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PRELIMINARY REGULATORY IMPACT ANALYSIS

Effectiveness
IV-19
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REAR SEAT LAP SHOULDER BELTS IN PASSENGER VEHICLES UNDER 10,001 LBS. GVWR

OFFICE OF REGULATORY ANALYSIS
PLANS AND POLICY
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION

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SUMMARY

Following is a summary of the findings of this preliminary examination of rear seat lap shoulder belts:

- At current rear seat lap belt usage rates (9.5 percent for passenger cars, 6-18 percent for trucks and MPVs) rear seat lap/shoulder belts in passenger cars would prevent 10 fatalities and 330 moderate to critical injuries annually. In light trucks and multipurpose vehicles (MPVs), rear seat lap/shoulder belts could prevent 55 moderate to critical injuries.

- If current usage rates were to double, rear seat lap/shoulder belts in passenger cars could prevent 22 fatalities and 695 moderate to critical injuries annually. In light trucks and multipurpose vehicles, rear seat lap/shoulder belts could prevent 3 fatalities and 110 moderate to critical injuries annually.

- If 70 percent of all rear seat occupants wore their safety belts in passenger cars, lap/shoulder belts could prevent 76 fatalities and 2430 moderate to critical injuries annually. A 70 percent usage rate in light trucks and MPVs would prevent 8 fatalities and 280 moderate to critical injuries annually.

- For passenger cars, roughly 90 percent of all safety benefits occur from outboard seating positions. For light trucks and MPVs, roughly 70 percent of all safety benefits occur from outboard seating positions.

- About 90 percent of the potential rear seat safety benefits for light trucks and vans occurs from the second seat (the first rearward seat).

- Additional safety benefits may occur to front seat passengers through a reduction in force loading on front seats caused by rear seat passengers, or to rear seat passengers if lap/shoulder belts in themselves cause an increase in rear seat belt usage.

- Installing lap/shoulder belts in the rear outboard seats of passenger cars would increase per vehicle costs by $12. Installing lap/shoulder belts in the center seating position would increase costs by an additional $20.

- Component costs of outboard rear seat lap/shoulder belts in light trucks and multipurpose vehicles would range from $7-$33 depending on vehicle type. The total cost for all rear seating positions (including center seats) would range from $13-$190.

- Limiting the requirements for lap/shoulder belts to second seats only would reduce per vehicle costs of light trucks and MPVs to $7-$13 for outboard seats only and $13-$65 for all rear seating positions.

- The added weight from lap/shoulder belts will have a minor effect on lifetime fuel costs, increasing passenger car costs by $1-$4 and light trucks and multipurpose vehicle costs by $1-$12.

- Installing lap/shoulder belts in the rear outboard seats of passenger cars would result in total annual costs of $139 million. The inclusion of center seats as well could increase total costs by nearly 80 percent to $248 million.

- Installing lap/shoulder belts in all rear outboard seats of light trucks and MPV's would result in total annual costs of $21 million. The inclusion of center seats as well would increase total costs by over 200 percent to $63 million.

- Limiting the requirements for lap/shoulder belts to second seats only would reduce total annual costs for light trucks and MPVs to $16 million for outboard seats only and $56 million for all rear seating positions.

- Because of limited incidence of rear seat injury in buses, there is very little potential for safety improvement in these vehicles. Total annual costs for buses could range from $68,000 for second seat, outboard positions only installation to $804,000 for all rear seats, all positions.

I. INTRODUCTION & BACKGROUND

Federal Motor Vehicle Safety Standard (FMVSS) No. 208 currently requires that all passenger cars except convertibles come equipped with Type 2 safety belts (lap and shoulder belts) at all front seat outboard seating positions. For all other positions, Type 1 belts (lap belts only) are required but Type 2 belts may be installed at the manufacturers' discretion. This same requirement applies to the rear seats of trucks, school buses and multipurpose passenger vehicles with a gross vehicle weight rating (GVWR) of 10,000 lbs. or less. Non-school buses in this same category are not required to have rear seat lap belts but lap belts are currently supplied by all manufacturers.

When it was first issued in 1967, FMVSS No. 208 required only lap belts in all rear seating positions. At that time rear outboard seats were excluded from the Type 2 requirement because the reduction in the relatively small number of injuries that occurred in rear seats (over 90 percent of all occupant fatalities occur in the front seat) did not appear to justify the significant cost increase (essentially a doubling of the front seat only cost) that would have been incurred. Although Type 2 belts are not required in rear seats, FMVSS No. 210 requires that all passenger cars have anchorage points with sufficient reinforcement to enable the voluntary installation of a Type 2 belt by either the manufacturer or vehicle owner.

In 1982, Kathleen Weber and John Melvin petitioned the agency to amend FMVSS No. 208 to require the installation of Type 2 safety belts in the rear outboard seating positions in passenger cars. The basis for their petition was that the shoulder harness could be used to secure child restraint systems and children on booster seats and would provide additional protection for other rear seat occupants as well. NHTSA denied the petition in 1984 (49 FR 15241), citing the superiority of the harness system already available in child restraints and the potential for misuse of these systems with the shoulder harness. The agency did agree with the petitioners that Type 2 belts in rear seats might give some added degree of protection to adults. However, the agency believed that the additional cost ($20 for a non-detachable Type 2 belt with emergency locking retractor) could not be justified by the relatively minor benefits that would result due to the marginal increase in belt effectiveness or usage.

