250859

Memorandum

U.S. Department of Transportation
National Highway Traffic Safety Administration

Subject: ACTION: Preliminary Economic Assessment Costs and Benefits of Putting a Shoulder Belt in the Center Seats of Passenger Cars and Light Trucks

Date: JUL 31 2003

From: Rose McMurray
Rose McMurray
Associate Administrator
for Planning, Evaluation, and Budget

Reply to Attn. of:

To:

NHTSA 03-15817-2

Docket NHTSA-03-15817; Notice 1

Thru: Jacqueline Glassman
Chief Counsel
CMC for JG

Please submit the attached "Preliminary Economic Assessment, Costs and Benefits of Putting a Shoulder Belt in the Center Seats of Passenger Cars and Light Trucks" to the appropriate docket.

Attachment

cc:
Associate Administrator for Rulemaking
Associate Administrator for Enforcement
Chief Counsel

#

U.S. Department
Of Transportation

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Preliminary Economic Assessment

COSTS AND BENEFITS OF PUTTING A SHOULDER BELT IN THE CENTER SEATS OF PASSENGER CARS AND LIGHT TRUCKS

Office of Regulatory Analysis and Evaluation
Planning, Evaluation and Budget
July 2003

Table of Contents

EXECUTIVE SUMMARY

Approximately eight percent of occupants in tow-away crashes for the period 1988 to 1999 were seated in the center seats of vehicles, almost all of which were equipped with a lap belt only. The agency believes that increasing the availability of lap/shoulder belts will improve the effectiveness of restraints in these positions, will result in lower injury rates, and will increase usage rates.

Benefits

Compared to the lap belts, the incremental benefits of:

Lap/shoulder belts in the **front** center seating positions of passenger cars and light trucks are a reduction of: 16 fatal injuries, 104 MAIS 1 injuries, and 68 MAIS 2 + nonfatal injuries.

Lap/shoulder belts in the **rear** center seating positions of passenger cars and light trucks are a reduction of: 33 fatal injuries, 137 MAIS 1 injuries, and 495 MAIS 2+ nonfatal injuries.

(See Table 13 for more details)

Costs

Approximately 5 percent of passenger cars and 40 percent of light trucks have a seating position with a lap belt in the front center seat, and approximately 23 percent of passenger cars and 51 percent of light trucks have a seating position with a lap belt in the rear center seat. The cost of installing the shoulder belt portion of the lap/shoulder belt in these seating positions ranges from $15.41 to $16.04 per belt. The total cost of installing shoulder belts in the front and rear center seats of the model year 2000 fleet of passenger cars is approximately $39 million, and light trucks is approximately $126 million.

The estimated cost of reinforcing seats to accommodate the shoulder belt and not have those shoulder belt anchorages impinge on necessary foot or cargo space is $31.08. The cost of reinforcing the front center seats of the 2000 fleet of passenger cars is approximately $14 million, and the cost of reinforcing the front and rear center seats of light trucks is $171 million.

Total annual cost are estimated to be:

Costs (2000Dollars)

	Passenger Cars	Light Trucks	Total
Front Center Seat	$21.3 million	$110.6 million	$131.9 million
Rear Center Seat	$31.3 million	$186.7 million	$218.0 million
Total	$52.6 million	$297.3 million	$349.9 million

The cost per equivalent life saved, at the seven percent discount level, for all center seating positions, front and rear is $2.13 million for passenger cars and $6.88 million for light trucks. The breakout by seating position is shown in the following table:

Cost per Equivalent Life Saved

	Passenger Cars	Light Trucks
Front Center Seat	$6.04 million	$9.29 million
Rear Center Seat	$1.48 million	$5.96 million
Total	$2.13 million	$6.88 million

Introduction

Federal Motor Vehicle Safety Standard (FMVSS) No. 208 specifies performance requirements for the protection of vehicle occupants in crashes. These requirements place limits on the force and acceleration measured on anthropomorphic dummies seated in the driver and right front passenger seat in test crashes, and specify equipment requirements for active and passive restraint systems.

FMVSS No. 208 requires that all passenger cars be equipped with lap/shoulder belts at all front and rear outboard seating positions. Front outboard seating positions must also be equipped with an air bag. However, the front and rear center seats are only required to have a lap belt. Studies have shown that lap/shoulder belts are more effective than lap belts in reducing fatalities in motor vehicle crashes.

Although the Notice of Proposed Rulemaking (NPRM) proposes lap/shoulder belts in rear center seating positions only, this Preliminary Regulatory Evaluation takes a broader view. The analysis examines the costs and benefits of requiring lap/shoulder belts in the front as well as the rear center seats of light passenger vehicles.

Background

On December 4, 2002, the President signed into law "Anton's Law", P.L. 107- 318 (December 4, 2002; 116 Stat. 2772), which provides for the improvement of child safety devices when installed in motor vehicles. One of the provisions of Anton's Law concerns the installation of lap and shoulder belts in rear seating positions. Specifically, the Secretary of Transportation, through NHTSA, was directed to issue a final rule by December 2004 that would:

> "require a lap and shoulder belt assembly for each rear designated seating position in a passenger motor vehicle with a gross vehicle weight rating of 10,000 pounds or less, except that if the Secretary determines that installation of a lap and shoulder belt assembly is not practicable for a particular designated seating position in a particular type of passenger motor vehicle, the Secretary may exclude the designated seating position from the requirement."

The statute further specifies that the final rule be implemented in phases on a production year basis, beginning with the closest production year after the final rule is published. The rule is to be effective for all vehicles by the third production year of the phase-in. Thus, if NHTSA were to issue a final rule in December 2004, the phase-in would commence on September 1, 2005, and all vehicles not covered by the regulation would have to meet the requirements of the final rule by September 1, 2007.

While Anton's Law requires NHTSA to take action regarding lap/shoulder belts within a specified time frame, NHTSA had already planned to initiate rulemaking that would expand upon the current requirement in Federal motor vehicle safety standard No. 208, *Occupant crash protection* (FMVSS No. 208) that, subject to certain exceptions, all rear seating positions be equipped with lap/shoulder belts.

The agency first addressed mandatory lap/shoulder belts for rear seats in 1984, when it denied a petition to initiate rulemaking that would require such belts for rear outboard seating positions. The petition had largely focused on the need for such systems to adequately restrain children in booster seats. At the time of the denial, NHTSA was considering a requirement that vehicles be equipped with a tether anchorage. The agency believed such anchorages would offer greater protection than requiring a lap/shoulder belt. While NHTSA acknowledged that a lap/shoulder belt would offer additional protection, it concluded that rear lap belts already provided effective protection to occupants in the rear seat. It also concluded that the cost associated with a rear lap/shoulder belt would be too great, given the low rate of belt use in the rear seat.

The agency was again petitioned to require rear lap/shoulder belts in 1986. Once again the petition focused on the increased protection that would be afforded to children. NHTSA granted the petition because of two new factors: many states had adopted mandatory safety belt use laws, and the child restraint industry had moved away from child seat designs that could be tethered to the vehicle. While still concerned about the high cost of rear lap/shoulder belts relative to the expected reduction in deaths and injuries, the agency published first an advance notice of

proposed rulemaking (ANPRM) and then a notice of proposed rulemaking (NPRM) to require manufacturers to install lap/shoulder belts in all forward-facing rear outboard seating positions in vehicles with a gross vehicle weight rating under 10,000 pounds. See 52 FR 22818, June 16, 1987 and 53 FR 47982, November 29, 1988, respectively.

On June 14, 1989, the agency published the first of two final rules addressing the issues raised in the 1988 NPRM (54 FR 47982). The rule established a new requirement mandating lap/shoulder belts for forward-facing rear outboard seating positions in all passenger cars other than convertibles. At that time, the agency estimated that approximately 90% of the projected benefits for lap/shoulder belts in all rear designated seating positions would accrue to occupants in the outboard seats. Given the relatively small projected benefits related to center seating positions and the potential costs and technical difficulties associated with anchoring the shoulder portion of the belt at the center seating position, NHTSA decided against mandating lap/shoulder belts for any rear seat other than forward-facing outboard seats.

On November 2, 1989, NHTSA published its second final rule on rear lap/shoulder belts. This rule extended the requirements of the June 14 final rule to convertibles, light trucks, multi-purpose vehicles like vans and sport utility vehicles (SUVs), and small buses other than school buses. As with the earlier final rule center seating positions and non-forward-facing seating positions were excluded from the requirements. Outboard seating positions that abutted an aisle located against the side of the vehicle were likewise excluded. The agency noted that while rear lap belts reduce the risk of death by 24-40 percent, rear lap/shoulder belts would reduce that risk

by 32-50 percent. The agency postulated that even more benefits would be found if occupants were more willing to use the lap/shoulder belt than the lap belt.

