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Fifth / Sixth Report to Congress

Effectiveness of Occupant Protection Systems and Their Use

National Highway Traffic Safety Administration
U. S. Department of Transportation
Washington, D.C. 20590

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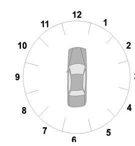
TABLE OF CONTENTS

EXECUTIVE SUMMARY

The Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991, enacted by Congress on December 18, 1991, directed the Secretary of Transportation to report on the effectiveness of occupant protection systems based on their actual use, and on lap and shoulder belt use by the public and various groups at both the State and national levels (Section 2508 (e)). This report is the Fifth/Sixth Report to Congress on the effectiveness of occupant protection systems and safety belt use. The major findings of this report are presented below:

System Effectiveness[1]

- The following statistics are updated from the previous report (dated May 1999) using additional data that have become available since its publication.



- Air bags provide **fatality protection** in potentially fatal crashes. Drivers protected by air bags experienced reduced fatality risk of 29 percent in purely frontal crashes (12:00 point of impact on the vehicle), 20 percent in all frontal crashes (10:00 to 2:00), and 12 percent in all crashes.

- It is estimated that air bags have saved 7,224 lives from 1987 through July 1, 2001.

- Driver air bags appear to be as effective in reducing fatality risk in purely frontal crashes for light trucks (29 percent) as they are in passenger cars (29 percent).

- Air bags provide about a 11 percent reduction in fatality risk for the belted driver (relative to a belted driver without air bags), and 14 percent for the unbelted driver in all crashes.

- Air bags and lap-shoulder belts when used together have an estimated 51 percent fatality-reducing effectiveness.

- In purely frontal crashes, passenger air bags appear to be about as effective (32 percent) for right-front passengers age 13 and older as driver air bags (29 percent) are for drivers.

- Concerning **overall injury reduction for drivers**, for serious injury, the air bag plus a lap-shoulder belt (when used) and manual lap-shoulder belts alone each provided about 68 percent reduction in injury risk, while automatic belts exhibited 43 percent effectiveness when they were used. The estimated effectiveness of the air bag alone was 30 percent (not statistically significant).

- The combination of an air bag plus use of the lap-shoulder belt provides the greatest moderate injury protection (73 percent) followed by manual lap-shoulder belts (60 percent), automatic belts (46 percent) and the air bag alone (29 percent, non-significant).

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[1] Estimates of effectiveness shown in this report are statistically significant at p=.01 unless otherwise noted. When estimates of injury reduction were non-significant, they were usually based on small sample sizes.

- As of July 1, 2001, NHTSA has confirmed 116 crashes where the deployment of the passenger-side air bag resulted in a fatal injury to a child 12 years old or younger in a crash with speed change less than 25 mph. Nineteen of these children were in a rear facing child seat and the remaining 97 were not. The rate of confirmed and unconfirmed child passenger-air-bag-related fatalities per registered air-bag-equipped vehicles has steadily declined since 1995-96.

Public Information and Rulemaking

The following summary covers rulemaking activities that have occurred since the previous report. A summary of rulemaking activities between 1995 and 1998 is supplied in the Appendix.

- NHTSA had published a Notice of Proposed Rulemaking dealing with advanced air bags on September 18, 1998 that gave manufacturers and suppliers the maximum benefits of emerging advanced air bag technology.

- In November 1998, NHTSA conducted two public meetings to discuss the September NPRM on the agency's proposed injury criteria and to present data on high-speed crash test options. NHTSA received 67 initial comments from vehicle manufacturers, organizations and the public.

- As a result of these and other interactions with the public, NHTSA prepared a Supplemental Notice of Proposed Rulemaking, which refined many of the issues, deleted redundant requirements and focused on the most important performance requirements. For example, the SNPRM proposed a new neck injury criteria formulation employing revised critical intercept values based on comments to the September NPRM.

- On May 12, 2000, NHTSA published an interim final rule that amended Standard No. 208, Occupant Crash Protection, to require that future air bags be designed to create less risk of serious air bag-induced injuries than current air bags, particularly for small adults and young children; and provide improved frontal crash protection for all occupants, by means that include advanced air bag technology.

- Concurrent with the advanced air bag rulemaking, the agency issued final rules (January-March 2000) to add four sizes of test dummies to the battery of test devices used by the agency, including: the 12-month-old infant, 3-year-old child, 6-year-old child, and 5^{th} percentile adult female.

- After considering eight petitions for reconsideration to the interim final rule, NHTSA published a final rule; response to petitions for reconsideration in the Federal Register on December 18, 2001, in which some of the petitions were granted and some denied.

Seat Belt Use

- The Department and NHTSA continued support of the *National Initiative to Increase Seat Belt Use*, a program designed to increase nationwide seat belt and child safety seat use, including: (1) the formation of public-private partnerships; (2) improved seat belt and child passenger safety legislation; (3) high visibility enforcement of those laws; and, (4) intensive public information and education programs.

- Nationally, the overall observed seat belt use rate, based on NHTSA's 2001 National Occupant Protection Use Survey (MiniNOPUS) was 73 percent, compared to 71 percent observed in 2000, 69 percent observed in 1998 and 61 percent observed in 1996.

- Belt use is about the same for passenger car occupants (76 percent) and occupants of vans and sport utility vehicles (75 percent). Belt use for pickup truck occupants is significantly lower (62 percent).

- Regionally, overall shoulder belt use is highest in the West (77 percent) and the South (76 percent); it is lowest in the Northeast (62 percent), and the Midwest is in between at 72 percent.

- Results from State safety belt use surveys conducted during 2000 ranged from a high of 89 percent in California to a low of about 48 percent in North Dakota.

- California, New Mexico, Maryland, and Puerto Rico reported use rates of 85 percent or higher.

- States with the highest increase in use rates from 1999 to 2000 include Michigan (70 percent to 84 percent), Alabama (58 percent to 71 percent) and New Jersey (63 percent to 74 percent). Each of these States introduced a standard enforcement seat belt use law in 2000.

- Since 1997, six States (Maryland, Indiana, Oklahoma, Alabama, New Jersey, Michigan) and the District of Columbia passed a standard seat belt enforcement law.

- States that have standard enforcement of seat belt laws have always out-performed secondary law States. In 2001, belt use was 11 percentage points higher (78 vs. 67 percent) in standard law States than in secondary law States.

- Executive Order 13043, issued in 1997, required seat belt use by all federal employees on the job, all motor vehicle occupants in national parks, and all motor vehicle occupants in defense installations. The Executive Order also recommends that there be seat belt use policies and programs for federal contractors, grantees, and Tribal governments. Belt use information is not routinely collected for the military, government employees, or law enforcement personnel; however, based upon the existence of Executive Order 13043, training programs, and promotional campaigns, use among these groups is expected to be higher than in the general population.

Section I -- BACKGROUND

History of FMVSS 208 Requirements

Federal Motor Vehicle Safety Standard (FMVSS) 208 ("Occupant Crash Protection"), as amended on July 17, 1984, required that automatic occupant protection, such as air bags or automatic belts, be phased into passenger cars during 1987-1990. When the National Highway Traffic Safety Administration (NHTSA) issued FMVSS 208, it also began a nationwide effort to increase belt use through encouragement of State buckle-up laws, enforcement and public education. While the use of manual lap-shoulder belts has been determined to reduce the risk of fatal injury to front-seat occupants by 45 percent, in 1983 only 14 percent of the general driver population buckled up. Initially, automatic belts installed in response to FMVSS 208 helped increase belt use. In the long run, however, NHTSA believed that the best protection would come from air bags in combination with State buckle-up laws to ensure high rates of belt use.

FMVSS 208's automatic occupant protection phase-in requirements were: 10 percent of model year 1987 passenger cars, 25 percent of model year 1988, 40 percent of model year 1989, and all cars manufactured after September 1, 1989 (or model year 1990). FMVSS 208 was later amended to allow an exclusion from the automatic protection requirement for the right-front passenger position until September 1, 1993, if an air bag was installed for the driver. All vehicles manufactured after September 1, 1993, are required to have automatic protection for the driver and right-front passenger. The 1987-1990 phase-in schedule of the automatic occupant protection requirement was successful.

The two components of NHTSA's occupant protection program have reinforced each other. FMVSS 208 initially offered a more lenient equipment standard for newer cars if a certain proportion of the nation had safety belt laws, and thus encouraged the adoption of state "buckle-up" laws. In 1983, prior to FMVSS 208 (as amended), no State had a belt use law. Currently, 49 States (all except New Hampshire) plus the District of Columbia, Puerto Rico, and the Territories have safety belt use laws. In addition, national safety belt use, as estimated from State reported belt use rates, has risen dramatically from 14 percent in 1983 to 73 percent in 2001.

The Intermodal Surface Transportation Efficiency Act (ISTEA), passed by the Congress in 1991, required all passenger cars manufactured after September 1, 1997, and light trucks manufactured after September 1, 1998, to have driver and passenger air bags, and manual lap-shoulder belts. Also in 1991, NHTSA extended the automatic occupant protection requirements to light trucks and vans, on a phased-in basis for model years 1995, 1996, 1997, and 1998.

Descriptions of Occupant Protection Systems

Several distinct types of automatic occupant protection systems are available currently in the on-road fleet, including automatic safety belts, manual safety belts, air bags, and various combinations of the air bag with either manual or automatic belts. For the purpose of conducting the analysis of injury-reducing effectiveness, these systems were restricted to drivers only, and grouped as follows:

- *Frontal air bag plus safety belts*: If a frontal air bag was available for the driver (the vehicle was equipped with either driver-only or dual air bags) plus the driver used the available safety belt system.

- *Any air bag alone*: If a frontal air bag was available for the driver, and no belt system was used.

- *Automatic safety belts*: The driver used either the available motorized 2-point (torso) belt (with or without a manual lap belt), a non motorized 3-point (lap/shoulder) belt, or a non motorized 2-point belt (with or without a manual lap belt).

- *Manual 3-point safety belts*: The driver used the available traditional lap-and-shoulder belt system.

- *Unrestrained*: The driver did not use any safety belt and no frontal air bag was available.

How Air Bags Work

An air bag is an automatic crash protection system that deploys quicker than the blink of an eye. Air bags are the result of extensive research to provide maximum crash protection. By themselves, air bags protect only in frontal crashes and offer maximum protection when used in conjunction with safety belts. (**Note**: In recent years, side air bags and other similar types of systems have been introduced in new vehicles. In this report, references to *air bags* refer to ***frontal** air bags*, that is, those generally mounted in the steering column and instrument panel). Air bags should NOT be used as the only form of occupant protection; they are intended to provide supplemental protection for belted front-seat occupants in frontal crashes.

Typical air bag systems consist of three components: an air bag module, crash sensor(s), and a diagnostic unit. The air bag module, containing an inflator and a vented or porous lightweight fabric air bag, is located in the hub of the steering wheel on the driver side or in the instrument panel on the passenger side. Crash sensor(s), located on the front of the vehicle or in the passenger compartment, measure deceleration, the rate at which a vehicle slows down. These crash sensor(s) send the deceleration information to the air bag control module where a determination is made as to the severity of the crash. The crash severity information may be used in conjunction with other information about belt use, seat position, occupant size, and/or occupant position to make a deployment decision as to if, when, and/or how to deploy the air bag. The diagnostic unit is an electronic device that monitors the operational readiness of the air bag system whenever the vehicle ignition is turned on and while the ignition is powered. The unit uses a warning light to alert the driver if the air bag system is inoperative or needs service.

Air bags are designed to deploy (inflate) in moderate-to-severe frontal and near-frontal crashes. Although not all air bags are alike, they generally inflate when the crash forces are about equivalent to striking a brick wall head-on at 10-15 miles per hour or a similar sized vehicle head-on at 20-30 mph. Frontal air bags are not designed to deploy in side, rear, or rollover crashes. Rollover crashes can be particularly injurious to vehicle occupants because of the unpredictable motion of the vehicle. In a rollover crash, unbelted occupants can be thrown against the interior of the vehicle and strike hard surfaces such as steering wheels, windows, other interior components, and other passengers. They also have a great risk of being ejected, which usually results in very serious injuries. Ejected occupants also can be struck by their own or other vehicles. Since air bags provide supplemental protection only in frontal crashes, safety belts should always be used to provide maximum protection in rollovers and all crashes.

For a crash in which the entire front of the vehicle is impacted, the bag typically inflates within about 1/20 of a second after impact. The inflated air bag creates a protective cushion between the occupant and part of the vehicle's interior (i.e., steering wheel, dashboard, and windshield). At about 4/20 of a second following impact, the air bag begins to deflate. The entire deployment, inflation, and deflation cycle is over in less than one second.

After deployment, the air bag deflates rapidly as the gas escapes through vent holes or through the porous air bag fabric. Initial deflation enhances the cushioning effect of the air bag by maintaining approximately the same internal pressure as the occupant strokes into the bag. Subsequent rapid and total deflation enables the driver to maintain control if the vehicle is still moving after the crash and ensures that the driver and/or the right-front passenger are not trapped by the inflated air bag.

Dust-like particles present during the inflation cycle primarily come from dry powder that is often used to lubricate the tightly packed air bag to ease rapid unfolding during deployment. Small amounts of particulate produced from combustion within the inflator also are released as gas is vented from the air bag. These dust particles may produce minor throat and/or eye irritation. Once an air bag is deployed, it cannot be reused. Air bag system parts must be replaced by an authorized service dealer for the system to once again be operational.

To ensure that infants and children ride safely, with or without a passenger-side air bag, NHTSA urges caregivers to follow three principles:

- For every trip, make sure ***all*** infants and children are properly restrained in appropriate child safety seats, booster seats, or, if they are old enough, lap and shoulder belts;

- The ***back seat*** is the safest place for children of any age; and,

- Infants riding in rear-facing child safety seats should ***never*** be placed in the front seat of a vehicle with a passenger-side air bag.

Exhibit 1 is the warning label posted on child safety seats.

Exhibit 1

Market Shares of the Various Occupant Protection Systems

Americans are using safety belts more than ever before, and air bags are now available in virtually all new cars, and light trucks, vans and sport utility vehicles. Their market share is nearly universal. During the phase-in of automatic occupant protection (1987-1990), automatic belts were the most frequently sold automatic occupant protection system. During 1990 to 1993, manufacturers equipped more and more new cars with driver air bags, which became increasingly popular among new car buyers. By 1995, cars equipped with driver or dual air bag systems represented more than 98 percent of new cars sold. Exhibit 2 shows the commutative number of new passenger car registrations by protective system type since 1987 and Exhibit 3 presents the distribution of occupant protection systems in new passenger cars sold between 1987 and 1999.

CUMULATIVE REGISTRATIONS – PASSENGER CARS By OCCUPANT PROTECTION SYSTEM TYPE 1987 - 1999 (NO ATTRITION INCLUDED)	
Protective System Type	**Cumulative Registrations**
Driver Air Bags with Belts	17,991,726
Dual Air Bags with Belts	47,090,615
Automatic Belts Only	26,635,470
Manual Belts Only	20,000,478

Exhibit 2

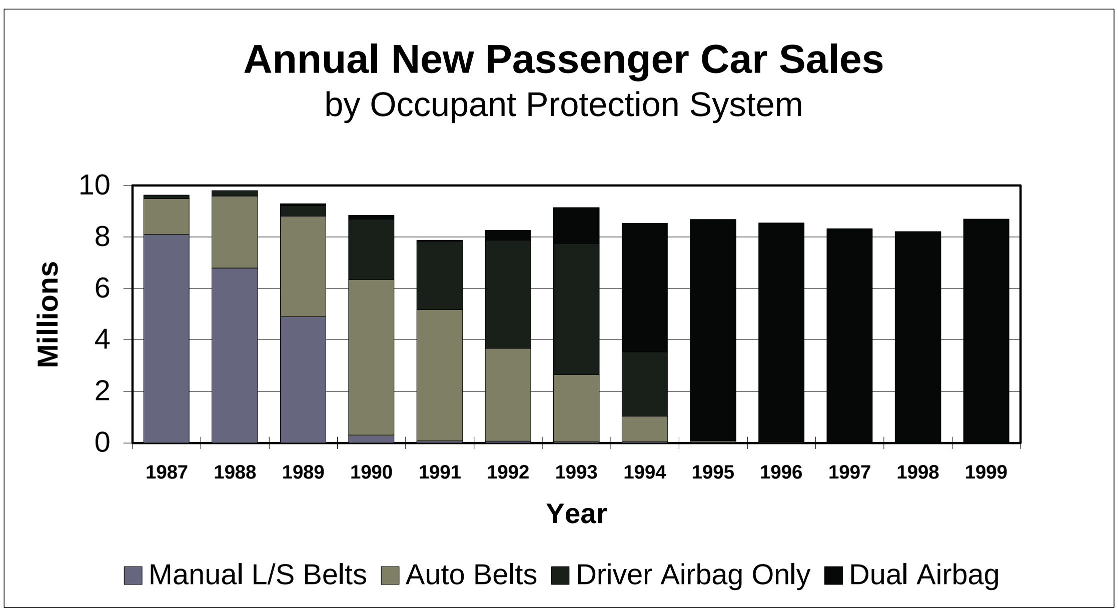

Exhibit 3

Section II -- ESTIMATING EFFECTIVENESS

The Analytic Challenge

Assessing the benefits of occupant protection systems, that is, their effectiveness in reducing the chances of occupant mortality and morbidity, is not a simple task. While it would be quite easy to compare the observed injury and fatality rates for occupants protected by the various systems, differences in fatality- and injury-reducing effectiveness can be masked by a multitude of factors not directly related to the air bag or automatic belt systems.

For example, air bags originally were offered in the larger, more expensive and the sporty, high-performance model lines. These vehicles may be driven much differently than, for example, station wagons or family-size sedans. The different use patterns of these vehicles will result in a different mix of crashes; for example, some make/models will experience more single-vehicle crashes on rural, higher speed roads, which tend to be more severe than the average two-vehicle crash in an urban, lower speed environment. Also, scientific studies have demonstrated that heavier cars, on average, offer greater protection to their occupants than do lighter cars (which were generally not included during the early introduction of air bags). These and other factors need to be identified and accounted for in any analysis of system effectiveness and are among the challenges of conducting an accurate assessment.

Other challenges include the identification and availability of appropriate data for conducting this assessment, in terms of relevance, sufficient numbers of cases for study, and quality. Safety belt use laws were critical to increasing belt use to the levels we have achieved. However, repeated analyses have demonstrated that self-reported safety belt use, such as that contained in most police accident reports, overstates the level of safety belt use in these crashes. This may be due to penalties for non-use of safety belts, discounts offered by some automobile insurance companies for a signed commitment that the policyholder will always use his or her safety belt, or other reasons. What has been observed is a tendency for surviving drivers and passengers (especially those receiving no or only minor injury) to say that they were wearing their belts at the time of the crash when actually they were unrestrained. This causes higher reported safety belt use rates for occupants in police-reported crashes than for those in the general population. It is very unlikely that crash-involved occupants could have higher safety belt use rates than the general public since the very behavior which leads to increased risk of crash involvement is hypothesized to be associated with an increased tolerance for risk, such as not wearing safety belts, or driving after drinking too much alcohol.

The effect of higher reported safety belt use, especially among the less seriously injured and uninjured vehicle occupants, *is to make safety belts appear safer than they actually are*. If some of the unbelted, uninjured people had been incorrectly reported as belted, this would increase the computed injury rate among unbelted occupants (fewer uninjured persons) and decrease the injury rate among the belted occupants, artificially increasing the “gap” between belted and unbelted occupants and inflating the estimated advantage of using safety belts.

Analysis -- Fatality-Reducing Effectiveness

The database used to conduct the assessment of the fatality-reducing effectiveness of air bags is NHTSA's Fatality Analysis Reporting System (FARS). FARS is a census of all fatal traffic crashes that occur in the U.S., on roads customarily open to the public, where at least one person dies of crash-related causes within 30 days of the crash. Depending on the State, the information entered into the FARS database by State analysts includes the following:

- police accident reports
- State vehicle registration files
- State driver licensing files
- State highway department data
- vital statistics
- death certificates
- coroner/medical examiner reports
- hospital medical records
- emergency medical service reports.

