The Likelihood of Human Casualty in Highway Crashes

Eleventh Briefing: Casualty Projections from Scene Data

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

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DeBlois Associates
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"The Likelihood of Casualty in Highway Crashes"

Introduction

This eleventh briefing concerning the cited subject addresses
the projection of casualties on the basis of crash scene
observable data that serve as predictors. The following
specific topics are treated below:

1. Description and Characterization of projected casualty
populations, in Tables I to V.
2. Description and Characterization of scene observable
predictors, in Table VI.
3. Formulation of Algorithms for Occupants with: (a) at least one
Compelling Injury; and (b) Any Injury, in Tables VII to IX , and
4. Preliminary numerical applications as a function of
predictors, based on crash scene data; see Table X.

The data compiled in the eight years, 1988-1995, of NASS/CDS are
the basic data used. The NASS weights are used as weighing
factors in any data processing procedure. Algorithm
development is accomplished by methods described in earlier
briefings.

Table I.   NASS/CDS 1988-1995 Sample Strength

240,000   Towaway Car Occupant Injuries
 17,000   Compelling Injuries

 91,000   Towaway Car Occupants
  5,900   Occupants w at Least One Compelling Injury

Table II.   Estimated U.S. Incidence per Year

                              (Compelling)
140,000   Towaway Car Occupant Injuries
 50,000   Occupants w at Least One Compelling Injury

Table III. Distribution of Towaway Car Occupant Injuries

AIS	Percent
1	76.3
2	13.7
3	6.8
4	1.9
5	0.9
6	0.4
All	100.0

Injuries	Percent
Noncompelling	93.2
Compelling	6.8

Table IV. Distribution of Towaway Car Occupants

Occupants by MAIS	Percent
0	53.3
1	33.8
2	5.3
3	1.6
4	0.3
5	0.2
6	0.1
Unkn	5.4
Total	100.0

Occupants with Shown Injury	
Noncompelling	98.9%
@ Least One Compelling	1.1%

Table V. Characterization and Perspective of Compelling Injuries

AIS	Compelling	%	
1	No	89.600	
2	No	6.537	
3	No	1.304	See Table V-a
3	Yes	1.166	See Table V-b
4	Yes	0.585	
5	Yes	0.289	
6	Yes	0.087	

Table V-a. Non Compelling Injuries at AIS=3

REGION	ORGAN	LESION	AIS	OIC	AIS-90	Percent of AIS 3
Upper Arm	Skeletal	Fracture	3	ASF3	752604.3	9.189
Upper Arm	Skeletal	Fracture	3	ASF3	752606.3	0.275
Back	Vertebrae	Rupture	3	BVR3	650403.3	0.048
Back	Vertebrae	Dislocation	3	BVD3	650412.3	0.017
Back	Skeletal	Fracture	3	BSF3	650422.3	0.048
Back	Skeletal	Fracture	3	BSF3	650424.3	0.264
Back	Skeletal	Fracture	3	BSF3	650426.3	0.033
Back	Skeletal	Fracture	3	BSF3	650434.3	0.081
Back	Skeletal	Fracture	3	BSF3	650622.3	0.036
Back	Skeletal	Fracture	3	BSF3	650624.3	0.183
Back	Skeletal	Fracture	3	BSF3	650626.3	0.252
Back	Skeletal	Fracture	3	BSF3	650634.3	0.639
Chest	Heart	Contusion	3	CHC3	441002.3	0.915
Chest	Heart	Contusion	3	CHC3	441004.3	0.366
Chest	Lung(s)	Unknown	3	CPU3	441499.3	0.021
Chest	Respirtry	Contusion	3	CRC3	442602.3	0.019
Chest	Skeletal	Fracture	3	CSF3	450214.3	0.749
Chest	Skeletal	Fracture	3	CSF3	450222.3	4.395
Chest	Skeletal	Fracture	3	CSF3	450230.3	5.387
Chest	Skeletal	Fracture	3	CSF3	450250.3	0.088
Chest	Respirtry	Other	3	CRO3	919202.3	0.049
Knee	Muscle(s)	Laceration	3	KML3	840406.3	0.103
Lower Leg	Skeletal	Fracture	3	LSF3	853408.3	0.989
Lower Leg	Skeletal	Fracture	3	LSF3	853422.3	4.397
Abdmn	Unknown	Unknown	3	MUU3	543800.3	0.140
Neck	Respirtry	Laceration	3	NRL3	340208.3	0.007
Neck	Respirtry	Laceration	3	NRL3	340606.3	0.007
Neck	Vertebrae	Rupture	3	NVR3	650203.3	0.007
Pelvis	Joint(s)	Detachment	3	PJG3	853000.3	1.113
Ankle, Ft	Skeletal	Fracture	3	QSF3	853418.3	0.526

