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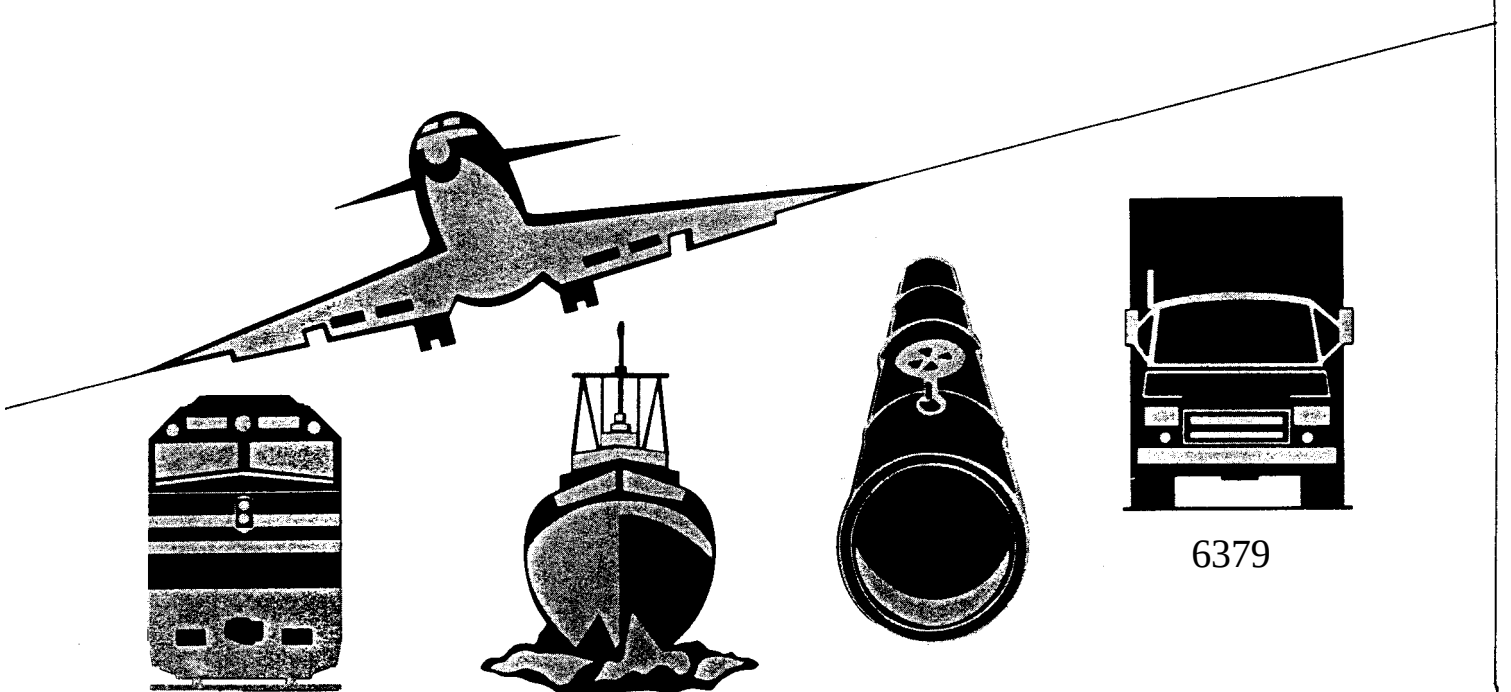
NATIONAL TRANSPORTATION SAFETY BOARD

WASHINGTON, D.C. 20594

SAFETY STUDY

THE PERFORMANCE AND USE OF CHILD RESTRAINT SYSTEMS, SEATBELTS, AND AIR BAGS FOR CHILDREN IN PASSENGER VEHICLES

VOLUME 1: ANALYSIS



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National Transportation Safety Board. 1996. The performance and use of child restraint systems, seatbelts, and air bags for children in passenger vehicles. Volume 1: Analysis. Safety Study NTSB/SS-96/01. Washington, DC.

Despite the effectiveness of child restraints and lap/shoulder belts to reduce the likelihood of severe and fatal injuries, accidents continue to occur in which restrained children are being injured and killed. The Safety Board conducted this study to examine the performance and use of occupant protection systems for children—child restraint systems, vehicle seatbelts, and air bags. The study analyzes data from 120 accidents involving at least one vehicle in which there was a child passenger younger than age 11 and in which at least one occupant was transported to the hospital. Volume 1 contains the Board's analysis of the data and its conclusions and recommendations. Volume 2 contains the summaries of the 120 accidents. The safety issues discussed in the report include (a) the dangers that passenger-side air bags pose to children; (b) factors that affect injury severity, including the use of an inappropriate restraint for a child's age, height, and weight, the improper use of the restraint, accident severity, and seat location; (c) the adequacy of Federal standards regarding the design and installation of child restraint systems; (d) the need to improve seatbelt fit for children; (e) the adequacy of public information and education on child passenger protection; and (f) the adequacy of State child restraint use laws. Safety recommendations concerning these issues were made to the National Highway Traffic Safety Administration, the Governors and legislative leaders of the 50 States, the U.S. Territories, and the Mayor of the District of Columbia; the domestic and international automobile manufacturers; and the child restraint manufacturers.

THE PERFORMANCE AND USE OF CHILD RESTRAINT SYSTEMS, SEATBELTS, AND AIR BAGS FOR CHILDREN IN PASSENGER VEHICLES

VOLUME 1: ANALYSIS

Safety Study

Safety Study NTSB/SS-96/01
Notation 6739

National Transportation
Safety Board

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Contents

Conversion Factors for International Standard (SI) Units

To convert from	*to*	*multiply by*
inch (in)	centimeter (cm)	2.54
mile (U.S. statute)	kilometer (km)	1.609
foot (ft)	meter (m)	0.3048
pound (lb)	kilogram (kg)	0.454

Executive Summary

According to the National Highway Traffic Safety Administration (NHTSA), U.S. Department of Transportation, child restraints have been shown to be 69 percent effective in reducing the risk of death to infants and 47 percent effective for children between the ages of 1 and 4. NHTSA also estimates that lap/shoulder belts reduce the risk of fatal injury by 45 percent and moderate to critical injury by 50 percent for passenger car occupants who are older than 5 years. Despite the effectiveness of child restraints and lap/shoulder belts to reduce the likelihood of severe and fatal injuries, accidents continue to occur in which restrained children are being injured and killed.

According to NHTSA's 1994 Fatal Accident Reporting System (FARS) data, 5,972 children younger than age 11 were passengers of motor vehicles in transport involved in accidents that resulted in at least one fatality. About 20 percent of the child passengers (1,203 of 5,972) were fatally injured. Restraint use was known for 1,114 of the 1,203 fatally injured children; about 54 percent of the fatally injured children (647 of 1,203) were unrestrained. Further, about 40 percent of all the children (2,402 of 5,972) involved in the fatal accidents were unrestrained; only 12 percent of these unrestrained children were not injured. These data show that the percentage of unrestrained children who were killed (26.9 percent) was almost double that of the percentage of restrained children who were killed (14.7 percent).

The National Transportation Safety Board, therefore, conducted this study to examine the performance and use of occupant protection systems for children—child restraint systems, vehicle seatbelts, and air bags. The study also examines the adequacy of relevant Federal Motor Vehicle Safety Standards, the comprehensiveness of State child restraint and seatbelt use laws, and the adequacy of public information and education on child passenger protection. In order to fully discuss the performance of air bags and children, the Board examined the accident experience with passenger-side air bags in general.