Over the last several years, there have been significant developments which argue for a reexamination of this issue. At present 24 states and the District of Columbia have enacted seat belt use laws (26 were originally enacted but 2 were rescinded in state-wide referendums; in addition, Virginia has passed, but not yet enacted a law). Although most of these laws apply only to front seat passengers, it is anticipated that the usage habits developed in response to state laws and increased public awareness of the importance of belt use will improve rear seat belt usage to some extent as well.

In August 1986, the agency granted a petition from the Los Angeles Area Child Passenger Safety Association requesting the agency to require the installation of rear seat lap/shoulder belts. The agency decided to grant the petition and re-examine whether to require the installation of rear seat lap/shoulder belts because of the widespread adoption of state safety belt use laws as a result of the Department's July 1984 decision on occupant crash protection (July 17, 1984, 49 FR 28962).

Recently the major domestic manufacturers (GM, Ford and Chrysler) have announced their intentions to voluntarily install rear seat outboard lap and shoulder belts on most or all of their vehicles over the next few years. Currently, at least thirteen foreign manufacturers (Audi, BMW, Honda, Jaguar, Mercedes, Mitsubishi, Nissan, Peugeot, Rolls Royce, SAAB, Volvo, VW, and Ford Merkur) are installing Type 2 safety belts in the rear seats of some of their passenger cars. Toyota, however, installed Type 2 belts in the 1981-82 Cressida but deleted them in 1983. Therefore, despite the encouraging trend towards voluntary installation, there is already a precedent for subsequent removal of these systems. A reexamination of the issue will therefore be made to determine whether a requirement for Type 2 belts in rear seats is warranted under current circumstances.

II. THE SAFETY NEED

The vast majority of occupant fatalities and injuries (over 90 percent) occur in the front seats of passenger vehicles. Although rear seats account for a small percentage of total injuries, in absolute terms they still represent a significant safety problem. Tables II-1, II-2 and II-3 list the 1985 fatality and injury experience in passenger cars, light trucks and MPV's and in buses for all age groups except children aged 0-4, most of whom would be placed in child restraints and who would not benefit from shoulder belts. Rear seat occupants accounted for nearly 1,700 fatalities and over 190,000 injuries in 1985. Roughly 99 percent of these fatalities and injuries occurred in second seats with the remainder occurring in vehicles with multiple rear seats such as vans or station wagons. Outboard seats accounted for roughly 85 percent of all fatalities and injuries with less than 15 percent occurring in center seating positions.

Historically, front and rear seat occupant fatalities have followed a roughly similar pattern, with fatalities rising in the late 1970's and then declining during the economic recession of the early 1980's. In 1984 with the economy picking up, driving increased and fatalities rose as well (see Figures II-1 and II-2). In 1985, front seat fatalities declined but rear seat fatalities continued to increase. This may have been partially due to safety belt use laws that became effective in several states in

1985. These laws typically applied to front seat passengers only. Surveys conducted by NHTSA indicate that belt use in the front seats of vehicles increased from 14.4 to 21.7 percent in 1985 while rear seat usage increased from 5.8 to 9.5 percent over the same period.

Rear seat fatalities and injuries are thus expected to continue to represent a significant and possibly increasing share of the overall occupant safety problem.

TABLE II-1

1985 REAR SEAT FATALITIES BY
VEHICLE TYPE AND SEAT LOCATION*
AGES 5 AND OVER

	Second Seat			Other Rear Seats			All Rear Seats		
	Outboard	Center	Total	Outboard	Center	Total	O	C	T
Passenger Cars	1315	207	1522	0	0	0	1315	207	1522
Pickups**	23	5	28	0	0	0	23	5	28
Vans***	21	31	52	1	1	2	22	32	54
Truck Based Station Wagons	6	0	6	0	0	0	6	0	6
On/Off Rd.****	62	15	77	0	0	0	62	15	[illegible]
Light Truck Total	112	51	163	1	1	2	113	52	165
Buses	0	0	0	0	0	0	0	0	0
TOTAL	1427	258	1685	1	1	2	1428	259	1687

* Unknowns distributed proportionally. "Other" seating positions (e.g., riding on someone's lap) ignored as not being eligible for benefit from belts.

** The portion of these pickup fatalities that fall under 10,001 lbs. GVW is unknown.

*** The distribution of fatalities in the second seat of vans was actually 38 in outboard seats and 14 in center seats. However, as discussed in Chapter V, most right rear seats in vans are considered to be center seats for purposes of safety belt requirements (due to the aisle on the right side of vans). The numbers listed in the above table conform to this definition. Vans with more than 10 person seating capacity are classified as buses for safety standard purposes. Data on the number of seating positions in vans is not available in the FARS data base. No rear seat fatalities were recorded in vans with more than 10 seats in the NASS file.

