The Likelihood of Human Casualty in Highway Crashes

Seventh Briefing: Perspective and Sensitivity Analyses

Based on an Investigation Conducted for
the FHWA/NHTSA Crash Analysis Center
at George Washington University, Virginia

July 31, 1996
DeBlois Associates
Washington, D.C.

"The Likelihood of Casualty in Highway Crashes"

Introduction

This is the seventh briefing concerning the cited subject. Work reported here: (a) puts in perspective car occupant casualties, as well as car and occupant involvement in towaway crashes; (b) develops and evaluates hybrid (ACN/Scene) algorithms projecting casualties by severity as a function of most influential predictors; and (c) conducts sensitivity analyses of said casualties to said predictors.

Raw Data & Processing

The data compiled in the eight years of NASS/CDS, 1988-1995, are the basic data used. The NASS weights are used as weighing factors in any data processing procedure. A further description of data processing, pre-processing, and post-processing may be found in the 4th Briefing, dated May 10 1996, including the nominal procedure for processing the raw data, as well as the estimation of standard errors and confidence bounds.

Perspective

An overall summary of the perspective is given on Table XXIX. Specifically presented here is the incidence (U.S. counts per year) of cars involved in towaway crashes, and of involved occupants, injured occupants, and incurred injuries by severity, as a function of crash configuration.

The control totals shown in Table XXIX are further resolved in the eight Tables A-I to A-VIII given in the Appendix. The resolution is primarily performed according to most influential variables, i.e crash severity for planar crashes, and travel speed for rollovers. Further aspects of the perspective are discussed next.

Injured Occupants with Compelling versus All Other Injuries

The about 2,800,000 car occupants involved each year in towaway crashes are partitioned by the compelling or not nature of the most severe injury, and by mortality/administered treatment. This joint distribution is displayed in Table XXX and illustrated in Fig. 68.

Table XXXI and Fig. 69 perform the same function, in partitioning occupants with compelling or not injuries, among maximum injury severity (MAIS).

Area and Extent of Damage

A car's general area of damage (front, left, right, rear, or top) and the extent of damage (defined in zones as shown on the following page) are variables primarily observed at the scene of a crash, as opposed to remotely sensed by sensors.

These two variables are also very influential, even in the absence of further information, ACN or other. The strength of these influences is summarized in Table XXXII and illustrated in several figures discussed next.

Figure 70 illustrates the effects of area and extent of damage on the probability of a car with at least a MAIS 3+, at a delta V of 40 mph. Stronger effects are observed in Fig. 71, concerning cars with at least one fatality. The probability of a car occupant incurring a compelling injury, is also strongly influenced by the area and extent of damage, as illustrated in Fig. 72.

For clarity, Figs 70 to 72 have been drawn for a delta V of 40 mph. However, the joint effects of delta V and extent of damage are illustrated in Fig. 73, concerning frontal impacts. This pattern is retained and basically raised to higher probabilities for side impacts, while it is very strongly depressed for rear impacts.

Occupant Attributes

Car occupant age and restraint use are observable at the scene of a crash, as they are currently not available in the ACN system. These two occupant attributes are also influential factors. By comparison, the occupant's seating position has a much weaker influence.

The influence of the occupant's age and restraint use becomes more pronounced as the casualty severity increases. This is evident in the succession of Figs 74, 75, and 76, concerning: MAIS 2+, MAIS 3+, and Compelling Injury or Fatality, respectively. In these three figures, all dealing with frontal crashes at delta V of 40 mph, the effects of extent of damage are displayed concurrently with the effects of the cited occupant attributes.

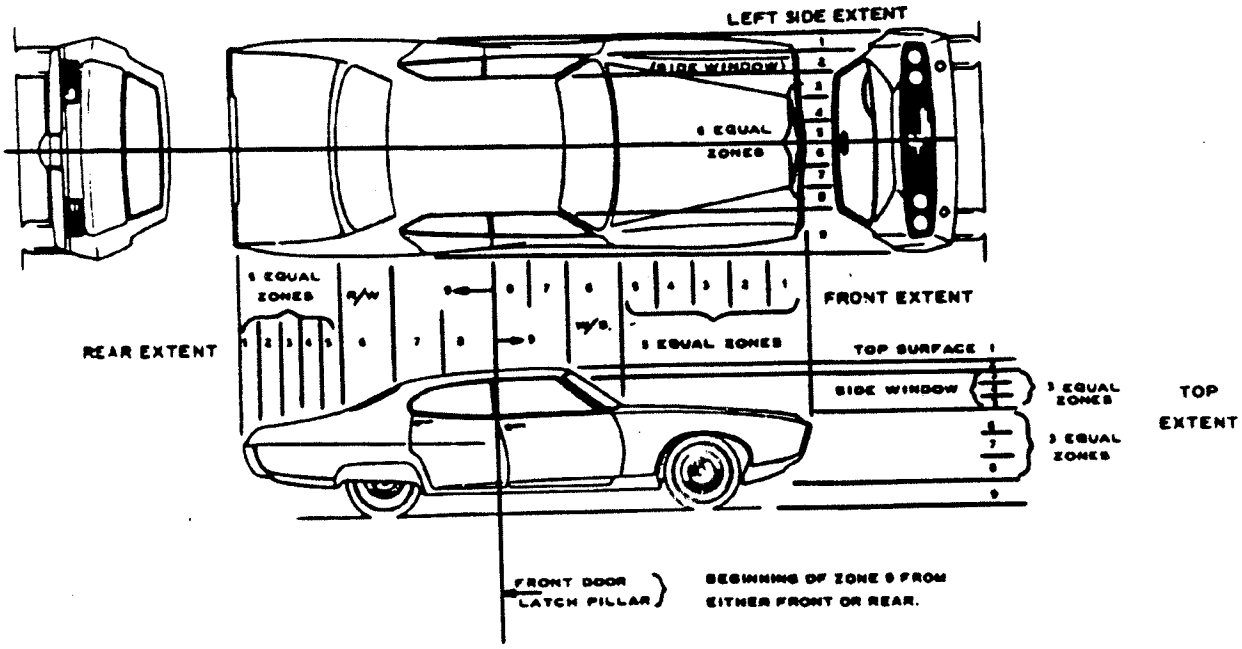


FIG. 6 - DEFORMATION EXTENT ZONES (FOR PASSENGER CARS)

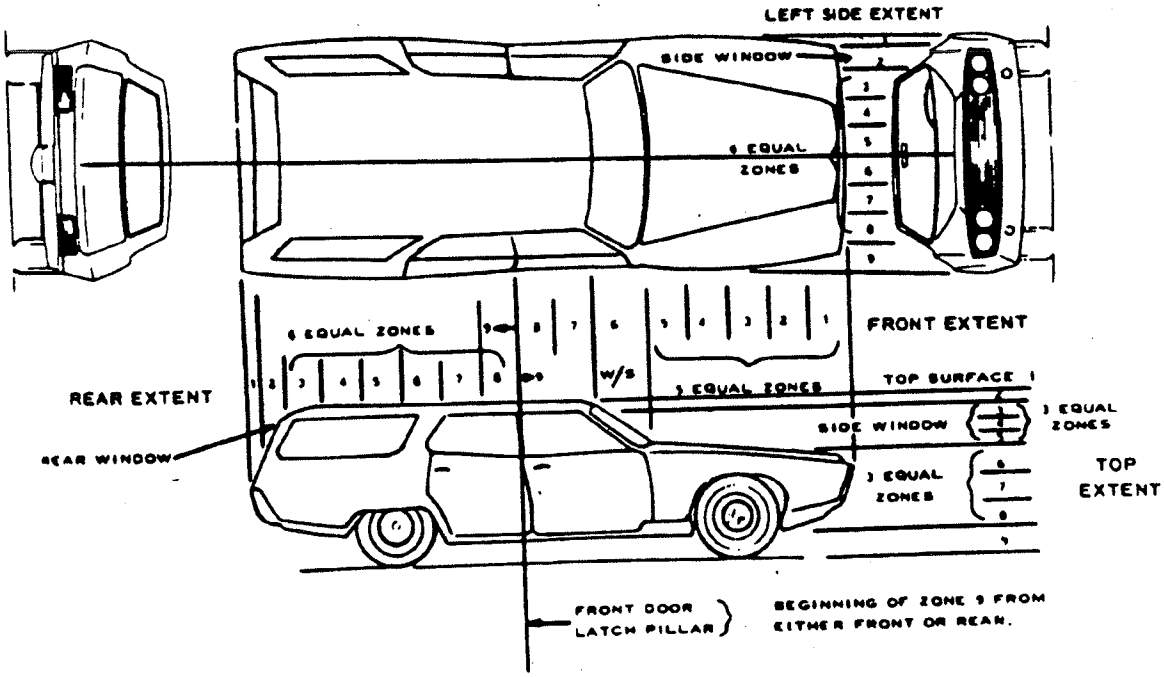


FIG. 7 - DEFORMATION EXTENT ZONES (FOR STATION WAGONS)

Further Illustrations of Sensitivity

As is evident, several factors from the combined ACN/Scene pool have very significant effects on the probability of casualty, while at the same time the strength of the influence depends also on the casualty severity.

A series of illustrations, Figs 77 to 85, are drawn with particular focus on car occupants incurring a compelling injury (including fatalities). Figures 77 and 78 display the joint effects of delta V and extent of damage. This is done at the two extremes of occupant attributes: restrained 30 year old occupants (Fig. 77), and unrestrained 75 year old occupants.

The joint effects of delta V and occupant attributes are illustrated in Fig. 79 (extent of damage: 2) and Fig. 80 (extent of damage: 4+). For clarity, cited figures 77 to 80 are drawn for frontal impacts only. The joint effects of delta V and area of damage are shown in Figs 81 and 82, at extent of damage 2 and 4+ respectively, concerning restrained 30 year old occupants. These illustrations are repeated in Figs 83 and 84, for 75 year old unrestrained occupants.

Presentation of Detailed Algorithms

In arriving at one or several pertinent algorithms the same nominal procedure is applied as that described in the 4th Briefing, dated May 10 1996. Specifically, the probability of a car occupant casualty is given by the logistic function:

$$P = 1 / [1 + \exp(-w)]$$

<u>Model for Planar Crashes</u>

$$w = A0 + A1*DVTOTAL + A2*GADF + A3*GADL + A4*GADR + A5*EXT1 + A6*EXT2 + A7*EXT3 + A8*AGE + A9*RESTR$$

DVTOTAL = Total Delta V in mph Continuously;
GADF=1 if the Area of Damage is Frontal; else GADF=0;
GADL=1 if the Area of Damage is Left; else GADL=0;
GADR=1 if the Area of Damage is Rigt; else GADR=0;
GADF=0 & GADL=0 & GADR=0 if the Area of Damage is Rear;
EXT1=1 if the Extent of Damage is Zone 1; else EXT1=0;
EXT2=1 if the Extent of Damage is Zone 2; else EXT2=0;
EXT3=1 if the Extent of Damage is Zone 3; else EXT3=0;
AGE = Occupant's Age in Years Continuously; and
RESTR = 1 if the Occupant is Restrained; else RESTR=0.