The Safety Board selected for study accidents involving at least one vehicle in which there was a child passenger younger than age 11 and in which at least one occupant was transported to the hospital. The Safety Board used a sampling strategy designed to obtain a predetermined number of children in specified age ranges and in certain types of restraint systems to ensure equal representation of ages and restraint categories in the sample. The Safety Board investigated a total of 133 accidents. A total of 13 accidents were omitted from the study: 12 because data required for this study could not be obtained, and 1 because the restraint system used in the vehicle was not designed for automobiles. The study, therefore, analyzes data from 120 vehicle accidents. Volume 1 (NTSB/SS-96/01) of the report contains the Board's analysis of the data, its conclusions, and safety recommendations; volume 2 (NTSB/SS-96/02) of the report contains case summaries of the 120 vehicle accidents.

The safety issues discussed in this study include the following:

- the dangers that passenger-side air bags pose to children;
- factors that affect injury severity, including the use of an inappropriate restraint for a child's age, height, and weight, the improper use of the restraint, accident severity, and seat location;
- the adequacy of Federal standards regarding the design and installation of child restraint systems;
- the need to improve seatbelt fit for children;
- the adequacy of public information and education on child passenger protection; and
- the adequacy of State child restraint use laws.

Prior to the completion of this study and as a result of the accidents involving children who were fatally injured by passenger-side air bag deployment, urgent recommendations were issued to NHTSA, the domestic and international automobile manufacturers, the child restraint system manufacturers, and other organizations and agencies associated with the distribution of educational material regarding child passenger protection. As a result of the completed study, additional recommendations were issued to NHTSA; the Governors and legislative leaders of the 50 States and the U.S. Territories, the Mayor and Chairman of the Council of the District of Columbia; the domestic and international automobile manufacturers; and the child restraint manufacturers.

Chapter 1

Introduction

About 7:55 p.m. on September 20, 1995, a 1994 Toyota Camry driven by a 26-year-old female failed to stop for the red light at an intersection and collided with the left front of a 1985 Toyota Corolla.[1] The weather was clear and dry and there were no visual obstructions. The air bags in the 1994 Toyota Camry deployed at impact. The driver sustained minor bruising on her inner arms and abdomen from contact with the air bag; the passenger-side air bag struck the back of the rear-facing child restraint system positioned in the right front passenger seat, breaking it in several places. The 5-month-old child in the restraint sustained fatal skull injuries. A 3-year-old child seated in a shield booster seat in the right rear vehicle seating position was not injured. All occupants of the 1985 Toyota Corolla were wearing their lap/shoulder belts. The driver and 10-year-old child who was seated in the right rear seating position sustained minor injuries. The adult occupying the right front seat was not injured.

The owner's manuals for the 1994 Toyota and for the rear-facing child restraint indicate that this type of child restraint system should never be used in the right front seat when the vehicle is equipped with an air bag for that position. These instructions were reinforced by two yellow and black labels, about 4 inches by 1½ inches, on each side of the child restraint with the words "WARNING: Place this restraint in a vehicle seat that does NOT have an air bag." The shoulder harness straps on the rear-facing child restraint system were not doubled back through the strap adjustment slide for proper securement, as directed by the restraint manufacturer's instructions. Further, the canopy on the child restraint—to shade the child's eyes from the sun—was being used in the vehicle despite the restraint manufacturer's instructions to the contrary.

The manufacturers' instructions for both the rear-facing child restraint and the booster seat in the 1994 Toyota recommend use of a locking clip[2] when the vehicle seatbelts utilize a free-sliding latch plate, as this vehicle did. The locking clip provided by the manufacturer of the rear-facing child restraint was found by the Safety Board's investigator in the storage area on the back of the child restraint. In summary, neither the rear-facing child restraint system nor the shield booster seat were being used according to the child restraint and/or vehicle manufacturers' instructions.

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[1] The driver of the 1994 Toyota said she was traveling about 35 miles per hour and tried to stop once she saw the red light. Investigators observed about 16 feet of skid marks from her vehicle.

[2] A locking clip is a metal clip that holds together the lap and shoulder portions of the vehicle seatbelt. Locking clips are shown in appendix A (tip #6) and are discussed in more detail in chapter 4.

This accident (study case 136) demonstrates the complexity of using child restraint systems in today's passenger vehicles and, more importantly, the dangers of using child restraints improperly. Researchers, safety advocates, and parents have expressed concerns about the effect of improper use on the performance of child restraint systems, the incompatibility of child restraint systems and vehicle restraints (both vehicle seatbelts and air bags), and the performance of vehicle seatbelts (lap-only or lap/shoulder belts) for children who have outgrown child restraint systems.

According to the National Highway Traffic Safety Administration (NHTSA), U.S. Department of Transportation, child restraints have been shown to be 69 percent effective in reducing the risk of death to infants and 47 percent effective for children between the ages of 1 and 4.[3] NHTSA also estimates that lap/shoulder belts reduce the risk of fatal injury by 45 percent and moderate to critical injury by 50 percent for passenger car occupants who are older than 5 years. Despite the effectiveness of child restraints and lap/shoulder belts to reduce the likelihood of severe and fatal injuries, accidents continue to occur in which restrained children are being injured and killed. The National Transportation Safety Board, therefore, conducted this study to examine the performance and use of occupant protection systems for children—child restraint systems, vehicle seatbelts, and air bags. The study also examines the adequacy of relevant Federal Motor Vehicle Safety Standards and the comprehensiveness of State child restraint and seatbelt use laws.

Description of Child Restraint Systems

The type of child restraint that should be used in a passenger vehicle depends on the child's height and weight. Several types of child restraint systems that are currently available on the market are referenced throughout this report. The types are briefly described below; diagrams of different models are contained in appendix A.[4]

Infant-only restraints are designed for infants from birth to about 20 pounds and 26 inches in length. These restraints are to be used rear-facing only. They typically have a harness, consisting of two shoulder straps that connect in a V-shape or to a small hip pad (T-shield) that is fastened between the child's legs. This type of harness is used solely for infant-only restraints. Car beds, another type of infant-only restraint, allow the infant to lie flat and perpendicular to the direction of vehicle travel with the infant's head toward the center of the vehicle; the infant is restrained by the same type of harness as for

[3] U.S. Department of Transportation, National Highway Traffic Safety Administration. 1996. Fatality and Injury Statistics on Children Ages 0-15, 1994. Conference Participant Manual, Conference on Moving Kids Safely. Washington, DC.

[4] The descriptions of the child restraint systems were taken, in part, from the NHTSA document entitled "Child Passenger Safety Resource Manual."

the infant-only restraint. The term "infant-only restraint," as used in this report, refers to a rear-facing restraint, unless otherwise noted.

Convertible restraints are designed for use by infants and toddlers. These seats are used rear-facing for infants up to 20 pounds, and they convert to forward-facing seats for toddlers weighing 20 to 40 pounds. Three types of convertible restraints are currently on the market. The first type is a five-point harness seat that secures the child at both shoulders, the hips, and between the legs. The second type incorporates an over-the-head, padded tray-like shield with a three-point harness that secures the child at both shoulders and between the legs. The third type is a harness/shield combination that has two shoulder straps that are joined to a padded T-shape or triangular shield that buckles between the child's legs. In this report, these restraints are referred to as "rear-facing" or "forward-facing" child restraints depending on how the restraint was used in the accident vehicle.

