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Effect of Vehicle Weight on Crash-Level Driver Injury Rates

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Summary

This report describes the association between vehicle curb weight and driver injury in light vehicle towaway crashes and uses the results to estimate the effect of changes in vehicle weight on annual occupant (driver and passenger) injuries. The results suggest that there would have been 1,823 more moderate and more severe injuries among occupants of light vehicles towed from a crash in 1993 if every passenger car had been one hundred pounds lighter and if there were no changes in the weights of light trucks. This estimate includes the effects of passenger car weight reductions on injuries to both passenger car occupants and occupants of light trucks involved in crashes with passenger cars.

There would have been an estimated 601 fewer moderate injuries among occupants of light vehicles in 1993 if every light truck had been one hundred pounds lighter and if there were no changes in the weights of passenger cars. This estimate includes the effects of light truck weight reductions on injuries to both occupants of light trucks and passenger car occupants involved in crashes with light trucks.

These two results suggest that overall injury risk (in the fleet as a whole) would increase if cars were lighter but would decrease if light trucks were lighter. This is consistent with an analysis of the association between driver injury risk and the weights of the two cars in car-to-car collisions. The analysis indicates that driver injury risk for the car-to-car crash as a whole is inversely related to the weight of the lighter car and directly related to the weight of the heavier car.

Data

The analysis described here is based on drivers of light passenger vehicles (passenger cars and light trucks) in cases investigated by the National Accident Sampling System (NASS) during the 12 years from 1981 to 1993; there was no NASS estimation file for 1987. Drivers were categorized in terms of injury outcome (fatality or survivor) and injury severity (using the Abbreviated Injury Scale -- AIS). There were 71,799 crashes that involved either a towed car or a towed light truck that collided with a car, and 13,783 of the drivers of the towed vehicles in these crashes were moderately injured (AIS 2 or greater, or fatality).

There were also 19,329 crashes that involved either a towed light truck or a towed car that collided with a light truck, and 4,193 of the drivers of the towed light vehicles in these crashes were moderately injured.

Method

Light passenger vehicles were classified as either passenger cars or light trucks (a category that includes utility vehicles, passenger vans, and pickup trucks) using the NASS body type variable. Vehicle impact type was defined by the object that produced the most-severe damage to the vehicle. Four impact types were considered, to produce separate crash-level estimates of the effect of vehicle weight changes on driver injury risk in crashes with:

objects,
large trucks,
passenger cars, and
light trucks.

Analysis of light vehicle collisions with objects was limited to towed light vehicles that did not experience a "primary rollover," which was defined as a rollover with primary damage attributed to either overturn, ground contact, or an impact with a ditch, culvert, or curb; rolled vehicles whose primary contact was unknown were also excluded from the analysis. Analysis of light vehicle collisions with large trucks was limited to towed light vehicles with primary damage caused by contact with a truck with a gross vehicle weight rating of at least 10,000 pounds. For simplicity, analysis of collisions between two light vehicles was limited to the first-two listed vehicles in the crash; further, the primary damage to each must have been caused by contact with the other, and at least one of the two vehicles must have been towed.

In addition, overall assessments were done for the following two damage situations, to produce summary estimates of the overall effects of vehicle weight changes on light vehicle driver safety:

all towed cars except those in primary rollovers, plus all towed light trucks whose primary damage was caused by contact with a car; and

all towed light trucks except those in primary rollovers, plus all towed cars whose primary damage was caused by contact with a light truck.

There is some overlap between these two damage situations (specifically, towed light vehicles whose primary damage was caused by contact with another light vehicle are included in each group), but that should not cause a problem in the analysis described here because the two groups were used for separate purposes (to evaluate the effects of changes in passenger car and light truck weights, respectively).

The NASS data are stored as Statistical Analysis System (SAS) files, and SAS was used to create the tables included here. The tables show the number of investigated cases, the national estimates produced by statistically weighting the data (using the national inflation factors), and the moderate injury rate. NASS is a statistical sample, and estimates derived from NASS contain both sampling and nonsampling errors. Some idea of the reliability of the estimates is suggested by the number of investigated cases on which each estimate is based, with estimates based on only a few cases being particularly susceptible to sampling error.

Single-Vehicle Crashes

The 12 years of NASS data used here include 18,338 towed light vehicles whose most severe impact was a collision with an object (excluding primary rollover crashes), and 5,048 of the drivers in these crashes were at least moderately injured. There are 36 data points that represent at least 30 investigated cases within a 100-pound range of the passenger car curb weight (Table 1). For example, cars that weighed between 1,950 and 2,049 pounds were grouped, and the 100-pound weight class was assigned the value of "20 hundred pounds" in the linear models of weight and driver injury. A simple regression line fit through these 36 data points has an R-squared of 0.41 for the equation:

$$\text{Moderate Injury Rate} = 18.45512 - 0.20617 * \text{Hundred pounds of car weight.}$$

The modeled moderate injury rate for a 3000-pound car was 12.270 percent; the modeled moderate injury rate for a 2900-pound car (which represents a loss of 100 pounds of car weight) is 12.476 percent. That is, the modeled injury rate is 1.7 percent higher after this 100-pound car weight loss. The results of this and other models are included in Summary Table 1.

There are 24 data points that represent at least 30 investigated cases within a 100-pound range of the light truck curb weight (Table 2). A simple regression line fit through the 24 data points has an R-squared of 0.14 for the equation:

Moderate Injury Rate = 18.51464
- 0.20611 * Hundred pounds of truck weight.

The modeled moderate injury rate for a 3600-pound truck was 11.095 percent; the modeled moderate injury rate for a 3500-pound truck (which represents a loss of 100 pounds of truck weight) is 11.301. That is, the modeled injury rate is 1.9 percent higher after this 100-pound light truck weight loss.

The results for cars and light trucks are similar, and both suggest that vehicle weight has some protective effect in single-vehicle crashes.

Crashes with Heavy Trucks

The data include 2,756 towed light vehicles whose most severe impact was a collision with a heavy truck, and 888 of the drivers of the light vehicles in these crashes were at least moderately injured. There are seven data points that represent at least 30 investigated cases within a 500-pound range of the car curb weight (Table 3). For example, cars that weighed between 1,950 and 2,449 pounds were grouped, and the 500-pound weight class was assigned the value of "22 hundred pounds" in the linear models of weight and driver injury. A simple regression line fit through these seven data points has an R-squared of 0.17, but the uncertainty in the coefficient of the car weight variable means that the effect of car weight on the injury rate in these crashes cannot be distinguished statistically from zero.

There are only four data points that represent at least 30 investigated cases within a 500-pound range of the light truck curb weight (Table 4). A simple regression line fit through the four data points has an R-squared of 0.55. However, the large standard error of the coefficient of the light truck weight variable means that the effect of light truck weight in these crashes cannot be distinguished statistically from zero.

The results do not suggest a protective effect of light vehicle weight in collisions with heavy trucks for either cars or light trucks. This may reflect either the overwhelming weight of the heavy truck or the small number of investigated cases available for this analysis.

Car-to-Car Crashes

The data include 10,201 towaway crashes involving two passenger cars with reported curb weights. In the first analysis of these data reported here, the injury rates (expressed as the number of driver injuries per hundred two-car crashes) were estimated within 500-pound weight ranges for the lighter and for the heavier car (Table 5). A simple regression line fit through the 29 data points that represent at least 30 investigated cases has an R-squared of 0.32 and the equation:

Moderate Injury Rate = 26.30383
- 0.50408 * Hundred pounds of lighter car
+ 0.20541 * Hundred pounds of heavier car.