Logistic Regression Coefficients for MAIS=1+

Predictor	A	Std Err	Probabil. of A=0
Intercept	-0.38	0.17	0.0227
DVTOTAL	0.08	0.00	0.0000
GADF	0.40	0.09	0.0000
GADL	0.53	0.11	0.0000
GADR	0.28	0.11	0.0098
EXT1	-0.86	0.12	0.0000
EXT2	-0.39	0.12	0.0006
EXT3	-0.12	0.12	0.3280
AGE OF OCCUPANT	0.01	0.00	0.0000
RESTR	-0.77	0.06	0.0000

Logistic Regression Coefficients for MAIS=2+

Intercept	-2.79	0.16	0.0000
DVTOTAL	0.06	0.00	0.0000
GADF	1.03	0.13	0.0000
GADL	1.01	0.14	0.0000
GADR	0.77	0.14	0.0000
EXT1	-1.38	0.11	0.0000
EXT2	-1.03	0.09	0.0000
EXT3	-0.38	0.09	0.0000
AGE OF OCCUPANT	0.02	0.00	0.0000
RESTR	-0.73	0.06	0.0000

Logistic Regression Coefficients for MAIS=3+

Intercept	-5.55	0.23	0.0000
DVTOTAL	0.09	0.00	0.0000
GADF	2.23	0.21	0.0000
GADL	2.08	0.21	0.0000
GADR	1.91	0.21	0.0000
EXT1	-2.03	0.14	0.0000
EXT2	-1.28	0.10	0.0000
EXT3	-0.55	0.10	0.0000
AGE OF OCCUPANT	0.03	0.00	0.0000
RESTR	-0.80	0.07	0.0000

Logistic Regression Coefficients for Fatalities

Intercept	-8.80	0.49	0.0000
GADF	2.67	0.37	0.0000
GADL	2.98	0.39	0.0000
GADR	2.76	0.42	0.0000
EXT1	-4.00	0.45	0.0000
EXT2	-2.91	0.20	0.0000
EXT3	-1.39	0.18	0.0000
AGE OF OCCUPANT	0.05	0.00	0.0000
RESTR	-1.03	0.16	0.0000

Logistic Regression Coefficients for Compelling Injury or Fatality

Intercept	-8.88	0.77	0.0000
GADF	3.11	0.44	0.0000
GADL	3.73	0.47	0.0000
GADR	3.49	0.48	0.0000
EXT1	-2.87	0.41	0.0000
EXT2	-1.37	0.30	0.0000
EXT3	-0.75	0.28	0.0073
AGE OF OCCUPANT	0.04	0.01	0.0000
RESTR	-0.66	0.19	0.0006

Model for Rollover

w = A0 + A1*SPEED + A2*ROLL + A3*AGE + A4*RESTR

SPEED = Pre-R/O Travel Speed in mph Continuously;
ROLL=1 if Rollover Occurs; else ROLL=0;
AGE = Occupant's Age in Years Continuously; and
RESTR=1 if the Occupant is Restrained; else RESTR=0.

Logistic Regression Coefficients for MAIS=3+

Intercept	-2.80	0.09	0.0000
TRAVEL SPEED	0.02	0.00	0.0000
ROLL	0.44	0.10	0.0000
AGE OF OCCUPANT	0.02	0.00	0.0000
RESTR	-0.82	0.06	0.0000

Logistic Regression Coefficients for Compelling Injury or Fatality

Intercept	-4.40	0.41	0.0000
TRAVEL SPEED	0.01	0.00	0.0051
ROLL	0.66	0.35	0.0630
AGE OF OCCUPANT	0.02	0.01	0.0004
RESTR	-1.08	0.24	0.0000

Results from the above algorithms for rollover are illustrated in Figs 85 and 86.

Table XXIX. Incidence (U.S. Counts per Year) of Car Involvement in Towaway Crashes, and of Related Casualties by Severity

Towaway Car Crash Configur.	Cars per Year with Shown Casualty Threshold				
	VAIS 1+	VAIS 2+	VAIS 3+	Fatality	All Cars
Planar	970737	284715	127596	16318	1738941
Rollover	89041	37522	21954	4829	115469
Total	1059778	322237	149550	21147	1854410

Towaway Car Crash Configur.	Car Occupants per Year with Shown Casualty Threshold				
	MAIS 1+	MAIS 2+	MAIS 3+	Fatality	All Occup.
Planar	1212041	236838	146770	18172	2633143
Rollover	116258	38564	25881	5328	181962
Total	1328299	275402	172651	23500	2815105

Towaway Car Crash Configur.	Car Occupant Injuries per Year		
	Compelling	All Other	All Injuries
Planar	58179	2869819	2927998
Rollover	13137	313030	326167
Total	71316	3182849	3254165

Towaway Car Crash Configur.	Injured Car Occupants per Year, w Shown Max Injury		
	Compelling	All Other	All Injured
Planar	31387	1145462	1176849
Rollover	6545	86627	93172
Total	37932	1232089	1270021

Towaway Car Crash Configur.	Injured Car Occupants per Year, w Shown Max Injury		
	Compelling or Fatality	All Other	All Injured
Planar	35372	1141478	1176849
Rollover	7758	85414	93172
Total	43130	1226892	1270021

Table XXX. Distribution of All Towaway Crash Involved Car Occupants, by Compelling Nature of Injury and Initial Treatment; in Toto this Table addresses the about 2,820,000 Car Occupants per Year involved in Towaway Crashes in the U.S.

Mortality/ Treatment	Percent Car Occupants in Towaway Crashes, by Compelling Nature of Injury		
	Compelling	All Other	Total
Fatalities			
% of All Occupants	0.36	0.26	0.62
% of Row	58.04	41.96	100.00
% of Column	28.46	0.26	
Hospitalizations			
% of All Occupants	0.82	4.75	5.57
% of Row	14.79	85.21	100.00
% of Column	65.97	4.81	
Xfer & Release			
% of All Occupants	0.07	26.47	26.54
% of Row	0.26	99.74	100.00
% of Column	5.57	26.81	
Minor Treatment			
% of All Occupants	0.00	7.88	7.88
% of Row	0.00	100.00	100.00
% of Column	0.00	7.98	
No Treatment			
% of All Occupants	0.00	59.39	59.39
% of Row	0.00	100.00	100.00
% of Column	0.00	60.14	
Total	1.25	98.75	100.00

Table XXXI. Distribution of All Towaway Crash Involved Car Occupants, by Compelling Nature of Injury and Maximum Injury Severity; in Toto this Table addresses the about 2,820,000 Car Occupants per Year involved in Towaway Crashes in the U.S.

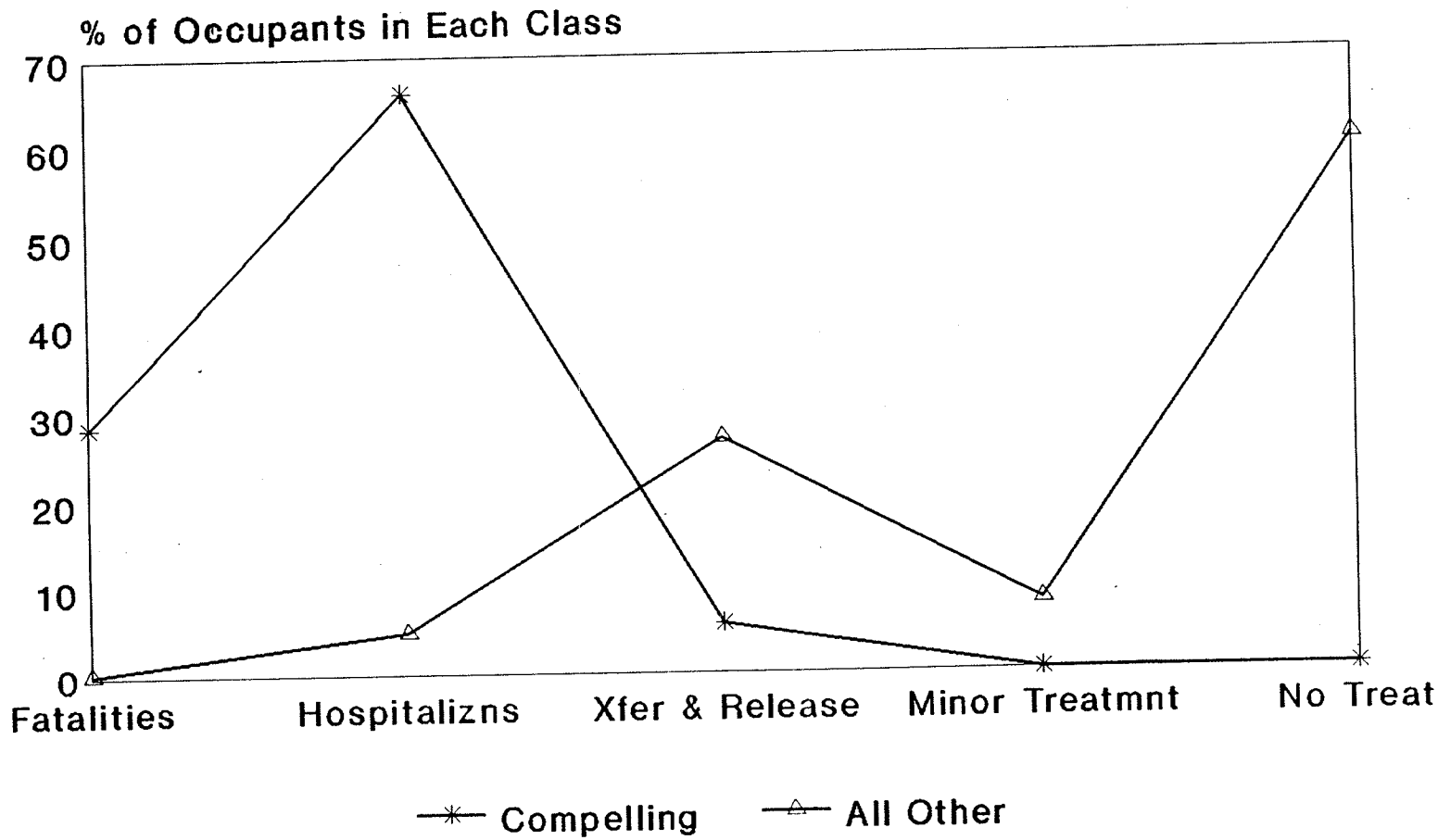
Maximum AIS	Percent Car Occupants in Towaway Crashes, by Compelling Nature of Injury		
	Compelling	All Other	Total
MAIS=0			
% of All Occupants	0.00	52.65	52.65
% of Row	0.00	100.00	100.00
% of Column	0.00	53.32	
MAIS=1			
% of All Occupants	0.00	39.64	39.64
% of Row	0.00	100.00	100.00
% of Column	0.00	40.14	
MAIS=2			
% of All Occupants	0.10	4.79	4.89
% of Row	2.00	98.00	100.00
% of Column	7.83	4.85	
MAIS=3			
% of All Occupants	0.51	1.45	1.97
% of Row	26.17	73.83	100.00
% of Column	41.22	1.47	
MAIS=4			
% of All Occupants	0.34	0.12	0.46
% of Row	74.65	25.35	100.00
% of Column	27.37	0.12	
MAIS=5			
% of All Occupants	0.22	0.07	0.29
% of Row	77.30	22.70	100.00
% of Column	17.99	0.07	
MAIS=6			
% of All Occupants	0.07	0.03	0.10
% of Row	67.63	32.37	100.00
% of Column	5.59	0.03	
Total	1.25	98.75	100.00

Table XXXII. Probability of Shown Casualty Occurrence, in Towaway Cars, as a Function of Area and Extent of Damage, in Planar Crashes, at Delta V of 40 mph, Averaged over All Occupant Ages and Restraint Use.