Much has changed since NHTSA issued the two final rules in 1989. At present, all 50 states and the District of Columbia have enacted laws requiring children to wear safety belts. In 1987, belt use in the rear seat was only 16 percent. Today, the agency estimates that the rate of belt use in the center rear seat is 50 percent in passenger cars and 57 percent in LTVs. Another factor to be considered is that increased numbers of children are riding in the back seat because of campaigns by NHTSA, the automotive industry and others designed to educate consumers about the risk to children riding in the front seat. NHTSA recently examined rear seat occupancy patterns for children up to nine years of age. It found that while the number of fatalities among children in this age group was evenly divided between the front and rear seat in 1991, by 2000, the front seat accounted for 56 percent fewer fatalities than the rear seat. The change in distribution occurred between 1996 and 2000, the time frame during which consumers were urged to place their children in the back seat because to the risk of air bag-related injury or death.

Additionally, consumer information campaigns, which advocate child restraints for children up to eight years of age or a height of 4'9", have been somewhat successful in convincing parents to keep their children in appropriate child restraints well past the age mandated by state law. Finally, states have recently begun to increase the minimum age requirements for child restraints. Two states (New Jersey and Pennsylvania) and the District of Columbia require child restraint usage up through age seven. Seven states have enacted legislation that requires children be

restrained in a child restraint at least to age six. Seven other states require child restraint use up to age five. The increase in child restraint usage by older children has led to greater use of belt-positioning booster seats. These seats, in which the vehicle lap/shoulder belt serves to hold both the child and the restraint in place, cannot be used without a lap/shoulder belt.

The proposal analyzed in this document seeks to increase the use of belt-positioning boosters and to improve the safety of all occupants in the center rear seating position, regardless of whether the occupant is seated in a booster seat.

Target Population

For the period 1988 to 1999 the National Automotive Sampling System (NASS) Crashworthiness Data System (CDS) data shows that approximately 19,590,000 individuals were involved in tow away crashes. Approximately 1,523,121 individuals were seated in the center seats. The percentage of occupants seated in the center seats was approximately eight percent (1,523,121/19,590,000). The data shows that a significant number of individuals travel in the center seats of vehicles and are potentially restrained by a lap belt only. The population of interest for this study is occupants seated in the center seats of passenger cars and light trucks and vans. The data used in the analysis comes from the CDS files, and included passengers age five and up for the following years 1996, 1998 and 1999 (there was no NOPUS figure available for 1997).

Tables 1(a) and 1(b) give a break out of the MAIS injury levels for occupants seated in the center seats of passenger vehicles annualized for the period 1996 to 1999. The fatal injuries included in these tables, came from the Fatality Analysis Reporting System (FARS) data base.

Of the center seat fatalities in passenger cars, 20 percent were in the front center seat and 80 percent were in the rear center seat. Of the center seat fatalities in light trucks, vans and sport utility vehicles (SUVs), 53 percent were in the front center seat and 47 percent in the rear center seats. The difference can be attributed to two facts. First, there are more pickup trucks with front center seats sold per year than passenger cars and the front center seat is used more in pickup trucks than in passenger cars. Second, the belt use rate in potentially fatal crashes in the

front center seats of pickup trucks is low (16 percent) compared to passenger cars (25.6 percent). This increases the probability that occupants will be killed riding in these positions in trucks.

Table 1(a)
Occupants in Passenger Cars in Center Seats by MAIS Level
Annualized for the Period 1996 to 1999

Seat Position	MAIS 1	MAIS 2	MAIS 3	MAIS 4	MAIS 5	Fatals	Total
Front Center	3,320	28	0	24	0	55	3,427
Second Center	13,579	1,219	238	36	28	225	15,325
Total	16,899	1,247	238	60	28	280	18,752
Percentage	90.12%	6.65%	1.27%	0.32%	0.15%	1.49%	100%

Table 1 (b)
Occupants in LTV's in Center Seats by MAIS Level Annualized for the Period 1996 to 1999

Seat Position	MAIS 1	MAIS 2	MAIS3	MAIS 4	MAIS 5	Fatals	Total
Front Center	6,780	529	102	31	67	146	7,655
Second Center	9,547	714	357	80	6	114	10,818
Third Center	1,030	141	49	0	79	17	1,316
Fourth Center	41	0	0	0	0	1	42
Total	17,398	1384	508	111	152	278	19,831
Percentage	87.72%	6.98%	2.56%	0.56%	0.77%	1.41%	100%

Vehicle Classes Subject to the Rear Center Lap/Shoulder Belt Requirement

The agency is proposing to require lap/shoulder belts for all forward-facing designated seating positions other than the front seat for all passenger cars and for most other vehicles with a gross vehicle rating (GVWR) under 10,000 pounds.

a. Passenger Cars
All passenger cars, including convertibles are subjected to this requirement. An increasing number of passenger cars are being equipped with lap/shoulder belts in center rear seats. Therefore, past engineering difficulties do not appear to be an impediment in the rear seat.

b. Light Trucks, Multipurpose Passenger Vehicles and Buses (excluding school buses)
The agency proposes that the requirements apply to light trucks, multipurpose vehicles and buses with a gross vehicle weight rating (GVWR) less than 4,536 kg (10,000 lbs.) with rear center DSPs. This vehicle class is likely to be transporting children in rear center seating positions. The agency proposes to subject light trucks less than 4,536 kg (10,000 lbs.) to the requirements for center lap/shoulder belts.

c. Swivel Seats
The agency is not planning to change the lap/shoulder belt requirement for swivel seats or for readily removable seats. Both these types of seats are required to have modified lap/shoulder belts assemblies. Currently FMVSS No. 208 specifies that swivel seats must have at least a lap belt at all positions that the seat may be placed while the vehicle is in motion. Also, the seat must have at least a non-integral lap/shoulder belt while the seat is in the forward-facing position.

d. Rear Facing Seats – The agency has tentatively decided to require that rear-facing seats and forward facing outboard seats adjacent to an aisle be included in the lap/shoulder belt requirements. While the agency is unable to determine whether a shoulder belt will reduce the risk of death or injury in a rear-facing seat during a frontal crash, it is unlikely that a shoulder belt would do any harm, and may provide benefits in other crash modes or even upon rebound in frontal crashes.

Vehicle Classes Exempt from the Rear Center Lap/Shoulder Belt Requirement

a. Walk-in van-type trucks and vehicles designed to be sold exclusively to the U.S. Postal Service with a GVWR of 4,536 kg (10,000 lbs.) or less – These vehicles currently are either required to have a lap belt or a lap/shoulder belt at each designated seating position. To mandate lap/shoulder belts at rear *center* seating positions would be difficult to justify based on the current limited outboard requirements. In addition, most of these vehicles don't have rear seats.

b. Vehicles with a GVWR of More than 4,536 kg (10,000 lbs.) – FMVSS No. 208 does not require lap/shoulder belts at outboard positions in this vehicle class. NHTSA stated in the final rule for rear outboard seat belt requirements (54 FR 46261) that NHTSA has traditionally used GVWRs as dividing lines for the purposes of applying occupant crash protection standards. Since NHTSA proposed applying the rear outboard lap/shoulder belt requirement to vehicles with a GVWR of 4,536 kg (10,000 lbs.) or less in the NPRM

and no comments were submitted to address this issue, the final rule was adopted as proposed.

c. Motor Homes – FMVSS No. 208 allows the option of lap belts or lap/shoulder belts to be installed in outboard DSPs in motor homes. In 1989, the agency considered requiring rear *outboard* lap/shoulder belts in motor homes, but instead decided to exclude these vehicles because lap/shoulder belts at rear seating positions might interfere with the residential purposes of those seats and because the agency had no evidence of significant potential benefits from lap/shoulder belts. The agency instead permitted the option for lap/shoulder or lap-only belts, at these seating positions.

d. Jump Seats – The agency is proposing that side-facing jump seats be excluded from the lap/shoulder belt requirements due to the uncertainty of shoulder belt performance in frontal crashes. However, the agency may want to discuss or raise questions regarding the safety of these seats that are being installed in compact extended pickup trucks that may be sold to families with children.

Restraint Use

NHTSA (1999) found that belt use was higher in vehicles equipped with lap/shoulder belts than in vehicles equipped with only a lap belt.[1] From the same analysis it was calculated that back seat outboard survivors belt use increased 10 percent in passenger cars equipped with lap/shoulder belts over cars equipped with lap belts. The agency is not sure why belt use was higher in cars equipped with lap/shoulder belts even after controlling for vehicle age and calendar year effects. Whatever the reason, lap/shoulder belts have more benefits than lap belts because they are more effective and because they are used more than lap belts. The same analysis found that seat belt use was higher in the front seat than in the back seat, 70 percent versus 40 percent.