The probability of a greater value of T-statistic for the coefficients of the two car weight variables (under the hypothesis that car weight is not associated with driver injury rates) was 0.0018 for the lighter car weight and 0.1078 for the heavier car weight, which are small enough that the model results should be useful for describing the association between vehicle weight and driver injury.

Estimates from this model are that the driver injury rate for the crash as a whole (the average number of injured drivers per crash) decreases by 0.50 injuries per hundred crashes for each 100-pound increase in the weight of the lighter car, while it increases by 0.21 injuries per hundred crashes for each 100-pound increase in the weight of the heavier car. This suggests that large differences in the weights of the two cars are associated with more injuries (in the crash as a whole) than are small weight differences. The model estimates 17.34 driver injuries per hundred crashes involving two 3000-pound cars and 17.64 driver injuries per hundred crashes involving two 2900-pound cars. This is a 1.7 percent increase in the driver injury rate associated with a 100-pound weight reduction for both cars involved.

Next, the data for the same two-car crashes were used with the weights expressed as the difference between the heavier and the lighter car, to the nearest 100 pounds (Table 6). The fitted line through the 27 data points that are based on at least 30 investigated cases has an R-squared of 0.18 and the equation:

Moderate Injury Rate = 18.13194
+ 0.27707 * Difference, hundreds of pounds.

The probability of a greater T-value for the coefficient of the variable for the difference between the two car weights is 0.0268. The estimate from this model is that the driver injury rate for the crash as a whole (the average number of injured drivers per crash) increases by 0.28 injuries per hundred crashes for each 100-pound increase in the difference between the weights of the two cars. This is consistent with the results of the previous model in suggesting that large weight differences are associated with more injuries (in the crash as a whole) than are small weight differences.

Finally, the data for the same two-car crashes were used with the weights expressed as the sum of the heavier and the lighter car weights, to the nearest 500 pounds (Table 7). The line fitted through the 12 data points that are based on a least 30 investigated cases has an R-squared of 0.45 and the equation:

Moderate Injury Rate = 31.08956
- 0.19438 * Sum, hundreds of pounds.

This model suggests that there are an estimated 19.427 driver moderate injuries per hundred crashes involving two 3000-pound cars, which means that 9.714 percent of the involved drivers were injured. In contrast, there are an estimated 19.816 driver moderate injuries per hundred crashes involving two 2900-pound cars, which is 9.908 percent of the involved drivers. This is an increase in the injury rate of 2.0 percent for this drop of 100 pounds in each car, which is consistent with the 1.7 percent increase estimated from the model of driver injury as a function of the lighter and heavier car weights.

LTV-to-LTV Crashes

There were 552 towaway crashes involving two light trucks (LTVs) with reported curb weights in the NASS data used, but none of the models tested here produced a statistically significant result for the light truck curb weight variable. The injury rates (expressed as driver injuries per hundred crashes) was first estimated within 500-pound weight ranges for the lighter and for the heavier light truck (Table 8). A simple regression line fit

through the seven data points that represent at least 30 investigated cases has an R-squared of 0.30, but the probability of a greater value of the T-value was 0.2593 and 0.4371 for the variables expressing the weights of the lighter and the heavier light trucks, respectively. The resulting estimates of the association between light truck weight and driver injury cannot be distinguished statistically from zero.

Next, the data for the LTV-LTV crashes were used with the weights expressed as the difference between the heavier and the lighter light truck, to the nearest 500 pounds (Table 9). The fitted line through the four data points that are based on at least 30 investigated cases has an R-squared of 0.18, and the probability of a greater T-value for the coefficient of the variable for the difference between the two light truck weights is 0.5794, which does not suggest an association between light truck weight differences and driver injury.

Finally, the data for the LTV-LTV crashes were used with the weights expressed as the sum of the heavier and the lighter car weights, to the nearest 500 pounds (Table 10). The fitted line through the seven data points that are based on a least 30 investigated cases has an R-squared of 0.25, and the probability of a greater T-value for the coefficient of the variable for the sum of the two light truck weights is 0.2547, which does not suggest an association between the sum of the light truck weights and driver injury.

The lack of statistically-significant results for crashes involving two light trucks may mean either that light truck weight has no more than a small effect on safety in these crashes or that the small number of investigated cases of this type were inadequate for detecting the weight effect.

Car-to-LTV Crashes

There were 4,193 towaway crashes involving a car and a light truck for which the curb weights for both vehicles were reported. The crash-level driver injury rates in towaway crashes involving a car and a light truck were expressed in two ways -- as a function of the car weight (without regard to the light truck weight) and as a function of the light truck weight (without regard to the car weight). The line fit through the eight data points that describe driver injury as a function of the car weight are based on at least 30 investigated cases (Table 11) has an R-squared of 0.37 and the equation:

Moderate Injury Rate = 30.58467
- 0.21221 * Hundred pounds of car weight.

This model suggests that the number of driver moderate injuries per hundred crashes involving a 3000-pound car and a light truck is 24.218 and that decreasing the car weight by 100 pounds would increase the driver injury rate to 24.430 -- by 0.8 percent.

The line fit through the seven data points for injuries as a function of light truck weight and based on at least 30 investigated cases (Table 12) has an R-squared of 0.73 and the equation:

Moderate Injury Rate = 1.83201
+ 0.65323 * Hundred pounds of truck weight.

This model suggests that the number of driver moderate injuries per hundred crashes involving a 3600-pound light truck and a passenger car is 25.348 and that decreasing the light truck weight by 100 pounds would decrease the driver injury rate to 24.695 -- by 2.6 percent.

Together, the two results suggest that increasing the weight of the car or decreasing the weight of the light truck would decrease the overall injury rate in crashes between a car and a light truck. Since the light truck tends to be the heavier vehicle in these collisions, this is consistent with the results for car-to-car collisions (which indicate that smaller differences

between the two car weights is associated with lower injury risk for the crash as a whole).

All Car Drivers plus Light Truck Drivers in Crashes with Cars

The NASS data include 71,799 drivers who fit one of the following two criteria: each was driving either a car towed from any type of crash (except a primary rollover) or a light truck towed after involvement with a car. The injury rates for these drivers were summarized as a function of the passenger car weight, in 100-pound ranges (Table 13 and Figure 1). The line fit through the 37 data points based on at least 100 investigated cases has an R-squared of 0.44 and the equation:

Moderate Injury Rate = 12.90165
- 0.14074 * Hundred pounds of car weight.

This model suggests that the driver injury rate in these crashes increases by 1.6 percent when the car weight changes from 3000 to 2900 pounds (from 8.679 to 8.820 injuries per 100 drivers).

Light Truck Drivers plus Car Drivers in Crashes with Light Trucks

The NASS data used here include 19,329 drivers in the combination of towed light trucks in all types of crashes (except primary rollovers) plus towed cars involved with light trucks. The injury rates for these drivers were summarized as a function of the light truck weight, in 100-pound ranges (Table 14 and Figure 2). The line fit through the 26 data points based on at least 100 investigated cases has an R-squared of 0.17 and the equation:

Moderate Injury Rate = 4.87235
+ 0.12601 * Hundred pounds of truck weight.

This model suggests that the driver injury rate decreases by 1.3 percent when the light truck weight changes from 3600 to 3500 pounds (from 9.409 to 9.283 injuries per 100 drivers).