Q1: Occupant Fatality
Q2: Occupant w Compelling Injury, Irrespective of Fatality
Q3: Occupant w Compelling Injury or Fatality
Q4: Occupant w at Least One Injury @ MAIS=3+
Q5: Car w at Least One Occupant @ MAIS=3+
Q6: Car w at Least One Fatality

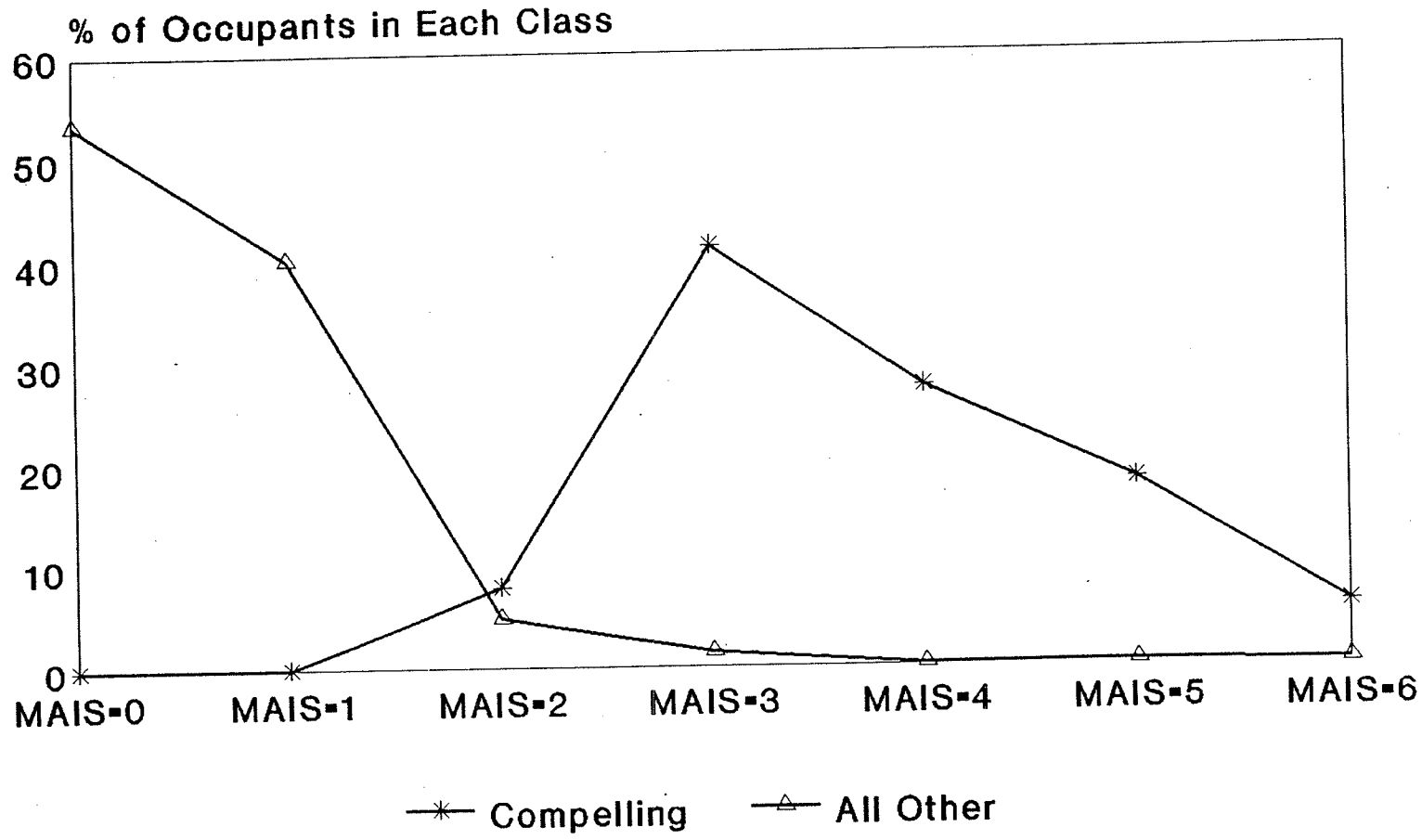
Area and Extent of Damage		Probability, Percent					
		Q1	Q2	Q3	Q4	Q5	Q6
Front	1	0.3	0.9	1.2	20.3	27.9	0.5
Front	2	0.9	4.4	4.9	34.5	43.8	1.3
Front	3	4.1	8.2	9.1	52.0	61.5	6.1
Front	4+	13.7	14.2	16.4	64.1	71.1	19.0
Left	1	0.4	1.7	2.3	19.2	27.1	0.7
Left	2	1.4	7.5	9.0	33.0	42.8	1.9
Left	3	6.1	13.7	16.1	50.2	60.6	9.2
Left	4+	19.3	22.8	27.3	62.5	70.3	26.7
Right	1	0.4	1.4	1.9	17.1	26.1	0.6
Right	2	1.2	6.2	7.8	29.9	41.6	1.7
Right	3	5.3	11.4	14.1	46.8	59.4	7.9
Right	4+	17.1	19.3	24.2	59.1	69.2	23.7
Rear	1	0.0	0.1	0.1	2.7	4.7	0.0
Rear	2	0.1	0.3	0.2	5.5	9.1	0.1
Rear	3	0.3	0.5	0.5	10.7	17.1	0.5
Rear	4+	1.1	1.0	0.9	16.5	24.0	1.6

Fig. 68. Distribution of Car Occupants among Mortality/Treatment Bins by Nature (Compelling or Not) of Most Severe Inj.



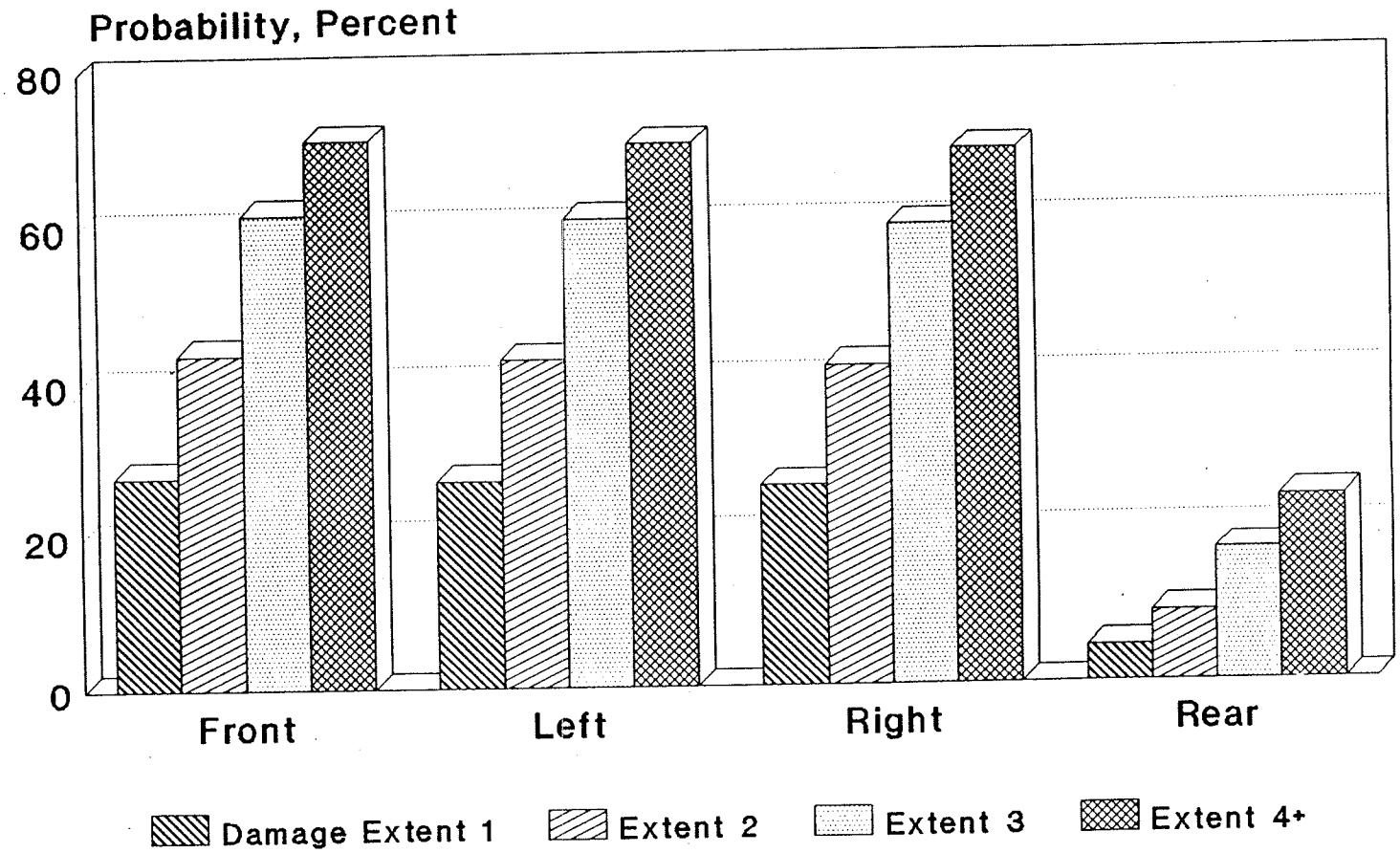
The NASS/CDS 1993-1995

Fig. 69. Distribution of Car Occupants among MAIS Values, by Nature (Compelling or Not) of Most Severe Injury



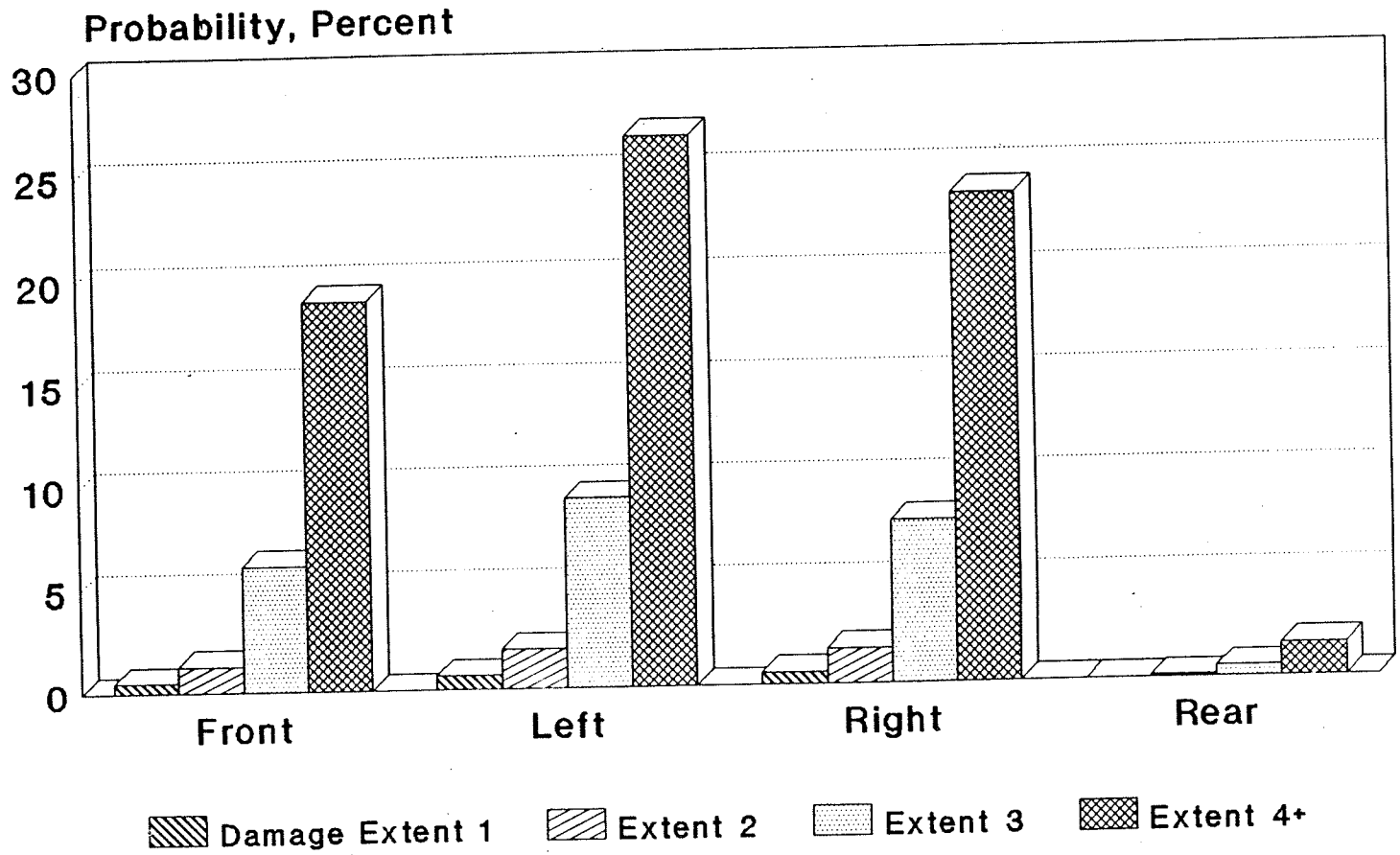
The NASS/CDS 1993-1995

Fig. 70. Probability of a Towaway Car w at Least a MAIS 3+, as a Function of Area and Extent of Damage, @ DV=40 mph