Tables 2(a) and 2(b) give a breakout of the belted status of occupants sitting in the center seating positions of passenger vehicles annualized for the period 1996 to 1999. These occupants have all suffered a MAIS1 or greater injury. Data from these tables are used to compare seat belt usage rates with seat belt usage rates in the National Occupant Protection Use Survey (NOPUS) study. Annualized data from the NOPUS study shows that the overall usage rate for front right seat passengers, for the 1996 – 1999 time period, is 63.3 and 57.6 percent for cars and light trucks, respectively (see Table 3).

[1]Morgan, C., "Effectiveness of Lap/Shoulder Belts in the Back Outboard Seating Positions", NHTSA Technical Report No. DOT HS 808 945, page 12, Washington, DC, 1999.

Table 2(a)

CDS Known Seat Belt Use Rate for Injured Passenger Car Occupants 5 and Older in Front and Rear Center Seats Annualized for the Period 1996 to 1999

Seat Position	Belted =Yes	Percent	Belted = No	Percent	Total
Front Center	1,984	64.6	1,087	35.4	3,071
Second Center	7,998	58.5	5,675	41.5	13,673
Total	9,982	59.6	6,762	40.4	16,744

Table 2(b)

Known Seat Belt Use Rate for Injured Light Truck Occupants 5 and Older in Front and Rear Center Seats Annualized for the Period 1996 to 1999

Seat Position	Belted=Yes	Percent	Belted=No	Percent	Total
Front Center	894	12.2	6,435	87.8	7,329
Second Center	3,165	52.0	2,919	48.0	6,084
Third Center	1,947	87.2	286	12.8	2,233
Fourth Center	14	34.1	27	65.9	41
Total	6,020	38.4	9,667	61.6	15,687

Table 3

Front Right Seat Passenger Lap/Shoulder Belt Use From NOPUS

	1996	1998	1999	Annualized
Cars	59.0	67.0	64.0	63.3
Light Trucks	53.0	59.8	60.0	57.6

It is generally believed that the CDS files overstate the seat belt usage rates because people tend to exaggerate their seat belt usage, particularly when they are not injured. In order to get a more realistic usage rate, a correction factor is calculated. This factor is derived by dividing the annualized NOPUS (Table 3) right front passenger use rates by the annualized CDS right front passenger use rates. We then apply the NOPUS/CDS factor to the center seat seating position for the various vehicle types. The results are shown in Table 4.

Table 4
Conversion of Seat Belt Use Rate

	Passenger Cars	Light Trucks
NOPUS Use Rate/CDS Use Rate Right Front Passenger Seat	63.3/74.7=0.847	57.6/66.5=0.866
Front Center Seats Use Rate	64.6	12.2
Front Center Seats Converted Rate	64.6x0.847=54.7	12.2x0.866=10.6
Rear Center Seats Use Rate	58.5	61.3
Rear Center Seats Converted Rate	58.5x0.847=49.6	61.3x0.866=53.1

Rather than have a different converted rate for each row of center seats in light trucks, the center seat values were combined and an average number used. These are the numbers that are used in the calculations of lives saved and injuries prevented. The calculation of lives saved and injuries prevented are simplified estimates that do not take into account the effectiveness of air bags.

Use in potentially fatal crashes (UPFC) shown in Table 5 is a reflection of safety belt use rate by all the occupants potentially killed in fatal crashes, not only those that died. It is an estimation of safety belt use rate among the occupants that would have been killed if they were not restrained by seat belts.

UPFC is calculated from belt use in FARS using the following formula:

I/ (1-C x (1-I))

Where: I is belt use in FARS; C the weighted (weighted according to potential fatalities) safety belt effectiveness against front seat outboard fatalities. In order to satisfy the variables in the above equation, front outboard lap belt effectiveness will be used as a proxy for center seat lap belt effectiveness, since the agency has no effectiveness figures for the center seat lap belt. The agency has estimated that the basic safety belt effectiveness against front seat outboard fatalities is 35 percent for passenger cars and 50 percent for light trucks and vans.[2]

Table 5
FARS and Use in Potentially Fatal Crashes (UPFC) (1996 – 1999 data average)

	Front Center	Rear Center
FARS		
Passenger Cars	0.184	0.137
Light Trucks	0.087	0.132
UPFC		
Passenger Cars	0.258	0.189
Light Trucks	0.160	0.291

2 Blincoe, L., "Estimating the Benefits from Increased Safety Belt Use," NHTSA Technical Report, June 1994, DOT HS 808 133.
Kahane, C., Fatality Reduction by Safety Belts for Front-Seat Occupants of Cars and Light Trucks, Updated and Expanded Estimates Based on 1986-99 FARS Data, NHTSA Technical Report, December, 2000, DOT HS 809 199.

BENEFITS

Effectiveness

There are many factors that influence seat belt effectiveness, such as height, weight, age/sex, as well as the ability to withstand trauma. The effectiveness of the lap/shoulder belt in the center seating position is defined as the percentage reduction in fatalities or injuries for restrained occupants as compared to unrestrained occupants.

Statistical analyses have shown that lap/shoulder belts are more effective than lap belts. Table 6 shows the estimated effectiveness of front and rear seats for both manual lap belts and lap/shoulder belts. Seat belts are more effective for light trucks than for passenger cars since seat belts are most effective in rollover crashes and a much higher percentage of the fatalities and serious injuries occur in rollover crashes in light trucks than in passenger cars.

Table 6
Estimated Percent Effectiveness of Front and Rear Seat Safety Belts in Passenger Vehicles

Passenger Cars	Front Seat		Rear Seat	
	Lap Belt	Lap/Shoulder Belt	Lap Belt	Lap/Shoulder Belt
AIS 1	10[1]	10[1]	5.5[4]	5.5[4]
AIS 2-5	30[1]	50[1]	37*	49*
Fatals	35[1]	45[1,2]	32[3]	44[3]
Light Trucks				
AIS 1	10[4]	10[4]	5.5[4]	5.5[4]
AIS 2-5	55[4]	65[4]	68*	78*
Fatals	50[4]	60[4]	63[3]	73[3]

1 "Final Regulatory Impact Analysis Amendment to FMVSS No 208. Passenger Car Front Seat Occupant Protection," Page IV-2. National Highway Traffic Safety Administration, Plans and Programs, Office of Planning and Analysis, July 1984.

2 "Fatality Reduction by Safety Belts for Front Seat Occupants of Cars and Light Trucks, Updated and Expanded Estimates Based on 1986 – 99 FARS Data" Page 3, U.S. Department of Transportation, National Highway Traffic Safety Administration, DOT HS 809 1999 NHTSA Technical Report.

3 "Effectiveness of Lap/Shoulder Belts in the Back Outboard Seating Positions," Pages 20 and 88, Evaluation Division, Plans and Policy, National Highway Traffic Safety Administration, Washington, D.C. June 1999, DOT HS 808 945

4 "Final Regulatory Impact Analysis, Extension of the Automatic Restraint Requirements of FMVSS 208 to Trucks, Buses, and Multi-Purpose Passenger Vehicles with a Gross Weight Rating of 8,500 Pounds or Less and an Unloaded Vehicle Weight of 5,500 Pounds or Less", page 23. National Highway Traffic Safety Administration, Plans and Policy, Office of Regulatory Analysis, November 1990.

* Assumed the same distribution of effectiveness for the rear as the front in passenger cars and light trucks. That is, five percentage points higher than the effectiveness for fatalities.

LIVES SAVED AND INJURIES PREVENTED

Passenger cars converted seat belt use annualized for the period 1996 to 1999 (see Table 4) by front center seated occupants was distributed in the ratio of 54.7 percent lap belt use to 45.3 percent non-use. In the front center seats of passenger cars (Table 1(a)), there were approximately 3,320 MAIS 1 injuries, 52 MAIS 2 and greater non-fatal injuries. Multiplying these injuries by the seat belt use ratio results in 1,816 lap belted to 1,504 unbelted MAIS1 injuries, 28 lap belted and 24 unbelted MAIS 2 and greater non-fatal injuries. There was an annual average of 55 front center seat fatalities in the 1996 to 1999 FARS. Of these, 10 were lap-belted and 45 were unbelted fatalities.

For the rear seat of passenger cars, the belt use ratio was 49.6 percent lap belt use to 50.4 percent non-use. In the rear center seat, there were approximately 13,579 MAIS 1 injuries, 1,521 MAIS 2 and greater non-fatal injuries. Dividing these injuries by the seat belt use ratio results in 6,735 lap belted to 6,844 unbelted MAIS 1 injuries, 754 lap belted and 767 unbelted MAIS 2 and greater non-fatal injuries. There was an annual average of 226 rear center seat fatalities in the 1996 to 1999 FARS. Of these, 31 were lap-belted and 195 were unbelted fatalities.

Similar calculations were made for light trucks. Table 7 shows the data that is used in the calculation of injuries prevented and lives saved.

