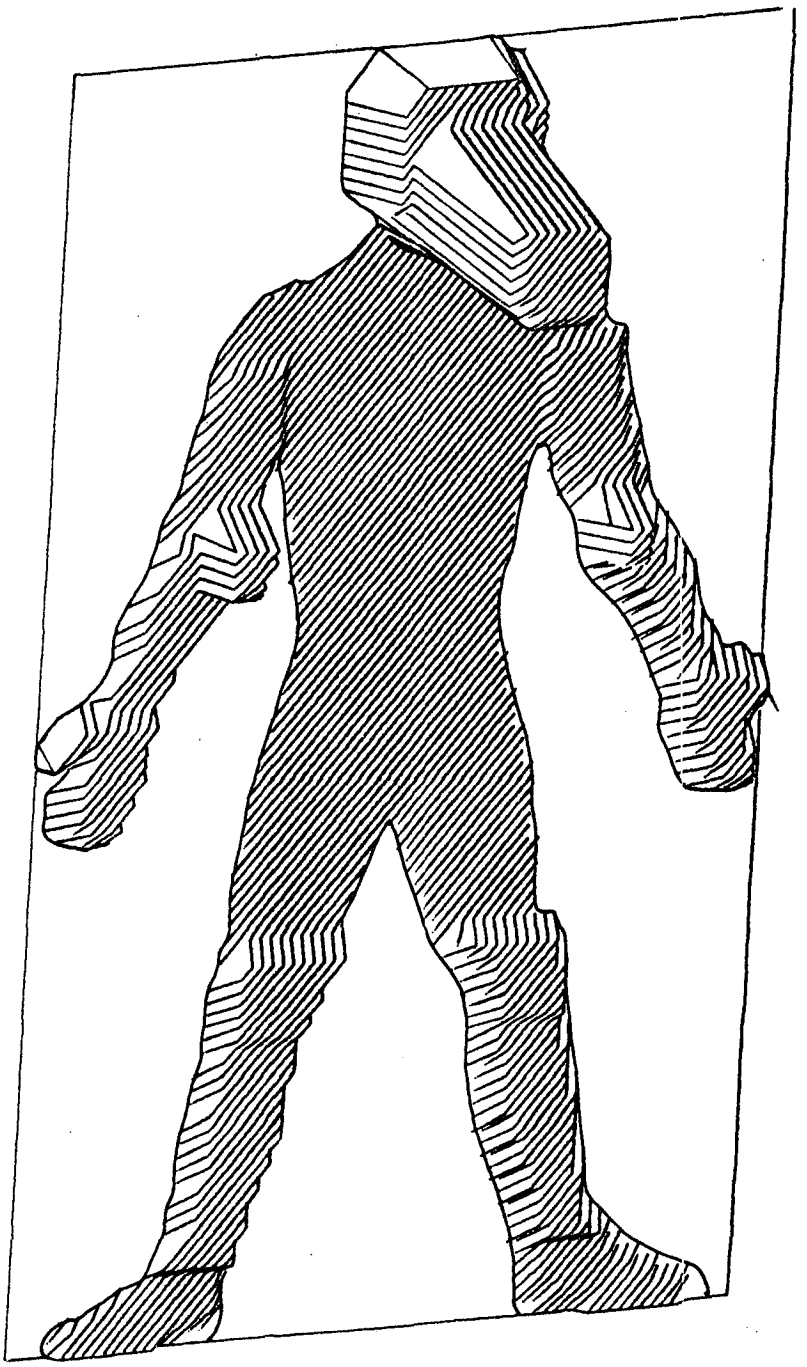


Figure 21. Distribution of abrasion injuries by body region for lap only belted occupants.

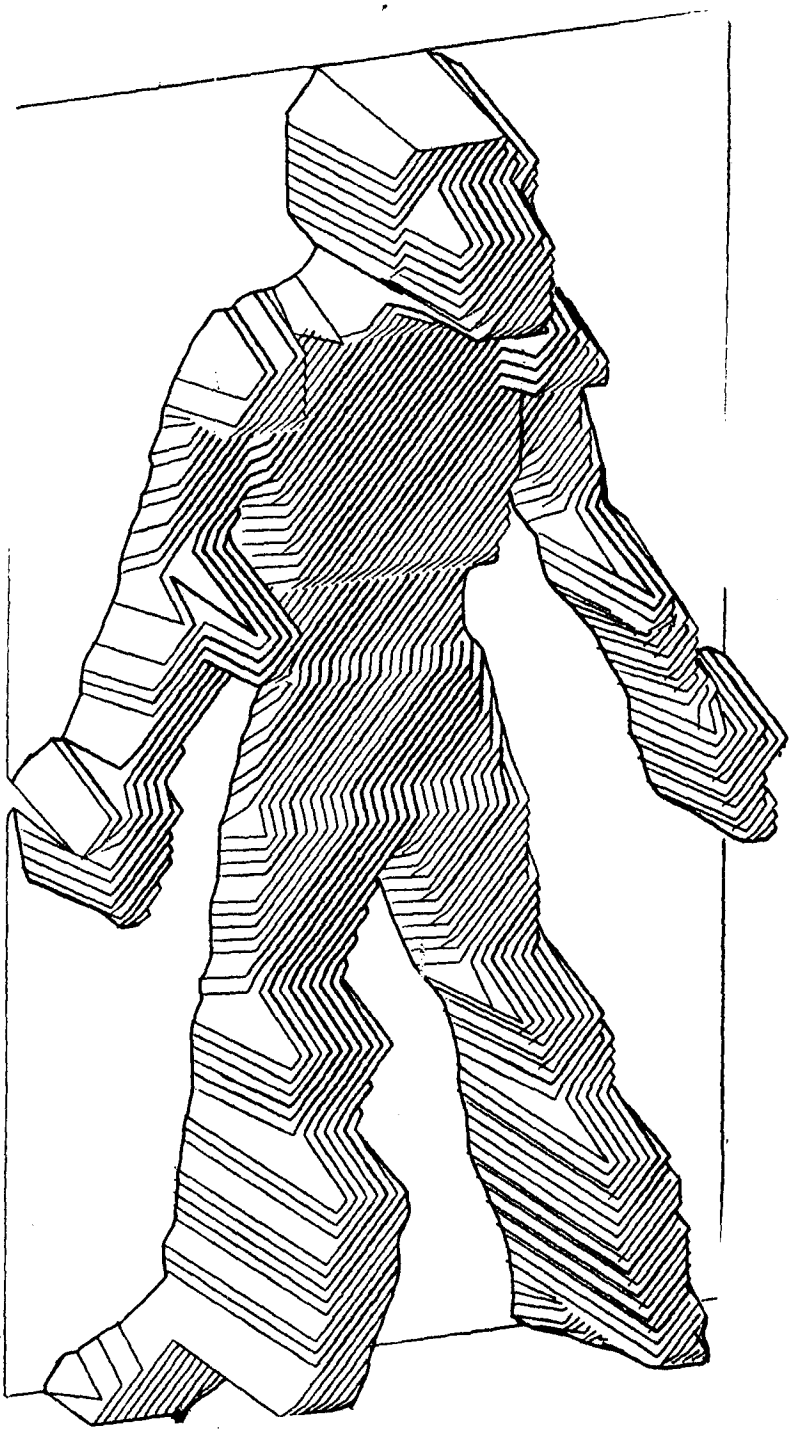


Figure 22. Distribution of abrasion injuries for lap and shoulder belted occupants.

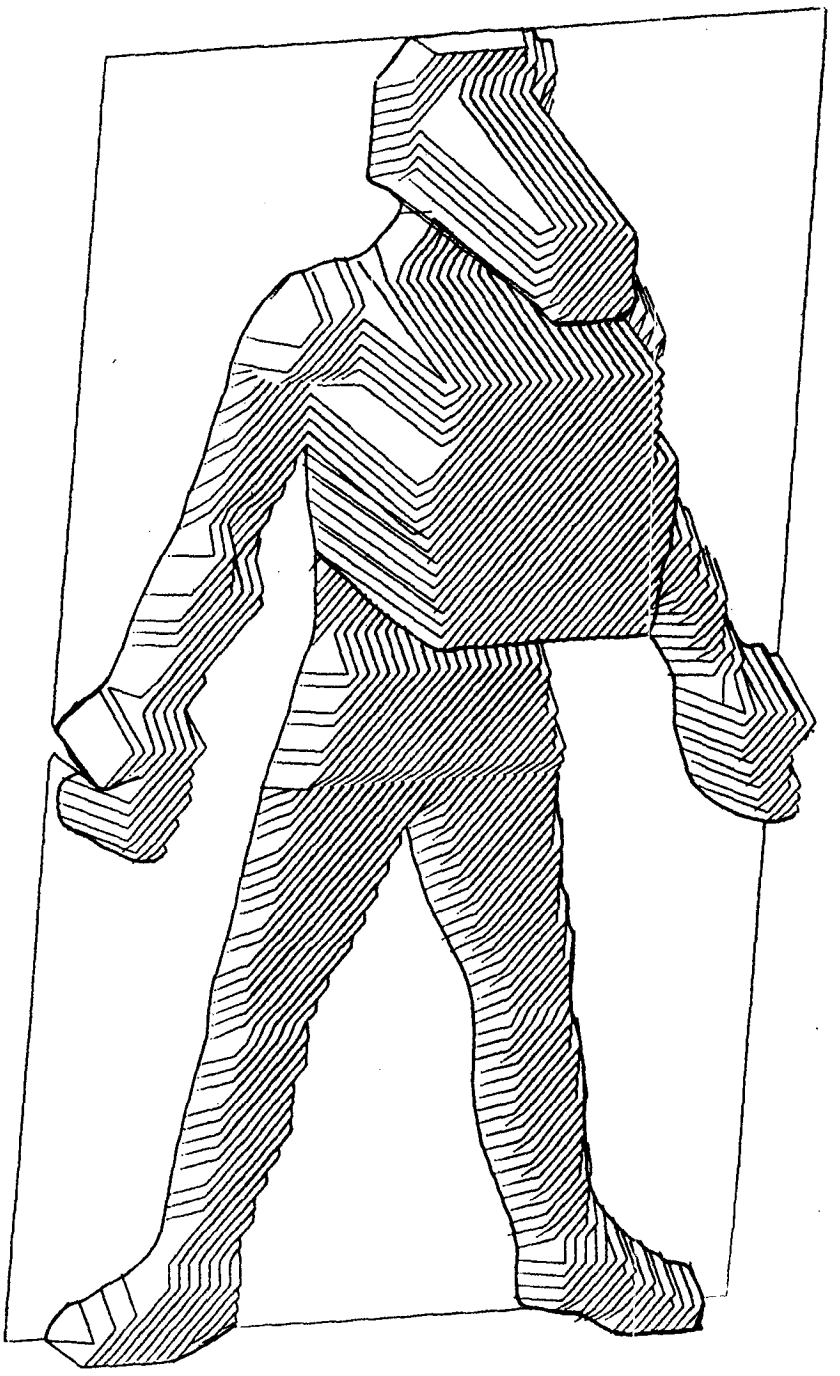


Figure 23. Distribution of fractures by body region for unrestrained occupants.

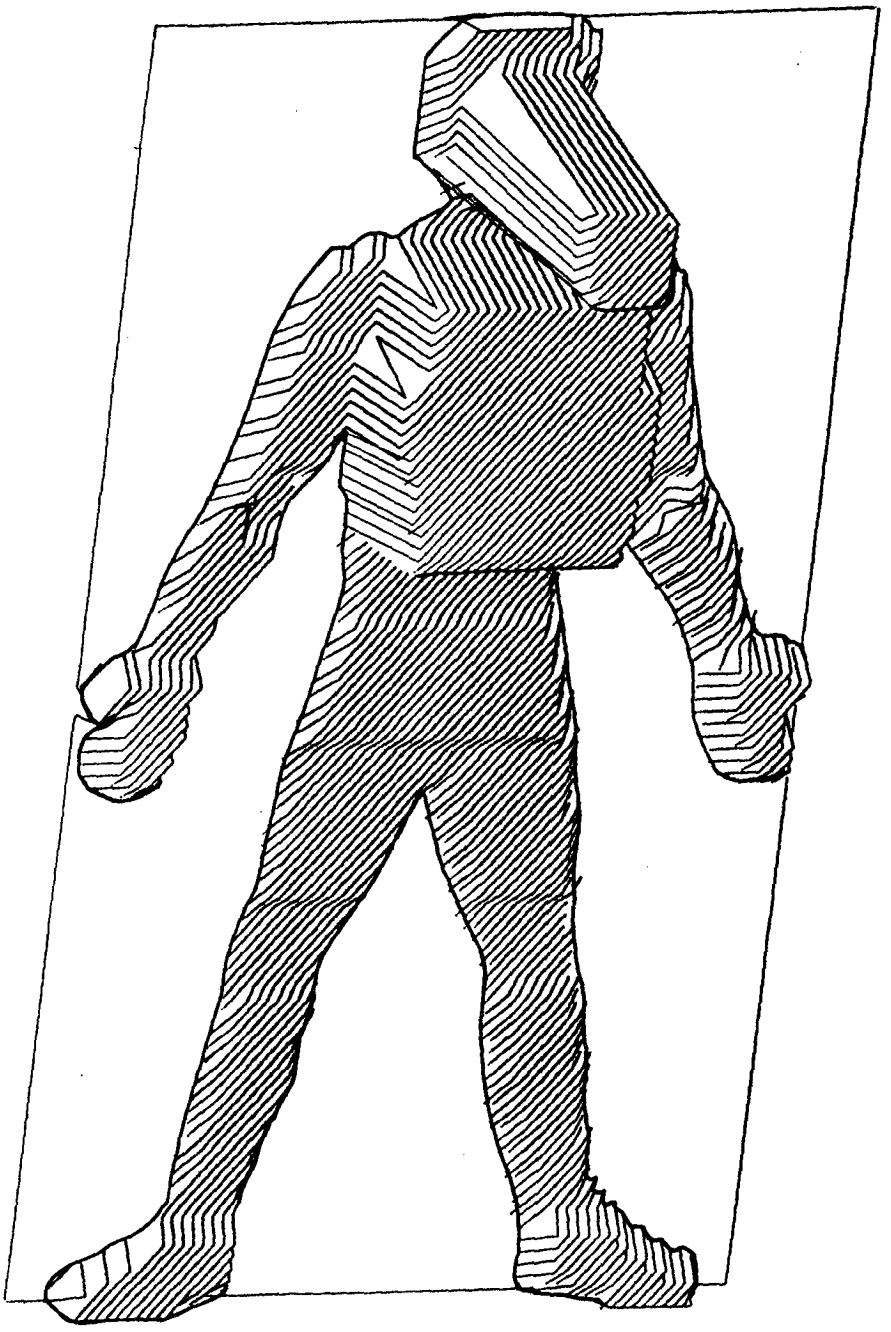


Figure 24. Distribution of fractures by body regions for lap only belted occupants.

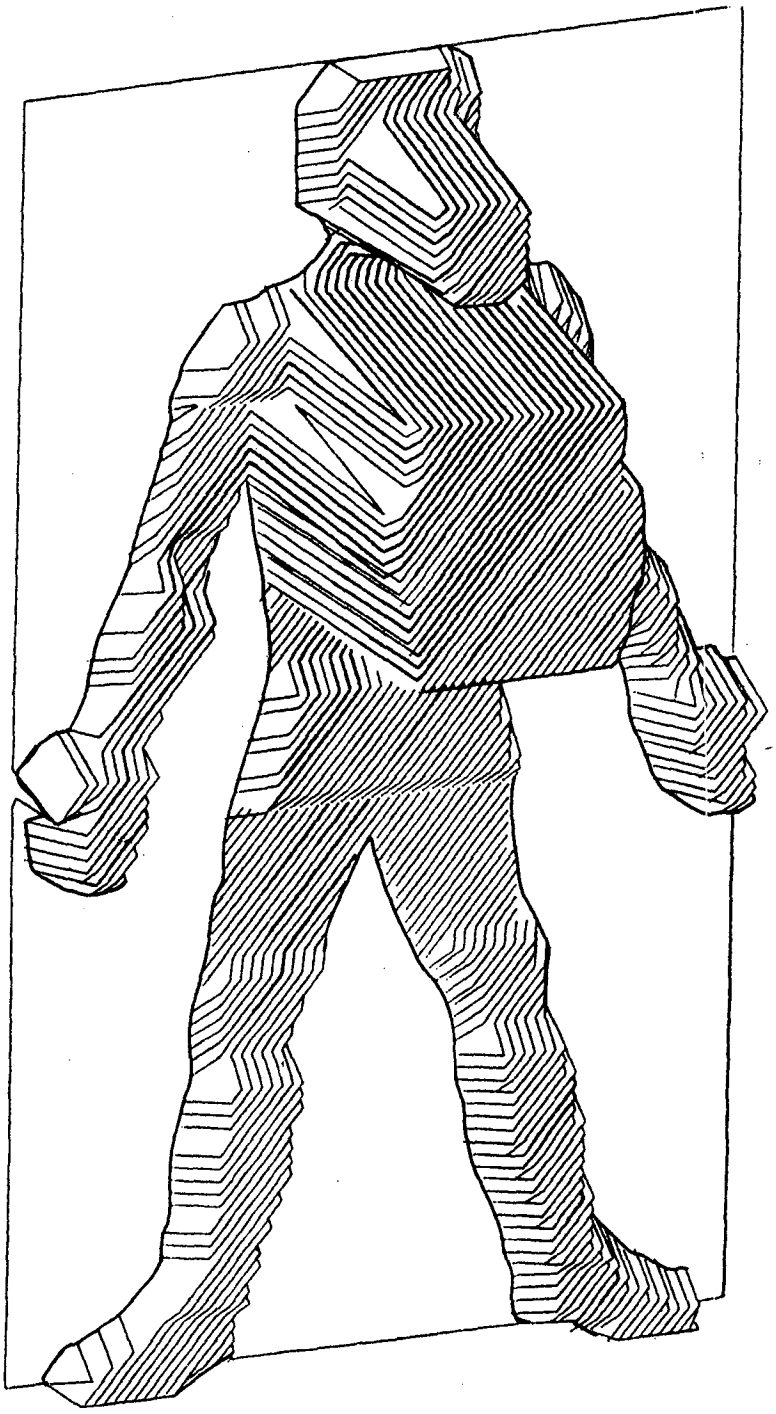


Figure 25. Distribution of fractures by body region for lap and shoulder belted occupants.

Table 107. Trauma type by damage severity.

		Minor	Moderate	Moderately Severe	Severe	Row Total
Avulsion, Rupture, Laceration, Hemorrhage	Lower Extremity	24.4	39.2	20.1	16.3	2.4
	Upper Extremity	20.6	20.0	0.0	60.0	0.0
	Face	30.9	44.7	16.7	7.8	13.5
	Head-Skull	27.5	39.1	21.2	12.2	4.4
Pain, Contusion, Abrasion	Lower Extremity	44.1	40.8	12.0	3.1	10.9
	Shoulder/Hip	37.0	42.0	18.3	2.7	3.0
	Back	41.5	41.0	13.8	3.7	4.0
	Abdomen	40.6	37.5	14.1	7.8	1.5
	Chest	31.4	46.1	15.5	7.0	4.3
	Upper Extremity	36.4	43.0	14.2	6.4	8.8
	Neck	46.0	36.4	12.4	5.2	10.7
	Face	43.9	39.5	13.1	3.6	12.2
	Head-Skull	38.4	46.0	11.2	4.4	10.4
Fracture, Crushing	Extremities	23.5	32.7	18.5	25.3	1.9
	Shoulder/Hip	28.7	37.3	27.3	6.7	2.4
	Chest	15.5	35.2	34.5	14.8	1.6
	Face	29.5	44.9	15.4	10.3	1.8
Sprain, Dislocation	Extremities	38.5	38.5	15.4	7.7	0.9
	Neck	34.6	33.3	19.2	12.8	0.9
Concussion	Head-Skull	29.6	38.5	2212	9.8	4.3
Column Total		36.9	41.1	15.4	6.7	8738

Table 108. Trauma type by extent of first impact.

		1	2	3	4	5	6	7	8	9	Row Total
Avulsion, Rupture, Laceration, Hemorrhage	Lower Extremity	22.5	30.6	27.8	13.4	1.9	1.9	0.0	1.0	1.0	2.4
	Upper Extremity	40.0	20.0	0.0	0.0	40.0	0.0	0.0	0.0	0.0	0.1
	Face	29.3	38.1	23.0	6.1	1.8	0.5	0.3	0.2	0.7	13.5
	Head-Skull	27.5	28.8	29.5	9.1	2.1	2.3	0.0	0.0	0.8	4.4
Pain, Contusion, Abrasion	Lower Extremity	38.8	38.6	18.6	2.2	0.7	0.2	0.7	0.0	0.0	10.9
	Shoulder/Hip	31.7	38.2	22.9	4.6	1.9	0.4	0.0	0.0	0.4	3.0
	Back	40.4	36.1	19.8	1.7	1.1	0.6	0.0	0.0	0.3	4.0
	Abdomen	35.2	31.3	24.2	4.7	3.1	0.8	0.8	0.0	0.0	1.5
	Chest	29.9	39.9	22.5	4.6	1.3	0.5	0.3	0.5	0.8	4.3
	Upper Extremity	35.1	37.4	20.0	5.0	1.4	0.7	0.0	0.0	0.4	8.8
	Neck	43.0	33.0	17.8	3.5	1.5	0.6	0.3	0.0	0.2	10.8
	Face	39.1	35.8	18.9	3.9	1.6	0.7	0.0	0.0	0.0	12.3
	Head-Skull	35.9	39.3	18.1	3.6	1.4	1.0	0.2	0.0	0.4	10.5
Fracture, Crashing	Extremities	25.0	29.4	17.5	18.8	1.9	4.4	1.3	0.6	1.3	1.8
	Shoulder/Hip	25.8	29.7	34.0	9.6	0.5	0.0	0.0	0.5	0.0	2.4
	Chest	17.3	25.2	41.0	10.8	3.6	0.7	0.0	0.0	1.4	1.6
	Face	32.7	31.4	21.8	5.1	4.5	3.2	0.6	0.0	0.6	1.8
Sprain, Dislocation	Extremities	37.1	31.0	24.3	2.6	1.3	0.0	3.8	0.0	0.0	0.9
	Neck	32.1	34.6	17.9	10.3	1.3	1.3	0.0	0.0	2.6	0.9
Concussion	Head-Skull	26.8	31.3	28.4	7.6	2.4	1.6	1.3	0.3	0.3	4.4
Column Total		34.3	35.6	21.6	5.2	1.6	0.8	0.3	0.1	0.4	8722

Table 109. Crash configuration by AIS level.

	AIS Level 0	1	2	3	4	5	6	Row Total
Head on	32.8	51.8	10.2	3.1	0.5	0.2	1.5	6.5
Rear striking	62.6	31.7	5.1	0.5	0.0	0.0	0.1	15.7
Struck in rear	32.9	62.6	3.4	0.8	0.1	0.0	0.1	6.9
Angle striking	48.8	44.7	5.5	0.8	0.1	0.0	0.1	21.8
Struck in left side	45.6	46.6	5.6	1.2	0.4	0.0	0.5	13.1
Struck in right side	50.3	40.8	6.7	1.3	0.2	0.2	0.5	13.1
Rollover & other	50.8	36.6	7.8	2.4	0.8	0.0	1.6	1.9
Sideswipe	65.0	30.1	3.1	1.2	0.2	0.0	0.5	3.3
Struck fixed object	53.0	34.3	9.3	2.2	0.4	0.0	0.8	13.0
Side of car into fixed object	55.2	31.0	8.7	2.6	0.6	0.2	1.8	4.8
Column Total	50.0	41.4	6.4	1.3	0.2	0.1	0.5	20043

Table 110. Cost of injury by crash configuration.

	Mean	S.D.	N
Head-on	1099.71	8349.48	1274
Rear striking	94.12	1254.30	3129
Struck in rear	209.83	2135.21	1350
Angle striking	120.58	1565.23	4319
Struck in left side	458.28	5215.28	2651
Struck in right side	448.15	4920.18	2607
Rollover & other	1412.11	10593.46	363
Sideswipe	402.28	5936.42	648
Struck fixed object	703.33	6866.77	2550
Side of car into fixed object	1283.83	9365.36	950

Table 111. AIS level by crash type.

		Crash Type				Row Total
		1	2	3	4	
AIS Level	0	48.2	49.9	54.6	43.3	50.0
	1	38.2	43.7	39.2	52.1	41.4
	2	9.3	6.2	5.4	3.3	6.4
	3	2.5	1.2	0.7	0.9	1.3
	4	0.5	0.3	0.1	0.1	0.2
	5	0.1	0.1	0.0	0.0	0.1
	6	1.2	0.5	0.1	0.2	0.5
Column Total		26.2	26.2	37.6	10.1	20043

Table 112. Cost of injury by damage severity.

	Mean	S.D.	N
Unknown	134.08	2264.18	3994
Minor	129.56	2314.04	7773
Moderate	287.16	3584.74	6408
Moderately Severe	898.99	7337.86	1884
Severe	4864.52	18546.98	794

Table 113. AIS level by impact site.

		Front	Side	Rear	Rollover	Row Total
AIS Level	0	51.7	50.6	32.9	50.8	50.0
	1	39.5	40.6	62.6	36.6	41.4
	2	6.8	6.2	3.4	7.5	6.4
	3	1.3	1.4	0.8	2.4	1.3
	4	0.2	0.3	0.1	0.8	0.2
	5	0.0	0.1	0.0	0.0	0.1
	6	0.4	0.7	0.1	1.6	0.5
Column Total		57.0	34.3	6.9	1.9	20043

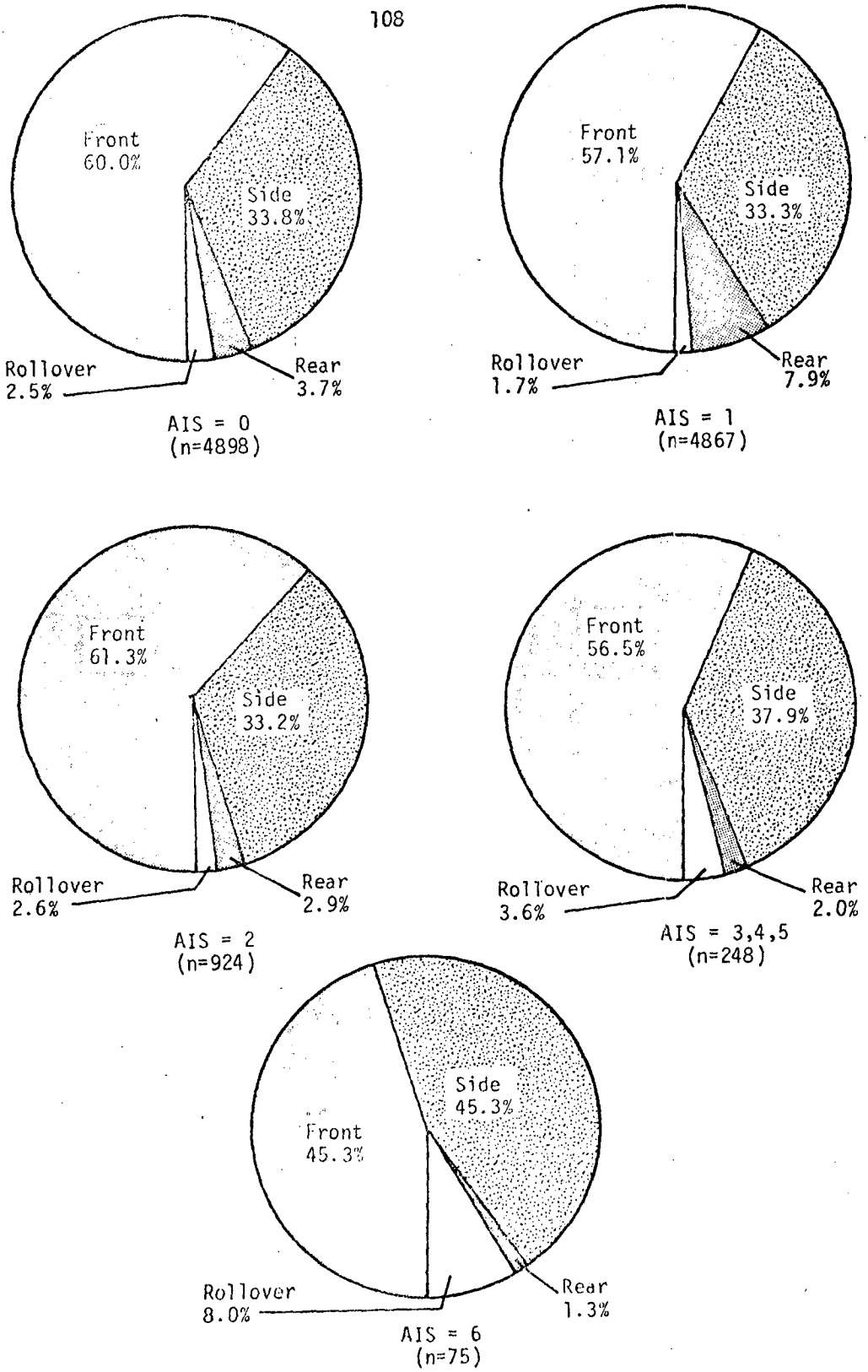


Figure 26. Impact site distribution of unrestrained occupants by AIS.

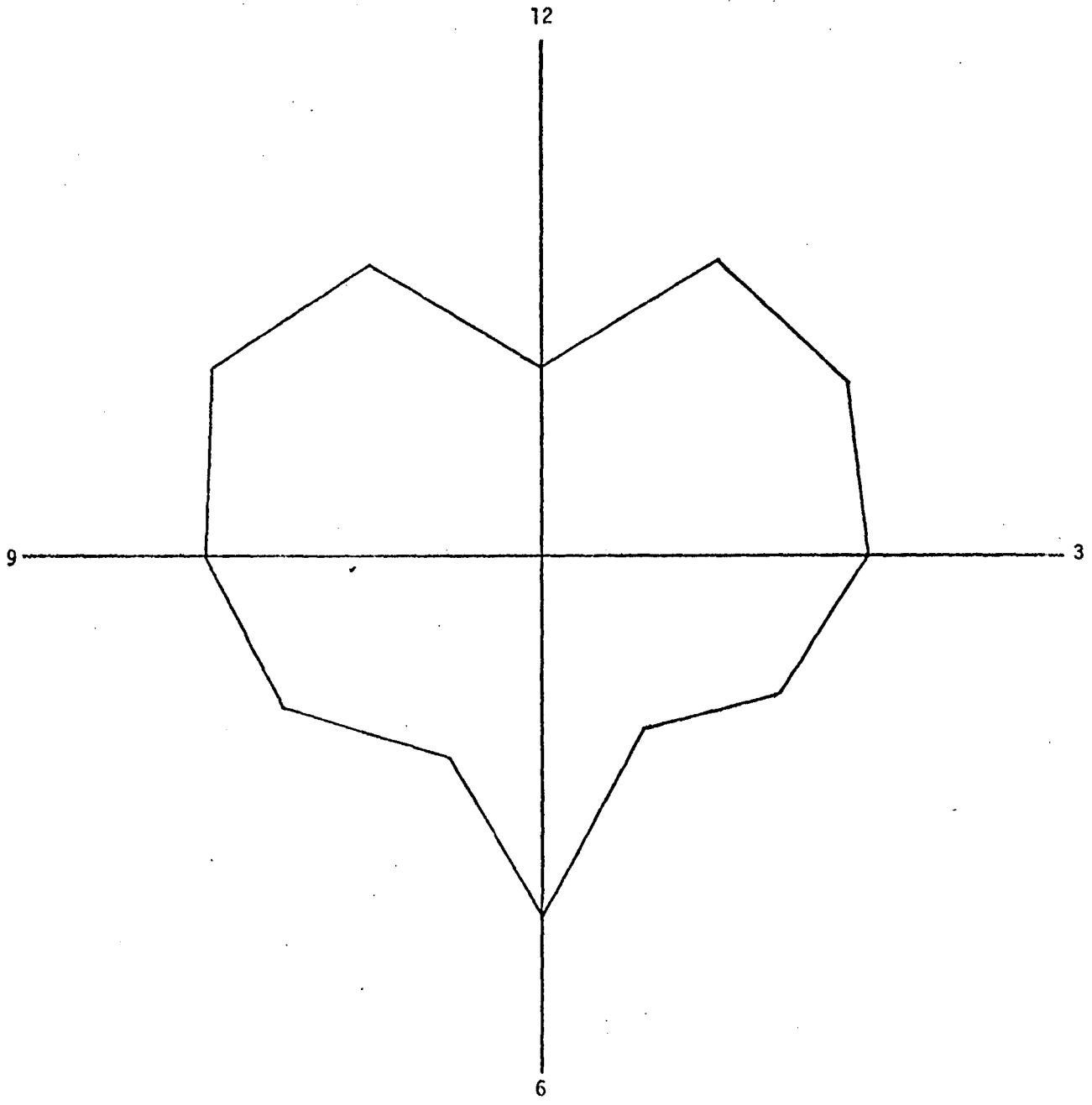


Figure 27. Mean AIS level by o'clock direction of force of first impact.