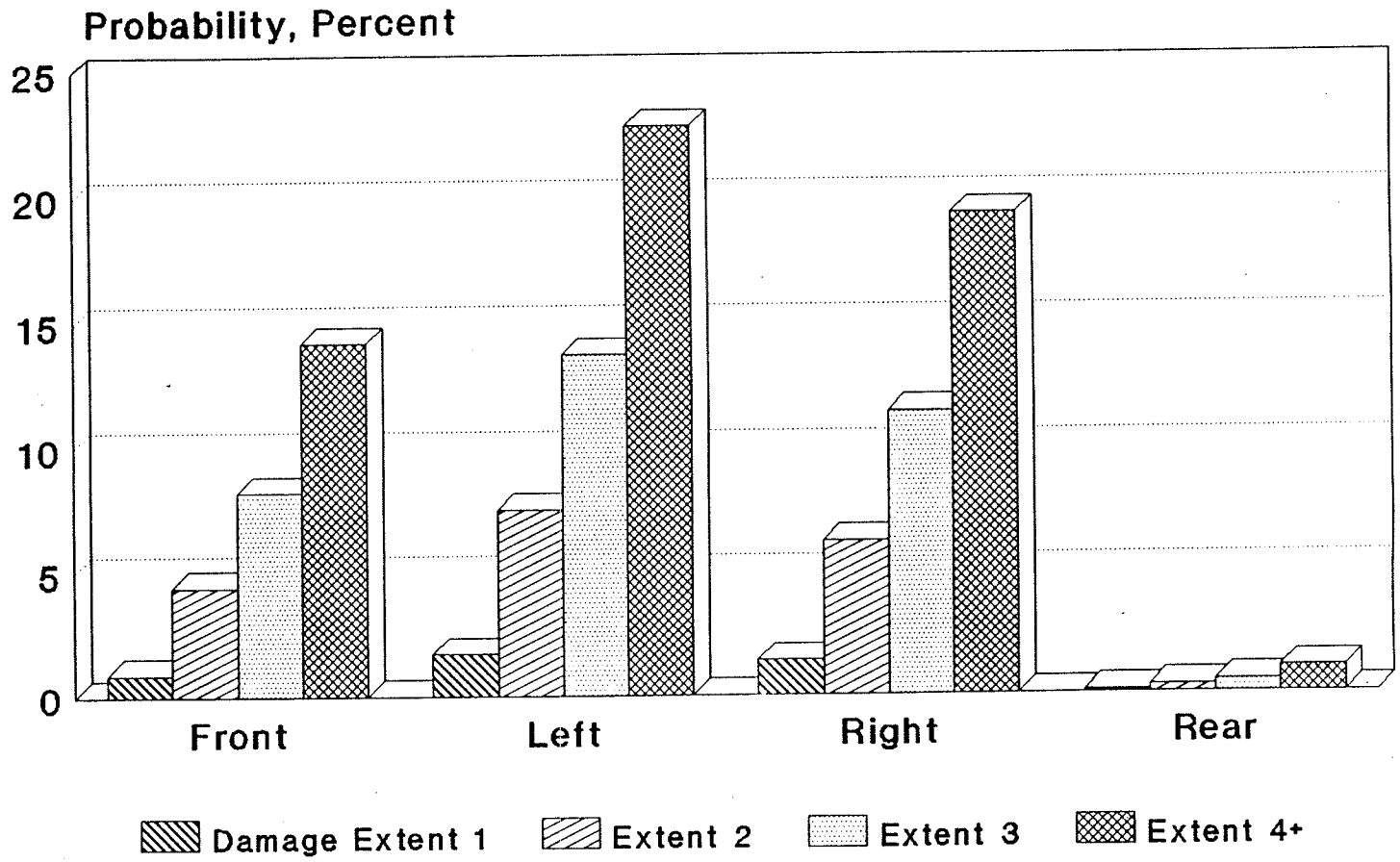
The NASS/CDS 1988-1995

Fig. 71. Probability of a Towaway Car with at Least One Fatality, versus Area and Extent of Damage, @ DV=40 mph



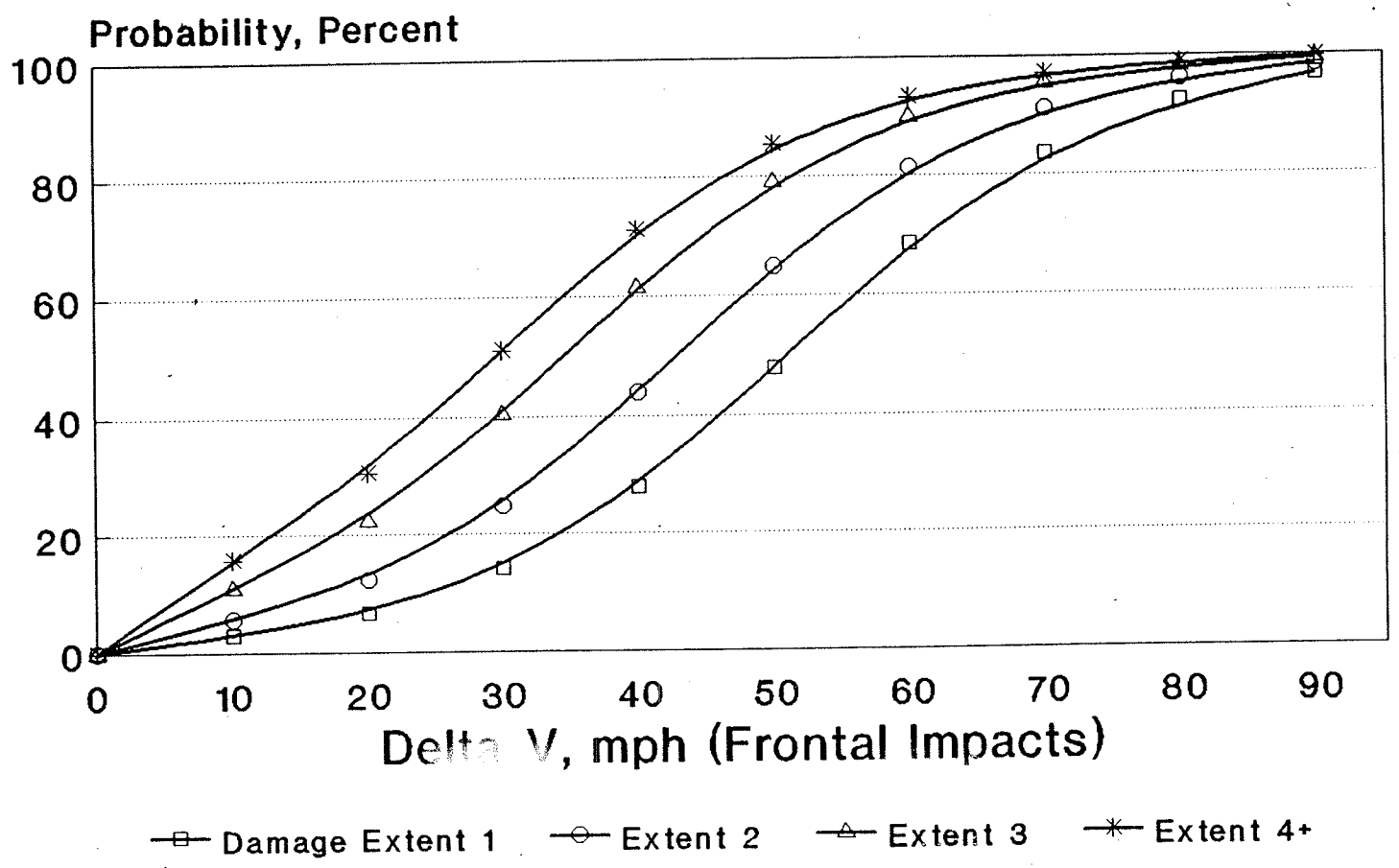
The NASS/CDS 1988-1995

Fig. 72. Probability of a Towaway Car Occupant Incurring a Compelling Injury, v. Area and Extent of Damage, @ 40 mph



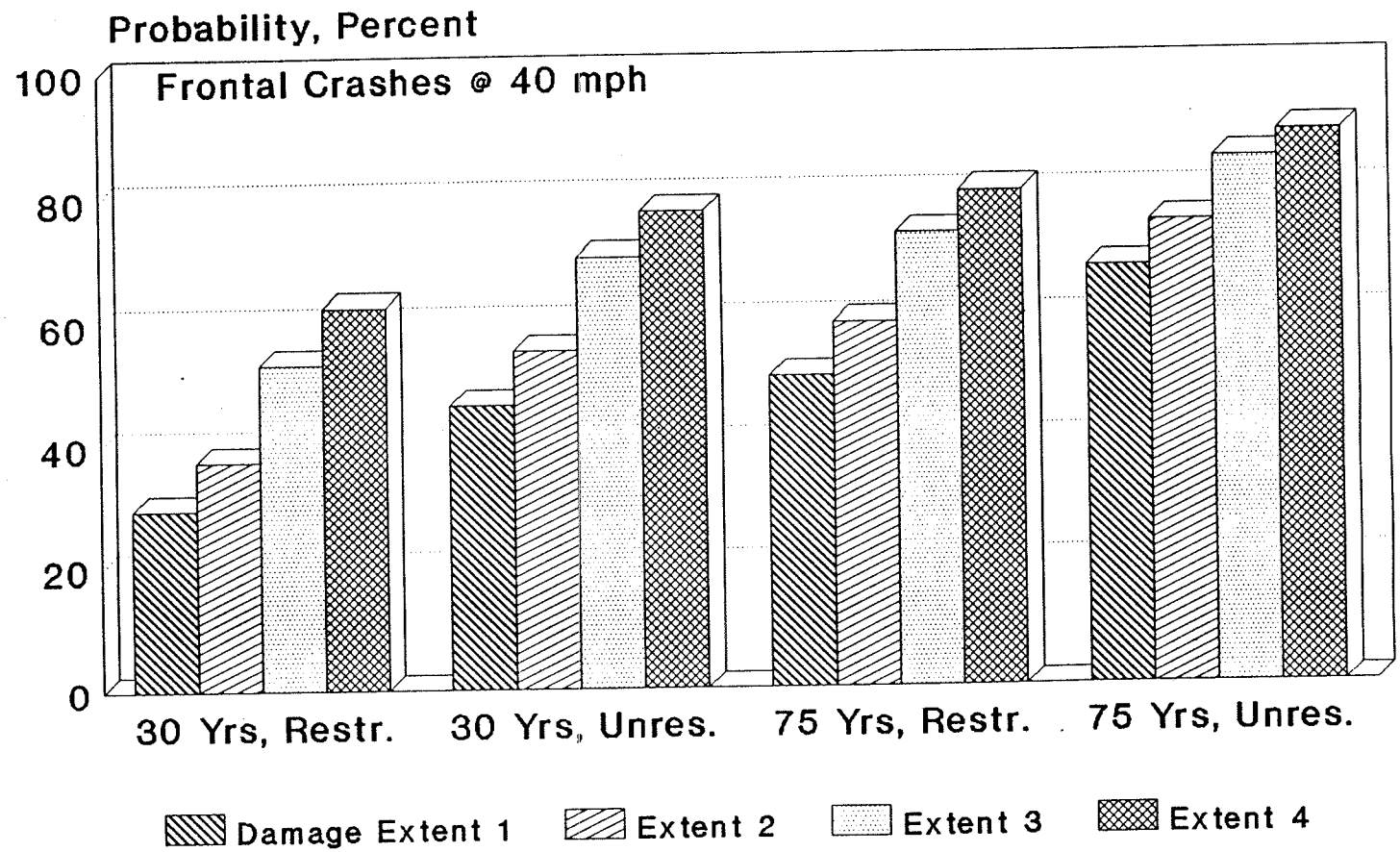
The NASS/CDS 1993-1995

Fig. 73. Probability of a Towaway Car with at Least a MAIS 3+, as a Function of Delta V and Extent of Damage