Table 7
Injuries/Fatalities By Belt Use/Nonuse

	Front Center			Rear Center		
Passenger Cars	Total	Use	Nonuse	Total	Use	Nonuse
MAIS 1	3,320	1,816	1,504	13,579	6,735	6,844
MAIS 2-5	52	28	24	1,521	754	767
FATALS	55	10	45	226	31	195
Light Trucks						
MAIS 1	6,780	719	6,061	10,618	5,638	4,980
MAIS 2-5	729	77	652	1,426	757	669
FATALS	146	13	133	132	17	115

To estimate the numbers of lives saves and injuries prevented, the following need to be determined:

a) The potential injuries/fatalities (if no one were restrained)

b) The potential injuries prevented/lives saved by lap belts

c) The potential injuries prevented/lives saved by lap/shoulder belts

The difference between b) and c) will be the incremental benefit from providing a lap/shoulder belt (over a lap belt alone).

Table 8 shows the potential injuries/fatalities if no one were restrained. If no one were restrained, injuries and fatalities would be higher due to the effectiveness of restraints in reducing death and injury.

Table 8
Potential Injuries/Fatalities (if no one were restrained)

	Front Center	Rear Center
Passenger Cars		
MAIS 1	3,512	13,960
MAIS 2-5	62	1,863
FATALS	60	241
Light Trucks		
MAIS 1	6,853	10,937
MAIS 2-5	774	2,232
FATALS	159	162

To compute potential injuries/fatalities (if no one were restrained), the following formula was used:

Potential injuries = N/(1-effectiveness x usage rate)

Where: N is either NASS injuries or FARS fatalities. NASS Injuries and FARS fatalities were provided in Table 7,

Effectiveness values were provided in Table 6 and,

Usage Rates were provided in Tables 4 and 5.

For MAIS2+ Potential Injuries:

52/(1-.3 x.547) = 62

For Fatalities:

55/(1-.35 x .26) = 60

Table 9 shows the tabulation of injuries prevented and lives saved at current use rates with lap belts. Lap belts are available in all seating positions. An example of the calculations for passenger car front seat is: AIS 2^+ Injuries Prevented = potential injuries x effectiveness x belt use (observed use for injuries; UPFC for fatalities). For example, MAIS 2^+ Injuries Prevented in front center seats in passenger cars is 62 x 0.3x .547 = 10 (or 62 – 52 = 10).

Table 9
Injuries Prevented/Lives Saved by Lap Belts

	Front Center	Rear Center
Passenger Cars		
MAIS 1	192	381
MAIS 2+	10	342
FATALS	5	15
Light Trucks		
MAIS 1	73	319
MAIS 2+	45	806
FATALS	13	30

Table 10 shows the tabulation of injuries prevented and lives saved with lap/shoulder belt.

Table 10
Injuries Prevented/Lives Saved by Lap/Shoulder Belts

	Front Center	Rear Center
Passenger Cars		
MAIS 1	192	381
MAIS 2+	17	453
FATALS	7	20
Light Trucks		
MAIS 1	73	319
MAIS 2+	53	924
FATALS	15	34

An example of the calculations for passenger cars front center seat using lap/shoulder belts is:

MAIS 2^+ Injuries Prevented = potential injuries x effectiveness x belt use

MAIS 2^+ Injuries Prevented = 62 x 0.5 x .547 = 17

Lives Saved = 60 x 0.45 x 0.26 = 7

Table 11 shows the difference between Tables 9 and 10.

Table 11
Incremental Benefit of Lap/Shoulder Belts Compared to Lap Belts

	Front Center	Rear Center
Passenger Cars		
MAIS 1	0	0
MAIS 2+	7	111
FATALS	2	5
Light Trucks		
MAIS 1	0	0
MAIS 2+	8	119
FATALS	3	5

Table 12 shows the lives saved and injuries prevented from an increase in seat belt usage. For Table 12, we assume that lap/shoulder belts will increase seat belt usage by 10 percentage points over lap belts only and at the current usage rate. The estimate is based on our evaluation of

outboard lap/shoulder belts. After controlling for vehicle age and calendar year, back seat outboard belt use is 7 – 10 percentage points higher in cars with lap/shoulder belts than cars with lap belts.[3]

In addition, the UPFC will also increase due to the installation of lap/shoulder belts. The 10% markup will be added directly to the current UPFCs to reflect the updated belt usage rates. The new UPFCs due to the installation of lap/shoulder belts are:

	$UPFC_{+10\%}$	
	Front Center	Rear Center
Passenger Cars	0.358	0.289
Light Trucks	0.260	0.391

Table 12
Lives Saved/Injuries Prevented by Lap/Shoulder Belts if Observed Usage Increased by 10 Percentage Points

	Front Center	Rear Center
Passenger Cars		
MAIS 1	227	458
MAIS 2+	20	544
FATALS	10	30
Light Trucks		
MAIS 1	141	380
MAIS 2+	104	1,098
FATALS	25	46

[3] "Effectiveness of Lap/Shoulder Belts in the Back Outboard Seating Positions," Evaluation Division Plans and Policy, National Highway Traffic Safety Administration, Washington, D.C. June 1999, DOT HS 808 945.

The formula is: potential injuries x effectiveness x (belt use + 0.1)

An example calculation for AIS2+ injuries prevented in the front center seat of passenger cars is:

62 x 0.5 x (0.547 +0.1) = 20

An example calculation for lives saved in the front center seat of passenger cars is:

60 x .45 x (0.26 + 0.1) = 10

Table 13 shows the incremental benefits of lap/shoulder belts over lap belts if observed usage increased by 10 percentage points (Table 12 – Table 9).

Table 13
Incremental Benefits of Lap/Shoulder Belts If Observed Usage Increased by 10 Percentage Points

	Front Center	Rear Center	Total
Passenger Cars			
MAIS 1	35	77	112
MAIS 2+	10	202	212
FATALS	4	16	20
Light Trucks			
MAIS 1	69	60	129
MAIS 2+	59	293	351
FATALS	12	17	29
Total PC and LT			
MAIS 1	104	137	241
MAIS 2+	69	495	563
Fatals	16	33	49

In order to calculate the equivalent lives saved, the percentage of injuries at each level must be available. The following tables present the percentage distribution of AIS 2-5 injuries in the target population (see Tables 1 (a) and 1 (b)).

Table 14(a)
Annualized Percent of AIS Levels

	MAIS2	MAIS3	MAIS4	MAIS5
Passenger Cars	79.28%	15.13%	3.81%	1.78%
Light Trucks	64.22%	23.57%	5.15%	7.05%

Tables 14 (b) and 14 (c) provide the distribution of injury benefits comparing lap/shoulder belts to lap belts and lap/shoulder belts plus 10 percentage point increase in usage to lap belts, respectively.

Table 14 (b)
Annualized AIS Levels For Lap/Shoulder Belts Injury Benefits

	MAIS1	MAIS2	MAIS3	MAIS4	MAIS5
Passenger Cars					
Front Center	0	5	1	0	0
Rear Center	0	88	17	4	2
Light Trucks					
Front Center	0	5	2	0	1
Rear	0	86	32	7	9

Table 14 (c)
Incremental Annualized AIS Levels For Lap/Shoulder Belts if Usage Increased by 10 Percent

	MAIS 1	MAIS2	MAIS3	MAIS4	MAIS5
Passenger Cars					
Front Center	35	8	2	0	0
Rear Center	77	160	31	8	4
Light Trucks					
Front Center	69	38	14	3	4
Rear	60	188	69	15	21

COSTS

Table 15 (a) shows the vehicle types that would need a shoulder belt in the front and/or rear seat, the total number of vehicles in each category, and the percentage of those vehicles to the total passenger cars or light trucks sold in calendar year 2000. Table 15 (b) gives a breakout of the distribution of the number of shoulder belts that would be needed. Some vehicles will need more than one or two belts e.g., LTVs front: 173,567+390,040+1,454,651 = 2,984,386. LTVs rear: 930,315+173,567+(285,156x2)+(390,040x2)+108,738+1,454,651+(59,033x2)=5,061,079

Table 15(a)
Vehicles with lap belts in the center seats that would need a shoulder belt*

Vehicles	Total	% Cars/Light Trucks
Cars		
5 seats (1 shoulder belt)	1,580,896	17.87
6 seats (2 shoulder belts)	451,946	5.11
Total	2,032,842	22.98 of cars
SUVs		
5and 7 seats (1 shoulder belt)	930,315	10.94
6 seats (2 shoulder belts)	173,567	2.04
8 seats (2 shoulder belts)	285,156	3.35
9 seats (3 shoulder belts)	390,040	4.59
Total	1,779,078	20.92 of LTV's
Light trucks		
3 seats (1 shoulder belt)	966,128	11.36
5 seats (1 shoulder belt)	108,738	1.28
6 seats (2 shoulder belts)	1,454,651	17.11
Total	2,529,517	29.75 of LTV's
Vans		
7 seats (1 shoulder belt)	925,350	10.88
8 seats (2 shoulder belts)	59,033	0.69
Total	984,383	11.57 of LTV's

* In the above Table, 1 shoulder belt means that the vehicle has one center seat and will need one shoulder belt for that center seat, 2 shoulder belts represent two center seats that will require shoulder belts, similarly, 3 shoulder belts mean there are three center seats that will need shoulder belts.