Net Injury Effect of Car Weight Reductions

The statistical models of car weight and injury can be used to estimate the effect on all light vehicles of a 100-pound fleet-wide passenger car weight reduction -- that is, the effect on the occupants of cars and other light vehicles with which they become involved. Summary Table 2 shows the estimated number of moderate injuries in all light vehicles in towaway crashes involving cars in 1993, based on the weighted NASS data for all occupants (both drivers and passengers). Applying the overall effect (an estimated 1.6 percent increase in moderate injuries for a 100-pound reduction in car weight) suggests that there would have been 1,823 more moderate injuries in 1993 if cars had been 100 pounds lighter and other vehicle weights had been unchanged. The estimated injury increase reflects the additional risk to car occupants riding in lighter cars (the lower crashworthiness of lighter cars), offset somewhat by the benefits to other occupants involved with lighter cars (the lower aggressivity of lighter cars towards other light vehicles).

The standard error of the coefficient of the car weight variable produced by the model was used to estimate a 95 percent confidence interval for the injury change. For example, the car weight coefficient (-0.1407) minus twice its standard error (0.0541) suggests -0.1948 as the lower-bound

value for the slope. The intercept corresponding to this slope was estimated using a Statistical Analysis System (SAS) regression procedure (PROC REG) to force the coefficient of the car weight variable to this value (by specifying "RESTRICT CURBWGT = -0.1948"). The result is a line with a slope of -0.1948 and an intercept of 14.7389. This line was used to estimate upper-bound moderate injury rates for cars weighing 2900 and 3000 pounds (rates of 9.0897 and 8.8949, respectively). This is 2.2 percent more injuries with a 100-pound car weight reduction, or 2,462 more injuries in 1993. These and other calculations are summarized in Table 15, and they suggest a range of 1,152 to 2,462 more injuries with a 100-pound reduction in average car weight. This is a large confidence interval, but it supports the direction of the effect suggested by the model (an increase in net injuries with a decrease in car weight).

Applying the statistically-significant results from Summary Table 1 to the estimated numbers of moderate injuries in 1993 produces estimates of the effect of a 100-pound weight reduction for specific crash types. This weight reduction would produce estimated increases of:

1,062 injuries in vehicle-to-object crashes,
531 injuries in car-to-car crashes, and
187 injuries in car-to-LTV crashes.

The combined effect is an estimated 1,780 increase in the number of moderate injuries in these crashes. This is close to the overall estimate (a 1,823 increase), and the differences may be caused by the uncertainty in the various estimates.

Net Injury Effect of Light Truck Weight Reductions

Summary Table 2 also shows the estimated number of moderate injuries in all light vehicles in towaway crashes involving light trucks in 1993. Applying the overall effect (an estimated 1.3 percent decrease in moderate injuries for a 100-pound reduction in light truck weight) suggests that there would have been 601 fewer moderate injuries in 1993 if light trucks had been 100 pounds lighter and other vehicle weights had been unchanged. The estimated injury decrease reflects the benefits to occupants involved with light trucks that weigh 100 pounds less than they did in 1993, offset somewhat by the additional risk to the occupants of the affected light trucks.

Table 16 summarizes the results of using the standard error of the coefficient of the light truck weight variable to bound this injury estimate, using the procedure described for car crashes. The calculations suggest a range of 49 to 1,160 fewer fatalities with a 100-pound reduction in average light truck weight. This confidence interval supports the direction of the effect suggested by the model (a reduction in net injuries with a decrease in light truck weight).

Applying the statistically-significant results from Summary Table 1 to the estimated numbers of moderate injuries in 1993 produces estimates of the effect of a 100-pound weight reduction for specific crash types. This weight reduction would produce an estimated:

376 more injuries in vehicle-to-object crashes and
550 fewer injuries in LTV-to-car crashes.

The combined effect is an estimated 174 decrease in the number of moderate injuries in these crashes. This is not particularly close to the overall estimate (a 601 decrease), but the difference is probably explained by the uncertainty in estimates made from relatively small numbers of investigated light trucks. The two methods do agree on the direction of the injury change that would result from reduced light truck weights.

Summary Table 1: Linear Models of Moderate Injury as a Function of Light Vehicle Weight

CARS crashed with:	NASS Cases: Crash Level	Pound Range in Cell	Minimum Cases in Cell	Number of Cells in Model	Fit of a Simple Linear Model R-sq	Pr>T	Intercept	Wt Coeff	Injury Rate At 3000 Pounds	Injury Rate At 2900 Pounds	Effect of 100 Pound Car Weight Reduction	Are R-sq>0.25 and Pr<0.15?
Object	15,367	100	30	36	0.41	0.0001	18.45512	-0.20617	12.270	12.476	1.7%	yes
Big truck	2,290	500	30	7	0.17	0.3645	12.06824	0.11518	15.524	15.408	-0.7%	no
Another car	10,201	500	30	12	0.45	0.0162	31.08956	-0.19438	19.427	19.816	2.0%	yes
LTV	4,193	500	30	8	0.37	0.1113	30.58467	-0.21221	24.218	24.430	0.9%	yes
TOTAL CRASHES (excluding primary rollovers)	71,799	100	100	37	0.44	0.0001	12.90165	-0.14074	8.679	8.820	1.6%	yes

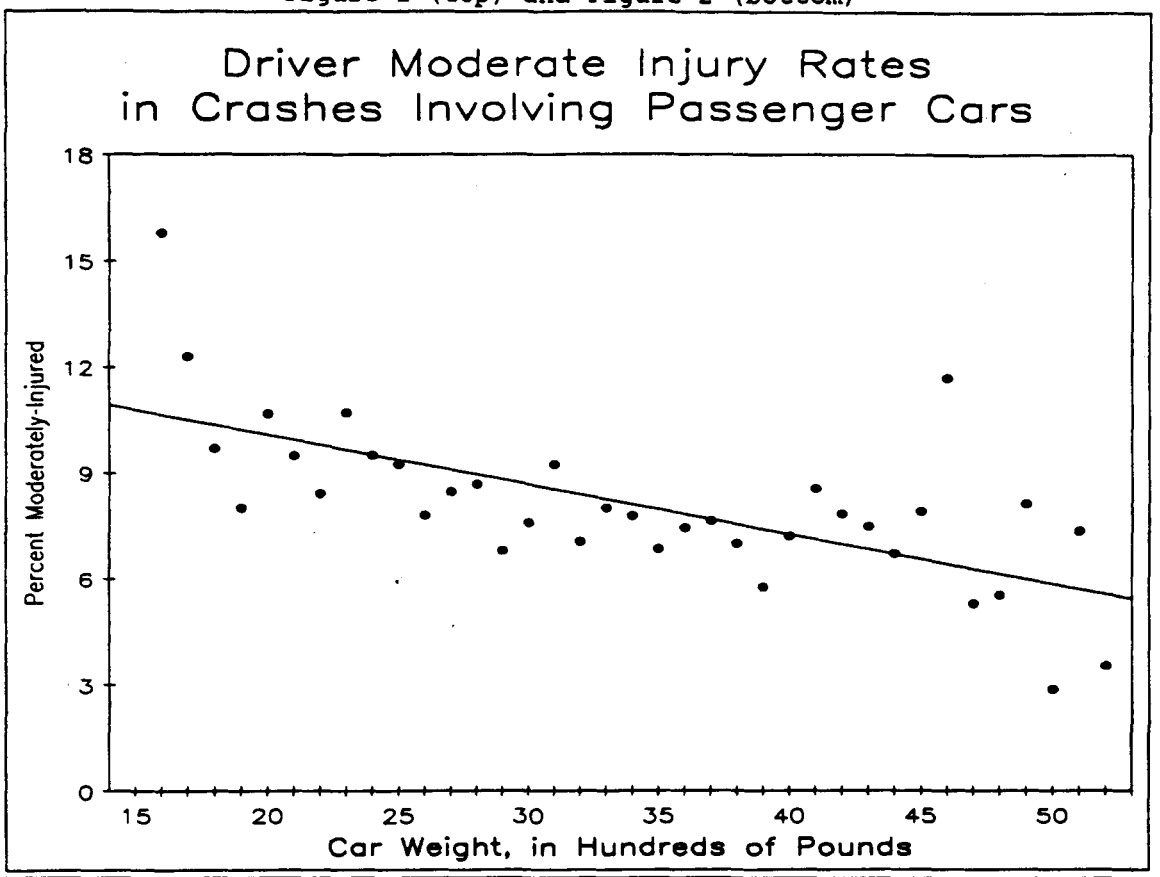
LTVS crashed with:	NASS Cases: Crash Level	Pound Range in Cell	Minimum Cases in Cell	Number of Cells in Model	Fit of a Simple Linear Model R-sq	Pr>T	Intercept	Wt Coeff	Injury Rate At 3600 Pounds	Injury Rate At 3500 Pounds	Effect of 100 Pound LTV Weight Reduction	Are R-sq>0.10 and Pr<0.15?
Object	2,971	100	30	24	0.14	0.0750	18.51464	-0.20611	11.095	11.301	1.9%	yes
Big truck	466	500	30	4	0.55	0.2565	39.50358	-0.59394	18.122	18.716	3.3%	no
Another LTV	552	500	30	7	0.25	0.2547	10.37200	0.24008	27.658	27.177	-1.7%	no
Car	4,193	500	30	7	0.73	0.0150	1.83201	0.65323	25.348	24.695	-2.6%	yes
TOTAL CRASHES (excluding primary rollovers)	19,329	100	100	26	0.17	0.0392	4.87235	0.12601	9.409	9.283	-1.3%	yes