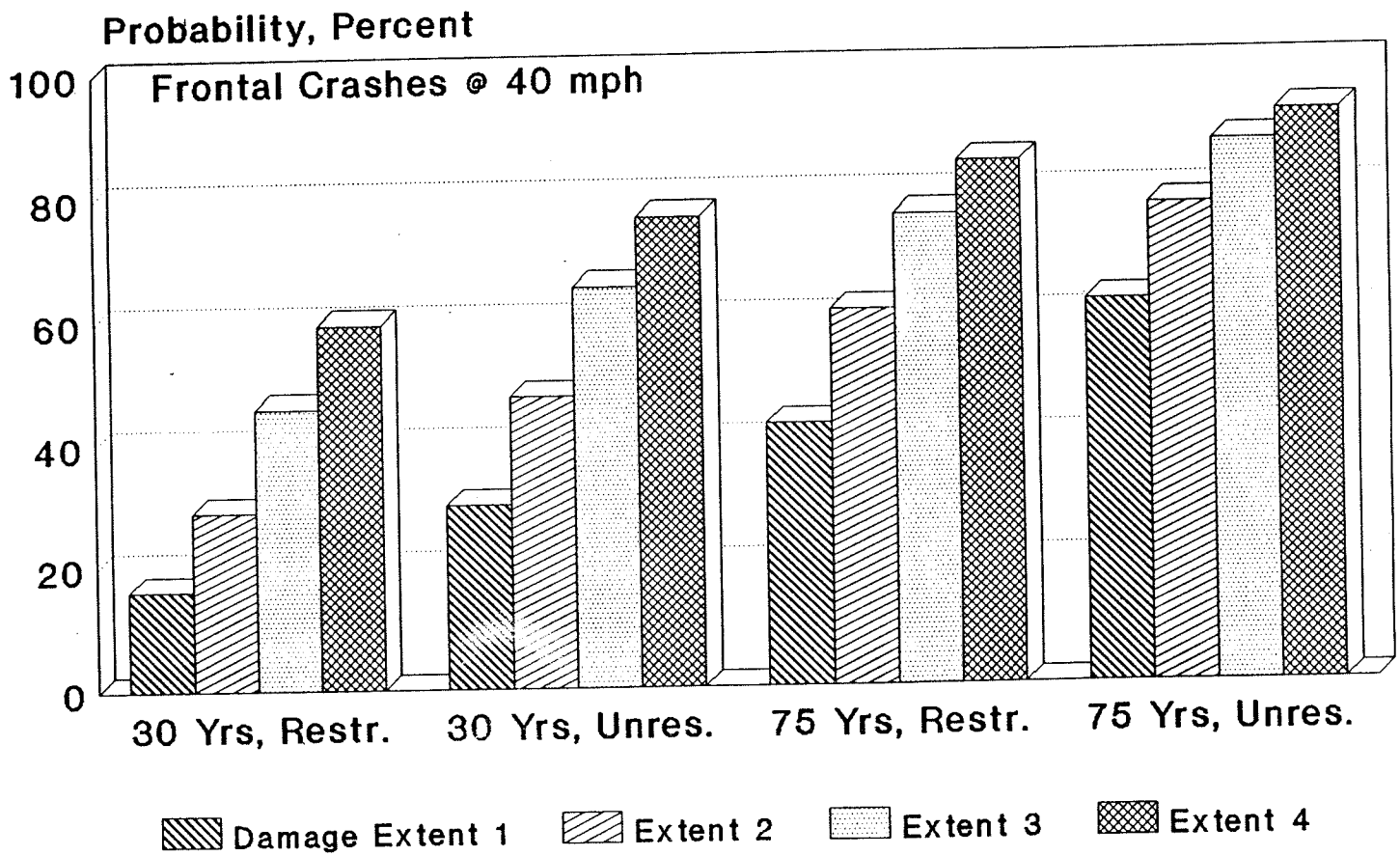
The NASS/CDS 1988-1995

Fig. 74. Probability of a Towaway Car Occupant Incurring an Injury @ MAIS 2+, v. Age, Restraint, and Extent of Damage



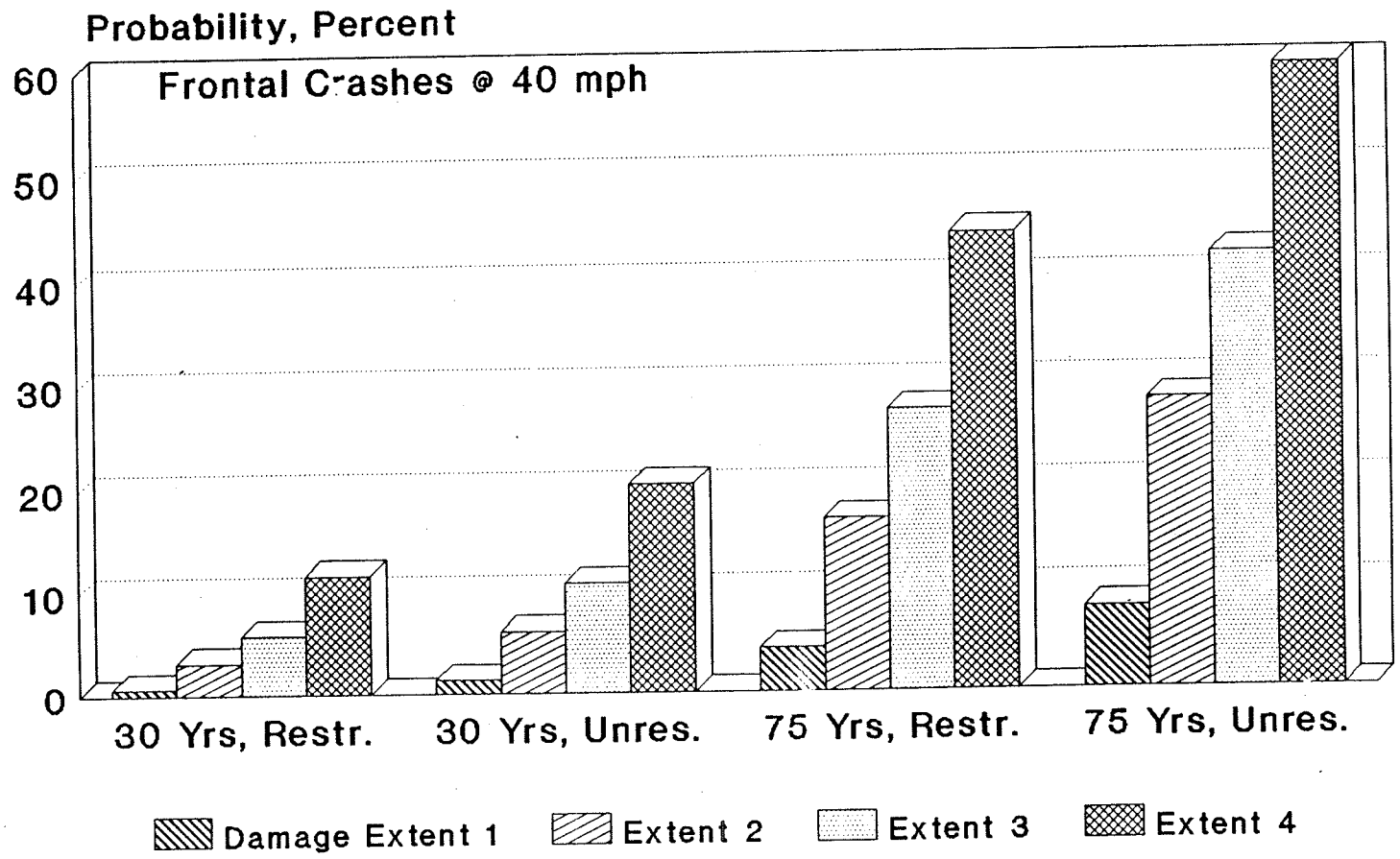
The NASS/CDS 1988-1995

Fig. 75. Probability of a Towaway Car Occupant Incurring an Injury @ MAIS 3+, v. Age, Restraint, and Extent of Damage



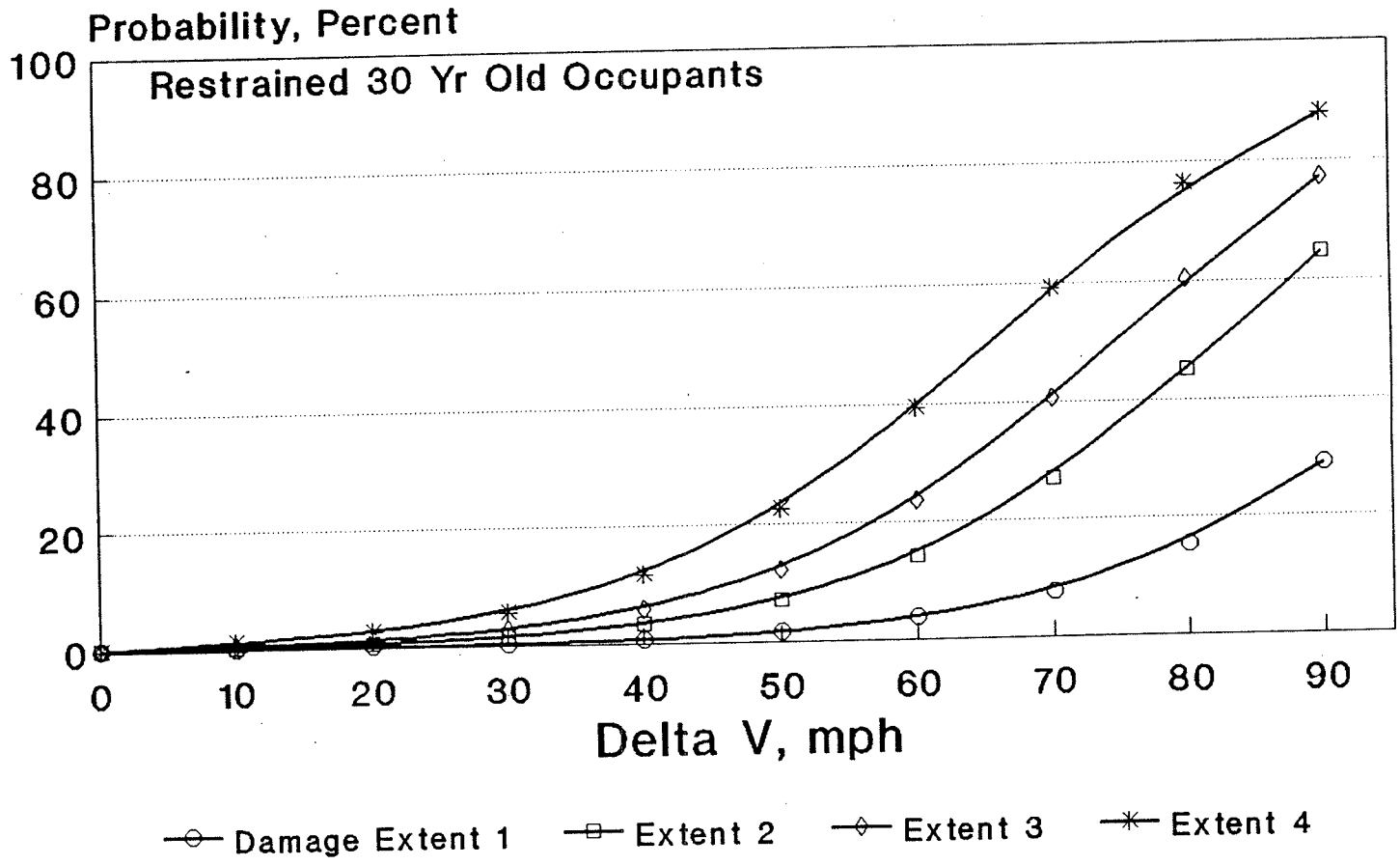
The NASS/CDS 1988-1995

Fig. 76. Probability of a Towaway Car Occupant Incurring a Compelling Injury or Fatality v. Age, Restraint, & Damage