Forearm	Skeletal	Fracture	3	RSF3	752804.3	5.476
Forearm	Skeletal	Fracture	3	RSF3	752806.3	0.165
Forearm	Skeletal	Fracture	3	RSF3	753204.3	3.607
Thigh	Arterial	Unknown	3	TAU3	820299.3	0.018
Thigh	Nerve(s)	Laceration	3	TNL3	830406.3	0.021
Thigh	Skeletal	Fracture	3	TSF3	851800.3	1.199
Thigh	Skeletal	Fracture	3	TSF3	851804.3	0.433
Thigh	Skeletal	Fracture	3	TSF3	851808.3	0.183
Thigh	Skeletal	Fracture	3	TSF3	851810.3	0.341
Thigh	Skeletal	Fracture	3	TSF3	851812.3	0.291
Thigh	Skeletal	Fracture	3	TSF3	851814.3	8.689
Thigh	Skeletal	Fracture	3	TSF3	851818.3	1.047
Thigh	Skeletal	Fracture	3	TSF3	851822.3	0.915

Table V-b.   Compelling Injuries at AIS=3

REGION	ORGAN	LESION	AIS	OIC	AIS-90	Percent of AIS 3
Back	Spine	Contusion	3	BCC3	640404.3	0.179
Back	Spine	Contusion	3	BCC3	640604.3	0.036
Chest	Arterial	Laceration	3	CAL3	421004.3	0.021
Chest	Arterial	Laceration	3	CAL3	421204.3	0.046
Chest	Arterial	Laceration	3	CAL3	421402.3	0.002
Chest	Arterial	Laceration	3	CAL3	421802.3	0.037
Chest	Heart	Laceration	3	CHL3	441008.3	0.018
Chest	Heart	Laceration	3	CHL3	441010.3	0.078
Chest	Lung(s)	Contusion	3	CPC3	441402.3	1.791
Chest	Lung(s)	Contusion	3	CPC3	441406.3	3.956
Chest	Lung(s)	Laceration	3	CPL3	441414.3	0.201
Chest	Lung(s)	Laceration	3	CPL3	441416.3	0.027
Chest	Lung(s)	Laceration	3	CPL3	441430.3	0.589
Chest	Lung(s)	Laceration	3	CPL3	441802.3	0.331
Chest	Unknown	Unknown	3	CUU3	442202.3	3.473
Chest	Unknown	Unknown	3	CUU3	442204.3	0.047
Face	Skeletal	Fracture	3	FSF3	250808.3	0.483
Face	Skeletal	Fracture	3	FSF3	251204.3	1.879
Head	Brain	Contusion	3	HBC3	140402.3	0.131
Head	Brain	Contusion	3	HBC3	140403.3	0.026
Head	Brain	Unknown	3	HBU3	140454.3	0.021
Head	Brain	Unknown	3	HBU3	140466.3	0.971
Head	Brain	Contusion	3	HBC3	140602.3	1.066
Head	Brain	Contusion	3	HBC3	140604.3	0.694
Head	Brain	Contusion	3	HBC3	140606.3	1.062
Head	Brain	Contusion	3	HBC3	140612.3	0.152
Head	Brain	Contusion	3	HBC3	140614.3	0.058
Head	Brain	Contusion	3	HBC3	140620.3	0.666
Head	Brain	Contusion	3	HBC3	140622.3	0.434