Summary Table 2: Effect of a 100-Pound Weight Reduction
on the Number of Light Vehicle Occupant Moderate Injuries in 1993

Moderate Injuries in Crashes in 1993	1993 NASS Cases	1993 NASS Estimate	Effect of 100 Pound Weight Reduction	Net Change	Sum of Net Changes
Car, single-vehicle					
Primary rollover	119	13,557			
Object	586	63,215	1.7%	1,062	
Unknown	17				
Car, multi-vehicle					
Big truck	18	1,338	ns	ns	
Another car	280	26,521	2.0%	531	
LTV	228	21,356	0.9%	187	1,780
Other	3	339			
TOTAL IN CAR CRASHES (excluding primary rollovers and car-with-other)	1,251	112,430	1.6%	1,823	
LTV, single-vehicle					
Primary rollover	102	17,975			
Object	132	20,259	1.9%	376	376
Unknown	17				
LTV, multi-vehicle					
Big truck	12	1,002	ns	ns	
Another LTV	40	2,275	ns	ns	
Car	228	21,356	-2.6%	-550	-174
Other	1	68			
TOTAL IN LTV CRASHES (excluding primary rollovers and LTV-with-other)	532	44,892	-1.3%	-601	

("ns" means not statistically significant)

Figure 1 (top) and Figure 2 (bottom)



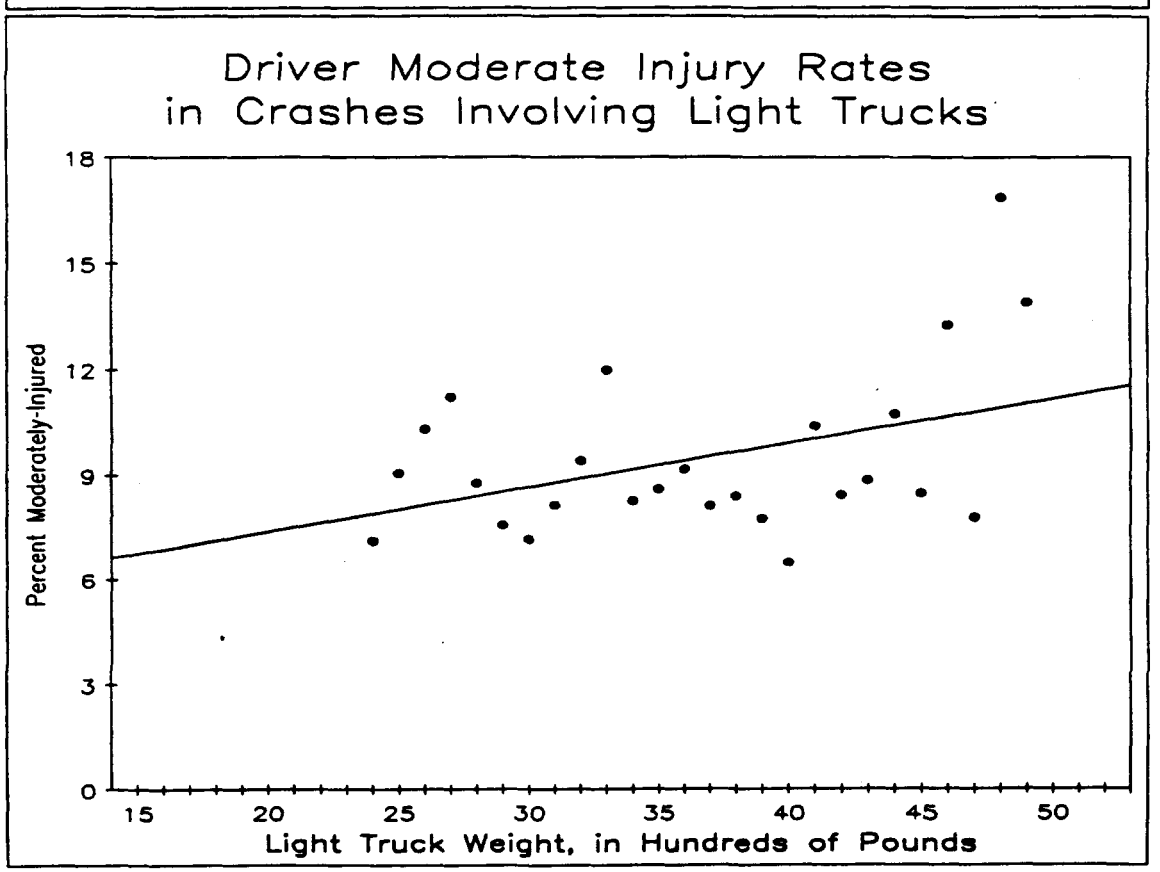


Table 1: Driver Injury Rates in Single-Vehicle Crashes
1981-1993 NASS Towed Passenger Cars, Excluding those with Primary Rollover