Booster seats are intended for use as a transition to vehicle seatbelts for children who have outgrown convertible seats (ideally, between 40 to 60 pounds and older than 4 years). There are two configurations: shield, and belt-positioning booster seats. A shield booster seat has a small abdominal shield to distribute crash forces. A belt-positioning booster seat consists of a base that raises the child so that the vehicle lap/shoulder belt will fit properly across the child's chest. These seats also have guides for the lower end of the shoulder belt to improve fit as well as for the lapbelt to position it properly over the thighs and to keep it from riding up over the child's abdomen. Some also have a high back with a guide for the upper end of the shoulder belt.

Integrated or built-in restraints are for toddlers and older children weighing 20 to 65 pounds. An integrated restraint is built into the vehicle seat and is usually hidden from view when not in use behind a fold-down cushion on the vehicle seatback. Most of these integrated restraints have a five-point harness, some have a harness/shield combination, and some function like a belt-positioning booster when the child is older.

Description of Relevant Federal Motor Vehicle Safety Standards

The National Highway Traffic Safety Administration has the authority to regulate child and adult restraint systems through its Federal Motor Vehicle Safety Standards (FMVSS).[5] There are two applicable standards, which are briefly described below. The standards are discussed in more detail later in this report.

[5] Title 49 Code of Federal Regulations Part 571 (49 CFR Part 571).

FMVSS 208, "Occupant Crash Protection," specifies performance requirements for the protection of vehicle occupants in crashes. The purpose of this standard is to reduce the severity of injuries and the number of deaths of vehicle occupants by specifying vehicle crashworthiness dynamic testing performance requirements in terms of forces and accelerations measured on anthropomorphic dummies in test crashes, and by specifying equipment requirements for manual and automatic restraint systems.[6] The current standard requires that all passenger cars manufactured after September 1, 1997, be equipped with an air bag and manual lap/shoulder belts for the driver and right front passenger. Light trucks and vans must meet this requirement by September 1, 1998.

FMVSS 213, "Child Restraint Systems," specifies requirements for child restraint systems used in motor vehicles and aircraft. This standard applies to devices used to restrain or position children 50 pounds or less and covers restraint types including infant-only, toddler-only, infant/toddler convertible restraints, booster seats, integrated or built-in seats, and related harnesses. Current requirements include such items as dynamic sled testing, labeling and installation instructions, and flammability limits. The dynamic sled testing covers head and chest injury criteria, head and knee forward movement, structural integrity of the child restraints, belt and buckle performance, position change of the seat, and containment of the child. Amendments in 1995 and 1996, respectively, doubled the number of child-size crash test dummies and increased the size and weight range of dummies to be used in the dynamic compliance tests. The intent of the amendments was to make the tests more reflective of the infants and children using child restraint systems.

Overview of State Laws Relevant to Child Restraint and Seatbelt Use

Forty-nine States require the use of seatbelts, and in addition, all 50 States require children under a specified age to be in a child restraint system (appendix B). The ages of the occupants and the seating positions covered by the laws vary considerably among States. Only 12 States and 2 U.S. Territories require all occupants in front and back seating positions to be restrained. Only 11 States and all 5 U.S. Territories permit a vehicle to be stopped solely for a violation of the seatbelt use law (primary enforcement). The variations in State laws are addressed in more detail in chapter 5.

[6] Manual belts are sometimes referred to as "active belts," and automatic belts are sometimes referred to as "passive belts." Air bags are also considered to be automatic restraints.

Statistics on Motor Vehicle Accidents Involving Children

Approximately 4 million children are born in the United States each year. According to the U.S. Census Bureau, there are 42,855,000 children younger than 11 years.[7] The National Center for Health Statistics reports that one of the leading causes of death for children is motor vehicle accidents. In 1994, 5,972 children younger than age 11 were passengers of motor vehicles in transport involved in accidents that resulted in at least one fatality (FARS 1994 data;[8] see table 1.1). About 20 percent of the child passengers (1,203 of 5,972) were fatally injured. Restraint use was known for 1,114 of the 1,203 fatally injured children; about 54 percent of the fatally injured children (647 of 1,203) were unrestrained. Further, about 40 percent of all the children (2,402 of 5,972) involved in the fatal accidents were unrestrained; only 12 percent of these unrestrained children were not injured. These data show that the percentage of unrestrained children who were killed (26.9 percent) was almost double that of the percentage of restrained children who were killed (14.7 percent).

Previous Safety Board Studies Related to Occupant Protection

The Safety Board has had a longstanding interest in occupant protection. In 1983, the Board examined the performance of child restraint systems and concluded that when properly used according to the manufacturers' instructions, child restraint systems provide excellent protection.[9] The Board also found that misuse of child restraint systems was a significant and widespread problem and consequently issued several safety recommendations to the Federal government, the States, and child restraint manufacturers. Following these recommendations, all 50 States eventually mandated use of child restraint systems. In addition, the recommendations contributed to improved designs of child restraint systems. In 1985, the Safety Board conducted a symposium to explore ways to increase proper use of child restraint systems. Symposium participants included safety advocates and representatives of automobile and child restraint manufacturers, Federal, and State agencies.[10]

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[7] These numbers are current as of May 1, 1996.

[8] The Fatal Accident Reporting System (FARS) is maintained by the U.S. Department of Transportation, National Highway Traffic Safety Administration. FARS contains data on fatal traffic accidents.

[9] National Transportation Safety Board. 1983. Child Passenger Protection Against Death, Disability, And Disfigurement In Motor Vehicle Accidents. Safety Study NTSB/SS-83/01. Washington, DC.

[10] National Transportation Safety Board. 1985. Child Passenger Safety Symposium: Ways To Increase Use and Decrease Misuse of Child Restraints. Safety Study NTSB/SS-85/03. Washington, DC.

Table 1.1—Injury severity and restraint status of children younger than age 11 involved in U.S. motor vehicle accidents that resulted in at least one fatality, 1994

Injury severity	Restrained[a]	Unrestrained	Other restraint status or unknown[b]	Total
None	1,065	283	92	1,440
Injury	1,635	1,468	214	3,317
Fatal	467	647	89	1,203
Injured, severity unknown	3	4	5	12
Total	3,170	2,402	400	5,972

[a] Includes lap/shoulder belt, shoulder portion or lap portion of lap/shoulder belt, lap-only belt, child restraint system, and restraint used but type unknown.

[b] Includes 14 children wearing safety helmets.

Source: Data from the Fatal Accident Reporting System (FARS) maintained by the U.S. Department of Transportation, National Highway Traffic Safety Administration.

The Safety Board has also examined the performance of lap-only belts and lap/shoulder belts. In its 1986 study on the performance of lap-only belts, the Safety Board concluded that lap-only belts did not provide adequate protection and could cause injury.[11] Accordingly, the Board recommended that NHTSA require the installation of lap/shoulder belts at all outboard seating positions and noted that many automobile manufacturers were already doing so. NHTSA enacted the requirement effective for passenger cars with vehicle model year 1990 and for light trucks and vans with model year 1992.

In its 1988 study on the performance of lap/shoulder belts, the Safety Board concluded that properly used lap/shoulder belts can reduce the level of serious injuries or chance of death in a wide range of motor vehicle crash types and crash severities.[12] As a result of that study, the Board recommended an end to the practice of allowing small children to put shoulder belts behind their backs and made other recommendations to improve the comfort and fit of shoulder belts. In February 1991, the Safety Board issued two safety recommendations to NHTSA related to revising FMVSS 213 to allow the manufacture of belt-positioning booster seats and evaluating the performance standards

[11] National Transportation Safety Board. 1986. Performance of Lap Belts in 26 Frontal Crashes. Safety Study NTSB/SS-86/03. Washington, DC.