Head	Brain	Unknown	3	HBU3	140660.3	0.299
Head	Brain	Unknown	3	HBU3	140662.3	0.061
Head	Brain	Unknown	3	HBU3	140668.3	1.063
Head	Brain	Unknown	3	HBU3	140670.3	0.255
Head	Brain	Unknown	3	HBU3	140682.3	1.112
Head	Brain	Unknown	3	HBU3	140684.3	5.395
Head	Brain	Unknown	3	HBU3	140699.3	0.007
Head	Skeletal	Fracture	3	HSF3	150200.3	1.816
Head	Skeletal	Fracture	3	HSF3	150202.3	0.695
Head	Skeletal	Fracture	3	HSF3	150204.3	0.165
Head	Skeletal	Fracture	3	HSF3	150404.3	2.243
Head	Brain	Concussion	3	HBK3	160204.3	0.185
Head	Brain	Concussion	3	HBK3	160206.3	0.211
Head	Brain	Concussion	3	HBK3	160408.3	0.109
Head	Brain	Concussion	3	HBK3	160412.3	0.065
Head	Brain	Concussion	3	HBK3	160604.3	0.094
Head	Brain	Concussion	3	HBK3	160608.3	0.014
Head	Brain	Concussion	3	HBK3	160612.3	0.011
Head	Brain	Concussion	3	HBK3	160802.3	0.985
Head	Brain	Concussion	3	HBK3	160806.3	0.024
Head	Brain	Concussion	3	HBK3	160810.3	0.022
Head	Brain	Concussion	3	HBK3	160899.3	0.253
Knee	Arterial	Laceration	3	KAL3	820608.3	0.029
Knee	Arterial	Laceration	3	KAL3	820806.3	0.029
Abdmn	Respirtry	Laceration	3	MRL3	440604.3	0.816
Abdmn	Arterial	Laceration	3	MAL3	520602.3	0.002
Abdmn	Arterial	Laceration	3	MAL3	521204.3	0.086
Abdmn	Arterial	Laceration	3	MAL3	521402.3	0.062
Abdmn	Arterial	Laceration	3	MAL3	521404.3	0.069
Abdmn	Arterial	Laceration	3	MAL3	521602.3	0.046
Abdmn	Arterial	Unknown	3	MAU3	521699.3	0.075
Abdmn	Digestive	Laceration	3	MDL3	540824.3	0.067
Abdmn	Digestive	Laceration	3	MDL3	541020.3	0.016
Abdmn	Digestive	Laceration	3	MDL3	541022.3	0.011
Abdmn	Digestive	Laceration	3	MDL3	541224.3	0.079
Abdmn	Digestive	Laceration	3	MDL3	541424.3	0.418
Abdmn	Kidney(s)	Contusion	3	MKC3	541614.3	0.088
Abdmn	Kidney(s)	Laceration	3	MKL3	541624.3	0.046
Abdmn	Liver	Contusion	3	MLC3	541814.3	0.522
Abdmn	Liver	Laceration	3	MLL3	541824.3	0.897
Abdmn	Digestive	Laceration	3	MDL3	542024.3	0.051
Abdmn	Digestive	Laceration	3	MDL3	542824.3	0.138
Abdmn	Spleen	Contusion	3	MQC3	544214.3	0.110
Abdmn	Spleen	Laceration	3	MQL3	544224.3	0.561
Abdmn	Spleen	Rupture	3	MQR3	544240.3	0.513
Abdmn	Urogenitl	Laceration	3	MGL3	545024.3	0.020
Abdmn	Urogenitl	Laceration	3	MGL3	545026.3	0.068
Neck	Arterial	Laceration	3	NAL3	320806.3	0.041
Neck	Spine	Contusion	3	NCC3	640200.3	0.076
Neck	Spine	Contusion	3	NCC3	640201.3	0.008
Neck	Spine	Contusion	3	NCC3	640204.3	0.010