One of the important ways to group drivers is by their safety belt use. Separate estimates are presented for the fatality-reducing effectiveness of air bags plus manual lap-shoulder belts **and** air bags alone, relative to an unrestrained occupant, as requested in the 1991 ISTEA legislation. At the same time, an updated estimate of the effectiveness of manual lap-shoulder belts alone was not developed for this report -- it has been known for some time, and recently reconfirmed[2] that manual safety belts are 45 percent effective in reducing fatality risk. Also, with the phasing out of automatic safety belts, no fatality-reducing effectiveness estimates of these systems were computed.

For the analysis of the fatality-reducing effects of air bags, the ability to control for the various crash circumstances by comparing drivers and right-front passengers involved in precisely the same crashes alleviated the need for detailed statistical modeling. A second approach compared the driver fatality experience in air bag-equipped vehicles in frontal fatal crashes (for which air bags were specifically designed) to their experience in non-frontal fatal crashes. This analysis assumes that air bags have no effect in non-frontal crashes, such as side and rear impacts and rollovers.

Overall and Frontal Crash Effectiveness for Fatalities

As of May 2001, NHTSA's Fatality Analysis Reporting System contains over 40,000 records of fatally injured front-seat occupants of cars and light trucks who were sitting at positions equipped with air bags. The agency has enough data to estimate the fatality reduction by air bags plus safety belts, and air bags without safety belts, relative to an unrestrained occupant, as requested in the 1991 ISTEA legislation. There are also enough data to compare the fatality reduction by air bags in purely frontal crashes for car drivers, car passengers, as well as drivers and passengers of light

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[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*, DOT-HS-809-199, December 2000.

trucks and to compare the fatality-reducing effectiveness of air bags for drivers of small and large cars, and for younger and older occupants.

The basic analyses of data from the Fatality Analysis Reporting System are updates of the findings in NHTSA's *Fourth Report to Congress*. These analyses estimate the fatality reduction by air bags for drivers of passenger cars, and they are measured on the combined population of belted and unbelted occupants of cars equipped with driver air bags. The analyses studied the fatality experience of drivers in frontal crashes vs. two select comparison groups: their right-front passengers and the drivers in non-frontal crashes[3].

The first analysis considers crash-involved passenger cars equipped with air bags and 3-point belts at the driver's seat, but only 3-point belts at the right-front seat and with both front outboard seats occupied. (Although this configuration has not been in general production since the mid-nineties, sizable amounts of cars with it remain in use.) The ratio of driver fatalities (with the air bag) to right-front passenger fatalities (without the air bag) is calculated, and it is compared to the corresponding ratio in earlier cars of the same makes and models, equipped only with 3-point belts at both seating positions. The fatality-reducing effectiveness of air bags is estimated by the relative difference in the two ratios. This analysis includes all drivers and right-front passengers of the cars, both belted and unbelted.

In purely frontal crashes (principal impact of 12:00, see Exhibit 4, excluding cases where the most harmful event was a rollover), air bags are now associated with a statistically significant fatality-reducing effectiveness of 28 percent. This result is slightly lower than the 33 percent cited in NHTSA's *Fourth Report to the Congress*. In all frontal crashes (including pure and partial frontals; principal and/or initial impact point of 10:00 to 2:00), the analysis indicates a statistically significant 19 percent reduction in fatality risk for air bags, the same as in the Fourth Report. For all types of crashes combined, including non-frontals, the fatality reduction is a statistically significant 11 percent, up one percentage point from the Fourth Report.

The second analysis utilizes another distinctive characteristic of air bags: that they are primarily designed for action in frontal crashes. With an inclusive definition of "frontal and partially frontal" crashes (initial or principal impact location between 10:00 and 2:00), it can be assumed that air bags have little effect, relative to manual belt use alone, in the remaining "non-frontal" crashes. These non-frontal fatalities represent an exposure-based *control group* for the current analysis.

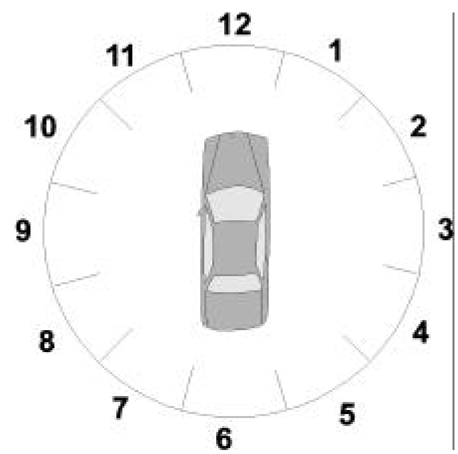

Exhibit 4

The ratio of frontal to non-frontal driver fatalities in cars equipped

[3] *Fatality Reduction by Air Bags – Analyses of Accident Data through Early 1996*, DOT-HS-808-470, August 1996.

with driver air bags is compared to the corresponding ratio in earlier cars of the same makes and models, equipped only with 3-point belts. The fatality-reducing effectiveness of air bags in frontal crashes is estimated by the relative difference in the two ratios. This approach has the disadvantage of relying on the unproven assumption of zero effectiveness for air bags in non-frontal crashes, but it allows a larger sample size than the preceding method, since it is not limited to cases where the right-front seat was occupied.

When driver fatalities in purely frontal crashes (principal point of impact of 12:00, excluding cases where the most injurious or damaging event was a rollover) are compared to those in non-frontal crashes, the fatality reduction for air bags is a statistically significant 29 percent. For all frontal or partially frontal crashes (principal and/or initial impact point of 10:00 to 2:00), there is an estimated 20 percent reduction of fatality risk (statistically significant). With the assumption that air bags have negligible effect in non-frontal crashes, the combined fatality reduction for air bags in all types of crashes is estimated at 13 percent, by this analysis method.

Air bags have a substantially lower but still statistically significant effect in partially frontal crashes (principal and/or initial point of impact between 10:00 and 2:00, excluding purely frontal crashes with 12:00 point of principal impact) by either analysis method. The first and second methods both yielded an 8 percent fatality decrease with air bags.

Exhibit 5 summarizes the results of these two analytical approaches and presents the set of estimates that result from computing the average of the two approaches, which is the final estimate of effectiveness.

FATALITY-REDUCING EFFECTIVENESS OF DRIVER AIR BAGS			
Crash Type	**Comparison Group**		**Mean Effectiveness**
	Right Front Passengers	**Non-frontal Crashes**	
Purely frontal crashes	***28%***	***29%***	***29%***
All frontal crashes	***19%***	***20%***	***20%***
All crashes	***11%***	***13%***	***12%***

Exhibit 5

Note: The ***bold italics font*** means that the estimate is statistically significantly different from zero.

The analyses indicate that the life-saving benefits of air bags derive primarily from purely frontal crashes; that their benefit in partially frontal crashes is limited; and that the fatality reduction in all types of crashes is between one-third and one-half of the reduction in purely frontal crashes.

It has become possible to apply the same analytical methods to certain subgroups of the driver or vehicle population and to calculate the fatality reduction by air bags for those subgroups. The analyses that follow primarily estimate the effectiveness of air bags in purely frontal crashes. All of the estimates that follow are statistically significant.

One of the most important ways to group drivers is by their belt use. Belted drivers in cars equipped with air bags experienced a statistically significant 21 percent fatality reduction in purely frontal crashes, relative to belted drivers in comparable cars without air bags. Unbelted drivers with air bags experienced a statistically significant 36 percent fatality reduction in purely frontal crashes, relative to unbelted drivers without air bags. In other words, air bags have significant life saving benefits in purely frontal crashes for belted **and** unbelted drivers; however, the benefit appears to be somewhat larger, relatively speaking, for the unbelted driver.

The two preceding estimates need to be carefully interpreted. The 21 percent reduction for the belted driver with an air bag is measured relative to the belted driver without an air bag; it does not include the very substantial effect of belts, but represents the increment of air bags plus belts over belts alone. Both estimates are for purely frontal crashes; the fatality reduction in all types of crashes is substantially less than the reduction in purely frontal crashes -- viz., about 11 percent for the belted driver (relative to a belted driver without air bags) and 14 percent for the unbelted driver. NHTSA estimates that safety belts alone reduce fatality risk by 45 percent. Thus, if an unrestrained driver has a fatality risk of 100, a driver protected by both a safety belt and an air bag will have a risk of:

$$100 \times (1-.45) \times (1-.11) = 49.$$

Based on these considerations, NHTSA can now update the Fourth Report's estimates of the *when-used* fatality reduction for three types of occupant protection systems, for passenger car drivers in crashes of all types, as requested by the 1991 ISTEA legislation, and presented in Exhibit 6.

ESTIMATED EFFECTIVENESS IN REDUCING FATALITY RISK FOR PASSENGER CAR DRIVERS, By OCCUPANT PROTECTION SYSTEMS	
Occupant Protection System	**Effectiveness**
Air bag plus lap-shoulder belt	***51%***
Air bag alone	***14%***
Manual lap-shoulder belt	***45%***

Exhibit 6

Note: The ***bold italics font*** means that the estimate is statistically significantly different from zero.

For example, if 100 drivers not using seat belts driving cars not equipped with air bags were killed in crashes, 51 of them would have been saved if they had been wearing a lap-shoulder belt and their cars had been equipped with a driver air bag (49 would still have been killed, analogous to the risk of 49 in the example above Exhibit 6). Had these same 100 drivers been unbelted in a vehicle with air bags, 14 of them would have been saved.

While the estimates presented in Exhibit 6 are based on *when* safety belts actually were or were not used, the fatality-reducing effectiveness estimates that follow combine both belted and unbelted drivers, or passengers as noted, and are therefore considered *as used*, in the same spirit as the overall effectiveness estimates presented earlier in Exhibit 5.

Another important way to group drivers is by their age. Drivers age 29 or less experienced a statistically significant 29 percent fatality reduction with air bags in purely frontal crashes, relative to drivers of that age in comparable cars without air bags. The fatality reduction for drivers age 30-55 was a statistically significant 30 percent. For drivers age 56-69, the observed effectiveness is also a significant 30 percent, and for drivers age 70 or older, it dropped to a still significant 20 percent. These statistics suggest that air bags are effective for drivers of all ages, but possibly somewhat less so for drivers older than 70 than for younger adults.

Cars can be grouped by their weight; specifically, the cars on the Fatality Analysis Reporting System were subdivided, by car weight, into three groups containing equal numbers of crash records. The weight ranges for these three groups were: up to 2778 pounds, 2779-3119 pounds, 3120 pounds or greater. The observed fatality reduction by air bags in purely frontal crashes is a statistically significant 30 percent in the light cars, a statistically significant 28 percent in the medium-weight cars, and a statistically significant 26 percent in the heavy cars. In other words, air bags are effective in cars of all sizes.

There are now enough crash data involving light trucks -- pickup trucks, vans or sport utility vehicles -- for analyses of fatality reduction by driver air bags. Drivers of light trucks equipped with air bags experienced a statistically significant 29 percent fatality reduction in purely frontal crashes, relative to drivers of trucks of the same makes and models, but without air bags. This is the same effectiveness as for passenger car drivers (29 percent), and it suggests that driver air bags may be as effective in light trucks as they are in passenger cars.

There are also enough crashes involving passenger cars and light trucks with dual air bags for analyses of the effect of passenger air bags. However, it is important to distinguish between two quite different groups of right-front passengers: preteen children (including infants and toddlers), as opposed to teenagers and adult passengers. In-depth investigations of individual crashes have shown that air bags of current design have fatally injured a number of preteen children in frontal crashes, especially unrestrained children and infants in rear-facing safety seats. The crash data involving child passengers age 0-12 on the Fatality Analysis Reporting System are sufficient for limited statistical analyses, and the results support the unfavorable findings of the in-depth crash investigations. Every analysis that includes frontal crashes shows a higher fatality risk for children in cars with dual air bags than for children in comparable cars without passenger air bags. Depending on the analytical method, some, but not all, of the increases are statistically significant. In other words, although a specific numerical value on the effect of passenger air bags on children 0-12 years old cannot yet be determined, the results are consistent with the conclusion, from special crash investigations, that child passengers are experiencing problems with air bags.

On the other hand, as shown in Exhibit 7, for right-front passengers age 13 or older, passenger air bags have significant benefits. Passengers of cars equipped with dual air bags experienced a statistically significant 32 percent fatality reduction in purely frontal crashes, relative to passengers of cars of the same makes and models, but equipped only with driver air bags. Passengers of light trucks, age 13 or older, likewise experienced a statistically significant 32 percent fatality reduction. These are essentially the same reductions as for drivers of cars and light trucks (both 29 percent), and they suggest that passenger and driver air bags may be equally effective for occupants age 13 or older.

ESTIMATES OF THE FATALITY-REDUCING EFFECTS OF AIR BAGS IN PURELY FRONTAL CRASHES (12:00)	
Group	**Fatality Reduction**
Drivers of passenger cars	***29%***
Belted drivers of passenger cars	***21%***
Unbelted drivers of passenger cars	***36%***
Light cars (up to 2778 pounds)	***30%***
Medium cars (2779-3119 pounds)	***28%***
Heavy cars (3120 pounds or greater)	***26%***
Age 29 years and younger	***29%***
Age 30-55 years old	***30%***
Age 56-69 years old	***30%***
Age 70 years and older	***20%***
Drivers of light trucks (pickups, vans, sport utility vehicles)	***29%***
Right front passengers of cars	
Under age 13	non-quantifiable but increased risk
Age 13 and older	***32%***
Right front passengers of light trucks	
Under age 13	non-quantifiable but increased risk
Age 13 and older	***32%***

Exhibit 7

Note: The ***bold italics font*** means the estimate is statistically significantly different from zero.

Analysis -- Injury-Reducing Effectiveness

While most of the fatality-reducing effectiveness estimates presented in the previous section were based on the combination of belted and unbelted occupants, without regard to whether the available safety belts actually were used (that is, *as-used*), ALL of the estimates of injury-reducing effectiveness presented in this report are based on **when** safety belts actually were or were not used.

Data in this section are based on the NHTSA's National Automotive Sampling System (NASS) Crashworthiness Data System (CDS). The NASS CDS is a crash data collection system which is based on a nationally representative sample of crashes selected from police reported crashes involving at least one passenger motor vehicle which had to be towed from the scene due to damage from the crash. Approximately 4,500 crashes are investigated each year in 24 geographic areas across the Continental United States. NASS CDS data are based on information from the crash scene, measurement of damage to the vehicles involved, interviews of survivors, and medical records of victim injuries. Because the data collected in the NASS CDS are based on a sample, all estimates in this analysis are statistically weighted. Consequently, lack of statistical significance reported for some factors may be due to small sample sizes.

Overall and Frontal Crash Effectiveness Estimates for Moderate Injury

The results of statistical modeling of the 1988 through 1997 NASS CDS data are presented in Exhibit 8. Effectiveness was estimated for two vehicle damage populations: all damage areas combined and damage to the front of the vehicle. Remember that air bag effectiveness is based on its *presence* in the vehicle, and not only when it actually deployed.

Effectiveness means that an occupant using the particular system will experience the cited percentage reduction in the chance of injury, given that a crash has occurred, compared to an unrestrained occupant.

**ESTIMATED EFFECTIVENESS
OF OCCUPANT PROTECTION SYSTEMS
IN REDUCING THE LIKELIHOOD OF DRIVER MODERATE
AND GREATER INJURY (MAIS 2+)**

System Used	All Damage Areas	Front Damage
Air bag plus lap-shoulder belt	***73%***	***76%***
Air bag alone	29%	***35%***
Automatic (2-point and 3-point) belt	***46%***	***48%***
Manual lap-shoulder belt	***60%***	***62%***

Exhibit 8

Note: The ***bold italics font*** means statistically significant difference from the risk of unrestrained occupants.

All Damage Areas – As can be seen in Exhibit 8, both automatic and manual safety belt systems provide significant overall injury-reducing benefits, at the moderate and higher injury level, compared to being unrestrained. The estimates for these two safety belt systems, which have generally been very close in previous reports, (e.g., 51 percent for automatic belts and 53 percent for manual lap-shoulder belts) have diverged somewhat, with manual safety belt effectiveness estimated at 60 percent and automatic belt effectiveness at 46 percent (both estimates are statistically significant). The air bag plus lap-shoulder belt system provides the greatest injury protection, 73 percent (although the difference between that estimate and safety belts alone at 60 percent is not statistically significant). The injury-reducing effectiveness of the air bag alone, without the use of safety belts, increased from the estimated 10 percent in the Fourth Report, to the current 29 percent. However, neither estimate was significantly different than being unrestrained.

Front Damage – For vehicles with frontal damage, the air bag plus manual lap-shoulder belt provides the greatest protection against moderate and greater injury (again, the differences compared to the other systems are not significant). For air bags with manual belts, the effectiveness in reducing the chance of moderate and greater injury is about the same in frontal crashes as in all crashes (76 percent). The effectiveness of the air bag alone was greater in frontal crashes than in all crashes, and possibly more important, was statistically significant for the first time in this series of reports. The estimates for the two safety belt systems were both statistically significant, at 48 percent for the automatic and 62 percent for the manual.

Overall and Frontal Crash Effectiveness Estimates for Serious Injury

In addition to the analysis of system effectiveness in preventing moderate and greater injury, investigations were conducted to assess system effectiveness in preventing serious and greater injury, which occurs less frequently. The results of this analysis are presented in Exhibit 9.

ESTIMATED EFFECTIVENESS OF OCCUPANT PROTECTION SYSTEMS IN REDUCING THE LIKELIHOOD OF DRIVER SERIOUS AND GREATER INJURY (MAIS 3+)		
System Used	**All Damage Areas**	**Front Damage**
Air bag plus lap-shoulder belt	***67%***	***80%***
Air bag alone	30%	***49%***
Automatic (2-point and 3-point) belt	***43%***	42%
Manual lap-shoulder belt	***69%***	***80%***

Exhibit 9

Note: The ***bold italics font*** means statistically significant difference from the risk of unrestrained occupants.

All Damage Areas – As can be seen in Exhibit 9, manual lap-shoulder belts, both with and without an air bag, provide significant overall injury protection at the serious injury level, compared to being unrestrained (about 68 percent reduction in serious injury risk for both systems). Thus, the air bag did not appear to provide additional protection to a driver who was already using his/her belts. The serious injury protection afforded by automatic belts (43 percent) also was statistically significant. The injury-reducing effectiveness of the air bag alone, without the use of safety belts, is a non-significant 30 percent in all crashes.

Front Damage – A similar pattern for serious injury lap-shoulder belt effectiveness can be observed for vehicles with front damage. Manual lap-shoulder belts, both with and without an air bag, provide significant injury protection (80 percent); however, the air bag did not appear to enhance the effectiveness of the lap-shoulder belt alone. A major finding for the air bag alone is the estimated 49 percent effectiveness in preventing serious injury in frontal crashes. While this is essentially the same as reported in the Fourth Report (50 percent), it is now statistically significant.

Effectiveness Estimates for Major Body Regions (Moderate and Serious Injury)

A number of additional analyses were conducted to estimate, in greater detail, the effectiveness of occupant protection systems in preventing injury to the following major body regions: head, chest, upper extremity, and lower extremity. It should be emphasized that these analyses required further subsetting of the database, which considerably reduced the available number of cases for analysis. Therefore this analysis was done for all crashes, and not just frontal crashes. As a result, many of these estimates are not statistically significant. In addition, the small sample sizes result in some substantial changes in estimates from the previous report. However, for the purposes of conducting exploratory analyses, this series of estimates may provide *suggestive* evidence of patterns that might indicate the need for further research and analysis. Even though there may appear to be a large change from the previous report, in the estimate of protection offered by the restraint system in question, in almost all cases the result is the same – the estimate currently is, and was, not statistically significant. The focus of these analyses was to investigate the performance of air bags plus lap-shoulder belts contrasted with lap-shoulder belt use only, and air bag alone contrasted with totally unrestrained. Thus, no analysis of automatic safety belt performance is reported.

The effectiveness estimates in each column of Exhibit 10 represent the percentage reduction in the risk of moderate or serious injury to the respective major body region, without regard to other body regions that may have been injured. Thus, the 85 percent effectiveness for the air bag plus lap-shoulder belt in the column titled **Head** means that drivers protected by that system experienced an 85 percent reduction in the risk of moderate head injury, compared to if that driver had been unrestrained, without an air bag.

