## APPENDIX A

## THE SAFETY PROBLEM:

## FRONTAL IMPACTS, AIR BAG SAVES AND AIR BAG FATALITIES

**Frontal impacts**. Frontal impacts are the number one fatality and injury causing mode of crash, resulting in 64 percent of all driver and right-front passenger fatalities and 65 percent of all driver and right-front passenger AIS 2-5 injuries. (AIS 2-5 stands for Abbreviated Injury Scale levels of moderate to critical injuries.) The estimated fatality and injury totals for 1994 are shown below. The injuries are those for National Accident Sampling System-Crashworthiness Data System (NASS-CDS) towaway accidents only.

**1994 Fatalities and Moderate to Serious Injuries**

**in Frontal Impacts**

**(Passenger Cars and Light Trucks)**

| | Drivers | Right Front Passengers | Total |
|---|---|---|---|
| **Fatalities** | 13,437 | 3,814 | 17,251 |
| **Injuries** | 124,484 | 30,299 | 154,783 |
| **Total** | 137,921 | 34,113 | 172,034 |

### B. Air Bag Saves and Fatalities.

As the agency has confronted the problem of low speed fatalities and injuries

from air bags, it has faced a serious dilemma. On the one hand, air bags have proven to be highly effective in reducing fatalities, and are resulting in substantial net benefits in terms of lives saved. The agency estimates that, to date, air bags have saved driver and passenger 1,664 lives (1,500 drivers and 164 passengers).[1]

At the same time, air bags are actually causing fatalities in some situations, especially to children. As of November 15, 1996, NHTSA's Special Crash Investigation program had identified 31 crashes in which the deployment of the passenger-side air bag resulted in fatal injuries to a child. One adult passenger and 19 drivers have also been fatally injured.

**Air Bag Saves and Fatalities**

**1986 - Present**

**(Passenger Cars and Light Trucks)**

| | Drivers | Right Front Passengers | Total |
|---|---|---|---|
| **Air Bag Saves** | 1,500 | 164 | 1,664 |
| | | | |

[1] [illegible] 1, 1996. [illegible] 1,614.

| | | | |
|---|---|---|---|
| **Air Bag Fatalities** | 19 | 32 | 52 |

**Passenger Fatalities**. The fatalities involving children have occurred in 1993 and later calendar years. Nine of the fatalities involved infants in rear-facing child seats. Of the other children, 18 were unrestrained, two more were wearing only the lap belt with the shoulder belt behind them, and two were wearing a lap and shoulder belt at the time of the crash. Most children were either infants or between the ages of 4-7. See the tables below.

**Infant Passenger-side Air Bag Related Fatalities**

**(In Rear Facing Infant Seats)**

**(By MY of Vehicle and CY of Death)**

| | **CY 89** | **CY 90** | **CY 91** | **CY 92** | **CY 93** | **CY 94** | **CY 95** | **CY 96** | **Total # of infant passenger-side air bag fatalities** | **# of vehicles w/ passenger-side air bags** |
|---|---|---|---|---|---|---|---|---|---|---|
| **MY89** | | | | | | | | | | 78,000 |
| **MY90** | | | | | | | | | | 149,000 |
| **MY91** | | | | | | | | | | 44,000 |
| | | | | | | | | | | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **MY92** | | | | | | | | | | 421,000 |
| **MY93** | | | | | | | | | | 1,352,000 |
| **MY94** | | | | | | | 1 | 1 | 2 | 5,547,000 |
| **MY95** | | | | | | | 2 | 4 | 6 | 8,936,000 |
| **MY96** | | | | | | | | 1 | 1 | 10,750,000 |
| **TOTAL** | | | | | | | 3 | 6 | 9 | 27,277,000 |

## Child (Non-infant) Passenger-side Air Bag Related Fatalities

## (By MY of Vehicle and CY of Death)

| | CY 89 | CY 90 | CY 91 | CY 92 | CY 93 | CY 94 | CY 95 | CY 96 | Total # of child (non-infant) passenger-side air bag fatalities | # of vehicles w/ passenger-side air bags |
|---|---|---|---|---|---|---|---|---|---|---|
| **MY89** | | | | | | | | | | 78,000 |
| **MY90** | | | | | | | | | | 149,000 |
| **MY91** | | | | | | | | | | 44,000 |
| **MY92** | | | | | | | | | | 421,000 |
| **MY93** | | | | | 1 | 1 | 1 | | 3 | 1,352,000 |
| **MY94** | | | | | | 3 | 1 | 1 | 5 | 5,547,000 |
| **MY95** | | | | | | 1 | 3 | 7 | 11 | 8,936,000 |
| **MY96** | | | | | | | | 3 | 3 | 10,750,000 |
| **TOTAL** | | | | | 1 | 5 | 5 | 11 | 22 | 27,277,000 |

## Age of Children Fatally Injured in Air Bag Deployments

| <1 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 9 | | | 1 | 5 | 7 | 4 | 3 | | 2 | | | | | 31 |

## Type of Restraint

## Used by Children Fatally Injured by Air Bags

| Type of restraint used | # of children |
|---|---|
| None | 18 |
| Lap belt only | 2 |
| Lap and shoulder belt | 2 |

| | |
|---|---|
| Unknown | |
| Rear-facing infant restraint | 9 |
| Forward-facing child restraint | |
| Booster seat | |
| Total | 31 |

These cases involved pre-impact braking, and were relatively low speed crashes. The nonuse, or improper use of safety belts in conjunction with pre-impact braking resulted in the forward movement of the children such that they were close to the instrument panel and the air bag system at the time of the air bag deployment. Because of this proximity, the children appear to have sustained fatal head or neck injuries from the deploying passenger-side air bag. The agency has examined all air bag cases with child fatalities in its Fatal Accident Reporting System (FARS) and believes it has identified all cases involving fatalities.