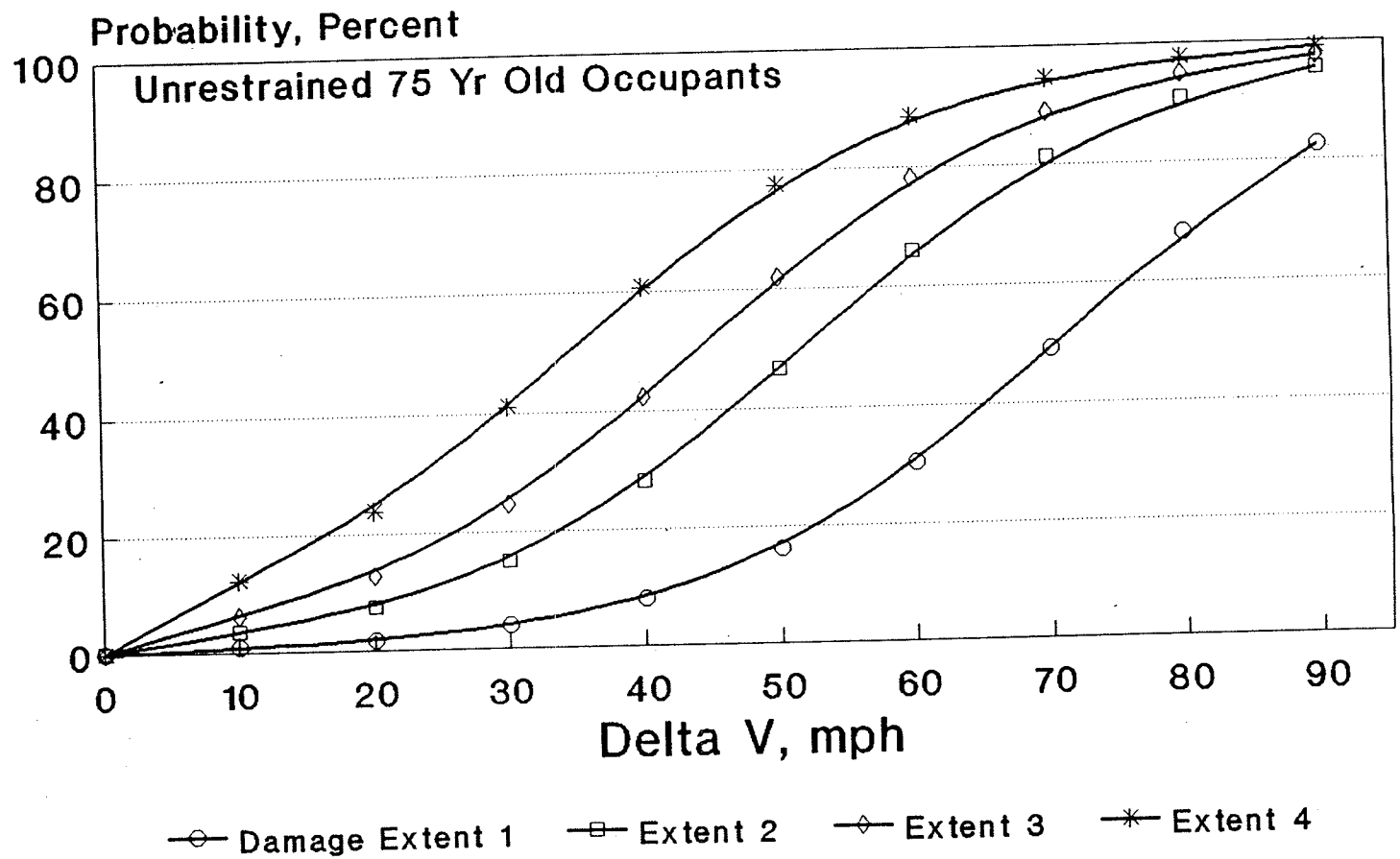
The NASS/CDS 1988-1995

Fig. 77. Probability of a Towaway Car Occupant with a Compelling Injury or Fatality for Shown Frontal Crashes



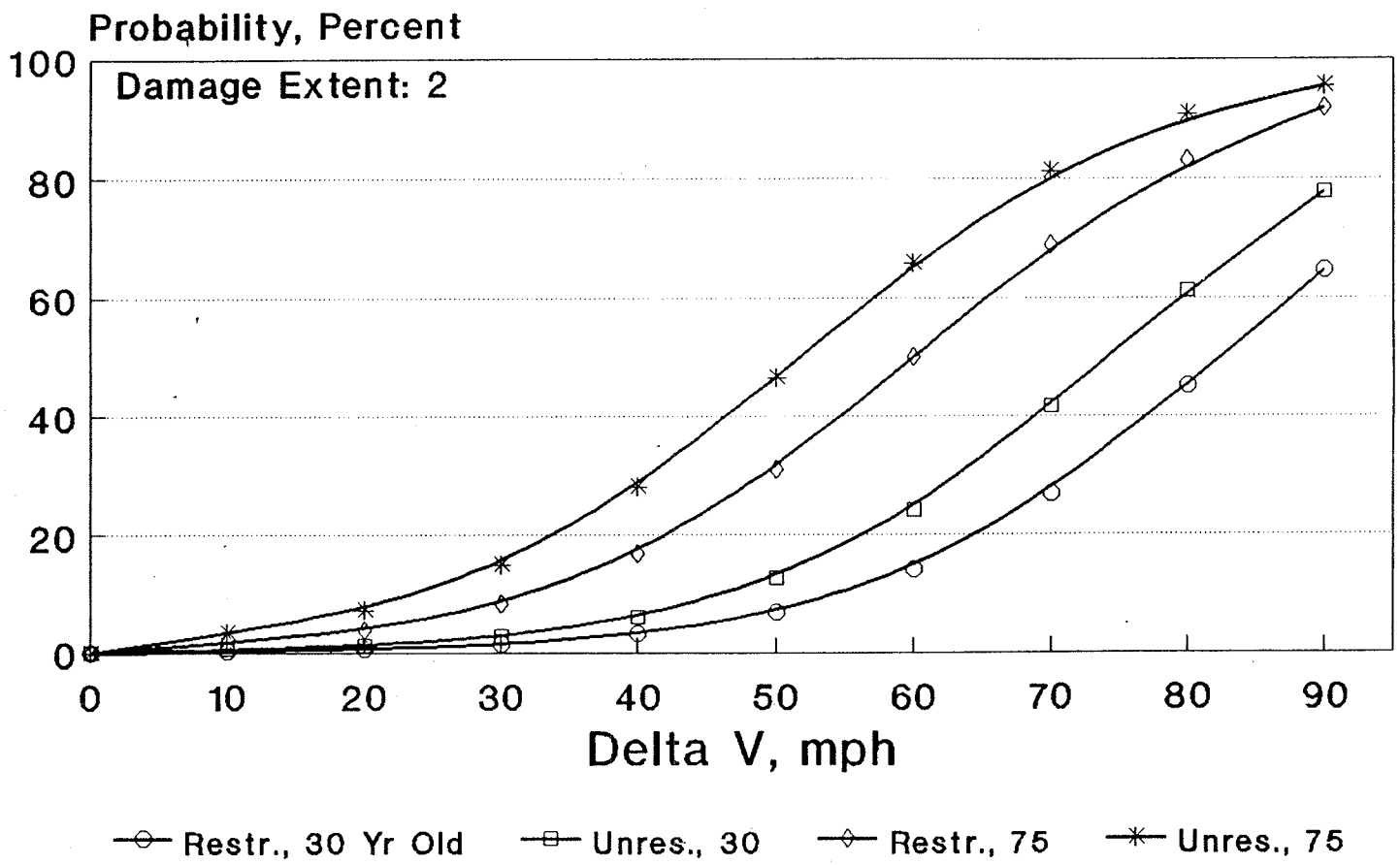
The NASS/CDS 1993-1995

Fig. 78. Probability of a Towaway Car Occupant with a Compelling Injury or Fatality for Shown Frontal Crashes



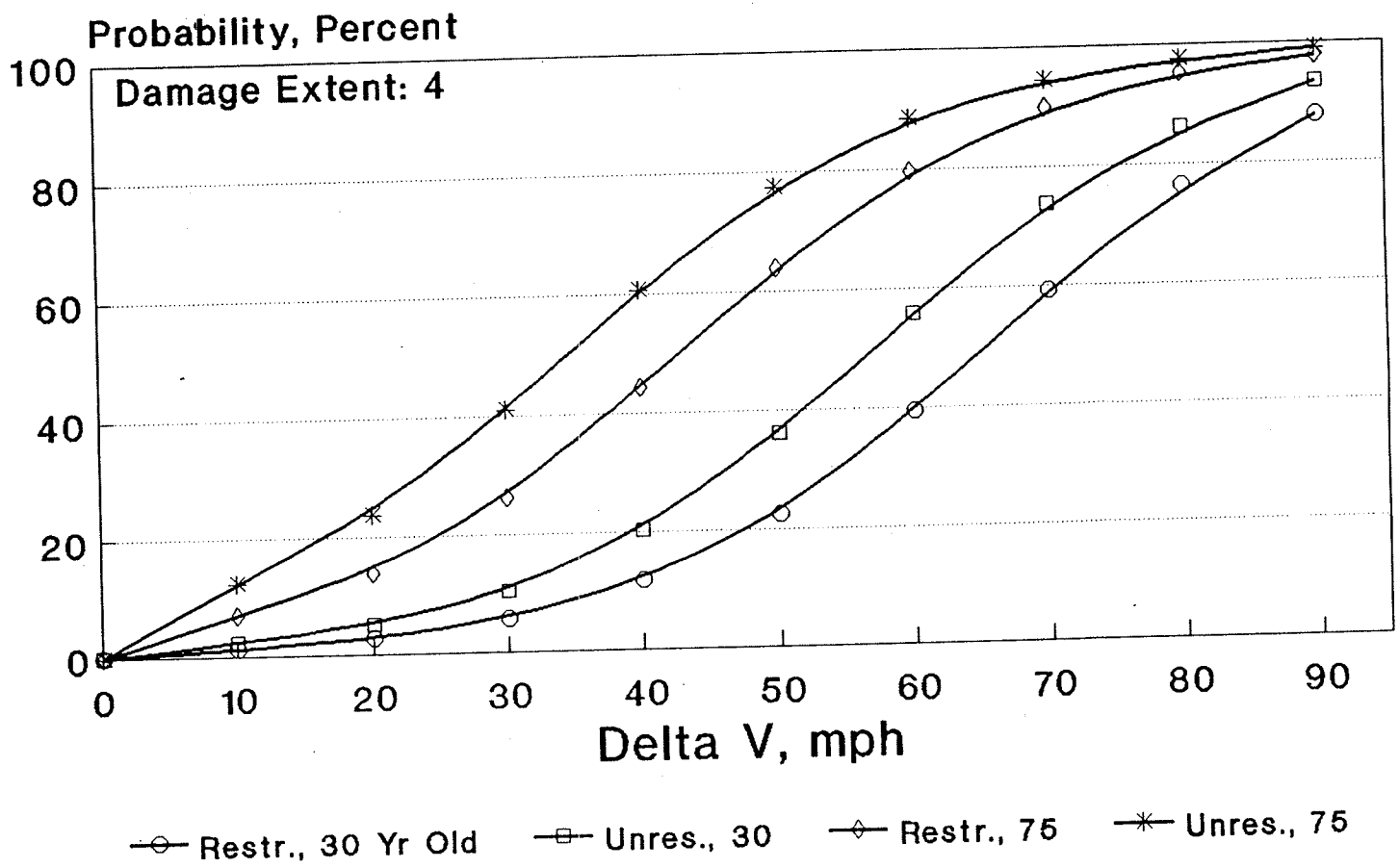
The NASS/CDS 1993-1995

Fig. 79. Probability of a Towaway Car Occupant with a Compelling Injury or Fatality for Shown Frontal Crashes