HEAD -- Manual lap-shoulder safety belts provide significant injury-reducing benefits for moderate and serious head injury. The addition of an air bag to a lap-shoulder belt appears to result in increased head injury protection at both injury levels. The estimated effectiveness of the air bag alone is a statistically significant 57 percent in reducing moderate head injury. This 57 percent effectiveness for the air bag alone is much greater than the 29 percent effectiveness in reducing moderate injury to **any** body region (Exhibit 8) and suggests that the air bag alone affords good protection in reducing moderate head injury. However, much can be gained from the addition of a lap-shoulder belt (effectiveness increased from 57 percent to 85 percent). Further analysis indicates that the air bag alone provides some measure of protection in preventing serious head injury (a relatively high, yet non-significant, 43 percent), while the protective benefits of the air bag plus lap-shoulder belt combination remains high (85 percent).

CHEST -- The air bag plus lap-shoulder belt provided the only statistically significant injury protection to drivers at the moderate injury level. The estimated effectiveness of the manual lap-shoulder belt system in reducing moderate chest injury was 48 percent (not statistically significant), indicating that drivers experienced less risk (by about one-half) of a moderate chest injury if they wore their lap-shoulder belts compared to being unrestrained. However, at the serious injury level, manual lap-shoulder belt effectiveness increased to a significant 58 percent. The air bag alone was associated with a non-significant 10 percent decrease in the risk of moderate chest injury, but a non-significant *increase* of 26 percent for serious chest injuries. (In the previous report dated May 1999, air bags alone had a nonsignificant 17 percent reduction in the risk for serious chest injuries. The fluctuations in these nonsignificant estimates are due to the small sample size.) The air bag plus lap-shoulder belt system exhibited a non-significant 35 percent reduction in the risk of serious chest injury (compared to a 58 percent reduction for lap-shoulder belts alone), indicating some potential injurious effect of the air bag for persons already belted (similar to the 26 percent *increase* in risk for the air bag alone).

UPPER EXTREMITIES -- Manual safety belts provide statistically significant protection against moderate upper extremity injury. Drivers wearing manual lap-shoulder belts experienced an estimated 51 percent reduction in the risk of moderate arm injury and a (non-significant) 57 percent reduction of serious arm injury, compared to if they had been unrestrained. The addition of an air bag resulted in an increased benefit from 51 percent to a statistically significant 58 percent at the moderate level. For serious upper extremity injuries, the addition of an air bag to a belted driver resulted in somewhat lower effectiveness, 46 percent, which is much better than the 20 percent effectiveness reported in the Fourth Report. It appears that restrained drivers face a higher risk of serious arm injury from the deploying air bag than do unbelted drivers. The unrestrained driver in a crash experiences forward movement of his/her body into the bag, while a belted driver's torso is held in place, possibly allowing his/her arms to flail forward into the path of a deploying air bag. The expanding air bag may then injure the driver's arm, or propel the arms upward or laterally into hard passenger compartment surfaces. Another arm injury mechanism involves the positioning of the arm across the steering wheel, directly in the path of a deploying air bag, while the vehicle is turning left or right. In the Fourth Report, it was noted that the estimates at the serious injury level for all three restraint systems showed dramatic improvement over those presented in the Third and previous reports. At that time, it was noted that whether these changes were due to statistical fluctuations due to the small sample size or represent an actual improvement in air bag redesign could not be determined. While it is still difficult to know for certain, the current analyses appear to confirm observations from the Fourth Report, that all three restraint systems have shown and continue to show improvement in upper extremity injury prevention.

LOWER EXTREMITIES -- For serious lower extremity injury (which is very high severity for lower extremities, since AIS 4 is the highest possible coding for a lower extremity injury, e.g., severing of the femoral artery), manual lap-shoulder belts, with and without the air bag, provide a very high degree of protection, 72 and 83 percent effectiveness (both statistically significant and relatively unchanged from the Fourth Report), respectively. The air bag plus lap-shoulder belt provided a significant 59 percent reduction in moderate injury risk, while the manual belt alone provided a non-significant 52 percent reduction in the risk of moderate lower extremity injury. At the same time, the effectiveness of the air bag alone is 39 percent for serious injury and -5 percent for moderate injury, suggesting the possibility of some increase in risk of moderate lower extremity injury (neither of these two estimates is statistically significant). For the air bag alone, some degree of submarining, similar to unbelted drivers without an air bag, may be occurring.

Many of the estimates presented in this exploratory analysis of injury by body region are not statistically significant. However, the patterns that emerge are suggestive that the addition of an air bag to a lap-shoulder belt system appears to involve a beneficial trade-off: reductions in the more life-threatening moderate and serious injury to the head and chest, at the risk of some increased likelihood of serious upper and lower extremity injury. The air bag system alone (without the use of a safety belt) appears to be associated with increased risk of moderate injury to the lower extremities, while providing less protection to the head and upper extremity than when a belt is worn. This is further evidence of the need to always use safety belts, whether or not the vehicle is equipped with air bags.

ESTIMATED EFFECTIVENESS OF OCCUPANT PROTECTION SYSTEMS IN REDUCING THE LIKELIHOOD OF DRIVER MODERATE AND SERIOUS INJURY TO THE HEAD, CHEST, UPPER EXTREMITY AND LOWER EXTREMITY				
System Used / Injury Severity	**Major Body Region**			
	Head	**Chest**	**Upper Extremity**	**Lower Extremity**
Moderate Injury Reduction				
Air bag plus lap-shoulder belt	***85%***	***62%***	***58%***	***59%***
Air bag alone	***57%***	10%	41%	- 5%
Manual lap-shoulder belt	***70%***	48%	***51%***	52%
Serious Injury Reduction				
Air bag plus lap-shoulder belt	***85%***	35%	46%	***72%***
Air bag alone	43%	-26%	61%	39%
Manual lap-shoulder belt	***60%***	***58%***	57%	***83%***

Exhibit 10

Note: The ***bold italics font*** means statistically significant difference from the risk of unrestrained drivers.

Section III - - AIR BAG RELATED FATALITIES

This section discusses the results of in-depth crash investigations on drivers, adult passengers and children with air bag deployment-related, life threatening and fatal injuries in low and moderate speed crashes conducted by NHTSA's Special Crash Investigations (SCI) program.

Background

In October 1996, NHTSA began publishing summary tables for each confirmed air bag related fatality and seriously injured occupant. Currently, the tables are published quarterly, and are available on the National Center for Statistics and Analysis' web site at http://www-nrd.nhtsa.dot.gov/departments/nrd-30/ncsa/SCI.html . These tables contain basic information about serious injuries and fatalities related to air bag deployments in low to moderate speed crashes by:

- infants in rear facing child safety seats (RFCSS);
- children not in RFCSS;
- adult drivers; and
- adult passengers.

NHTSA has defined children as occupants 12 years of age and under. Serious injury has been defined as a level sufficient to be a threat to life. The injuries that are considered a threat to life have a significant effect on mortality. Low to moderate speed crashes have been defined as crashes with a speed change under 25 miles per hour.

To be fatally injured by an air bag, the deployment energy of the air bag must be imparted to the occupant. For the deployment energy to be imparted to the occupant, he/she must be in the path of the deploying air bag. In low and moderate speed crashes the occupant is most typically out-of-position (OOP) and in the path of a deploying air bag in one of the following two scenarios:

- The occupant's initial seating position will place them in the air bag deployment path. Initial positioning may include: small or short-stature occupants seated in close proximity to the air bag; occupants that fall asleep, have passed out or are leaning into the air bag deployment path; and infants in rear-facing child safety seats. This scenario includes both belted and unbelted occupants.

- The occupant is repositioned to a location within the air bag deployment path just prior to deployment by a pre-impact or at-impact event. The event that repositions the occupant into the deployment path includes a number of factors such as pre-impact braking, multiple closely spaced near deployment events, running off the road, and striking a relatively soft structure at or around the deployment threshold (which may also result in late deployment). Unbelted or improperly belted occupants are more likely to become out-of-position in these scenarios.

NHTSA has made an exhaustive effort through the SCI program to locate, document and confirm air bag deployment-related, life threatening and fatal injuries to drivers, adult passengers and children in low and moderate speed crashes. In addition to the Agency's wide notification network, SCI routinely attempts to locate cases by screening NHTSA's census of fatalities in the Fatality Analysis Reporting System (FARS) program. As a result, we believe that the SCI files contain a near census of low to moderate speed air bag related fatalities. While non-fatal crashes do provide valuable engineering information regarding occupant/air bag interactions, in the case of SCI investigations of non-fatal injuries, there is no scientific method in place to insure that they are sampled thoroughly. Since including non-fatal injuries in the calculations could produce risk estimates that are inconsistent with actual trends, only fatality counts were used in these estimates.

Beginning in May 1998, NHTSA began reporting unconfirmed air bag related fatal injury counts in their monthly reports. Unconfirmed cases are crashes under active investigation where the air bag is suspected of being the injury mechanism. The unconfirmed case fatal counts were initially reported to alleviate a false sense of improvement in declining confirmed case counts. Confirmed case counts typically lag approximately six months from initiation to confirmation. The primary reason for the lag time is medical record acquisition for injured occupants.

For unconfirmed cases, there is always the possibility that the investigation, when completed, will not support a conclusion of an air bag-related injury or fatality. However, since 1997, the SCI headquarters team has pre-screened the notifications submitted. As a result, approximately 90% of the unconfirmed cases are eventually confirmed.

As of July 1, 2001, NHTSA's Special Crash Investigations (SCI) program had a total of 234 cases (191 confirmed and 43 unconfirmed) where the deployment of the driver or passenger air bag resulted in a fatal injury to an occupant in a low or moderate speed crash. These cases are summarized in Exhibit 11 with the unconfirmed counts in brackets.

AIR BAG RELATED FATALITIES CONFIRMED AND UNCONFIRMED BY AGE, POSITION, AND CRASH YEAR						
Crash Year	**Age**				**Total**	
	Children		**Adults**			
	In RFCSS	**Not in RFCSS**	**Drivers**	**Passengers**	**Confirmed**	**[Unconfirmed]**
1990	0	0	1	0	1	[0]
1991	0	0	4	0	4	[0]
1992	0	0	3	0	3	[0]
1993	0	1	4	0	5	[0]
1994	0	5	7[1]	0	12	[1]
1995	3	5 [1]	5	0	13	[1]
1996	6	19 [1]	7	2	34	[1]
1997	4	27 [0]	17 [3]	4 [1]	52	[4]
1998	4	20 [10]	12	1 [2]	37	[12]
1999	2[1]	14 [9]	3[2]	0	19	[12]
2000	0	6[3]	4[2]	1[2]	11	[7]
2001	0	0[5]	0	0	0	[5]
TOTAL	19[1]	97 [29]	67 [8]	8 [5]	191	[43]

Exhibit 11

In Exhibits 12 through 15, NHTSA used R.L. Polk's vehicle registration data to determine the number of new air bag-equipped passenger cars and light trucks registered in the United States for each model year. These registration counts are used to normalize the SCI fatality counts in order to obtain rate data, i.e., the number of air bag-related fatalities per million registered vehicle years

(MRVY). This analysis includes model years (MY) 1988 through 2001. The SCI fatality counts are based on confirmed and unconfirmed data. Rates were calculated by dividing the SCI count of air bag related fatality crashes for each 12-month production interval by the total number of registered vehicles with a driver and passenger air bag during that same interval. Each 12-month production interval was aligned with the production year; hence it starts in September and ends in August.

Children

Of the 234 fatal cases (confirmed and unconfirmed) reported (Exhibit 11), one hundred and forty six are children. One hundred twenty-six (97 confirmed and 29 unconfirmed) of these children were not in a rear facing child safety seat. Twenty (19 confirmed and 1 unconfirmed) were children in a rear facing child safety seat (RFCSS).

NHTSA and its partners (manufacturers, insurance companies and other organizations) have committed a high volume of public education resources in an effort to prevent air bag related injuries and fatalities, especially to children. This media attention appears to be having a positive effect on reducing child fatality cases. Despite the insurgence of more than 15 million vehicles equipped with passenger air bags annually, the child passenger fatality rate, normalized for the number of passenger-air-bag-equipped vehicles in a twelve-month period, has decreased in the past three years (see Exhibit 12).

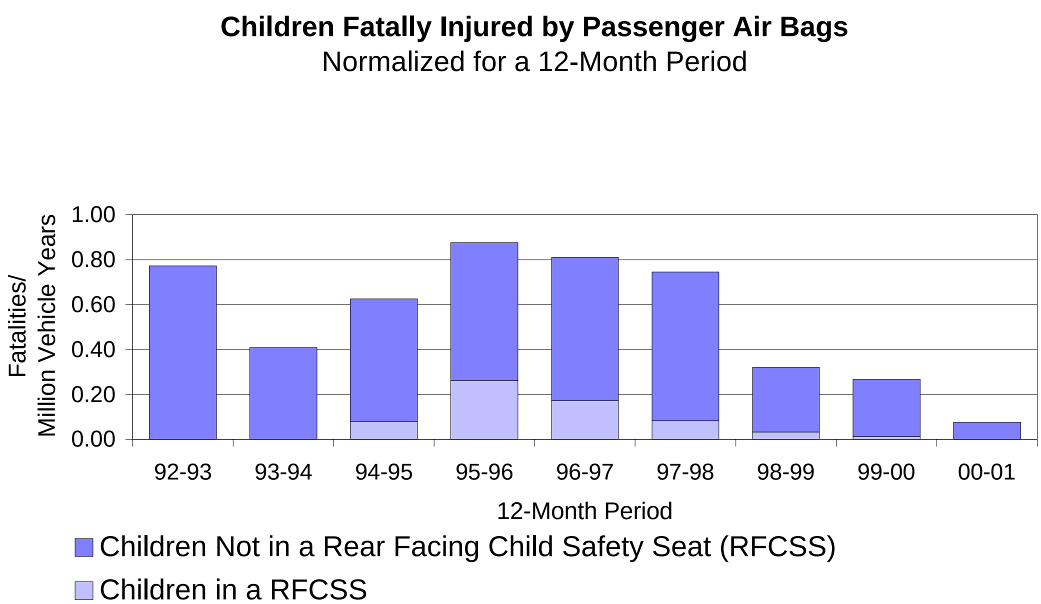

Exhibit 12

NHTSA issued a rulemaking action in March of 1997 that allowed automobile manufacturers to expediently reduce the force at which their air bags deployed. A number of manufacturers began installing these reduced power air bags in their 1998 model year vehicles. NHTSA refers to these as redesigned air bags. NHTSA has investigated 10 cases (6 confirmed, 4 unconfirmed) where the deployment of a redesigned passenger air bag resulted in a child fatality. Each of model years 2000 and 2001 have seen one child fatality investigated. Exhibit 13 shows the rate of child passenger air bag fatalities, per million vehicle years, by vehicle model year of as July 1, 2001. (Note that although there has been only one child fatality involving a model year 2001 vehicle air bag, the *rate* for model year 2001 is pushed up by the lower exposure of the introductory year. It can be expected to recede as 2001 vehicles gain more time on the roads.)

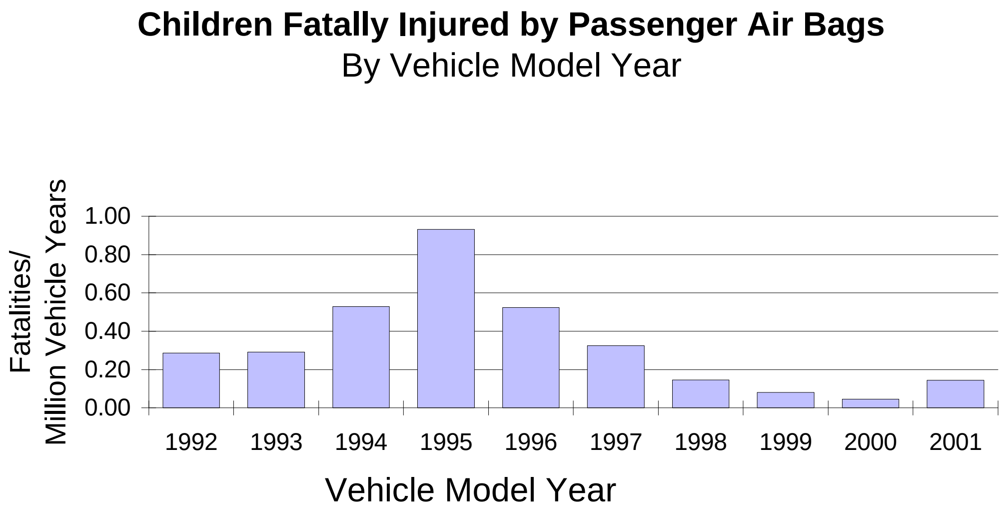

Exhibit 13

Child Passenger Kinematics and Injury Mechanisms

The following sections discuss child passenger kinematics and injury mechanisms associated with front right passenger air bag induced injuries. In all cases, the crash investigators have identified the passenger air bag and/or air bag cover flap as the source of the critical-to-fatal injuries. Little or no intrusion of the occupant compartment was reported, and the cases are low to moderate speed crashes. Given the level of the crash severities involved, one would not expect that these children would have sustained life threatening or fatal injuries in the absence of an air bag.

Almost all child air bag injuries are from passenger air bags, and these most logically break down into two situations: infants in rear-facing child safety seats or children facing forward located in the front right passenger seat position. Injury mechanisms for each group are discussed below.

Rear-Facing Infant Injuries

Of the 19 infants fatally injured while in a rear-facing infant seat, eleven were correctly installed in the seat. However, the seats were secured in the front right seating position of an air bag equipped vehicle, contrary to recommended procedure, and therefore these infants are not considered properly restrained. The exceptions are vehicles without a back seat equipped with an air bag on/off switch. In the other eight cases, the investigators have pointed out departures from the installation directions in the owner's manual, such as not using a locking clip, or holding the infant seat on a passenger's lap. In all cases, the vehicle's driver and/or other adult passengers ignored the warning labels located on the sun visor and in the owner's manual and placed the infant in the deployment path of the air bag in the front right seating position.

The crash scenario for air bag involvement with rear-facing infant seats is similar for all cases. Upon impact, the deploying passenger air bag interacts violently with the back of the rear-facing infant seat, typically with sufficient force to crack or break the plastic shell. The force and rapid acceleration of this impact are carried through the rear facing child safety seat and into the child's head typically causing skull fractures and associated brain injuries.

Forward-Facing Children Injuries

Of the 97 forward facing children, 93 were struck by the passenger air bag and four were struck by the driver air bag. Of the 93 children fatally injured by the passenger air bag, 88 were either unrestrained or improperly restrained by the available safety belt system. (Examples of improper restraint include such situations as only wearing a lap belt or sharing a safety belt with another passenger.) Seventy-four of these 88 fatalities involved pre-impact braking which caused the child to move forward into close proximity of the passenger air bag prior to deployment. Occupant contact with the instrument panel prior to deployment has been confirmed for some of the cases by the identification of tissue, fluid, and/or clothing transfers on the air bag cover flap and/or instrument panel.

In the vast majority of cases, upon impact, the air bag deploys into the out-of-position child's chest, neck, and face resulting in a rapid translation and extension of the air bag under the chin against the neck and then wrapping upward from ear to ear. The occupant's head is effectively lifted upward off the neck resulting in an atlanto-occipital fracture (C1-C2), a transection of the spinal cord, and/or multiple brain stem injuries. Diffuse axonal brain injuries, consistent with rapid movements of the head, are also commonly reported. Skull fractures were typically not observed.

The four cases where children were fatally injured by driver air bags involved circumstances such as young children on drivers' laps or children actually driving the vehicle. The five passenger air bag cases with fatalities of restrained children also involved unusual circumstances. Two of the five children who were wearing safety belts were at an age where a child seat would have been the appropriate restraint. The other cases involved such events as a child leaning forward to pick up a tissue at the time of impact and a child who was pushed forward due to a rebound from a rear collision.