[12] National Transportation Safety Board. 1988. Performance of Lap/Shoulder Belts in 167 Motor Vehicle Crashes (Volume 1). Safety Study NTSB/SS-88/02. Washington, DC.

for shield booster seats.[13] The U.S. Congress also directed NHTSA to initiate rulemaking on belt-positioning booster seats in its December 1991 Intermodal Surface Transportation Efficiency Act. NHTSA subsequently revised FMVSS 213 to regulate the manufacture of belt-positioning booster seats.

The current study provides an opportunity to specifically examine the performance of occupant restraints for children. The data collection procedures and a general overview of the sample data are presented in chapter 2. Chapter 3 describes the accidents in which a passenger-side air bag deployed at the right front seating position where a child was positioned. It also discusses actions that have been taken by government, industry, and safety advocates to improve the functionality and safety of air bags and additional measures that need to be taken. Chapter 4 examines the use of child restraint systems and seatbelts as well as two other factors affecting injury severity of children: accident severity and seating position in the vehicle. Specifically, that chapter discusses the difficulties in choosing the appropriate restraint for children and improper use of the restraint systems. Proposed solutions to some of the problems discovered from the Board's study cases are discussed in chapter 5. The last sections present the Safety Board's conclusions and recommendations made as a result of this study.

[13] Safety Recommendations H-91-1 and -2 were issued to NHTSA on February 22, 1991.

Chapter 2

Methodology and Sample

This chapter provides a description of the study design, details of the data collection methodology, and a general overview of the accidents in this sample involving children younger than age 11.

Methodology

Selection and Notification Criteria.—The Safety Board selected for study accidents involving at least one vehicle in which there was a child passenger younger than age 11 and in which at least one occupant was transported to the hospital.[14] To ensure timely accident investigations, qualifying accidents were limited to those occurring in States with close proximity to the Safety Board's highway regional offices located in California, Georgia, New Jersey, and Texas. Notification criteria did not include accidents that were considered by the responding police officer to be unsurvivable or accidents in which there was fire.

Accidents meeting the qualification criteria were accepted sequentially for investigation from March 1994 through October 1995, as the Board received notification.[15] The Safety Board used a sampling strategy designed to obtain a predetermined number of children in specified age ranges and in certain types of restraint systems to ensure equal representation of ages and restraint categories in the sample. Table 2.1 shows the planned and the actual number of cases obtained for the specified age and restraint type categories. The planned number of cases was met or exceeded in four categories.[16] In the remaining categories, the actual number of children in the sample did not meet the planned number; however, the Safety Board determined that data analysis could be conducted on the sample that had been obtained.

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[14] For the purposes of this study, occupants younger than age 11 are referred to as "children."

[15] One accident that occurred on February 17, 1996, was accepted for the study because the Board was still in the early stages of data analysis at that time.

[16] Some accident vehicles were transporting a child who met a specified age and restraint type category for which the planned number of child occupants had already been obtained. However, when an accident vehicle also included a child who met an age and restraint type category for which the planned number had not been obtained, both children were included in the sample. Consequently, the number of children in two age and restraint type categories exceeded the number planned.

Table 2.1—Number of children in study sample, by type of restraint

Child's age, and number of children in sample	Child restraint system		Booster seat		Seatbelt		Unrestrained		Undetermined
	Sampling stragegy[a]	Actual	Sampling strategy	Actual	Sampling strategy	Actual	Sampling strategy	Actual	Actual
Under 2 yrs, n=41	20	24	0	1	5	4	10	11	1
Over 2 but under 6 yrs, n=103	30	12	20	13	28	45	32	26	7
Over 6 but under 11 yrs, n=63			5	0	40	32	40	28	3
Total,	50	36	25	14	73	81	82	65	11

[a] The sampling strategy was designed to obtain the number indicated.

Because the Safety Board was particularly interested in the interaction of air bags with children, an exception was made to the notification criteria for accidents involving deployment of passenger-side air bags. Of the notifications received from March 1994 through October 1995, the Board accepted any accident within or outside the study geographic areas that involved an air bag deployment at the passenger-side seat occupied by a child younger than age 11. The study sample includes 13 such cases.

The Safety Board investigated a total of 133 accidents. A total of 13 accidents were omitted from the study: 12 because data required for this study could not be obtained, and 1 because the restraint system used in the vehicle was not designed for automobiles.[17] The most frequent reason that data were not obtained was because the child's parents would not cooperate with the investigators in terms of providing demographic, injury, or restraint information related to the child. The study analyzes data from 120 vehicle accidents.

Investigative Procedures.—The Safety Board used its standard investigative procedures for these accidents. Although the accident scene was not typically secured for the Board's investigators, there was an inspection of each accident site and of the vehicles involved.

For the set of accidents used in this study, the probable cause of the accident was not determined because it was not needed to understand the effects of restraint systems on children. The Safety Board obtained detailed information about the injuries sustained by the vehicle occupants and the source of those injuries and determined the type of restraint system used by the occupants without the need to determine the probable cause.

Safety Board investigators collected information regarding the restraint system available in the vehicle at the occupant's seating position and determined whether the occupant used the restraint system. Investigators used medical information, load marks on the seatbelts, physical evidence of occupant contact inside the vehicle, and witness statements to determine use of the restraint system.

[17] An aircraft cargo strap was used to restrain an infant in a child restraint system, an infant in a carrier seat (not to be used in automobiles), and four additional children on an aftermarket bench seat that was installed in the rear of the van. One adult was also sitting on the bench seat but was not restrained by the cargo strap. The strap was about 1½ inches wide and wrapped around the entire seat. It was fastened with a hook and cinching-type locking mechanism at the back of the seat. The child restraint system and carrier seat were located on the center bench which created an inverted V-shape of the strap used as a lapbelt. The other four children could slide freely in and out of the strap that was being used as their lapbelt. Three of the belted children sustained no injury and one sustained minor injuries. The child in the restraint system sustained a minor injury and the child in the carrier seat sustained no injury in the moderate-speed collision (Delta V of 16.5 mph). (Accident No. WRH-95-FH-C15.)

Vehicle crush measurements were taken to estimate collision severity, expressed as the velocity change (Delta V) experienced by the case vehicle. Delta V is generally considered to be the best single measure of collision severity. Delta V, as used in these investigations, is the estimated instantaneous change of the speed of a vehicle at impact. Investigators computed the Delta V using EDCRASH (Engineering Dynamics Corporation Reconstruction of Accident Speeds on the Highway).[18] At a minimum, EDCRASH requires a description of the vehicle damage in order to compute Delta V.

For purposes of some data analyses, the estimated Delta V values were represented by five categories: low (≤ 10 mph), moderate (10.1–20 mph), moderately severe (20.1–30 mph), severe (30.1–40 mph), and very severe (> 40 mph). For other analyses, Delta V values were divided into two categories representing low to moderate accident severity (< 20 mph) and high accident severity(≥ 20 mph).

Injury information was documented through medical reports and from information provided by the driver, parent, and/or occupant. The Lehman Injury Research Center at Jackson Memorial Hospital, Miami, Florida, assisted the Safety Board in coding this information using the Abbreviated Injury Scale (AIS).[19] The AIS is an anatomically based system that classifies individual injuries by body region on a six-point ordinal scale of risk to life:

AIS Code	Description
1	Minor
2	Moderate
3	Serious
4	Severe
5	Critical
6	Maximum
9	Unknown

The AIS does not assess the combined effects of multiple injuries. The maximum AIS (MAIS) is the highest single AIS code for an occupant with multiple injuries and has been used by investigators to describe overall severity.