Table 114. Cost of injury by direction of force of first impact.

O'clock Direction of Force of First Impact	Mean	S.D.	N
Rollover	1088.76	8875.65	460
1	519.47	5579.55	1935
2	348.15	4046.23	1623
3	774.64	7217.29	940
4	85.94	242.42	300
5	302.43	3372.17	203
6	166.92	1677.66	1371
7	417.97	5380.20	234
8	352.46	5059.29	375
9	629.04	6201.17	938
10	553.36	5795.57	1566
11	488.01	5739.84	2353
12	384.88	4742.36	7095

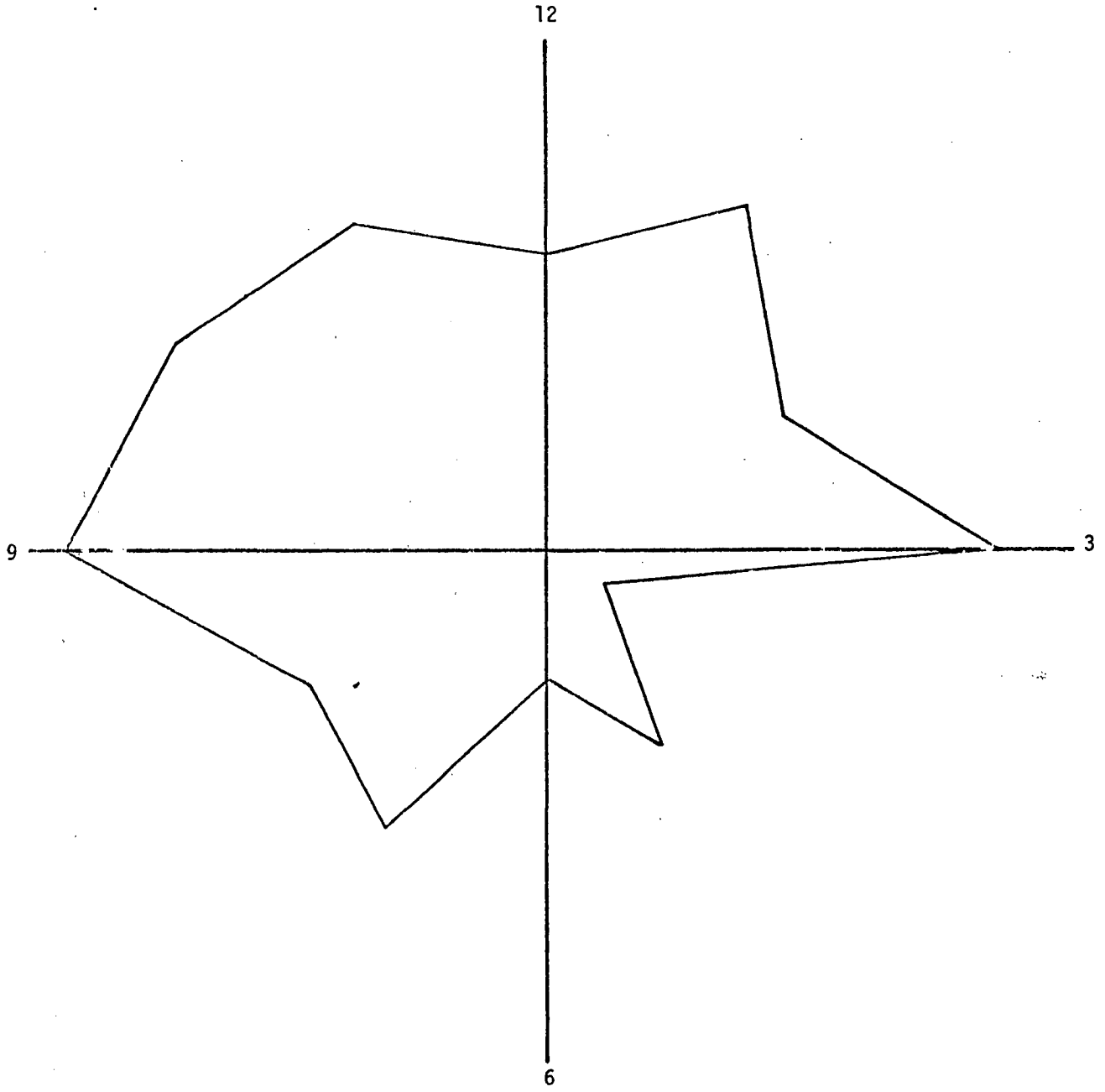


Figure 28. Mean cost of injury by o'clock direction of force of first impact.

Table 115. General area of damage by AIS level.

	AIS Level 0	1	2	3	4	5	6	Row Total
Undercarriage	56.3	34.3	4.5	3.7	0.0	0.0	1.1	1.3
Top	53.9	33.5	7.8	2.2	0.9	0.0	1.7	1.2
Right side	51.3	39.4	6.8	1.3	0.2	0.2	0.8	17.1
Left side	48.5	43.1	5.8	1.5	0.4	0.0	0.6	17.3
Front	51.3	39.9	6.9	1.3	0.2	0.0	0.4	55.6
Back	35.6	60.0	3.5	0.7	0.1	0.0	0.1	7.5
Column Total	19.8	41.7	6.4	1.3	0.2	0.1	0.5	19893

Table 116. Cost of injury by general area of damage.

	Mean	S.D.	N
Undercarriage	856.40	7864.00	262
Top	1516.30	11156.88	222
Right Side	579.40	5814.42	3387
Left Side	559.77	5990.00	3461
Front	361.46	4607.77	10904
Rear	197.38	2041.50	1479

Table 117. Cost of injury by horizontal impact area.

		Mean	S.D.	N
Distributed		497.71	5253.99	4710
Left or Right	Left	395.57	5209.94	2260
	Center	1213.00	9986.95	486
	Right	358.03	4876.48	2202
Front or Rear	Front	188.43	2733.06	2918
	Center	1241.65	8764.78	699
	Rear	459.17	5495.44	727
Front Corner		618.34	6087.31	2361
Back Corner		341.45	4283.06	2200

Table 118. Cost of injury by damage distribution

	Mean	S.D.	N
Wide Impact	439.78	5001.94	12937
Sideswipe	672.58	7001.41	1043
Rollover	1277.16	9120.58	293
Narrow Impact	801.96	7473.09	1528
Corner	159.32	2488.94	1982
Overhanging Str.	761.09	7752.02	384

Table 119. Cost of injury by extent of first impact.

	Mean	S.D.	N
1	164.08	2566.89	7213
2	204.04	2809.39	5679
3	728.47	6618.22	2918
4	2141.18	11377.71	603
5	5102.86	20136.41	182
6	7278.81	22281.39	114
7	414.62	665.53	37
8	29133.00	40616.59	13
9	4782.21	20345.03	80

Table 120. Object struck by AIS level.

	AIS Level							Row Total
	0	1	2	3	4	5	6	
Subcompact	53.9	41.5	3.8	0.5	0.1	0.1	0.1	6.6
Compact	53.5	39.0	5.8	1.1	0.2	0.1	0.3	8.6
Intermediate	50.2	41.8	6.2	1.0	0.2	0.1	0.4	13.1
Full-sized	46.8	45.9	5.7	1.1	0.1	0.0	0.3	29.7
Other vehicle	47.0	43.1	7.2	1.7	0.3	0.0	0.7	11.6
Non-fixed object	78.8	19.2	1.0	0.5	0.0	0.0	0.5	1.0
Fixed object	54.0	35.6	7.4	1.8	0.4	0.1	0.8	29.4
Column Total	50.8	40.8	6.3	1.3	0.2	0.1	0.5	20756

V. Usage

Now that the occupants of the vehicles and the accidents themselves have been described, we report the usage rates for various combinations of occupant variables. The usage rates are of interest in and of themselves, as a special effort was made (beyond the police report) to establish whether the seat belt was being worn or not. The actual usage rates were also essential in computing the seat belt effectiveness measures in later chapters.

As to who wears seat belts, the data show that age and sex play no role in determining belt usage in persons older than 9 years of age. What seems to be important is the role the occupant plays - drivers show a higher usage rate for both types of belts and except for extreme values, the size of the occupant is unimportant.

Table 121. Sex of occupant by restraint system usage.

	None Used	Lap Only	Lap and Shoulder	Row Total
Male	58.1	16.6	25.3	57.8
Female	57.4	17.4	25.2	42.2
Column Total	57.8	17.0	25.2	20483

Table 122. Age by restraint system usage

	None Used	Lap Only	Lap and Shoulder	Row Total
$\leq$ 9	73.5	13.1	13.4	1.8
10-25	60.1	15.4	24.5	46.0
26-55	55.2	18.3	26.5	42.5
56 & up	55.1	19.7	25.2	9.7
Column Total	55.7	17.0	25.3	20415

Table 123. Age by restraint system usage by sex.

	Male				Female			
	None Used	Lap Only	Lap and Shoulder	Row Total	None Used	Lap Only	Lap and Shoulder	Row Total
≤9	79.9	11.1	9.0	1.6	66.3	15.4	18.3	2.0
10-25	60.1	15.6	24.4	45.4	60.0	15.2	24.8	46.8
26-55	56.0	17.2	26.8	43.0	54.1	19.7	26.2	41.9
56 & up	53.5	20.5	26.0	9.9	57.3	18.5	24.2	9.3
Column Total	58.0	16.7	25.3	11779	57.4	17.4	25.2	8620

Table 124. Occupant role by restraint system used.

	None Used	Lap Only	Lap and Shoulder	Row Total
Driver	55.3	17.8	26.9	74.1
Passenger	65.1	14.5	20.4	25.9
Column Total	57.9	16.9	25.2	20584

Table 125. Occupant weight by restraint system usage.

	None Used	Lap Only	Lap and Shoulder	Row Total
$\leq$ 100	65.5	15.2	19.3	4.6
101 - 135	55.3	18.3	26.5	33.6
136 - 170	55.3	17.4	27.3	36.9
171 - 210	55.5	18.3	26.3	21.2
211 & up	54.9	15.0	30.1	3.8
Column Total	55.8	17.7	26.5	17273

Table 126. Occupant height in inches by restraint system usage.

	None Used	Lap Only	Lap and Shoulder	Row Total
≤ 60	62.8	16.8	20.4	5.8
61 - 66	56.1	17.9	26.0	37.3
67 - 72	54.6	17.5	27.9	47.6
73 & up	55.6	18.5	25.9	9.3
Column Total	55.7	17.7	26.6	17323

One of the most striking findings in the data is the sudden shift in belt usage between 1973 and 1974 model year vehicles. There is a strong shift from lap only belts to lap and shoulder belts. This is due to the starter interlock system mandated in 1974 model year cars and the coincident shift to inertia reel mechanisms for seat belts. Note that there is only a small drop in the usage rates in 1975 model year cars after the starter interlock requirement was eliminated. The shift remains relatively constant over breakdowns by age, sex, and seating position.

Table 127. Vehicle model year by restraint system usage.

	None Used	Lap Only	Lap and Shoulder	Row Total
1973	63.4	30.5	6.1	45.8
1974	52.2	5.8	41.9	43.2
1975	57.3	4.3	38.4	11.0
Column Total	57.9	16.9	25.1	20562

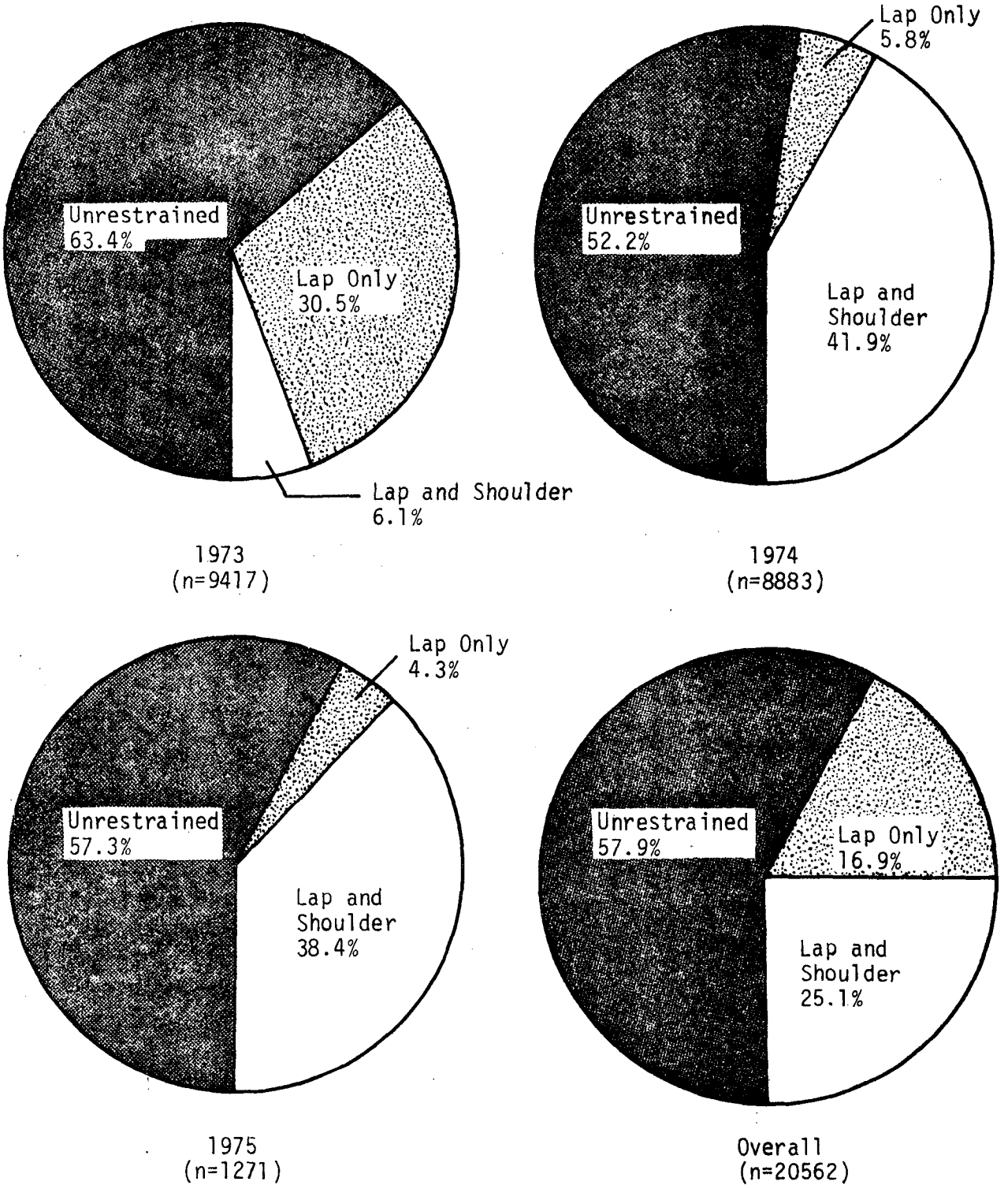


Figure 29. Restraint system usage distribution by model year.

Table 128. Sex of occupant by restraint system usage by vehicle model year.

		None Used	Lap Only	Lap & Shoulder	Row Total
1973	Male	63.6	29.9	6.5	56.5
	Female	62.9	31.4	5.6	43.5
	Column Total	63.3	30.6	6.1	9364
1974	Male	53.1	6.1	40.8	58.5
	Female	50.9	5.4	43.7	41.5
	Column Total	52.2	5.8	42.0	8842
1975	Male	56.2	5.2	38.6	59.9
	Female	58.8	3.1	38.1	40.1
	Column Total	57.2	4.3	38.4	2256

Table 129. Age by restraint system usage by vehicle model year.

	1973			1974			1975		
	None Used	Lap Only	Lap and Shoulder	None Used	Lap Only	Lap and Shoulder	None Used	Lap Only	Lap and Shoulder
≤9	81.4	18.6	0.0	68.3	8.3	23.4	55.6	5.6	38.9
10-25	65.2	28.9	5.9	55.5	4.9	39.7	58.4	3.4	38.2
26-55	61.3	32.5	6.2	48.1	6.4	45.5	56.2	4.6	39.1
56+	60.0	32.1	7.9	48.2	7.7	44.1	59.2	6.8	34.0

Table 130. Front seat position by restraint system usage by vehicle model year.

		None Used	Lap Only	Lap and Shoulder	Row Total
1973	Left	60.6	32.4	7.0	75.6
	Right	70.5	25.6	3.8	24.4
	Column Total	63.0	30.8	6.2	9265
1974	Left	49.8	5.7	44.5	74.7
	Right	57.5	5.5	37.0	25.3
	Column Total	51.8	5.6	42.6	8735
1975	Left	55.2	4.4	40.4	77.0
	Right	62.6	3.3	34.0	23.0
	Column Total	56.9	4.2	39.0	2231

The size of the vehicle shows an interaction with belt usage. Lap belt usage increases from subcompact to full-sized cars. On the other hand, lap and shoulder belt usage drops considerably with an increase in vehicle weight. Some makes of vehicles do show higher usage rates than others. Japanese makes, AMC vehicles, and Capris report high usage rates. Not surprising is the fact that bucket seats show a much higher lap and shoulder usage rate. This factor has remained constant over the different model years, but is reduced in importance in larger vehicles. The odometer readings indicate that the lap and shoulder usage rates drop considerably as mileage goes up.

Table 131. Vehicle weight by restraint system usage.

	None Used	Lap Only	Lap and Shoulder	Row Total
Subcompact	54.3	15.6	30.1	30.9
Compact	56.4	15.4	28.2	25.0
Intermediate	60.7	16.8	22.4	22.4
Full-sized	61.7	19.7	18.6	21.8
Column Total	57.9	16.7	25.4	19852

Table 132. Vehicle weight by restraint system usage by model vehicle year.

		None Used	Lap Only	Lap & Shoulder	Row Total
1973	Subcompact	58.1	31.9	10.0	28.3
	Compact	61.6	31.2	7.2	22.8
	Intermediate	66.9	29.0	4.1	22.4
	Full-sized	68.4	29.3	2.3	26.5
	Column Total	63.6	30.4	6.0	9073
1974	Subcompact	51.2	4.0	44.7	35.5
	Compact	52.6	4.5	43.0	26.7
	Intermediate	54.2	6.3	39.5	20.6
	Full-sized	50.8	8.9	40.3	17.2
	Column Total	52.1	5.5	42.4	8579
1975	Subcompact	53.6	2.7	43.7	23.8
	Compact	53.4	2.7	43.9	27.2
	Intermediate	59.3	7.3	33.3	28.8
	Full-sized	61.8	4.1	33.9	20.2
	Column Total	56.9	4.4	38.8	2178

Table 133. Vehicle make by restraint system usage.

	None Used	Lap Only	Lap and Shoulder	Row Total
Chevrolet	57.1	17.9	25.0	22.0
Oldsmobile	58.8	18.0	23.2	5.7
Pontiac	60.2	17.8	22.0	6.9
Buick	58.5	16.6	25.0	3.9
Cadillac	58.6	16.5	24.9	4.6
GM Total	58.3	17.7	24.1	43.1
Plymouth	63.1	23.1	13.9	5.6
Dodge	60.5	22.0	17.5	3.7
Chrysler Total	62.1	22.6	15.3	9.3
Ford	59.8	15.2	24.9	20.8
Mercury	58.6	16.5	24.9	4.6
Capri	48.4	18.8	32.8	1.5
Ford Total	59.0	15.6	25.4	26.9
AMC	56.7	20.1	23.2	5.2
VW	67.6	2.4	30.0	4.3
Datsun	53.5	15.5	31.0	2.4
Toyota	42.9	13.3	43.8	3.6
Mazda	53.3	25.5	21.2	1.3
Japanese Total	48.2	16.3	35.5	7.3
Other	50.9	15.9	33.2	6.6
Column Total	57.9	16.8	25.2	20347

Table 134. Make of vehicle by restraint system usage for 1973 model year vehicles

	None Used	Lap only	Lap and Shoulder	Row Total
Chevrolet	63.8	32.2	4.0	52.1
Oldsmobile	68.2	30.1	1.7	14.9
Pontiac	67.0	29.3	3.7	19.0
Cadillac	66.9	29.9	3.1	3.8
Buick	66.9	33.1	0.0	9.8
GM Total	65.5	31.2	3.3	3926
Plymouth	60.5	36.0	3.6	59.8
Dodge	58.0	37.0	5.1	40.2
Chrysler Total	59.5	36.4	4.2	935
Ford	67.2	29.1	3.7	75.9
Mercury	64.2	30.6	5.2	18.1
Capri	45.3	39.6	15.1	6.0
Ford Total	65.4	30.0	4.6	2330
AMC	61.3	36.3	2.4	416
VW	72.2	3.8	23.9	443
Datsun	49.4	40.0	10.6	28.7
Toyota	62.1	33.1	4.8	42.8
Mazda	52.5	38.5	8.9	28.5
Japanese Total	55.7	36.6	7.6	628
Other	51.9	28.2	19.9	609
Column Total	63.4	30.5	6.1	8428

Table 135. Vehicle make by restraint system usage for 1974 model year vehicles.

	None Used	Lap Only	Lap and Shoulder	Row Total
Chevrolet	49.8	6.8	43.4	57.8
Oldsmobile	48.5	6.7	44.8	13.4
Pontiac	50.8	2.8	46.5	14.4
Cadillac	55.3	7.5	37.3	5.0
Buick	50.2	3.9	45.9	9.4
GM Total	50.0	6.0	44.0	3235
Plymouth	67.7	9.0	23.3	60.6
Dodge	66.3	5.4	28.2	39.4
Chrysler Total	67.2	7.6	25.3	792
Ford	53.7	5.5	40.8	78.1
Mercury	47.0	6.7	46.3	15.4
Capri	50.6	2.4	47.1	6.7
Ford Total	52.5	5.3	42.2	2,531
AMC	53.1	10.7	36.1	559
VW	64.0	1.1	34.9	372
Datsun	58.4	1.1	40.5	37.9
Toyota	23.8	2.3	73.9	49.2
Mazda	52.7	1.1	46.2	12.8
Japanese Total	40.6	1.7	57.7	709
Other	49.3	5.2	45.5	600
Column Total	52.3	5.7	42.1	8802

Table 136. Vehicle make by restraint system usage for 1975 model year vehicles.

	None Used	Lap Only	Lap and Shoulder	Row Total
Chevrolet	57.3	2.2	40.4	52.8
Oldsmobile	54.2	3.5	42.3	13.6
Pontiac	55.9	7.1	37.1	16.3
Cadillac	65.3	1.4	33.3	6.9
Buick	52.0	4.6	43.4	10.4
GM Total	56.7	3.4	40.0	1041
Plymouth	55.9	18.9	25.2	63.3
Dodge	46.8	14.5	38.7	36.7
Chrysler Total	52.7	17.2	30.2	169
Ford	58.5	4.2	37.3	78.1
Mercury	75.0	0.0	25.0	21.1
Capri	60.0	0.0	40.0	0.8
Ford Total	62.0	3.3	34.7	608
AMC	59.4	0.0	40.6	69
VW	54.7	0.0	45.3	53
Datsun	37.1	0.0	62.9	75.3
Toyota	55.5	0.8	43.7	22.5
Mazda	100.0	0.0	0.0	2.5
Japanese Total	52.5	0.6	46.8	158
Other	53.0	8.2	38.8	134
Column Total	57.3	4.3	38.4	2,234

Table 137. Type of front seat by restraint system usage.

	None Used	Lap Only	Lap and Shoulder	Row Total
Bench	61.4	18.2	20.4	47.4
Bucket	55.1	15.2	29.8	52.6
Column Total	58.1	16.6	25.3	18129

Table 138. Type of seat by restraint system usage by vehicle model year.

		None Used	Lap Only	Lap & Shoulder	Row Total
1973	Bench	67.0	30.2	2.8	51.5
	Bucket	59.6	30.9	9.5	48.5
	Column Total	63.4	30.6	6.0	8184
1974	Bench	54.9	7.0	38.0	43.2
	Bucket	51.3	3.9	44.8	56.8
	Column Total	52.9	5.2	41.9	7862
1975	Bench	60.1	5.3	34.7	47.0
	Bucket	54.0	4.0	42.0	53.0
	Column Total	56.9	4.7	38.5	2060

Table 139. Type of seat by restraint system usage by vehicle weight.

		None Used	Lap Only	Lap and Shoulder	Row Total
Subcompact	Bench	64.8	10.5	24.6	4.5
	Bucket	54.2	15.5	30.3	95.5
	Column Total	54.7	15.3	30.0	5716
Compact	Bench	60.4	15.6	24.1	45.9
	Bucket	53.3	14.3	32.3	54.1
	Column Total	56.6	14.9	28.6	4470
Intermediate	Bench	61.7	17.8	20.5	68.9
	Bucket	59.2	15.8	25.0	31.1
	Column Total	60.9	17.2	21.9	3931
Full-sized	Bench	61.6	20.5	18.0	91.0
	Bucket	69.3	10.3	20.3	9.0
	Column Total	62.3	19.5	18.2	3884

Table 140. Odometer reading by restraint system usage.

	None Used	Lap Only	Lap and Shoulder	Row Total
<5000	47.4	10.0	42.6	19.3
5,000 - 9,999	54.3	7.4	38.3	15.1
10,000 - 19,999	58.8	15.4	25.8	28.0
20,000 & up	64.6	23.9	11.5	37.6
Column Total	58.1	16.4	25.6	17651

Table 141. Sex by restraint system usage by odometer reading.

		None Used	Lap Only	Lap and Shoulder	Row Total
<5,000	Male	48.2	9.5	42.3	56.0
	Female	46.4	10.7	42.9	44.0
	Column Total	47.4	10.0	42.5	3396
5,000- 9,999	Male	54.0	6.8	39.2	53.7
	Female	54.5	8.1	37.4	46.3
	Column Total	54.2	7.4	38.3	2653
10,000-19,999	Male	58.4	14.8	26.9	56.1
	Female	59.1	16.2	24.7	43.9
	Column Total	58.7	15.4	25.9	4904
20,000 & up	Male	64.0	23.6	12.4	61.7
	Female	65.1	24.8	10.1	38.3
	Column Total	64.4	24.0	11.5	6605

Table 142. Odometer reading by restraint system usage by vehicle model year.

		None Used	Lap Only	Lap and Shoulder	Row Total
1973	<5,000	53.9	38.9	7.2	7.2
	5,000- 9,999	63.8	29.7	6.5	4.2
	10,000-19,999	60.7	31.8	7.5	24.7
	20,000 & up	65.8	28.7	5.4	63.8
	Column Total	63.6	30.3	6.1	8077
1974	<5,000	41.9	4.2	53.9	22.3
	5,000- 9,999	49.0	4.2	46.8	23.8
	10,000-19,999	58.1	4.0	37.9	35.3
	20,000 & up	60.3	7.2	32.5	18.5
	Column Total	52.7	4.7	42.6	7592
1975	<5,000	52.6	3.9	43.5	56.4
	5,000- 9,999	66.5	4.1	29.4	26.1
	10,000-19,999	51.3	8.0	40.8	13.4
	20,000 & up	58.6	9.0	32.4	4.1
	Column Total	56.3	4.7	39.0	1968

Another factor influencing usage rates is the type of environment with which the car is interacting. For example, the usage rates, especially for lap and shoulder belts, falls appreciably in rural areas. This difference is magnified in older cars. Similarly, limited access roads are associated with an increased lap and shoulder usage rate. There is a concurrent increase in usage of lap and shoulder with an increase in the number of lanes.

Table 143. Accident area by restraint system usage.

	None Used	Lap Only	Lap and Shoulder	Row Total
Rural	64.7	14.4	20.9	11.7
Urban	57.0	17.3	25.8	88.3
Column Total	57.9	16.9	25.2	20584

Table 144. Accident area by restraint system usage by vehicle model year.

		None Used	Lap Only	Lap & Shoulder	Row Total
1973	Urban	62.4	31.3	6.4	87.8
	Rural	70.8	24.7	4.4	12.2
	Column Total	63.4	30.5	6.1	9418
1974	Urban	51.4	5.9	42.8	87.9
	Rural	58.6	5.3	36.1	12.1
	Column Total	52.2	5.8	41.6	8881
1975	Urban	56.9	4.4	38.7	92.1
	Rural	61.5	3.4	35.2	7.9
	Column Total	57.3	4.3	38.4	2264

Table 145. Limited access by restraint system usage.

	None Used	Lap Only	Lap and Shoulder	Row Total
Limited Access	52.9	18.5	28.5	13.9
Free Access	58.8	16.6	24.7	86.1
Column Total	57.9	16.8	25.2	19058

Table 146. Sex by restraint system usage by type of road access.

		None Used	Lap Only	Lap and Shoulder	Row Total
Limited Access	Male	52.7	18.0	29.3	58.5
	Female	52.9	19.3	27.8	41.5
	Column Total	52.8	18.5	28.7	2635
Free Access	Male	58.9	16.4	24.7	57.7
	Female	58.4	16.9	24.7	42.3
	Column Total	58.7	16.6	24.7	16326

Table 147. Age by restraint system usage by type of road access.

		None Used	Lap Only	Lap and Shoulder	Row Total
Limited Access	≤9	74.2	12.9	12.9	1.2
	10-25	54.3	18.6	27.1	39.7
	26-55	51.7	18.0	30.3	50.9
	56 & up	48.6	22.0	29.4	8.8
	Column Total	52.7	18.5	28.8	2629
Free Access	≤9	74.8	13.8	11.4	1.8
	10-25	61.2	14.6	24.2	46.6
	26-55	55.7	18.4	25.9	41.3
	56 & up	55.8	19.4	24.8	10.2
	Column Total	58.6	16.6	24.7	16267

Table 148. Number of lanes by restraint system usage.

	None Used	Lap Only	Lap and Shoulder	Row Total
1	54.6	13.2	32.2	1.7
2	59.6	15.7	24.7	34.4
3	55.1	20.0	24.9	5.2
4	54.8	17.6	27.6	39.5
5	59.5	12.9	27.5	4.0
6	57.9	16.7	25.4	8.9
7 & up	49.0	20.4	30.6	6.4
Column Total	56.5	16.9	26.5	15631

One reasonable hypothesis is that persons use seat belts only when the occupant is likely to be in danger. Some of the data exemplifing this point are those developing from when and where people use seat belts.