Adult Drivers and Adult Passengers

There are 75 (67 confirmed and 8 unconfirmed) adult driver and 13 (8 confirmed and 5 unconfirmed) adult passenger air bag related fatalities. Exhibit 14 presents the data for driver and passenger air bags by 12-month automobile production periods. The normalized rates were calculated by dividing the SCI count of air bag fatalities for each 12-month production period by the total number of registered vehicles with driver or passenger air bags during that same interval. Each 12-month production period was aligned with the vehicle production year.

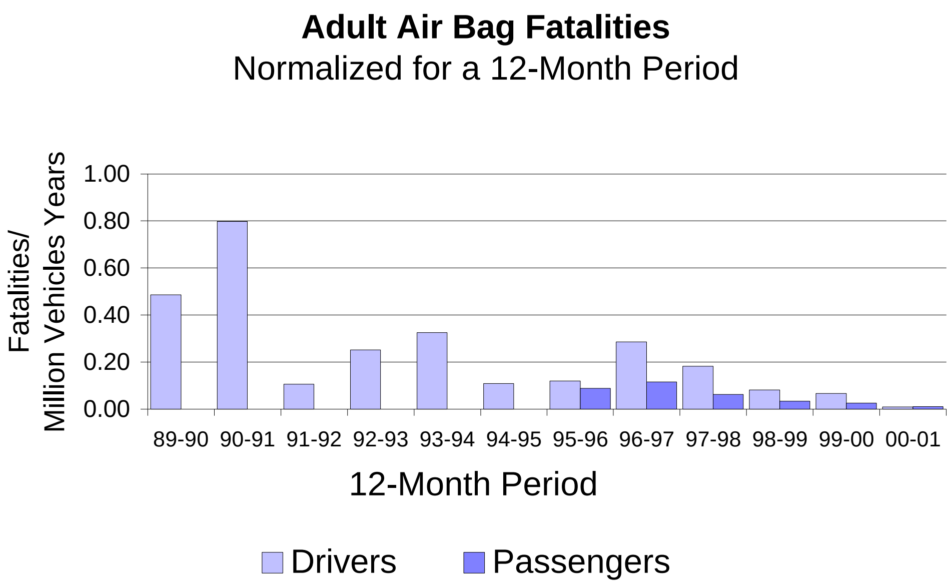

Exhibit 14

With driver air bags, there has been a decrease in the fatality rate beginning in the 1996-1997 interval, dropping from 0.26 fatalities per million registered vehicle years (MRVY) to 0.06 fatalities per million registered vehicle years (MRVY) in the 1999-2000 interval and 0.008 in the 2000-2001 interval as of July 2001. Passenger air bags have undergone an even larger decrease, dropping from about 0.1 fatalities per million registered vehicle years (MRVY) in the 96-97 interval to about 0.02 in the 1999-2000 interval and about 0.01 in the current interval.

Exhibit 15 presents the data for vehicle model years for driver and passenger air bags. There has been a decrease in the fatality rate for the driver air bag beginning with model year (MY) 1996, dropping from 0.12 fatalities per million registered vehicle years (MRVY) in model year 1996 to 0.04 fatalities per million registered vehicle years (MRVY) in model year (MY) 1998. As of July 1, 2001, there have been no driver air bag fatalities in model year (MY) 1999 or newer vehicles.

Exhibit 15

Driver and Adult Passenger Kinematics and Injury Mechanisms

The following sections discuss driver and adult passenger kinematics and injury mechanisms associated with the air bag-induced injuries. In all cases, the crash investigators have identified either the driver or passenger air bag and/or air bag cover flap as the source of the critical-to-fatal injuries. Little to no intrusion of the occupant compartment was reported in these low speed crashes. Given the low level of the crash severities involved, one would not expect that these occupants would have sustained critical-to-fatal injuries.

The air bag injury patterns for drivers and adult passengers are uniquely different due to the location, size and shape of the air bags. The driver's air bag, because of its location in the steering wheel hub, is situated in close proximity to the occupant seating position. The front right passenger air bag is typically mounted in the instrument panel and is much larger in size. This is done in an effort to protect the right front passenger and, if present, a front middle passenger.

Driver Injuries

As discussed earlier, to be fatally injured by a driver air bag, the deployment energy of the air bag must be imparted to the out-of-position (in the path of a deploying air bag) occupant. This is primarily due to the air bag size, location and deployment path. Other factors are the air bag cover flap geometry, tethers, fold patterns, inflation rate, peak pressure and venting.

The driver air bag injury patterns are directly affected by the occupants' at-deployment positioning in relationship to the body region exposed to the deploying air bag. When the occupant is seated with their chest in the deployment path, the most common fatal-to-life-threatening injuries include: multiple bilateral rib fractures; flail chest; lung contusions; fractured sternum; laceration of the myocardium/pericardium; and, aorta laceration/tear. In addition, some short stature drivers have received neck extension fractures at the atlanto-occipital joint (fracture at C1-C2) with and without spinal cord involvement. Head injuries are typically diffuse axonal brain injuries, brain stem injuries, and/or basilar skull fractures resulting from rapid acceleration of the head from interaction with the inflating driver air bag.

Adult Passenger Injuries

Passenger air bags are typically much larger to afford crash protection to the front right occupant. Some of these air bags inflate over an extremely large area in an effort to protect the front middle occupied positions. Because of the sheer volume of the front right air bag, there is a high potential for injury when an occupant is in close proximity to the air bag deployment path.

The injury patterns for adult passengers are similar to those seen in the forward facing children. Most adult occupants who are seriously or fatally injured by air bags are unbelted and placed out-of-position into the deployment path by a number of factors including pre-impact braking, multiple closely spaced near deployment events, running off the road or striking a relatively soft structure at or around the deployment threshold, which may also result in late deployment. Upon impact, the air bag deploys into the out-of-position adult passenger's neck and head. As the air bag expands, it results in the rapid translation and extension of the air bag under the chin against the neck and then wrapping upward from ear to ear. The occupant's head is forcefully lifted upward, resulting in an atlanto-occipital joint fracture (C1-C2) and a transection of the spinal cord, and probable brain stem injuries. Diffuse axonal brain injuries are also commonly reported, but skull fractures were typically not observed. These head injuries are consistent with rapid movements of the head.

Section IV -- MAJOR REGULATORY ACTIONS AND PUBLIC ANNOUNCEMENTS

Earlier Events

On May 23, 1995, NHTSA published a final rule (60 FR 27233), effective June 22, 1995, that allowed manufacturers to install on-off switches for the front passenger-side air bag in vehicles in which infant restraints can be used in the front seat only. The affected vehicles were passenger cars and light trucks without rear seats, and vehicles with rear seats that are too small to accommodate typical rear-facing infant seats. On-off switches are needed because when rear-facing infant restraints are used in the front seats of dual air bag vehicles, they extend forward to a point near the dashboard where they can be struck by a deploying air bag, with the potential for serious injury or death to the infant.

On October 27, 1995, because of the incidence of several fatalities to improperly restrained children in air bag-equipped positions, NHTSA issued a strong warning in a press release, "SAFETY AGENCY ISSUES WARNING ON AIR BAG DANGER TO CHILDREN." It "warned that children who are not protected by a safety belt could be seriously injured or killed by an air bag, and in the strongest possible terms urged parents to insist that their children ride belted in the back seat whenever possible." This release repeated previous agency warnings of the dangers of placing a rear-facing seat in front of an air bag and **broadened** the previous warnings to apply to older children and even adults who may ride unrestrained. To ensure that infants and children ride safely, with or without a passenger-side air bag, this warning and advisory urges care-givers to follow three principles:

- Make sure ***all*** infants and children are properly restrained in child safety seats, booster seats, or lap and shoulder belts for every trip.
- The ***back seat*** is the safest place for children of any age.
- Infants riding in rear-facing child safety seats should ***never*** be placed in the front seat of a vehicle with a passenger-side air bag.

On November 9, 1995, NHTSA published, in the *Federal Register*, a request for comments to inform the public about its efforts to reduce the adverse effects of air bags and to invite the public to share information and views with the agency (60 FR 56554). The request for comments focused on possible technological changes to air bags to reduce their adverse effects, including possible regulatory changes.

Since publishing its October 1995 warning and November 1995 request for comments, NHTSA has intensified its efforts to educate the public about air bag performance and the campaign to properly restrain children and to place them in the back seat. A large part of the agency's plan is to increase information to the affected public through the traffic safety community throughout the country. With this support, the agency will be able to extend the reach of its safety messages to a wider population.

On May 21, 1996, Secretary of Transportation Federico Peña announced the formation of a coalition of automobile manufacturers, air bag suppliers, insurance companies, safety organizations, and the Federal government to prevent injuries and fatalities that may be inadvertently caused by air bags, especially to children. NHTSA served a central role in uniting these private-sector partners to form the National Automotive Occupant Protection Campaign (now known as the Air Bag and Seat Belt Safety Campaign). Coalition members pledged almost $10 million to pursue a three-point program:

- An extensive national effort to educate drivers, parents and care-givers about safety belt and child safety seat use in all motor vehicles, with special emphasis on those equipped with air bags.
- A campaign to assist States to pass "primary" or standard safety belt use laws.
- Activities at State and local levels to increase enforcement of all safety belt and child seat use laws, such as increased public information and use of belt checkpoints.

On November 22, 1996, NHTSA announced a comprehensive approach to preserve the safety benefits of air bags while minimizing their danger to children and at-risk adults. Its approach centered on accelerating the development of advanced air bag technology for future vehicles with the intent of having systems available for 1999 models. More immediate measures included adopting enhanced warning labels, reducing the aggressivity of air bags and continuing to allow the use of on-off switches in vehicles without a rear seat to protect children, and allowing dealers to install on-off switches for any owner who requests it.

On November 27, 1996, NHTSA published a final rule requiring vehicles with air bags to bear three new warning labels. Two of the labels replace existing labels on the sun visor. The third is a temporary label on the dash. These labels would not be required on vehicles having an advanced passenger-side air bag. This rule also requires rear-facing child seats to bear a new, enhanced warning label. The sun visor labels are shown as Exhibit 16.

Visor in Up Position

Visor in Down Position

Exhibit 16

The initial major rulemaking actions were directed at making air bags already installed in motor vehicles less aggressive under certain specified circumstances, and to pave the way for manufacturers to install air bags that were redesigned. Continuing the Department of Transportation's comprehensive effort to preserve the benefits of air bags and minimize their risk, a Notice of Proposed Rulemaking was published early in January 1997, offering proposals for on-off switches for air bags. This effort was to take almost one year to develop satisfactory responses for each of the many issues surrounding the topic of air bag switches. In parallel with this effort, rulemaking deliberations proceeded concurrently on facilitating the development of redesigned air bags by vehicle manufactures, with the goal of mitigating the injurious effects of air bags. At the same time, a final rule was issued, extending until September 1, 2000, the time period during which vehicle manufacturers would be permitted to offer manual on-off switches for the passenger-side air bag for vehicles without rear seats or with rear seats that are too small to accommodate rear-facing infant seats.

During March 1997, the agency's rulemaking deliberations regarding redesigned air bags came to a conclusion. On March 19, 1997 (62 FR 12960) the final rule was issued. Although air bags had saved more than 1,750 lives from 1986 to early 1997, the agency at that time had identified 52 crashes in which the deployment of the air bag resulted in fatal injuries to a driver or passenger, including 38 children. The new rule stimulated manufacturers to install redesigned air bags. The next generation of air bags was, among other things, 20 to 35 percent less powerful, and should provide a significant reduction in air bag-caused injury risk. The new rule also provided manufacturers and suppliers with additional time to develop a variety of advanced air bag technologies to tailor air bag deployment more appropriately to crash severity, occupant size and position, safety belt use and other vehicle factors. Because these changes were effective immediately, manufacturers were given maximum opportunity to install less aggressive air bags that should reduce the risk of air bag-induced injury during a vehicle crash. The rule provided changes that would affect new production vehicles. The issue of what to do about vehicles already on the road came next.

On-Off Switches

On November 21, 1997, the agency announced the final rule permitting on-off switches in certain situations. This rulemaking resolved many issues raised by manufacturers, safety groups, the public, and other interested parties. Transportation Secretary Rodney E. Slater stated: "This is the practical solution that allows you to turn off the air bag for someone at risk and turn it back on to preserve the lifesaving benefits for everyone else." Air bags provide life-saving benefits for the vast majority of people, who can virtually eliminate any risk from deployments by following basic safety practices:

> **Always buckle your seat belt.**
>
> **Never place a rear-facing infant seat in front of an air bag.**
>
> **Keep approximately 10 inches between your breastbone and the air bag.**
>
> **Place children in the back seat and make sure they are properly restrained, either in a seat belt or a child safety seat appropriate for their size and weight.**

Few people would need an air bag on-off switch. To guide the general public in their actions regarding air bag switches, the agency issued guidelines describing the eligibility groups. The eligibility profiles are:

- Those who cannot avoid placing rear-facing infant seats in the front passenger seat.
- Those who have a medical condition that places them at specific risk.

- Those who cannot adjust their driver's position to keep back approximately 10 inches from the steering wheel.

- Those who cannot avoid situations – such as a car pool – that require a child 12 or under to ride in the front seat.

Auto dealers and service outlets were able to begin installing air bag on-off switches on January 19, 1998.

To obtain a switch, consumers must follow a simple four-step process. First, they must obtain an information brochure and a request form from NHTSA, both of which are available from the agency through the Auto Safety Hotline and at vehicle dealerships, repair shops, State motor vehicle offices, and other locations. The form and brochure can also be downloaded from the NHTSA web site at http://www.nhtsa.dot.gov/airbags.

Second, they must fill out the request form and return it to the agency. Vehicle owners must certify on the form that they have read the information brochure and that they, or someone they transport in their vehicle, fit one of four profiles of people at risk.

Third, the agency will send an authorization letter to the vehicle owner.

Finally, the vehicle owner takes the letter to a dealership or other service outlet to have the on-off switch(es) installed. The switch that is installed will only be able to turn off the air bag(s) that affects the person(s) in the risk group. The service outlet will inform NHTSA when the work is done.

To help consumers make informed and appropriate decisions about air bag safety, the Department of Transportation initiated a major educational effort in partnership with many organizations, including the Air Bag and Seat Belt Safety Campaign, the American Automobile Association, the Centers for Disease Control, the Insurance Institute for Highway Safety, auto dealers, State motor vehicle departments, and many other public and private organizations and individual companies.

As of October 1999, the agency had issued 57,103 air bag on-off switch authorizations for 70,275 passenger- and/or driver-side switches. A total of 11,195 switches had been installed. In the spring of 1999, the agency conducted a survey of 2,000 people who had been granted authorization, but who had not had the switches installed. Approximately 700 people responded to the survey. The agency found several predominant reasons the switches were not installed. The primary reason cited by respondents was that very few dealerships would install switches. Second, the average $300 cost of installation discouraged owners. While other reasons were given, these were the primary problems.

NHTSA does not have the authority to require vehicle manufacturers, dealers or repair businesses either to permanently deactivate an air bag or to provide the means of installing an air bag on-off switch. Despite the agency's best efforts to inform these businesses that they face little risk if they install switches subject to the applicable regulation, some manufacturers and many dealers have not provided or specifically refused to provide on-off switches and to do the installation work, due to liability concerns.

Some businesses have expressed concerns that they will be sued if they install an air bag switch. All of the vehicle manufacturers who are producing on-off switches generally have agreed to indemnify their dealers for all causes of action other than negligence. Manufacturers will be able to provide the specific details on their indemnification agreements. Generally, negligence actions are covered by liability policies to the same extent as negligence actions for a faulty brake repair. In any case, the switch installer may require a vehicle owner to sign a waiver that releases the business from liability if it chooses to install a switch.

Moreover, NHTSA believes the risk of a lawsuit being filed is remote. Since 1995, NHTSA has allowed air bag on-off switches to be placed in pick-up trucks, sports cars, or other vehicles with either no back seat or a back seat that is too small to accommodate a rear-facing infant seat. As of July 1, 2000, there were over 8.6 million vehicles with air bag switches installed as original equipment, and as of July 1, 2001, NHTSA estimates that approximately 10.2 million vehicles were so equipped. NHTSA is not aware of a single lawsuit or claim made against any manufacturer, dealer, or repair business with respect to any matter involving such a switch.

NHTSA recognizes that the decision to install air bag on-off switches is one that every business must make on its own. It hopes that more businesses will be willing to install these switches after they have objectively evaluated the risks involved in installing a switch. Because of the disparity in the numbers of people requesting switches and people having switches installed, and because of numerous letters from vehicle owners who are searching for someone to install a switch, NHTSA has decided to publish, on its web site, a list of dealers and repair businesses willing to install switches. The agency would be pleased to add companies that would like to be added to this list. Companies that are willing to install switches and would like to have their name added to NHTSA's web site can simply contact NHTSA at counsel@nhtsa.dot.gov. Conversely, companies that no longer choose to install switches should contact us so we can keep the list up-to-date.

NHTSA has taken specific actions addressing liability concerns of dealers and repair businesses:

- *Before a switch can be installed,* certain requirements must be met. Switch applicants must certify that they have read a NHTSA information brochure detailing the risks associated with a deactivated air bag. A switch installer is under no obligation to tell the customer when to turn the air bag off and when to turn it back on. The applicants must also certify that they understand the switch installer may require the applicant to sign a waiver that releases the business from liability if it chooses to install a switch. The National Automobile Dealers Association has drafted a model waiver based upon its expertise, as well as input from all the major liability insurers.

- *After the switch has been installed,* the switch requirements provide additional safeguards. NHTSA requires that any switch have a telltale (a light warning that the air bag has been turned off) that is visible to anyone sitting in the seat affected by the air bag when the switch has been activated, and visible to the driver regardless of whether the driver-side or passenger-side air bag has been turned off. This measure was adopted so that the driver will always know when an air bag has been temporarily deactivated, and so that a passenger will know if there is a working air bag.

- NHTSA also requires that the *air bag readiness indicator* (the light which tells the driver that an air bag is not working properly) be separate from the telltale so that there would be no confusion as to whether an air bag is capable of functioning properly, even though it has been temporarily deactivated.

- In order to prevent an inadvertent change in air bag status, NHTSA requires that *the switch be operable by a key or key-like object*. This requirement was adopted to prevent children from turning the air bag on or off without a responsible adult being aware of it. An insert must be placed in the vehicle owner's manual that describes how the switch works, lists the risks groups for which a switch will be authorized, states that the air bag should be turned off only for individuals within these risk groups, and states the safety consequences for individuals not in these risk groups when the air bag is turned off (including any information concerning seat belt energy managing features like load limiters). Vehicle manufacturers should include this insert as part of the switch installation kit.

These four requirements give the vehicle driver the ultimate opportunity and responsibility to use the air bag on-off switch appropriately, even if that person did not own the vehicle when the switch was installed. The agency will continue to encourage manufacturers and dealers to participate in this important program.

In summary, NHTSA continues to work with individual consumers, vehicle manufacturers, and dealers to facilitate installation of air bag switches. NHTSA continues to work with vehicle manufacturers to encourage switch availability in newer vehicles. We believe our efforts will continue to resolve the majority of situations where at-risk people require on-off switch relief.

Recent Regulatory Actions on Future Vehicles

The previous regulatory actions were aimed at reducing the risks from the older or the current generations of air bags in vehicles already on the road and those that will be built during the next few years. Continued changes and emerging technologies will lead to air bags with improved performance that eliminate risks to all vehicle passengers.

The primary focus of regulatory action is to require that improvements be made in the ability of air bags to cushion and protect occupants of different sizes, belted and unbelted, and to require that air bags be redesigned to minimize the risks they pose to infants, children, youth and small adults. To further this effort, the agency has undertaken an aggressive research program. On September 14, 1998, the National Highway Traffic Safety Administration announced that it would require additional air bag system performance tests for passenger cars and light trucks in order to provide maximum protection for properly seated adults and reduced risks for infants, young children and out-of-position adults. Proposed crash tests would incorporate a new crash test dummy family with improved injury criteria that better represents human tolerances. The family includes 1-, 3- and 6-year-old child dummies, a small (5^{th} percentile) female dummy, and an average size (50^{th} percentile) male dummy. The proposal also includes full car crash tests to preserve and enhance the current level of air bag protection.