Table 15(b)
Total Number of Belts

Vehicle Type	Front	Rear	Total
Cars	451,946	2,032,842	2,484,788
LTV's	2,984,386	5,061,079	8,045,465
Total	3,436,332	7,093,921	10,530,253

An annualized average of vehicles sold for the period 1999 to 2000 is used in the calculation of the vehicles that would require a shoulder belt in the center seat. For the period, there were 8,509,367 passenger cars sold annually. Of the passenger vehicles sold, approximately 725,279 or 8.2 percent of the passenger cars sold were either two or four seaters and did not have a center seat. Using the market distribution of passenger cars with six seating positions for 2000 as a proxy, approximately 451,946 or 5.1 percent of passenger cars have a front center seat with a lap belt. Approximately 2,032,842, or 22.98 percent, of these passenger cars would need a rear seat shoulder belt. All other passenger cars were already equipped with a center lap/shoulder belt or did not need any.

Similarly for the period, there were approximately 7,521,302 light trucks sold annually. Using the 2000 volume of light trucks with a front center position as a proxy, approximately 2.98 million or 39.68 percent of these light trucks have a lap belt in the front center seating position of the vehicle. There are approximately 5.06 million light truck rear seating positions that have a lap belt and will need a shoulder belt.

The average cost to the consumer of installing a lap/shoulder belt in the front outboard seat of passenger cars is $28.25 (in 2000$)[4]. The lap belt only portion of the lap shoulder belt for the front center seat has an average cost of $12.21 (in 2000$). The remaining $16.04 is the cost of the shoulder belt portion. This analysis assumes that lap shoulder belt systems for the center seat cost the same as for the outboard seats. However, comments are requested on the validity of this assumption.

The lap belt only portion of the lap shoulder belt for the rear center seat of passenger cars has an average cost of $12.84 (in 2000$). The cost of the shoulder belt portion of the lap/shoulder belt for the rear seat is estimated to cost $28.25 - $12.84 = $15.41.

The average cost of installing a lap/shoulder belt in the front outboard seat of light trucks is $35.79 (2000$). The higher cost of lap/shoulder belts for light trucks is due to some systems having dual retractors, longer distances to anchorage points, longer belt guides, etc. These are the results of physical differences in the geometry of the seating positions. The agency does not believe these differences in the belt systems will occur when considering center seat belts between passenger cars and light trucks. The simpler belt designs are all that are required for center seats and the agency expects the costs to be the same for passenger cars and light trucks.

[4] Fladmark,G., Khadilkar, A.V., Cost Estimates of (1) Side Impact Crash Protection of 1993/94/95 vs 1996 Model Year Passenger Cars, (2) Automatic Crash Protection of 1996 Model Year Pickup trucks, Vans and Multipurpose Passenger Vehicles, and (3) Automatic Crash Protection of Two 1996 Model Year Passenger Cars, Biodynamics Engineering, Inc., Contract # DTNH22-95-C-06006,1997.

The total cost of installing the shoulder belt portion of a lap/shoulder portion is:

Passenger cars front center seat is 451,946 x $16.04 = $7,249,214.

Passenger cars rear center seat is 2,032,842 x $15.41 = $31,326,095.

Light trucks front center seat is 2,984,386 x $16.04 = $47,869,551

Light trucks rear center seat is 5,061,079 x $15.41 = $77,991,227.

The total cost is approximately $164.46 million.

Approximately 5.11 percent (451,946) of the passenger cars, and 30.51 percent (2,018,258) of trucks and vans will need the front seat reinforced or strengthened to take the load of having the seat belt anchored to the seat. An integrated lap/shoulder belt has the upper shoulder anchorage physically attached to the seat back rather than to the vehicle structure.

Table 16
Cost of Reinforcing Front Seat and Other Free Standing Seats*

	Seat/Back Reinforcement	Anchorage and Crash Bar	Total
Vehicle MFR'S Variable Cost	$8.033	$10.059	$18.092
Consumer Cost $1993			$27.32
Consumer Cost $2000			$31.08

*Final Review, Contract DTNH22-91-D-02086 Task Order 003, Analysis of Safety Restraint Designs for Improved Belt Fit and Comfort, June 1, 1993. EASI Engineering.

Table 16 shows the cost of reinforcing the seat. The cost of strengthening the front seat of passenger cars to accommodate the shoulder belt portion of the lap shoulder belt is $14,046,482 (451,946 x $31.08). The total cost of reinforcing the front seats of passenger cars and adding the shoulder portion of the lap/shoulder belt is $21,295,696 ($14,046,482+$7,249,214). The cost of strengthening the front seat of light trucks to accommodate the shoulder belt portion of the lap shoulder belt is $62,727,459 (2,018,258 x $31.08). The total cost of reinforcing the front seats of light trucks and adding the shoulder portion of the lap/shoulder belt is $110,597,010 ($47,869,551+$62,727,459).

The rear seat of passenger cars and pickup trucks do not need to be reinforced to anchor the center seat lap/shoulder belts. The anchors can be attached to the back package shelf or down to the floor frame of the vehicle without impinging on floor space for occupants sitting behind them or trunk cargo space. This is not the case for passenger vans and SUVs. In their case the floor space where you might want to put an anchorage is valuable occupant or cargo space. Thus, we assume that the anchorage will be attached to the seat and they will be reinforced at a cost of $31.08 per seating position.

Some vans and SUVs have two rows of seats that will have to be strengthened. The seats to be strengthened to accommodate the shoulder belt portion the lap/shoulder belt are 3,497,690 (1,779,078+984,383+285,156+390,040+59,033). The cost of strengthening the rear seats of vans and SUVs to accommodate the shoulder portion of the lap shoulder belt is $108,708,205 (3,497,690 x $31.08). The total cost of reinforcing the rear seat of LTVs and adding the shoulder

belt portion of the lap/shoulder belt is $186,699,432 ($108,708,205 + $77,991,227).

These costs are summarized in Table 17.

Table 17
Summary of Costs Required to Add Lap/Shoulder Belt

	Added Belt	Strengthening Seat	Total
Passenger Car Front	$7,249,214	$14,046,482	$21,295,696
Passenger Car Rear	$31,326,095	NA	$31,326,095
LTVs Front	$47,869,551	$62,727,459	$110,597,010
LTVs Rear	$77,991,227	$108,708,205	$186,699,432
Total	$164,436,087	$185,482,146	$349,918,233

NA = Not Applicable

LEAD TIME

Anton's law requires that NHTSA issue a final rule no later than December, 2004. It further specifies that the final rule be implemented, in stages, starting no later than September 1, 2005 and be fully implemented no later than September 1, 2007. The agency is proposing the following phase-in schedule:

- MY 06 (September 1, 2005 through August 31, 2006): 50 % of all vehicles produced by manufacturers subject to the phase-in must comply. Advance credits are allowed on a one-to-one basis.
- MY 07 (September 1, 2006 through August 31, 2007): 80% of all vehicles produced by manufacturers subject to the phase-in must comply. Advance credits are allowed on a one-to-one basis.
- September 1, 2007: all vehicles, regardless of whether they are subject to the phase-in, must comply. No advance credits are allowed.

The agency is proposing to exclude vehicles manufactured in two or more stages and altered vehicles from the phase-in requirements. Final stage manufacturers have no control over the vehicles that the previous-stage manufacturer decides to use to meet the phase-in requirements. Accordingly, the final-stage manufacturer may have little or no choice in purchasing an incomplete vehicle that meets the requirements of the proposed rule. While alterers have more control, since they are only purchasing completed vehicles, they may have limited control over purchasing completed, certified vehicles in a manner that allows them to meet the phase-in requirements. This is because, as with the final-stage manufacturers, the end customer often

makes the final decision as to which type of vehicle it wishes to purchase. All multi-stage and altered vehicles manufactured on or after September 1, 2007 must be certified as complying with the new requirements.

The agency is proposing to also exclude small volume manufacturers (i.e., manufacturers of less than 5,000 vehicles per year produced for the U.S. market) from the phase-in because of their small size.

The agency is proposing to allow manufacturers of two or fewer vehicle lines to opt out of the first year of the phase-in as long as 100% of their vehicles are certified as complying with the new requirements during the second year of the phase-in.