**** Some on/off road vehicles would be exempt by being either a convertible or open-body type vehicle.

SOURCE: Fatal Accident Reporting System (FARS)

TABLE II-2

1985 REAR SEAT AIS 2-5 INJURIES BY VEHICLE TYPE AND SEAT LOCATION* AGES 5 AND OVER

	Second Seat			Other Rear Seats			All Rear Seats		
	Outboard	Center	Total	Outboard	Center	Total	O	C	T
Passenger Cars	17772	2028	19800	0	0	0	17772	2028	19800
Pickups**	308	0	308	0	0	0	308	0	308
Vans***	310	394	704	92	118	210	402	512	914
Truck Based Station Wagons	0	0	0	0	0	0	0	0	0
On/Off Rd.****	976	29	1005	0	0	0	976	29	1005
Light Truck total	1594	423	2017	92	118	210	1686	541	2227
Buses*****	29	105	134	72	0	72	101	105	206
TOTAL	19395	2556	21951	164	118	282	19559	2674	22233

* Unknowns distributed proportionally. "Other" seating positions ignored as not being eligible for benefit from belts.

** The portion of these pickup injuries that fall under 10,001 lbs. GVWR is unknown.

*** The distribution of injuries in the second seat of vans was actually 694 in outboard seats and 10 in center seats. In third seats injuries were 181 in outboard seats and 29 in center seats. However, as discussed in Chapter V, the right rear seats in vans are considered to be center seats for purposes of safety belt requirements (due to the aisle on the right side of vans). The numbers listed in the above table conform to this definition. No AIS 2-5 injuries were recorded in vans with more than 10 person seating capacity (which would be classified as buses).

**** Some on/off road vehicles would be exempt by being either a convertible or open-body type vehicle.

***** The portion of these injuries sustained in buses under 10,001 lbs. GVWR is unknown. Injuries clearly coded as being sustained in vehicles >10,000 lbs. GVWR are excluded. No bus AIS 2-5 injuries were coded as being <10,000 lbs. GVWR. The injuries shown here were coded as unknown GVWR. Center seat numbers include all "other" designations in NASS.

SOURCE: National Accident Sampling System (NASS)

TABLE II-3

1985 REAR SEAT AIS 1 INJURIES BY
VEHICLE TYPE AND SEAT LOCATION*
AGES 5 AND OVER

	Second Seat			Other Rear Seats			All Rear Seats		
	Outboard	Center	Total	Outboard	Center	Total	O	C	T
Passenger Cars	136073	12290	148363	146	0	146	136219	12290	148509
Pickups**	23	0	23	0	0	0	23	0	23
Vans***	1506	2957	4463	549	1067	1616	2055	4024	6079
Truck Based Station Wagons	618	0	618	0	0	0	618	0	618
On/Off Rd.****	8550	230	8780	0	0	0	8550	230	8780
Light Truck Total	10697	3187	13884	549	1067	1616	11246	4254	15500
Buses*****	198	2845	3043	298	0	298	496	2845	3341
TOTAL	146968	18322	165290	993	1067	2060	147961	19389	167350

* Unknowns distributed proportionally. "Other" seating positions ignored as not being eligible for benefit from belts.

** The portion of these pickup injuries that fall under 10,000 lbs. GVWR is unknown.

*** The distribution of injuries in the second seat of vans was actually 3860 in outboard seats and 621 in center seats. In third seats AIS 1 injuries were 2072 in outboard seats and 1418 in center seats. However, as discussed in Chapter V, the right rear seats in vans are considered to be center seats for purposes of safety belt requirements (due to the aisle on the right side of vans). The numbers listed in the above table conform to this definition. Vans exceeding 10 person seating capacity are considered to be buses and are reflected in that category.

**** Some on/off road vehicles would be exempt by being either a convertible or open-body type vehicle.

***** The portion of these injuries sustained in buses under 10,001 lbs. GVWR is unknown. Center seat numbers include all "other" designations in NASS.

SOURCE: National Accident Sampling System (NASS)