In order to establish benchmarks that delineate the current state of the art, numerous efforts were initiated to obtain appraisals of current technology. Two programs were initiated together to find out more about current commercial efforts to develop advanced air bag technology. These programs were initiated to obtain independent assessments of the future technology.

The first program was a joint effort between the NHTSA and National Aeronautics and Space Administration (NASA). NHTSA and NASA signed a memorandum of understanding for NASA to assess the capability of advanced technology to reduce air bag inflation-induced injuries and increase air bag effectiveness. NASA designated the Jet Propulsion Laboratory (JPL) to conduct the research effort. JPL provided the agency with a list of critical parameters affecting air bag performance, a survey of advanced technologies, and their state of readiness.

A second program involved an assessment by Management Engineering Associates (MEA) of Washington State. MEA was assigned the task to identify current advanced air bag designs and to determine, where possible, the feasibility of near-term (two years) or long-term (more than two years) production readiness. Both reports have been received by the agency and placed in the public docket (Internet: http://dms.dot.gov/, docket 2814). Much of the information reported by JPL and MEA corroborated and substantiated the agency's previous understanding about where the technology was headed. The reports indicated that there were no known sciences that were being ignored as candidates for advanced air bag technology.

As discussed in the previous reports to Congress, the agency has conducted a comprehensive research program aimed at improving advanced air bag technology. The assessments made by JPL and MEA were incorporated into this program. The opportunities for advancing the state of the art of air bags are indicated by the range of technological candidates identified by JPL and MEA for use in complete systems. Some of these systems may require advances in anthropomorphic test devices, and could require additional effort to develop test dummies that are suitable for being detected by the new systems, such as warm dummies that simulate a real person more closely, or dummies that have dielectric properties more closely resembling live occupants. In the interim, the agency is making every effort to incorporate as many different standard dummy configurations as possible into the on-going regulatory changes for advanced air bags. These dummies include the 3-year old, the 6-year old, the 5^{th} percentile female, the 95^{th} percentile male and the 12-month old infant dummy to augment our testing capabilities.

The agency then supplemented these analyses by re-contacting many of the equipment suppliers and vehicle manufacturers contacted by JPL and MEA. This allowed the agency to develop direct partnerships with these companies.

On December 17, 1997, the agency sent out information requests to nine vehicle manufacturers on air bag system designs. In those letters the agency asked vehicle manufacturers about the designs of vehicles they had already manufactured. This information is being analyzed to determine the most significant characteristics of air bag design. The public portion of the manufacturer responses is available in the DOT docket on the Internet: http://dms.dot.gov/, docket 2814.

On April 8, 1998, NHTSA sent information request letters to nine air bag component or system suppliers. In those letters, the agency asked about future designs that were currently under development. This information was used to evaluate the likelihood that certain technologies would come to fruition. Additionally, the data from these letters were used to refine previous cost and lead-time estimates. Based on these data, the agency was able to re-enforce the direction of the advanced air bag rulemaking and the supporting research. The public portion of these data is in the DOT docket at Internet: http://dms.dot.gov/, docket 2814.

The NHTSA also maintained contact with vehicle manufacturers and equipment suppliers to stay up with the advances in air bag technology and manufacturers' production plans (see Internet: http://dms.dot.gov/, docket 4405). During these meetings, manufacturers reiterated concerns with the agency's ongoing rulemaking and kept the agency informed on their production design decisions. This information was extremely helpful to NHTSA in identifying pros and cons and making decisions.

Research to Support Advanced Air Bag Rule

This agency's ongoing research was continually upgraded to refine our advanced air bag regulatory strategy. The upgraded information includes not only the results of our own research efforts, but also the research done by other interested parties, such as vehicle manufacturers, equipment manufacturers, the Insurance Institute for Highway Safety, and Transport Canada.

Transport Canada, a transportation technology and regulatory department of the Canadian government, is working in conjunction with NHTSA on a cooperative research program to develop advanced crash test procedures and to investigate the efficacy of advanced air bags and different test protocols. The joint program with Transport Canada has been a valuable resource in evaluating the biofidelity of the 5^{th} percentile female Hybrid III test dummy, the assessment of redesigned air bag performance, and the understanding of vehicle crash sensor performance in low severity crashes.

The results of all of these research entities have been consolidated to form the basis for the advanced air bag program strategy. These data (except where confidential) are being presented to the public at Internet: http://dms.dot.gov/, docket 4405.

Many different technical approaches are currently being considered as candidates for advanced air bag technology by both government and industry. While it was apparent that some manufacturers are currently capable of implementing dual-stage or multi-stage inflators, it was not apparent that all manufacturers would choose this course of action when alternative and possibly more advanced systems are available, such as automatic suppression technology. Systems that resort to more advanced technology to control the restraining forces acting on the occupant during an air bag crash seem to be well enough along in the development cycle to merit careful consideration by vehicle manufacturers.

Advanced air bag technology stands today at a crossroads in engineering development. Many scientific technologies and complex disciplines interact currently to make the state-of-the-art in advanced air bag development an evolving science. Concepts such as recessed mounting, variable venting, lighter air bag covers, non-aggressive fold patterns, lighter mass fabrics, tailorable inflator output, the use of computer neural networks, programming fuzzy logic, the allocation of ultrasonic, infrared, and electric field sensing technology to new sensor designs, and weight sensing technologies represent a widely diverse array of potential candidates for eventual use in advanced air bag systems.

To account for all of these technologies, and to give manufacturers and suppliers the maximum benefits of possibly unproven but promising hardware, the agency decided that the optimum path for future rulemaking should be performance-based regulatory requirements. This approach would permit varied choices and options in order to provide manufacturers with utmost flexibility to design new systems. The architecture of the advanced air bag rulemaking is based on maximizing the availability of these options in order to provide design flexibility and to promote widespread opportunities to develop innovative solutions to a difficult problem.

In the advanced air bag rulemaking, the agency has sought to <u>avoid</u>:

- inadvertently preventing the use of superior air bag designs;
- favoring one viable technology or design over another, where either would meet the need for safety;
- requiring an expensive solution, where an inexpensive one will work; or
- requiring implementation of a particular technology before it can be developed and proven reliable and durable.

Advanced Air Bag Rule Proposals

Overview

NHTSA's advanced air bag proposals followed the basic requirements specified by both the Intermodal Surface Transportation Efficiency Act of 1991 and the Transportation Equity Act for the 21st Century (TEA 21). These proposals have been interactive because of the technological complexity of the issues involved and because of the enormous social significance of preventing further fatalities from air bags to small children and small out-of-position adults. NHTSA's proposals as summarized in the table below led to an Interim Final Rule on advanced air bags issued on May 12, 2000.

The Notice of Proposed Rulemaking

On Friday, September 18, 1998, a Notice of Proposed Rulemaking was published in the *Federal Register* (63 FR 49958), proposing a new series of crash tests that would incorporate a new crash test dummy family with improved injury criteria to better represent human tolerances. The new dummy family includes 1-, 3- and 6- year old child dummies, a small (5th percentile) female dummy and an average size (50th percentile) male dummy. The NPRM offers a series of options that preserve and enhance the benefits of air bags while reducing risks, to ensure that various types of occupants are protected in a wide variety of crash conditions. The proposed requirements are planned to become phased in, with 25 percent of each manufacturer's production required to meet the new standard beginning in model year 2003, 40 percent in model year 2004, then 70 percent in model year 2005 with full implementation scheduled for model year 2006.

Summary of Advanced Air Bag Rulemaking Milestones		
Action	**Date**	**Status**
Notice of Proposed Rulemaking	Sept 18, 1998, 63 FR 49958	Completed
Supplementary Notice of Proposed Rulemaking	Nov 5, 1999, 64, FR 60566	Completed
Interim Final Rule	May 12, 2000, 65 FR 30680	NHTSA is responding to petitions for reconsideration at this time.

Exhibit 17

The official public comment period closed on December 17, 1998. The agency received 67 initial comments from vehicle manufacturers, organizations and the public. (On the Internet at http://dms.dot.gov/, docket 4405.) The comments were quite diverse.

All commenters agreed that advanced air bags must mitigate risks. Most commenters believed different sized dummies should be used in performance tests. These should include the 12-month-old infant, 3-year-old, 6-year-old and 5th percentile female dummies.

Consumer groups favored re-instating a mandatory 30 mile-per-hour unbelted rigid barrier test. They favored instituting the new proposed injury criteria for head, neck and chest injury measurement on the test dummies. They suggested on-off switches be phased out as an available option. Also, the issue of adding an even larger test dummy, representing the 95th percentile male, was recommended.

Manufacturers believed the agency's proposal was too complex and the need for some of the proposed tests was not substantiated by real world data. Vehicle manufacturers urged the agency to maintain the "sled test" which had permitted them to quickly re-design their 1998 model year air bags. The vehicle manufacturers and suppliers supported the concept of reducing the risks due to air bags. However they speculated that the current level of protection, using the sled test and a 30 mph belted test would actually maintain the benefits of air bags. They speculated that it was not necessary to return to the 30 mph unbelted barrier test. They urged the agency to continue looking at the real world crash data to justify the various tests proposed in the regulation. They urged the agency to reduce the number of tests, to give them the design flexibility to set the best performance levels on some criteria such as air bag inflation levels and deployment speed thresholds.

The agency has conducted numerous public meetings to provide opportunities for open discussions and agreements concerning the advanced air bag notice. In November 1998, the agency conducted two public meetings to discuss the September NPRM. The first meeting presented the agency's proposed injury criteria. The second meeting presented the agency's data on high-speed crash test options. These meetings gave the agency a perspective of the nature and magnitude of the pending comments. Then, after the comment period closed and the comments were analyzed, the agency conducted an additional public meeting to present the test dummy injury criteria. The agency used the comments by the world experts who testified, to further our understanding of these issues. NHTSA believes these interactions with our partners have permitted the agency's decisions to be based on the best data available.

The agency also continued to have meetings with vehicle manufacturers, systems manufacturers and technology experts. Vehicle manufacturers, such as General Motors, Ford, and Toyota, met with the agency to discuss their production plans and their concerns with the proposed rulemaking. Organizations such as the University of Michigan Transportation Research Institute, International Electronics Engineering (IEE) and First Technology Safety Systems (FTSS) met with the agency to discuss test procedures. These meetings are documented in the advanced air bag rulemaking docket 4405 (Department of Transportation Docket Management System Internet address http://dms.dot.gov, docket 4405).

The Supplementary Notice of Proposed Rulemaking

As a result of this interaction with the public, the National Highway Traffic Safety Administration prepared a Supplemental Notice of Proposed Rulemaking (SNPRM), which refined many of the issues, deleted redundant requirements and focused on the most important performance requirements. For example, the agency significantly reduced the number of child safety seats that would have to be tested, and selected a representative set. The agency deferred the use of a specific dynamic test to measure air bag suppression systems, due to the lack of a universal test procedure or systems to test. The agency also refined the injury criteria. For example, the agency decided to use an internationally accepted head injury criterion measured at a 15-millisecond duration (HIC15) rather than the old agency standard of a 36-millisecond duration. Chest injury criteria were simplified to two simple values of deceleration and compression. Neck injury criteria were maintained in the proposal. The SNPRM was published on November 5, 1999, and asked for comments from the public on these new concepts. One hundred and fifty comments have been received in response to the docket.

In the SNPRM, the agency proposed several unprecedented test procedures. One involves adding an unbelted offset deformable barrier test to help ensure that crash sensing and software systems adequately address crashes with relatively soft (deformable) structures (in such crashes, air bag deployment is sometimes slightly delayed). In another, for testing air bag suppression systems, the agency proposed using live human beings. With appropriate safety precautions, the agency agrees that the best way to test a system that would detect the presence of a human being is to use an actual human. Next, the agency proposed expedited rulemaking procedures to permit dynamic suppression systems manufacturers the latitude to develop test procedures appropriate to their technologies and then propose the tests to be incorporated into the Federal standard. These processes are intended to remove more barriers to technological advancements and appear in the Interim Final Rule for advanced air bags.

The Interim Final Rule

On May 12, 2000, we published in the **Federal Register** (65 FR 30680) an interim final rule to require advanced air bags. (Docket No. NHTSA 00-7013; Notice 1.) The rule amended

Standard No. 208, Occupant Crash Protection, to require that future air bags be designed to create less risk of serious air bag-induced injuries than current air bags, particularly for small adults and young children; and provide improved frontal crash protection for all occupants, by means that include advanced air bag technology.

To achieve these goals, the rule added a wide variety of new requirements, test procedures, and injury criteria, using an assortment of new dummies. Among other things, it replaced the current sled test with a rigid barrier crash test for assessing the protection of unbelted occupants.

The issuance of the rule completed the implementation of our 1996 comprehensive plan for reducing air bag risks. It was also required by the Transportation Equity Act for the 21st Century (TEA 21), which was enacted in 1998. That Act required us to issue a rule amending Standard No. 208:

> to improve occupant protection for occupants of different sizes, belted and unbelted, under Federal Motor Vehicle Safety Standard No. 208, while minimizing the risk to infants, children, and other occupants from injuries and deaths caused by air bags, by means that include advanced air bags. (Emphasis added.)

The rule will improve protection and minimize risk by requiring new tests and injury criteria and specifying the use of an entire family of test dummies: the existing dummy representing 50th percentile adult males, and new dummies representing 5th percentile adult females, six-year old children, three-year old children, and one-year old infants. With the addition of those dummies, Standard No. 208 will more fully reflect the range in sizes of vehicle occupants.

The rule is phased in during two stages. The first stage phase-in requires vehicles to be certified as passing the unbelted test requirements for both the 5th percentile adult female and 50th percentile adult male dummies in a 32-40 km/h (20-25 mph) rigid barrier crash, and belted test requirements for the same two dummies in a rigid barrier crash with a maximum test speed of 48 km/h (30 mph). In addition, the first stage requires vehicles to include technologies that will minimize risk for young children and small adults.

The second stage phase-in requires vehicles to be certified as passing the belted test requirements for the 50th percentile adult male dummy at up to 56 km/h (35 mph). This requirement will ensure improved protection for belted occupants.

During the first stage phase-in, from September 1, 2003 to August 31, 2006, increasing percentages of motor vehicles will be required to meet requirements for minimizing air bag risks, primarily by either automatically turning off the air bag in the presence of young children or deploying the air bag in a manner much less likely to cause serious or fatal injury to out-of-position occupants. If they so wish, manufacturers may choose to use a combination of those two approaches.

Manufacturers that decide to turn off the passenger air bag will use weight sensors and/or other means of detecting the presence of young children. To test the ability of those means to detect the presence of children, the rule specifies that child dummies be placed in child seats that are, in turn, placed on the passenger seat. It also specifies tests that are conducted with unrestrained child dummies sitting, kneeling, standing, or lying on the passenger seat.

The ability of air bags to deploy in a low risk manner will be tested using child dummies on the passenger side and the small adult female dummy on the driver side. For manufacturers that decide to design their passenger air bags to deploy in a low risk manner, the rule specifies that unbelted child dummies be placed against the instrument panel. This location was selected because pre-crash braking can cause unrestrained children to move forward into or near that position before the air bag deploys. The air bag is then deployed, and injury measures are evaluated. The ability of driver air bags to deploy in a low risk manner will be tested by placing the 5th percentile adult female dummy against the steering wheel and then deploying the air bag.

In addition, the vehicle manufacturers will be required to meet a rigid barrier crash test with both unbelted 5th percentile adult female dummies and unbelted 50th percentile adult male dummies. The unbelted rigid barrier test replicates what happens to motor vehicles and their occupants in real world crashes better than the current sled test does. The maximum test speed for unbelted dummy testing will be 40 km/h (25 mph).

Our decision to set the maximum test speed for unbelted dummy testing at 40 km/h (25 mph) was issued as an interim final rule. We concluded that was the appropriate test speed for at least the TEA 21 implementation period (MY2004-2007). We explained that that speed would provide vehicle manufacturers with the flexibility they need during that period to meet the technological challenges involved in simultaneously improving protection and minimizing risk. To achieve those twin goals, the manufacturers will have to comply with the wide variety of new requirements using an array of new dummies during this near-term time frame.

However, we did not draw any final conclusion about the appropriateness of that test speed in the longer run. We explained that, at this time, we could not assess whether the uncertainty about the manufacturers' ability to improve protection further and minimize risk simultaneously will persist beyond the TEA 21 implementation period. We stated that, in addition, while we believed that it was unlikely that a 40 km/h (25 mph) maximum test speed would lead to a reduction in high-speed protection, we could not rule out that possibility. We noted that if manufacturers were to engage in significant depowering, it could result in lesser crash performance for teenage and adult occupants. On the other hand, even if current levels of real world protection were only maintained, rather than improved, the marginal benefits of a 48 km/h (30 mph) unbelted maximum test speed would be significantly diminished or eliminated.

We stated that, to help resolve these issues and concerns, we were planning a multi-year effort to obtain additional data. We stated that, based on the results of those information gathering and analysis efforts, we would make a final decision regarding the maximum test speed for unbelted dummy testing in the long run, after providing opportunity for informed public comment.

The Interim Final Rule made still other additions to Standard No. 208. To ensure that vehicle manufacturers upgrade their crash sensing and software systems as necessary to prevent late air bag deployments in crashes with soft pulses, vehicles will be required to meet an up-to-40 km/h (25 mph) offset deformable barrier test using belted 5th percentile adult female dummies. Research has shown that late deployment events in this crash mode can result in the 5^{th} percentile female being in close proximity to the driver air bag at the time of deployment. Thus, the occupant could be at risk of a severe or fatal injury from the air bag. In addition, the 5th percentile female dummy is added to the 48 km/h (30 mph) belted rigid barrier test.

During the second stage phase-in, from September 1, 2007 to August 31, 2010, the maximum test speed for the belted rigid barrier test will increase from 48 km/h (30 mph) to 56 km/h (35 mph) in tests with the 50th percentile adult male dummy only. As in the case of the first-stage requirements, this second-stage requirement will be phased in for increasing percentages of motor vehicles. We explained that we did not include the 5th percentile adult female dummy in this requirement because we have sparse information on the practicability of such a requirement. We stated that would initiate testing to examine this issue and anticipated proposing increasing the test speed for belted tests using the 5th percentile adult female dummy to 56 km/h (35 mph), beginning at the same time that the belted test must be met at that speed using the 50th percentile adult male.

We revised the warning labels to inform the vehicle occupants that air bags remain risky, and that improper use can still result in unwanted outcomes causing injury or death, particularly if small children are improperly positioned in a vehicle. The revised labels required by the Interim Final Rule are shown as Exhibit 18.

Removable Dash Label

Sun Visor Label

Exhibit 18
Advanced Air Bag Labels as Required by the Interim Final Rule

Petitions for Reconsideration

The Interim Final Rule was not unanimously received by all interested parties. Eight petitions for reconsideration were submitted to the agency. Four of the petitions were from manufacturers of vehicles or air bags. Petitions were also filed by three industry associations representing vehicle manufacturers, and by a coalition of consumer groups. In addition, Isuzu and TRW submitted requests for clarification before the period of time for filing petitions had run. Honda, Autoliv, and Ferrari filed comments that would be considered petitions for reconsideration had they been timely filed.

The coalition of consumer groups that filed a petition included the Center for Auto Safety, the Consumer Federation of America, Parents for Safer Air Bags, and Public Citizen. (We will refer to this coalition of consumer groups as the “Consumer Groups.”) The Consumer Groups requested several changes to the final rule. First, they requested we amend the rigid barrier test requirements in the final rule to require a higher test speed for passenger cars (30 mph) than for light trucks, vans and SUVs (25 mph). They also requested that we require that the 25 mph offset deformable barrier test be conducted with unbelted rather than belted dummies and that the vehicle impact the barrier on both the driver and passenger sides. Finally, they asked that all rigid barrier tests be conducted in both the perpendicular and oblique modes.

The Coalition of Small Volume Automobile Manufacturers (COSVAM) petitioned NHTSA to expand that definition to manufacturers of no more than 10,000 vehicles per year. Alternatively, it petitioned that the 5,000 vehicle cap be limited to vehicles sold in the United States per year or that the 5,000 vehicle cap be averaged over the phase-in period. Under the averaged approach, if a manufacturer produced more than 5,000 vehicles in a single year, it could still take advantage of the exclusion as long as the average of production during the phase-in was not more than 5,000 vehicles per year.