In addition to the 31 children who have been fatally injured during passenger-side air bag deployments, one adult, a 98 year old woman, sustained a fatal injury under similar air bag deployment circumstances.

**Driver Fatalities**. As of November 15, 1996, NHTSA's Special Crash Investigation program had identified 19 minor to moderate severity crashes in which fatal injuries to the driver were associated with the deployment of the driver-side air bag. The data suggest that unrestrained small statured and/or older drivers are more at risk than other drivers from a driver air bag. (See tables below.) The agency notes that older drivers are more at risk than younger drivers under a wide range of crash circumstances, regardless of type of restraint used.

NHTSA notes that these driver fatalities are very rare in comparison to the number of vehicles equipped with driver air bags and to the number of drivers saved by air bags. Further, NHTSA notes that the last reported death of a female driver 5 feet 2 inches or less that was due to an air bag was in November 1995, 12 months ago. Proper belt use is important. Ten of the 19 drivers appear to have been unrestrained at the time of the crash. In addition, two appeared to be out-of-position (slumped over the wheel). (See tables below.)

**Driver Air Bags: Fatalities and Lives Saved**

**(Fatalities Shown by MY of Vehicle and CY of Fatality)**

| | CY 89 | CY 90 | CY 91 | CY 92 | CY 93 | CY 94 | CY 95 | CY 96 | Driver air bag fatalities | Drivers saved by air bag | # of Vehicles produced w/ driver air bags |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **MY89** | | | | | | | 1 | | 1 | | 500,000 |
| **MY90** | | 1 | 1 | | 1 | 2 | 1 | | 6 | | 2,500,000 |
| **MY91** | | | 2 | 2 | 1 | | 1 | | 6 | | 2,867,000 |
| **MY92** | | | | | 1 | 1 | | | 2 | | 5,084,000 |
| **MY93** | | | | | | | | | | | 7,595,000 |
| **MY94** | | | | | | 2 | 1 | | 3 | | 9,890,000 |
| **MY95** | | | | | | | | 1 | 1 | | 13,690,000 |
| **MY96** | | | | | | | | | 0 | | 14,321,000 |
| **TOTAL** | 0 | 1 | 3 | 2 | 3 | 5 | 4 | 1 | 19 | 1,500 | 56,447,000 |

**Driver Air Bag Fatalities--Women (5'2" or Less)**

**(By MY of Vehicle and CY of Fatality)**

| | CY 89 | CY 90 | CY 91 | CY 92 | CY 93 | CY 94 | CY 95 | CY 96 | Total # of driver air bag | # of vehicles produced w/ |
|---|---|---|---|---|---|---|---|---|---|---|

| | | | | | | | | | fatalities (women 5'2" or less) | driver air bags |
|---|---|---|---|---|---|---|---|---|---|---|
| **MY89** | | | | | | | 1 | | 1 | 500,000 |
| **MY90** | | 1 | | | 1 | | 1 | | 3 | 2,500,000 |
| **MY91** | | | 1 | 1 | | | 1 | | 3 | 2,867,000 |
| **MY92** | | | | | 1 | 1 | | | 2 | 5,084,000 |
| **MY93** | | | | | | | | | | 7,595,000 |
| **MY94** | | | | | | | 1 | | 1 | 9,890,000 |
| **MY95** | | | | | | | | | | 13,690,000 |
| **MY96** | | | | | | | | | | 14,321,000 |
| **TOTAL** | | 1 | 1 | 1 | 2 | 1 | 4 | | 10 | 56,447,000 |

## Driver Air Bag Fatalities--other Adults

## (By MY of Vehicle and CY of Fatality)

| | CY 89 | CY 90 | CY 91 | CY 92 | CY 93 | CY 94 | CY 95 | CY 96 | Total # of driver air bag fatalities (other adults) | # of vehicles produced w/ driver air bags |
|---|---|---|---|---|---|---|---|---|---|---|
| **MY89** | | | | | | | | | | 500,000 |
| **MY90** | | | 1 | | | 2 | | | 3 | 2,500,000 |
| **MY91** | | | 1 | 1 | 1 | | | | 3 | 2,867,000 |
| | | | | | | | | | | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **MY92** | | | | | | | | | | 5,084,000 |
| **MY93** | | | | | | | | | | 7,595,000 |
| **MY94** | | | | | | 2 | | | 2 | 9,890,000 |
| **MY95** | | | | | | | | 1 | 1 | 13,690,000 |
| **MY96** | | | | | | | | | | 14,321,000 |
| **TOTAL** | | | 2 | 1 | 1 | 4 | | 1 | 9 | 56,447,000 |