In particular note that people do not use seat belts at night, especially after midnight. This factor is confounded by day of week. On Friday the distribution is similar except there is greater usage in the evening hours. Saturday reports a low usage rate in the early morning hours and a relatively constant rate over the rest of the day. Sunday shows an inconsistent pattern of usage. One should note that, as the number of accidents in the midnight to 6:00 AM category increases from week day to weekend, the usage rate for lap and shoulder belts also goes up. The time of highest usage, however, is the morning rush hour. The trend of increased belt usage in the early morning runs contrary to the overall trend which shows usage of lap and should belts decreasing with the weekend.

When one considers the surface condition, one observes that the three different surface condition categories do not indicate differential usage rates.

Table 149. Time of accident by restraint system usage.

	None Used	Lap Only	Lap and Shoulder	Row Total
Midnight - 5:59 am	66.2	13.5	20.3	16.3
6:00 - 8:59 am	51.5	17.0	31.5	7.9
9:00 - 3:59 pm	54.9	19.2	25.9	32.4
4:00 - 5:59 pm	55.4	16.2	28.4	15.2
6:00 - 11:59 pm	59.3	16.8	23.9	28.1
Column Total	57.8	17.0	25.2	20462

Table 150. Time of accident by restraint system usage by sex.

	Male				Female			
	None Used	Lap Only	Lap and Shoulder	Row Total	None Used	Lap Only	Lap and Shoulder	Row Total
Midnight - 5:59 am	65.7	13.8	20.6	20.4	66.0	13.7	20.3	10.8
6:00 - 8:59 am	53.2	14.6	32.2	7.2	49.6	19.8	30.6	9.0
9:00 - 3:59 pm	54.8	19.2	26.0	29.9	55.0	19.2	25.8	36.0
4:00 - 5:59 pm	54.4	16.6	29.0	13.7	56.4	15.8	27.8	17.2
6:00 - 11:59 pm	58.8	16.7	24.5	28.8	60.0	17.0	23.0	27.1
Column Total	58.0	16.7	25.3	11773	57.3	17.5	25.2	8627

Table 151. Time by restraint system usage by day of the week.

		None Used	Lap Only	Lap and Shoulder	Row Total
Monday Through Thursday	Midnight - 5:59 am	69.4	12.8	17.9	10.2
	6:00 - 8:59 am	50.9	16.5	32.6	10.9
	9:00 - 3:59 pm	54.7	18.6	26.7	35.4
	4:00 - 5:59 pm	53.1	16.8	30.1	16.5
	6:00 - 11:59 pm	60.0	15.6	24.4	27.0
	Column Total	56.9	16.7	26.4	10723
Friday	Midnight - 5:59 am	64.3	13.5	22.1	14.4
	6:00 - 8:59 am	43.8	22.1	34.1	7.4
	9:00 - 3:59 pm	51.0	20.7	28.3	28.2
	4:00 - 5:59 pm	57.1	18.1	24.8	16.5
	6:00 - 11:59 pm	56.6	19.7	23.7	33.6
	Column Total	55.3	19.0	25.7	3492
Saturday	Midnight - 5:59 am	66.2	15.3	18.5	26.6
	6:00 - 8:59 am	61.7	16.7	21.7	3.3
	9:00 - 3:59 pm	57.9	20.1	22.0	30.2
	4:00 - 5:59 pm	57.7	17.4	24.9	11.0
	6:00 - 11:59 pm	56.1	16.8	27.1	28.8
	Column Total	59.7	17.5	22.8	3595
Sunday	Midnight - 5:59 am	62.5	12.7	24.8	30.5
	6:00 - 8:59 am	71.2	8.2	20.5	2.7
	9:00 - 3:59 pm	56.8	18.8	24.5	28.9
	4:00 - 5:59 pm	61.5	9.3	29.2	13.6
	6:00 - 11:59 pm	66.3	16.5	17.2	24.3
	Column Total	61.9	14.8	23.3	2688

Table 152. Time of accident by restraint system usage by vehicle model year.

		None Used	Lap Only	Lap and Shoulder	Row Total
1973	Midnight - 5:59 am	72.6	23.3	4.1	15.5
	6:00 - 8:59 am	59.6	31.5	8.9	7.9
	9:00 - 3:59 pm	59.6	33.6	6.7	33.8
	4:00 - 5:59 pm	60.4	31.6	8.1	14.8
	6:00 - 11:59 pm	65.2	30.1	4.7	27.9
	Column Total	63.3	30.6	6.1	9358
1974	Midnight - 5:59 am	58.9	6.6	34.5	16.7
	6:00 - 8:59 am	45.0	5.3	49.7	8.1
	9:00 - 3:59 pm	50.0	6.3	43.7	31.8
	4:00 - 5:59 pm	51.3	3.9	44.8	15.1
	6:00 - 11:59 pm	53.2	6.0	40.8	28.3
	Column Total	52.2	5.8	42.0	8829
1975	Midnight - 5:59 am	69.7	3.8	26.4	18.5
	6:00 - 8:59 am	43.6	3.1	53.3	7.1
	9:00 - 3:59 pm	53.2	5.0	41.6	29.1
	4:00 - 5:59 pm	52.8	3.4	43.8	16.7
	6:00 - 11:59 pm	58.7	4.7	36.6	28.5
	Column Total	57.1	4.4	38.6	2252

Table 153. Light condition by restraint system usage.

	None Used	Lap Only	Lap and Shoulder	Row Total
Daylight	55.0	18.0	27.0	61.3
Dawn	47.9	14.4	37.8	1.0
Dusk	55.5	22.3	22.1	2.3
Dark	65.0	15.6	19.4	15.2
Dark - lighted	62.9	13.9	23.2	13.8
Dark - not lighted	60.4	15.1	24.5	6.5
Column Total	58.0	17.0	25.0	19761

Table 154. Light condition by restraint system usage by sex.

	Male				Female			
	None Used	Lap Only	Lap and Shoulder	Row Total	None Used	Lap Only	Lap and Shoulder	Row Total
Daylight	55.0	17.7	27.3	56.5	55.1	18.3	26.6	68.0
Dawn	52.3	5.4	42.3	1.0	41.6	27.3	31.2	0.9
Dusk	53.0	21.5	25.6	2.4	58.9	23.9	17.2	2.2
Dark	64.5	16.0	19.4	17.6	65.3	15.1	19.5	11.7
Dark - lighted	63.5	14.3	22.2	15.0	61.4	13.6	25.0	11.8
Dark - not lighted	58.3	14.8	26.9	7.5	64.1	16.0	19.8	5.0
Column Total	58.1	16.7	25.2	11314	57.5	17.4	25.1	8287

Table 155. Light condition by restraint system usage by model year.

		None Used	Lap Only	Lap and Shoulder	Row Total
1973	Daylight	59.4	33.2	6.8	62.4
	Dawn	56.9	30.6	12.5	0.8
	Dusk	58.1	40.9	1.1	2.1
	Dark	69.6	26.7	3.7	15.0
	Dark-lighted	70.3	24.8	4.9	13.2
	Dark-not lighted	66.7	26.6	6.7	6.4
	Column Total	63.3	30.8	6.0	8934
1974	Daylight	50.2	5.3	44.5	59.9
	Dawn	44.9	2.0	53.1	1.2
	Dusk	49.3	11.3	39.4	2.4
	Dark	59.3	7.3	33.4	15.8
	Dark-lighted	56.0	5.4	38.7	14.0
	Dark-not lighted	53.8	5.7	40.5	6.8
	Column Total	52.6	5.8	41.6	8500
1975	Daylight	52.9	3.6	43.4	61.3
	Dawn	27.8	16.7	55.6	0.8
	Dusk	68.3	3.2	28.6	2.8
	Dark	70.0	3.5	26.5	13.9
	Dark-lighted	62.0	6.2	31.8	15.5
	Dark-not lighted	61.7	7.0	31.3	5.7
	Column Total	57.5	4.3	38.5	2245

Table 156. Day of week by restraint system usage.

	None Used	Lap Only	Lap and Shoulder	Row Total
Monday	57.9	16.9	25.1	13.1
Tuesday	57.1	16.9	26.0	13.0
Wednesday	57.6	15.6	26.8	12.8
Thursday	55.5	17.1	27.4	13.4
Friday	55.4	18.9	25.7	17.1
Saturday	59.8	17.4	22.7	17.5
Sunday	61.8	14.8	23.4	13.1
Column Total	57.9	16.9	25.2	20584

Table 157. Day of week by restraint system usage by sex.

	Male				Female			
	None Used	Lap Only	Lap and Shoulder	Row Total	None Used	Lap Only	Lap and Shoulder	Row Total
Monday	56.4	17.7	25.9	13.1	60.0	15.9	24.1	13.1
Tuesday	57.1	17.9	25.0	12.2	56.8	15.9	27.3	14.0
Wednesday	59.0	14.0	27.1	12.4	55.7	17.7	26.5	13.3
Thursday	55.2	15.8	29.0	12.8	55.7	18.8	25.6	14.3
Friday	56.2	18.2	25.6	16.7	54.2	19.9	25.9	17.7
Saturday	61.3	17.4	21.3	18.8	57.5	17.5	25.0	15.8
Sunday	60.4	14.8	24.8	14.0	63.8	15.1	21.1	11.9
Column Total	58.1	16.6	25.3	11829	57.4	17.4	25.2	8653

Table 158. Month of accident by restraint system usage by vehicle model year.

	1973				1974				1975			
	None Used	Lap Only	Lap and Shoulder	Row Total	None Used	Lap Only	Lap and Shoulder	Row Total	None Used	Lap Only	Lap and Shoulder	Row Total
January	60.2	32.2	7.6	5.6	47.9	8.6	43.6	6.6	49.1	3.5	47.4	5.0
February	62.9	30.1	7.0	6.7	55.8	5.5	38.7	7.2	43.5	5.6	50.9	4.8
March	61.1	32.9	6.0	9.0	49.9	6.2	43.9	7.4	61.7	2.5	35.8	8.9
April	66.1	28.7	5.2	6.5	58.7	4.8	36.5	5.6	62.9	5.3	31.8	6.7
May	67.6	25.2	7.1	9.4	56.9	4.8	38.3	9.4	48.7	4.3	47.0	10.2
June	66.5	27.2	6.3	10.4	52.5	6.5	41.0	9.0	64.8	3.8	31.4	11.5
July	61.7	33.4	4.9	8.9	48.1	5.1	46.8	9.3	60.1	5.2	34.7	11.0
August	64.2	30.3	5.5	9.2	53.8	5.9	40.3	9.7	62.2	4.3	33.6	13.4
September	59.5	32.7	7.8	10.4	59.4	7.2	33.4	10.9	66.1	1.0	32.9	12.6
October	66.1	28.2	5.7	8.0	52.9	4.2	42.9	8.8	43.3	9.8	46.9	7.9
November	58.9	35.4	5.7	8.2	44.4	6.1	49.5	8.6	44.2	4.7	51.2	3.8
December	65.3	30.2	4.5	7.8	45.2	4.8	50.1	7.6	53.7	4.2	42.1	4.2
Column Total	63.4	30.5	6.1	9417	52.2	5.8	41.9	8882	57.3	4.3	38.4	2263

Table 159. Surface condition by restraint system usage.

	None Used	Lap Only	Lap and Shoulder	Row Total
Dry	58.2	16.6	25.2	77.4
Wet	56.2	18.7	25.1	18.2
Snow/Ice	59.5	16.0	24.5	4.4
Column Total	57.9	17.0	25.1	19816

Table 160. Surface condition by restraint system usage by sex.

	Male				Female			
	None Used	Lap Only	Lap and Shoulder	Row Total	None Used	Lap Only	Lap and Shoulder	Row Total
Dry	58.6	16.1	25.3	77.3	57.6	17.3	25.1	77.6
Wet	56.1	19.5	24.4	18.4	55.8	17.9	26.3	17.8
Snow/Ice	58.8	14.0	27.2	4.3	60.3	18.4	21.3	4.6
Column Total	58.1	16.7	25.2	11389	57.4	17.5	25.1	8327

Table 161. Surface condition by restraint system usage by vehicle model year

		None Used	Lap Only	Lap and Shoulder	Row Total
1973	Dry	63.6	30.6	5.8	77.4
	Wet	60.2	33.0	6.8	18.6
	Snow/Ice	68.4	24.9	6.6	4.0
	Column Total	63.2	30.8	6.0	8971
1974	Dry	52.2	5.5	42.3	76.1
	Wet	53.4	5.9	40.7	18.8
	Snow/Ice	53.0	10.7	36.3	5.1
	Column Total	52.5	5.8	41.7	8586
1975	Dry	59.2	3.7	37.1	82.9
	Wet	48.9	8.7	42.4	13.9
	Snow/Ice	54.9	2.8	42.3	3.2
	Column Total	57.6	4.4	38.0	2237

One might hypothesize that seat belts are worn primarily by people who are involved in a certain type of accident. Speaking to this point, we can see that lap and shoulder users are underrepresented in head-on collisions, rollovers, and accidents involving striking a fixed object. When model year is taken into account, angle striking is underrepresented in 1973 and 1974 vehicles. Rear striking and sideswiping are underrepresented in 1975 vehicles.

Table 162. Crash configuration by restraint system usage.

	None Used	Lap Only	Lap and Shoulder	Row Total
Head-on	63.9	16.4	19.7	6.6
Rear striking	56.1	15.7	28.2	15.4
Struck in rear	46.7	20.4	32.9	6.7
Angle striking	57.9	17.4	24.8	21.9
Struck in left side	56.5	17.4	26.1	13.2
Struck in right side	56.6	16.3	27.1	13.3
Rollover & other	69.6	8.7	21.7	1.9
Sideswipe	57.1	14.9	28.0	3.1
Struck fixed object	66.1	15.2	18.7	13.1
Side of vehicle into fixed object	61.7	16.5	21.9	4.9
Column Total	58.4	16.6	25.1	19519

Table 163. Crash configuration by restraint system usage for 1973 model year vehicles.

	None Used	Lap Only	Lap and Shoulder	Row Total
Head-on	69.8	28.1	2.1	7.0
Rear striking	64.0	29.3	6.7	13.4
Struck in rear	50.6	35.2	14.2	7.9
Angle striking	61.7	33.0	5.3	21.4
Struck left side	63.3	30.7	6.1	14.1
Struck right side	63.1	31.7	5.2	12.9
Rollover & other	79.6	14.3	6.1	1.7
Sideswipe	62.6	27.2	10.2	2.9
Struck fixed object	72.0	23.9	4.1	14.3
Side of vehicle into fixed object	61.2	31.5	7.4	4.4
Column Total	63.9	30.0	6.1	8865

Table 164. Crash configuration by restraint system usage for 1974 model year vehicles.

	None Used	Lap Only	Lap and Shoulder	Row Total
Head-on	58.0	5.0	37.0	6.6
Rear striking	47.4	8.1	44.5	16.5
Struck in rear	41.5	3.5	55.0	5.8
Angle striking	54.9	5.2	39.9	22.0
Struck left side	49.7	4.8	45.5	12.8
Struck right side	51.3	4.0	44.7	13.7
Rollover & other	58.7	4.8	36.5	2.0
Sideswipe	51.2	6.2	42.6	3.4
Struck fixed object	59.4	7.1	33.5	12.0
Side of vehicle into fixed object	60.9	6.3	32.9	5.3
Column Total	52.7	5.6	41.6	8476

Table 165. Crash configuration by restraint system usage for 1975 model year vehicles.

	None Used	Lap Only	Lap and Shoulder	Row Total
Head-on	60.4	7.9	31.7	4.7
Rear striking	62.7	2.6	34.6	19.3
Struck in rear	45.4	2.5	52.1	5.5
Angle striking	54.6	4.3	41.1	23.7
Struck in left side	52.5	6.5	41.4	12.1
Struck in right side	53.4	3.2	43.5	11.7
Rollover & other	76.4	5.5	18.2	2.6
Sideswipe	62.7	5.1	32.2	2.6
Struck fixed object	63.1	5.5	31.4	12.7
Side of vehicle into fixed object	67.0	3.8	29.2	4.9
Column Total	58.0	4.4	37.6	2155

If crashes are classed into severity groupings, one can observe that, for all model years, the most severe accident group (type 1) shows the lowest usage rate. All other trends are similar to those discussed before. Once again the use of a special damage severity rating shows inconsistent results.

Table 166 . Crash type by restraint system usage by vehicle model year.

		1973			1974			1975		
		None Used	Lap Only	Lap and Shoulder	None Used	Lap Only	Lap and Shoulder	None Used	Lap Only	Lap and Shoulder
Crash Type	1	70.1	25.6	4.2	59.3	6.2	34.5	64.7	5.6	29.7
	2	63.2	31.2	5.7	50.5	4.4	45.1	52.8	4.9	42.3
	3	62.6	31.6	5.8	51.7	6.4	41.9	58.3	3.6	38.2
	4	53.8	33.1	13.2	45.1	4.5	50.4	51.1	3.4	45.5

Table 167. Damage severity by restraint system usage

	None Used	Lap only	Lap and Shoulder	Row total
Minor	56.6	26.9	16.5	46.0
Moderate	59.6	24.2	16.2	38.1
Moderately Severe	65.5	21.5	13.0	11.3
Severe	59.6	24.8	15.3	4.6
Column Total	58.9	25.1	15.9	17010

Table 168 . Damage severity by restraint system usage by vehicle model year.

		None Used	Lap Only	Lap and Shoulder	Row Total
1973	Minor	62.6	5.4	32.0	43.6
	Moderate	65.6	6.6	27.8	40.6
	Moderately Severe	71.7	4.2	24.1	11.1
	Severe	65.9	6.9	27.2	4.8
	Column Total	65.0	5.8	29.2	7805
1974	Minor	51.6	43.8	4.6	46.6
	Moderate	53.4	41.6	5.1	36.4
	Moderately Severe	62.5	33.6	3.9	12.4
	Severe	52.6	43.9	3.5	4.6
	Column Total	53.6	41.7	4.7	7381
1975	Minor	53.8	41.5	4.7	51.9
	Moderate	55.9	38.4	5.6	33.3
	Moderately Severe	63.6	34.0	2.4	11.2
	Severe	63.6	27.3	9.1	3.5
	Column Total	55.9	39.1	4.9	1866

Similarly, one can observe that, after rollover accidents, which have the lowest rate, usage rate increases as the impact site of the collision moves toward the rear.

In addition, the severity of the accident as measured by both an extent of impact scale and an assessment of the danger of striking certain objects is inversely related to the usage rate.

Table 169. Impact site by restraint system usage.

	None Used	Lap Only	Lap and Shoulder	Row Total
Front	60.0	16.3	23.7	57.0
Side	57.3	16.6	26.0	34.4
Rear	46.7	20.4	32.9	6.7
Rollover	69.6	8.7	21.7	1.9
Column Total	58.4	16.6	25.1	19519

Table 170. Impact site by restraint system usage by vehicle model year.

		None Used	Lap Only	Lap and Shoulder	Row Total
1973	Front	65.9	29.2	4.9	56.1
	Side	62.9	30.9	6.3	34.3
	Rear	50.6	35.2	14.2	7.9
	Rollover	79.6	14.3	6.1	1.7
	Column Total	63.9	30.0	6.1	8865
1974	Front	54.1	6.4	39.6	57.1
	Side	52.1	4.8	43.0	35.2
	Rear	41.5	3.5	55.0	5.8
	Rollover	58.7	4.8	36.5	2.0
	Column Total	52.7	5.6	41.6	8477
1975	Front	59.7	4.3	36.2	60.4
	Side	55.9	4.7	39.4	31.5
	Rear	45.4	2.5	52.1	5.5
	Rollover	76.4	5.5	18.2	2.6
	Column Total	58.0	4.4	37.6	2155

Table 171. Extent of first impact by usage

		None Used	Lap Only	Lap and Shoulder	Row Total
	1	41.1	43.6	46.3	42.8
	2	33.7	34.5	32.9	33.6
	3	18.9	16.1	15.3	17.5
Extent	4	3.9	3.0	3.3	3.6
of	5	1.0	1.3	1.1	1.1
First	6	0.6	0.5	0.8	0.6
Impact	7	0.2	0.3	0.2	0.2
	8	0.1	0.1	0.0	0.1
	9	0.5	0.6	0.1	0.4
Column Total		58.9	16.0	25.2	16990

Table 172. Extent of first impact by restraint system usage by vehicle model year.

		1973				1974				1975			
		None Used	Lap Only	Lap and Shoulder	Row Total	None Used	Lap Only	Lap and Shoulder	Row Total	None Used	Lap Only	Lap and Shoulder	Row Total
Extent of First Impact	1	63.4	31.5	5.1	40.0	51.0	4.7	44.3	44.2	53.1	5.4	41.5	49.2
	2	64.5	28.6	6.9	35.8	53.2	4.8	41.9	32.5	56.3	4.7	39.0	29.2
	3	68.6	25.8	5.5	17.9	58.3	4.8	36.8	17.2	60.4	4.4	35.2	17.3
	4	70.2	24.4	5.4	3.8	56.0	2.5	41.5	3.8	66.7	5.1	28.2	2.1
	5	59.6	32.6	7.9	1.1	50.0	6.8	43.2	1.0	50.0	6.3	43.8	0.9
	6	63.2	26.3	10.5	0.5	45.9	4.9	49.2	0.8	66.7	0.0	33.3	0.3
	7	47.1	52.9	0.0	0.2	53.3	0.0	46.7	0.2	66.7	0.0	33.3	0.2
	8	81.8	18.2	0.0	0.1	100.0	0.0	0.0	0.0	66.7	33.3	0.0	0.2
	9	61.4	38.6	0.0	0.6	82.4	0.0	17.6	0.2	86.7	0.0	13.3	0.8
Column Total		64.9	29.2	5.8	7798	53.2	4.7	42.1	7311	55.9	5.0	39.1	1859

Table 173. Object struck by restraint system usage.

	None Used	Lap Only	Lap and Shoulder	Row Total
Subcompact	52.7	15.3	32.0	6.6
Compact	56.5	17.4	26.1	8.5
Intermediate	56.7	18.8	24.5	13.3
Full sized	56.0	17.0	26.9	30.0
Other vehicle	56.6	17.1	26.3	11.5
Non-fixed object	47.8	32.2	20.0	1.0
Fixed object	63.0	15.2	21.7	29.2
Column Total	58.0	16.8	25.2	20302

VI. Belt Effectiveness

The raison d'être of this project is to estimate seat belt effectiveness. The first volume of this report is devoted exclusively to this end using mathematical models. This section of this volume will provide a brief summary of the results of that volume (without the mathematics) and then present some of the basic data.

Because of the problems that were encountered in analyzing some of the data, estimates of belt effectiveness could not be obtained using the methods of the first volume for all possible breakdowns. Keeping in mind that this is only a crude estimate of belt effectiveness, the reader can calculate the seat belt effectiveness for various tables in this volume using the following formula:

$$\frac{\%\text{injured with no belt usage} - \%\text{ injured using belt}}{\%\text{ injured with no belt usage}}$$

In this manner effectiveness can be quickly (but crudely) estimated for various combinations of belts, AIS levels, and demographical variables.

The effectiveness measures estimated in Volume I will be summarized first. One can observe that the lap and shoulder belts are more effective than the lap only belts except in the case of fatalities (a very small part of the sample). Lap and shoulder belts show an injury reduction of almost 50 percent at all injury levels. Lap only belts are not as effective in reducing AIS≥2 level injuries, but are almost as effective in preventing severe injuries (AIS≥3).

The age of the occupant is also important. We note that effectiveness of both types of belts increases with age. In addition, the lap only belts show a much larger increase in effectiveness as opposed to the lap and shoulder belts. Note also that the overall trend of lap belts becoming more effective than lap and shoulder belts as the level of injury increases is confounded by age. For occupants between the ages of 10 and 25, the lap and shoulder belt remains the most effective. In the 26-55 age bracket lap belts become only as effective as lap and shoulder belts in preventing severe injuries. Finally, in the older age group, lap belts have almost the same level of effectiveness at the AIS=2 level, but are much more effective in preventing more serious injuries.

Table 174. Overall estimates of standardized injury rates, direct costs and corresponding belt effectiveness.

Estimate[1]	Restraint System[2]	Estimation Procedure				
		Injury			Cost	
		Gencat		Unadjusted[3]	Mantel-Haenszel	
		AIS≥2	AIS≥3	AIS=6	All cases	Non-fatals
$\hat{R}$	U	.116	.031	.008	$588	$144
	L	.080	.017	.002	267	109
	LS	.051	.013	.003	281	90
$\hat{E}$	U vs L	.309	.463	.792	.546[4]	.239
	U vs LS	.565	.568	.607	.522	.377
	L vs LS	.371	.197	-.893	-.053	.181

[1] $\hat{R}$ = Standardized injury rate
$\hat{E}$ = Effectiveness estimate

[2] U = Unrestrained
L = Lap belt
LS = Lap and shoulder belt

[3] Based on only 86 fatals

[4] Proportionate reduction in cost

Effectiveness also changes as a function of the weight of the vehicle and the type of accident, and some trends are noted here. Lap and shoulder belts are always more effective than lap only belts in preventing injury, but the difference between the effectiveness levels is much less for larger cars than smaller ones. Also, the lap only belts are more effective at high AIS levels for compacts and intermediate cars, but the larger and smaller vehicles indicate more effectiveness for the lap and shoulder belts.

The crash types which are arranged by severity show relatively consistent results with the exception of type 2 crashes (moderately severe). This same pattern is found when one looks at the damage severity variable. The lap and shoulder belt is more effective than the lap only belts at the AIS=2 level. At the AIS=3 level, the lap only belts are at least as effective as lap and shoulder belts except in the type 2 crashes. When impact site is examined, it is suggested that these type 2 crashes are likely to begin with impact from the side. Both types of belts are very effective in reducing injuries in rollover accidents.

Table 175. Belt effectiveness by age.

Age	Restraint System	Mantel-Haenszel AIS≥2	Mantel-Haenszel AIS≥3
10-25	U vs L	.174	.241
	U vs LS	.480	.505
	L vs LS	.371	.348
26-55	U vs L	.324	.416
	U vs LS	.535	.412
	L vs LS	.312	-.006
56+	U vs L	.562	.811
	U vs LS	.591	.533
	L vs LS	.067	-.147

Table 176. Injury rates and effectiveness measures by model year (AIS $\geq$ 2).

Model Year	Estimate	Restraint System	Estimation Procedure: Unadjusted	Estimation Procedure: Mantel-Haenszel
1973	$\hat{R}$	U	.120	.113
		L	.067	.071
		LS	.044	.034
	$\hat{E}$	U vs L	.438	.375
		U vs LS	.630	.698
		L vs LS	.342	.516
1974	$\hat{R}$	U	.124	.118
		L	.117	.098
		LS	.053	.061
	$\hat{E}$	U vs L	.059	.170
		U vs LS	.573	.487
		L vs LS	.547	.382
1975	$\hat{R}$	U	.109	.104
		L	.083	.049
		LS	.026	.037
	$\hat{E}$	U vs L	.235	.531
		U vs LS	.761	.647
		L vs LS	.687	.248
Pooled[1]	$\hat{R}$	U	.121	.114
		L	.074	.081
		LS	.047	.055
	$\hat{E}$	U vs L	.388	.294
		U vs LS	.612	.520
		L vs LS	.365	.320

[1]Includes 22 (weighted) observations on 1976 models

Table 177. Belt effectiveness by vehicle weight.

Vehicle Weight	Restraint System	Mantel-Haenszel AIS≥2	Mantel-Haenszel AIS≥3
Subcompact	U vs L	.254	.325
	U vs LS	.517	.599
	L vs LS	.352	.406
Compact	U vs L	.086	.580
	U vs LS	.522	.480
	L vs LS	.477	-.238
Intermediate	U vs L	.402	.478
	U vs LS	.450	.066
	L vs LS	.080	-.789
Full-sized	U vs L	.480	.358
	U vs LS	.597	.680
	L vs LS	.226	.502

Table 178. Belt effectiveness by crash type.

Crash Type[1]	Restraint System	Mantel-Haenszel AIS≥2	Mantel-Haenszel AIS≥3
1	U vs L	.262	.298
	U vs LS	.392	.290
	L vs LS	.176	-.011
2	U vs L	.366	.326
	U vs LS	.577	.534
	L vs LS	.333	.309
3	U vs L	.232	.783
	U vs LS	.614	.752
	L vs LS	.497	-.140
4	U vs L	.494	.755
	U vs LS	.655	.720
	L vs LS	.317	-.143

[1] 1 = (Head-on with vehicle) + (rollover) + (head-on with fixed object) + (skidded sideways into fixed object)

2 = (Rear-end, striking) + (angle, striking)

3 = (Angle, struck in left side) + (Angle, struck in right side)

4 = (Rear-end, struck) + (sideswipe)

Table 179. Belt effectiveness by damage severity.

Damage	Restraint System	Gencat AIS≥2	Gencat AIS≥3
Minor	U vs L	.243	.461
	U vs LS	.564	.498
	L vs LS	.424	.068
Moderate	U vs L	.286	.344
	U vs LS	.602	.653
	L vs LS	.443	.471
Moderately Severe	U vs L	.329	.549
	U vs LS	.548	.623
	L vs LS	.326	.164
Severe	U vs L	.418	.494
	U vs LS	.508	.489
	L vs LS	.154	-.010

Table 180 . Belt effectiveness by impact site.

Impact Site[1]	Restraint System	Gencat AIS≥2	Gencat AIS≥3
Front	U vs L	.231	.494
	U vs LS	.530	.539
	L vs LS	.389	.089
Side	U vs L	.403	.413
	U vs LS	.589	.582
	L vs LS	.311	.288
Rear	U vs L	.233	.385
	U vs LS	.478	.355
	L vs LS	.319	-.048

[1]Adjusted estimates for ROLLOVER are not presented due to severe sample size limitations (190 unbelted, 14 lap belted and 61 lap and shoulder belted). The unadjusted injury rates (AIS≥2) are .174, .214 and .049 for U, L and LS, respectively; the unadjusted effectiveness estimates are -.234 for U vs L, .717 for U vs LS and .770 for L vs LS. For AIS≥3, the corresponding injury rates are .074, .071 and .000, and the effectiveness estimates are .031, 1.000 and 1.000.

Returning to our more general consideration of seat belts, we can see that seat belts are obviously effective. Any kind of belt seems to reduce minor injuries and the lap and shoulder appears most effective in reducing more severe injuries. In terms of cost of treatment, both belt types are less expensive than no belt usage, but the lap only belt injuries are less expensive than injuries sustained while wearing lap and shoulder belts.

Table 181. Overall injury severity by restraint system usage.