The petitions from manufacturers and their associations requested numerous changes in other aspects of the final rule. DaimlerChrysler and Toyota requested that the unbelted rigid barrier test be conducted at only 25 mph, with the possibility of a small tolerance, instead of the specified range of 20 to 25 mph. They claimed that meeting the requirements of the unbelted barrier tests at speeds below 25 mph might prevent them from certifying compliance on the passenger side using low risk deployment option. They also claimed they would have difficulty meeting the low risk deployment requirements on the driver side. Several petitioners also expressed concern over the seating position for the 5th percentile adult female test dummy in the rigid barrier tests.

Several requests were made concerning the static suppression option, most of which concerned the level of seat belt cinch-down force for the belted test procedures and the selection of child restraints. Toyota, the Alliance, DaimlerChrysler and Takata all stated that they believed the 134N cinch-down force specified in the final rule was unreasonable. Petitioners urged NHTSA to adopt a cinch-down force of 67N, which is currently specified in FMVSS No. 213.

Toyota also raised several issues in its petition related to the use of current anthropomorphic test dummies and humans in static suppression tests. It urged the agency to work with industry in developing better test dummies because of the recognition problems many static suppression systems have with the current test dummies. Mitsubishi echoed this request.

We received several requests regarding the test procedures for both the driver and passenger low-risk deployment tests, as well as the 300 ms time frame specified in the final rule for those tests. Additionally, several issues regarding the low-risk deployment test procedures were raised at a December 2000 technical workshop the agency conducted to explore issues related to test procedures. Several petitioners, including Toyota, the Alliance, TRW, and DaimlerChrysler have argued against the extension of the 300 ms data acquisition requirement for measuring injury criteria in the low risk deployment tests. The petitioners argued that data should only be counted prior to impact of the head, neck and torso with interior components other than the air bag. DaimlerChrysler petitioned the agency to change the test procedure for determining which stage or stages of air bag to fire in the low risk deployment tests. It argued in favor of allowing the use of the dummies for which the low-risk deployment technology is designed to be used in the initial test. Thus, if a manufacturer certifies to the low-risk deployment requirement for the six-year-old child dummy, the barrier test would be run using that dummy.

While the petitions regarding the low risk deployment tests for the passenger air bag addressed both the head-on-instrument panel and chest-on-instrument panel test positions, the greatest criticism was leveled against the chest-on-instrument panel position. While other petitioners expressed general concerns about the test procedure in their petitions, the most comprehensive analysis was provided by TRW. TRW noted that when both the 3-year-old and the 6-year-old test dummies were initially positioned as required and then moved forward, dummy contact with the windshield or instrument panel could position the dummy a considerable distance from the air bag. They noted that if the dummy was not moved once contact was made then the dummy could be a considerable distance from the instrument panel.

Several petitioners, including TRW, DaimlerChrysler, and Toyota sought clarification of what was meant by the "geometric center of the right air bag tear seam". They noted that many passenger systems do not have a true tear seam. Rather, they may have a cover that opens as part of the instrument panel, or the instrument panel may be a solid structure with no visible tear seam. In both of these instances, the "geometric center of the right air bag tear seam" is difficult to determine and could vary depending on who is conducting the test.

Petitions concerning the positioning procedure for the low risk deployment test on the driver side focused on the chin-on-rim test procedure. Toyota stated in its petition that the final rule did not adequately ensure that the dummy's chin would not catch on the rim of the steering wheel, leading to artificially high neck extension bending moments. Honda raised similar concerns. Toyota also stated that using the seat to move the dummy forward results in pre-loading the dummy. Toyota presented no data analyzing the effect of such pre-loading. Mitsubishi and TRW queried whether forward head movement was to cease if the dummy chest or torso impacted the steering wheel before the head contacted the windshield.

The Alliance, DaimlerChrysler, and Toyota petitioned for changes in the final rule's new injury criteria. The Alliance and DaimlerChrysler petitioned the agency to scale the HIC measurements for the 5th percentile adult female dummy and the 6-year-old child dummy at a maximum HIC of 779 and 723, respectively. The Alliance, Toyota and DaimlerChrysler petitioned the agency to adopt the Alliance's scaled chest acceleration measurement of 73 g. They expressed particular concern over the effect the 60 g limit would have in the belted barrier test for the 50th percentile adult male dummy. In their petitions for reconsideration, both Toyota and DaimlerChrysler reiterated their concerns with the Hybrid III neck design and with the adoption of Nij as an injury criterion. Toyota petitioned that the introduction of Nij be delayed until the bending moment issues are resolved. DaimlerChrysler petitioned the agency to measure only axial force rather than using Nij due to problems it believes the current Hybrid III neck has in measuring bending moments.

We also received petitions for reconsideration for and comments on both the changed label and on the allowance of additional information other than that required by the warning label. Toyota urged us to keep the existing warning label, except for the addition of the statement "even with advanced air bags", arguing that the advanced air bag technology is not yet developed enough to justify a weaker label. DaimlerChrysler, Toyota, GM, the Alliance and Ford have all requested that NHTSA limit any information beyond that in the required label to the owner's manual. Parents for Safer Air Bags asked for clarification of the agency's position.

The Alliance, DaimlerChrysler, and Mitsubishi petitioned the agency to revise the current requirement that the telltale be visible to occupants of all ages, and urged us instead to adopt the requirements of FMVSS No. 101, Controls and Displays. DaimlerChrysler also requested the regulatory text be clarified to assure that the telltale would be visible to all occupants seated in a forward-facing position, and that it not be obstructed by a rear facing child restraint. The Alliance requested that they be allowed to use the abbreviation "pass" in lieu of "passenger" in the message text, and DaimlerChrysler requested that manufacturers be allowed to use a universal symbol representing the status of the air bag rather than a specified text.

On December 18, 2001, NHTSA responded to all of the outstanding petitions for reconsideration, and published a final rule; response to petitions for reconsideration (Docket No. NHTSA 01-11110; Notice 1) in the *Federal Register* (66 FR 65375). After careful consideration of all petitions, NHTSA made a number of modifications to the final rule, including:

- Eliminated the seat belt cinch down force specification for car beds only (it will remain at 134N for other relevant situations).
- Made minor changes in the seating position for the 5th percentile female dummy for both out-of-position and dynamic tests.
- Updated the list of child restraints used for the automatic suppression test, and stated that any amendments to that list will not become effective until one year from publication.
- Allowed a 5th percentile female dummy rather than a 50th percentile male dummy to be placed in the front passenger seat position during the 16 mph rigid barrier test that determines the air bag stage to be used for the low risk deployment tests.
- Modified portions of the child dummies positioning procedures for the low risk deployment tests to achieve more appropriate test positions in the greatest number of vehicles.
- Set the time duration for the low risk deployment test to 125 ms from the initiation of deployment of the final stage air bag that will fire in a 16 mph rigid barrier impact.
- Removed the specification of thread as the only acceptable material for holding dummies in place.
- Allowed, on the sun visor, additional labels providing design-specific information about a particular advanced air bag system.
- Clarified the text dealing with telltale location by requiring that the telltale be in a location where it cannot be obscured by a rear-facing child restraint from the vision of a properly seated driver.
- Clarified that the telltale is required only in vehicles with automatic suppression systems.
- Authorized the abbreviation "pass" for "passenger" on the telltale.
- Specified that only owner's manual in vehicles with advanced air bags need include certain information.

- Redefined the vehicle cap for small vehicle manufacturer to a limit of not more than 5000 vehicles produced or assembled by the original vehicle manufacturer for the U.S. market per year.

- For the requirement that injury criteria be calculated using a phaseless digital filter, changed the effective date from September 1, 2000 to September 1, 2001.

- Authorized that automatic suppression tests using a car bed and tests using a rear-facing child safety seat or a convertible child restraint may be conducted, at manufacturer's option, with a human child; the child, if used, must be between 18 and 20 pounds in weight and between 24 and 26 inches in height.

Full details and explanations on these decisions and others can be found in the *Federal Register* of December 18, 2001 (66 FR 65375), or at the Department of Transportation Docket Management System, Internet address http://dms.dot.gov, docket 11110.

Section V -- SEAT BELT USE ANALYSES

In addition to reporting on the effectiveness of occupant protection systems, Section 2508(e) of ISTEA requests that the Secretary of Transportation, in consultation with the Secretary of Labor and the Secretary of Defense, provide a biennial report of seat belt use by the public at the national and State levels and by Federal, State and local law enforcement officers, military personnel, Federal and State employees other than law enforcement officers. This chapter presents currently available information on seat belt use by a number of these sub-populations.

Seat Belt Use by The Public

On January 23, 1997, former President Clinton directed the Department of Transportation to prepare a plan to increase the use of seat belts Nationwide. The Department, in turn, tasked NHTSA to take the lead in developing this plan. Shortly thereafter, NHTSA met with and solicited input from Congress, other Federal Agencies, States, the private sector (including automobile manufacturers and insurers), and many other groups and organizations. As a result of these meetings, a plan was developed, *The National Initiative to Increase Seat Belt Use.* This plan was submitted on April 16, 1997.

National Initiative to Increase Seat Belt Use

The *National Initiative to Increase Seat Belt Use* set bold, ambitious goals to increase seat belt use and to reduce child occupant fatalities. The first goal called for increasing the national seat belt use rate to 85 percent by the year 2000 and 90 percent by 2005. The second goal called for reducing child occupant fatalities (0-4 years) by 15 percent by 2000 and 25 percent by 2005. When achieved, these goals will prevent an estimated 5,500 fatalities and 132,000 injuries each year.

NHTSA, as the lead DOT agency, is responsible for *Buckle Up America*. The campaign has four basic elements: (1) building **public-private partnerships** among organizations and individuals to help increase seat belt and child restraint use; (2) **enactment of strong seat belt and child safety seat legislation** by States; (3) waves of **active, high visibility law enforcement** by local and State law enforcement agencies; and, (4) well-coordinated and effective **public education** conducted by communities.

The *Buckle Up America* Campaign has been instrumental in saving thousands of lives and millions of dollars each year. The goal of a 15 percent reduction in child occupant fatalities (0-4 years) by the year 2000 was reached one year early in 1999; in 2000, fatalities in this age group decreased another 2 percent. Reaching this goal ahead of time was in large part due to the rise in restraint use among children since the campaign began in 1997. In 1996, restraint use among infants (1-12 months) was 85 percent and restraint use for toddlers (1-4 years) was 60 percent. In 1998–just one year after the campaign began–restraint use among infants rose to 97 percent and restraint use for toddlers rose to 91 percent. In 2000, restraint use among infants and toddlers was 95 percent and 91 percent, respectively.

Restraint use among adults is also increasing. The national seat belt use rate in June 2001 was 73 percent–the highest in our nation's history. In 2000, eight States, the District of Columbia, and Puerto Rico had seat belt use rates over 80 percent. Some States experienced dramatic increases in seat belt use during 2000: Michigan (from 70 percent to 84 percent), Alabama (from 58 percent to 71 percent), and New Jersey (from 63 percent to 74 percent). Over 11,000 lives were saved by seat belts in 2000, saving millions of dollars in health care and other societal costs. However, the campaign's goal of an 85 percent use rate nationwide by 2000 was not met. A major reason for not reaching this goal was in large part due to the difficulty in changing the behavior of the remaining 29 percent of the population who still do not buckle up.

Child Passenger Safety Initiatives

According to data compiled by the Centers for Disease Control and Prevention, motor vehicle crashes are the single leading cause of death of American children from 4 to 12 years of age, and a major cause of death in children under four. Research conducted by NHTSA has shown that the back seat is the safest place to be in the event of a crash. Thus, NHTSA currently recommends that all children 12 years of age and under be appropriately restrained in the back seat whenever riding in vehicles. Two major initiatives, Child Passenger Safety Week (held each February) and *Operation ABC Mobilizations* (conducted each May and November) reinforce the message about age-appropriate child passenger safety and the fact that children under 12 are safest in the back seat. NHTSA's *Buckle Up America* Campaign and its Standardized Child Passenger Safety Training Program (created with the American Automobile Association and other partners) also ensure that accurate and consistent information about children being safest in the back seat is disseminated to the general public.

In February 2000, during Child Passenger Safety Week, NHTSA launched a new nationwide campaign, *Don't Skip a Step*, to educate parents and care givers about age-appropriate child passenger safety as children outgrow their child safety seats. This outreach effort supports other NHTSA initiatives to improve the protection of older children between 40 and 80 pounds and up to 4'9" tall. These children have outgrown child safety seats, but are too small for adult lap and shoulder seat belts. As part of the campaign, NHTSA distributed campaign brochures to enlist the support of child safety advocates, health care providers, law enforcement personnel and others to help spread the booster seat safety message across the country. (NHTSA guidelines for booster seat use are currently under agency review based on additional data and information on the subject.)

In November 2000, Congress enacted the Transportation Recall Enhancement, Accountability, and Documentation (TREAD) Act in the wake of the Firestone tire investigation. An expanded booster seat education program was included in this legislation that directs the DOT to undertake various activities to improve highway safety, including child passenger safety. The agency's efforts to improve the performance of child restraints include child safety seat tests with different size dummies in different crash modes, assessment of the benefits of booster seats for older children, and updating the test seat assembly for the child restraint standard (FMVSS No. 213). The agency will conduct testing, develop countermeasures, and assess a test procedure that is being developed by the International Standards Organization, with the goal of adopting a procedure for testing child seats in side impact crashes. The FY 2002 request supports frontal and side crash tests under the New Car Assessment Program with child seats and 3-year-old dummies in the rear seat to assess the best approach for a child restraint ratings program. Furthermore, in support of this requirement, NHTSA will conduct focus group testing to ensure that child restraint ratings are readily understandable to consumers. The agency will expand and improve the “Selecting, Installing, and Using” database allowing consumers to view specific features and proper installation instructions for current models of child restraint systems.

Legislative Issues Regarding Seat Belt Use

Through the *Buckle Up America* Campaign, NHTSA plays a key role in providing information and technical support to States wishing to upgrade their seat belt laws. As of May 2000, all 50 States, the District of Columbia, and Puerto Rico had child passenger safety laws and 49 States had adult seat belt laws in effect. Also as of May 2000, seventeen States, the District of Columbia and Puerto Rico had standard (or “primary”) seat belt laws in effect. All remaining States had secondary laws except New Hampshire, which continues to have no adult seat belt law.

A *standard* seat belt law is a law that allows a citation to be issued if a law enforcement officer simply observes an unbelted driver or passenger. A *secondary* seat belt law requires an officer to stop a motorist for another infraction before being able to issue a citation for not buckling up. Standard seat belt laws are effective in increasing seat belt use, because the general public is much more likely to buckle up and place their children in child safety seats when there is the possibility of receiving a citation for not doing so. In 2000, the overall shoulder belt use in States with standard enforcement laws was 77 percent compared to 64 percent in States without standard enforcement laws.

Although seat belts were first installed by automobile manufacturers in the 1950s, seat belt use was very low–only 10 to 15 percent nationwide–until the early 1980s. From 1984 through 1987, national seat belt use increased from 14 percent to 42 percent as seat belt use laws were passed in 31 States. From 1990 through 1992, national belt use rose from 49 percent to 62 percent attributable, in part, to a national effort of highly visible seat belt law enforcement and public education.

During the 1990s, some States began upgrading their seat belt laws to standard laws to increase belt use rates. In 1993, California became the first State to upgrade its seat belt law from a secondary to a standard law. As a result, the belt use rate increased by 13 percentage points (from 70 percent to 83 percent) in the first year after the law was upgraded. In 1995, Louisiana became the second State to upgrade its secondary belt law to a standard law. Over the following two years, Louisiana experienced an 18-percentage-point increase in its belt use rate (from 50 percent to 68 percent). Other States soon followed suit and experienced sharp increases in belt use rates when their secondary laws were upgraded to standard laws. Perhaps the most dramatic example was when the District of Columbia upgraded its law; in just one year, the belt use rate increased 24 percentage points–from 58 percent to 82 percent. The following map shows the states with a primary belt use law in effect as of May 2001. Exhibit 19 is a map showing the States with Primary Seat Belt Laws (in red) in effect in 2000. Exhibits 20 and 21 list the provisions of the safety belt use laws and child restraint use laws in effect in each State.

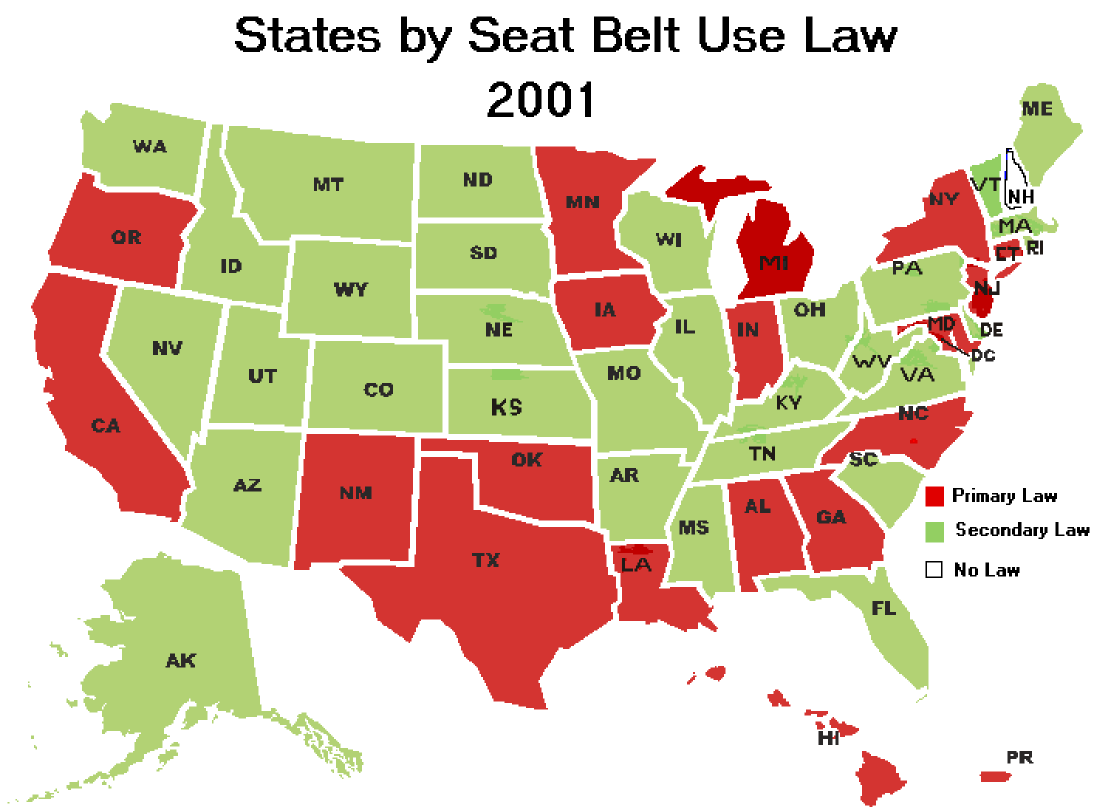

Exhibit 19

Through strong legislation, America can achieve seat belt use rates at least as high as those seen in many other industrialized countries (85 percent), thereby saving thousands of lives and billions of dollars each year. NHTSA reports that 32,061 occupants of passenger vehicles were killed in motor vehicle crashes in 1999 and an estimated 31,894 were killed in 2000. The use of occupant restraint systems by passenger vehicle occupants over 4 years old saved 11,197 lives in 1999. If seat belt use in America had been 85 percent in 1999, the lives of an additional 5,309 people over 4 years of age could have been saved.

Enforcement Issues

Strong enforcement of seat belt laws enhances the perceived importance of the seat belt law with both the public and the police. Ultimately, this perception leads to greater compliance. Strong, consistent enforcement sends a clear message that the State views seat belt use (and the seat belt law) as being essential for the safe operation of a motor vehicle.