COST EFFECTIVENESS

This section combines costs and benefits to provide a comparison of the estimated injuries and lives saved per dollar spent. It should be noted that costs occur when the vehicle is purchased, but benefits accrue over the lifetime of the vehicle. Benefits must therefore be discounted to reflect their present value and to put them on a common basis with costs.

In some instances, costs may exceed economic benefits, and in these cases, it is necessary to derive a net cost per equivalent fatality prevented. An equivalent fatality is defined as the sum of fatalities and nonfatal injuries prevented converted into fatality equivalents. This conversion is accomplished using the relative values of fatalities and injuries measured using a "willingness-to-pay" approach. This approach measures individuals' willingness to pay to avoid the risk of death or injury based on societal behavioral measures, such as pay differentials for more risky jobs.

Table 18 presents the relative estimated rational investment level to prevent one injury, by maximum injury severity. The data represent average costs for crash victims of all ages. MAIS is an anatomically based system that classifies individual injuries by body region on a six point ordinal scale of risk to life. Injuries are assumed to be valued based on the relative costs of MAIS injuries[5].

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[5] The relative value of an MAIS 1 injury was estimated by subtracting from MAIS 1 comprehensive costs the costs of travel delay and property damage. This calculation is:($15,017-$777-$3,844=$10,346), where $777 is travel delay and $3,844 is property damage. Dividing this by the total comprehensive costs for a fatality (3,366,388-19,412) gives .0031(10,396/3,346,976) to four decimal places. The MAIS figures are taken from The Economic Impact of Motor Vehicle Crashes 2000", page 62.

Table 18 shows the estimated equivalent fatalities for adding a shoulder belt to the lap portion of a center seat.

Table 18
Comprehensive Fatality and Injury Relative Values

Injury Severity	2000 Relative Value* per injury
MAIS 1	.0031
MAIS 2	.0458
MAIS 3	.0916
MAIS 4	.2153
MAIS 5	.7124
Fatals	1.000

*Includes the economic cost components and valuation for reduced quality of life

Tables 19 (a) and (b) show the equivalent fatalities for passenger cars and light trucks under an assumed usage increase by 10 percentage points from Tables 13 and 14 (c).

Table 19(a)
Equivalent Fatalities
Passenger Cars Front and Rear Center Seats

	Injury Benefits		Equivalent Fatalities	
	Front	Rear	Front	Rear
MAIS 1	35	77	(35*.0031)=0.11	(77*.0031)=0.24
MAIS 2	8	160	(8*.0458)=0.37	(160*.0458)=7.34
MAIS 3	2	31	(2*0.0916)=0.18	(30*0.0916)=2.75
MAIS 4	0	8	(0*0.2153)=0.0	(8*0.2153)=1.72
MAIS 5	0	4	(0*0.7124)=0.0	(4*0.7124)=2.85
Fatals	4	16	4	16
Total			5.09*	30.58*

* Difference between actual total and the sum of equivalent fatalities in the above table is due to the level of precision in the original calculations.

Table 19(b)
Equivalent Fatalities
Light Trucks Front and Rear Center Seats

	Injury Benefits		Equivalent Fatalities	
	Front	Rear	Front	Rear
MAIS 1	69	60	(69*.0031) =0.21	(60*.0031)=.19
MAIS 2	38	188	(38*.0458) =1.74	(188*.0458)=8.61
MAIS 3	14	69	(14*.0916) =1.28	(69*.0916)=6.32
MAIS 4	3	15	(3*.2153) =0.65	(15*.2153)=3.25
MAIS 5	4	21	(4*.7124) =2.85	(21*.7124)=14.70
Fatals	12	17	12	17
Total			18.85*	49.57*

* Difference between actual total and the sum of equivalent fatalities is the above table is due to the level of precision in the original calculations.

The following is an example of the calculation of the cost per equivalent fatalities for adding a shoulder belt to the lap belt portion of the center seat and the cost of free-standing seat reinforcement seats before discounting.

Cost/Equivalent Fatal Before Discounting

Passenger cars front $21.3 million /5.09 = $4.18 million

Passenger cars rear: $31.3 million /30.58 = $1.02 million

Total passenger cars: $52.6 million/35.67 =$1.48 million

Light trucks front: $110.6 million /18.85 = $5.87 million

Light trucks rear: $186.7 million /49.57 = $3.77 million

Total trucks: $297.3 million/68.42 = 4.35 million

Appendix V of the "Regulatory Program of the United States Government, April 1, 1990 - March 31,1991", sets out guidance for regulatory impact analyses. One of the guidelines deals with

discounting the monetary values of benefits and costs occurring in different years to their present value so that they are comparable. Historically, the agency has discounted future benefits and costs when they were monetary in nature. For example, the agency has discounted future increases in fuel consumption due to the increased weight caused by safety countermeasures, or decreases in property damage crash costs when a crash avoidance standard reduced the incidence of crashes, such as with center high-mounted stop lamps. The agency has not assigned dollar values to the reduction in fatalities and injuries, thus those benefits have not been discounted. The agency performs a cost-effectiveness analysis resulting in an estimate of the cost per equivalent life saved, as shown on the previous pages. The guidelines state, "An attempt should be made to quantify all potential real incremental benefits to society in monetary terms of the maximum extent possible." For the purposes of the cost-effectiveness analysis, the Office of Management and Budget (OMB) has requested that the agency compound costs or discount the benefits to account for the different points in time that they occur.

There is general agreement within the economic community that the appropriate basis for determining discount rates is the marginal opportunity costs of lost or displaced funds. When these funds involve capital investment, the marginal, real rate of return on capital must be considered. However, when these funds represent lost consumption, the appropriate measure is the rate at which society is willing to trade off future for current consumption. This is referred to as the social rate of time preference, and it is generally assumed that the consumption rate of interest, i.e. the real, after- tax rate of return on widely available savings instruments or investment opportunities, is the appropriate measure of its value.

Estimates of the social rate of time preference have been made by a number of authors. Robert Lind[6] estimated that the social rate of time preference is between zero and 6 percent, reflecting the rates of return on Treasury bills and stock market portfolios. Kolb and Sheraga[7] put the rate at between one and five percent, based on returns to stocks and three month Treasury bills. Moore and Viscusi[8] calculated a two percent real time rate of time preference for health, which they characterize as being consistent with financial market rates for the period covered by their study. Moore and Viscusi's estimate was derived by estimating the implicit discount rate for deferred health benefits exhibited by workers in their choice of job risk.

Four different discount values are shown as a sensitivity analysis. The 2 and 4 percent rates represent different estimates of the social rate of time preference for health and consumption. The 10 percent figure was required by OMB Circular A-94, until October 29,1992. The 7 percent figure is the current OMB requirement, which represents the marginal pretax rate of return on an average investment in the private sector in recent years.

Safety benefits occur when there is a crash severe enough to potentially result in occupant death and injury, which could be at any time during the vehicle's lifetime. For this analysis, the agency

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[6]Lind, RC, A primer on the Major Issues Relating to the Discount Rate for Evaluating National Energy Options, in Discounting for Time and Risks in Energy Policy, 1982, (Washington, D.C. Resources for the Future, Inc.).

[7]J. Kolb and J.D. Sheraga, A Suggested Approach for Discounting the Benefits and Costs of Environmental Regulations, unpublished working papers.

[8]Moore, M.J., and Viscusi, W.K.,Discounting Environmental Health Risks: New Evidence and Policy Implications, Journal of Environmental Economics and Management, V.18, No. 2, March 1990, part 2 of 2.

assumes that the distribution of weighted yearly vehicle miles traveled is an appropriate proxy measure for the distribution of such crashes over the vehicle's lifetime (see Tables 20(a and b)).