		None Used	Lap Only	Lap and Shoulder	Row Total
AIS Level	0	45.3	55.1	57.0	49.9
	1	43.5	38.8	38.5	41.4
	2	8.3	4.8	3.4	6.5
	3	1.9	0.7	0.7	1.4
	4	0.3	0.3	0.1	0.2
	5	0.1	0.1	0.1	0.1
	6	0.7	0.2	0.3	0.5
	Column Total	57.6	17.0	25.4	19884

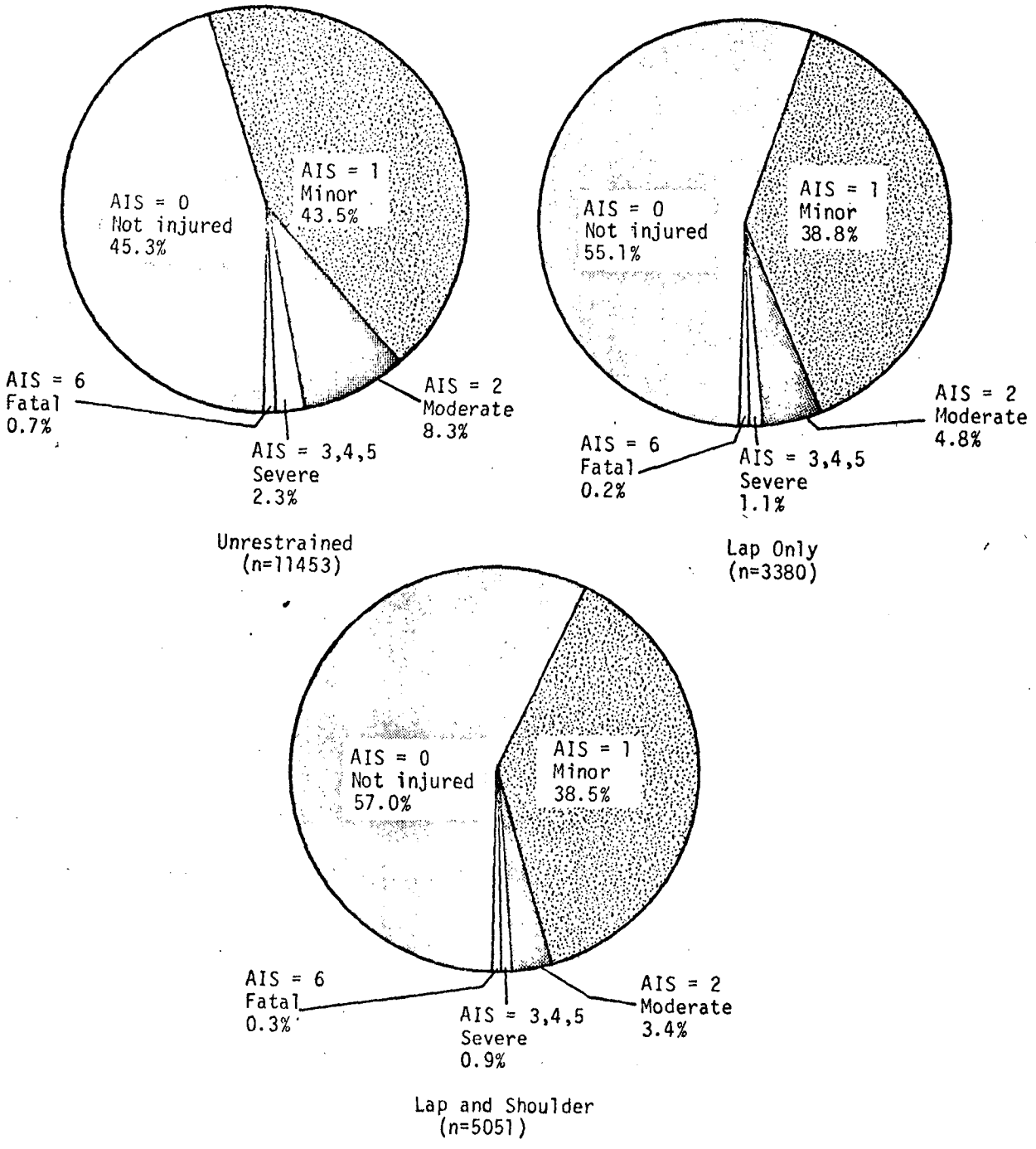


Figure 30. AIS distribution by restraint system usage.

Table 182. Mean cost of injury by AIS level and restraint system usage.

		None Used	Lap Only	Lap and Shoulder
AIS Level	1	134.45	130.87	125.97
	2	546.94	488.08	587.98
	3	1354.02	1178.44	1351.94
	4	1601.24	1828.33	1672.75
	5	1096.29	1180.00	972.00
	6	66807.88	57240.66	58242.50

Table 183. Cost of injury by restraint system usage.

	Mean	S.D.	N
None used	586.76	6038.12	11321
Lap only	189.06	2975.83	3375
Lap and shoulder	241.58	3418.11	5015

Several conclusions can be reached concerning the effectiveness of belts in relation to the person wearing them. Seat belts appear to be more effective for males than females, especially at the higher AIS levels. Effectiveness increases with age, and they seem to have greater effectiveness in the front right seat position.

Table 184. AIS level by restraint system usage by sex

		Male				Female			
		None Used	Lap Only	Lap & Shoulder	Row Total	None Used	Lap Only	Lap & Shoulder	Row Total
AIS Level	0	53.3	18.2	28.5	56.0	50.0	20.0	30.0	41.3
	1	60.3	15.9	23.8	35.6	60.6	16.0	23.4	49.6
	2	77.1	11.1	13.8	6.2	72.0	14.8	13.2	6.9
	3	78.6	10.4	11.0	1.3	78.6	7.7	13.7	1.4
	4	68.0	28.0	4.0	0.2	78.3	8.7	13.0	0.2
	5	75.0	12.5	12.5	0.1	33.3	33.3	33.3	0.0
	6	83.1	6.8	10.2	0.5	71.1	7.9	21.1	0.4
Column Total		57.7	16.8	25.5	11469	57.4	17.4	25.2	8344

Table 185. Sex of occupant by restraint system usage by AIS level.

		None Used	Lap Only	Lap and Shoulder	Row Total
AIS = 0	Male	53.3	18.2	28.5	65.1
	Female	50.0	20.0	30.0	34.9
	Column Total	52.2	18.8	29.0	9869
AIS = 1	Male	60.3	15.9	23.8	49.7
	Female	60.6	16.0	23.4	50.3
	Column Total	60.5	16.0	23.6	8228
AIS $\geq$ 2	Male	76.0	11.2	11.2	55.9
	Female	73.1	13.7	13.2	44.1
	Column Total	74.7	12.1	13.2	1715

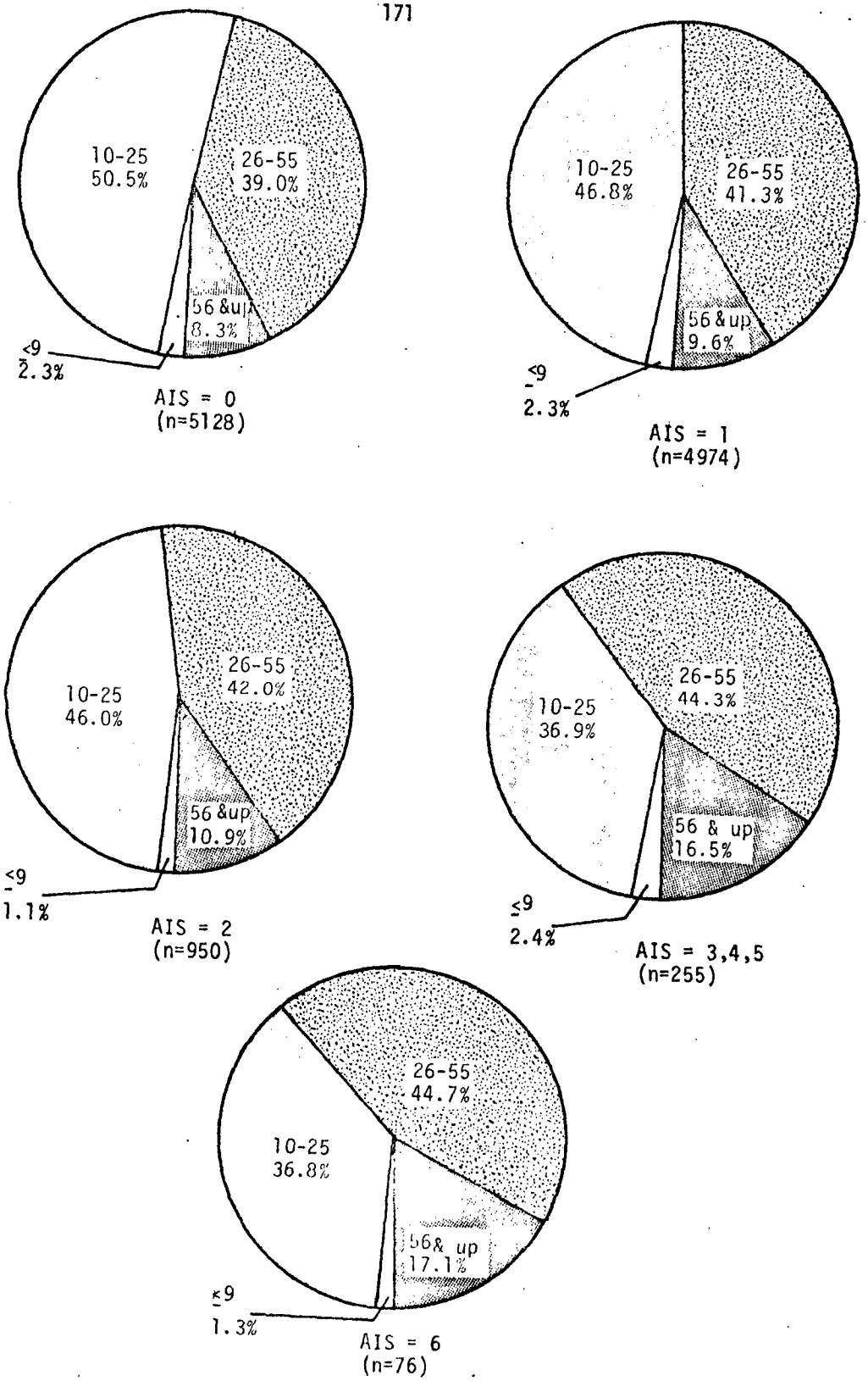


Figure 31. Age distribution of unrestrained occupants by AIS.

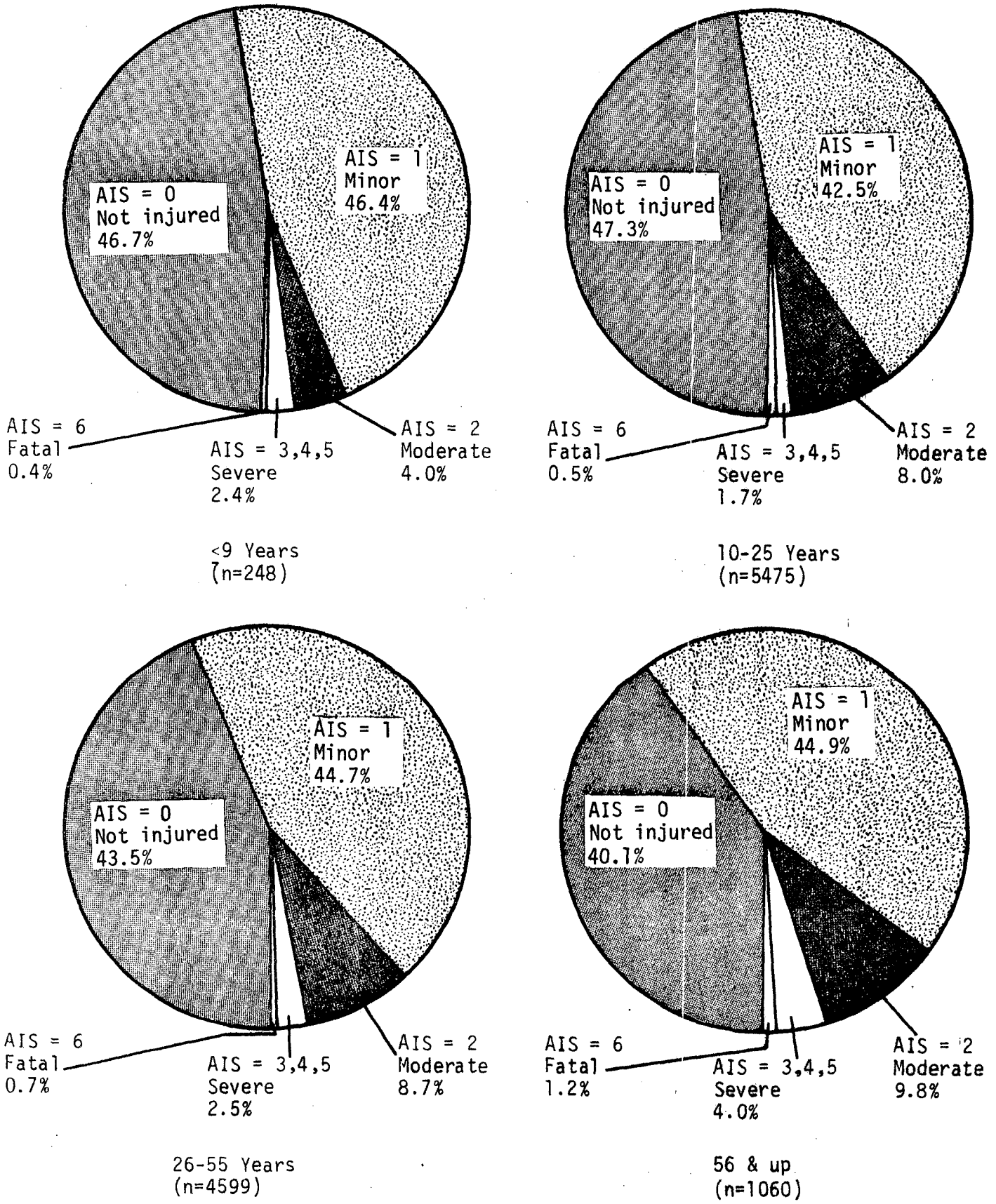


Figure 32. AIS distribution of unrestrained occupants by occupant age.

Table 186. AIS level by age by restraint system usage.

		None Used				Lap Only				Lap & Shoulder			
		≤9	10-25	26-55	56 & up	≤9	10-25	26-55	56 & up	≤9	10-25	26-55	56 & up
AIS Level	0	46.8	47.3	43.5	40.1	54.5	53.9	55.9	57.3	78.7	57.8	55.0	58.8
	1	46.4	42.5	44.7	44.9	43.2	39.5	38.4	37.6	14.9	38.0	40.5	35.0
	2	4.0	8.0	8.7	9.8	2.3	5.1	4.9	4.0	4.3	3.3	3.5	3.7
	3	1.2	1.4	2.0	3.7	0.0	0.9	0.7	0.5	0.0	0.4	0.7	1.4
	4	1.2	0.2	0.4	0.3	0.0	0.4	0.3	0.0	0.0	0.1	0.0	0.2
	5	0.0	0.1	0.1	0.0	0.0	0.1	0.0	0.3	0.0	0.0	0.0	0.2
	6	0.4	0.5	0.7	1.2	0.0	0.1	0.3	0.3	2.1	0.3	0.2	0.6
Column Total		248	5475	4599	1060	44	1421	1531	375	47	2254	2238	486

Table 187. Mean cost of injury by AIS level by age by restraint system usage.

		≤9	10-25	26-55	56 & up
None Used	AIS Level 1	36.87	81.67	187.09	193.10
	AIS Level 2	254.00	379.66	678.40	770.02
	AIS Level 3	889.33	935.88	1642.56	1501.66
	AIS Level 4	546.00	1419.00	1916.00	1706.66
	AIS Level 5	-	490.33	1550.75	-
	AIS Level 6	29460.00	75683.18	79954.00	32134.15
Lap Only	AIS Level 1	42.06	73.88	173.85	189.76
	AIS Level 2	40.00	312.65	622.74	698.33
	AIS Level 3	-	774.30	1538.20	2006.50
	AIS Level 4	-	1101.80	2736.50	-
	AIS Level 5	-	1155.00	-	1205.00
	AIS Level 6	-	61564.00	88057.00	17709.00
Lap and Shoulder	AIS Level 1	22.28	68.16	166.58	209.09
	AIS Level 2	286.50	357.22	807.98	604.55
	AIS Level 3	-	1136.70	1646.43	986.28
	AIS Level 4	-	1195.00	2945.00	1356.00
	AIS Level 5	-	1263.00	-	681.00
	AIS Level 6	45412.00	53505.83	91481.75	27673.66

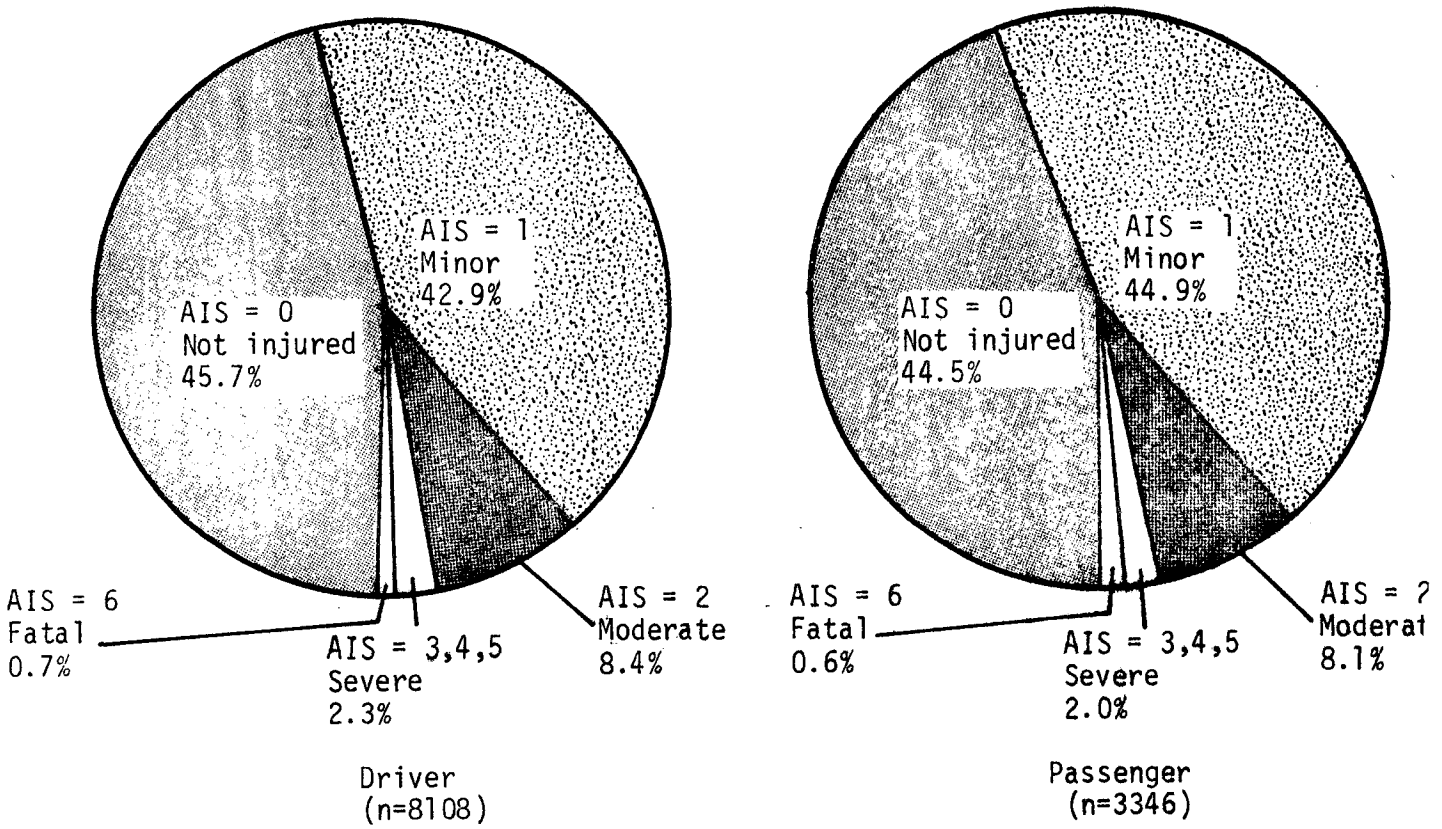
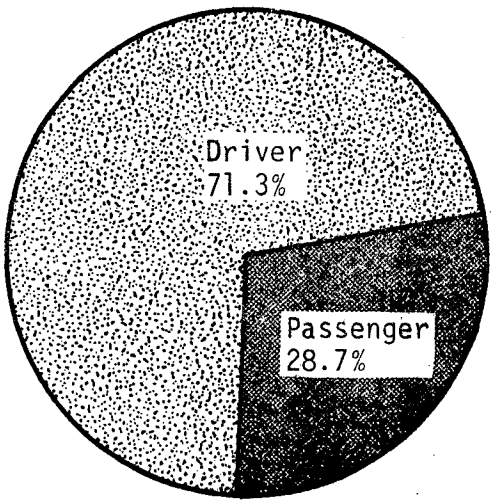
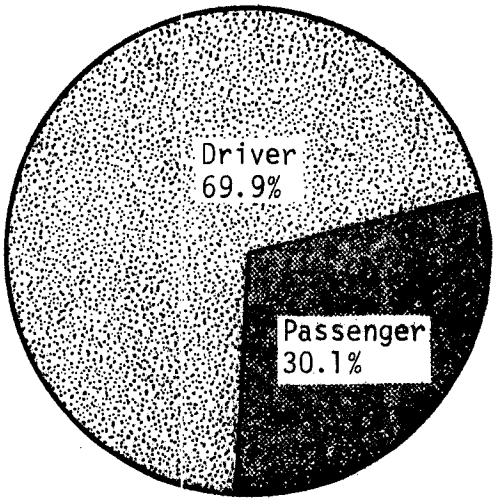


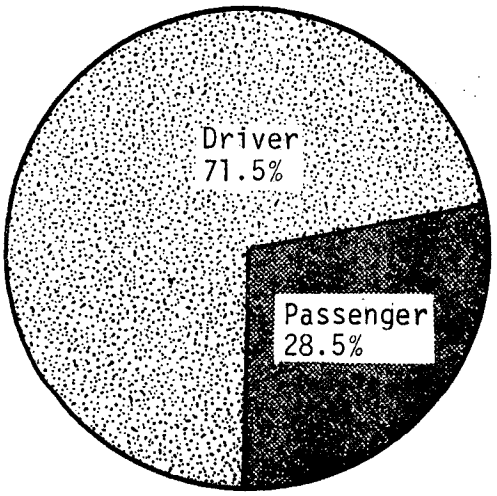
Figure 33. AIS distribution of unrestrained occupants by occupant role.



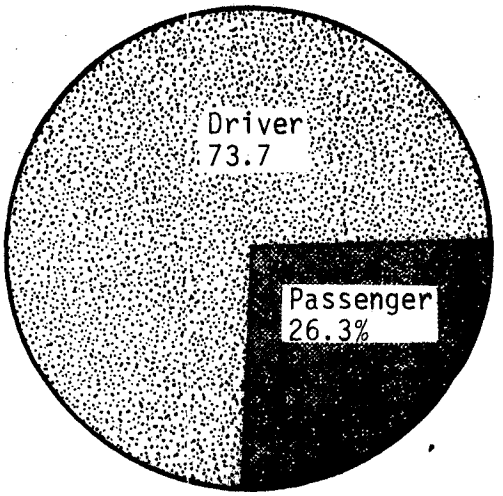
AIS = 0
(n=5191)



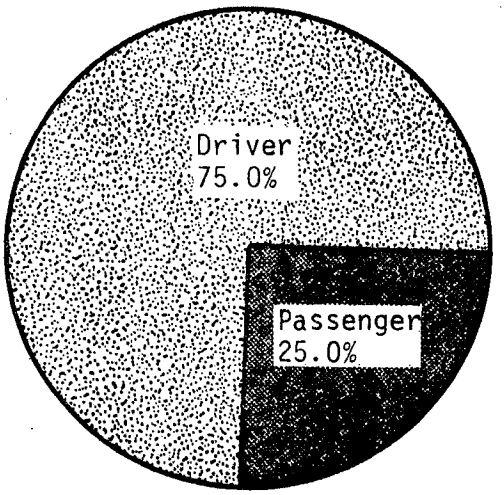
AIS = 1
(n=4982)



AIS = 2
(n=950)



AIS = 3,4,5
(n=255)



AIS = 6
(n=76)

Figure 34. Unrestrained occupant distribution by AIS.

Table 188. Front seat position by restraint system usage by AIS level.

		None Used	Lap Only	Lap and Shoulder	Row Total
AIS = 0	Left	50.0	19.5	30.5	74.7
	Center	80.7	17.4	1.9	1.6
	Right	57.5	16.5	26.0	23.7
	Column Total	52.3	18.8	29.0	9930
AIS = 1	Left	57.4	17.0	25.6	73.6
	Center	85.8	14.2	0.0	1.5
	Right	68.1	12.9	19.1	24.9
	Column Total	60.5	15.9	23.6	8239
AIS $\geq$ 2	Left	72.9	13.3	13.8	74.1
	Center	91.4	8.6	0.0	2.0
	Right	78.8	8.5	12.7	23.9
	Column Total	74.7	12.1	13.2	1715

Table 189. AIS level by seating position by restraint system usage

		None Used			Lap Only			Lap & Shoulder	
		Left	Center	Right	Left	Center	Right	Left	Right
AIS Level	0	45.7	49.1	44.0	54.6	58.3	56.5	56.8	57.9
	1	42.9	38.9	45.5	39.0	35.4	38.4	38.9	37.2
	2	8.4	8.3	8.0	5.2	6.3	3.5	3.4	3.5
	3	2.0	1.9	1.5	0.8	0.0	0.7	0.6	0.9
	4	0.2	1.1	0.4	0.3	0.0	0.3	0.1	0.2
	5	0.1	0.0	0.0	0.0	0.0	0.3	0.1	0.1
	6	0.7	0.8	0.6	0.2	0.0	0.3	0.3	0.3

The type of car that the individual is in may also be a factor in seat belt effectiveness. For example, seat belts in 1975 cars are more effective than those in the 1974 vehicles, particularly at the higher injury levels. In evaluating the 1973 vehicle, the lap only effectiveness was compared with the lap and shoulder effectiveness for the other years. It can be seen that the lap only belt (1973) is not as effective in preventing AIS $\geq$ 2 injuries, but does seem to be more effective in reducing AIS = 1 injuries.

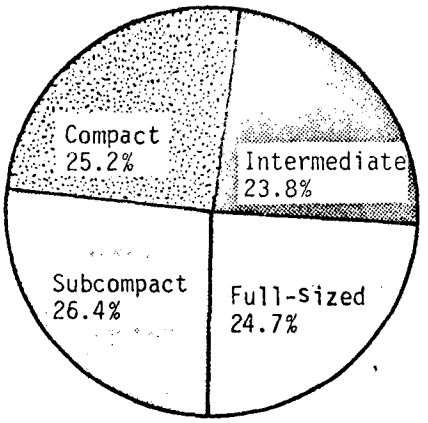
Table 190. Vehicle model year by restraint system usage by AIS level.

		None Used	Lap Only	Lap and Shoulder	Row Total
AIS = 0	1973	59.1	34.5	6.4	44.4
	1974	45.5	6.8	47.7	44.1
	1975	52.0	4.4	43.7	11.5
	Column Total	52.3	18.8	28.9	9913
AIS = 1	1973	64.9	28.9	6.2	47.1
	1974	55.9	4.5	39.5	42.1
	1975	58.8	4.2	37.0	10.8
	Column Total	60.5	15.9	23.6	8235
AIS $\geq$ 2	1973	77.6	19.5	2.9	48.1
	1974	70.0	5.2	24.8	42.6
	1975	81.3	5.0	13.8	9.3
	Column Total	74.7	12.1	13.2	1715

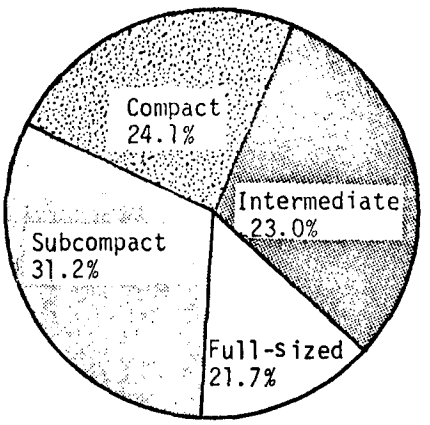
One can see that the size of the vehicle also plays an important role in determining effectiveness. The larger vehicles show much more seat belt effectiveness than the subcompacts and compacts do. There does not appear to be any difference in the cost of injury treatment over the difference usage categories for each weight classification, however. The reader can explore the effectiveness of various makes of cars for the different belt types. Bench seat types appear to be more effective in reducing injury levels with lap and shoulder belts.

Table 191. Vehicle weight by AIS level by restraint system usage.

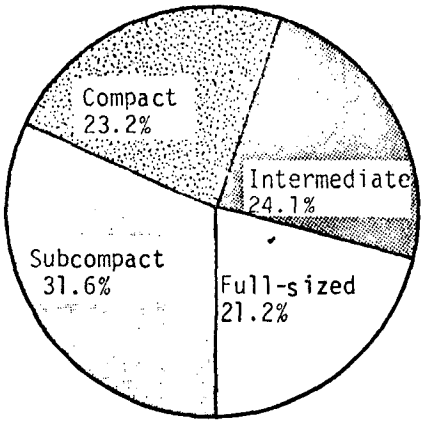
		AIS = 0	AIS = 1	AIS ≥ 2	Row Total
None Used	Subcompact	48.7	56.1	69.7	29.0
	Compact	50.8	60.0	72.4	24.4
	Intermediate	54.4	63.5	78.0	23.5
	Full-sized	55.6	64.8	81.2	23.1
	Column Total	52.2	60.5	74.6	11095
Lap Only	Subcompact	16.2	15.8	13.2	28.9
	Compact	16.9	13.3	13.3	22.4
	Intermediate	19.6	15.2	10.3	22.6
	Full-sized	21.8	20.0	10.9	26.0
	Column Total	18.5	15.9	12.1	3243
Lap & Shoulder	Subcompact	35.1	28.1	17.1	36.6
	Compact	32.2	26.7	14.3	27.8
	Intermediate	25.9	21.3	11.6	20.0
	Full-sized	22.5	15.2	7.9	15.6
	Column Total	29.4	23.6	13.3	4924



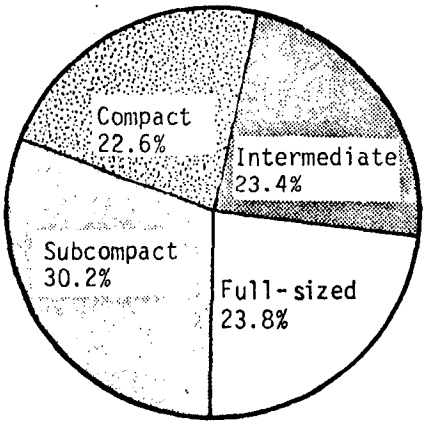
AIS = 0
(n=4956)



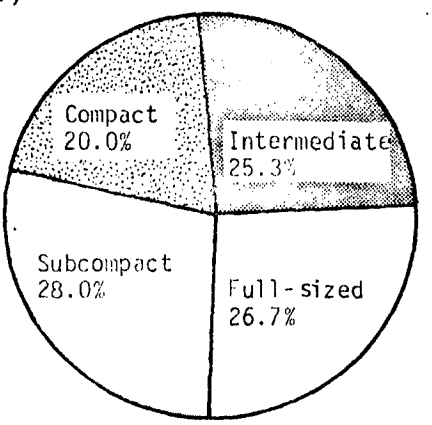
AIS = 1
(n=4881)



AIS = 2
(n=931)



AIS = 3,4,5
(n-252)



AIS = 6
(n=75)

Figure 35. Vehicle weight distribution of unrestrained occupants by AIS.