Hundred Pounds	Investigated NASS Cases				Twelve-Year National Estimates				Injury Rates		
	Total	AIS>=2	AIS>=3	Fatal	Total	AIS>=2	AIS>=3	Fatal	AIS>=2	AIS>=3	Fatal
Total	15,367	4,155	2,025	754	5,417,092	649,071	219,365	52,844	11.98	4.05	0.98
14	2	2	2	2	250	250	250	250	100.00	100.00	100.00
15	6	3	1	0	1,248	281	12	0	22.52	0.99	0.00
16	28	13	7	2	8,202	1,226	812	200	14.95	9.90	2.44
17	84	28	14	6	23,521	4,443	1,808	338	18.89	7.69	1.44
18	266	80	41	16	88,399	12,180	4,507	1,126	13.78	5.10	1.27
19	343	93	50	14	112,229	12,360	4,236	1,227	11.01	3.77	1.09
20	598	175	77	22	213,548	31,148	10,273	885	14.59	4.81	0.41
21	698	202	98	38	250,102	35,248	10,590	2,837	14.09	4.23	1.13
22	860	265	131	46	301,768	37,419	11,529	3,428	12.40	3.82	1.14
23	604	196	91	37	201,508	31,242	9,131	2,264	15.50	4.53	1.12
24	693	240	112	32	236,549	40,074	9,060	2,676	16.94	3.83	1.13
25	764	213	100	31	271,299	33,030	10,167	1,606	12.17	3.75	0.59
26	767	229	115	43	267,531	30,140	10,560	2,519	11.27	3.95	0.94
27	608	201	106	36	213,612	32,634	10,282	2,053	15.28	4.81	0.96
28	652	206	94	34	228,013	36,096	16,190	3,973	15.83	7.10	1.74
29	515	145	65	23	178,946	20,802	6,304	1,331	11.62	3.52	0.74
30	567	138	72	25	211,773	17,560	8,160	1,690	8.29	3.85	0.80
31	671	188	86	44	244,967	25,034	7,481	1,687	10.22	3.05	0.69
32	853	239	119	45	308,385	36,032	13,274	3,168	11.68	4.30	1.03
33	830	203	101	49	311,723	33,489	10,183	3,181	10.74	3.27	1.02
34	526	110	53	21	190,863	20,772	7,452	1,544	10.88	3.90	0.81
35	610	148	79	28	232,485	23,179	8,822	1,841	9.97	3.79	0.79
36	467	112	55	25	148,662	14,622	5,203	2,056	9.84	3.50	1.38
37	462	126	63	25	162,791	20,019	6,246	1,713	12.30	3.84	1.05
38	505	119	59	23	157,160	16,035	6,662	2,618	10.20	4.24	1.67
39	321	63	34	15	95,659	9,200	3,763	917	9.62	3.93	0.96
40	484	107	54	21	167,694	18,448	5,777	1,093	11.00	3.44	0.65
41	281	42	19	6	99,173	11,012	1,831	348	11.10	1.85	0.35
42	244	50	24	9	86,605	6,754	2,581	439	7.80	2.98	0.51
43	331	77	37	11	119,620	12,616	5,714	1,304	10.55	4.78	1.09
44	174	34	18	8	60,331	6,895	2,437	583	11.43	4.04	0.97
45	166	33	13	6	55,834	5,667	2,417	857	10.15	4.33	1.53
46	53	12	6	1	24,808	3,429	1,703	38	13.82	6.86	0.15
47	55	10	6	2	22,936	1,503	671	157	6.55	2.92	0.68
48	99	22	8	1	36,654	3,467	1,277	15	9.46	3.48	0.04
49	50	14	6	2	17,618	1,782	857	133	10.11	4.86	0.75
50	40	4	1	0	15,344	409	78	0	2.67	0.51	0.00
51	39	8	4	2	12,424	1,772	331	45	14.26	2.67	0.36
52	34	3	3	3	30,894	706	706	706	2.29	2.29	2.29
53	11	0	0	0	5,118	0	0	0	0.00	0.00	0.00
54	6	2	1	0	847	94	29	0	11.06	3.43	0.00

Table 2: Driver Injury Rates in Single-Vehicle Crashes
1981-1993 NASS Towed Light Trucks and Vans, Excluding those with Primary Rollover

Hundred Pounds	Investigated NASS Cases				Twelve-Year National Estimates				Injury Rates		
	Total	AIS>=2	AIS>=3	Fatal	Total	AIS>=2	AIS>=3	Fatal	AIS>=2	AIS>=3	Fatal
Total	2,971	893	461	158	1,111,896	125,893	48,217	11,417	11.32	4.34	1.03
19	1	0	0	0	1,130	0	0	0	0.00	0.00	0.00
20	4	1	0	0	626	19	0	0	2.98	0.00	0.00
21	12	3	1	0	1,378	187	49	0	13.55	3.58	0.00
22	7	2	2	1	2,366	224	224	7	9.48	9.48	0.29
23	15	2	1	1	3,951	204	108	108	5.16	2.74	2.74
24	72	19	8	4	28,634	4,259	711	254	14.88	2.48	0.89
25	114	38	21	4	34,318	4,100	1,952	498	11.95	5.69	1.45
26	199	72	37	6	73,176	11,465	5,140	476	15.67	7.02	0.65
27	144	53	29	6	42,242	7,964	3,242	222	18.85	7.67	0.52
28	103	39	19	7	53,623	4,267	1,441	517	7.96	2.69	0.96
29	100	32	16	7	27,455	2,523	1,013	361	9.19	3.69	1.32
30	74	28	8	3	21,064	2,852	594	173	13.54	2.82	0.82
31	76	29	16	5	53,907	4,287	712	165	7.95	1.32	0.31
32	115	31	13	3	36,130	3,511	1,286	94	9.72	3.56	0.26
33	85	23	10	3	26,041	3,350	964	239	12.87	3.70	0.92
34	97	22	12	6	35,349	2,593	1,200	540	7.34	3.39	1.53
35	169	52	29	11	70,206	8,322	3,829	640	11.85	5.45	0.91
36	216	61	32	12	69,407	8,876	3,218	600	12.79	4.64	0.86
37	208	67	32	11	63,451	10,872	3,351	1,136	17.14	5.28	1.79
38	206	56	31	13	74,544	10,771	3,823	1,113	14.45	5.13	1.49
39	201	64	35	14	67,419	8,488	4,115	1,019	12.59	6.10	1.51
40	133	33	21	8	78,814	4,618	2,446	400	5.86	3.10	0.51
41	142	36	23	11	57,662	4,216	1,731	504	7.31	3.00	0.87
42	113	33	16	6	46,061	4,532	803	206	9.84	1.74	0.45
43	78	23	13	2	41,770	3,126	1,883	192	7.48	4.51	0.46
44	85	24	10	6	33,662	3,346	1,141	633	9.94	3.39	1.88
45	44	12	6	1	11,227	1,667	546	13	14.85	4.86	0.12
46	39	12	7	2	12,964	1,662	1,200	696	12.82	9.26	5.37
47	39	5	2	0	20,179	390	226	0	1.93	1.12	0.00
48	18	5	3	3	4,743	733	170	170	15.45	3.59	3.59
49	12	3	2	0	4,097	555	110	0	13.55	2.69	0.00
50	11	3	1	0	3,956	200	45	0	5.06	1.13	0.00
51	7	1	0	0	2,314	102	0	0	4.43	0.00	0.00
52	4	1	0	0	954	99	0	0	10.38	0.00	0.00
53	4	1	0	0	952	208	0	0	21.87	0.00	0.00
54	5	1	1	0	649	197	197	0	30.28	30.28	0.00
55	2	1	0	0	1,283	321	0	0	25.02	0.00	0.00
56	2	2	2	0	309	309	309	0	100.00	100.00	0.00
58	3	1	0	0	1,371	38	0	0	2.79	0.00	0.00
60	4	0	0	0	646	0	0	0	0.00	0.00	0.00
61	3	0	0	0	188	0	0	0	0.00	0.00	0.00
63	1	0	0	0	1,056	0	0	0	0.00	0.00	0.00
64	1	0	0	0	155	0	0	0	0.00	0.00	0.00
66	1	0	0	0	27	0	0	0	0.00	0.00	0.00
73	1	1	1	1	433	433	433	433	100.00	100.00	100.00
86	1	1	1	1	8	8	8	8	100.00	100.00	100.00

Table 3: Driver Injury Rates in Crashes into Heavy Trucks
1981-1993 NASS Towed Passenger Cars