Table 20(a)
Passenger Cars Vehicle Miles Traveled and Discount Factor

Passenger Cars						
Vehicle Age (Years)	'VMT	Survival Probability	Weighted 'VMT	Fraction of 'VMT	7 Percent Mid-Year Discount Factor	7 Percent Present Discount Value Factor
1	13533	0.995	13465.3	0.1063	0.9667	0.1028
2	12989	0.988	12833.1	0.1013	0.9035	0.0915
3	12466	0.978	12191.7	0.0962	0.8444	0.0813
4	11964	0.962	11509.4	0.0909	0.7891	0.0717
5	11482	0.938	10770.1	0.0850	0.7375	0.0627
6	11020	0.908	10006.2	0.0790	0.6893	0.0544
7	10577	0.87	9202.0	0.0726	0.6442	0.0468
8	10151	0.825	8374.6	0.0661	0.602	0.0398
9	9742	0.775	7550.1	0.0596	0.5626	0.0335
10	9350	0.721	6741.4	0.0532	0.5258	0.0280
11	8974	0.644	5779.3	0.0456	0.4914	0.0224
12	8613	0.541	4659.6	0.0368	0.4593	0.0169
13	8266	0.445	3678.4	0.0290	0.4292	0.0125
14	7933	0.358	2840.0	0.0224	0.4012	0.0090
15	7614	0.285	2170.0	0.0171	0.3749	0.0064
16	7308	0.223	1629.7	0.0129	0.3504	0.0045
17	7014	0.174	1220.4	0.0096	0.3275	0.0032
18	6731	0.134	902.0	0.0071	0.326	0.0023
19	6460	0.103	665.4	0.0053	0.286	0.0015
20	6200	0.079	489.8	0.0039	0.2673	0.0010
		11.946	126,678	1		0.6922

Table 20(b)
Light Trucks Vehicle Miles Traveled and Discount Factor

Light Trucks						
Vehicle Age (years)	Vehicle Miles Traveled	Survival Probability	Weighted Vehicle Miles Traveled	Fraction of Total VMT	7 Percent Mid-Year Discount Factor	7 Percent Present Discounted Value Factor
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1	12,885	0.998	12,859	0.0839	0.9667	0.0811
2	12,469	0.995	12,407	0.0809	0.9035	0.0731
3	12,067	0.989	11,934	0.0778	0.8444	0.0657
4	11,678	0.980	11,444	0.0746	0.7891	0.0589
5	11,302	0.967	10,929	0.0713	0.7375	0.0526
6	10,938	0.949	10,380	0.0677	0.6893	0.0467
7	10,585	0.924	9,781	0.0638	0.6442	0.0411
8	10,244	0.894	9,158	0.0597	0.602	0.0360
9	9,914	0.857	8,496	0.0554	0.5626	0.0312
10	9,594	0.816	7,829	0.0511	0.5258	0.0268
11	9,285	0.795	7,382	0.0481	0.4914	0.0237
12	8,985	0.734	6,595	0.0430	0.4593	0.0198
13	8,696	0.669	5,818	0.0379	0.4292	0.0163
14	8,415	0.604	5,083	0.0332	0.4012	0.0133
15	8,144	0.539	4,390	0.0286	0.3749	0.0107
16	7,882	0.476	3,752	0.0245	0.3504	0.0086
17	7,628	0.418	3,189	0.0208	0.3275	0.0068
18	7,382	0.364	2,687	0.0175	0.326	0.0057
19	7,144	0.315	2,250	0.0147	0.286	0.0042
20	6,913	0.217	1,873	0.0098	0.2673	0.0026
21	6,691	0.232	1,552	0.0101	0.2498	0.0025
22	6,475	0.196	1,282	0.0083	0.2335	0.0019
23	6,266	0.169	1,059	0.0069	0.2182	0.0015
24	6,064	0.143	867	0.0057	0.2039	0.0012
25	5,869	0.121	710	0.0046	0.1906	0.0009
			---	---		
			153,706	1.0000		0.6315

Multiplying the percent of a vehicle's total lifetime mileage that occurs in each year by the discount factor and summing these percentages over the 20 (passenger cars) or 25 (LTV's) years of the vehicle's operating life, results in the following multipliers for the average of passenger cars and light trucks as shown in Table 21.

Table 21
Discounting Multipliers

	2 Percent	4 Percent	7 Percent	10 Percent
Passenger Cars	0.8906	0.8004	0.6921	0.6078
Light Trucks	0.8625	0.7545	0.6315	0.5409
PC/LT Average	0.8766	0.7775	0.6618	0.5744

These values are multiplied by the equivalent lives saved to determine their present value (e.g., Table 22(a) 5.09 x 0.8906 = 4.53). The costs per equivalent life saved for passenger cars and light trucks are then recomputed and shown in Table 22(b) and 23(b) (e.g., $21.3 million/4.53 = $4.70 million, $21.3 million/3.52 = $6.04 million).

Table 22(a)
Equivalent Lives Saved

Base Equivalent	2 Percent	4 Percent	7 Percent	10 Percent
Lap/Shoulder belt	X .8906	X .8004	X .6921	X .6078
Passenger Car Front = 5.09	4.53	4.07	3.52	3.09
Passenger Car Rear = 30.58	27.24	24.48	21.17	18.59
Total = 35.67	31.77	28.55	24.69	21.68

Table 22(b)
Costs per Equivalent Life Saved (in millions)

Lap/Shoulder Belt	Undiscounted	2 percent	4 percent	7 percent	10 percent
Passenger Car Front ($21.3)	$4.18	$4.70	$5.23	$6.04	$6.88
Passenger Car Rear ($31.3)	$1.02	$1.15	$1.28	$1.48	$1.69
Total = $52.6	$1.48	$1.66	$1.84	$2.13	$2.43

Table 23(a)
Equivalent Lives Saved

Base Equivalent	2 Percent	4 Percent	7 Percent	10 Percent
Light Truck Front = 18.85	16.26	14.22	11.90	10.20
Light Truck Rear = 49.57	42.75	37.40	31.30	26.81
Total = 68.42	59.01	51.62	43.21	37.01

Table 23(b)
Costs per Equivalent Life Saved (in millions)

Lap/Shoulder Belt	Undiscounted	2 percent	4 percent	7 percent	10 percent
Light Truck Front ($110.6)	$5.87	$6.80	$7.78	$9.29	$10.85
Light Truck Rear ($186.7)	$3.77	$4.37	$4.99	$5.96	$6.96
Total = $297.3	$4.35	$5.04	$5.76	$6.88	$8.03

UNFUNDED MANDATES REFORM ACT ANALYSIS

The Unfunded Mandates Reform Act of 1995 (Public Law 104-4) requires agencies to prepare a written assessment of the costs, benefits and other effects of proposed or final rules that include a Federal mandate likely to result in the expenditure by State, local or tribal governments, in the aggregate, or by the private sector, of more than $100 million annually.

These effects have been discussed in detail in previous sections of this Preliminary Economic Assessment, see sections on "Cost," and "Benefits." To summarize, NHTSA is issuing this proposed rule to require lap/shoulder belts in the rear seats of passenger vehicles. The proposed rule will improve the safety of individuals traveling in the rear center seats in passenger vehicles. The cost of the proposed rule to put a shoulder belt in the rear seats of passenger vehicles is estimated to be $218 million (see Table 17).

SMALL BUSINESS IMPACTS

A. Regulatory Flexibility Act

The Regulatory Flexibility Act of 1980 (5 U.S.C. §601 et seq.) requires agencies to evaluate the potential effects of their proposed and final rules on small businesses, small organizations and small governmental jurisdictions.

Small Vehicle Manufacturers

Currently, there are about 4 small motor vehicle manufacturers of passenger cars in the United States. As far as we know, all four of these manufacturers make sports cars that have two seats in the front and have either no seats in the rear or two seats in the rear. Thus, we don't believe that any of these vehicles have center seating positions. Comments are requested on whether this is actually the case. There are no small motor vehicle manufacturers of light trucks or multi-purpose vehicles at this time that the agency is aware of.

There are a large number of van converters that are small businesses that would be affected by the proposal, since they would have to provide lap/shoulder belts at center seating positions. As with other systems in the vehicle, these manufacturers will have to rely on suppliers to provide the hardware, and then they would have to integrate the system into their vehicles. The agency is providing an alternative for the small vehicle manufacturers to meet the final rule in the last year of the phase-in period, giving them as much lead time as possible. The agency does not believe this will cause a significant economic burden on these manufacturers.

CUMULATIVE IMPACTS

Section 1(b) II of Executive Order 12866 Regulatory Planning and Review requires the agencies to take into account to the extent practicable "the costs of cumulative regulations". To adhere to this requirement, the agency has decided to examine both the costs and benefits by vehicle type of all substantial final rules with a cost or benefit impact effective from MY 1990 or later. In addition, proposed rules are also identified and preliminary cost and benefit estimates provided.

Costs include primary cost, secondary weight costs and the lifetime discounted fuel costs for both primary and secondary weight. Costs will be presented in two ways, the cost per affected vehicle and the average cost over all vehicles. The cost per affected vehicle includes the range of costs that any vehicle might incur. For example, if two different vehicles need different countermeasures to meet the standard, a range will show the cost for both vehicles. The average cost over all vehicles takes into account voluntary compliance before the rule was promulgated or planned voluntary compliance before the rule was effective and the percent of the fleet for which the rule is applicable. Costs are provided in 2000 dollars, using the implicit GNP deflator to inflate previous estimates to 2000 dollars.

Benefits are provided on an annual basis for the fleet once all vehicles in the fleet meet the rule. Benefit and cost per average vehicle estimates take into account voluntary compliance.