STATE HIGHWAY SAFETY LAWS
KEY PROVISIONS OF SEAT BELT USE, BY STATE -- May 23, 2001

State	Law (Standard = Primary)	Penalty		Coverage		Vehicles Exempted
		Fine	Pts	Seat	Age	
AL	Standard	$25		Front	6+	Designed for > 10 passengers, Mfg. < 1965
AK	Secondary	$15		All	16+	School bus
AZ	Secondary	$10		Front	5+	Designed for > 10 passengers, Mfg. < 1972
AR	Secondary	$25		Front	5+	School, church, or public bus, Mfg. < 1968
CA	Standard	$20		All	16+	None
CO	Secondary*	$15		Front*	16+	Passenger bus, school bus
CT	Standard	$37		Front	4+ (<16 all)	Truck or bus >15,000 lbs.
DE	Secondary	$20		Front	All	None
DC	Standard	$50	2	All	16+	Seating > 8 people
FL	Secondary	$30		Front	6+; 6-17 in rear	School bus, public bus, truck > 5,000 lbs.
GA	Standard	$15		Front	4+; 4-17 in rear	Designed for > 10 passengers, pickup
HI	Standard	$20		Front	rear; under 18	Bus or school bus > 10,000 lbs.
ID	Secondary	$5		Front	4+	Weighing > 8,000 lbs.
IL	Secondary	$25		Front[1]	6+	None
IN	Standard	$25		Front	4+; 4-11 in rear	Truck, tractor, RV
IA	Standard	$25		Front	6+	None
KS	Secondary	$10		Front	14+	Designed for >10 people, truck >12,000 lbs
KY	Secondary	$25		All	Over 40 in. tall	Designed for > 10 people
LA	Standard	$25		Front	13+	Mfg. before 1981
ME	Secondary	$60		All	4+	Mfg. without seat belts
MD	Standard	$25		Front	16+	Historic Vehicle
MA	Secondary	$25		All	16+	Truck > 18,000 lbs., bus and taxi operators
MI	Standard	$25		Front	4+; 4-15 in rear	Taxi, bus, school bus
MN	Secondary	$25		Front	All; 3-10 in rear	Farm pickup truck
MS	Secondary	$25		Front	4+; 4-7 in rear	Farm vehicle, bus
MO	Secondary	$10		Front	4+; 4-15 in rear	Designed for >10 people, truck >12,000 lbs
MT	Secondary	$20		All	4+	None
NE	Secondary	$25		Front	5+	Mfg. < 1973
NV	Secondary	$25		All	6+	Taxi, bus, school bus
NH	No adult law	$25		All	*Under 18 only-Standard Law*	School bus, vehicles for hire, mfg. < 1968
NJ	Standard	$42		Front	5+	None
NM	Standard	$25	2	All	11+	Vehicle > 10,000 lbs.
NY	Standard	$50		Front	16+front;<16 rear	Bus, school bus, taxi, emergency vehicles
NC	Standard	$25		Front	16+	Designed for > 10 people
ND	Secondary+	$20		Front	18+	Designed for > 10 people
OH	Secondary	$25		Front	4+	None
OK	Standard	$20		Front	all	Farm vehicle, truck, truck-tractor, RV
OR	Standard	$75		All	16+	Newspaper/mail/meter/transit vehicles**
PA	Secondary	$10		Front	4+	Truck > 7,000 lbs.
RI	Secondary	$50		All	>12;<6 must ride in rear	None
SC	Secondary	$10		Front	6+	School bus, public bus
SD	Secondary+	$20		Front	5+	Bus, school bus
TN	Secondary	$10		Front	13+	Vehicle > 8,500 lbs.
TX	Standard	$50		Front	4+; 4-14 in rear	Designed for >10 people, truck >15,000 lbs
UT	Secondary#	$10		All	19+	None
VT	Secondary	$10		All Front	13+	Bus, taxi
VA	Secondary	$25		All	16+	Designed for > 10 people, taxi
WA	Secondary	$71		Front	all	Designed for > 10 people
WV	Secondary	$25		All	9+; 9-17 in rear	Designed for > 10 people
WI	Secondary	$10			4+; 4-15 in rear	Taxi, farm truck
WY	Secondary	$25^		All	5+	Designed for > 10 people, bus
PR	Standard	$50		Front	All passengers	None

Exhibit 20

*Std enforcement for all seating positions if driver is under 17 years ^Driver fine is $25; passenger fine >12 yrs is $10
+Std enforcement for all seating positions if occupant is under 18 years (SD law effective 7/1/01; currently SB use required for >5yrs)
#Std enforcement for all seating positions if occupant is under 19 years **Police/emergency vehicles exempted in some situations

Exhibit 21
STATE HIGHWAY SAFETY LAWS
KEY PROVISIONS OF CHILD[1] PASSENGER SAFETY LAWS, BY STATE
May 23, 2001

State	Age (in Years) Required to Use		May Use Child Seat or Seat Belt	Penalty		Major[12] Exemptions to Child Passenger Laws	Children Allowed in Rear of Pickups?
	Rear Seat Belt[2]	Safety Seat		Max Fine[10]	Pts	The CPS law doesn't apply if . . .	
AL	< 6	< 6	Age 4-5 yrs	$10		Vehicle is registered out of state	No
AK	< 16	< 4	-	$50	2	-	Yes
AZ	< 5	< 5	Age 4 yrs	$50		All vehicle's belts are in use	Yes
AR	< 15	< 6	Age 6 yrs or >60 lbs	$100		-	Yes
CA	< 16	< 4 [4]	-	$100	1	-	No[20]
CO	< 16	<4 and <40 lbs[5]	40 lbs and over	$50		Transported during emergency	Yes[21]
CT	< 16	< 4 [5]	40 lbs and over	$60		-	No[20]
DE	< 16 [3]	< 4	-	$29		-	Yes
DC	< 16	< 4	Age 3 -15 yrs	$55	2	All vehicle's belts are in use[13]	No
FL	< 16	< 6	Age 4 yrs	$70	3	-	No
GA	< 16	< 5	Age 3-4 yrs	$50	1	-	on non-interstate roadway
HI	< 18	< 3	Age 4 yrs	$100		All vehicle's belts are in use[13]	No[22]
ID	< 4	< 4 [5]	-	$100		All vehicle's belts are in use[13], [14]	Yes
IL	< 16	< 4	Age 4-5 yrs	$25		-	Yes
IN	< 12	< 4	Age 4 -11yrs	$25	4	Vehicle is registered out of state	Yes
IA	< 6	< 3	Age 3 -5 yrs	$25		Vehicle is registered out of state	No
KS	< 14	< 4	-	$20		All vehicle's belts are in use	If > 13 yrs
KY	< 16	40" & Under	-	$50		-	Yes
LA	< 13	< 3	Age 3 -12 yrs	$50		-	If > 11 yrs
ME	< 18	< 4	Age 4 -17 yrs	$60		All vehicle's belts are in use, [15]	< 16 yrs not allowed
MD	< 16	< 4 [4]	> 40 lbs.	$25		All vehicle's belts are in use[13]	No
MA	< 16	< 5 [4]	>Age 5 yrs	$25		All vehicle's belts are in use[13]	If > 16 yrs
MI	< 16	< 4	-	$15		The child is being nursed	No[20], [22]
MN	< 11	< 4	-	$50		-	No[20], [23]
MS	< 8	< 4	-	$25		-	Yes
MO	< 16	< 4	-	$25		-	No
MT	< 16	< 2	Age 3-4 yrs	$25+		-	No[20], [22], and [23]
NE	< 16	< 5 [4]	< 40 lbs.	$25		-	Yes
NV	< 16	< 5 [4]	-	$100		-	No
NH	< 18	< 4	-	$50		-	No
NJ	< 5	< 5	Age 1.5 -5 yrs[8]	$25		All vehicle's belts are in use[13]	No
NM	< 18	< 5 [26]	-	$25		-	If > 10 yrs
NY	< 16	< 4	-	$25	3	-	Yes[24]
NC	< 6	< 5	-	$100		All vehicle's belts are in use, [14]	If > 11 yrs[20],[23], [25]
ND	< 18	< 4	Age 4 -17 yrs	$0	1	All vehicle's belts are in use	Yes
OH	< 4 [4]	< 4 [4]	-	$100		Vehicle is registered out of state	If traveling < 25 MPH[20]
OK	< 6	< 4 [6]	Age 4-5 yrs	$25		All vehicle's belts are in use	Yes
OR	< 16	< 4 [5]	Age 4 yrs or over	$75		All vehicle's belts are in use	Yes
PA	< 16	< 4	-	$25		-	Yes
RI	< 12	< 6 [7]	Age 5 yrs or over	$50		All vehicle's belts are in use	No up to age 16

State	Rear Seat Belts Required[2]	Safety Seat Required	May Use Child Seat or Seat Belt	Penalty		Major[12] Exemptions to Child Passenger Laws	Children Allowed in Rear of Pickups?
				Max Fine[10]	Pts	The CPS law doesn't apply if . . .	
SC	< 16	< 4	Age 1 yr-5 yrs	$25		Vehicle is registered[16] out of state [14] [17]	Yes

Exhibit 21
STATE HIGHWAY SAFETY LAWS
KEY PROVISIONS OF CHILD[1] PASSENGER SAFETY LAWS, BY STATE
May 23, 2001

SD[2]	< 18	<5 and <40 lbs	Age 5-17 yrs and > 40lbs	$20		None	Yes
TN	< 12	< 4	-	$50[11]		All vehicle's belts are in use[14], [18]	If > 5 yrs or moving <20 mph
TX	< 15	< 2	Age 3-4 yrs	$50		All vehicle's belts are in use	If > 11 yrs or moving <35 mph
UT	< 16	< 5	Age 2 -16 yrs	$45		All vehicle's belts are in use	No
VT	< 13	< 5	-	$25		All vehicle's belts are in use[19]	Yes
VA	< 16	< 4	Age 3-4[9] yrs	$50	3	-	Yes
WA	< 16	< 3	Age 3 -10 yrs	$71		-	Yes
WV	< 16	< 3	Age 3 -8 yrs	$20		All vehicle's belts are in use	No [20]
WI	< 8	< 4	Age 4 -8 yrs	$75		Attending to child's personal needs	No [23]
WY	< 5	<5 and <40 lbs	-	$50		Physician provides medical exemptions and/or care rendered to child by parent/guard.	Yes
PR	< 12	< 4	-	$100		-	No

Footnotes

(1) - This chart applies to children under age 16

(2) - Front seat restraints are required for all children under 16

(3) - Children < 12 years old and < 66 inches may not occupy front seat if equipped with passenger-side air bag.

(4) - Or less than 40 lbs.

(5) - And less than 40 lbs.

(6) - And less than or equal to 60 lbs.

(7) - Children under age 6 must be transported in the rear

(8) - In rear only.

(9) - If the size and weight of the child makes the use of a seat belt practical and the use of a child safety seat impractical and.

(10) - Maximum fine for first offense of child safety seat laws. Fines may be different for older children.

(11) - Or 30 days in jail.

(12) - Major exemptions are considered to be exemptions in private passenger vehicles (cars, vans, or pickups). Many states have exemptions for buses, taxis, or other public transportation, children with medical conditions, and emergency situations.

(13) - Unrestrained children must be in the rear

(14) - Law doesn't apply if the child's personal or physiological needs are being met

(15) - Only for children > 1 year old

(16) - Or primarily operated

(17) - Law doesn't apply if all the vehicle's belts are in use

(18) - Only for ages 4 through 11.

(19) - Only for children over age 4.

(20) - Unless properly restrained in a seat belt or child safety seat

(21) - If sitting and tailgate is closed

(22) - Unless number of children exceeds number of safety belts available.

(23) - Unless used in farm work or farm activity

(24) - Unless there are more than 5 children under age 18 not accompanied by a person more than 18

(25) - Unless supervised by an adult

(26) - Children <1 years old must be secured in the rear with a rear-facing child passenger restraint

Highly visible enforcement of seat belt and child restraint laws is at the core of any plan to increase seat belt use; no State has ever achieved a high compliance rate without strong enforcement of such laws. The case for conducting highly visible enforcement is well documented. The increase in Canada's seat belt use rate, after well-publicized enforcement efforts, is an excellent example of enforcement success: through such a strategy, Canada has achieved a seat belt use rate above 90 percent. Enforcement alone will not achieve America's goal of 90 percent seat belt use by 2005. However, enforcement *combined* with effective media support is successful because the perceived risk of receiving a seat belt citation is increased, even if the actual risk is only slightly higher. Behavioral research shows that the public will buckle up if they believe the police are enforcing the law.

The issue of a law enforcement officer stopping a citizen based purely on race or ethnicity, known as differential enforcement or "racial profiling," has recently become an issue in traffic safety. NHTSA is working with the Department of Justice to develop and promote best practices for conducting fair, professional traffic stops. NHTSA also continues to work with its State and community public safety partners to ensure that traffic stops are made for legitimate law violations. NHTSA encourages agencies to adopt policies, management practices, training, and community outreach efforts to eliminate differential enforcement. NHTSA has produced and promotes a model training curricula titled *Conducting Complete Traffic Stops,* which heightens law enforcement officer awareness to the civil rights implications of a traffic stop. A booklet titled *Strengthening the Citizen and Law Enforcement Partnership at the Traffic Stop* has also been produced and distributed widely to State and local law enforcement agencies.

NHTSA has also partnered with leading civil rights organizations to engage their membership in traffic safety injury prevention, to work with State and local law enforcement, and to assist NHTSA in the development of culturally appropriate traffic safety educational materials. NHTSA participated in summits held in 2001 by the International Association of Chiefs of Police (IACP) and the National Organization of Black Law Enforcement Executives (NOBLE). As a result of these summits, NHTSA will expand its efforts with these and other organizations to promote fairness in traffic stops, improve training for officers, implement better management practices, and build community partnerships. NHTSA will also disseminate a "best practices" document produced in FY 2001 to law enforcement agencies and organizations in FY 2002.

Measuring Seat Belt Use -- The National Occupant Protection Use Survey

The survey by which NHTSA obtains overall nationwide estimates of shoulder belt use and user characteristics is the National Occupant Protection Use Survey (NOPUS). NHTSA began conducting the NOPUS in 1994. A Full NOPUS is composed of two separate studies: the *Moving Traffic Study*, which provides information on overall shoulder belt use; and the *Controlled Intersection Study*, which provides detailed information about shoulder belt use by vehicle type, characteristics of the belt users and child restraint use. A Full NOPUS was conducted in the fall of 1994, 1996, 1998 and 2000. NHTSA also conducts the MiniNOPUS, comprised only of a Moving Traffic Study, in certain time slots between the Full NOPUS. A MiniNOPUS was conducted in May, June, and December 1998, in December 1999, in June 2000, and in June 2001. NOPUS and MiniNOPUS results have been used to measure the progress of increasing belt use for the *Buckle Up America* Campaign.

NOPUS Survey and Data Collection Design

The National Occupant Protection Use Survey, in both Full and MiniNOPUS form, was designed as a multi-stage probability sample to ensure that the results would represent occupant protection use in the country as a whole. In the first stage, counties were grouped by region (Northeast, Midwest, South, West), level of urbanization (metropolitan or not), and level of belt use (high, medium, or low). Fifty counties or groups of counties (called primary sampling units or PSUs) were selected, within the resulting strata, based on the vehicle miles of travel. In the next stage, within each PSU a probability based sample of roadways was selected from two categories: major roads and local roads. Observational sites – an exit ramp on an interstate highway, an intersection controlled by a stop sign or stoplight, or an uncontrolled intersection – were identified on each of the sampled roadways. The roadway sample for the June 2001 MiniNOPUS was 2,030 sites.

Data collection for the Moving Traffic Study of the Full NOPUS, as well as the MiniNOPUS, consists of observing shoulder belt use in passenger motor vehicles. Observers were stationed for 30 minutes at each selected observational site. Shoulder belt use was obtained for drivers and right-front passengers only (front outboard seating positions) in passenger cars, pickup trucks, vans, minivans, and sport utility vehicles (SUVs). Commercial and emergency vehicles were excluded. Every day of the week and all daylight hours (8 a.m. to 6 p.m.) were covered.

In the June 2001 MiniNOPUS Moving Traffic Study, 175,723 passenger vehicles were observed: 102,015 passenger cars; 45,450 vans and SUVs; and 28,258 pick-up trucks.

Recent NOPUS Results

Note: Estimates from the NOPUS are based on a sample, are statistically weighted according to the sample design, and are subject to sampling error. Each estimate in the following tables is shown with its corresponding sampling error (expressed in percentage points) in parentheses. Thus, adding and subtracting twice the sampling error from the corresponding estimate will produce an approximate 95 percent confidence interval for the estimate. This means that one can be 95 percent confident that the true use rate lies within this interval.

Exhibit 22 shows overall national use rates for shoulder belts in June 2001. Overall front seat outboard occupant (driver/passenger closest to the window) shoulder belt use in the United States was estimated at 73 percent. Driver use was slightly higher than passenger use for all vehicles except pickup trucks, where rates were similar. Overall use rates for occupants of pickup trucks were significantly lower (13 to 14 percentage points) than use rates for occupants of other passenger vehicles. The table also shows shoulder belt use rates by the enforcement status of the State safety belt use laws in effect at the time of the survey. Estimates from the survey show that overall shoulder belt use in States with standard enforcement (primary) seat belt laws was 78 percent compared with 67 percent in States without standard enforcement laws. Pickup trucks trailed passenger cars by 21 percentage points in States without standard enforcement laws, but by only 11 percentage points in States with standard enforcement laws.

Shoulder Belt Use by Vehicle Type, Occupant Type, and Enforcement Status NATIONAL OCCUPANT PROTECTION USE SURVEY, Moving Traffic Study June 2001 Estimates and sampling errors (shown in parentheses) are in percentage points.			
Vehicle and Occupant	**Overall**	**Primary Enforcement**	**Secondary Enforcement**
All Passenger Vehicles	73 (1.3)	78 (1.9)	67 (2.2)
Drivers	74 (1.4)	79 (1.9)	67 (2.2)
Passengers	72 (1.4)	76 (2.4)	66 (2.5)
Passenger Cars	76 (1.1)	81 (1.7)	71 (1.9)
Drivers	77 (1.2)	82 (1.6)	71 (2.0)
Passengers	74 (1.3)	78 (2.3)	69 (1.9)
Vans and SUVs	75 (1.4)	79 (1.8)	70 (2.2)
Drivers	75 (1.2)	79 (1.8)	70 (1.7)
Passengers	74 (2.0)	80 (1.9)	68 (3.7)
Pickup Trucks	62 (2.6)	70 (3.5)	50 (3.6)
Drivers	62 (3.1)	71 (3.8)	49 (4.4)
Passengers	62 (2.0)	66 (3.7)	54 (2.8)

Exhibit 22

Exhibit 23 shows June 2001 shoulder belt use by geographic region. Safety belt use was estimated to be highest in the West, where the combined driver and passenger use rate was 77 percent for all passenger vehicles and 81 percent for passenger cars, vans, and SUVs. Van and SUV drivers in the West reached 83 percent and were the group closest to meeting the Department of Transportation's 1999 Performance Plan Goal of 85 percent seat belt use by the end of 2000. Rates in the South were close behind the West for all vehicles expect pickups, where the South was slightly higher than the West. Observed use rates for pickups in the Northeast were more than 20 percentage points lower than in the West, Midwest or South.

Exhibit 24 shows overall shoulder belt use estimates for each NOPUS. A designation of "Fall," i.e., "Fall 94," is the time period when a Full NOPUS was conducted, generally October - November for the year indicated. Those designated by a month, i.e., "June 98," refer to the month in which a MiniNOPUS was conducted. The data show an increasing trend for shoulder belt use in all categories since the first Full NOPUS was conducted. Overall, shoulder belt use has increased 15 percentage points, from 58 percent in fall 1994 to 73 percent in June 2001. Since van and SUV occupants tend toward higher belt use, the large increase by occupants of pickups, vans, and SUVs – 19 percentage points – is likely related to an increase in the numbers of vans and SUVs relative to pickups.

The most recent NOPUS to measure motorcycle helmet use was the Fall 2000 NOPUS, in which 645 motorcycles were observed. In that survey, 72 percent of drivers and 62 percent of passengers were observed to be wearing helmets.