Neck	Spine	Contusion	3	NCC3	640208.3	0.063
Neck	Vertebrae	Dislocation	3	NVD3	650206.3	0.096
Neck	Vertebrae	Dislocation	3	NVD3	650212.3	0.091
Neck	Skeletal	Fracture	3	NSF3	650222.3	0.231
Neck	Skeletal	Fracture	3	NSF3	650224.3	1.173
Neck	Skeletal	Fracture	3	NSF3	650226.3	0.328
Neck	Skeletal	Fracture	3	NSF3	650228.3	0.322
Pelvis	Skeletal	Fracture	3	PSF3	852604.3	4.600
Pelvis	Skeletal	Fracture	3	PSF3	852800.3	0.949
Unknown	Integum.	Burn	3	UIB3	992016.3	0.027
Unknown	Integum.	Burn	3	UIB3	992018.3	0.028
Wrist Hnd	All	Crush	3	WWN3	752006.3	0.186
Wrist Hnd	Integum.	Avulsion	3	WIV3	794006.3	0.113
Upr Limbs	All	Amputation	3	XWM3	711000.3	0.263
Upr Limbs	All	Crush	3	XWN3	713000.3	0.037
Upr Limbs	Arterial	Laceration	3	XAL3	721008.3	0.007
Lwr Limbs	All	Amputation	3	YWM3	811000.3	0.002
Lwr Limbs	All	Amputation	3	YWM3	811002.3	0.200
Lwr Limbs	Integum.	Avulsion	3	YIV3	894006.3	0.042

Table VI.   Summary of Predictors Observable at the Scene

	OTHVEH0	Single Car Crash
	OTHVEH	Collision with Car or Light Vehicle
	ROLL	Rollover Occurrence
	GADF	Front Damage
	GADSC	Side Center Damage
	GADSE	Side End Damage
	GADT	Top Damage
	EXT1	Crush Extent 1
	EXT2	Crush Extent 2
	EXT3	Crush Extent 3
	CURBWT	Car Curb Weight
	LOSSINT	Loss of Integrity
	INTRU	Intrusion (Front Seats)
	SEATDISR	Seat Disruption
	RIMDEF	Rim Deformation
	FIRE	Fire Occurrence
	SEATF	Front Seating Pos.
	BELT	Belt Use
	BAG	Air Bag Deployment
	BEBA	Belt Use & Bag Deployment
	OCCWT	Occupant Weight
	OCCHT	Occupant Height
	AGE	Occupant Age
	GENDER	Occupant Gender
	ABNPOST	Abnormal Posture
	ENTRAP	Entrapment
	EJC	Complete Ejection
	EJP	Partial Ejection
	OTHRINJ	Other Seriously Injured Occ

All predictors are binary (1=Yes, 0=No), except:
Curb Weight in Hundreds of Pounds,
Occupant Weight in Pounds,
Occupant Height in Inches,
Occupant Age in Years, and
Intercept = Constant.

Certain, not explicitly stated predictors, assume implicit values.
Specifically: If EJC=0 and EJP=0 then "No Ejection"; if OTHVEH0=0
and OTHVEH=0 then Collision is with Heavy Vehicle;
if GADF=GADSC=GADSE=GADT=0 then "Rear Damage"; if EXT1=EXT2=EXT3=0
then "Crush Extent" = 4+; if BELT=BAG=BEBA=0 then "No Restraint".

Table VII. Algorithm for Casualty Probability

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

```
w = A0 + A1*OTHVEH + A2*ROLL + A3*GADF + A4*GADSC + A5*GADSE
  + A6*GADT + A7*EXT1 + A8*EXT2 + A9*EXT3 + A10*LOSSINT
  + A11*INTRU + A12*SEATDISR + A13*RIMDEF + A14*FIRE
  + A15*SEATF + A16*BELT + A17*BEBA + A18*ENTRAP + A19*EJC
  + A20*EJP + A21*OTHRINJ + A22*AGE;
```