Hundred Pounds	Investigated NASS Cases				Twelve-Year National Estimates				Injury Rates		
	Total	AIS>=2	AIS>=3	Fatal	Total	AIS>=2	AIS>=3	Fatal	AIS>=2	AIS>=3	Fatal
Total	2,290	704	441	257	606,881	99,611	48,221	18,417	16.41	7.95	3.03
17	126	37	28	18	29,019	3,141	1,981	800	10.82	6.83	2.76
22	521	188	116	70	170,084	29,787	12,854	4,317	17.51	7.56	2.54
27	492	148	90	53	129,032	18,328	8,977	4,038	14.20	6.96	3.13
32	440	153	106	60	105,227	21,510	10,536	3,695	20.44	10.01	3.51
37	362	93	52	26	89,884	13,001	6,037	2,004	14.46	6.72	2.23
42	249	55	33	19	59,231	9,156	5,208	1,821	15.46	8.79	3.07
47	85	24	13	9	22,082	3,867	2,327	1,516	17.51	10.54	6.87
52	15	6	3	2	2,323	820	302	226	35.30	12.98	9.72

Table 4: Driver Injury Rates in Crashes into Heavy Trucks
1981-1993 NASS Towed Light Trucks and Vans

Hundred Pounds	Investigated NASS Cases				Twelve-Year National Estimates				Injury Rates		
	Total	AIS>=2	AIS>=3	Fatal	Total	AIS>=2	AIS>=3	Fatal	AIS>=2	AIS>=3	Fatal
Total	466	184	122	63	140,539	30,621	13,136	3,922	21.79	9.35	2.79
22	21	11	7	6	3,151	2,323	371	223	73.72	11.79	7.08
27	75	36	26	11	32,179	8,549	3,634	770	26.57	11.29	2.39
32	85	37	23	18	27,620	4,305	1,687	969	15.59	6.11	3.51
37	154	53	37	15	38,533	6,955	4,747	1,185	18.05	12.32	3.08
42	91	36	24	10	27,352	4,335	2,447	715	15.85	8.95	2.61
47	27	8	3	3	9,676	3,959	59	59	40.92	0.61	0.61
52	7	2	1	0	1,442	123	119	0	8.53	8.25	0.00
57	1	1	1	0	72	72	72	0	100.00	100.00	0.00
62	3	0	0	0	215	0	0	0	0.00	0.00	0.00
67	1	0	0	0	130	0	0	0	0.00	0.00	0.00
87	1	0	0	0	170	0	0	0	0.00	0.00	0.00

Table 5: Driver Injury Rates in Two-Car Towaway Collisions
1981-1993 NASS Data

Car Weights in Hundreds of Pounds		NASS Cases		Twelve-Year NASS Estimates		
Lighter	Heavier	Total	AIS>=2	Total	AIS>=2	Rate
12	27	1	0	259	0	0.00
17	17	25	8	6,788	2,039	30.04
17	22	215	95	70,944	13,570	19.13
17	27	196	71	70,271	8,398	11.95
17	32	196	69	48,832	9,823	20.12
17	37	126	68	23,516	8,200	34.87
17	42	60	26	9,810	3,655	37.26
17	47	23	7	6,192	1,544	24.94
17	52	6	2	2,084	148	7.11
22	22	585	276	158,875	35,180	22.14
22	27	1,108	474	330,737	63,207	19.11
22	32	967	388	243,181	55,823	22.96
22	37	632	259	166,086	32,454	19.54
22	42	376	140	97,726	25,420	26.01
22	47	88	33	25,117	4,749	18.91
22	52	39	18	5,805	1,197	20.62
27	27	602	269	167,635	37,252	22.22
27	32	1,033	397	303,325	59,225	19.53
27	37	677	242	182,575	35,828	19.62
27	42	378	141	96,371	18,618	19.32
27	47	129	36	37,702	10,440	27.69
27	52	31	14	8,266	2,056	24.87
32	32	489	188	142,813	28,213	19.75
32	37	698	248	183,368	34,211	18.66
32	42	393	119	106,691	17,684	16.58
32	47	119	49	26,762	6,891	25.75
32	52	46	15	11,694	2,364	20.21
37	37	257	106	76,587	12,487	16.30
37	42	346	97	109,173	14,390	13.18
37	47	110	34	29,751	6,516	21.90
37	52	37	6	10,353	970	9.37
42	42	112	35	28,331	5,217	18.42
42	47	59	12	15,303	1,501	9.81
42	52	29	6	7,781	790	10.15
47	47	6	0	2,364	0	0.00
47	52	6	2	1,262	317	25.15
52	52	1	0	170	0	0.00

Table 6: Driver Injury Rates in Two-Car Towaway Collisions
1981-1993 NASS Data

Difference, Hundreds of Pounds	NASS Cases		Twelve-Year NASS Estimates		
	Total	AIS>=2	Total	AIS>=2	Rate
0	444	164	116,187	25,237	21.72
1	847	363	242,446	49,331	20.35
2	876	357	254,881	54,364	21.33
3	778	310	227,519	40,764	17.92
4	713	273	218,461	37,406	17.12
5	656	268	191,476	37,124	19.39
6	634	248	185,843	35,712	19.22
7	634	217	177,154	31,301	17.67
8	555	214	150,315	30,544	20.32
9	512	188	129,708	24,490	18.88
10	468	170	133,877	20,795	15.53
11	423	171	115,249	25,068	21.75
12	393	137	95,844	21,644	22.58
13	358	139	87,163	17,169	19.70
14	317	128	81,228	18,008	22.17
15	287	95	82,696	12,749	15.42
16	225	74	65,151	11,499	17.65
17	185	92	42,212	13,860	32.83
18	171	60	45,328	8,315	18.34
19	160	71	36,322	9,582	26.38
20	143	56	32,420	10,138	31.27
21	94	36	24,121	7,555	31.32
22	69	24	15,203	4,104	26.99
23	71	25	14,971	3,774	25.21
24	35	12	7,822	1,285	16.42
25	40	16	11,724	3,748	31.97
26	12	5	1,983	862	43.44
27	32	15	10,534	1,857	17.63
28	18	6	4,538	891	19.63
29	17	1	5,544	58	1.04
30	16	9	2,308	515	22.33
31	9	2	1,565	100	6.39
32	3	2	623	382	61.40
33	3	1	1,307	108	8.26
35	2	0	737	0	0.00
37	1	1	40	40	100.00

Table 7: Driver Injury Rates in Two-Car Towaway Collisions
1981-1993 NASS Data

Sum, Hundreds of Pounds	NASS Cases		Twelve-Year NASS Estimates		
	Total	AIS>=2	Total	AIS>=2	Rate
32	4	0	552	0	0.00
37	87	32	24,512	6,349	25.90
42	545	227	163,516	28,427	17.38
47	1,129	495	332,729	66,071	19.86
52	1,621	694	434,793	94,897	21.83
57	1,710	699	463,836	98,282	21.19
62	1,668	632	449,094	94,281	20.99
67	1,347	491	377,549	70,264	18.61
72	908	331	235,500	49,516	21.03
77	629	193	187,142	26,775	14.31
82	340	107	90,657	18,591	20.51
87	149	40	35,794	5,710	15.95
92	45	5	12,806	649	5.07
97	16	4	5,504	568	10.31
102	2	0	345	0	0.00
107	1	0	170	0	0.00