FIGURE II-1

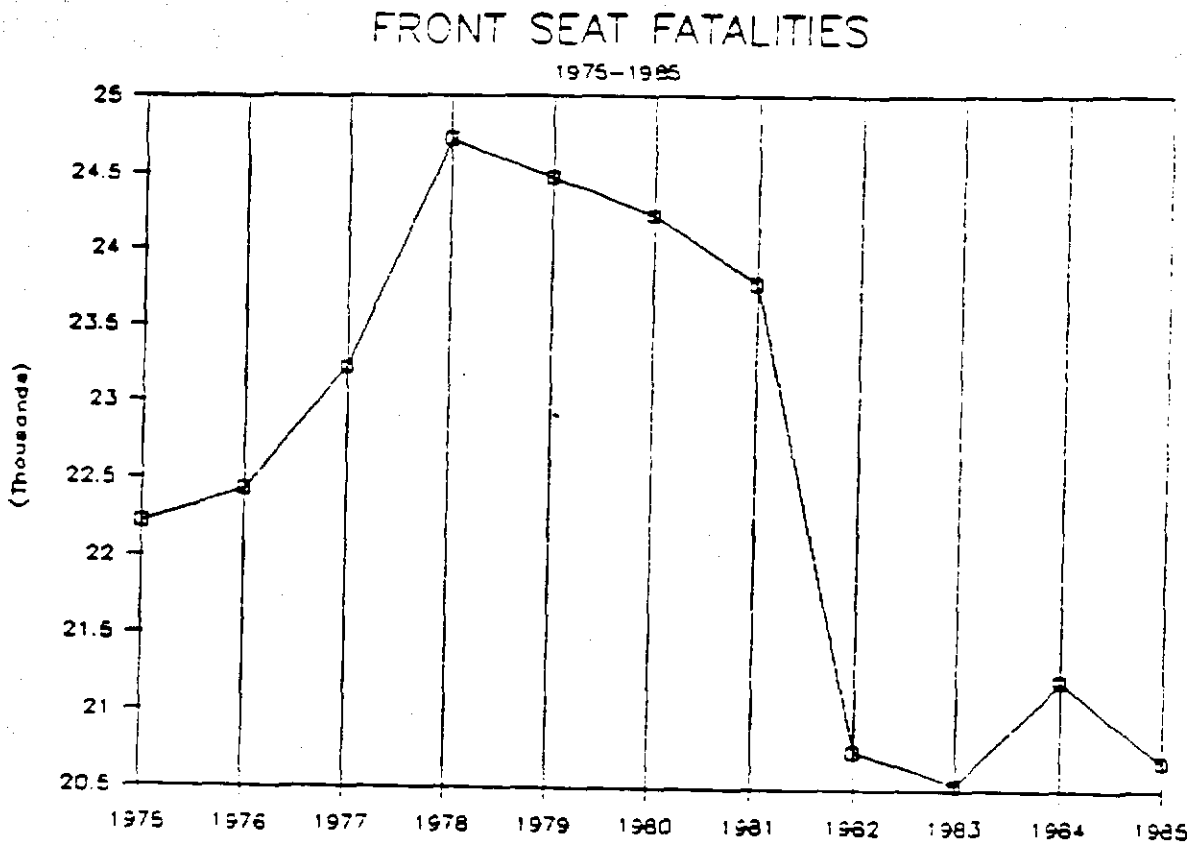
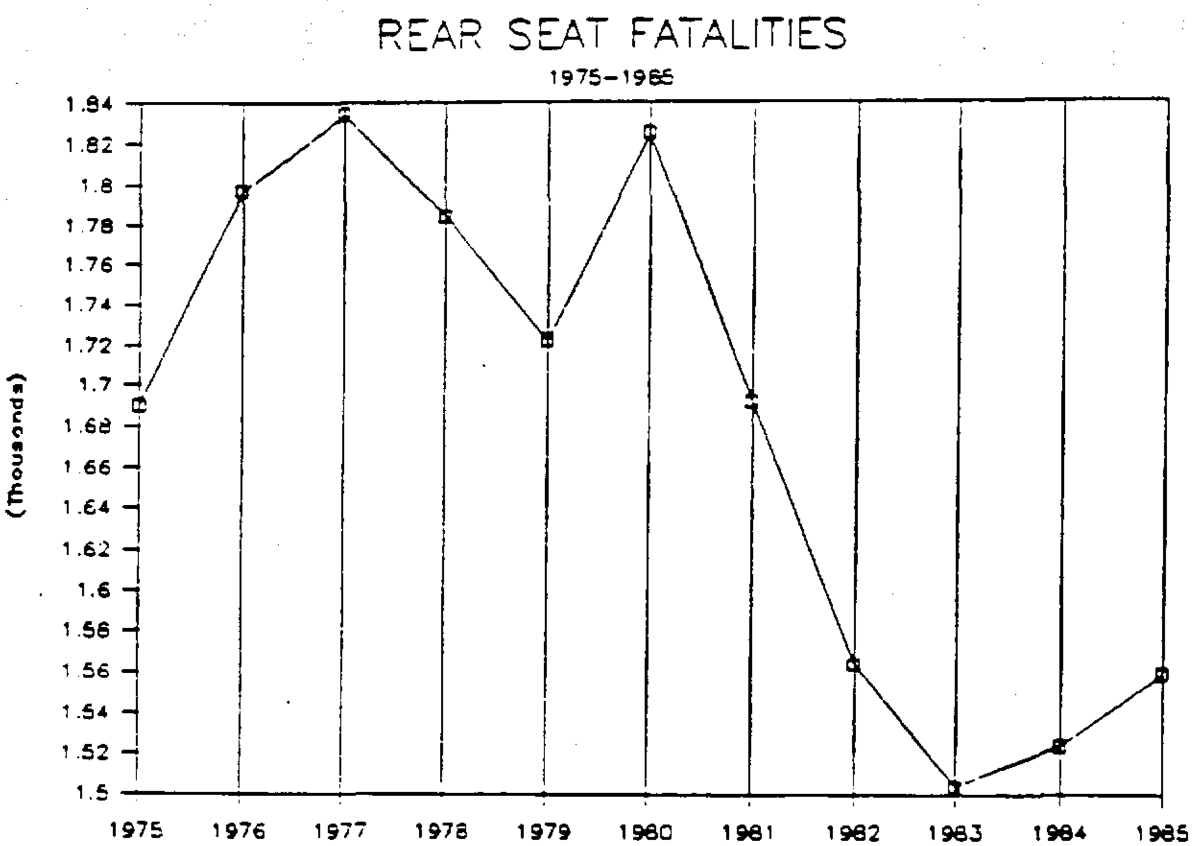