Table VIII. Coefficients of Algorithm for Compelling Injury

Predictor	Ai Coefficnt	Std Error	Test
INTERCPT	-2.9758	0.28	0.0000
OTHVEH	-0.3294	0.10	0.0009
ROLL	0.1850	0.14	0.1767
GADF	1.1661	0.21	0.0000
GADSC	1.1744	0.20	0.0000
GADSE	0.5692	0.43	0.1848
GADT	0.2552	0.26	0.3199
EXT1	-2.4421	0.19	0.0000
EXT2	-1.3138	0.12	0.0000
EXT3	-0.8241	0.10	0.0000
LOSSINT	0.7827	0.14	0.0000
INTRU	0.6416	0.12	0.0000
SEATDISR	0.5034	0.13	0.0001
RIMDEF	0.4898	0.10	0.0000
FIRE	1.3994	0.38	0.0002
SEATF	0.3077	0.16	0.0503
BELT	-0.7021	0.09	0.0000
BEBA	-0.7701	0.31	0.0132
AGE	0.0295	0.00	0.0000
ENTRAP	1.9102	0.21	0.0000
EJC	2.0919	0.16	0.0000
EJP	1.7889	0.16	0.0000
OTHRINJ	2.2067	0.12	0.0000
OTHVEH0	0.0423	0.13	0.7442
CURBWT	-0.0109	0.01	0.1908
BAG	0.3415	0.29	0.2434
OCCWT	-0.0025	0.00	0.1348
OCCHT	0.0015	0.01	0.8783
GENDER	-0.0462	0.11	0.6610
ABNPOST	-0.4437	0.28	0.1118

Table IX. Coefficients of Algorithm for All Injured

Predictor	Ai Coefficnt	Std Error	Test
OTHVEH0	-0.4746	0.08	0.0000
OTHVEH	-0.1052	0.06	0.0860
ROLL	0.7736	0.15	0.0000
GADF	0.1941	0.08	0.0193
GADSC	-0.3889	0.09	0.0000
GADSE	-0.3650	0.10	0.0005
GADT	-1.0678	0.19	0.0000
EXT1	-0.6104	0.09	0.0000
EXT2	0.0177	0.08	0.8328
EXT3	0.2000	0.09	0.0236
CURBWT	-0.0164	0.00	0.0000
LOSSINT	0.6934	0.07	0.0000
INTRU	0.7578	0.07	0.0000
SEATDISR	0.7362	0.16	0.0000
RIMDEF	1.1212	0.09	0.0000
SEATF	0.8608	0.07	0.0000
BELT	-0.8405	0.05	0.0000
BEBA	0.4070	0.18	0.0239
OCCWT	0.0019	0.00	0.0213
OCCHT	0.0067	0.00	0.1094
AGE	0.0073	0.00	0.0000
GENDER	-0.8328	0.05	0.0000
ABNPOST	0.2310	0.11	0.0442
ENTRAP	5.8477	0.23	0.0000
EJC	3.2363	0.83	0.0001
EJP	4.4939	0.16	0.0000
OTHRINJ	2.9799	0.39	0.0000
INTERCPT	0.1340	0.25	0.5974
BAG	0.8800	0.35	0.1210

Table X.   Numerical Applications of the Algorithm
for Occupants with Compelling Injury