## Age of Drivers Fatally Injured in Air Bag Deployments

| **<20** | **20-29** | **30-39** | **40-49** | **50-59** | **60-69** | **70-79** | **>80** | **Total** |
|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 4 | 4 | 2 | 1 | 6 | | 19 |

## Type of Restraint

## Used by Drivers Fatally Injured in Air Bag Deployments

| **Type of restraint used** | **# of drivers** |
|---|---|
| None | 10 |
| | |

| | |
|---|---|
| Belts misused | 1 |
| Lap and shoulder belt (Driver blacked out and slumped forward at time of crash due to medical condition.) | 2 |
| Lap and shoulder belt | 4 |
| Unknown | 2 |
| Total | 19 |

**Comparison of passenger and driver air bag fatalities**. Several comparisons between the data for child fatalities and driver fatalities need to be drawn. The annual number of child fatalities is very small, but growing steadily. The number of adult fatalities is not growing. Most child fatalities have occurred in very recent model year vehicles, model year 1994 and 1995 vehicles. In contrast, only one woman 5 feet 2 inches or less has died in a post model year 1992 vehicle. Most fatalities of those women occurred in model year 1990-1992 vehicles. (See tables below.)

**Driver Air Bag Fatalities by Calendar Year of Death**

| | CY 89 | CY 90 | CY 91 | CY 92 | CY 93 | CY 94 | CY 95 | CY 96 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|
| **Women (5'2" or less)** | | 1 | 1 | 1 | 2 | 1 | 4 | | 10 |
| **Other adults** | | | 2 | 1 | 1 | 4 | | 1 | 9 |
| **TOTAL** | | 1 | 3 | 2 | 3 | 5 | 4 | 1 | 19 |

**Child Air Bag Fatalities by Calendar Year of Death**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|

| | CY 90 | CY 90 | CY 91 | CY 92 | CY 93 | CY 94 | CY 95 | CY 96 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|
| **Children (non-infant)** | | | | | 1 | 5 | 5 | 11 | 22 |
| **Infants** | | | | | | | 3 | 6 | 9 |
| **TOTAL** | | | | | 1 | 5 | 8 | 17 | 31 |

**Drivers Air Bag Fatalities by Model Year of Vehicle**

| | MY 89 | MY 90 | MY 91 | MY 92 | MY 93 | MY 94 | MY 95 | MY 96 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|
| **Women (5'2" or less)** | 1 | 3 | 3 | 2 | | 1 | | | 10 |
| **Other adults** | | 3 | 3 | | | 2 | 1 | | 9 |
| **TOTAL** | 1 | 6 | 6 | 2 | | 3 | 1 | | 19 |

**Children**

**Air Bag Fatalities by Model Year of Vehicle**

| | MY 89 | MY 90 | MY 91 | MY 92 | MY 93 | MY 94 | MY 95 | MY 96 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|
| **Children (non-infant)** | | | | | 3 | 5 | 11 | 3 | 22 |
| **Infants** | | | | | | 2 | 6 | 1 | 9 |
| **TOTAL** | | | | | 3 | 7 | 17 | 4 | 31 |

**Potential Number of Persons Saved or Fatally Injured by Current Air Bags**.

The dilemma faced by NHTSA, and ultimately the public, is how to address the problem of low speed fatalities from air bags while preserving their substantial life-saving benefits. Based on analyses of real world data, NHTSA estimates that if all passenger

cars and light trucks on the road today had current air bags, there would be more than 3,000 lives saved each year, as compared to a no-air-bag fleet (assuming current belt use rates). On the driver side, 616 belted drivers and 1,686 unbelted drivers would be saved, for a total of 2,302 lives saved. This is a net figure, i.e., it accounts for the possibility of some drivers being fatally injured by the air bag.

The potential number of lives saved by passenger-side air bags is much smaller than driver-side air bags primarily because the passenger seat is occupied much less frequently than the driver's seat, and because children ride there. If all passenger cars and light trucks had current passenger-side air bags, the agency estimates that 223 belted and 491 unbelted passengers aged 13 and above would be saved annually, for a total of 714 lives saved.

However, this 714 figure would be partially offset by fatalities caused by the air bag to children 12 and under. If current rates of child fatalities were experienced in an all-air-bag fleet, 128 children would be fatally injured by air bags annually, again assuming no technological improvements, changes to air bags, or behavioral changes by vehicle operators (e.g., ensuring that any children placed in the front seat properly use occupant restraints or, preferably, placing children in the rear seat). The figure of 128 includes 90 forward-facing children, most of whom would be unbelted, and 38 infants in rear-facing child restraints.

NHTSA emphasizes that this and the other rulemaking proceedings and related educational efforts are intended to ensure that risks of adverse effects of air bags are reduced so that the theoretically projected air bag fatalities never materialize, while the

potential benefits of air bags are retained, to the maximum extent possible.