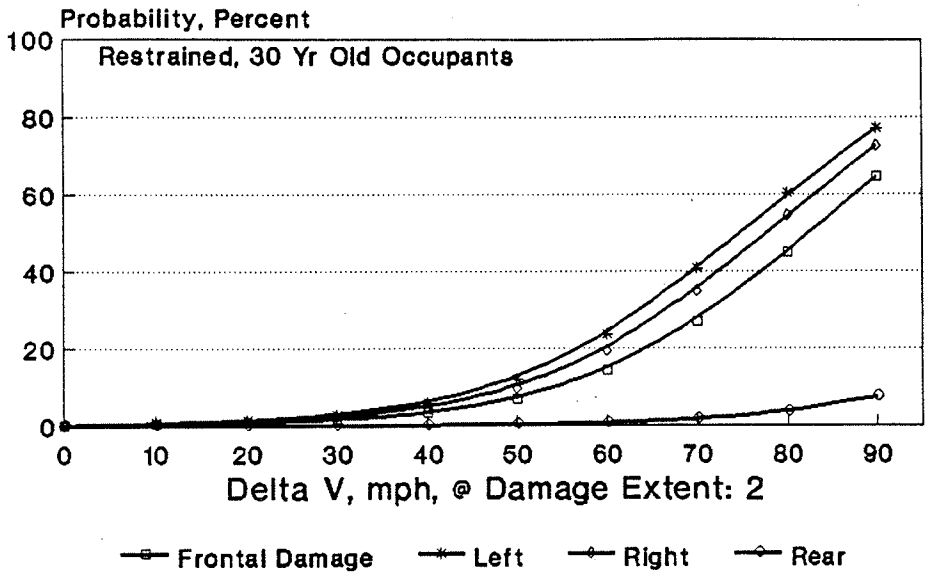
The NASS/CDS 1993-1995

Fig. 80. Probability of a Towaway Car Occupant with a Compelling Injury or Fatality for Shown Frontal Crashes



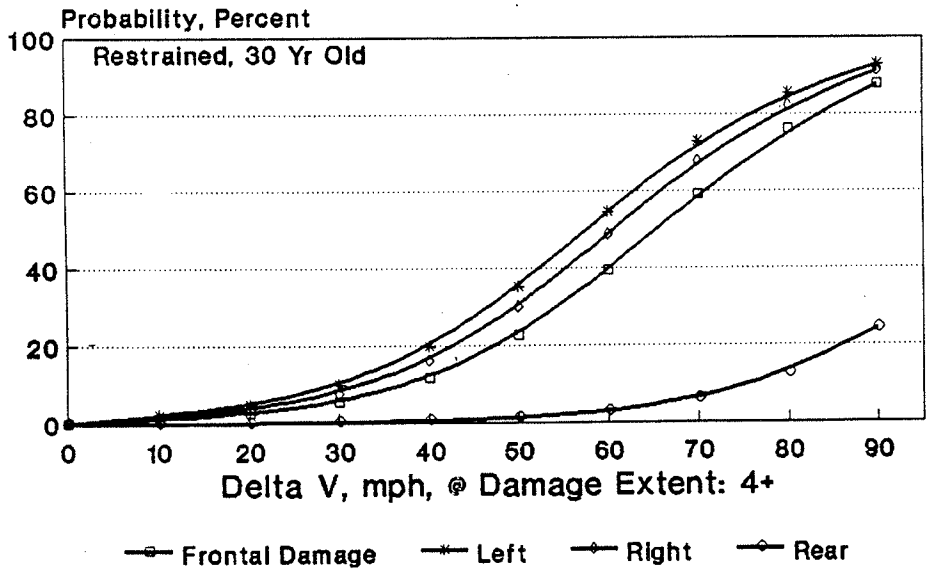
The NASS/CDS 1993-1995

Fig. 81. Probability of a Towaway Car Occupant with a Compelling Injury or Fatality for Shown Crashes



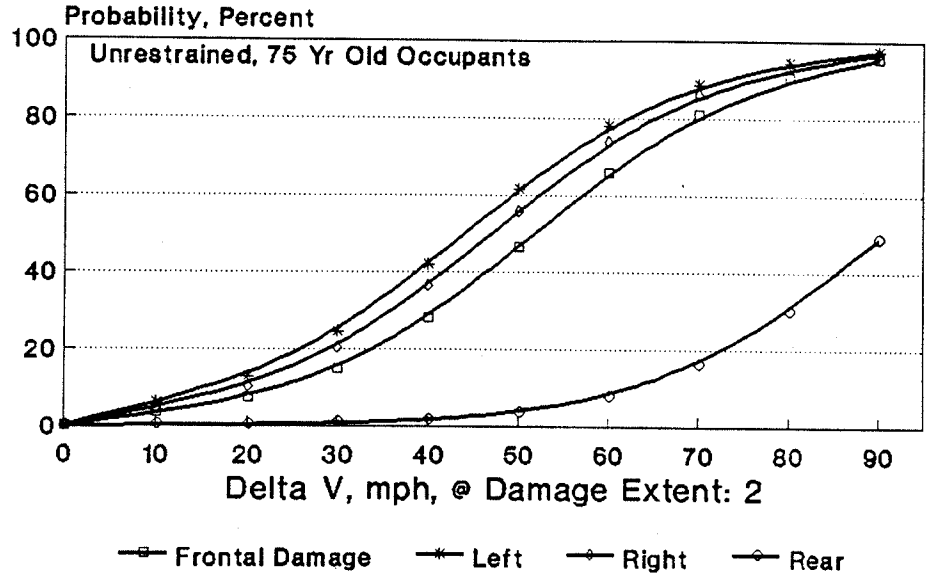
The NASS/CDS 1993-1995

Fig. 82. Probability of a Towaway Car Occupant with a Compelling Injury or Fatality for Shown Crashes



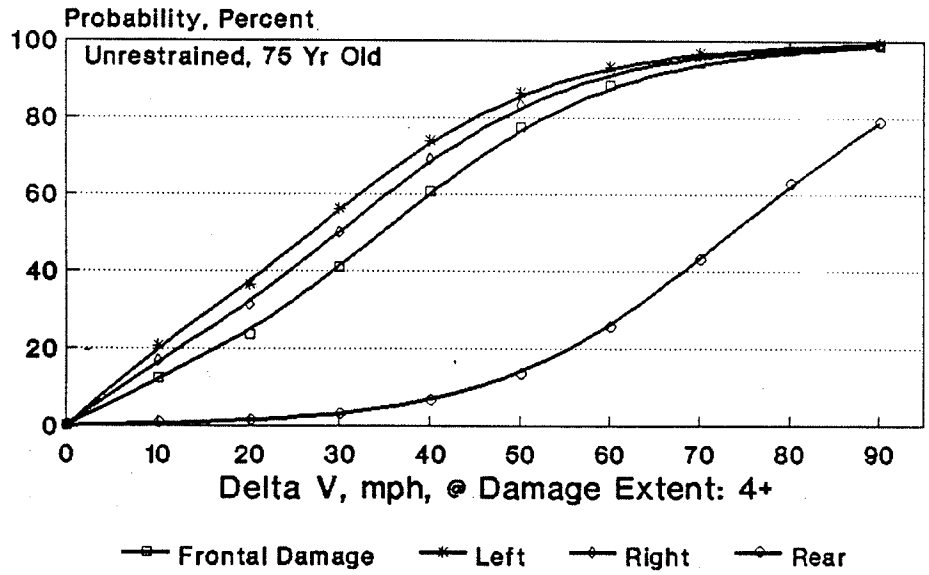
The NASS/CDS 1993-1995

Fig. 83. Probability of a Towaway Car Occupant with a Compelling Injury or Fatality for Shown Crashes



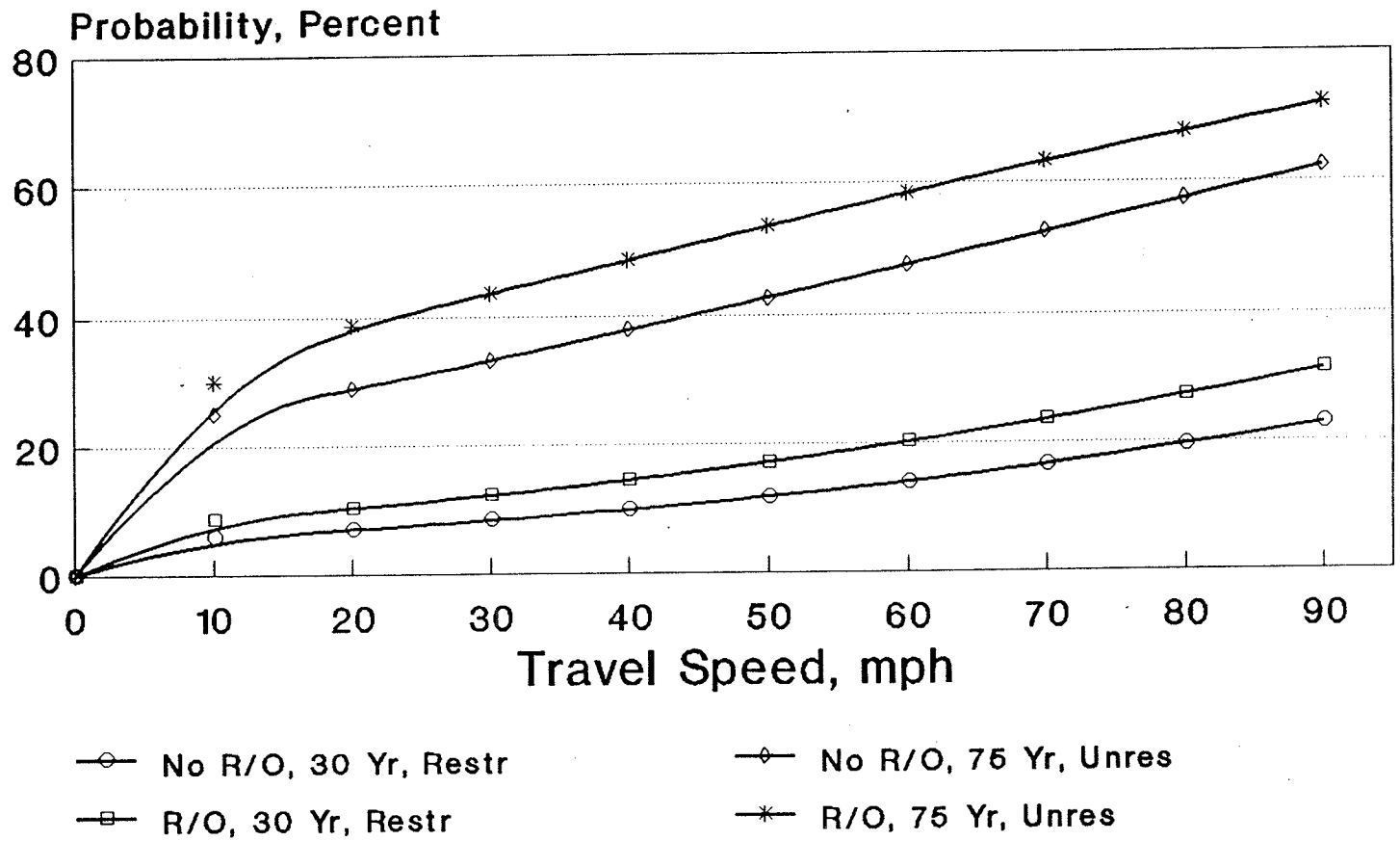
The NASS/CDS 1993-1995

Fig. 84. Probability of a Towaway Car Occupant with a Compelling Injury or Fatality for Shown Crashes