Table 8: Driver Injury Rates in Two-LTV Towaway Collisions
1981-1993 NASS Data

LTV Weights in Hundreds of Pounds		NASS Cases		Twelve-Year NASS Estimates		
Lighter	Heavier	Total	AIS>=2	Total	AIS>=2	Rate
17	27	1	0	1,310	0	0.00
17	37	1	1	33	33	100.00
22	22	1	0	400	0	0.00
22	27	8	3	2,239	633	28.30
22	32	9	2	1,866	36	1.95
22	37	15	9	4,561	919	20.15
22	42	7	1	2,276	281	12.36
22	47	2	0	317	0	0.00
22	57	1	1	484	484	100.00
27	27	30	20	7,400	2,667	36.05
27	32	47	24	7,692	2,233	29.03
27	37	77	39	15,866	2,681	16.90
27	42	28	21	4,223	1,265	29.96
27	47	10	5	2,307	964	41.77
27	52	5	3	1,100	353	32.10
27	97	1	0	230	0	0.00
32	32	14	7	3,496	1,042	29.82
32	37	68	32	24,778	3,909	15.78
32	42	35	18	9,145	2,431	26.58
32	47	10	5	1,964	680	34.59
32	52	5	2	463	41	8.82
32	62	1	0	157	0	0.00
32	67	1	0	17	0	0.00
37	37	50	23	15,453	4,737	30.66
37	42	51	29	15,469	7,173	46.37
37	47	15	4	4,306	383	8.88
37	52	3	1	768	80	10.36
37	62	2	1	634	232	36.64
42	42	28	16	3,613	818	22.64
42	47	16	7	4,465	251	5.63
42	52	5	0	1,172	0	0.00
42	62	1	1	77	77	100.00
47	47	2	0	441	0	0.00
47	52	1	0	57	0	0.00
87	92	1	0	218	0	0.00

Table 9: Driver Injury Rates in Two-LTV Towaway Collisions
1981-1993 NASS Data

Difference, Hundreds of Pounds	NASS Cases		Twelve-Year NASS Estimates		
	Total	AIS>=2	Total	AIS>=2	Rate
2	204	104	53,073	13,928	26.24
7	176	87	47,132	12,301	26.10
12	103	47	24,995	3,968	15.88
17	43	24	8,544	2,077	24.31
22	18	10	3,259	1,358	41.65
27	4	2	1,107	287	25.97
32	3	1	657	484	73.62
72	1	0	230	0	0.00

Table 10: Driver Injury Rates in Two-LTV Towaway Collisions
1981-1993 NASS Data

Sum, Hundreds of Pounds	NASS Cases		Twelve-Year NASS Estimates		
	Total	AIS>=2	Total	AIS>=2	Rate
47	4	1	1,943	105	5.40
52	30	16	7,435	2,074	27.90
57	48	27	11,715	2,969	25.34
62	96	48	19,930	4,355	21.85
67	91	53	19,324	3,831	19.83
72	101	46	31,142	8,355	26.83
77	73	38	19,887	5,442	27.36
82	67	32	17,854	6,444	36.09
87	20	10	4,846	408	8.41
92	15	2	3,687	112	3.05
97	3	1	306	232	75.94
102	2	1	478	77	16.00
122	1	0	230	0	0.00
182	1	0	218	0	0.00

Table 11: Driver Injury Rates in Car-LTV Towaway Collisions
1981-1993 NASS Data

Car Weight, Hundreds of Pounds	NASS Cases		Twelve-Year NASS Estimates		
	Total	AIS>=2	Total	AIS>=2	Rate
17	165	93	44,894	12,940	28.82
22	948	514	208,722	51,436	24.64
27	990	516	303,159	60,272	19.88
32	932	453	236,038	67,353	28.53
37	625	263	157,610	35,346	22.43
42	387	166	115,985	28,534	24.60
47	113	42	41,382	6,738	16.28
52	33	14	9,067	1,896	20.91

Table 12: Driver Injury Rates in Car-LTV Towaway Collisions
1981-1993 NASS Data

LTV Weight, Hundreds of Pounds	NASS Cases		Twelve-Year NASS Estimates		
	Total	AIS>=2	Total	AIS>=2	Rate
17	3	2	236	126	53.32
22	127	56	39,451	4,913	12.45
27	870	462	202,235	54,083	26.74
32	794	367	229,207	54,593	23.82
37	1,313	611	415,438	83,956	20.21
42	756	377	169,660	46,556	27.44
47	250	149	43,965	15,547	35.36
52	42	19	7,079	2,547	35.98
57	9	0	2,492	0	0.00
62	17	10	2,686	1,492	55.53
67	9	7	1,055	429	40.69
77	1	1	275	275	100.00
82	1	0	72	0	0.00
102	1	0	3,008	0	0.00

Table 13: Driver Injury Rates in 1981-1993 NASS Towed Vehicles -- for Car Drivers and for LTV Drivers involved with Cars, Considering the Effect of the Car Curb Weight (100-Pound Groups)

Car Weight, Hundreds of Pounds	NASS Cases		Twelve-Year NASS Estimates		
	Total	AIS>=2	Total	AIS>=2	Rate
Total	71,799	13,783	24,695,502	2,050,260	8.30
11	1	0	146	0	0.00
12	1	0	259	0	0.00
13	1	0	477	0	0.00
14	3	2	1,039	250	24.06
15	50	10	12,684	1,324	10.44
16	146	36	52,622	8,317	15.80
17	407	108	122,290	15,045	12.30
18	1,228	286	394,303	38,244	9.70
19	1,720	361	677,262	54,271	8.01
20	2,869	614	951,625	101,672	10.68
21	3,325	745	1,192,597	113,187	9.49
22	4,382	971	1,517,439	127,656	8.41
23	3,118	703	1,036,413	111,061	10.72
24	3,703	866	1,290,611	122,773	9.51
25	4,189	863	1,436,457	132,889	9.25
26	3,753	779	1,334,048	104,134	7.81
27	3,021	649	1,077,817	91,283	8.47
28	3,319	660	1,162,603	100,913	8.68
29	2,426	489	917,973	62,456	6.80
30	2,542	459	874,499	66,372	7.59
31	3,000	587	1,064,527	98,364	9.24
32	3,887	727	1,435,120	101,340	7.06
33	3,860	673	1,290,009	103,328	8.01
34	2,087	341	729,244	56,786	7.79
35	2,583	420	914,550	62,631	6.85
36	2,046	350	644,276	47,998	7.45
37	2,194	383	708,825	54,223	7.65
38	2,088	324	668,366	46,840	7.01
39	1,446	202	454,951	26,268	5.77
40	1,998	299	635,990	45,923	7.22
41	1,207	173	376,489	32,214	8.56
42	934	143	314,933	24,734	7.85
43	1,256	171	412,915	30,943	7.49
44	734	90	232,873	15,650	6.72
45	671	97	220,923	17,506	7.92
46	235	34	70,676	8,263	11.69
47	212	24	67,950	3,611	5.31
48	427	52	136,865	7,602	5.55
49	196	33	64,705	5,268	8.14
50	142	15	69,920	2,005	2.87
51	160	21	46,677	3,439	7.37
52	129	8	54,609	1,933	3.54
53	68	8	19,031	1,061	5.58
54	30	7	7,009	481	6.87
55	1	0	55	0	0.00
58	1	0	712	0	0.00
59	2	0	97	0	0.00
82	1	0	43	0	0.00

Table 14: Driver Injury Rates in 1981-1993 NASS Towed Vehicles -- for Car Drivers and for LTV Drivers involved with Cars, Considering the Effect of the Car Curb Weight (100-Pound Groups)