OBS	CRASH	ROLLOVER	GAD	CRUSH	P
1	Coll w Car	No Roll	Front	1	3.1
2	Coll w Car	No Roll	Front	2	9.0
3	Coll w Car	No Roll	Front	3	13.9
4	Coll w Car	No Roll	Front	4	27.0
5	Coll w Car	No Roll	Side C	1	3.1
6	Coll w Car	No Roll	Side C	2	9.1
7	Coll w Car	No Roll	Side C	3	14.0
8	Coll w Car	No Roll	Side C	4	27.1
9	Coll w Car	No Roll	Side E	1	1.7
10	Coll w Car	No Roll	Side E	2	5.2
11	Coll w Car	No Roll	Side E	3	8.2
12	Coll w Car	No Roll	Side E	4	16.9
13	Coll w Car	No Roll	Top	1	1.3
14	Coll w Car	No Roll	Top	2	3.8
15	Coll w Car	No Roll	Top	3	6.1
16	Coll w Car	No Roll	Top	4	12.9
17	Coll w Car	No Roll	Zear	1	1.0
18	Coll w Car	No Roll	Zear	2	3.0
19	Coll w Car	No Roll	Zear	3	4.8
20	Coll w Car	No Roll	Zear	4	10.3
21	Coll w Car	Rollover	Front	1	3.7
22	Coll w Car	Rollover	Front	2	10.7
23	Coll w Car	Rollover	Front	3	16.3
24	Coll w Car	Rollover	Front	4	30.8
25	Coll w Car	Rollover	Side C	1	3.7
26	Coll w Car	Rollover	Side C	2	10.7
27	Coll w Car	Rollover	Side C	3	16.4
28	Coll w Car	Rollover	Side C	4	30.9
29	Coll w Car	Rollover	Side E	1	2.1
30	Coll w Car	Rollover	Side E	2	6.2
31	Coll w Car	Rollover	Side E	3	9.7
32	Coll w Car	Rollover	Side E	4	19.6
33	Coll w Car	Rollover	Top	1	1.5
34	Coll w Car	Rollover	Top	2	4.6
35	Coll w Car	Rollover	Top	3	7.3
36	Coll w Car	Rollover	Top	4	15.2
37	Coll w Car	Rollover	Zear	1	1.2
38	Coll w Car	Rollover	Zear	2	3.6
39	Coll w Car	Rollover	Zear	3	5.7
40	Coll w Car	Rollover	Zear	4	12.2
41	Other Coll	No Roll	Front	1	4.3
42	Other Coll	No Roll	Front	2	12.1
43	Other Coll	No Roll	Front	3	18.4

44	Other Coll	No Roll	Front	4	33.9
45	Other Coll	No Roll	Side C	1	4.3
46	Other Coll	No Roll	Side C	2	12.2
47	Other Coll	No Roll	Side C	3	18.5
48	Other Coll	No Roll	Side C	4	34.1
49	Other Coll	No Roll	Side E	1	2.4
50	Other Coll	No Roll	Side E	2	7.1
51	Other Coll	No Roll	Side E	3	11.0
52	Other Coll	No Roll	Side E	4	22.0
53	Other Coll	No Roll	Top	1	1.8
54	Other Coll	No Roll	Top	2	5.3
55	Other Coll	No Roll	Top	3	8.3
56	Other Coll	No Roll	Top	4	17.1
57	Other Coll	No Roll	Zear	1	1.4
58	Other Coll	No Roll	Zear	2	4.1
59	Other Coll	No Roll	Zear	3	6.6
60	Other Coll	No Roll	Zear	4	13.8
61	Other Coll	Rollover	Front	1	5.1
62	Other Coll	Rollover	Front	2	14.2
63	Other Coll	Rollover	Front	3	21.3
64	Other Coll	Rollover	Front	4	38.2
65	Other Coll	Rollover	Side C	1	5.1
66	Other Coll	Rollover	Side C	2	14.3
67	Other Coll	Rollover	Side C	3	21.4
68	Other Coll	Rollover	Side C	4	38.4
69	Other Coll	Rollover	Side E	1	2.9
70	Other Coll	Rollover	Side E	2	8.4
71	Other Coll	Rollover	Side E	3	13.0
72	Other Coll	Rollover	Side E	4	25.4
73	Other Coll	Rollover	Top	1	2.1
74	Other Coll	Rollover	Top	2	6.3
75	Other Coll	Rollover	Top	3	9.8
76	Other Coll	Rollover	Top	4	19.9
77	Other Coll	Rollover	Zear	1	1.6
78	Other Coll	Rollover	Zear	2	4.9
79	Other Coll	Rollover	Zear	3	7.8
80	Other Coll	Rollover	Zear	4	16.1