[18] Engineering Dynamic Corporation. 1989. EDCRASH: Reconstruction of Accident Speeds on the Highway. 5th ed. Lake Oswego, Oregon.

[19] Association for the Advancement of Automotive Medicine. 1990. The Abbreviated Injury Scale. Des Plaines, IL.

For the purposes of this report, if the occupant was fatally injured but none of the individual injuries was fatal, the occupant's overall injury severity was defined as a six; otherwise, the occupant's injury severity was computed using the highest AIS value associated with an individual injury.[20] The Lehman Center coded the injuries and assigned an AIS score to each injury if sufficient medical information was available for the injury. The Lehman Center used the medical information to code the body region of the injury, the general location of the injury, the specific location of the injury, the specific injury, a six-digit injury identifier, as well as the AIS code.

Additional Accidents Known to Involve Passenger-Side Air Bag Deployment.—The Safety Board's study sample, as previously noted, includes 13 cases involving deployment of the air bag at the passenger-side seat occupied by a child younger than age 11; 5 of the children were fatally injured. Before the investigation phase of the study began (in March 1994), the Safety Board investigated an earlier accident in Canton, Ohio,[21] in which an unrestrained 6-year-old was killed by contact with a passenger-side air bag. Also during the investigation of study case 137, the Safety Board obtained information on another accident in Orem, Utah, in which an unrestrained child was killed as a result of the passenger-side air bag.[22] The Board also investigated fatal accidents in St. James, Missouri (June 1996), and Nashville, Tennessee (September 1996).

In addition to the accidents investigated by the Board, NHTSA has investigated 17 other accidents in which a child has been killed by the passenger-side air bag in an otherwise survivable accident.[23] (Appendix C contains a chronological list and supplemental information about these additional accidents.) The Board is also aware of other organizations that have investigated accidents in which a child was injured by a passenger-side air bag.[24] This report references the fatal accidents in Canton, Orem, St.

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[20] Volume 2 of this report provides the specific injuries for each child occupant and the associated AIS code for each injury.

[21] Accident No. NRH-93-FH-011. In the April 1993 accident, which involved a 1993 Volvo, the unrestrained child died of a brain injury caused by blunt force trauma from the air bag.

[22] Accident No. WRH-96-FH-003. In the September 1994 accident, which involved a 1994 Dodge Caravan, the unrestrained child was propelled by the passenger-side air bag, resulting in contact with the roof header at the juncture of the windshield. The child died of a depressed skull fracture and also sustained severe facial and neck abrasions and lacerations.

[23] Ten of these accidents investigated by NHTSA occurred after October 31, 1995, and thus were not investigated by the Safety Board for inclusion in this study. NHTSA examined its FARS data for the accidents that occurred prior to May 1995 to identify any child fatalities that could have resulted from contact with the air bag and investigated those that were air bag-related. The Board did not conduct its own investigations of these particular accidents.

[24] The Children's National Medical Center, Washington, D.C., under contract to NHTSA, has investigated six other accidents, and the Insurance Institute for Highway Safety, Arlington, Virginia, has investigated three accidents in which a child was positioned in the right front seat of a vehicle in which the passenger-side air bag deployed. None of the children sustained fatal injuries.

James, Nashville, and those investigated by NHTSA, where relevant. They are not included in the analysis of the Board's study cases, however, because they were not part of the Board's study sample.

Overview of the Study Sample

The Board investigated 120 accidents that met the criteria for inclusion in this study. There were 229 vehicles involved in these accidents, of which 124 vehicles were case vehicles; that is, in 124 vehicles there was at least one child younger than age 11 and at least one occupant (of any age) who was transported to the hospital. A total of 420 occupants were involved in the 120 accidents; 207 of the occupants were children younger than age 11. (Appendix D contains general information about the accidents and the vehicles.)

Almost all of the accidents were collisions with other vehicles (n = 119). Delta V was calculated for 119 of the 124 case vehicles involved in collisions; it ranged from 4.60 mph to 54.50 mph. Delta V was less than 20 mph for more than half the vehicles (60.5 percent) (figure 2.1). Three case vehicles were involved in rollovers, one vehicle was involved in a sideswipe, and one hit a curb in a parking lot and sustained only minor damage to the undercarriage. (Delta V was not calculated for these five vehicles.)

The ages of the 207 children in the sample ranged from 2 weeks to 10 years (figure 2.2). Their weight ranged from 10 to 120 pounds (n = 194) and their height ranged from 19 inches to 63 inches (n = 190). Figures 2.3 and 2.4 provide information on the weight and height of the children.[25]

Thirty of the 207 children were in nonvalid seating positions: 13 were held on the laps of other occupants, and 16 were seated as follows: 8 were sharing seat positions,[26] 2 were in the middle of the back seat in positions that were not designated as vehicle seats and thus did not have seatbelts available, 1 was lying down in the back seat, 2 were on the floor, and 3 were in the bed of a pickup truck. The seating position for one child could not be determined.

[25] Weight was not known for 13 children, and height was not known for 17 children.

[26] In case 25, two children were seated one in front of the other. This case was coded as a shared seat.

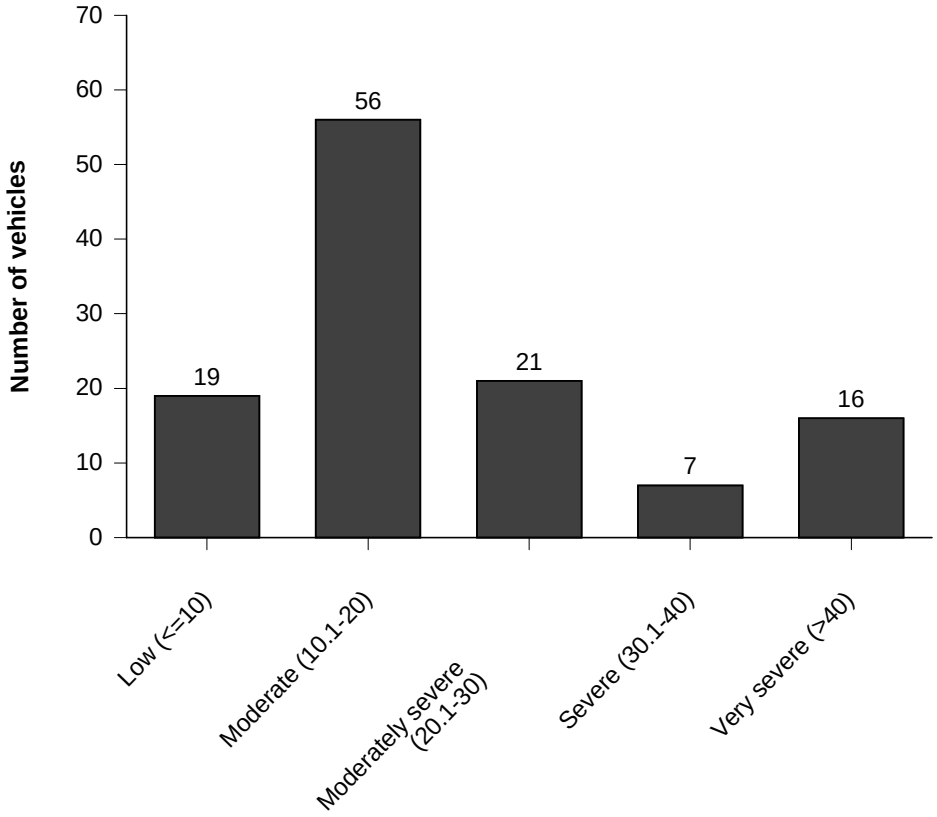

Figure 2.1—Accident severity (Delta V) of 119 case vehicles involved in collisions. (Delta V was not calculated for the five vehicles involved in the rollovers, the sideswipe, or the crash resulting in undercarriage damage.)