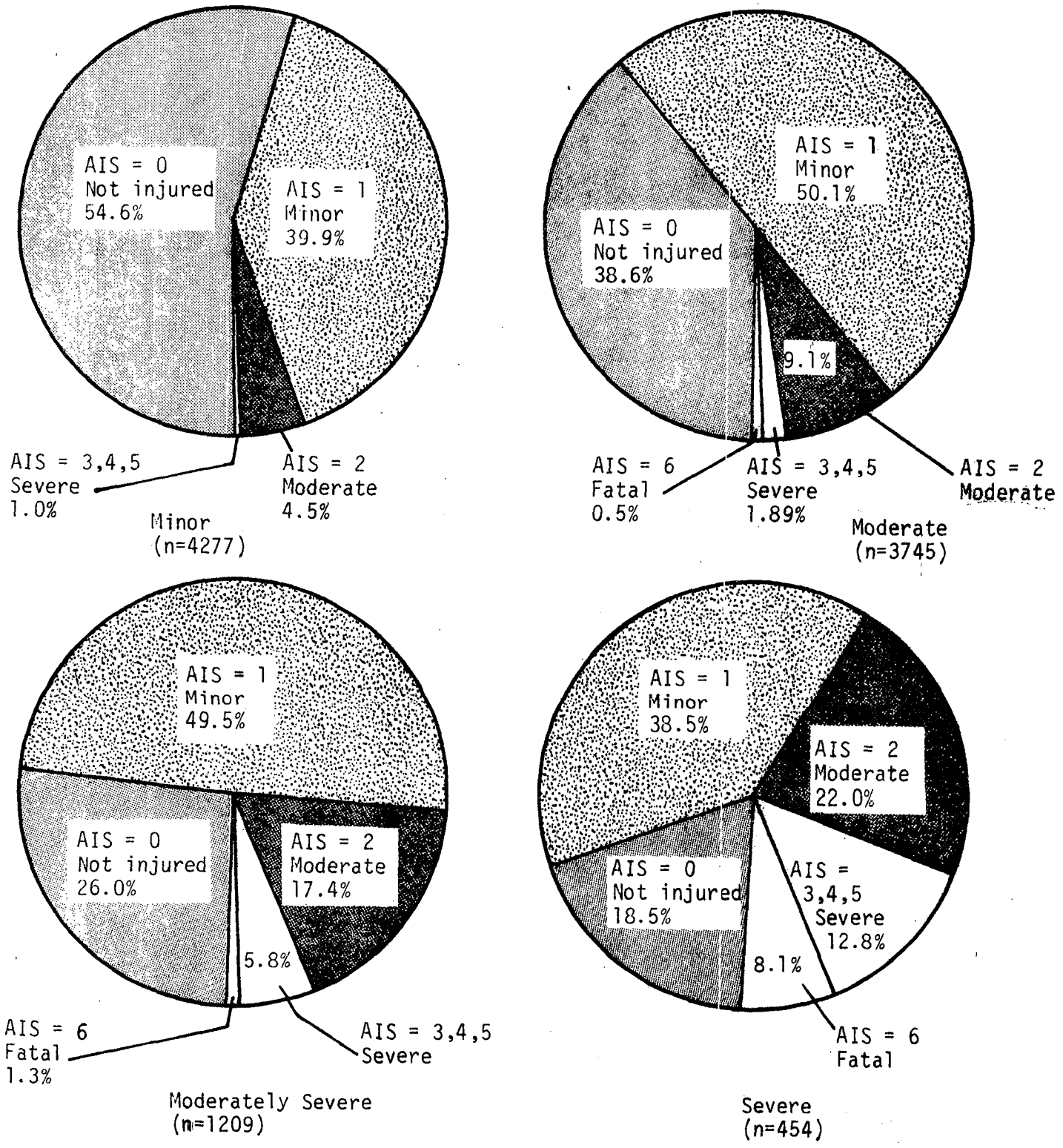


Figure 36. AIS distribution of unrestrained occupants by damage severity.

Table 192. AIS level by vehicle weight for unrestrained occupants.

		Subcompact	Compact	Intermediate	Full-sized	Row Total
AIS Level	0	26.4	25.2	23.8	24.7	43.1
	1	31.2	24.1	23.0	21.7	42.5
	2	31.6	23.2	24.1	21.2	8.1
	3	31.3	20.9	24.6	23.2	1.8
	4	22.9	28.6	20.0	28.6	0.3
	5	33.3	50.0	0.0	16.7	0.1
	6	28.0	20.0	25.3	26.7	0.7
Column Total		29.0	24.4	23.5	23.1	11095

Table 193. AIS level by vehicle weight for lap only belted occupants.

		Subcompact	Compact	Intermediate	Full-sized	Row Total
AIS Level	0	24.8	23.7	24.2	27.3	52.8
	1	33.3	20.3	20.9	25.5	38.6
	2	35.4	28.0	19.5	17.1	4.9
	3	34.8	26.1	17.4	21.7	0.7
	4	66.7	0.0	33.3	0.0	0.3
	5	50.0	0.0	0.0	50.0	0.1
	6	16.7	16.7	16.7	50.0	0.2
Column Total		28.9	22.4	22.6	26.0	3243

Table 194. AIS level by vehicle weight by lap and shoulder belted occupants.

		Subcompact	Compact	Intermediate	Full-sized	Row Total
AIS Level	0	33.8	28.3	20.2	17.7	56.7
	1	40.0	27.4	19.7	13.0	38.8
	2	45.7	24.3	18.5	11.6	3.5
	3	28.1	31.3	25.0	15.6	0.6
	4	25.0	25.0	50.0	0.0	0.1
	5	0.0	0.0	50.0	50.0	0.0
	6	50.0	28.6	14.3	7.1	0.3
Column Total		36.6	27.8	20.0	15.6	4924

Table 195. Mean cost of injury by AIS level by vehicle weight by restraint system usage.

		Subcompact	Compact	Intermediate	Full-sized
None Used Used	AIS Level 1	129.49	123.04	133.24	148.72
	2	485.02	573.78	500.30	679.26
	3	1176.56	1286.54	1477.16	1508.10
	4	2063.12	1430.30	1551.50	1432.50
	5	1464.00	490.33	-	1918.00
	6	73876.94	54118.38	77098.69	68978.81
Lap Only	AIS Level 1	111.48	130.02	135.75	153.76
	2	455.90	440.09	690.12	402.68
	3	1060.12	1120.50	1335.75	1685.60
	4	1910.67	-	1663.67	-
	5	1155.00	-	-	1205.00
	6	61564.00	-	106731.00	78720.00
Lap and Shoulder	AIS Level 1	123.70	120.90	115.38	149.07
	2	505.82	555.21	742.09	746.25
	3	1612.66	982.00	1445.38	1644.00
	4	669.00	2945.00	1538.50	-
	5	-	-	1263.00	681.00
	6	53735.28	83953.00	29012.00	45412.00

Table 196. Make of vehicle by AIS level by restraint system usage for 1973 model year vehicles.

	None Used				Lap Only				Lap and Shoulder			
	AIS = 0	AIS = 1	AIS ≥ 2	Row Total	AIS = 0	AIS = 1	AIS ≥ 2	Row Total	AIS = 0	AIS = 1	AIS ≥ 2	Row Total
Chevrolet	47.4	42.6	10.0	22.3	57.4	37.8	4.9	23.1	48.8	47.5	3.8	14.8
Oldsmobile	44.1	45.2	10.7	6.7	49.4	46.4	4.0	6.3	44.4	55.6	0.0	1.7
Pontiac	45.5	43.3	11.2	8.7	62.8	32.7	4.5	8.1	57.1	39.3	3.6	5.2
Buick	40.7	44.0	15.4	4.2	50.4	45.1	4.4	4.1	16.7	83.3	0.0	2.2
Cadillac	43.3	53.6	3.1	1.7	64.0	28.0	8.0	1.8	0.0	0.0	0.0	0.0
GM Total	45.7	43.7	10.6	43.6	56.8	38.4	4.8	43.4	47.3	49.6	3.1	23.9
Plymouth	44.1	43.8	12.2	5.8	57.0	36.0	7.0	7.2	60.0	40.0	0.0	3.7
Dodge	51.4	36.3	12.3	3.7	47.1	41.2	11.8	4.9	78.9	15.8	5.3	3.5
Chrysler Total	47.0	40.9	12.2	9.5	53.0	38.1	8.9	12.1	69.2	28.2	2.6	7.2
Ford	46.4	42.9	10.7	20.3	48.0	46.2	5.8	18.2	42.9	50.0	7.1	10.4
Mercury	46.1	45.3	8.6	4.5	60.9	35.9	3.1	4.6	78.9	21.1	0.0	3.5
Capri	35.6	52.5	11.9	1.0	32.1	60.4	7.5	1.9	52.4	42.9	4.8	3.9
Ford Total	45.9	43.7	10.4	25.8	49.2	45.4	5.4	24.7	52.1	42.7	5.2	17.8
AMC	41.5	44.4	14.1	4.3	57.1	38.6	4.3	5.1	60.0	40.0	0.0	1.9
VW	44.1	45.7	10.3	5.4	64.7	29.4	5.9	0.6	47.4	48.5	4.1	18.0
Datsun	38.6	52.3	9.1	1.5	42.3	52.1	5.6	2.6	52.6	31.6	15.8	3.5
Toyota	35.5	53.0	11.4	2.9	52.9	41.4	5.7	3.1	15.4	76.9	7.7	2.4
Mazda	37.0	45.7	17.4	1.6	40.3	50.0	9.7	2.2	0.0	93.3	6.7	2.8
Japanese Total	36.7	50.9	12.4	6.0	45.9	47.3	6.8	7.9	25.5	63.8	10.6	8.7
Other	39.4	45.0	15.6	5.3	57.3	33.9	8.8	6.2	58.7	37.2	4.1	22.4
Column Total	44.7	44.1	11.2	5713	53.7	40.5	5.8	2767	50.6	44.9	4.5	539

Table 197. Make of vehicle by AIS level by restraint system usage for 1974 model year vehicles.

	None Used				Lap Only				Lap and Shoulder			
	AIS = 0	AIS = 1	AIS ≥ 2	Row Total	AIS = 0	AIS = 1	AIS ≥ 2	Row Total	AIS = 0	AIS = 1	AIS ≥ 2	Row Total
Chevrolet	44.0	44.9	11.0	20.0	56.1	34.1	9.8	25.4	58.0	38.7	3.3	21.9
Oldsmobile	48.8	40.9	10.3	4.6	75.9	17.2	6.9	6.0	61.8	35.6	2.6	5.3
Pontiac	43.3	41.1	15.6	5.1	23.1	69.2	7.7	2.7	62.1	33.2	4.7	5.9
Cadillac	53.6	38.1	8.3	1.9	41.7	58.3	0.0	2.5	87.0	13.0	0.0	1.5
Buick	49.0	42.0	9.1	3.2	72.7	18.2	9.1	2.3	61.7	30.8	7.5	3.7
GM Total	45.5	43.2	11.3	34.8	56.9	34.6	8.5	38.9	60.6	35.7	3.7	38.3
Plymouth	42.7	42.4	15.0	7.3	63.4	29.3	7.3	8.5	57.3	37.3	5.5	3.0
Dodge	48.7	46.7	4.5	4.5	47.1	41.2	11.8	3.5	36.4	51.1	12.5	2.4
Chrysler Total	45.0	44.0	11.0	11.8	58.6	32.8	8.6	12.0	48.0	43.4	8.6	5.4
Ford	43.2	45.1	11.7	23.3	63.8	32.7	3.7	22.1	56.5	38.1	5.3	21.8
Mercury	48.9	41.6	9.6	4.0	79.2	16.7	4.2	5.0	56.2	38.8	5.1	4.9
Capri	39.5	51.2	9.3	1.9	25.0	75.0	0.0	0.8	51.9	40.5	7.6	2.2
Ford Total	43.8	45.0	11.2	39.2	65.2	31.1	3.7	27.9	56.1	38.4	5.4	28.9
AMC	42.6	46.5	11.0	6.4	60.3	34.5	5.2	12.0	53.0	41.0	6.0	5.5
VW	43.6	44.0	12.4	5.1	50.0	25.0	25.0	0.8	65.3	29.0	5.6	3.4
Datsun	45.8	41.3	12.9	3.5	33.3	0.0	66.7	0.6	56.5	37.0	6.5	3.0
Toyota	43.4	39.8	16.9	1.9	66.7	33.3	0.0	1.2	54.3	40.6	5.1	7.0
Mazda	46.7	42.2	11.1	1.0	0.0	100.0	0.0	0.2	55.0	42.5	2.5	1.1
Japanese Total	45.2	41.0	13.8	6.4	50.0	30.0	20.0	2.0	55.0	39.8	5.2	11.1
Other	46.6	40.9	12.5	6.4	61.3	19.4	19.4	6.4	52.6	41.4	6.0	2.3
Column Total	44.7	43.8	11.5	4425	59.9	32.2	7.9	484	57.2	37.8	5.0	3621

Table 198. Make of vehicle by AIS level by restraint system usage for 1975 model year vehicles.

	None Used				Lap Only				Lap and Shoulder			
	AIS = 0	AIS = 1	AIS ≥ 2	Row Total	AIS = 0	AIS = 1	AIS ≥ 2	Row Total	AIS = 0	AIS = 1	AIS ≥ 2	Row Total
Chevrolet	46.5	44.6	9.0	24.3	32.7	51.0	16.3	13.0	58.0	39.7	2.3	26.0
Oldsmobile	45.3	37.3	17.3	6.1	40.0	40.0	20.0	5.3	58.3	41.7	0.0	7.1
Pontiac	52.3	38.6	9.1	7.1	83.3	16.7	0.0	12.7	58.1	37.1	4.8	7.4
Cadillac	38.3	42.6	19.1	3.8	100.0	0.0	0.0	1.1	70.8	20.8	8.3	2.9
Buick	33.2	61.3	5.5	4.4	40.0	60.0	0.0	5.3	66.0	31.9	2.1	5.6
GM Total	45.3	44.1	10.6	45.7	54.3	37.1	8.6	37.4	58.0	38.7	2.3	49.0
Plymouth	60.0	30.0	10.0	4.8	44.4	50.6	4.9	21.4	63.0	37.0	0.0	3.2
Dodge	30.4	56.5	13.0	1.9	66.7	22.2	11.1	9.5	66.7	29.2	4.2	2.9
Chrysler Total	51.8	37.3	10.8	6.7	51.7	41.4	6.9	30.9	64.7	33.3	2.0	6.1
Ford	53.4	36.6	10.1	21.7	50.8	44.4	5.6	19.0	68.9	28.8	2.3	20.4
Mercury	58.3	32.3	9.4	7.8	0.0	0.0	0.0	0.0	43.8	53.1	3.1	3.8
Capri	0.0	100.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.2
Ford Total	54.2	36.0	9.8	29.7	50.8	44.4	5.6	19.0	64.4	33.2	2.4	24.4
AMC	36.6	58.5	4.9	3.3	0.0	0.0	0.0	0.0	53.6	42.9	3.6	3.3
VW	25.0	60.7	14.3	2.3	0.0	0.0	0.0	0.0	49.5	46.4	4.1	2.9
Datsun	15.4	69.2	15.4	1.1	0.0	0.0	0.0	0.0	19.0	81.0	0.0	2.5
Toyota	68.2	25.8	6.1	5.3	0.0	100.0	0.0	1.1	51.0	49.0	0.0	6.1
Mazda	50.0	25.0	25.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Japanese Total	59.0	32.5	8.4	6.7	0.0	100.0	0.0	1.0	40.0	60.0	0.0	8.6
Other	27.1	55.7	17.1	5.7	63.6	18.2	18.2	11.6	46.9	46.9	6.1	5.8
Column Total	47.5	42.0	10.5	1238	52.9	38.6	8.5	95	58.3	39.0	2.6	842

Table 199. Restraint system usage by seat type by AIS level.

		None Used	Lap Only	Lap and Shoulder	Row Total
AIS = 0	Bench	55.0	20.9	24.1	48.4
	Bucket	49.9	16.0	34.1	51.6
	Column Total	52.4	18.4	29.2	8630
AIS = 1	Bench	65.1	16.8	18.1	46.3
	Bucket	56.3	15.1	28.6	53.7
	Column Total	60.4	15.9	23.7	7417
AIS $\geq$ 2	Bench	78.0	11.1	10.9	46.8
	Bucket	73.0	12.1	15.0	53.2
	Column Total	75.3	11.6	13.0	1557

Table 200. Odometer reading by restraint system usage by AIS level.

		None Used	Lap Only	Lap and Shoulder	Row Total
AIS = 0	<5000	41.3	11.0	47.6	19.7
	5000 - 9999	46.5	8.2	45.3	14.8
	10000 - 19999	52.2	16.0	31.8	26.9
	20000 & up	60.4	26.0	13.7	38.6
	Column Total	52.4	17.7	29.9	8226
AIS = 1	<5000	49.4	9.2	41.4	19.2
	5000 - 9999	58.2	6.5	35.3	15.3
	10000 - 19999	62.0	15.4	22.6	28.9
	20000 & up	66.0	23.6	10.4	36.6
	Column Total	60.5	15.9	23.7	7365
AIS $\geq$ 2	<5000	67.3	8.1	24.6	18.6
	5000 - 9999	73.3	8.6	18.1	15.9
	10000 - 19999	74.4	11.9	13.7	28.2
	20000 & up	77.8	16.8	5.5	37.2
	Column Total	74.1	12.5	13.4	1524

Any difference that the environment has on seat belt effectiveness is also of interest. For example, there is a marked decrease in the difference between urban and rural usage rates as the AIS level increases. This would indicate that seat belts may be relatively less effective in urban accidents at more severe injury levels.

There seems to be no difference in effectiveness at an AIS level of 2 or greater, but at AIS = 1 the belt effectiveness in daylight accidents is less than the effectiveness in accidents happening in the dark. Note the cost of dark condition accidents is much higher than the cost for daylight or evening rush hour accidents. Similarly, weekend accidents are more expensive.

Table 201. Accident area by restraint system usage by AIS level.

		None Used	Lap Only	Lap and Shoulder	Row Total
AIS = 0	Urban	51.4	18.9	29.6	89.1
	Rural	59.1	17.4	23.6	10.9
	Column Total	52.3	18.7	29.0	9931
AIS = 1	Urban	59.7	16.3	24.0	88.2
	Rural	66.4	13.0	20.7	11.8
	Column Total	60.5	15.9	23.6	8239
AIS $\geq$ 2	Urban	74.1	12.7	13.2	81.5
	Rural	77.4	9.1	13.5	18.5
	Column Total	74.7	12.1	13.2	1715

Table 202. Time of accident by restraint system usage by AIS level.

		None Used	Lap Only	Lap and Shoulder	Row Total
AIS = 0	Midnight - 5:59 am	61.6	15.3	23.1	15.6
	6:00 - 8:59 am	47.7	18.8	33.5	7.6
	9:00 - 3:59 pm	47.5	22.5	29.9	33.0
	4:00 - 5:59 pm	49.4	17.6	33.0	15.4
	6:00 - 11:59 pm	55.1	17.0	27.9	28.4
	Column Total	52.2	18.8	29.0	9877
AIS = 1	Midnight - 5:59 am	66.3	13.1	20.6	15.2
	6:00 - 8:59 am	53.5	15.6	30.9	8.4
	9:00 - 3:59 pm	60.2	16.5	23.3	32.4
	4:00 - 5:59 pm	59.2	14.4	26.4	15.6
	6:00 - 11:59 pm	60.3	17.8	21.9	28.4
	Column Total	60.4	16.0	23.6	8184
AIS $\geq$ 2	Midnight - 5:59 am	78.8	10.0	11.2	26.3
	6:00 - 8:59 am	63.2	13.5	23.3	7.8
	9:00 - 3:59 pm	70.9	13.0	16.2	27.5
	4:00 - 5:59 pm	77.8	12.8	9.4	11.9
	6:00 - 11:59 pm	76.1	12.6	11.3	26.5
	Column Total	74.6	12.1	13.3	1706

Table 203. Light condition by restraint system usage by AIS level.

		None Used	Lap Only	Lap and Shoulder	Row Total
AIS = 0	Daylight	48.9	20.5	30.6	62.0
	Dawn	52.4	10.7	36.9	.9
	Dusk	50.0	23.0	27.0	2.4
	Dark	60.6	17.7	21.8	15.4
	Dark-lighted	58.4	13.1	28.5	13.0
	Dark-not lighted	57.6	15.8	26.6	6.3
	Column Total	52.5	19.4	28.8	9580
AIS = 1	Daylight	58.8	15.9	25.4	62.5
	Dawn	42.9	20.8	36.4	1.0
	Dusk	58.2	23.2	18.6	2.3
	Dark	66.1	15.2	18.7	13.6
	Dark-lighted	63.4	16.0	20.6	14.1
	Dark-not lighted	58.2	16.5	25.3	6.5
	Column Total	60.2	16.1	23.7	7792
AIS $\geq$ 2	Daylight	73.0	13.3	13.8	51.4
	Dawn	35.0	10.0	55.0	1.2
	Dusk	74.2	9.7	16.1	1.9
	Dark	78.7	9.7	11.5	23.8
	Dark-lighted	77.1	12.5	10.4	14.6
	Dark-not lighted	80.2	6.9	12.9	7.1
	Column Total	75.0	11.8	13.2	1640

Table 204. Surface condition by restraint system usage by AIS level.

		None Used	Lap Only	Lap and Shoulder	Row Total
AIS = 0	Dry	53.2	18.6	28.2	76.1
	Wet	49.3	20.0	30.7	19.3
	Snow/Ice	54.4	28.3	17.2	4.6
	Column Total	52.5	18.8	28.7	9625
AIS = 1	Dry	59.8	15.5	24.6	78.3
	Wet	61.8	18.3	19.9	17.4
	Snow/Ice	61.6	16.7	21.7	4.3
	Column Total	60.2	16.1	23.7	7859
AIS $\geq$ 2	Dry	75.1	11.5	13.4	78.8
	Wet	74.3	12.1	13.6	16.6
	Snow/Ice	76.3	6.6	17.1	4.6
	Column Total	75.0	11.6	13.4	1640

Tables reflecting the seat belt effectiveness for various crash configurations, crash severities and parts of the vehicle deformation index are presented here.

Table 205. Crash configuration by restraint system usage for AIS = 0.

	None Used	Lap Only	Lap and Shoulder	Row Total
Head on	52.4	21.5	26.1	4.0
Rear striking	51.5	16.4	32.1	19.6
Struck in rear	45.1	23.2	31.8	4.4
Angle striking	52.8	17.2	30.0	21.5
Struck in left side	49.5	20.3	30.3	12.3
Struck in right side	49.6	19.1	31.3	13.6
Rollover & other	68.9	9.5	21.5	1.9
Sideswipe	53.0	17.6	29.4	3.9
Struck fixed object	59.3	18.4	22.3	13.6
Side of vehicle into fixed object	55.3	20.0	24.7	5.2
Column Total	52.7	18.3	29.0	9297

Table 206. Crash configuration by restraint system usage for AIS = 1.

	None Used	Lap Only	Lap and Shoulder	Row Total
Head-on	68.8	14.5	16.7	8.2
Rear striking	62.3	14.2	23.4	11.9
Struck in rear	46.9	18.6	34.5	10.2
Angle striking	59.8	18.6	21.6	23.8
Struck in left side	59.6	16.3	24.1	12.8
Struck in right side	61.3	13.2	25.5	12.8
Rollover & other	63.4	8.2	28.4	1.7
Sideswipe	59.3	12.6	27.5	2.3
Struck fixed object	68.8	13.1	18.0	11.0
Side of vehicle into fixed object	63.5	15.2	21.3	3.7
Column Total	60.8	15.7	23.5	7999

Table 207. Crash configuration by restraint system usage for AIS $\geq$ 2.

	None Used	Lap Only	Lap and Shoulder	Row Total
Head-on	71.4	12.2	16.3	11.8
Rear striking	69.0	15.5	15.5	10.5
Struck in rear	55.0	25.0	20.0	3.6
Angle striking	75.4	13.5	11.0	16.9
Struck in left side	73.6	9.6	16.8	11.8
Struck in right side	73.9	12.6	13.5	13.5
Rollover & other	84.8	6.5	8.7	2.8
Sideswipe	81.3	6.3	12.5	1.9
Struck fixed object	82.7	9.0	8.3	19.5
Side of car into fixed object	75.8	10.6	13.6	7.9
Column Total	74.9	12.0	13.1	1664

Table 208. Crash configuration by AIS level for unrestrained occupants.

	AIS Level							Row Total
	0	1	2	3	4	5	6	
Head-on	25.0	57.2	11.8	3.6	0.6	0.0	1.8	7.1
Rear striking	56.9	35.8	6.4	0.8	0.0	0.0	0.1	15.0
Struck in rear	30.6	63.9	4.5	0.8	0.0	0.0	0.2	5.4
Angle striking	43.9	47.3	7.2	1.3	0.2	0.0	0.1	21.8
Struck in left side	40.1	49.6	7.3	1.7	0.6	0.1	0.6	12.8
Struck in right side	44.3	44.1	8.8	1.5	0.1	0.4	0.8	12.9
Rollover & other	49.6	34.6	9.8	2.8	0.8	0.0	2.4	2.2
Sideswipe	59.0	33.0	4.9	2.4	0.3	0.0	0.3	3.0
Struck fixed object	46.3	37.2	12.0	3.1	0.4	0.0	1.0	14.7
Side of car into fixed object	48.3	33.8	11.5	3.2	0.7	0.2	2.3	5.1
Column Total	44.5	44.2	8.4	1.9	0.3	0.1	0.7	11013

Table 209. Crash configuration by AIS level for lap only belted occupants.

	AIS Level							Row Total
	0	1	2	3	4	5	6	
Head-on	40.5	47.5	8.0	2.0	0.5	0.0	1.5	6.2
Rear striking	64.9	29.3	5.6	0.2	0.0	0.0	0.0	14.3
Struck in rear	36.0	58.2	3.8	1.1	0.4	0.0	0.4	8.1
Angle striking	46.7	48.1	4.9	0.1	0.1	0.0	0.0	22.8
Struck in left side	52.5	43.2	3.0	0.9	0.2	0.0	0.2	13.6
Struck in right side	59.7	33.4	5.7	1.0	0.2	0.0	0.0	12.5
Rollover & other	54.8	35.5	6.5	0.0	3.2	0.0	0.0	1.0
Sideswipe	71.9	25.8	1.1	0.0	0.0	0.0	1.1	2.8
Struck fixed object	61.8	30.5	5.6	1.1	0.5	0.3	0.3	11.7
Side of car into fixed object	62.2	28.8	5.1	2.6	0.6	0.6	0.0	4.8
Column Total	52.7	38.9	4.8	0.8	0.3	0.1	0.2	3224

Table 210. Crash configuration by AIS level for lap and shoulder belted occupants.

	AIS Level							Row Total
	0	1	2	3	4	5	6	
Head-on	41.0	45.6	8.8	2.9	0.4	0.4	0.8	5.0
Rear striking	70.1	26.6	2.9	0.4	0.0	0.0	0.0	17.4
Struck in rear	30.5	66.7	2.1	0.7	0.0	0.0	0.0	8.8
Angle striking	57.5	39.5	2.7	0.3	0.0	0.0	0.0	21.7
Struck in left side	52.2	42.7	3.9	0.6	0.0	0.0	0.5	13.8
Struck in right side	57.7	37.9	2.9	0.9	0.1	0.0	0.4	14.3
Rollover & other	47.5	47.5	3.8	1.3	0.0	0.0	0.0	1.7
Sideswipe	66.0	31.5	1.9	0.0	0.0	0.0	0.6	3.4
Struck fixed object	60.4	33.8	4.3	0.6	0.2	0.0	0.6	9.7
Side of car into fixed object	59.7	31.3	6.0	1.5	0.5	0.0	1.0	4.2
Column Total	56.3	39.2	3.5	0.7	0.1	0.0	0.3	4792

Table 211. Mean cost of injury by AIS level by crash configuration for unrestrained occupants.

	1	2	3	4	5	6
Head on	146.71	587.75	1358.37	1756.00	--	58793.93
Rear striking	109.17	452.45	1026.85	--	--	48916.50
Struck in rear	153.79	696.67	1559.60	--	--	48063.00
Angle striking	144.16	497.83	1195.26	1573.00	--	70607.50
Struck in left side	137.56	670.24	1406.25	841.89	1357.00	70636.06
Struck in right side	121.37	538.04	1155.55	2001.50	889.00	70072.13
Rollover	98.56	711.67	1759.71	1967.50	--	76086.63
Sideswipe	153.26	393.19	1159.13	1560.00	--	108405.00
Struck fixed object	177.46	534.79	1674.16	2270.58	--	81284.63
Side of car into fixed object	158.61	576.54	1071.17	1600.25	1872.00	61695.84

Table 212. Mean cost of injury by AIS by crash configuration for lap only belted occupants.

	1	2	3	4	5	6
Head-on	144.61	566.69	1234.75	1859.00	--	77798.31
Rear striking	108.11	396.50	1841.00	--	--	--
Struck in rear	154.67	736.00	810.67	596.00	--	61564.00
Angle striking	120.30	323.83	524.00	2936.00	--	--
Struck in left side	132.65	711.46	310.75	2359.00	--	48485.00
Struck in right side	143.39	458.78	1052.25	637.00	--	--
Rollover	398.10	902.50	--	2029.00	--	--
Sideswipe	160.57	957.00	--	--	--	--
Struck fixed object	100.35	543.86	1914.00	2362.50	1205.00	--
Side of car into fixed object	113.02	674.00	1654.25	1155.00	--	--

Table 213. Mean cost of injury by AIS level by crash configuration for lap and shoulder belted occupants.

	1	2	3	4	5	6
Head-on	117.03	515.33	1551.00	669.00	1263.00	56003.00
Rear striking	113.64	521.33	1268.33	--	--	--
Struck in rear	143.17	568.89	995.00	--	--	--
Angle striking	113.73	496.18	1206.33	--	--	--
Struck in left side	131.21	634.81	1711.25	--	--	68477.63
Struck in right side	141.55	669.40	1148.67	1356.00	--	33559.33
Rollover	124.13	124.00	497.00	--	--	--
Sideswipe	122.80	1140.67	--	--	--	105427.00
Struck fixed object	104.77	720.35	1198.67	2945.00	--	68084.00
Side of car into fixed object	88.76	885.45	1839.33	1721.00	--	43799.60

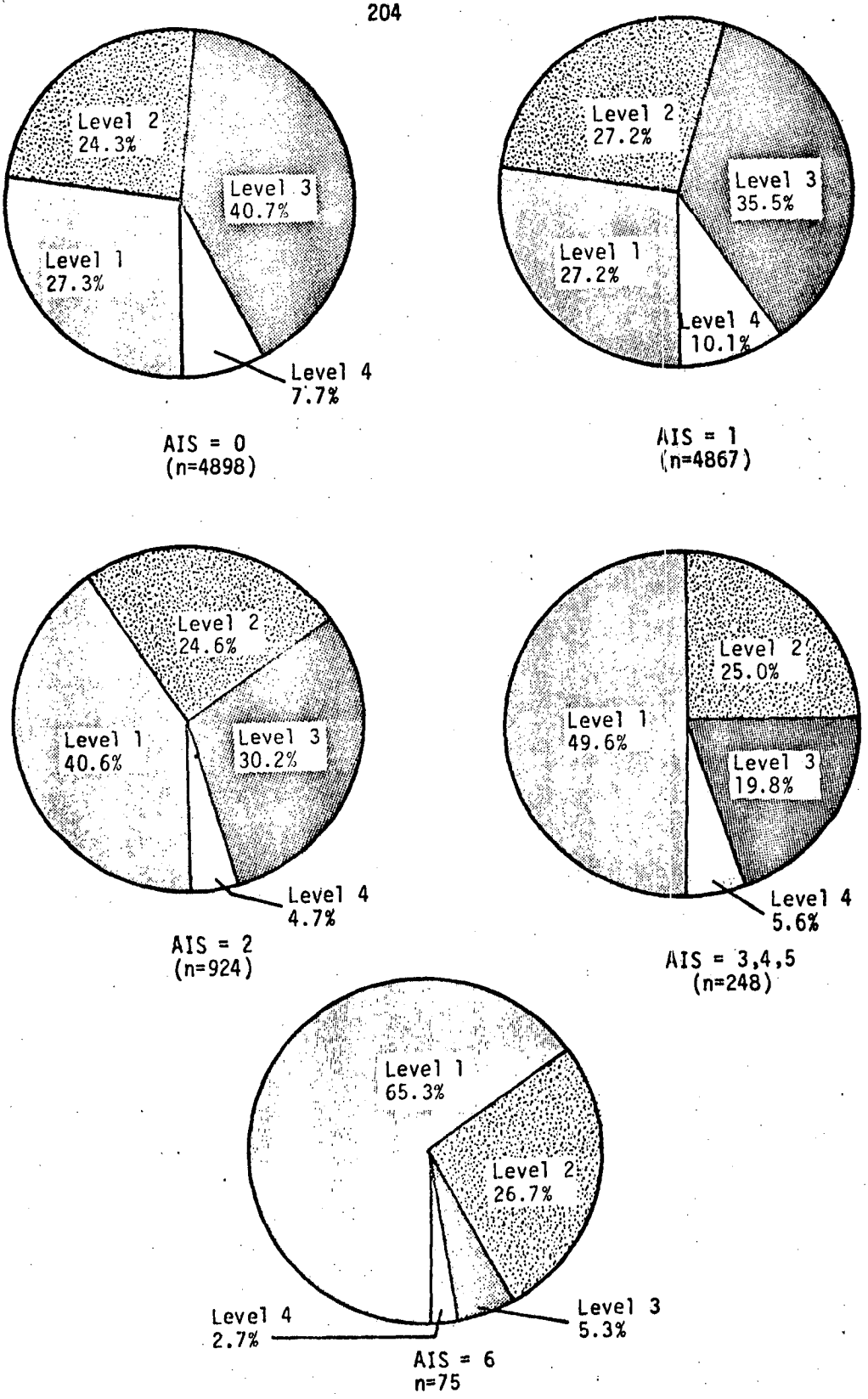


Figure 37. Crash type distribution of unrestrained occupants by AIS.