Shoulder Belt Use by Vehicle Type, Occupant Type, and Region NATIONAL OCCUPANT PROTECTION USE SURVEY, Moving Traffic Study June 2001 Estimates and sampling errors (shown in parentheses) are in percentage points.				
Vehicle and Occupant	**Northeast**	**Midwest**	**South**	**West**
All Passenger Vehicles	62 (4.2)	72 (2.9)	76 (1.9)	77 (2.2)
Drivers	62 (4.0)	72 (2.9)	76 (2.1)	79 (2.2)
Passengers	60 (5.2)	72 (3.0)	74 (1.9)	74 (2.6)
Passenger Car	67 (2.3)	74 (2.4)	79 (2.0)	81 (2.7)
Drivers	68 (2.1)	75 (2.5)	80 (2.3)	82 (2.5)
Passengers	64 (3.3)	73 (2.6)	76 (1.5)	78 (3.7)
Vans and SUVs	63 (4.2)	73 (2.8)	78 (1.9)	81 (2.3)
Drivers	64 (2.7)	72 (2.7)	78 (1.9)	83 (2.3)
Passengers	59 (9.6)	74 (3.4)	78 (2.1)	77 (2.4)
Pickup Trucks	38 (8.6)	62 (4.9)	67 (4.1)	65 (2.4)
Drivers	34 (11.8)	61 (5.1)	68 (4.9)	66 (2.5)
Passengers	49 (2.6)	64 (4.7)	63 (3.9)	61 (2.4)

Exhibit 23

Shoulder Belt Use by Vehicle Type and Occupant Type, and Survey NATIONAL OCCUPANT PROTECTION USE SURVEYS, 1994 through 2001 Estimates and sampling errors (shown in parentheses) are in percentage points.										
Vehicle and Occupant	**Fall 94**	**Fall 96**	**May 98**	**Jun 98**	**Fall 98**	**Dec 98**	**Dec 99**	**Jun 00**	**Fall 00**	**Jun 01**
All Passenger Vehicles	58 (1.9)	61 (2.0)	62 (2.6)	65 (1.9)	69 (1.7)	70 (2.2)	67 (1.3)	71 (1.6)	71 (1.4)	73 (1.3)
Drivers	59 (1.9)	62 (1.8)	63 (2.4)	66 (1.9)	70 (1.8)	70 (2.2)	67 (1.3)	71 (1.6)	72 (1.5)	74 (1.4)
Pass.	55 (1.8)	59 (3.3)	60 (3.3)	63 (2.0)	65 (1.9)	69 (2.3)	64 (1.8)	70 (1.6)	68 (1.5)	72 (1.4)
Pass. Cars	63 (1.9)	65 (2.1)	66 (2.8)	69 (1.5)	71 (1.7)	72 (2.3)	70 (1.2)	73 (1.5)	74 (1.5)	76 (1.1)
Drivers	64 (1.8)	65 (2.1)	67 (2.5)	70 (1.5)	72 (1.9)	73 (2.4)	71 (1.2)	74 (1.5)	75 (1.6)	77 (1.2)
Pass.	59 (2.2)	62 (2.3)	62 (3.8)	66 (1.7)	68 (2.0)	72 (2.1)	66 (1.7)	71 (1.7)	70 (1.5)	74 (1.3)
Vans/SUVs/ Pickups	50 (1.8)	56 (2.0)	56 (2.4)	60 (2.6)	66 (2.0)	66 (2.4)	62 (1.6)	67 (2.0)	68 (1.7)	69 (1.8)
Drivers	51 (1.9)	58 (1.6)	57 (2.6)	61 (2.7)	67 (2.1)	67 (2.4)	62 (1.8)	67 (2.0)	69 (1.9)	70 (1.8)
Pass.	49 (1.8)	53 (5.2)	55 (2.7)	58 (2.7)	61 (2.3)	65 (2.8)	60 (2.1)	68 (1.9)	65 (1.4)	69 (1.9)

Exhibit 24

Measuring Seat Belt Use -- State-Based Survey Use Estimates

Forty-eight States, the District of Columbia, and Puerto Rico reported to the National Highway Traffic Safety Administration a statewide estimate of front seat out-board passenger vehicle shoulder belt use for 2000. Exhibit 25 shows these use rates and those reported for 1998 and 1999. Use rates at or above the Department of Transportation's 1999 Performance Plan goal of 85 percent by the end of 2000 were reported by California (88.9 percent), Puerto Rico (87.0 percent), New Mexico (86.6 percent), and Maryland (85.0 percent). The District of Columbia, Hawaii, Michigan, North Carolina, Oregon, and Washington reported use rates greater than 80 percent. The lowest reported use rate was 47.7 percent in North Dakota. States with the highest increase in use rates from 1999 to 2000 were Michigan (from 70.1 percent to 83.5 percent), Alabama (from 57.9 percent to 70.6 percent) and New Jersey (from 63.3 percent to 74.2 percent). Each of these States introduced a standard enforcement seat belt use law in 2000. Twenty-eight States had increases in rates both from 1998 to 1999 and from 1999 to 2000. The largest increase was in Alabama, from 52.0 percent in 1998 to 57.9 percent in 1999 and to 70.6 percent in 2000. Only three States decreased in both years. The largest decrease was reported by Mississippi – from 58 percent in 1998 to 54.5 percent in 1999 and to 50.4 percent in 2000. Twenty-one States and Puerto Rico reported use rates at or above 71 percent, the nationwide estimate of overall front seat outboard passenger shoulder belt use in 2000 (Fall 2000 National Occupant Protection Use Survey [NOPUS]). In the Fall 2000 NOPUS, overall shoulder belt use in States with standard enforcement seat belt laws was 77 percent and was 64 percent in States without standard enforcement laws. In 2000, except for Washington, all States reporting use rates 80 percent or above had standard enforcement laws. (Note that although a June 2001 MiniNOPUS took place as documented earlier in this report, we use the 2000 NOPUS in this section for purposes of year 2000 State comparisons.)

Until 1998, State seat belt surveys differed in design. Many States utilized probability-based designs that allowed the accuracy of the survey to be calculated. Others utilized convenience samples, which may have produced reasonable indicators of belt use but did not have a known degree of accuracy or precision. Most of the States that conducted probability-based surveys did so to qualify for an incentive grant program that was established under Section 153 of the ISTEA of 1991. In 1998, a new incentive grant program was established under Section 157 of the TEA-21. This incentive grant program required all States to follow guidelines issued by NHTSA for the design and conduct of their restraint use observational surveys.

Due to the variability in methodology and frequency among the State-reported use surveys, in September 1998, the National Highway Traffic Safety Administration issued, in the *Federal Register*, overall guidelines to be used by the States for conducting State seat belt use surveys, in order for them to be eligible for the Section 157 Grant Program. These guidelines superseded those for the Section 153 Grant Program. According to these guidelines, a State is required to measure seat belt use with an observational survey wherein observation sites were a probability sample of sites in the State. The sites must represent all but the smallest geographical areas (in terms of population) in the State, including urban and rural areas, and the resulting seat belt use estimates must meet a specified level of statistical precision. Finally, the same set of motor vehicles (passenger cars, pickup trucks, vans, and sport utility vehicles) and occupants (driver and right-front passenger) must be observed. The survey designs and subsequent estimates were to be adequately documented and submitted for approval by NHTSA. Approved surveys provide statewide representative estimates of seat belt use with a known margin of error.

State Reported Shoulder Belt Use Rates Front Seat Outboard Passengers in Passenger Vehicles, by State and Year							
STATE	**Year**			**STATE**	**Year**		
	1998	**1999**	**2000**		**1998**	**1999**	**2000**
ALABAMA[#]	**52.0%**	**57.9%**	***70.6%***	**MONTANA**	**73.1%**	**74.0%**	**75.6%**
ALASKA	**57.0%**	**60.6%**	**61.0%**	**NEBRASKA**	**65.1%**	**67.9%**	**70.5%**
ARIZONA	**61.5%**	**71.1%**	**75.2%**	**NEVADA**	**76.2%**	**79.8%**	**78.5%**
ARKANSAS	**52.6%**	**57.2%**	**52.4%**	**NEW HAMPSHIRE**	*	*	*
CALIFORNIA[#]	***88.6%***	***89.3%***	***88.9%***	**NEW JERSEY[#]**	**63.0%**	**63.3%**	***74.2%***
COLORADO	**66.0%**	**65.2%**	**65.1%**	**NEW MEXICO[#]**	***82.6%***	***88.4%***	***86.6%***
CONNECTICUT[#]	***70.1%***	***72.9%***	***76.3%***	**NEW YORK[#]**	***75.3%***	***76.1%***	***77.3%***
DELAWARE	**62.3%**	**64.4%**	**66.1%**	**NORTH CAROLINA[#]**	***76.7%***	***78.1%***	***80.5%***
DISTRICT OF COLUMBIA[#]	***79.6%***	***77.9%***	***82.6%***	**NORTH DAKOTA**	**40.0%**	**46.7%**	**47.7%**
FLORIDA	**57.2%**	**59.0%**	**64.8%**	**OHIO**	**60.6%**	**64.8%**	**65.3%**
GEORGIA[#]	***73.6%***	***74.2%***	***73.6%***	**OKLAHOMA[#]**	***56.0%***	***60.7%***	***67.5%***
HAWAII[#]	***80.5%***	***80.3%***	***80.4%***	**OREGON[#]**	***82.6%***	***82.7%***	***83.6%***
IDAHO	**57.3%**	**57.9%**	**58.6%**	**PENNSYLVANIA**	**67.8%**	**69.7%**	**70.7%**
ILLINOIS	**64.5%**	**65.9%**	**70.2%**	**RHODE ISLAND**	**58.6%**	**67.3%**	**64.4%**
INDIANA[#]	***61.8%***	***57.3%***	***62.1%***	**SOUTH CAROLINA**	**64.8%**	**65.2%**	**73.9%**
IOWA[#]	***76.9%***	***78.0%***	***78.0%***	**SOUTH DAKOTA**	**45.7%**	*	**53.4%**
KANSAS	**58.7%**	**62.6%**	**61.6%**	**TENNESSEE**	**56.7%**	**61.0%**	**59.0%**
KENTUCKY	**54.3%**	**58.6%**	**60.0%**	**TEXAS[#]**	***74.4%***	***74.0%***	***76.6%***
LOUISIANA[#]	***65.6%***	***67.0%***	***68.2%***	**UTAH**	**66.7%**	**67.4%**	**75.7%**
MAINE	**61.3%**	*	*	**VERMONT**	**62.7%**	**69.8%**	**61.6%**
MARYLAND[#]	***82.6%***	***82.7%***	***85.0%***	**VIRGINIA**	**73.6%**	**69.9%**	**69.9%**
MASSACHUSETTS	**51.0%**	**52.0%**	**50.0%**	**WASHINGTON**	**79.1%**	**81.1%**	**81.6%**
MICHIGAN[#]	**69.9%**	**70.1%**	***83.5%***	**WEST VIRGINIA**	**56.5%**	**51.9%**	**49.5%**
MINNESOTA	**64.2%**	**71.5%**	**73.4%**	**WISCONSIN**	**61.9%**	**65.1%**	**65.4%**
MISSISSIPPI	**58.0%**	**54.5%**	**50.4%**	**WYOMING**	**50.1%**	*	**66.8%**
MISSOURI	**60.4%**	**60.8%**	**67.7%**	**PUERTO RICO[#]**	***78.3%***	***77.8%***	***87.0%***

Exhibit 25

*** Did not submit a use rate. [#] Standard Enforcement Seat Belt Law in effect in for years with Rate in *Bold Italics***

Seat Belt Use by Federal Employees

On April 16, 1997, former President Clinton signed Executive Order 13043, *Increasing Seat Belt Use in the United States*. This Order superseded Executive Order 12566, *Seat Belt Use Requirements for Federal Employees*. Both Orders required Federal employees to use seat belts when traveling on official Government business. The new Order substantially expanded the requirement for DOT to energize, mobilize, and recognize our fellow Federal Agencies, contractors, and customers in the effort. As a result, NHTSA has significantly increased activities to promote seat belt programs with Federal Agencies and the military.

ONE DOT BUA Initiatives

To promote the use of seat belts among DOT employees and their customers, a Department-wide initiative was created to facilitate communication about the *Buckle Up America* Campaign within the various DOT agencies. This initiative has been very active during the period covered by this report; the following are some of the activities of the various DOT agencies:

- Transportation Administrative Services Center (TASC) placed *Buckle Up America* static stickers in all executive vehicles and all other vehicles used by DOT employees for business travel. TASC also placed "Buckle Up America" and "Always Buckle Children" messages on their electronic bulletin boards.

- Office of the Inspector General (OIG) sent personal letters and *Buckle Up America* posters to each of the Inspectors General in the Federal Government. OIG also placed the *Buckle Up America* logo on its web site and sent e-mail to all employees reminding them to use their seat belts during travel over the Independence Day 2000 weekend.

- United States Coast Guard (USCG) used its web site to post information on seat belt/child restraint use, the Federal Agency Seat Belt Survey, the Coast Guard's policy on seat belt use, and Child Passenger Safety Week. The Coast Guard has established a 100 percent seat belt/child restraint use goal. The USCG also focused on Joint (Military) Services Safety efforts, improved traffic mishap investigation and analysis, improved traffic safety policy, and improved traffic safety training programs.

- Federal Aviation Administration (FAA) sent out a message to all employees before Thanksgiving 2000, stressing the importance of seat belt use and not drinking and driving. The November issue of FAA's employee newsletter, "The Intercom," included a story on the *Buckle Up America* Campaign.

- Federal Highway Administration (FHWA) staff spoke about seat belt safety and distributed *Buckle Up America* materials at their National Summer Transportation Institute program, the National Safety Council's Highway Safety Executive Committee Meeting, and the annual meeting of the Institute of Transportation Engineers. FHWA also installed plates on mail metering machines at 81 locations throughout the country that print the *Buckle Up America* logo on all outgoing mail.

- Federal Motor Carrier Safety Administration promoted seat belt use and distributed *Buckle Up America* outreach materials at the International Truck Show in Las Vegas, NV, an event that was attended by more than 100,000 people.

- Federal Railroad Administration distributed an employee health advisory in November 2000 that wished everyone a safe and happy Thanksgiving Holiday and ended with the line, "Always expect a train and ALWAYS wear your seat belt!"

- Maritime Administration staff displayed *Buckle Up America* literature at an exhibit booth during their quarterly meeting of the Ship Operations Cooperative Program held at the Great Lakes Maritime Academy and also at their fall 2000 meeting in Linthicum Heights, MD.

Seat Belt Use in Other Federal Agencies

NHTSA continues to work with other Federal Agencies outside of DOT to implement the requirements of the Executive Order. The following is a partial list of Federal Agencies that are partnering with NHTSA to achieve the goals of the *Buckle Up America* Campaign:

- Central Intelligence Agency
- Department of Health and Human Services
- Department of the Air Force
- Department of the Army
- Department of Labor
- Department of the Navy
- Department of State
- Department of Veterans Affairs
- Export-Import Bank
- Indian Health Service
- National Aeronautics and Space Administration
- Nuclear Regulatory Commission
- Office of Personnel Management
- Smithsonian Institution
- Social Security Administration
- Tennessee Valley Authority
- The Undersecretary of Defense
- United States Marine Corps
- United States Soldiers' and Airmen's Home
- United States Agency for International Development

Other Important Partnerships

Of the hundreds of public and private partnerships NHTSA has developed since the *Buckle Up America* Campaign began, two warrant special attention. The first is the nationwide law enforcement initiative known as *Operation ABC Mobilization* (**A**merica **B**uckles Up **C**hildren);

the second is the partnership formed with the American Automobile Association (AAA) in developing the NHTSA Standardized Child Passenger Safety Training Program.

Operation ABC Mobilization, developed in conjunction with the Air Bag & Seat Belt Safety Campaign, seeks to increase seat belt and child safety seat use by encouraging waves of highly visible law enforcement. The approach is simple: conduct weeklong waves of increased, highly visible law enforcement activities in May and November, during the peak holiday travel periods of Memorial Day and Thanksgiving. The *Mobilization* is based on an effective law enforcement model that combines periodic waves of stepped-up enforcement with aggressive publicity highlighting the enforcement. Support for this effort has increased significantly since its inception. During the first *Mobilization* in May 1997, approximately 1,000 agencies participated; during the May 2001 *Mobilization*, over 10,000 agencies in all 50 States participated, reaching 99 percent of the U.S. population.

Another initiative, the NHTSA Standardized Child Passenger Safety Training Program, has also experienced phenomenal growth. This course was created in 1998 as a joint effort between NHTSA, the American Automobile Association (AAA), and other partners to ensure that accurate and consistent information about child passenger safety be disseminated to the general public by trained instructors and technicians. As of May 2001, over 19,000 technicians and over 900 instructors have become certified nationwide.

Future Plans and Activities

In 1980, the seat belt use rate in America was only 11 percent; by 2001, this rate had increased to 73 percent. Use of child safety seats among infants and toddlers (children ages 0 through 4 years of age) had increased to 91 percent in 2000. Data show that some States (California and New Mexico) are already approaching a 90 percent seat belt use rate and the 2000 national goal of reducing child occupant fatalities (0-4 years of age) by 15 percent was met one year early in 1999. These successes have been in large part due to the hard work of literally thousands of partners committed to the goals of the *Buckle Up America* Campaign.

To achieve a 90 percent seat belt use rate nationally and a 25 percent reduction in child occupant fatalities (0-4 years of age) by 2005, NHTSA will continue to support law enforcement officials, deliver effective public education, devise new technologies to promote occupant protection, and support States in their efforts to enact strong occupant protection legislation. NHTSA will also maintain and build upon partnerships with representatives from industry, the medical community, private and public organizations, and diverse populations. Finally, NHTSA will expand its efforts to reach high-risk groups, including children and teens, part-time seat belt users, and those living in rural areas.

Appendix

Summary of Public Policy and Rulemaking Activities 1995-1999

- In May 1995 NHTSA published a final rule (60 FR 27233) that allowed manufacturers the option of installing an on-off switch for the front passenger-side air bag in vehicles in which infant restraints can be used in the front seat only.

- NHTSA launched a comprehensive public education program designed to: (1) alert the public to the dangers air bags pose to children and at-risk adults; (2) increase the correct use of safety belts; and, (3) increase the proper positioning and use of child safety seats (including a strong warning in a press release dated October 27, 1995).

- In November 1995 NHTSA published a request for comments to inform the public about its efforts to reduce the adverse effects of air bags and to invite the public to share information and views on possible technological changes to air bags to reduce their adverse effects, including possible regulatory changes with the agency (60 FR 56554).

- In 1996, the Department and NHTSA successfully led the effort to create a private-public partnership (the Air Bag and Seat Belt Safety Campaign [ABSBSC]), which would undertake and fund a national program to address air bag safety issues.

- In 1996, NHTSA published a final rule (61 FR 60206) requiring vehicles with air bags to bear three new warning labels: two labels replace existing labels on the sun visor; and, the third is a temporary label on the dash. These labels would not be required on vehicles having an advanced passenger-side air bag. This rule also requires rear-facing child seats to bear a new, enhanced warning label.

- In January 1997 a Notice of Proposed Rulemaking offering proposals for installation of air bag on-off switches was published, and a final rule extending until September 1, 2000, the time period during which vehicle manufacturers would be permitted to offer manual on-off switches for the passenger-side air bag for vehicles without rear seats or with rear seats that are too small to accommodate rear-facing infant seats, was issued.

- On March 19, 1997, (62 FR 12960) the final rule, allowing manufacturers to quickly implement redesigned air bags, was issued. The new rule paved the way for manufacturers to install air bags that were redesigned, with the goal of mitigating the injurious effects of air bags, while maintaining their proven benefits. The new rule also provides manufacturers and suppliers with additional time to develop a variety of advanced air bag technologies to tailor air bag deployment more appropriately to crash severity, occupant size and position, seat belt use and other vehicle factors.

- On November 21, 1997, the agency announced the final rule permitting on-off switches. Auto dealers and service outlets could begin installing on-off switches for air bags on January 19, 1998.