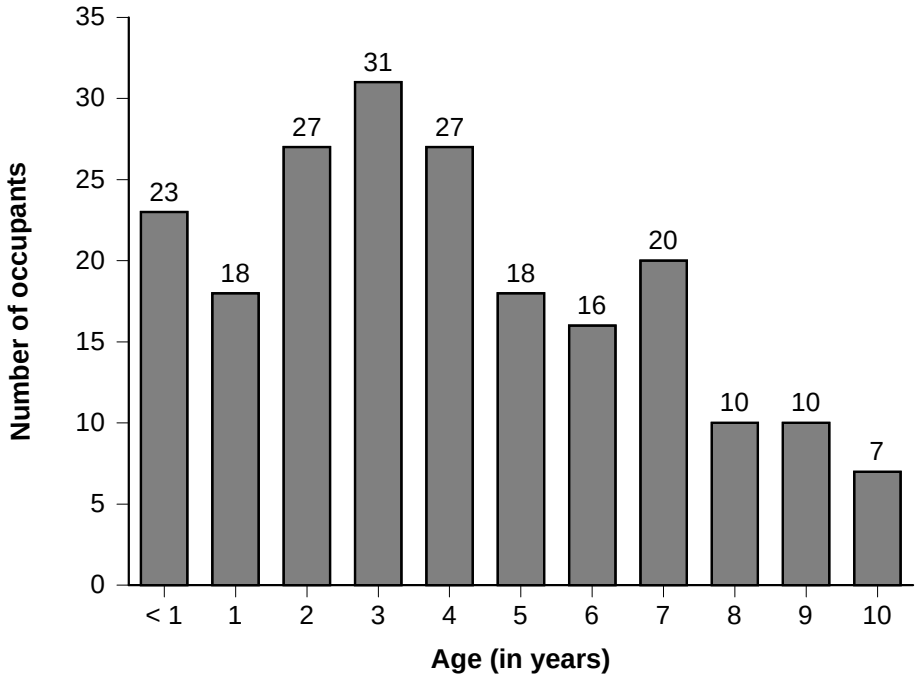

Figure 2.2—Ages of the 207 children in the case vehicles.

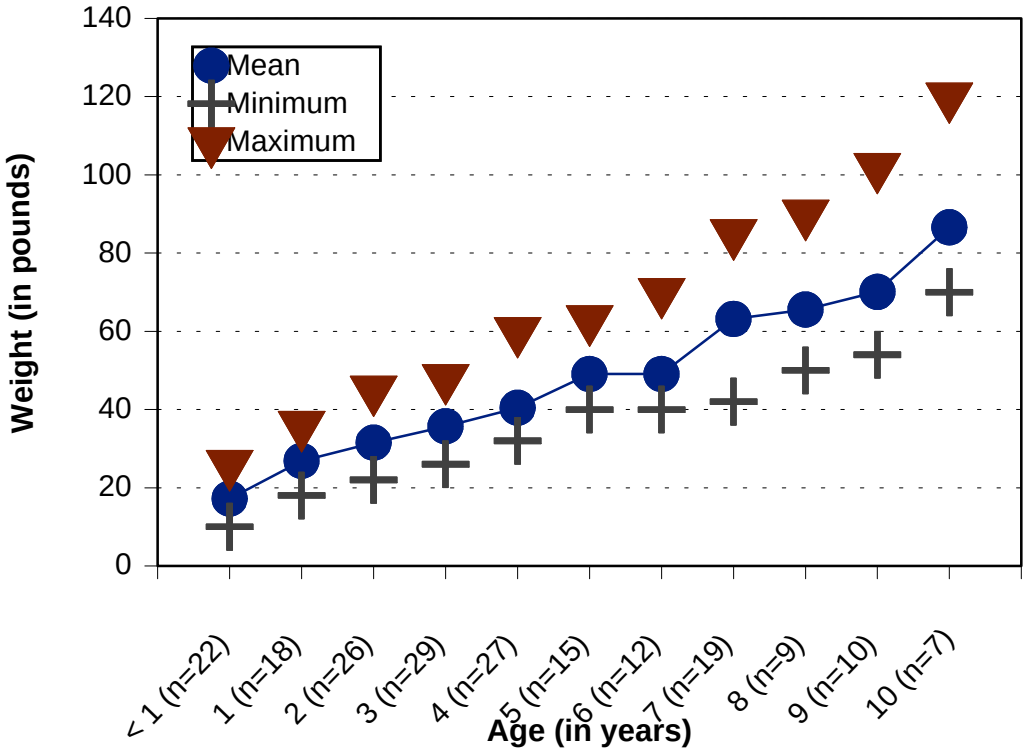

Figure 2.3—Mean weight and weight ranges of the children in the case vehicles, by age group, for whom the data were available (n=194).

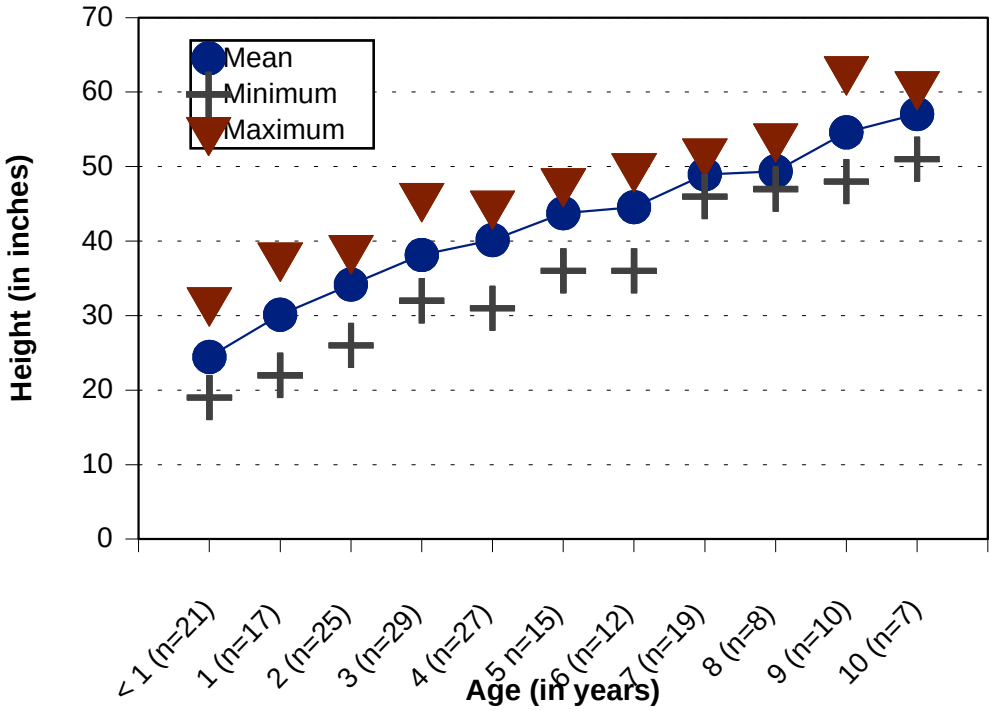

Figure 2.4—Mean height and height ranges of the children in the case vehicles, by age group, for whom the data were available (n=190).