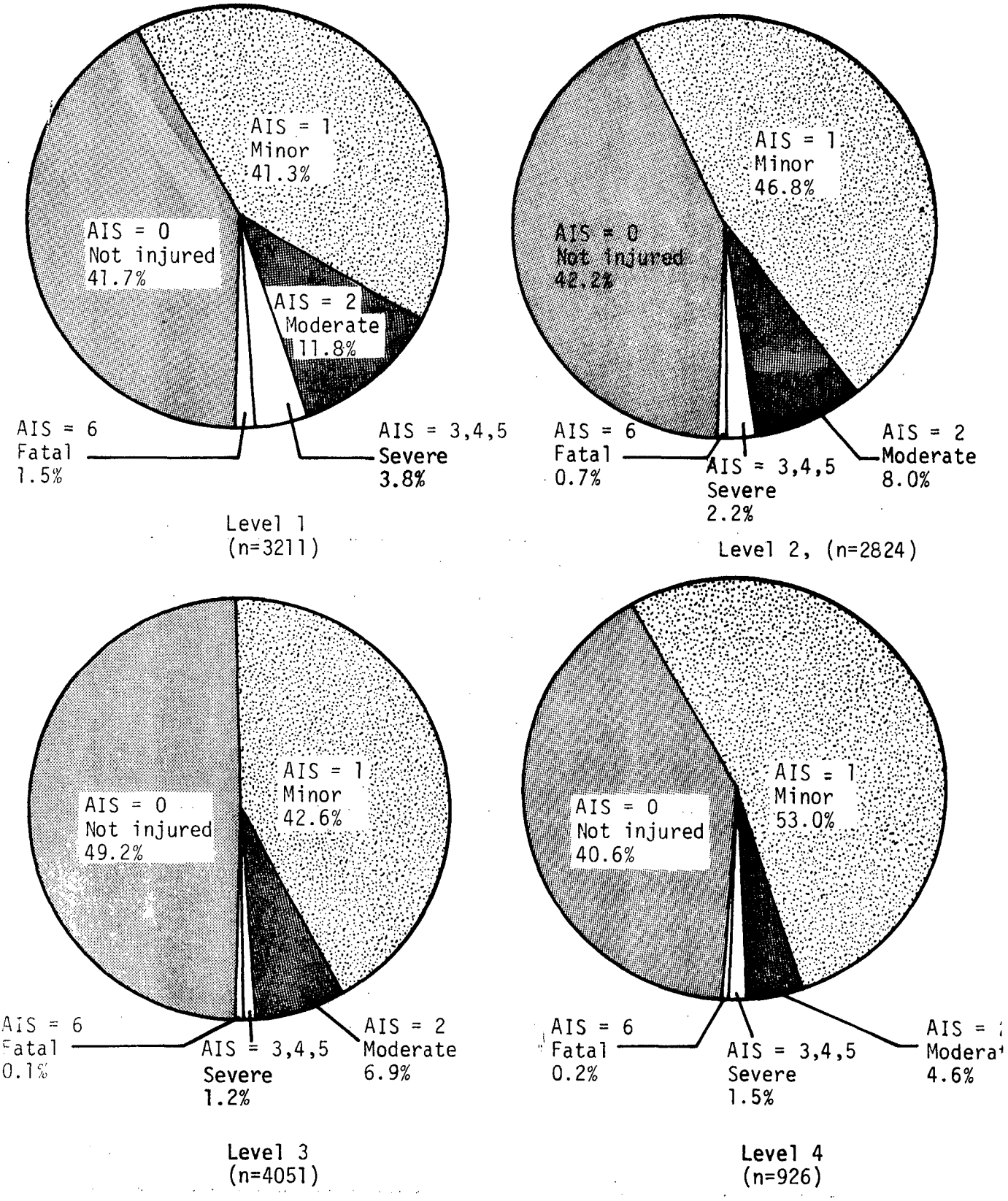


Figure 38. AIS distribution of unrestrained occupants by crash type.

Table 214. AIS level by restraint system usage for type 1 crashes.

		None Used	Lap Only	Lap and Shoulder	Row Total
AIS Level	0	58.1	18.6	23.4	46.4
	1	67.6	13.6	18.8	39.5
	2	78.5	9.8	11.7	9.6
	3	80.0	9.2	10.8	2.6
	4	69.2	19.2	11.5	0.5
	5	25.0	50.0	25.0	0.1
	6	81.7	6.7	11.7	1.2
Column Total		64.7	15.4	19.9	4962

Table 215. AIS level by restraint system usage for type 2 crashes.

		None Used	Lap Only	Lap and Shoulder	Row Total
AIS Level	0	49.6	19.6	30.8	48.0
	1	60.4	14.8	24.8	13.7
	2	73.5	11.7	14.9	6.2
	3	71.4	12.7	15.9	1.3
	4	78.6	14.3	7.1	0.3
	5	100.0	0.0	0.0	0.1
	6	74.1	3.7	22.2	0.5
Column Total		56.3	16.8	26.0	5016

Table 216. AIS level by restraint system usage for type 3 crashes.

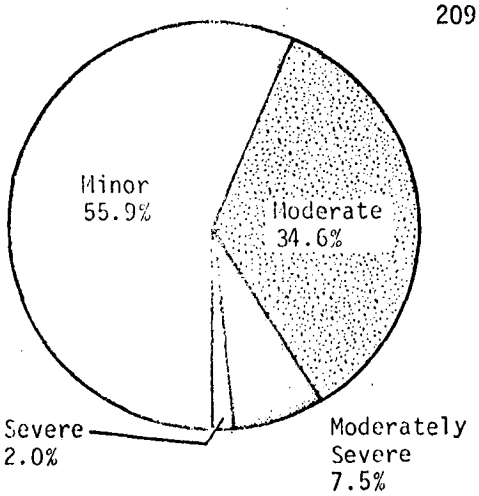
		None Used	Lap Only	Lap and Shoulder	Row Total
AIS Level	0	52.2	16.8	31.0	53.6
	1	60.6	17.1	22.2	40.0
	2	71.0	15.8	13.2	5.5
	3	84.6	3.8	11.5	0.7
	4	83.3	16.7	0.0	0.1
	5	0.0	0.0	0.0	0.0
	6	100.0	0.0	0.0	0.1
Column Total		56.9	16.8	26.3	7120

Table 217. AIS level by restraint system usage for type 4 crashes.

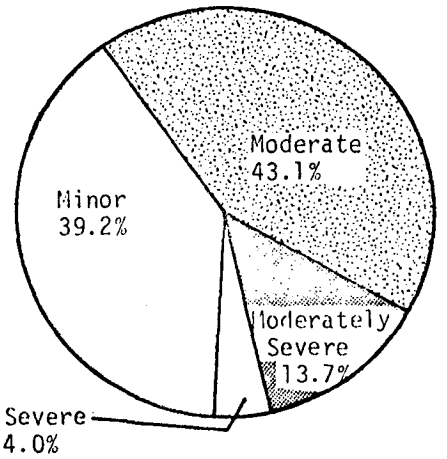
		None Used	Lap Only	Lap and Shoulder	Row Total
AIS Level	0	48.8	20.5	30.6	41.4
	1	49.1	17.5	33.3	53.7
	2	65.2	16.7	18.2	5.0
	3	68.4	15.8	15.8	1.0
	4	50.0	50.0	0.0	0.1
	5	0.0	0.0	0.0	0.0
	6	40.0	40.0	20.0	0.3
Column Total		49.8	18.8	31.4	1861

Table 218. Restraint system usage by damage severity by AIS level

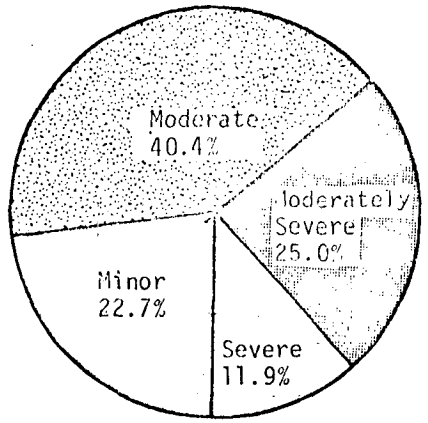
		None Used	Lap Only	Lap and Shoulder	Row Total
AIS = 0	Minor	53.2	16.9	29.9	56.2
	Moderate	52.5	18.0	29.6	35.2
	Moderately Severe	61.8	13.4	24.8	6.5
	Severe	50.9	23.0	26.1	2.1
	Column Total	53.5	17.2	29.4	7811
AIS = 1	Minor	59.7	16.1	24.2	40.0
	Moderate	62.8	15.4	21.8	41.8
	Moderately Severe	61.7	14.0	24.3	13.6
	Severe	53.0	16.1	30.9	4.6
	Column Total	61.0	15.5	23.5	7148
AIS $\geq$ 2	Minor	69.6	15.0	15.3	22.2
	Moderate	76.6	10.8	12.6	36.4
	Moderately Severe	79.4	9.4	11.3	24.4
	Severe	75.3	10.0	14.7	17.0
	Column Total	75.5	11.3	13.2	1526



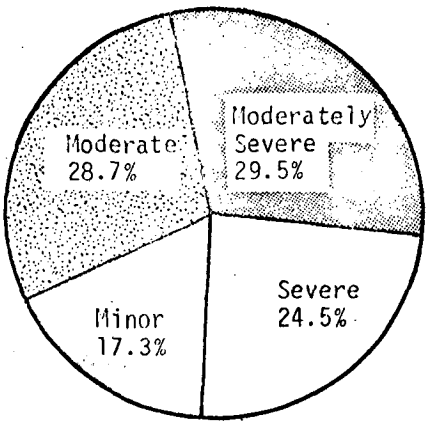
AIS = 0
(n=4176)



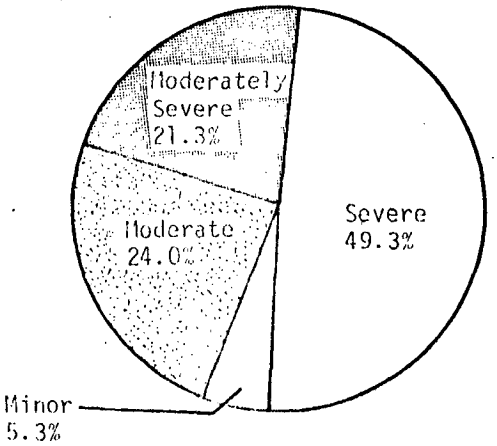
AIS = 1
(n-4357)



AIS = 2
(n=840)



AIS = 3,4,5
(n=237)



AIS = 6
(n=75)

Table 39. Damage severity distribution of unrestrained occupants by AIS.

Table 219. Impact site by restraint system usage by AIS level.

		None Used	Lap Only	Lap and Shoulder	Row Total
AIS=0	Front	53.8	17.5	28.6	58.7
	Side	50.8	19.4	29.7	35.0
	Rear	45.1	23.2	31.8	4.4
	Rollover	68.9	9.6	21.5	1.9
	Column Total	52.7	18.3	29.0	9297
AIS=1	Front	63.5	15.9	20.6	54.7
	Side	60.7	14.7	24.6	33.4
	Rear	46.9	18.6	34.5	10.2
	Rollover	63.4	8.2	28.4	1.7
	Column Total	60.9	15.7	23.5	7998
AIS≥2	Front	75.9	12.1	12.0	58.6
	Side	74.6	10.8	14.6	35.0
	Rear	55.0	25.0	20.0	3.6
	Rollover	84.8	6.5	8.7	2.8
	Column Total	74.9	12.0	13.2	1664

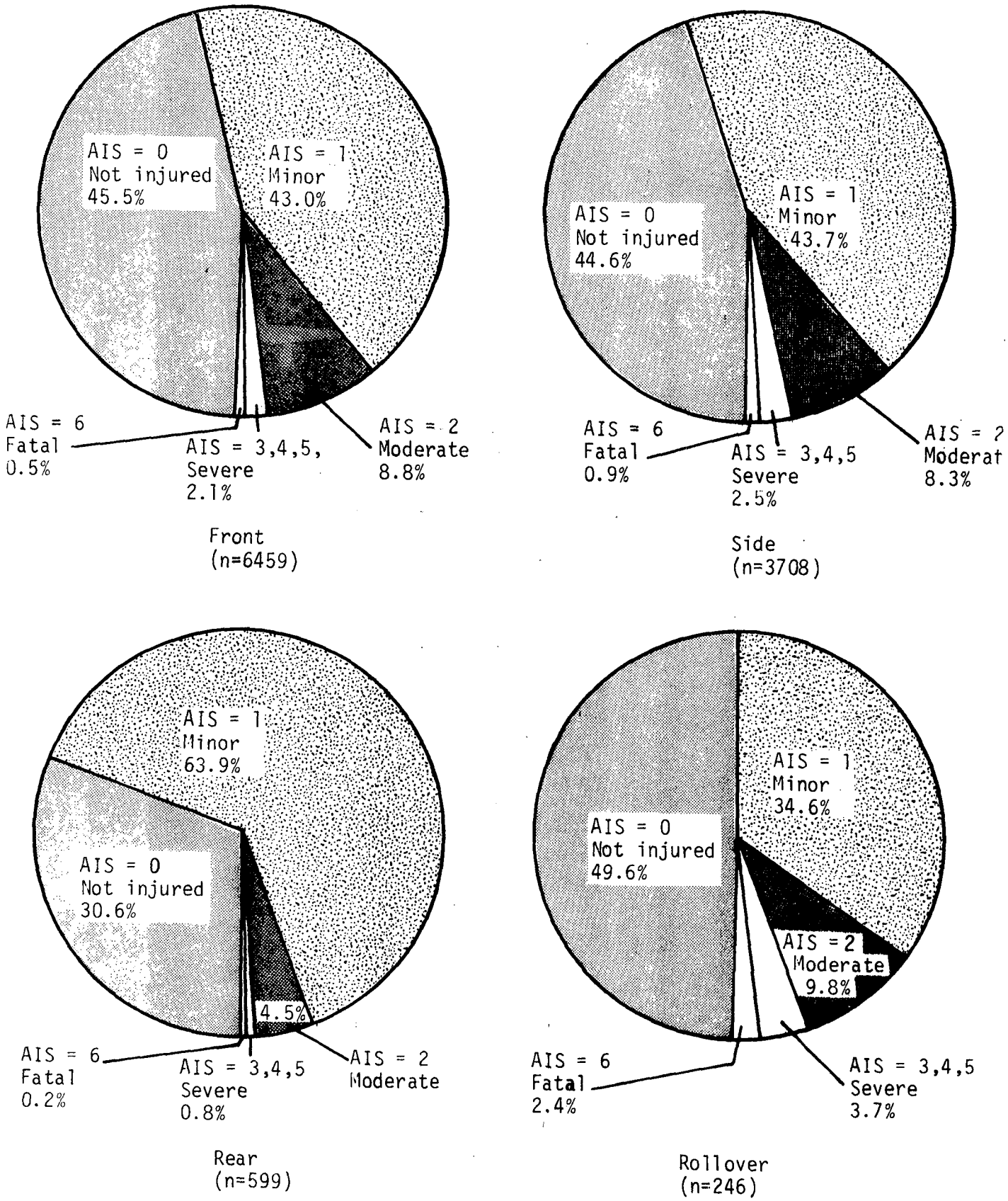


Figure 40. AIS disbribution of unrestrained occupants by impact site.

Table 220. Extent of first impact by AIS level by restraint system usage.

		None Used				Lap Only				Lap and Shoulder			
		AIS=0	AIS=1	AIS≥2	Row Total	AIS=0	AIS=1	AIS≥2	Row Total	AIS=0	AIS=1	AIS≥2	Row Total
Extent of First Impact	1	51.5	36.0	21.2	41.1	50.7	37.4	26.0	43.3	54.5	37.8	24.5	47.4
	2	31.5	37.6	27.9	33.8	32.7	37.4	34.4	34.8	31.6	35.4	28.5	33.0
	3	13.9	20.0	31.9	18.8	12.7	18.6	25.0	16.1	11.5	19.2	27.0	15.3
	4	1.8	3.8	12.0	3.9	2.1	4.0	4.2	3.1	1.3	4.8	10.5	3.2
	5	0.3	1.2	2.8	1.0	0.4	1.4	6.3	1.3	0.5	1.5	3.0	1.1
	6	0.4	0.4	1.9	0.6	0.1	0.7	1.6	0.5	0.5	1.0	3.5	0.8
	7	0.0	0.3	0.4	0.2	0.2	0.4	0.5	0.3	0.1	0.1	1.5	0.2
	8	0.0	0.1	0.7	0.1	0.1	0.0	1.0	0.1	0.0	0.1	1.5	0.1
	9	0.6	0.4	1.2	0.6	1.0	0.0	1.0	0.6	0.0	0.0	0.0	0.0
Column Total		43.2	45.0	11.8	9668	50.7	42.0	7.3	2646	55.0	40.3	4.8	4172

Table 221. Object struck by AIS level by restraint system usage.

		AIS Level							Row Total
		0	1	2	3	4	5	6	
None Used	Subcompact	49.9	43.6	5.3	0.7	0.1	0.0	0.3	6.0
	Compact	45.1	45.0	7.7	1.8	0.0	0.1	0.3	8.3
	Intermediate	43.7	45.2	8.6	1.6	0.3	0.1	0.5	13.0
	Full-sized	40.8	49.5	7.4	1.5	0.3	0.1	0.5	28.9
	Other vehicle	43.7	44.0	9.0	2.0	0.4	0.1	0.8	11.3
	Non-fixed object	66.0	30.9	1.0	1.0	0.0	0.0	1.0	0.9
	Fixed object	48.8	37.4	9.8	2.5	0.4	0.0	1.0	31.6
	Column Total	45.2	43.6	8.3	1.9	0.3	0.1	0.7	11312
Lap Only	Subcompact	56.1	40.2	3.2	0.5	0.0	0.0	0.0	5.7
	Compact	55.9	38.7	3.7	0.7	1.0	0.0	0.0	8.9
	Intermediate	55.5	39.7	4.4	0.2	0.2	0.0	0.0	15.0
	Full-sized	49.5	44.1	5.6	0.7	0.0	0.0	0.1	30.2
	Other vehicle	48.5	42.3	6.8	1.0	0.3	0.0	1.0	11.5
	Non-fixed object	95.5	4.5	0.0	0.0	0.0	0.0	0.0	2.0
	Fixed object	59.8	33.4	4.8	1.1	0.5	0.2	0.2	26.5
	Column Total	54.9	38.9	4.9	0.8	0.3	0.1	0.2	3320
Lap and Shoulder	Subcompact	61.0	37.0	1.7	0.2	0.0	0.0	0.0	8.3
	Compact	65.0	30.2	4.1	0.2	0.0	0.0	0.5	8.7
	Intermediate	58.4	37.4	3.1	0.3	0.2	0.2	0.5	12.9
	Full-sized	53.8	42.5	2.8	0.8	0.0	0.0	0.1	32.0
	Other vehicle	49.0	43.8	4.7	1.8	0.2	0.0	0.5	12.0
	Non-fixed object	82.1	15.4	2.6	0.0	0.0	0.0	0.0	0.8
	Fixed object	58.5	36.4	4.1	0.4	0.2	0.1	0.4	25.3
	Column Total	56.8	38.7	3.4	0.7	0.1	0.0	0.3	4980

VII. Belt Caused Injuries

One of the main detriments to seat belts as an injury prevention countermeasure is that seat belts themselves cause injuries. However, one can see that with the exception of the "probable" category, the belt caused injuries are much less costly (and hence less severe) than the non-belted caused injuries.

The location and types of injuries that are belt caused were also examined. The first two figures in this section enable one to compare the distribution of belt caused injuries to that of non-belt caused injuries. Belt caused injuries are primarily contusions and pains in the hip, abdomen and chest. The distributions for lacerations, contusions and pain for belt caused and non-belt caused injuries are also shown.

Table 222. Cost of injury by belt causation.

	Mean	S.D.	N
Not Belt Caused	418.26	4994.88	20241
Possible	256.85	509.65	142
Probable	614.41	4403.12	94
Definite	147.98	297.11	75

Table 223. Belt causation by restraint system usage by AIS level.

		None Used	Lap Only	Lap and Shoulder	Row Total
AIS = 1	No	99.9	96.3	87.1	96.3
	Possible	0.1	1.0	6.0	1.6
	Probable	0.0	1.5	3.7	1.1
	Definite	0.0	1.2	3.1	0.9
	Column Total	60.6	15.8	23.6	8149
AIS = 2	No	100.0	99.4	96.5	99.4
	Possible	0.0	0.6	2.9	0.5
	Probable	0.0	0.0	0.0	0.0
	Definite	0.0	0.0	0.6	0.1
	Column Total	74.0	12.6	13.4	1271
AIS $\geq$ 3	No	99.4	87.5	88.7	97.0
	Possible	0.0	5.0	7.5	1.4
	Probable	0.0	2.5	3.8	0.7
	Definite	0.6	5.0	0.0	0.9
	Column Total	78.0	9.5	12.6	422

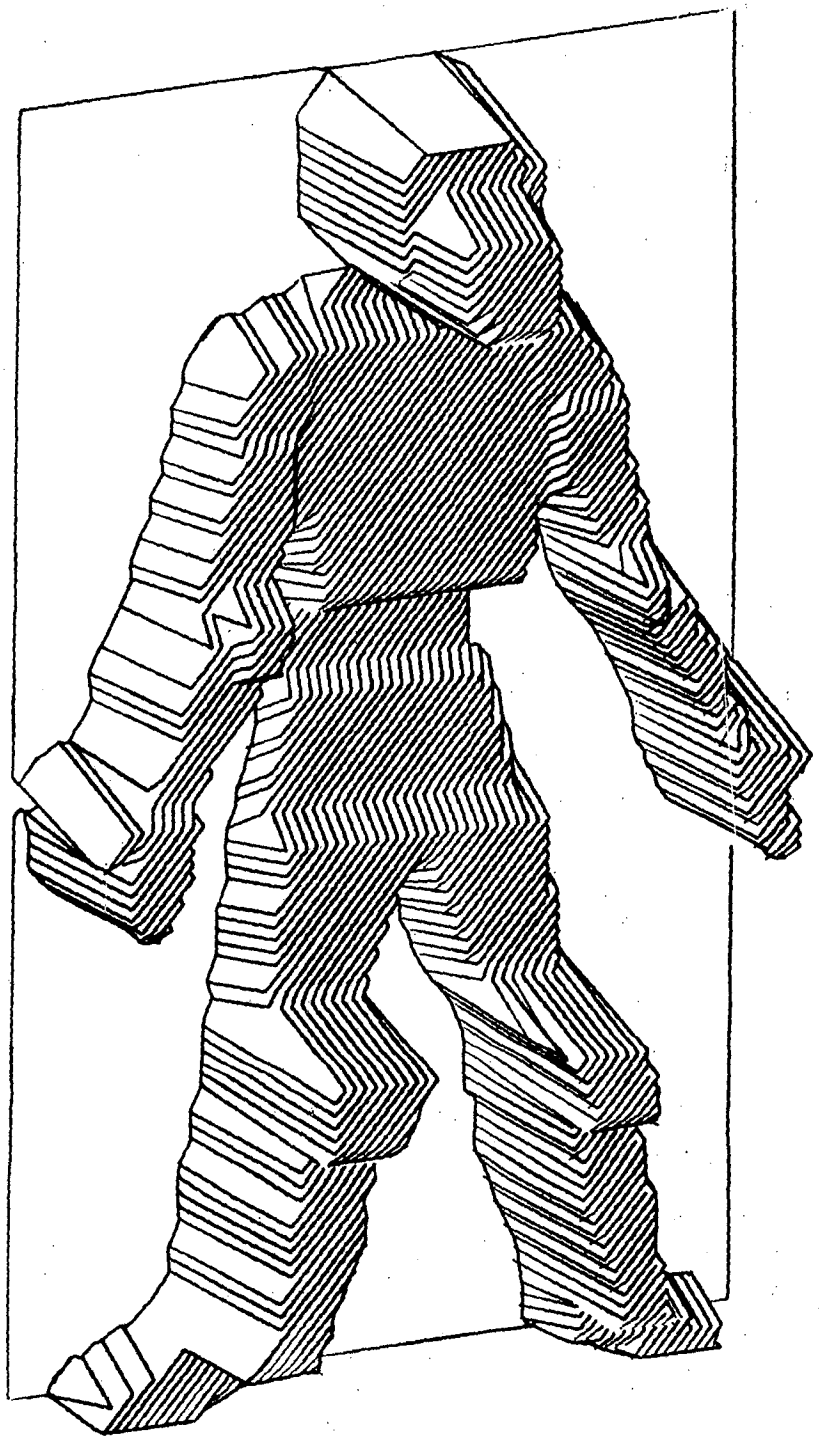


Figure 41. Distribution of non-belt caused injuries by body region.

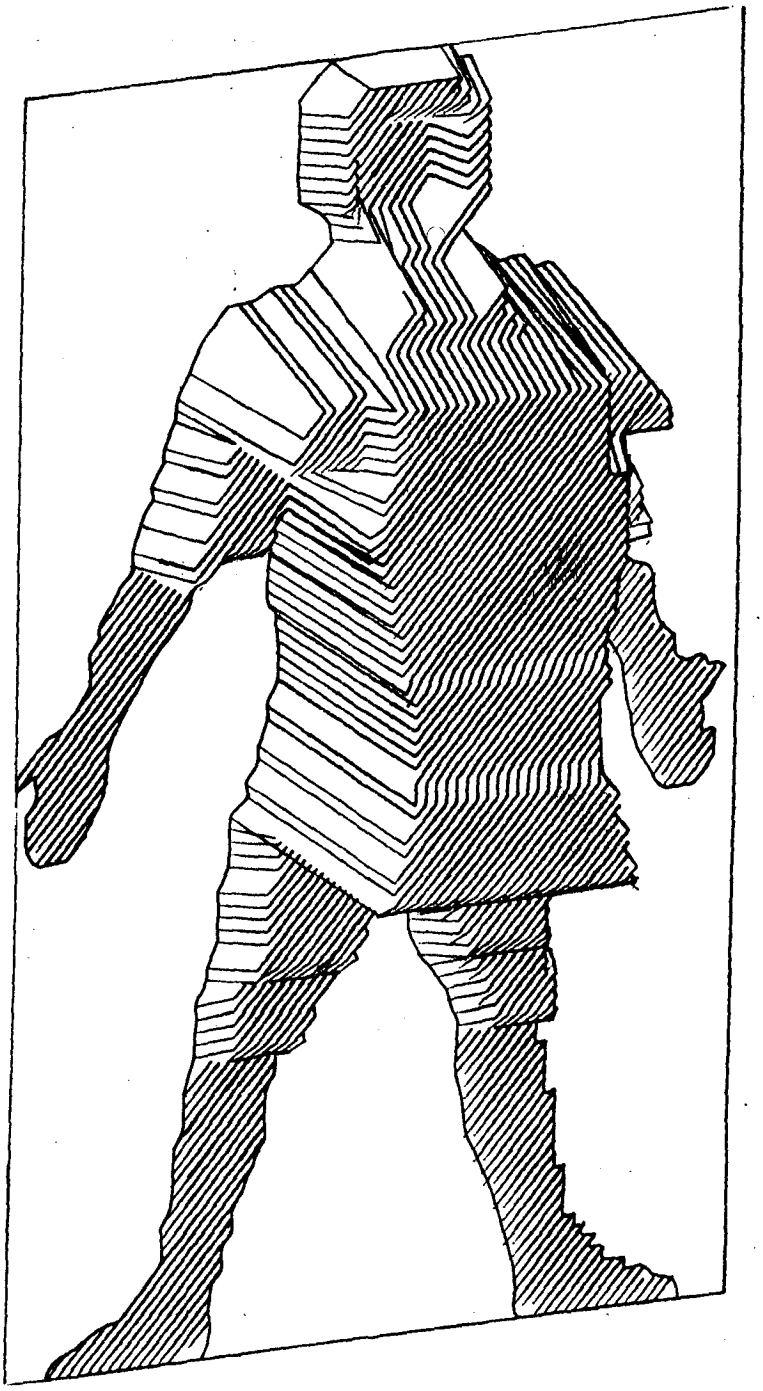


Figure 42. Distribution of belt caused injuries by body region.

Table 224. Body region by type of lesion for belt caused injuries.