FRONT SEAT FATALITIES
1975–1985
(Thousands)
25
24.5
24
23.5
23
22.5
22
21.5
21
20.5
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985

FIGURE II-2


REAR SEAT FATALITIES
1975–1985
(Thousands)
1.84
1.82
1.8
1.78
1.76
1.74
1.72
1.7
1.68
1.66
1.64
1.62
1.6
1.58
1.56
1.54
1.52
1.5
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985

III. ALTERNATIVES

In addressing the issue of requiring lap and shoulder belts in the rear seat of passenger vehicles, a variety of alternative approaches are possible. Specifically, requiring Type 2 belts may be appropriate in certain types of vehicles but not others, and in certain, but not necessarily all seating positions. This analysis separately examines the costs and benefits associated with standards applicable to the following categories:

Vehicles:

Passenger Cars

Light Trucks and Multipurpose Vehicles

Buses under 10,001 lbs. GVWR

Seating Positions:

Second seat -- outboard seat only

Second seat -- all positions

All other rear seats

Each vehicle category will be examined for each set of possible seating position categories.

In addition, the analysis will consider whether it is appropriate to extend existing requirements for seat belt comfort and convenience and dynamic testing to any new rear seat belt requirements. A discussion of these issues will be presented separately in Section VI.

IV. Benefits

The benefits that can be derived from rear seat Type 2 safety belts are a function of both the level of protection that is provided by these systems or their effectiveness, and of the willingness of consumers to actually use the belts. In the following sections these variables will be estimated and combined with injury and fatality rates to provide an estimate of potential safety benefits for each alternative and vehicle type.

A. Effectiveness

The effectiveness of a safety belt system is defined as the percentage reduction in fatalities or injuries for restrained occupants compared to unrestrained occupants. In the Final Regulatory Impact Analysis (FRIA) amending FMVSS 208 to require automatic restraints,[1/] NHTSA provided an extensive analysis of the effectiveness of safety belts in front seating positions. Table IV-1 lists the results of this analysis.

TABLE IV-1

Percent Effectiveness of Front Seat Safety Belts

	Manual Lap Belt	Manual Lap/Shoulder Belt
Fatalities	30-40	40-50
AIS 2-5 injuries	25-35	45-55
AIS 1 injuries	10	10

These estimates were based on a combination of statistical analyses of real world accident experience and laboratory testing. Although they are judged to be fairly accurate estimates of belt effectiveness in front seats, they may not be applicable to similar systems in rear seats because front seating positions involve potential occupant collisions with different vehicle structures. Front seat occupants, for example, are more likely to impact the steering wheel, dashboard or windshield, while rear seat occupants are more likely to impact front seat backs. In addition, in a frontal collision, the distance to initial impact of front and rear passengers is likely to be different depending on the adjusted position of the front seat. In any given vehicle, these distances would be inverse i.e: the further back a front seat is pushed the closer the rear seat occupant is to the seat back and vice-versa. Overall, the effect of crash dynamics for rear seat occupants could differ significantly from front seat occupants.

There have been a number of attempts made to estimate the effectiveness of rear seat lap belts; NHTSA knows of no existing estimates of the effectiveness of rear seat lap-shoulder belts. This is probably due to the fact that they are currently found on only 1.5% of the existing passenger car fleet. Table IV-2 summarizes the existing analyses[2/] of rear seat lap belt effectiveness and their results. Where the estimates for fatalities and serious injuries noted in this table are identical, the specific study lumped both categories together and separate estimates are not available.

TABLE IV-2

ESTIMATES OF REAR SEAT LAP BELT EFFECTIVENESS

Author	Basis	Effectiveness: Fatality	Serious Injury	Minor or All Injury
National Ctr for Statistics and Analysis (NCSA), NHTSA	North Carolina Accident Data	41-49%*	41-49%*	17-18%*
NCSA, NHTSA	Maryland Accident Data	30-59%*	30-59%*	9-22%*
Transport Canada	Canadian Accident Data	41%	41%	-----
NCSA-NHTSA Partyka	NCSS & NASS Data	39%	57%	23%
NCSA-NHTSA Najjar	NCSS	59%	59%	-----
Campbell	North Carolina Accident Data	25-30%	50%	------
Evans-GM	FARS	18%	-----	-----
Kahane-NHTSA	FARS & Penn. Accident Data	17-26%	37%	11%

*Effectiveness rates for persons age 15 or greater

These results are also listed in Table IV-9. When all seats are considered, statistically significant results are found for pickups, vans, truck based station wagons and buses. When second seats only are considered, a statistically significant result is found for vans, truck based station wagons and buses only.