Numerical Applications of the Algorithm
for Occupants with Compelling Injury

OBS	LINTEGR	INTRUS	SEATDIS	RIMDEFRM	FIREOCC	P
1	No	No	No	No	No	5.1
2	No	No	No	No	Yes	17.8
3	No	No	No	Yes	No	8.0
4	No	No	No	Yes	Yes	26.1
5	No	No	Yes	No	No	8.1
6	No	No	Yes	No	Yes	26.4
7	No	No	Yes	Yes	No	12.6
8	No	No	Yes	Yes	Yes	36.9
9	No	Yes	No	No	No	9.2
10	No	Yes	No	No	Yes	29.2
11	No	Yes	No	Yes	No	14.2
12	No	Yes	No	Yes	Yes	40.2
13	No	Yes	Yes	No	No	14.4
14	No	Yes	Yes	No	Yes	40.5
15	No	Yes	Yes	Yes	No	21.5
16	No	Yes	Yes	Yes	Yes	52.7
17	Yes	No	No	No	No	10.5
18	Yes	No	No	No	Yes	32.2
19	Yes	No	No	Yes	No	16.0
20	Yes	No	No	Yes	Yes	43.6
21	Yes	No	Yes	No	No	16.2
22	Yes	No	Yes	No	Yes	44.0
23	Yes	No	Yes	Yes	No	24.0
24	Yes	No	Yes	Yes	Yes	56.1
25	Yes	Yes	No	No	No	18.2
26	Yes	Yes	No	No	Yes	47.4
27	Yes	Yes	No	Yes	No	26.6
28	Yes	Yes	No	Yes	Yes	59.5
29	Yes	Yes	Yes	No	No	26.9
30	Yes	Yes	Yes	No	Yes	59.8
31	Yes	Yes	Yes	Yes	No	37.5
32	Yes	Yes	Yes	Yes	Yes	70.9