	Sprain	Rupture	Pain	Other	Laceration	Hemorrage	Fracture	Dislocation	Contusion	Abrasion	Row Total
Arm	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Thigh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.0	0.4
Shoulder	9.1	0.0	12.0	28.6	28.6	0.0	5.6	100.0	10.0	14.6	11.4
Hip	0.0	0.0	6.0	28.6	28.6	0.0	33.3	0.0	35.2	26.8	21.5
Whole Body	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.0	0.4
Neck	45.5	0.0	24.4	28.6	14.3	0.0	0.0	0.0	4.5	26.8	14.8
Abdomen	0.0	100.0	18.7	0.0	28.6	80.0	0.0	0.0	24.5	19.5	21.3
Knee	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.3
Head-Skull	0.0	0.0	0.0	0.0	0.0	20.0	0.0	0.0	0.9	0.0	0.6
Chest	0.0	0.0	13.0	14.3	0.0	0.0	61.1	0.0	20.6	12.2	17.2
Back	45.5	0.0	25.1	0.0	0.0	0.0	0.0	0.0	0.3	0.0	11.2
Upper Arm	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	1.5	0.0	0.8
Column Total	1.5	0.4	41.4	1.0	1.0	0.7	2.5	0.1	45.7	5.7	722

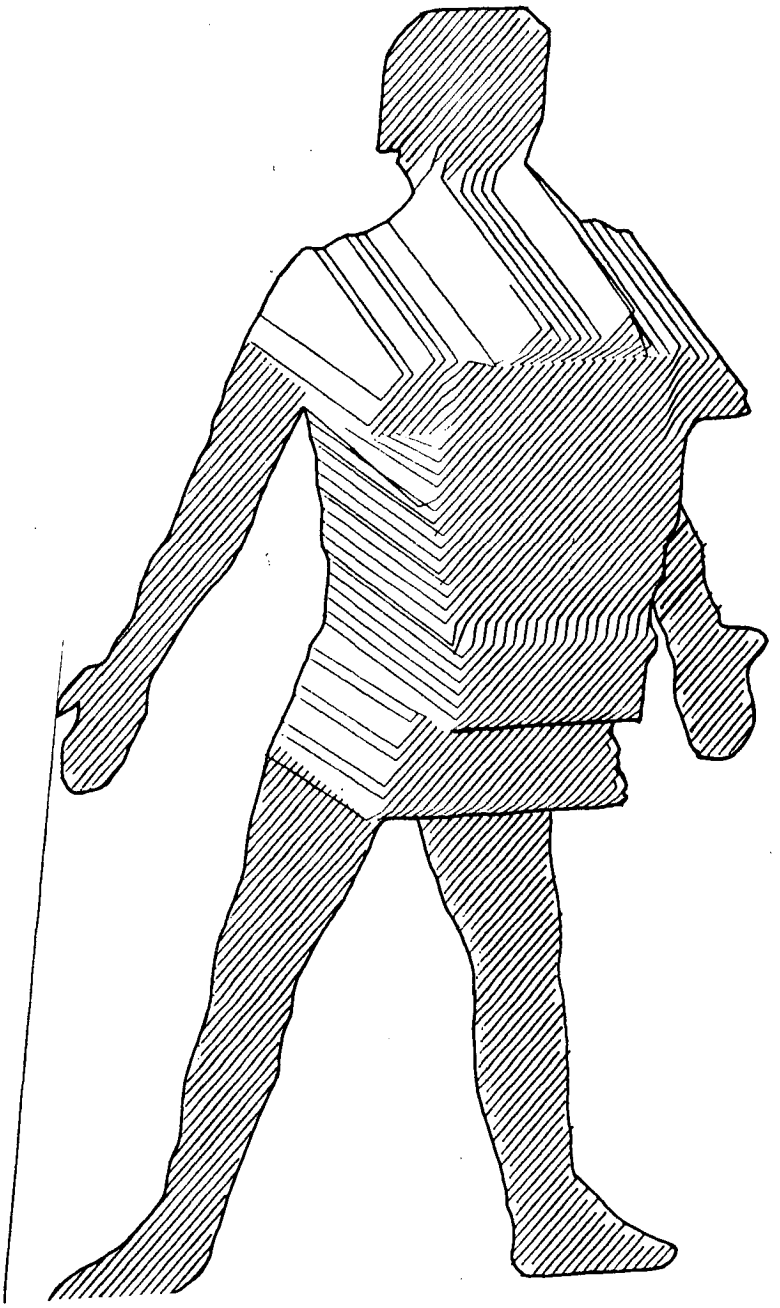


Figure 43. Distribution of belted caused pain injuries by body region.

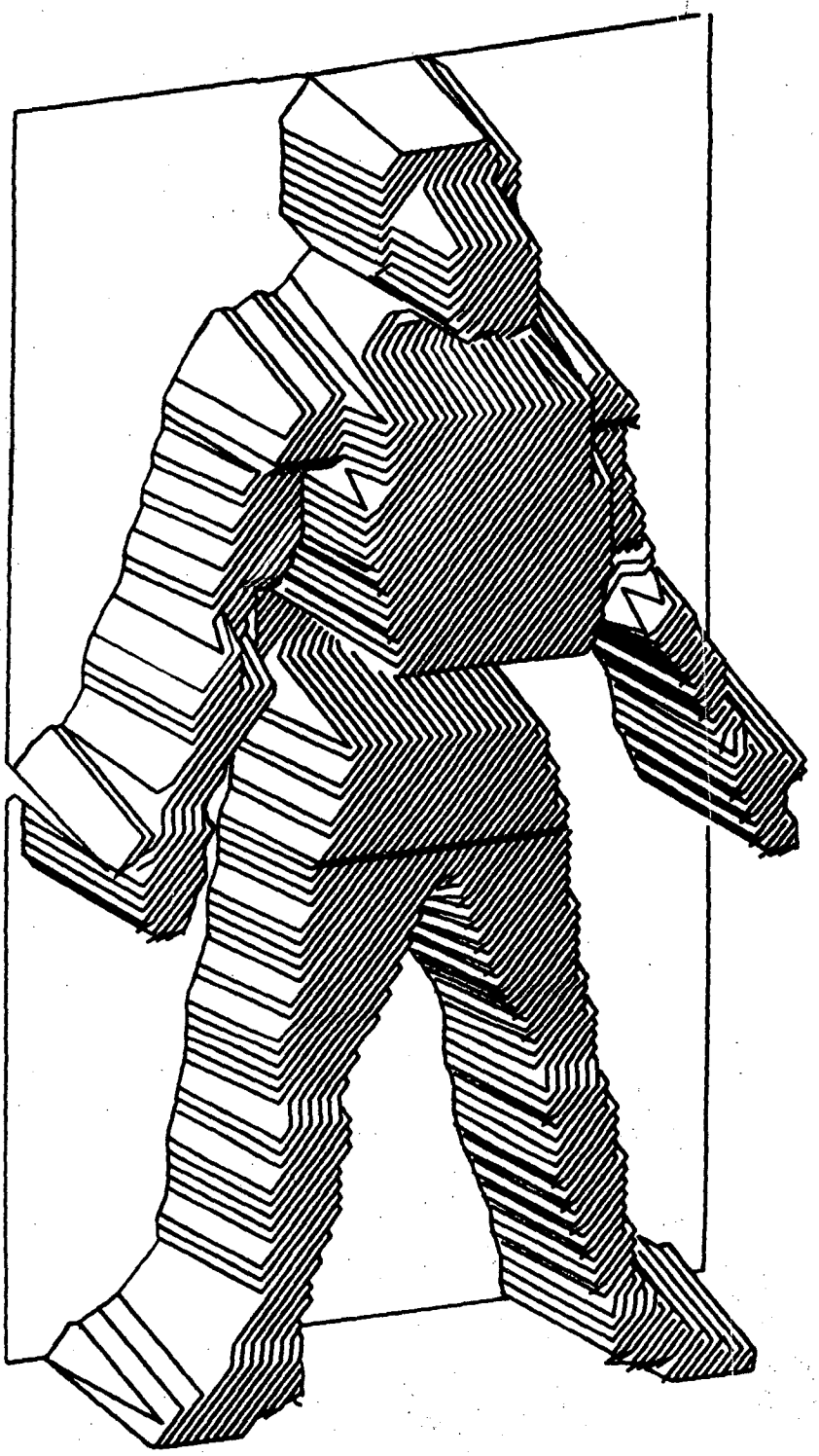


Figure 44. Distribution of non-belt caused pain injuries by body region.

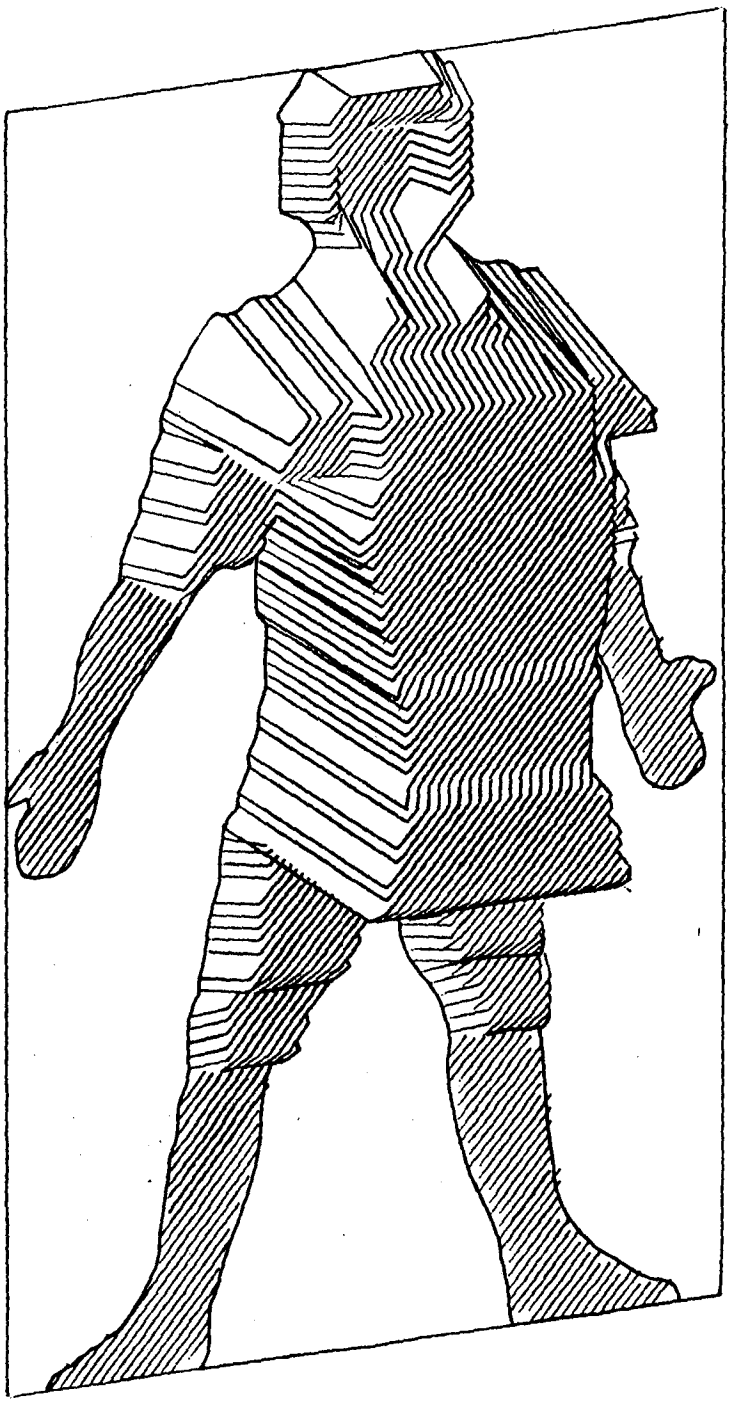


Figure 45. Distribution of belt caused <u>contusion</u> injuries by body region.

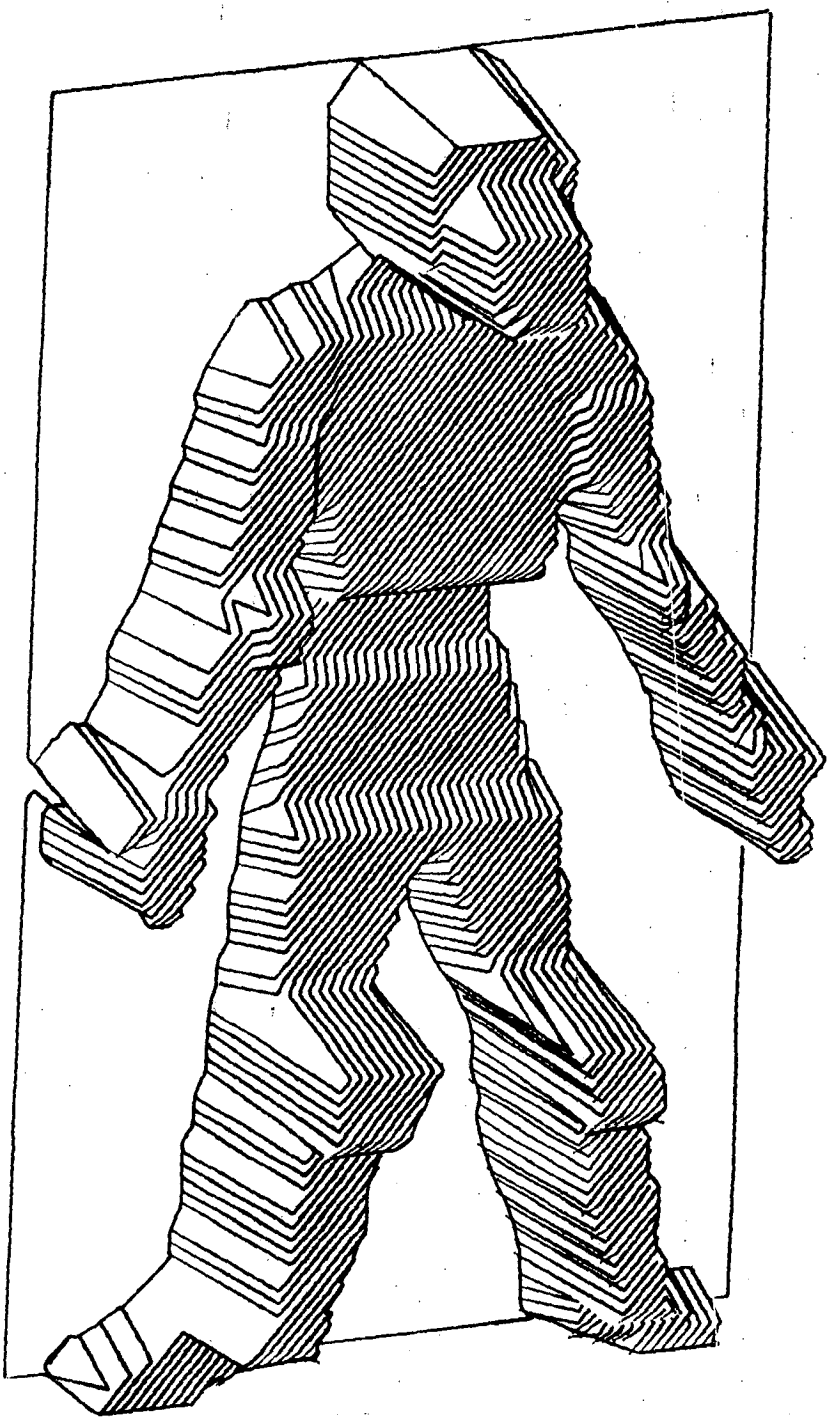


Figure 46. Distribution of non-belt caused contusions by body region.

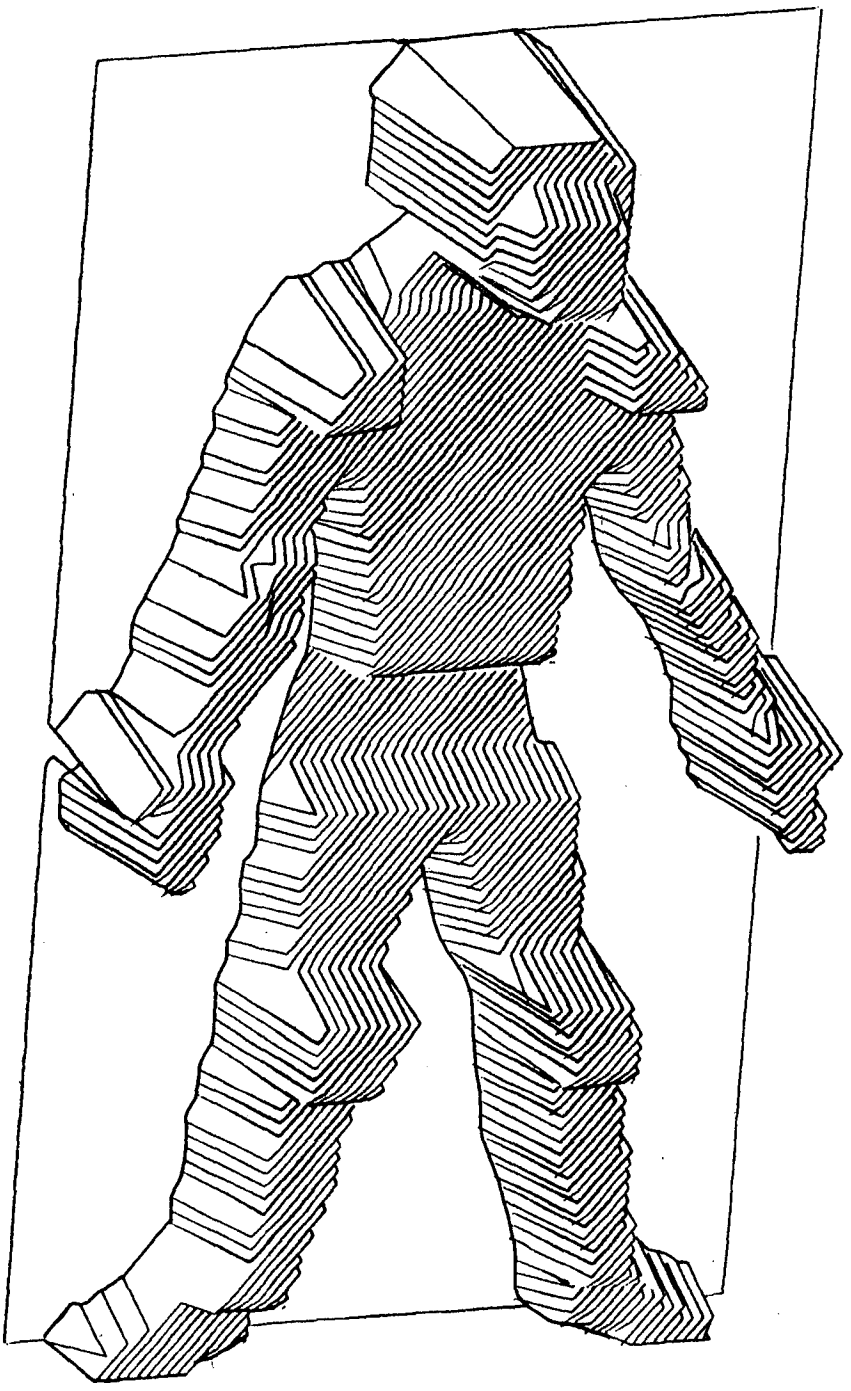


Figure 47 . Distribution of non-belt caused lacerations by body region.

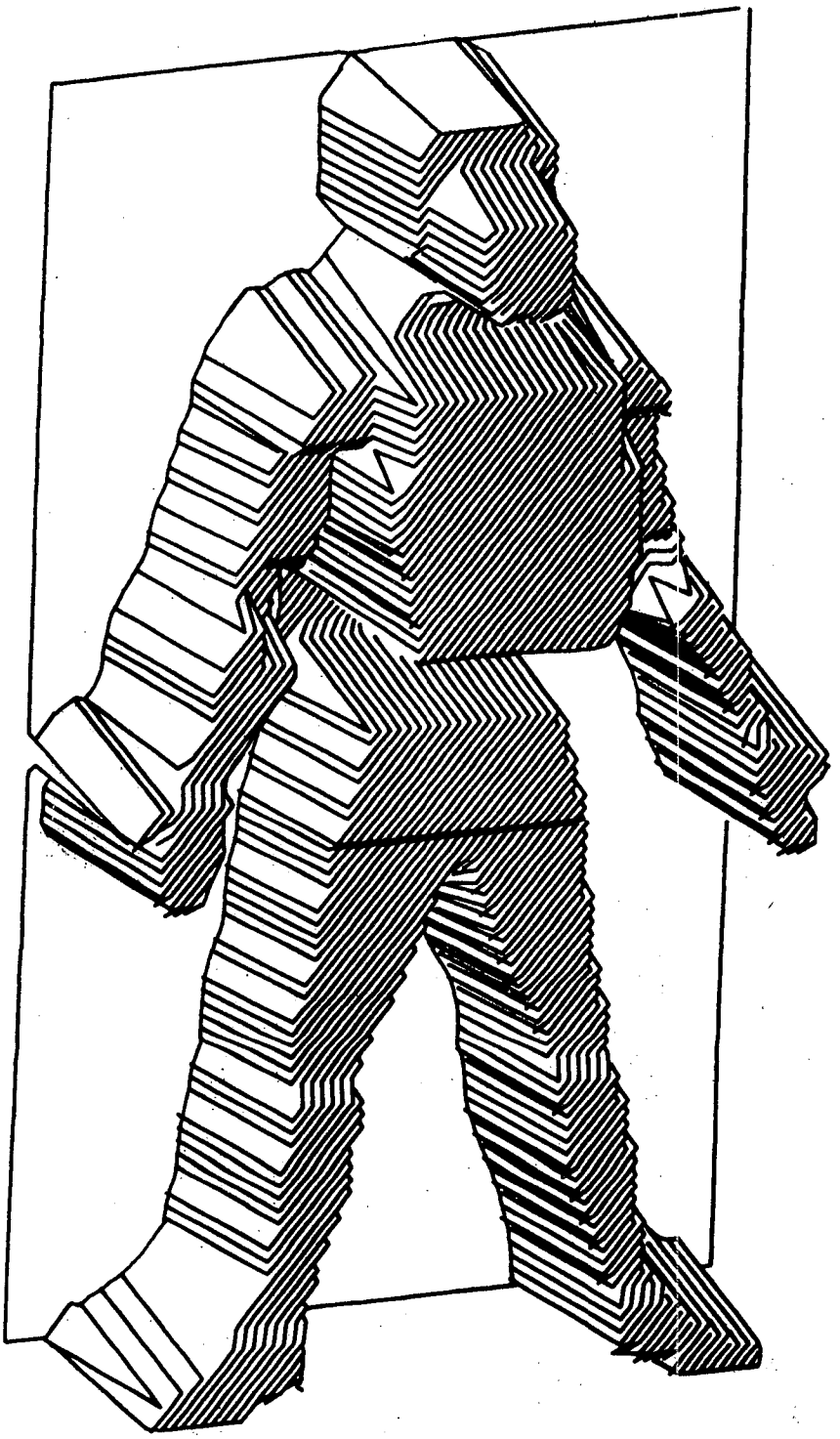


Figure 48 . Distribution of non-belted caused fractures by body region.

VIII. Seat Belt Problems

One of the many problems involved in research with seat belts is that they are relatively easy to abuse. The occupant can defeat them or adjust them improperly or they can simply malfunction. The data presented in this chapter is based on the assumption that if one of the occupants of a vehicle falls under one of these three categories then all other occupants also fall into one of the categories. For example, if one of the occupants was not using a seat belt, then what are the chances that the other occupants in the car had either defeated their system, adjusted the belt improperly, or had a malfunctioning belt.

One can see that except for the maladjustment of the lap only belts in the 1974 and 1975 cars, the maladjustment rates are uniformly low. The defeat rates for the belts are higher, especially if the other occupants were not using their belt system. Defeat of lap and shoulder system is rather constant over the three model years, but the defeat of the lap only system increases in the newer model cars.

One can examine these same factors for various makes of cars. Note for example, the high malfunction rate for 1974 Mazdas and 1975 Toyotas.

Malfunction and maladjustment seem to drop after the car has accumulated some mileage, but unfortunately the defeat of the system increases with the odometer reading. Individuals who do defeat their belt system are most likely to be in rollover accidents or striking fixed objects. People who do not defeat the system are more likely to be involved in struck in the rear accidents.

It is interesting to note that there is an increase in AIS level as one finds malfunctioning belts. Maladjustment of the lap and shoulder belt also seems to allow serious injury. The same does not hold true for lap only maladjustment.

Table 225. Malfunction, defeat, and maladjustment of belts by seating position by restraint system usage by vehicle model year.

		1973			1974			1975		
		None Used	Lap Only	Lap and Shoulder	None Used	Lap Only	Lap and Shoulder	None Used	Lap Only	Lap and Shoulder
Malfunction	Left	2.5	1.7	3.9	2.5	0.9	3.2	1.4	0.0	3.1
	Right	1.8	0.8	2.0	1.7	0.6	2.6	1.1	1.3	1.4
Defeat	Left	86.9	37.4	22.0	87.4	53.8	21.5	84.7	59.2	29.4
	Right	86.9	47.1	31.0	86.6	56.1	25.2	83.3	58.3	35.1
Maladjustment	Left	2.6	1.5	1.2	9.9	37.6	4.1	9.0	24.4	8.1
	Right	2.2	1.3	0.0	9.3	43.8	3.8	0.0	20.0	2.4

Table 226. Malfunction, defeat and maladjustment of restraint system by vehicle make by model year by seat position.

	Malfunction						Defeat						Maladjustment					
	Left			Right			Left			Right			Left			Right		
	1973	1974	1975	1973	1974	1975	1973	1974	1975	1973	1974	1975	1973	1974	1975	1973	1974	1975
Chevrolet	2.2	1.4	2.2	0.7	1.4	1.3	66.6	50.0	57.9	70.3	55.4	60.1	1.9	8.5	12.9	3.5	6.8	7.6
Oldsmobile	2.4	1.7	1.5	0.6	2.8	0.0	68.7	49.4	60.6	73.7	47.8	70.3	1.7	15.9	14.1	0.0	10.3	0.0
Pontiac	1.2	0.9	3.4	0.8	0.6	0.0	74.0	54.1	54.7	75.6	63.9	62.4	3.3	7.5	11.6	0.0	11.9	12.5
Cadillac	3.2	0.0	0.0	4.0	0.0	0.0	66.9	53.6	64.7	67.9	55.5	66.0	0.0	13.6	13.6	0.0	25.0	0.0
Buick	2.0	0.7	1.8	2.6	1.0	0.0	68.4	58.9	68.6	73.4	63.8	64.7	2.0	3.1	7.5	4.8	20.0	0.0
GM Total	2.1	1.3	2.1	1.0	1.3	0.8	68.6	51.6	59.4	72.0	56.6	62.7	2.1	9.2	12.4	2.4	9.3	5.9
Plymouth	1.1	3.6	1.0	1.1	1.9	0.0	69.3	70.5	84.4	74.0	71.0	88.4	2.5	5.7	2.5	0.0	4.1	0.0
Dodge	3.1	5.0	0.0	2.9	1.9	10.5	59.8	68.6	68.9	64.1	64.6	57.1	1.7	4.3	0.0	0.0	2.4	0.0
Chrysler Total	1.9	4.1	0.6	1.8	1.9	4.0	65.6	69.7	78.3	70.2	68.4	75.4	2.2	5.1	1.5	0.0	3.5	0.0
Ford	1.4	2.3	1.2	1.6	1.5	0.6	68.6	60.3	64.4	72.6	63.3	67.6	1.7	9.3	11.0	1.1	16.5	0.0
Mercury	0.0	3.6	0.0	0.0	3.9	0.0	73.6	56.0	78.0	80.3	53.3	77.9	0.0	7.9	3.8	0.0	4.2	0.0
Capri	5.5	4.9	0.0	0.0	1.8	0.0	48.9	66.0	50.0	52.8	60.5	100.0	0.0	8.4	0.0	0.0	0.0	0.0
Ford Total	1.4	2.7	0.9	1.2	1.9	0.5	68.3	60.0	67.1	72.8	61.7	69.8	1.2	9.0	10.0	0.8	12.1	0.0
AMC	3.8	3.7	0.0	2.3	2.5	0.0	73.9	63.2	61.8	76.1	65.3	60.7	0.0	6.0	0.0	0.0	0.0	0.0
VW	6.2	1.4	0.0	4.9	0.0	0.0	68.5	66.3	61.0	69.9	63.9	63.9	0.0	9.0	0.0	0.0	5.8	0.0
Datsun	5.7	0.0	3.7	3.7	0.0	0.0	68.5	58.7	37.6	67.1	64.4	39.7	0.0	0.0	4.1	0.0	0.0	0.0
Toyota	1.7	9.0	17.0	0.7	6.3	5.7	69.2	37.0	41.2	74.9	35.2	35.9	2.4	4.6	8.9	10.0	9.3	0.0
Mazda	3.0	12.3	0.0	0.0	16.3	0.0	61.5	61.1	100.0	70.1	70.5	100.0	2.3	0.0	0.0	0.0	0.0	0.0
Japanese Total	3.3	6.3	14.2	1.5	5.3	4.5	66.7	48.1	41.9	71.2	51.9	38.7	1.6	2.8	7.5	2.6	5.4	0.0
Other	3.2	4.4	0.0	1.5	3.1	2.2	53.8	55.8	68.1	63.9	51.2	69.0	2.0	3.5	4.3	0.0	2.7	0.0
Column Total	2.3	2.7	2.3	1.5	1.9	1.3	67.4	57.1	62.1	71.5	59.2	63.8	1.7	7.6	9.5	1.4	8.2	2.9

Table 227. Malfunction, defeat, and maladjustment by odometer reading by model year by seat position.

	Malfunction						Defeat						Maladjustment					
	Left			Right			Left			Right			Left			Right		
	1973	1974	1975	1973	1974	1975	1973	1974	1975	1973	1974	1975	1973	1974	1975	1973	1974	1975
<5,000	4.1	4.0	2.4	3.8	2.6	1.0	41.2	43.0	56.0	43.8	43.7	57.4	2.1	6.2	9.0	0.0	3.6	3.2
5,000-9,999	4.5	2.3	1.6	6.3	1.8	0.5	62.2	55.2	72.7	59.8	56.8	75.3	0.0	9.0	15.6	0.0	7.1	3.4
10,000-19,000	1.9	2.9	4.9	0.5	2.3	4.8	61.6	63.0	69.5	69.5	66.1	71.1	2.5	4.5	9.8	0.0	7.0	0.0
20,000 & up	2.6	2.9	2.6	1.6	1.7	2.9	73.9	70.3	58.9	76.9	73.5	53.8	1.6	3.7	0.0	2.3	2.6	0.0
Column Total	2.5	2.9	2.5	1.6	2.1	1.4	68.5	58.3	62.4	72.7	60.5	64.1	1.8	5.9	10.0	1.5	5.5	2.6

Table 228. Malfunction, defeat and maladjustment for crash configuration by model year by seat position.

	Malfunction						Defeat						Maladjustment					
	Left			Right			Left			Right			Left			Right		
	1973	1974	1975	1973	1974	1975	1973	1974	1975	1973	1974	1975	1973	1974	1975	1973	1974	1975
Head on	1.4	3.3	1.1	0.0	0.6	0.0	65.7	54.0	68.7	73.3	55.4	73.2	1.7	10.1	8.6	0.0	8.3	16.7
Rear striking	2.1	3.5	4.7	0.0	3.1	3.5	64.7	56.2	64.5	71.5	58.5	65.6	2.1	11.6	7.1	6.1	10.5	2.8
Struck in rear	3.0	0.5	7.3	2.4	0.6	0.0	58.8	45.9	63.9	62.7	47.6	61.0	3.3	7.0	6.1	0.0	9.2	0.0
Angle striking	3.3	3.5	0.4	3.1	2.0	0.0	66.8	60.9	60.2	70.9	63.5	61.3	1.1	4.4	11.6	0.9	2.3	8.5
Struck in left side	2.3	3.7	0.8	1.1	3.5	0.0	69.5	55.2	59.6	74.7	57.9	56.3	0.0	7.4	16.9	0.0	4.6	0.0
Struck in right side	2.3	1.6	1.3	1.0	1.4	0.0	69.4	60.5	65.9	70.5	62.8	72.9	1.1	5.5	10.0	0.0	3.6	0.0
Rollover & other	5.1	3.8	0.0	1.0	2.8	0.0	72.6	54.9	42.9	78.4	58.0	42.6	0.0	7.7	6.3	0.0	0.0	0.0
Sideswipe	0.0	0.8	0.0	0.0	0.0	0.0	69.7	53.8	53.6	72.1	55.2	65.0	2.3	7.8	13.4	0.0	27.3	0.0
Struck fixed object	1.3	1.4	4.5	0.0	1.1	3.4	69.8	58.8	66.8	73.3	60.4	67.6	3.0	12.0	3.7	3.5	15.6	0.0
Side of car into fixed object	1.7	0.8	4.1	0.0	0.3	7.9	69.1	59.9	66.7	73.9	61.6	75.6	0.0	6.8	2.1	0.0	7.5	0.0
Column Total	2.3	2.6	2.4	1.4	1.9	1.3	67.2	57.4	62.6	71.5	59.6	64.4	1.5	7.8	9.6	1.1	8.6	3.1

Table 229. Belt condition by restraint system usage by seat position by AIS level.