Noticeable discrepancies exist between relative estimates based on second seats and estimates based on all seats. A Z test was therefore run between seat locations as well. The result of these tests are shown in the last column of Table IV-9. The tests confirm that the large differences between all seat and second seat only usage estimates for passenger cars and buses are significant. The smaller differences found in other types of vehicles are not significant. The higher relative usage levels that result from second seat only data thus appear to be a valid function of the lower usage rates found in rear seats of passenger cars and buses while the validity of higher rear seat rates in other vehicles is uncertain.

A comparison between Tables IV-8 and IV-9 reveals a significant discrepancy between estimates of passenger car restraint use. The 19 city survey indicates a usage rate of 21.1 percent in 1985 for all seating positions and a rate of 9.5 percent for rear seat positions. The NASS accident files, on the other hand, indicate usage rates of 42 percent for all seats and 30 percent for rear seats.

TABLE IV-9
Restraint Usage of Occupants Aged 5 and Over
1985 NASS File

	All Seats			Second Seats			
	Usage	Usage Relative to P.C.	Z Test Relative to P.C.	Usage	Usage Relative to P.C.	Z Test Relative to P.C.	Z Test, Second Seat vs. Front Seats
Passenger Cars	41.7	1.0	-	29.6	1.0	-	3.59**
Pickups	27.7	.66	4.49*	ID	ID	ID	ID
Vans	51.2	1.23	-2.93*	55.1	1.86	-2.70*	-0.59
Truck Based Station Wagons	53.0	1.27	-3.45*	55.3	1.87	-2.84*	0.88
On/Off Rd. Vehicles	37.7	0.90	1.21	38.3	1.29	-0.84	-0.28
Buses	8.7	0.21	12.43*	6.2	0.21	3.00*	5.03**

ID = Insufficient data
* = Usage level is significantly different from that of passenger cars at .05 confidence level
** = Usage level is significantly different from that of front seats at .05 confidence level

It is likely that this discrepancy reflects an over-estimation of belt usage in NHTSA's accident files. Estimates of restraint usage in these files are derived from interviews with accident victims and police reports (which are often themselves based on occupant testimony). In recent years, with the passage of safety belt use laws in many states, NHTSA has been concerned that some unbelted occupants may claim to have been wearing a seat belt in order to avoid conflict with state laws. Similarily, false usage claims could be motivated by concerns about insurance coverage, contributory liability or negative social image. Preliminary results from an internal study by NHTSA's National Center for Statistics and Analysis (NCSA) indicate that usage estimates derived from 1985 NASS data are overstated by as much as 150 percent in areas where state belt use laws are in effect and 50 percent in areas with no laws. This phenomenon is confirmed by a Florida study[5/] of reported and observed seat belt use in which it was found that 41 percent of survey respondents claimed to wear seat belts regularly while only 22 percent usage was found in the observation survey. The results of a similar survey in Ohio[6/] found that adults claimed belt usage exceeded observed usage by roughly 100 percent.

Usage estimates from the 19 city survey, on the other hand, are based on observed usage rather than occupant testimony. They are therefore not subject to over-estimation due to false usage claims by vehicle occupants.

Estimates of belt usage in non-passenger cars are also available in observational surveys conducted by states,[7] primarily to determine the effect of their safety belt use laws. Table IV-10 summarizes the results of these surveys from 5 states in which usage by vehicle type was examinec.

TABLE IV-10
Usage by Vehicle Type Derived from State Observational Surveys

	USAGE			USAGE RELATIVE TO PASSENGER CARS	
State/Date	Passenger Cars	Pickup Trucks	Vans	Pickup Trucks	Vans
Illinois					
4/85	17.2	6.6	-	.38	-
4/86	38.9	21.9	-	.56	-
7/86	41.8	25.6	-	.61	-
Michigan					
7/85	60.4	45.8	53.1	.76	.88
12/86	44.6	30.3	38.2	.68	.86
4/86	45.0	33.2	39.5	.74	.88
Minnesota					
1983	13.8	5.1		.37	
1984	15.1	8.6		.57	
1985	17.8	10.0		.56	
Texas					
12/85	14.8	11.8		.80	
12/86	64.9	65.5		1.01	
Wisconsin					
1986	34.3	22.7*	22.7*	.66*	.66*

*Includes pickups and vans

The results of these surveys vary dramatically by state and time period. Variation between time periods often reflects the initiation of safety belt use laws and their aftermath. The high usage rate recorded in the 7/85 Michigan study for example, reflects the publicity and enforcement associated with the initial months of the state law. Usage declined to a level of roughly 45 percent in passenger cars and 30 percent in trucks shortly thereafter. Similarily, the dramatic differences found in the two Texas reports reflect pre and post law periods.