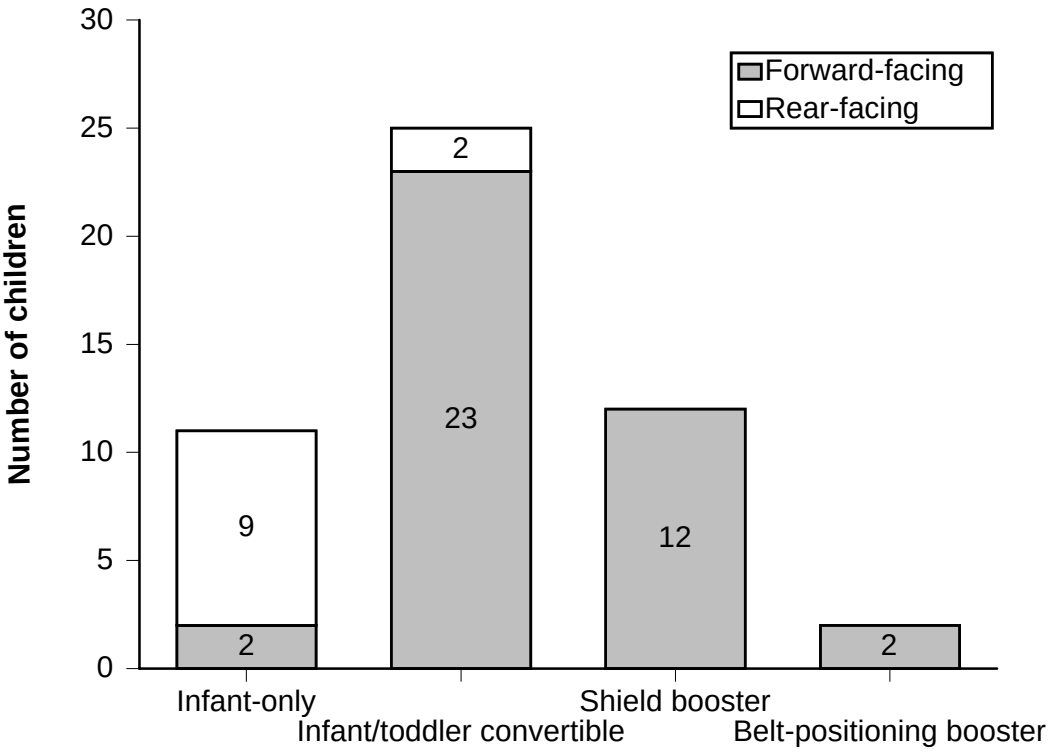

Figure 2.5—Type of child restraint system used.

Of the 207 children, 52 were in child restraint systems: 11 in infant-only restraint systems, 25 in infant/toddler convertible restraints, and 14 in booster seats[27] (figure 2.5). The other two children were in a child restraint system, but the type could not be determined.

[27] Nine of the infant-only and 2 of the convertible restraints were rear-facing; 2 of the infant-only restraints and 23 convertible restraints were forward-facing. Twelve children were in shield booster seats, and two were in belt-positioning booster seats.

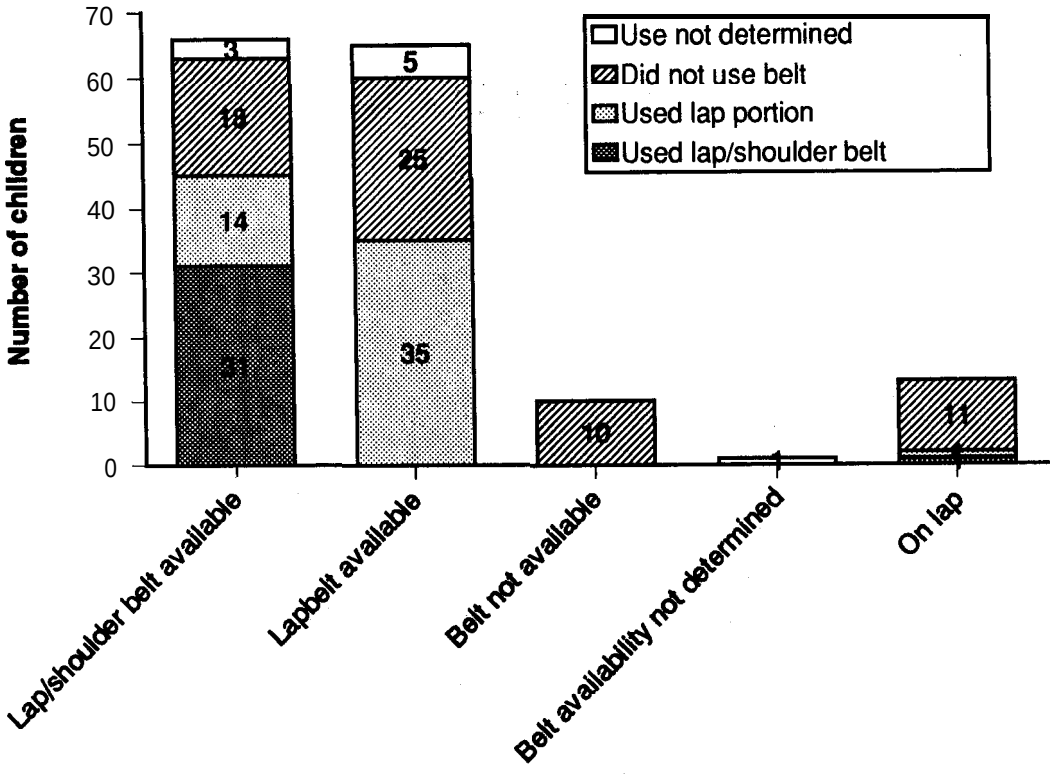

Figure 2.6—Availability and use of seatbelts for children not in child restraint systems.

Vehicle seatbelts were available at the seating positions occupied by 131 of the 155 children who were ‘not in child restraint systems (figure 2.6). Restraint systems were not available for the 13 children held on laps or for 10 other children who were not in valid seating positions; restraint availability could not be determined for 1 other child. Lap/shoulder belts were available for 66 children: 31 used their lap/shoulder belts, 14 used only the lap portions, 18 did not use the seatbelts, and lap/shoulder belt use could not be determined for 3 children. Lap-only belts were available for 65 children: 35 used them, 25 did not, and lapbelt use could not be determined for 5. Thus, a total of 43 children had some type of seatbelt available but did not use it.

Chapter 3

Accidents Involving Air Bags

Overview of the Air Bag-Involved Accidents in the Study Sample

Air bags were available in 32 vehicles: driver-side air bags were installed in all 32 vehicles, and passenger-side air bags were installed in 16 of the vehicles. Twenty-nine driver-side air bags deployed, and 14 passenger-side air bags deployed.[28] Driver- and passenger-side air bags were installed in two other vehicles, but in neither case did the driver- or passenger-side air bag deploy. Delta V values ranged from 4.6 mph to 48.2 mph for vehicles in which air bags deployed. The two vehicles in which the air bags did not deploy were involved in a rollover (no Delta V available) and a rear-end collision (Delta V of 13 mph.)[29] Although the focus of this study is on children in passenger vehicles, the Safety Board shares the current interest in the performance of air bags for all occupants; thus, the Board also examined the 29 accidents in which adults occupied the front seats of a vehicle in which the driver-side or passenger-side air bag deployed. A brief summary of those accidents is presented in appendix E.