			Lap Only	Lap and Shoulder
AIS = 1	Left	Malfunctioning	2.2	4.2
		Maladjusted	4.0	5.5
		Properly Functioning	93.8	90.3
	Right	Malfunctioning	0.7	2.8
		Maladjusted	1.6	2.2
		Properly Functioning	97.7	95.0
AIS = 2	Left	Malfunctioning	2.8	10.9
		Maladjusted	2.8	8.3
		Properly Functioning	94.4	80.8
	Right	Malfunctioning	4.3	7.5
		Maladjusted	1.1	3.8
		Properly Functioning	94.7	88.7
AIS $\geq$ 3	Left	Malfunctioning	5.6	10.0
		Maladjusted	2.8	2.0
		Properly Functioning	91.7	88.0
	Right	Malfunctioning	11.5	8.6
		Maladjusted	0.0	2.9
		Properly Functioning	88.5	88.6

Table 230. Restraint system usage by AIS level by front seat position by malfunction, defeat and maladjustment of the restraint system.

		AIS = 0	AIS = 1	AIS ≥ 2
	None Used	2.6	2.5	1.5
Left	Lap Only	0.9	2.2	3.4
	Lap & Shoulder	2.1	4.3	10.7
Malfunction				
	None Used	1.8	1.6	1.2
Right	Lap Only	0.4	0.7	5.9
	Lap & Shoulder	1.6	2.8	7.9
	None Used	87.5	86.5	84.8
Left	Lap Only	41.4	38.5	46.1
	Lap & Shoulder	23.2	23.4	21.0
Defeat				
	None Used	86.5	86.4	83.2
Right	Lap Only	49.2	48.0	58.0
	Lap & Shoulder	28.1	27.5	24.8
	None Used	7.3	4.9	8.3
Left	Lap Only	8.4	5.2	3.7
	Lap & Shoulder	3.6	5.9	7.7
Maladjustment				
	None Used	8.3	2.5	0.0
Right	Lap Only	11.5	3.4	2.2
	Lap & Shoulder	2.8	4.0	7.2

IX. Fatalities

Obviously, fatalities are a great concern in the evaluation of a restraint system. The effectiveness of seat belts in preventing deaths is shown in the first table. Both the lap only and the lap and shoulder system users are markedly underrepresented among the fatalities.

Several other factors can also be seen. The older cars and the lighter cars are both overrepresented in fatalities. In addition, Oldsmobiles, Pontiacs, Chryslers, Fords and Datsuns have a higher than anticipated involvement in fatal accidents.

By far the greatest correlation, however, is found in the time of the accident. The midnight to 6:00 AM category shows twice as many fatal accidents as might be expected, given the non-fatal accident distribution. Furthermore, these accidents occur primarily over the weekend. In addition, accidents involving fatally injured occupants are likely to involve head-on collisions, rollovers, and both types of striking fixed objects. The extent of impact is distributed in a very different pattern for fatal as opposed to non-fatal accidents.

One of the more interesting findings is shown in the figure comparing the o'clock direction of force of the first impact. We can see, as expected, that head-on or near head-on collisions account for a large proportion of both accident types. What is interesting, however, is the overrepresentation of the struck in the sides of the vehicle in fatal accidents. Two alternatives immediately suggest themselves: (1) seat belts do not provide sufficient protection from forces coming at angles greater than 45° from the front, and/or (2) the side portions of the vehicle need to be strengthened to protect the occupant.

Table 231. Restraint system usage by fatality.

	Non-Fatal	Fatal	Row Total
None Used	57.5	78.4	57.6
Lap Only	17.1	7.2	17.0
Lap and Shoulder	25.4	14.4	25.4
Column Total	99.5	0.5	19883

Table 232. Vehicle model year by fatality.

	Non-Fatal	Fatal	Row Total
1973	45.6	57.4	45.7
1974	43.1	36.6	43.1
1975	11.2	5.9	11.1
Column Total	99.5	0.5	21049

Table 233. Vehicle weight by fatality.

	Non-Fatal	Fatal	Row Total
Subcompact	31.2	29.9	31.2
Compact	24.9	22.7	24.9
Intermediate	22.3	22.7	22.3
Full-sized	21.6	24.7	21.6
Column Total	99.5	0.5	20179

Table 234. Vehicle make by fatality.

	Non-Fatal	Fatal	Row Total
Chevrolet	21.9	16.2	21.8
Oldsmobile	5.6	8.1	5.6
Pontiac	6.8	14.1	6.8
Buick	3.8	4.0	3.8
Cadillac	1.9	2.0	1.9
GM Total	40.0	44.4	39.9
Plymouth	5.6	7.1	5.6
Dodge	3.6	4.0	3.6
Chrysler Total	9.2	11.1	9.2
Ford	20.6	23.2	20.6
Mercury	4.6	3.0	4.6
Capri	1.6	0.0	1.6
Ford Total	26.8	26.2	26.8
AMC	5.2	0.0	5.1
VW	4.4	2.0	4.3
Datsun	2.4	4.0	2.5
Toyota	3.8	1.0	3.7
Mazda	1.3	2.0	1.3
Japanese Total	7.5	7.0	7.5
Other	6.9	9.1	6.9
Column Total	99.5	0.5	20898

Table 235. Odometer reading by fatality.

	Non-Fatal	Fatal	Row Total
<5,000	19.9	16.5	19.9
5,000-9,999	15.1	17.6	15.1
10,000-19,999	27.7	25.9	27.7
20,000 & up	37.3	40.0	37.3
Column Total	99.5	0.5	17680

Table 236. Time of day by fatality.

	Non-fatal	Fatal	Row Total
Midnight to 5:59 AM	16.4	32.7	16.5
6:00 to 8:59 AM	7.9	5.0	7.9
9:00 to 3:59 PM	32.2	35.6	32.2
4:00 to 5:59 PM	15.2	8.9	15.2
6:00 to 11:59 pm	28.2	17.8	28.2
Column Total	99.5	0.5	20965

Table 237. Light condition by fatality.

	Non-Fatal	Fatal	Row Total
Daylight	61.3	51.1	61.3
Dawn	0.9	1.1	0.9
Dusk	2.3	0.0	2.3
Dark	15.3	22.3	15.3
Dark - lighted	13.6	16.0	13.6
Dark - not lighted	6.3	9.6	6.3
Column Total	99.5	0.5	20208

Table 238. Day of week by fatality.

	Non-Fatal	Fatal	Row Total
Monday	13.0	13.9	13.0
Tuesday	12.9	11.9	12.9
Wednesday	12.8	9.9	12.8
Thursday	13.3	9.9	13.3
Friday	17.4	8.9	17.3
Saturday	17.6	21.8	17.6
Sunday	13.1	23.8	13.1
Column Total	99.5	0.5	21049

Table 239. Crash configuration by fatalities.

	Non-fatal	Fatal	Row Total
Head-on	6.4	19.2	6.5
Rear striking	15.8	2.0	15.7
Struck in rear	6.9	2.0	6.9
Angle striking	21.9	2.0	21.8
Struck in left side	13.1	13.1	13.1
Struck in right side	13.1	14.1	13.1
Rollover & other	1.8	6.1	1.9
Sideswipe	3.3	3.0	3.3
Struck fixed object	13.0	21.2	13.0
Side of car into fixed object	4.8	17.2	4.8
Column Total	99.5	0.5	20043

Table 240. O'clock direction of force of first impact by fatality.

O'clock Direction of Force of First Impact	Non-Fatal	Fatal	Row Total
Rollover	2.4	6.1	2.4
1	10.2	14.1	10.2
2	8.5	6.1	8.5
3	4.7	8.1	4.7
4	1.5	0.0	1.5
5	1.0	1.0	1.0
6	7.1	1.0	7.1
7	1.2	1.0	1.2
8	1.9	1.0	1.8
9	4.6	7.1	4.6
10	8.1	10.1	8.1
11	12.1	11.1	12.1
12	36.7	33.3	36.6
Column Total	99.5	0.5	19550

Table 241. Extent of first impact by fatality.

Extent of First Impact	Non-Fatal	Fatal	Row Total
1	42.9	15.6	42.7
2	33.9	10.4	33.8
3	17.4	22.9	17.4
4	3.5	18.8	3.6
5	1.0	10.4	1.1
6	0.6	12.5	0.7
7	0.2	0.0	0.2
8	0.1	5.2	0.1
9	0.4	4.2	0.5
Column Total	99.4	0.6	16892

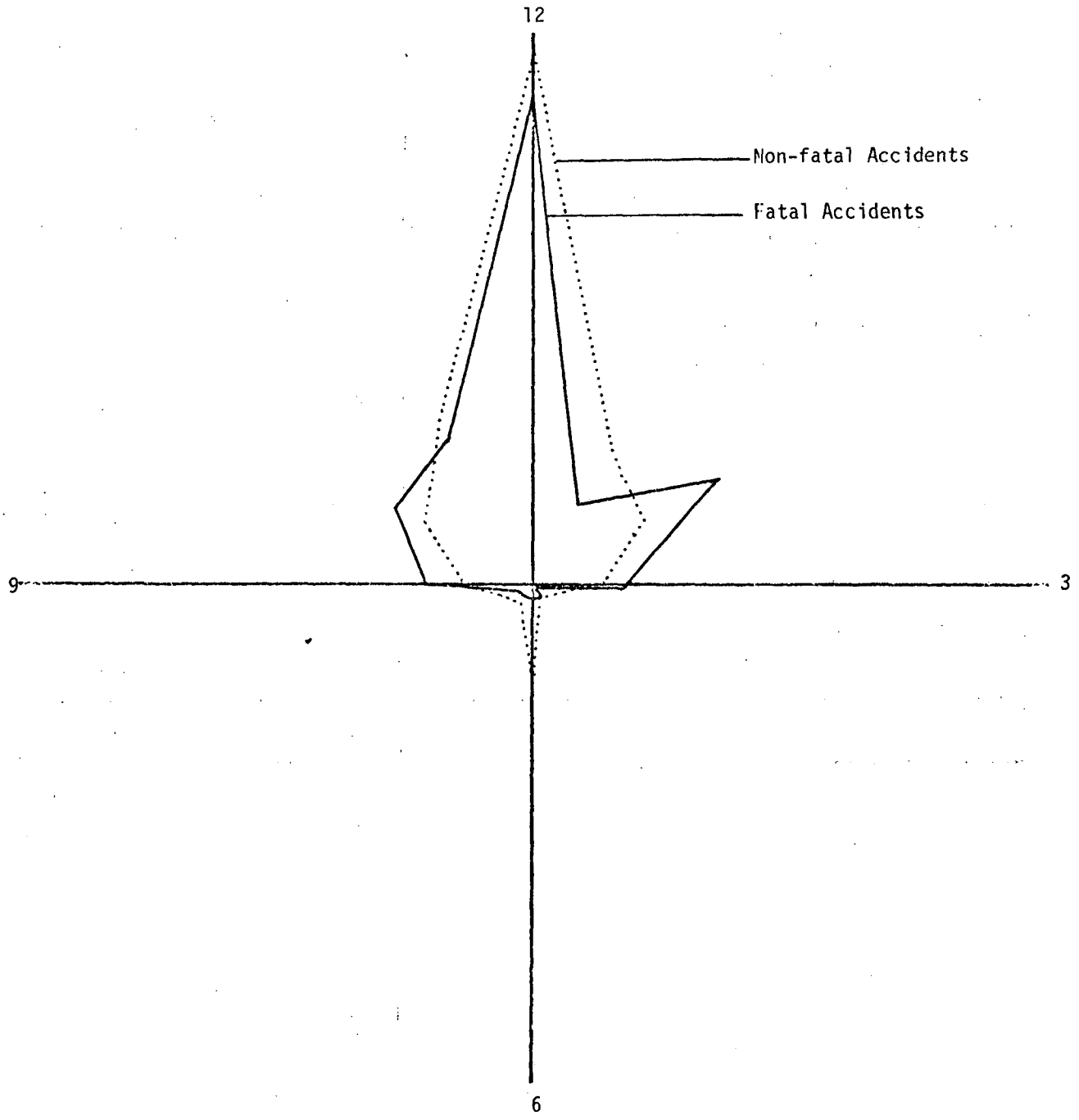


Figure 49. Relative frequency of accidents by o'clock direction of first impact.

X. Ejection

One of the universally accepted benefits of seat belts which no other restraint system offers is their efficiency at reducing ejection. This hypothesis is confirmed by the Level 2 data. Note that the level of total ejections drops for occupants using either belt system as compared to occupants who did not use seat belts. Note also that fears that the occupant is more likely to get trapped if the belt(s) is (are) worn are not borne out by the data.

Other observations can be made about ejections. First, occupants in subcompacts seem to be ejected more frequently than those in larger sized vehicles. Second, the data shows that several makes of cars are over-represented in the occupant ejected category: Oldsmobile, Buick, Cadillac, Ford and Volkswagen. Third, bucket seats show a higher tendency to ejection than bench seats. Head-on collisions, rollovers, sideswipes and skidding into fixed objects are the accident types that are likely to lead to ejection.

One can easily observe the success in either type of belt in preventing ejection. Almost no percentage of the occupants wearing belts were ejected. Some belted occupants were trapped, but this percentage did not differ from the number of trapped individuals that were not belted. Further, by examining the table of ejection by AIS one can see that any type of ejection can lead to very severe injuries or death, and the next table indicates that the head, the back, and the upper body are those body regions likely to be injured.

Table 242 . Occupant role by ejection.

	Not Ejected or Trapped	Ejected-Degree Not Stated	Partially Ejected and Trapped	Partially Ejected	Total Ejection	Trapped	Row Total
Driver	99.0	0.1	0.0	0.1	0.3	0.4	73.5
Passenger	99.1	0.2	0.0	0.1	0.3	0.4	26.5
Column Total	99.1	0.1	0.0	0.1	0.3	0.4	21627

Table 243. Vehicle weight by ejection

	Not Ejected or Trapped	Ejected-Degree Not Stated	Partially Ejected and Trapped	Partially Ejected	Totally Ejected	Trapped	Row Total
Subcompact	98.8	0.1	0.0	0.0	0.5	0.6	31.2
Compact	99.0	0.3	0.0	0.1	0.3	0.3	24.9
Intermediate	99.1	0.0	0.0	0.2	0.2	0.4	22.3
Full-sized	99.3	0.1	0.0	0.1	0.2	0.3	21.7
Column Total	99.0	0.1	0.0	0.1	0.3	0.4	20625

Table 244. Make of vehicle by ejection.

	Not Ejected or Trapped	Ejected-Degree Not Stated	Partially Ejected and Trapped	Partially Ejected	Totally Ejected	Trapped	Row Total
Chevrolet	99.3	0.1	0.0	0.0	0.1	0.4	22.0
Oldsmobile	98.6	0.2	0.1	0.3	0.4	0.5	5.5
Pontiac	98.7	0.2	0.0	0.1	0.7	0.3	6.8
Buick	98.6	0.1	0.0	0.0	0.5	0.8	3.9
Cadillac	98.5	0 0	0.0	1.0	0.0	0.5	1.9
GM Total	99.0	0.2	0.0	0.1	0.3	0.4	40.1
Plymouth	99.1	0.3	0.0	0.2	0.3	0.3	5.6
Dodge	99.4	0.0	0.0	0.0	0.3	0.4	3.6
Chrysler Total	99.2	0.2	0.0	0.1	0.3	0.3	9.2
Ford	98.8	0.2	0.0	0.0	0.4	0.6	20.6
Mercury	99.9	0.1	0.0	0.0	0.0	0.0	4.6
Capri	99.7	0.0	0.0	0.0	0.3	0.0	1.5
Ford Total	99.1	0.2	0.0	0.0	0.3	0.5	26.7
AMC	99.6	0.0	0.0	0.0	0.3	0.1	5.2
VW	98.8	0.2	0.1	0.0	0.3	0.5	4.4
Datsun	98.5	0.0	0.0	0.0	1.1	0.4	2.5
Toyota	99.6	0.0	0.0	0.0	0.3	0.1	3.7
Mazda	99.6	0.0	0.0	0.0	0.4	0.0	1.3
Japanese Total	99.2	0.0	0.0	0.0	0.6	0.2	7.5
Other	98.5	0.3	0.0	0.1	0.4	0.7	7.0
Column Total	99.0	0.1	0.0	0.1	0.3	0.4	21377

Table 245. Type of seat by ejection.

	Not Ejected or Trapped	Ejected-Degree Not Stated	Partially Ejected and Trapped	Partially Ejected	Total Ejection	Trapped	Row Total
Bench	99.3	0.1	0.0	0.1	0.2	0.4	46.7
Bucket	98.7	0.2	0.0	0.1	0.5	0.5	53.3
Column Total	99.0	0.1	0.0	0.1	0.3	0.5	18758

Table 246. Crash configuration by ejection.

	Not Ejected or Trapped	Ejected-Degree Not Stated	Partially Ejected and Trapped	Partially Ejected	Totally Ejected	Trapped	Row Total
Head-on	98.4	0.5	0.0	0.2	0.1	0.8	6.5
Rear striking	99.7	0.2	0.0	0.0	0.0	0.1	15.7
Struck in rear	99.4	0.2	0.0	0.0	0.0	0.4	6.9
Angle striking	99.7	0.0	0.0	0.0	0.0	0.2	21.7
Struck in left side	99.1	0.2	0.0	0.0	0.3	0.4	13.2
Struck in right side	98.9	0.2	0.0	0.2	0.5	0.3	12.9
Rollover & other	94.7	0.3	0.0	0.3	3.2	1.6	1.8
Sideswipe	98.4	0.3	0.1	0.0	0.1	1.0	3.3
Struck fixed object	98.6	0.0	0.0	0.2	0.4	0.6	13.1
Side of car into fixed object	97.6	0.0	0.1	0.1	1.3	0.9	4.9
Column Total	99.0	0.2	0.0	0.1	0.3	0.4	20492

Table 247 . Damage severity by ejection.

	Not Ejected or Trapped	Ejected-Degree Not Stated	Partially Ejected and Trapped	Partially Ejected	Total Ejection	Trapped	Row Total
Minor	99.4	0.1	0.0	0.1	0.1	0.3	46.2
Moderate	99.4	0.1	0.0	0.0	0.3	0.2	38.1
Moderately Severe	98.1	0.1	0.0	0.3	0.7	0.8	11.2
Severe	92.6	0.6	0.1	0.3	2.5	3.8	4.6
Column Total	98.9	0.1	0.0	0.1	0.4	0.5	17282

Table 248. Extent of first impact by ejection.

		Not Ejected or Trapped	Ejected-Degree Not Stated	Partially Ejected and Trapped	Partially Ejected	Total Ejection	Trapped	Row Total
Extent of First Impact	1	99.3	0.1	0.0	0.1	0.1	0.4	42.9
	2	99.5	0.1	0.0	0.0	0.2	0.2	33.8
	3	98.6	0.1	0.0	0.2	0.6	0.5	17.3
	4	95.7	0.5	0.1	0.2	1.8	1.8	3.5
	5	92.2	0.6	0.0	0.6	2.2	4.5	1.0
	6	91.2	0.9	0.9	0.0	1.8	5.3	0.7
	7	100.0	0.0	0.0	0.0	0.0	0.0	0.2
	8	85.7	0.0	0.0	0.0	0.0	14.3	0.1
	9	93.8	0.0	0.0	1.3	2.5	2.5	0.5
Column Total		99.0	0.1	0.0	0.1	0.4	0.5	17262

Table 249. O'clock direction of force of first impact by occupant role by ejection.

		No Ejection			Ejection or Trapping		
		Driver	Passenger	Row Total	Driver	Passenger	Row Total
O'clock direction of force of first impact	Rollover	2.2	2.6	2.3	9.7	12.0	10.3
	1	10.3	9.9	10.2	7.6	12.0	8.8
	2	8.1	9.1	8.4	6.3	10.0	7.2
	3	4.6	5.0	4.7	8.3	6.0	7.7
	4	1.4	1.7	1.5	0.7	2.0	1.0
	5	0.9	1.3	1.0	1.4	0.0	1.0
	6	6.9	7.9	7.2	2.8	10.0	4.6
	7	1.2	1.1	1.2	1.4	6.0	2.6
	8	1.9	2.0	1.9	1.4	0.0	1.0
	9	4.6	5.2	4.8	6.3	6.0	6.2
	10	7.9	8.2	8.0	12.5	14.0	12.9
	11	12.2	11.8	12.1	13.9	4.0	11.3
	12	37.7	34.2	36.8	27.8	18.0	25.3
	Column Total	73.4	26.6	19785	74.2	25.8	194

Table 250. Restraint system usage by ejection

	Not Ejected or Trapped	Ejected-Degree Not Stated	Partially Ejected and Trapped	Partially Ejected	Totally Ejected	Trapped	Row Total
None Used	98.5	0.1	0.0	0.1	0.5	0.4	11793
Lap Only	99.5	0.1	0.0	0.0	0.0	0.3	3469
Lap & Shoulder	99.3	0.2	0.0	0.0	0.0	0.4	5147

Table 251 . AIS level by ejection.

		Not Ejected or Trapped	Ejected-Degree Not Stated	Partially Ejected and Trapped	Partially Ejected	Total Ejection	Trapped	Row Total
AIS Level	1	99.3	0.1	0.0	0.1	0.2	0.2	8545
	2	96.5	0.2	0.0	0.3	1.3	1.8	1307
	3	92.6	0.0	0.4	0.4	3.3	3.3	270
	4	87.2	0.0	0.0	0.0	6.4	6.4	47
	5	75.0	0.0	0.0	8.3	8.3	8.3	12
	6	62.0	0.0	1.1	3.3	17.4	16.3	92
Column Total		98.4	0.1	0.0	0.2	0.6	0.7	10273

Table 252. Region of injury by ejection.

	Not Ejected or Trapped	Ejected-Degree Not Stated	Partially Ejected and Trapped	Partial Ejection	Total Ejection	Trapped	Row Total
Leg	95.2	0.0	0.0	0.0	0.0	4.8	0.4
Arm	100.0	0.0	0.0	0.0	0.0	0.0	0.2
Wrist-Hand	99.7	0.0	0.0	0.0	0.0	0.3	2.9
Thigh	98.6	0.7	0.0	0.0	0.7	0.0	1.4
Shoulder	98.5	0.0	0.0	0.0	0.2	1.2	3.9
Forearm	99.6	0.0	0.0	0.0	0.4	0.0	2.4
Ankle-Foot	98.5	0.0	0.0	0.0	0.0	1.5	1.3
Hip	97.8	1.0	0.0	0.0	0.0	1.1	1.8
Whole Body	100.0	0.0	0.0	0.0	0.0	0.0	0.4
Neck	99.1	0.2	0.0	0.1	0.2	0.4	12.1
Abdomen	98.3	0.0	0.0	0.6	0.6	0.6	1.7
Lower Leg	99.1	0.0	0.0	0.0	0.3	0.6	3.1
Knee	99.0	0.0	0.0	0.1	0.4	0.4	6.5
Head-Skull	97.1	0.1	0.0	0.3	1.3	1.1	20.3
Face	98.5	0.2	0.1	0.2	0.4	0.6	27.0
Elbow	97.8	0.5	0.0	0.0	1.1	0.5	1.8
Chest	98.1	0.0	0.0	0.0	1.1	0.8	6.2
Back	98.4	0.0	0.0	0.2	0.8	0.6	4.8
Upper Arm	99.3	0.0	0.0	0.0	0.0	0.7	1.5
Column Total	98.3	0.1	0.0	0.2	0.6	0.7	10264

Table 253. Cost of injury by ejection.

	Mean	S.D.	N
Not ejected or trapped	280.70	3735.16	20539
Ejected-degree not stated	80.45	209.32	31
Partially ejected & trapped	33711.00	55572.00	3
Partial ejection	15576.00	34518.32	17
Total ejection	20315.96	36483.75	63
Trapped	10314.17	24546.12	83

XI. Unusual Occupants

One argument that can be developed against seat belts is that, since they are designed for only a limited range of body sizes, they could be less effective in reducing injuries for persons not within that range (or they could indeed be dangerous for those persons!). To explore that question, the sample was divided into five segments: persons shorter than 5 feet or weighing less than 103 pounds - roughly the bottom five percent of the sample; persons 5 feet 2 inches or 111 pounds, about the next ten percent of the sample; complementary large groups with lower limits of 6 feet and 6 feet 4 inches, and 190 and 204 pounds, respectively; and a group of "normal" occupants which accounted for almost 70 percent of the sample.

Not surprising are the small groups consisting primarily of females and the large groups of males. Ignoring the very young ages, the older people were overrepresented in the larger categories. Similarly drivers were overrepresented in those categories.

Except for the very small occupants the usage rates are about the same. There is a trend for small people to be in small cars and large people to be in large cars, and a substantial shift from bucket seats to bench seats in the very large occupants. There are also differences in the types of accidents in which the individuals of different sizes are involved. Smaller persons are overrepresented in struck in left side collisions. Larger persons, on the other hand are involved in more than their share of struck fixed object accidents.

Looking at the AIS variables, one can observe that whereas the smaller people are more likely to be injured, they are less likely to be seriously injured.

The belts themselves are likely to malfunction most often for the larger individuals, and the small persons are more likely to have worn their belts improperly.

Table 254. Occupant size by sex.

	Male	Female	Row Total
Very Small	28.8	71.2	6.5
Small	8.9	91.1	8.8
Average	57.9	42.1	69.6
Large	95.0	5.0	9.5
Very Large	92.9	7.1	5.7
Column Total	57.2	42.8	17751

Table 255. Age by occupant size.

	Very Small	Small	Average	Large	Very Large	Row Total
$\leq$ 9	34.8	0.0	0.0	0.0	0.0	2.3
10-25	42.4	55.7	46.7	47.0	27.0	46.1
26-55	18.5	35.3	42.9	46.0	62.5	42.1
56 & up	4.2	8.9	10.3	7.0	10.5	9.5
Column Total	6.5	8.8	69.6	9.5	5.7	17735

Table 256. Occupant size by role.

	Driver	Passenger	Row Total
Very Small	33.6	66.4	6.5
Small	67.0	33.0	8.8
Average	76.2	23.8	69.6
Large	85.8	14.2	9.5
Very Large	87.7	12.3	5.7
Column Total	74.2	25.8	17761

Table 257. Occupant size by restraint system usage.

	None Used	Lap Only	Lap and Shoulder	Row Total
Very Small	63.0	16.6	20.5	5.8
Small	55.3	18.6	26.1	8.9
Average	55.1	17.6	27.3	70.0
Large	56.5	18.3	25.2	9.5
Very Large	55.8	16.9	27.3	5.8
Column Total	55.7	17.7	26.6	17402

Table 258. Vehicle weight by occupant size.

	Very Small	Small	Average	Large	Very Large	Row Total
Subcompact	36.2	34.7	31.4	29.1	20.6	31.2
Compact	21.8	27.2	25.1	24.5	19.7	24.7
Intermediate	22.0	22.7	22.8	22.7	24.0	22.8
Fullsized	20.0	15.4	20.8	23.7	35.8	21.4
Column Total	6.6	8.8	69.5	9.5	5.7	17573

Table 259. Type of seat by occupant size.

	Very Small	Small	Average	Large	Very Large	Row Total
Bench	46.4	42.7	47.0	46.7	58.7	47.2
Bucket	53.6	57.3	53.0	53.3	41.3	52.8
Column Total	6.6	8.8	69.6	9.4	5.7	16108

Table 260. Crash configuration by occupant size.

	Very Small	Small	Average	Large	Very Large	Row Total
Head-on	5.5	6.7	5.9	6.8	6.9	6.1
Rear striking	17.4	14.7	15.5	17.5	16.5	15.8
Struck in rear	6.6	5.6	7.1	4.9	7.0	6.7
Angle striking	24.1	24.7	22.4	21.9	23.3	22.7
Struck in left side	18.9	15.4	13.7	11.2	11.8	13.9
Struck in right side	14.5	13.5	13.6	12.1	15.0	13.6
Rollover & other	0.5	1.3	1.5	2.7	1.1	1.5
Sideswipe	1.7	3.6	3.3	3.1	2.6	3.1
Struck fixed object	8.5	9.7	12.4	13.6	11.7	12.0
Side of car into fixed object	2.4	4.9	4.5	6.1	4.0	4.5
Column Total	6.5	8.8	69.7	9.4	5.7	17055

Table 261. Impact site by occupant size.

	Very Small	Small	Average	Large	Very Large	Row Total
Front	6.4	8.6	69.2	9.9	5.9	56.6
Side	6.9	9.3	69.6	8.7	5.4	35.1
Rear	6.4	7.3	73.5	6.9	5.9	6.7
Rollover	1.9	7.4	69.3	17.1	4.3	1.5
Column Total	5.6	8.8	69.7	9.4	5.7	17055

Table 262. Extent of first impact by occupant size.

		Very Small	Small	Average	Large	Very Large	Row Total
Extent of First Impact	1	38.0	44.8	43.0	44.5	40.5	42.8
	2	37.6	31.9	34.4	33.1	32.7	34.2
	3	18.3	18.0	16.8	15.5	21.3	17.2
	4	3.9	3.9	3.3	4.2	3.8	3.5
	5	0.7	0.6	1.1	1.2	0.8	1.0
	6	0.6	0.2	0.7	0.9	0.7	0.6
	7	0.3	0.2	0.2	0.1	0.0	0.2
	8	0.0	0.0	0.0	0.2	0.1	0.1
	9	0.5	0.3	0.5	0.2	0.0	0.5
Column Total		6.5	8.6	69.5	9.6	5.9	15136

Table 263. AIS level by occupant size.

		Very Small	Small	Average	Large	Very Large	Row Total
AIS Level	0	44.9	42.5	49.7	52.7	49.0	49.0
	1	46.6	48.9	42.1	39.1	41.0	42.6
	2	7.0	7.0	6.3	5.8	7.2	6.4
	3	0.7	1.1	1.3	1.6	1.6	1.3
	4	0.4	0.3	0.2	0.3	0.4	0.2
	5	0.2	0.1	0.0	0.1	0.1	0.1
	6	0.3	0.2	0.4	0.5	0.8	0.4
Column Total		6.5	8.7	69.6	9.5	5.7	17517

Table 264. Occupant size by seating position by malfunction, defeat and maladjustment.

	Malfunction		Defeat		Maladjustment	
	Left	Right	Left	Right	Left	Right
Very Small	2.8	1.6	65.2	68.0	9.4	6.4
Small	2.4	1.9	62.2	64.3	5.6	3.6
Average	2.6	1.7	61.6	65.0	5.2	5.1
Large	2.3	1.5	66.0	70.4	3.9	3.0
Very Large	4.0	2.1	64.6	66.3	2.6	2.5

Conclusions

A large quantity of data is presented here. This data may be effectively used as (1) information necessary to understand the present estimates of seat belt effectiveness, (2) information to supplement other data banks as to who is involved in accidents, where accidents occur, etc., (3) information to evaluate seat belt effectiveness on a large number of variables based on an extensive sample, and (4) information which can be used to generate new projects or to answer questions independently of further data collection.