Numerical Applications of the Algorithm
for Occupants with Compelling Injury

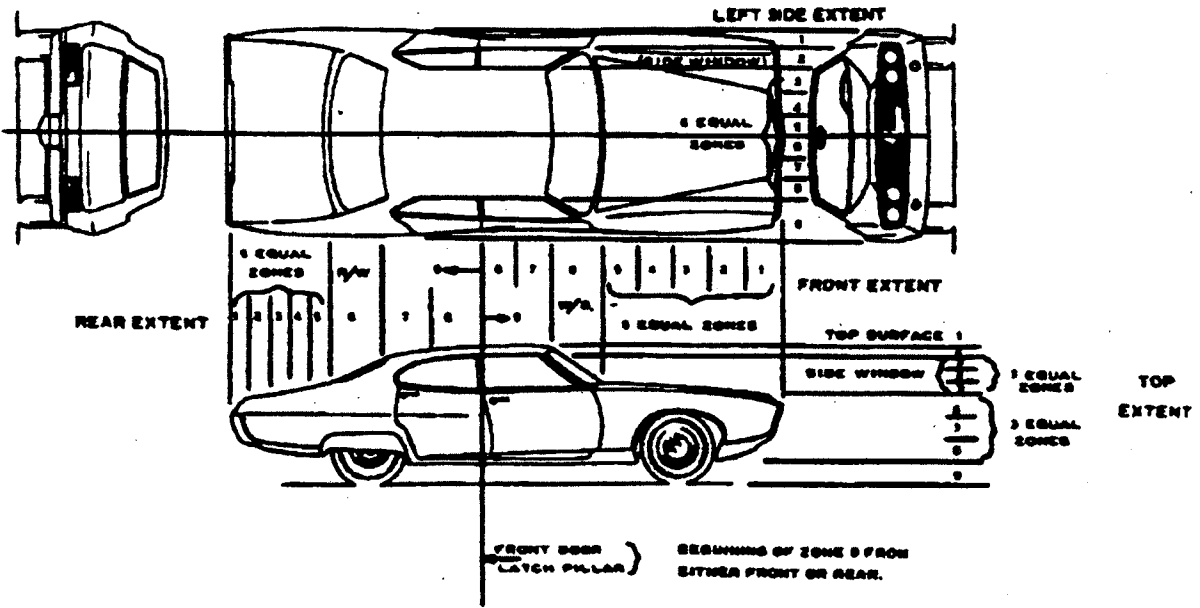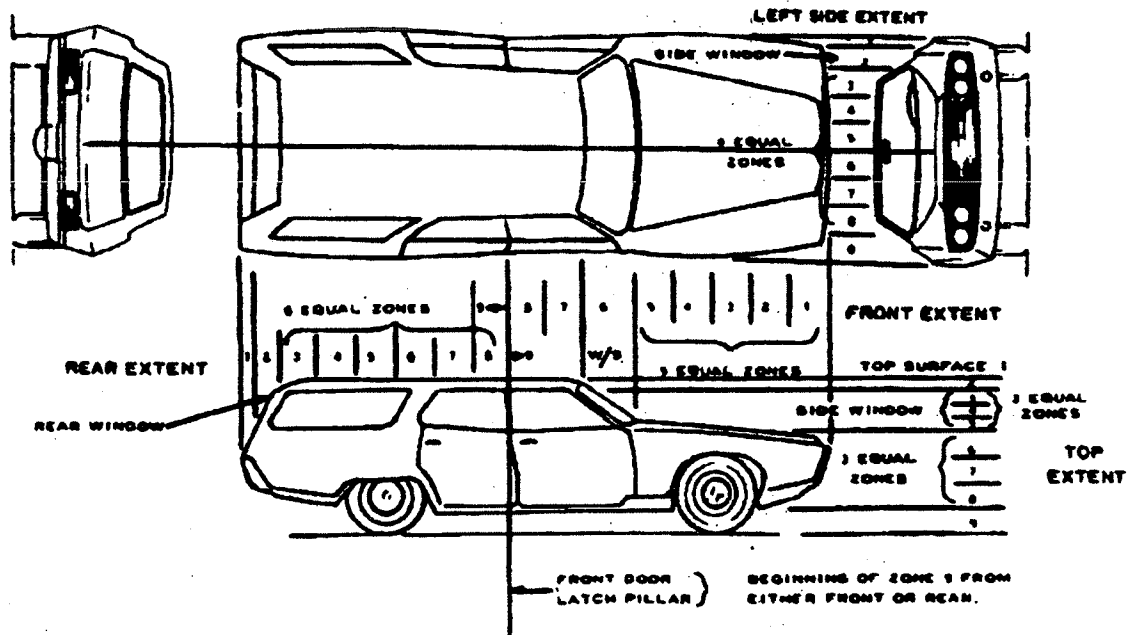| OBS	SEAT	PROT	OTHROCC	AGE	P
1	Fr Seat	Bag & Belt	No	25	4.8
2	Fr Seat	Bag & Belt	No	50	9.6
3	Fr Seat	Bag & Belt	No	75	18.1
4	Fr Seat	Bag & Belt	Yes	25	31.5
5	Fr Seat	Bag & Belt	Yes	50	49.0
6	Fr Seat	Bag & Belt	Yes	75	66.8
7	Fr Seat	Belt	No	25	5.1
8	Fr Seat	Belt	No	50	10.2
9	Fr Seat	Belt	No	75	19.1
10	Fr Seat	Belt	Yes	25	33.0
11	Fr Seat	Belt	Yes	50	50.7
12	Fr Seat	Belt	Yes	75	68.3
13	Fr Seat	None	No	25	9.8
14	Fr Seat	None	No	50	18.6
15	Fr Seat	None	No	75	32.3
16	Fr Seat	None	Yes	25	49.8
17	Fr Seat	None	Yes	50	67.5
18	Fr Seat	None	Yes	75	81.3
19	Rr Seat	Bag & Belt	No	25	3.6
20	Rr Seat	Bag & Belt	No	50	7.2
21	Rr Seat	Bag & Belt	No	75	14.0
22	Rr Seat	Bag & Belt	Yes	25	25.3
23	Rr Seat	Bag & Belt	Yes	50	41.4
24	Rr Seat	Bag & Belt	Yes	75	59.6
25	Rr Seat	Belt	No	25	3.8
26	Rr Seat	Belt	No	50	7.7
27	Rr Seat	Belt	No	75	14.8
28	Rr Seat	Belt	Yes	25	26.6
29	Rr Seat	Belt	Yes	50	43.1
30	Rr Seat	Belt	Yes	75	61.3
31	Rr Seat	None	No	25	7.4
32	Rr Seat	None	No	50	14.4
33	Rr Seat	None	No	75	26.0
34	Rr Seat	None	Yes	25	42.2
35	Rr Seat	None	Yes	50	60.4
36	Rr Seat	None	Yes	75	76.1

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

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