Table 24
COSTS OF RECENT PASSENGER CAR RULEMAKINGS
(Includes Secondary Weight and Fuel Impacts)
(2000 Dollars)

Description	Effective Model Year	Cost Per Affected Vehicle $	Cost Per Average Vehicle $
FMVSS 114, Key Locking System to Prevent Child-Caused Rollaway	1993	$9.44 – 19.58	$0.53 - 1.08
FMVSS 214, Dynamic Side Impact Test	1994 - 10% phase-in 1995 - 25% 1996 - 40% 1997 – 100%	$69.06 – 672.59	$62.52
FMVSS 208, Locking Latch Plate for Child Restraints	1996	$0.89 – 17.93	$2.40
FMVSS 208, Belt Fit	1998	$3.41 – 17.09	$1.26 - 1.82
FMVSS 208, Air Bags Required	1997 - 95% 1998 – 100	$503.50 – 608.39	$503.50 – 608.39
FMVSS 201, Upper Interior Head Protection	1999 - 10% 2000 - 25% 2001 - 40% 2002 - 70% 2003 – 100%	$37.76	$37.76
FMVSS 225, Child Restraint Anchorage Systems	2001 - 20% 2002 - 50% 2003 - 100%	$3.01 - $7.08	$6.07
FMVSS 208, Advanced Air Bags	two phases 2003 to 2010	$24.15 to 134.40	Depends on method chosen to comply
FMVSS 138 Tire Pressure Monitoring System	1-1-03 10% 1-1-04 35% 1-1-05 65% 1-1-06 100%	$39.90 to $105.74 ($66.50 + $39.24 in maintenance costs)	$46.84

Table 25

BENEFITS OF RECENT PASSENGER CAR RULEMAKINGS

(Annual benefits when all vehicles meet the standard)

Description	Fatalities Prevented	Injuries Reduced	Property Damage Savings $
FMVSS 114, Key Locking System to Prevent Child Caused Rollaway	None	50-99 Injuries	Not Estimated
FMVSS 214, Dynamic Side Impact Test	512	2,626 AIS 2-5	None
FMVSS 208, Locking Latch Plate for Child Restraints	Not estimated	Not estimated	None
FMVSS 208, Air Bags Required Compared to 12.5% Usage in 1983 Compared to 46.1% Usage in 1991	 4,570 - 9,110 2,842 - 4,505	AIS 2-5 85,930 - 155,090 63,000 - 105,000	None
FMVSS 201, Upper Interior Head Protection	575 - 711	251 - 465 AIS 2-5	None
FMVSS 225, Child Restraint Anchorage Systems – Benefits include changes to Child Restraints in FMVSS 213	36 to 50*	1,231 to 2,929*	None
FMVSS 208, Advanced Air Bags	117 to 215**	584 to 1,043 AIS 2-5**	Up to $85 per vehicle*
FMVSS 138 Tire Pressure Monitoring System	40	2,588	$1.32 in fuel and tread wear savings

* Total benefits for passenger cars and light trucks

** Total benefits for passenger cars and light trucks, does not count potential loss in benefits if air bags are significantly depowered.

Table 26
COSTS OF PROPOSED PASSENGER CAR RULES
(Includes Secondary Weight and Fuel Impacts)
(2000 Dollars)

Description	Effective Model Year	Cost Per Affected Vehicle $	Cost Per Average Vehicle $
FMVSS 301, Fuel Tank Integrity Upgrade	TBD – first model year starting 3 years after final rule	$5.00	$2.30
FMVSS 202, Head Restraint Upgrade	TBD – first model year starting 3 years after final rule	$8.10 to $17.15	$10.70

Table 27
BENEFITS OF PROPOSED PASSENGER CAR RULES
(Annual benefits when all vehicles meet the standard)

Description	Fatalities Prevented	Injuries Reduced	Property Damage Savings $
FMVSS 301, Fuel Tank Integrity Upgrade	4 to 11	none	none
FMVSS 202, Head Restraint Upgrade	None	12,395	None

* Total benefits for passenger cars and light trucks
** Total benefits for passenger cars and light trucks, does not count potential loss in benefits if air bags are significantly depowered.

Table 28
COSTS OF RECENT LIGHT TRUCK RULEMAKINGS
(Includes Secondary Weight and Fuel Impacts)
(2000 Dollars)

Description	Effective Model Year	Cost Per Affected Vehicle $	Cost Per Average Vehicle $
FMVSS 202, Head Restraints	1992	$46.87 – 113.70	$5.54
FMVSS 204, Steering Wheel Rearward Displacement for 4,000 to 5,500 lbs. unloaded	1992	$6.05 – 29.95	$1.07 – 2.03
FMVSS 208, Rear Seat Lap/Shoulder Belts	1992	$69.25	$0.41
FMVSS 114, Key Locking System to Prevent Child-Caused Rollaway	1993	$9.44 – 19.58	$0.01 - 0.03
FMVSS 208, Locking Latch Plate for Child Restraints	1996	$0.89 - 17.92	$2.40
FMVSS 108, Center High-Mounted Stop Lamp	1994	$15.06 – 22.76	$15.53
FMVSS 214, Quasi-Static Test (side door beams)	1994 – 90% 1995 – 100	$67.38 – 84.50	$62.45 – 78.45
FMVSS 216, Roof Crush for 6,000 lbs. GVWR or less	1995	$24.81 – 222.65	$0.89 – 8.82
FMVSS 208, Belt Fit	1998	$3.77 – 17.83	$6.44 - 8.68
FMVSS 208, Air Bags Required	1998 – 90% 1999 – 100	$503.50 – 608.39 dual air bags	$503.50 – 608.39 dual air bags
FMVSS 201, Upper Interior Head Protection	1999 – 10% 2000 - 25% 2002 - 70% 2003 - 100%	$37.40 – 81.90	$57.72
FMVSS 225, Child Restraint Anchorage Systems	2001 – 20% 2002 - 50% 2003 - 100%	$3.01 - $7.08	$6.07
FMVSS 208, Advanced Air Bags	two phases 2003 to 2010	$24.15 to 134.40	Depends on method chosen to comply
FMVSS 138 Tire Pressure Monitoring System	1-1-07 10% 1-1-08 35% 1-1-09 65% 1-1-10 100%	$39.90 to $108.89 ($66.50 + $43.39 in maintenance costs)	$46.84

Table 29
BENEFITS OF RECENT LIGHT TRUCK RULEMAKINGS
(Annual benefits when all vehicles meet the standard)

Description	Fatalities Prevented	Injuries Reduced	Property Damage Savings $
FMVSS 202, Head Restraints	None	470 - 835 AIS 1 20 - 35 AIS 2	None
FMVSS 204, Steering Wheel Rearward Displacement for 4,000 to 5,500 lbs. Unloaded	12 – 23	146 - 275 AIS 2-5	None
FMVSS 208, Rear Seat Lap/Shoulder Belts	None	2 AIS 2-5	None
FMVSS 114, Key Locking System to Prevent Child Caused Rollaway	None	1 Injury	Not Estimated
FMVSS 208, Locking Latch Plate for Child Restraint	Not estimated	Not estimated	None
FMVSS 108, Center High Mounted Stop Lamp	None	19,200 to 27,400 Any AIS Level	$119 to 164 Million
FMVSS 214, Quasi-Static Test (side door beams)	58 – 82	1,569 to 1,889 hospitalizations	None
FMVSS 216, Roof Crush for 6,000 lbs. GVWR or less	2 – 5	25-54 AIS 2-5	None
FMVSS 208, Belt Fit	9	102 AIS 2-5	None
FMVSS 208, Air Bags Required Compared to 27.3% Usage in 1991	1,082 – 2,000	21,000 - 29,000 AIS 2-5	None
FMVSS 201, Upper Interior Head Protection	298 – 334	303 - 424	None
FMVSS 225, Child Restraint Anchorage Systems – Benefits include changes to Child Restraints in FMVSS 213	36 to 50*	1,231 to 2,929*	None
FMVSS 208, Advanced Air Bags	117 to 215**	584 to 1,043 AIS 2-5**	Up to $85 per vehicle*
FMVSS 138 Tire Pressure Monitoring System	39	2,588	$3.85 in fuel and tread wear savings

* Total benefits for passenger cars and light trucks
** Total benefits for passenger cars and light trucks, does not count potential loss in benefits if air bags are significantly depowered.

Table 30
COSTS OF PROPOSED LIGHT TRUCK RULES
(Includes Secondary Weight and Fuel Impacts)
(2000 Dollars)

Description	Effective Model Year	Cost Per Affected Vehicle $	Cost Per Average Vehicle $
FMVSS 301, Fuel Tank Integrity Upgrade	TBD – 3 years after final rule	$5.00	$2.30
FMVSS 202, Head Restraint Upgrade	TBD -	$8.10 to $17.15	$10.70

Table 31
BENEFITS OF PROPOSED LIGHT TRUCK RULES
(Annual benefits when all vehicles meet the standard)

Description	Fatalities Prevented	Injuries Reduced	Property Damage Savings $
FMVSS 301, Fuel Tank Integrity Upgrade	4 to 10	none	none
FMVSS 202, Head Restraint Upgrade	None	1,852	None