For the reasons previously discussed, observational surveys are considered to provide the most accurate estimates of actual restraint usage. The 19 city survey summarized in Table IV-8 is the most comprehensive, and therefore the most nationally representative of the available surveys and it will be used to establish baseline (1985) usage rates for passenger cars. 1985 rear seat passenger car usage is therefore estimated to be 9.5 percent. Baseline usage for all other vehicles will be established relative to this level.

From Tables IV-9 and IV-10 there are 13 different estimates of relative usage rates for pickup trucks. None of these are specific to the second seat. A simple unweighted arithmetic average of these estimates yields a relative of .64. With the exception of 3 outliers, the second Texas survey and the 2 earliest surveys, all estimates lie between roughly 55 and 80 percent and the midpoint of these boundry estimates is 67.5, a result almost indentical with 3 of the surveys, including NASS, the largest one. Although the absolute usage rates derived from NASS are believed to be overstated, there is no evidence for a similar conclusion regarding the relative usage rates of different vehicles. Overestimation may, in fact, be larger for some vehicles, but it is assumed that this effect is minor. The relative consistency of results from the various surveys supports this assumption. Overall, it appears reasonable to assume that usage for light trucks is roughly 2/3 of that of passenger cars or 6.4 percent.

The two sources of data on the relative usage rates of vans produced contradictory results. The 3 Michigan observational surveys found van usage rates to be just under 90 percent of passenger car rates. (The Wisconsin study lumped vans with light trucks and is thus not useful). NASS data, on the other hand, found van usage rates that were 23 percent higher than passenger cars in all seats and 86 percent higher in second seats. Although the Michigan studies are probably accurate for that state, it is questionable whether they would accurately reflect usage habits nationwide.

As previously noted, the higher usage relatives found for van second seats primarily result from lower usage rates found in the rear seats of passenger cars. The most appropriate estimate for vans would therefore appear to be 86 percent greater than the passenger car rate or 17.7 percent.

It is unclear whether the rear seat estimate for vans is an accurate reflection of equality in both front and rear seat usage rates. The estimate is based on a fairly small sample (154 cases) and the usage rate based on the raw data (before ratio-weighting it to the national level) is only 38 percent (rather than 55 percent after weighting). This fact combined with the contradictory results noted in the Michigan studies leave considerable doubt about the validity of the NASS usage estimates for vans. However, given the lack of a more reliable nationwide measure, it will be used here with the caveat that it may result in an overly optimistic estimate of potential benefits to van occupants under current usage rates.

For truck based station wagons, the only specific estimate is from NASS files. As was the case with vans, this estimate is based on a very small number of cases and, although the Z test indicates that it does differ from passenger car usage, the accuracy of the estimate is subject to a large standard error. Nonetheless, this estimate will be used bearing in mind the fact that it may result in an optimistic benefit result. Usage for truck based station wagons is therefore estimated to be 87 percent higher than that of passenger cars or 17.7 percent.

Similarly the NASS estimate for on/off road vehicles is of suspect significance but will be used as the only available estimate keeping in mind its likely optimistic nature. Usage rates for on/off road vehicles are therefore estimated to be 29 percent higher than passenger cars or 12.3 percent.

Finally, the NASS bus estimate was found to vary significantly from that of passenger cars. A factor of .21 will be used, resulting in an estimated bus usage rate of 2.0 percent.

Table IV-11 summarizes the baseline 1985 usage rates that will be estimated in computing benefits for each vehicle type.

TABLE IV-11

Baseline Rear Seat Belt Usage Estimates
by Vehicle Type
(Percent)

Vehicle Type	1985 Rear Seat Belt Usage
Passenger Cars	9.5
Pickup Trucks	6.4
Vans	17.7
Truck Based Station Wagons	17.7
On/Off Road Vehicles	12.3
Buses	2.0

C. Calculation of Benefits

As previously mentioned, benefits for each alternative are a function of the effectiveness rates and usage levels that were calculated in the 2 previous sections. Net benefit calculations consist of 3 basic steps. First, effectiveness estimates and usage levels for the current manual lap belt system will be used to estimate the base number of fatalities and injuries that would have occurred had no one used the current systems. This is done using the following formula:

$$BI = \frac{CI}{1 - U \times E}$$

Where:

BI = Base fatalities or injuries
CI = Current fatalities or injuries (1985)
U = Current usage level (1985)
E = Effectiveness of current (lap belt only) system

For example, from Table II-1 (Chapter II), there were 1315 fatalities in the back outboard seats of passenger cars in 1985. From Table IV-7, manual lap belts were estimated to be 25 percent effective against fatalities and were estimated to be used by 9.5 percent of rear seat occupants (Table IV-11). The number of fatalities that would have occurred had no one worn their lap belts is therefore:

$$BI = \frac{1315}{1 - (.095 \times .25)} = 1348$$

VI. OTHER ISSUES

If Type 2 belts are required on vehicles, there are several related issues which must be resolved as a part of the final rule. Specifically NHTSA must decide whether it is appropriate to extend the comfort and convenience requirements of FMVSS 208 to rear seats as well and whether to require dynamic testing of rear seat Type 2 belts.