LTV Weight, Hundreds of Pounds	NASS Cases		Twelve-Year NASS Estimates		
	Total	AIS>=2	Total	AIS>=2	Rate
Total	19,329	4,198	6,720,275	594,317	8.84
16	1	1	31	31	100.00
17	10	3	2,036	159	7.81
18	2	0	337	0	0.00
19	3	0	2,423	0	0.00
20	32	4	10,504	672	6.39
21	94	25	41,484	3,449	8.31
22	75	16	26,445	2,003	7.57
23	84	15	23,158	735	3.17
24	410	79	153,438	10,941	7.13
25	728	171	236,455	21,411	9.06
26	,179	284	400,008	41,256	10.31
27	932	239	316,408	35,493	11.22
28	612	152	208,268	18,263	8.77
29	624	157	249,351	18,903	7.58
30	592	137	205,511	14,745	7.17
31	557	139	241,298	19,646	8.14
32	960	200	328,914	30,964	9.41
33	687	139	238,164	28,532	11.98
34	694	138	233,541	19,281	8.26
35	1,018	196	342,096	29,377	8.59
36	1,218	262	407,307	37,300	9.16
37	1,272	270	448,223	36,391	8.12
38	1,279	257	482,352	40,491	8.39
39	1,119	234	446,565	34,616	7.75
40	923	185	373,929	24,317	6.50
41	791	158	255,240	26,531	10.39
42	672	147	224,992	18,974	8.43
43	647	145	206,112	18,244	8.85
44	506	106	145,894	15,675	10.74
45	330	72	97,829	8,287	8.47
46	302	74	85,636	11,355	13.26
47	286	61	89,386	6,962	7.79
48	135	32	33,356	5,627	16.87
49	101	22	33,017	4,591	13.90
50	93	19	19,805	2,535	12.80
51	53	10	16,518	754	4.57
52	37	5	16,522	434	2.63
53	30	5	8,390	381	4.54
54	25	2	5,494	225	4.09
55	18	4	4,480	712	15.88
56	13	2	2,756	309	11.20
57	5	2	1,072	190	17.77
58	15	3	6,442	78	1.21
59	10	1	3,051	72	2.36
60	31	5	6,660	871	13.08
61	25	4	5,019	870	17.32
62	13	2	2,466	98	3.96
63	4	0	1,843	0	0.00
64	11	1	2,044	168	8.20
65	11	2	1,210	278	22.94
66	3	0	428	0	0.00
67	7	4	712	112	15.67
68	7	1	821	40	4.88
69	4	1	798	148	18.53

(continued)

Table 14 (continued): Driver Injury Rates in 1981-1993 NASS Towed Vehicles -- for Car Drivers and for LTV Drivers involved with Cars, Considering the Effect of the Car Curb Weight (100-Pound Groups)

LTV Weight, Hundreds of Pounds	NASS Cases		Twelve-Year NASS Estimates		
	Total	AIS>=2	Total	AIS>=2	Rate
70	3	0	635	0	0.00
71	2	0	9,395	0	0.00
73	3	1	737	433	58.74
74	2	0	291	0	0.00
75	2	0	272	0	0.00
76	2	1	550	275	50.00
78	1	0	691	0	0.00
80	1	0	166	0	0.00
81	2	0	143	0	0.00
86	4	1	1,220	8	0.62
87	1	0	218	0	0.00
88	1	1	15	15	100.00
89	2	0	376	0	0.00
90	1	0	678	0	0.00
92	2	1	108	91	84.10
93	1	0	218	0	0.00
95	2	0	492	0	0.00
96	1	0	230	0	0.00
99	1	0	895	0	0.00
100	3	0	6,087	0	0.00
115	1	0	326	0	0.00
120	1	0	295	0	0.00

Table 15: Confidence Ranges for Estimates of Car and Light Truck Injury Changes: Car Model Results Applied to 1993 NASS Injury Estimates

CAR MODEL RESULTS

Total AIS 2-6 injuries in car crashes (excluding primary rollovers)	112,430	NASS estimate for 1993
Intercept	12.9017	
Coefficient of weight variable	-0.1407	drivers injured per 100 involved (in cars and LTVs involved with cars) per 100 pounds of car weight
Standard error of coefficient	0.0270	
Two standard errors	0.0541	

RANGE OF ESTIMATES

LOWER ESTIMATE OF INJURIES		
Coefficient of weight variable	-0.0867	plus two standard errors
Corresponding intercept	11.0628	calculated by PROC REG Restriction
Injury rate at 3000 pounds	8.4624	percent injured
Injury rate at 2900 pounds	8.5491	percent injured
Effect of weight reduction	1.0%	more injuries
Effect of weight reduction	1,152	more injuries
BEST ESTIMATE OF INJURIES (CHECK)		
Coefficient of weight variable	-0.1407	best estimate
Corresponding intercept	12.9008	calculated by PROC REG Restriction
Injury rate at 3000 pounds	8.6786	percent injured
Injury rate at 2900 pounds	8.8194	percent injured
Effect of weight reduction	1.6%	more injuries
Effect of weight reduction	1,824	more injuries
BEST ESTIMATE OF INJURIES		
Coefficient of weight variable	-0.1407	best estimate
Corresponding intercept	12.9017	best estimate
Injury rate at 3000 pounds	8.6795	percent injured
Injury rate at 2900 pounds	8.8202	percent injured
Effect of weight reduction	1.6%	more injuries
Effect of weight reduction	1,823	more injuries
UPPER ESTIMATE OF INJURIES		
Coefficient of weight variable	-0.1948	minus two standard errors
Corresponding intercept	14.7389	calculated by PROC REG Restriction
Injury rate at 3000 pounds	8.8949	percent injured
Injury rate at 2900 pounds	9.0897	percent injured
Effect of weight reduction	2.2%	more injuries
Effect of weight reduction	2,462	more injuries

Table 16: Confidence Ranges for Estimates of Car and Light Truck Injury Changes: Light Truck Model Results Applied to 1993 NASS Injury Estimates

LIGHT TRUCK MODEL RESULTS		
Total AIS 2-6 injuries in LTV crashes (excluding primary rollovers)	44,892	NASS estimate for 1993
Intercept	4.8724	
Coefficient of weight variable	0.1260	drivers injured per 100 involved (in LTVs and cars involved with LTVs) per 100 pounds of LTV weight
Standard error of coefficient	0.0578	
Two standard errors	0.1156	
RANGE OF ESTIMATES		
LOWER ESTIMATE OF INJURIES		
Coefficient of weight variable	0.0104	minus two standard errors
Corresponding intercept	9.0897	calculated by PROC REG Restriction
Injury rate at 3600 pounds	9.4655	percent injured
Injury rate at 3500 pounds	9.4551	percent injured
Effect of weight reduction	0.1%	fewer injuries
Effect of weight reduction	49	fewer injuries
BEST ESTIMATE OF INJURIES (CHECK)		
Coefficient of weight variable	0.1260	best estimate
Corresponding intercept	4.8715	calculated by PROC REG Restriction
Injury rate at 3600 pounds	9.4078	percent injured
Injury rate at 3500 pounds	9.2818	percent injured
Effect of weight reduction	1.3%	fewer injuries
Effect of weight reduction	601	fewer injuries
BEST ESTIMATE OF INJURIES		
Coefficient of weight variable	0.1260	best estimate
Corresponding intercept	4.8724	best estimate
Injury rate at 3600 pounds	9.4086	percent injured
Injury rate at 3500 pounds	9.2826	percent injured
Effect of weight reduction	1.3%	fewer injuries
Effect of weight reduction	601	fewer injuries
UPPER ESTIMATE OF INJURIES		
Coefficient of weight variable	0.2416	plus two standard errors
Corresponding intercept	0.6533	calculated by PROC REG Restriction
Injury rate at 3600 pounds	9.3500	percent injured
Injury rate at 3500 pounds	9.1084	percent injured
Effect of weight reduction	2.6%	fewer injuries
Effect of weight reduction	1,160	fewer injuries