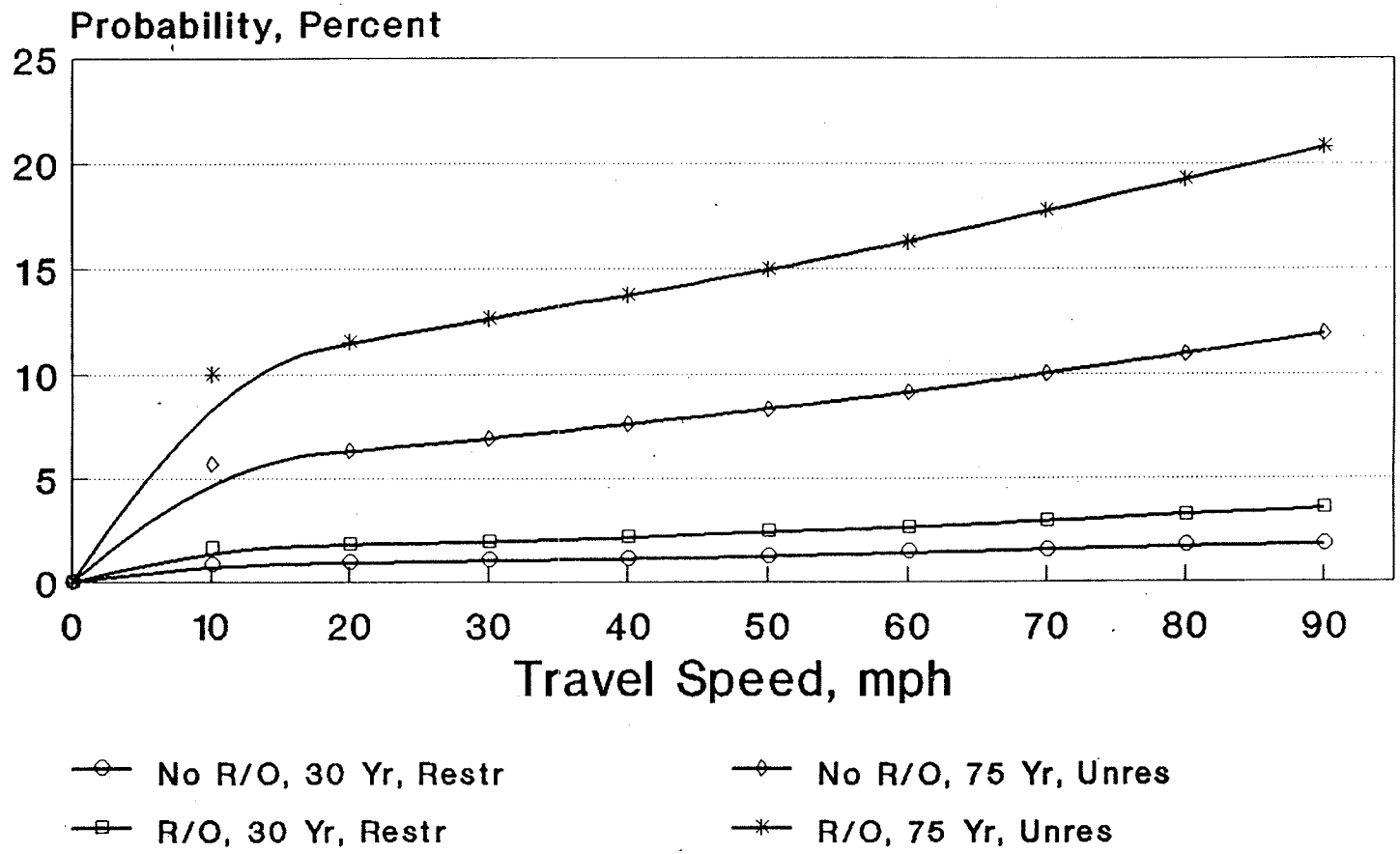
The NASS/CDS 1993-1995

Fig. 85. Probability of a Towaway Car Occupant with an Injury @ MAIS 3+ versus Travel Speed and Rollover Occurrence



The NASS/CDS 1988-1995

Fig. 86. Probability of a Towaway Car Occupant with a Compelling Injury or Fatality v. Travel Speed and Rollover



The NASS/CDS 1993-1995

Appendix

This Appendix presents, in eight tables, the distributions of towaway cars and associated casualties among the delta V values encountered in planar crashes, or the travel speed values encountered in rollovers. These tables essentially resolve further the control totals (car and casualty counts per year) shown in Table XXIX of this briefing, according to delta V or travel speed.

Table A-I

Cars per Year with Shown Casualty Threshold in Towaway Planar Crashes

Delta V mph	VAIS 1+	VAIS 2+	VAIS 3+	Fatality	All Cars
10	390430	77556	19382	594	839213
20	409457	128976	56321	5356	649494
30	125128	50793	30419	4290	194414
40	33588	17966	13806	2715	41908
50	8834	6349	5219	1849	10260
60	2039	1879	1493	746	2435
70	971	854	638	561	1043
80	291	256	242	132	348
90	97	85	77	75	174
Total	970737	284715	127596	16318	1738941

The Above Expressed in Column Percent

10	40.22	27.24	15.19	3.64	48.26
20	42.18	45.30	44.14	32.82	37.35
30	12.89	17.84	23.84	26.29	11.18
40	3.46	6.31	10.82	16.64	2.41
50	0.91	2.23	4.09	11.33	0.59
60	0.21	0.66	1.17	4.57	0.14
70	0.10	0.30	0.50	3.44	0.06
80	0.03	0.09	0.19	0.81	0.02
90	0.01	0.03	0.06	0.46	0.01
Total	100.00	100.00	100.00	100.00	100.00

Table A-II

Travel Speed mph	Rollover Cars per Year with Shown Casualty Threshold				
	VAIS 1+	VAIS 2+	VAIS 3+	Fatality	All Cars
10	2235	552	336	127	2321
20	1362	983	465	128	2044
30	2057	518	367	4	2159
40	11308	1722	836	102	14491
50	15395	4968	3409	796	23637
60	22955	11313	4075	1042	30946
70	17238	9287	7302	1090	19791
80	5779	3186	1715	598	7390
90	10712	5002	3451	940	12702
Total	89041	37522	21954	4829	115469

The Above Expressed in Column Percent

10	2.51	1.47	1.53	2.63	2.01
20	1.53	2.62	2.12	2.66	1.77
30	2.31	1.38	1.67	0.09	1.87
40	12.70	4.59	3.81	2.11	12.55
50	17.29	13.24	15.53	16.49	20.47
60	25.78	30.15	18.56	21.58	26.80
70	19.36	24.75	33.26	22.58	17.14
80	6.49	8.49	7.81	12.39	6.40
90	12.03	13.33	15.72	19.46	11.00
Total	100.00	100.00	100.00	100.00	100.00

Table A-III

Car Occupants per Year with Shown Casualty Threshold in Towaway Planar Crashes

Delta V mph	MAIS 1+	MAIS 2+	MAIS 3+	Fatality	All Occup.
10	477665	64917	20562	603	1281814
20	515239	105559	62700	5786	970050
30	158656	42181	36193	4661	302022
40	44482	15323	16937	3017	59246
50	11272	5637	6663	2152	13956
60	2909	1942	2290	1058	3686
70	1212	853	793	674	1580
80	485	379	499	147	527
90	121	95	117	76	263
Total	1212041	236838	146770	18172	2633143

The Above Expressed in Column Percent

10	39.41	27.41	14.01	3.32	48.68
20	42.51	44.57	42.72	31.84	36.84
30	13.09	17.81	24.66	25.65	11.47
40	3.67	6.47	11.54	16.60	2.25
50	0.93	2.38	4.54	11.84	0.53
60	0.24	0.82	1.56	5.82	0.14
70	0.10	0.36	0.54	3.71	0.06
80	0.04	0.16	0.34	0.81	0.02
90	0.01	0.04	0.08	0.42	0.01
Total	100.00	100.00	100.00	100.00	100.00

Table A-IV

Travel Speed mph	Car Occupants per Year with Shown Casualty Threshold in Rollovers				
	MAIS 1+	MAIS 2+	MAIS 3+	Fatality	All Occup.
10	2162	567	396	178	2456
20	1256	821	479	128	2293
30	2186	459	368	5	2729
40	14125	2067	942	102	24528
50	18218	4963	3952	797	32335
60	28890	10763	4845	1185	48930
70	25321	9155	8132	1195	32444
80	8708	3640	1972	684	12191
90	15404	6128	4793	1054	24037
Total	116258	38564	25881	5328	181962

The Above Expressed in Column Percent

10	1.86	1.47	1.53	3.35	1.35
20	1.08	2.13	1.85	2.41	1.26
30	1.88	1.19	1.42	0.09	1.50
40	12.15	5.36	3.64	1.92	13.48
50	15.67	12.87	15.27	14.96	17.77
60	24.85	27.91	18.72	22.24	26.89
70	21.78	23.74	31.42	22.42	17.83
80	7.49	9.44	7.62	12.83	6.70
90	13.25	15.89	18.52	19.78	13.21
Total	100.00	100.00	100.00	100.00	100.00

Table A-V

Car Occupant Injuries per Year
in Towaway Planar Crashes

Delta V mph	Compelling	All Other	All Injuries
10	925	326298	327350
20	11706	1285105	1296518
30	13463	764520	777969
40	15103	315967	331157
50	7831	113071	120926
60	4078	39604	43627
70	2903	14349	17275
80	1885	8609	10541
90	285	2583	2928
Total	58179	2869819	2927998

The Above Expressed in Column Percent

10	1.59	11.37	11.18
20	20.12	44.78	44.28
30	23.14	26.64	26.57
40	25.96	11.01	11.31
50	13.46	3.94	4.13
60	7.01	1.38	1.49
70	4.99	0.50	0.59
80	3.24	0.30	0.36
90	0.49	0.09	0.10
Total	100.00	100.00	100.00

Table A-VI

Travel Speed mph	Car Occupant Injuries per Year in Rollovers: Compelling	All Other	All Injuries
10	306	1784	2022
20	611	2410	2903
30	.	1346	1370
40	.	24573	24821
50	.	1628	1663
60	624	57691	58710
70	1842	40193	41978
80	905	51900	53100
90	8850	131567	139632
Total	13137	313030	326167

The Above Expressed in Column Percent

10	2.33	0.57	0.62
20	4.65	0.77	0.89
30	.	0.43	0.42
40	.	7.85	7.61
50	.	0.52	0.51
60	4.75	18.43	18.00
70	14.02	12.84	12.87
80	6.89	16.58	16.28
90	67.37	42.03	42.81
Total	100.00	100.00	100.00

Table A-VII

Car Occupants per Year at Shown Max Injury in Towaway Planar Crashes;

Delta V mph	Compelling	Compelling or Fatality	All Injured	All Occupants
10	804	867	477665	1281814
20	8440	8765	515239	970050
30	7894	8380	158656	302022
40	7966	8684	44482	59246
50	3211	4499	11272	13956
60	1472	2257	2909	3686
70	942	1160	1212	1580
80	568	601	485	527
90	91	159	121	263
Total	31387	35372	1212041	2633143

The Above Expressed in Column Percent

10	2.56	2.45	39.41	48.68
20	26.89	24.78	42.51	36.84
30	25.15	23.69	13.09	11.47
40	25.38	24.55	3.67	2.25
50	10.23	12.72	0.93	0.53
60	4.69	6.38	0.24	0.14
70	3.00	3.28	0.10	0.06
80	1.81	1.70	0.04	0.02
90	0.29	0.45	0.01	0.01
Total	100.00	100.00	100.00	100.00

Table A-VIII

Car Occupants per Year at Shown Max Injury in Rollovers

Travel Speed mph	Compelling	Compelling or Fatality	All Injured	All Occupants
10	282	304	2162	2456
20	565	659	1256	2293
30	.	.	2186	2729
40	.	.	14125	24528
50	.	.	18218	32335
60	541	583	28890	48930
70	1352	1514	25321	32444
80	368	396	8708	12191
90	3438	4301	15404	24037
Total	6545	7758	116258	181962

The Above Expressed in Column Percent

10	4.31	3.92	1.86	1.35
20	8.63	8.50	1.08	1.26
30	.	.	1.88	1.50
40	.	.	12.15	13.48
50	.	.	15.67	17.77
60	8.26	7.51	24.85	26.89
70	20.65	19.52	21.78	17.83
80	5.62	5.11	7.49	6.70
90	52.53	55.44	13.25	13.21
Total	100.00	100.00	100.00	100.00