Standard 208 requires that by September 1, 1989, manual belts in front seating positions installed in any vehicle with a GVWR of 10,000 pounds or less meet requirements for belt contact force, latch plate access, retraction and seat belt guides and hardware characteristics. The use of an anthropomorphic dummy is necessary to determine compliance with all of these requirements except for seat belt guides and hardware requirements. Since dummy positioning procedures have not been developed for the rear seating positions, compliance with belt contact force, latch plate access and retraction requirements cannot yet be ascertained. Once rear seat positioning procedures have been developed, an NPRM can be issued proposing the appropriate requirements for these areas. FMVSS 208 currently requires that all manual belt systems meet seat belt guide and hardware requirements, which do not require anthropomorphic dummies for compliance verification. NHTSA anticipates that this requirement would remain in effect for rear seat lap/shoulder belts.

Dynamic testing for FMVSS 208 will be required for all outboard seating positions in the front seat of passenger cars as of September 1, 1989 if two-thirds of the population is not covered by state belt usage laws (i.e., if automatic restraints requirements are rescinded). NHTSA has estimated that these requirements will increase testing costs by about $8500 per test. Application of dynamic testing to rear seats should be somewhat less expensive because much of this cost is not variable with the number of seating positions tested. Assuming that rear seat tests could be run concurrent with front seat tests, NHTSA's preliminary estimate of incremental costs associated with rear seat testing is $4,000-$5,000 per test. This includes the added costs of recording and processing data, certifying test dummies and installing additional outboard cameras. Costs could be considerably lower for some large manufacturers that run their own full time testing labs. Additional costs could be incurred if additional test dummies are purchased. Part 572 dummies currently cost roughly $12,000 each and Hybrid III dummies, which will be required after 1991, cost $30,000 each. This cost would be spread over a large number of tests.

A potential problem with running concurrent front and rear seat tests is that the added weight of the rear seat crash dummies (roughly 165 lbs per dummy) could result in added vehicle crush which could adversely impact test results. Therefore, unless some way was found to adjust for the effect of the added weight, extension of this requirement to rear seats would have the unintended effect of making it harder to comply with existing dynamic test requirements. The effect of added weight could be minimized by requiring that tests be conducted in only one position, but this could skew the impact load to one side of the vehicle and alter crash test results as well. In addition, it would not necessarily reflect adequate compliance at the other seating positions. Running separate rear seat compliance tests is another option; however, this would result in significant additional costs (such as additional prototype crash vehicles).

NHTSA is seeking public comment on both dynamic testing and seat belt comfort and convenience issues.

APPENDIX A. SENSITIVITY ANALYSIS, ALTERNATE EFFECTIVENESS RATES

The effectiveness estimates used in the body of this analysis to estimate benefits were derived from studies using the "double pair" comparison method. As noted in Chapter IV, this method is thought to provide more reliable estimates of effectiveness than more conventionally derived studies because it provides an automatic control for differences in crash severity and it can utilize FARS files, the best source of data for analyzing rear seat lap belt effectiveness against fatalities.

Studies based on double pair methodology, however, are relatively recent, and there are numerous studies based on more conventional methodology which produce consistently higher effectiveness estimates for rear seat lap belts. This appendix will examine benefit estimates based on these higher effectiveness estimates.

In Table IV-2 (see Chapter IV), these studies, as well as the two "double pair" based studies were summarized. The first 5 studies were based on the conventional approach which essentially examines the rate of injury for restrained occupants compared to unrestrained occupants as a group. Most of these studies lumped fatalities and serious injuries together but the one that did separate them (Partyka), found a higher rate of effectiveness against serious injuries that against fatalities. This is consistent with the findings of Kahane's "double pair" estimate. A simple average of all the conventional fatality estimates is roughly 42 percent. Since injuries, which are expected to have a higher effectiveness rate, were included in most of these estimates, the actual average fatality effectiveness is probably somewhat lower and actual injury effectiveness is probably higher. For this analysis we will examine a base lap belt fatality effectiveness of 40 percent and a serious injury effectiveness of 55 percent. These numbers are similar to the results of Partyka's study, one of the two that produced separate fatality and injury estimates. Campbell's study produced somewhat lower estimates but the higher estimates will be used to examine a wider range in the sensitivity analysis.

The incremental effectiveness of lap/shoulder belts will be based on the point differences found in front seat systems (see Table IV-1). Given the high base effectiveness rates examined here, use of percent rather than point increments would produce judgmentally absurd results (i.e., 90 percent effectiveness against injuries). Even the point based injury effectiveness estimate (75%) appears highly optimistic. The effectiveness estimates examined here are summarized below:

	Manual Lap Belts	Manual Lap/ Shoulder Belts
Fatalities	40	50
AIS 2-5 Injuries	55	75

Tables A-1, A-2 and A-3 summarize the benefits that would accrue under these effectiveness rates at current usage rates at double current usage rates and at 70 percent usage respectively. A comparison of these results with Tables IV-12, IV-13 and IV-14 indicates that these conventionally