In 13 accident vehicles in the study sample, a child was positioned in the right front seat of a vehicle in which the passenger-side air bag deployed. In 7 of the 13 accidents, the child was killed or critically injured by contact with the air bag. The seriousness of these seven accidents prompted the Safety Board to issue urgent safety recommendations related to the dangers that air bags pose to small children.[30] The children in only two of the accidents were uninjured; in the other four accidents, the children sustained less than critical injuries. Figure 3.1 shows the distribution of injury severity

[28] In case 140, the passenger-side air bag deployed, but the driver-side air bag did not deploy; the Delta V was 9.9 mph.

[29] The vehicle involved in the rear-end collision had a 33-month-old child restrained in the right front seating position. Even though the child should not have been positioned in front of the passenger-side air bag, the child was properly secured in a forward-facing child restraint system and sustained no injuries (case 85).

[30] These Safety Recommendations (H-95-17 through 31) were issued on November 2, 1995; relevant recommendations are discussed in more detail later in this chapter. A summary and the status of each recommendation not discussed in detail in the text are given in appendix F.

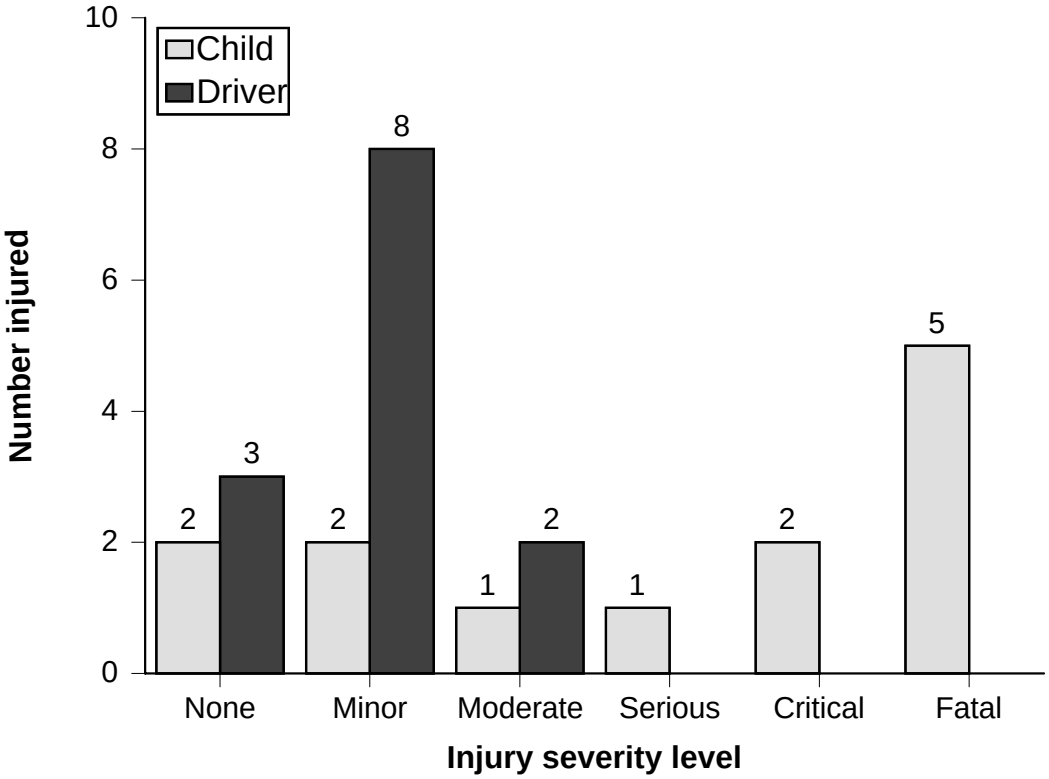

Figure 3.1—Injury severity for all front seat occupants for the 13 accidents in which a child was positioned in front of the passenger-side air bag that deployed.

for all front seat occupants in the 13 accidents. The drivers in 10 of the 13 accidents sustained injuries. The drivers in 7 of these 10 accidents sustained injuries as a result of contact with the air bag; the injuries were typically minor abrasions and contusions. The remainder of this chapter addresses children younger than age 11.

The accident severity was low to moderate (Delta V < 20 mph) in nine accidents, yet four of the nine children in these accidents sustained critical or fatal injuries. Although Delta V could not be determined using the EDCRASH program for two additional accidents—because one was a sideswipe and one involved only undercarriage damage—both involved relatively low-speed impacts. In one of these accidents (case 59), the child sustained critical injuries; in the other accident (case 137), the child died.

Accidents by Type of Restraint Used

The Safety Board examined the 13 air bag-involved accidents in which a child was positioned in the right front seat according to the type of restraint used by the children to determine similarities among the accidents, including the patterns of injuries. In 6 of the 13 accidents, the child was restrained by a child restraint system, and in 6 the child used the lap/shoulder belt or the lap portion of the lap/shoulder belt.[31] In one accident, restraint use could not be conclusively determined. (See table 3.1.)

Rear-Facing Child Restraint Systems.—In four of the six accidents in which the child was restrained by a child restraint system, the child was in a rear-facing child restraint system. In each of these cases, the child sustained a skull fracture, along with other head and neck injuries, as a result of contact with the passenger-side air bag. Further, the shell of three of the four child restraint systems cracked as a result of impact with the air bag compartment cover flap and/or the air bag. All four of the accident vehicles involving rear-facing child restraint systems had (a) a warning on the passenger-side sunvisor advising against using a rear-facing child restraint system in the front passenger seat, (b) cautionary information in the vehicle owner's manual, and (c) in two cases, warnings on the child restraint system and on the seatbelt. In addition to being inappropriately positioned in the front seat of a vehicle with a passenger-side air bag, each of the child restraint systems was improperly used in some way.[32] The Board does not believe that the improper use of the restraint systems played a role in the severity of the injuries sustained by these children. Given the low to moderate accident severity of three of the four accidents (cases 59, 136, and 138) and the lack of intrusion into the passenger compartments where these children were positioned, the Safety Board believes that the children in these three accidents would have sustained no injuries or only minor injuries had the passenger-side air bags not deployed. The accident in case 121 was moderately severe; however, given the lack of intrusion into the passenger compartment where this child was positioned, the Safety Board also believes that the child would have survived the accident had the passenger-side air bag not deployed.

[31] NHTSA also investigated several of these accidents and made determinations that differ from the Board's in terms of restraint use (cases 95, 137, and 140). The Safety Board and NHTSA staff met to discuss the differences but did not resolve them. (See appendix C regarding the differences.)

[32] In cases 59 and 136, the end of the webbing of the internal harness was not doubled back through the strap adjustment slide to tightly secure the internal harness; the child in case 59 was partially ejected from the child restraint system as a result of this misuse. In case 121, the locking clip was not used in the correct location. In cases 136 and 138, a locking clip was required but not used. Chapter 4 discusses misuse of child restraint systems in more detail.

Table 3.1-Summary of the 13 accidents in the study sample in which the passenger-side air bag deployed at the seating position occupied by a child younger than age 11

Case no.	Child's age and height	Injury severity	Restraint used and pre-crash posture	Delta v (mph)	Pre-crash braking	Seat track location	Distance from instrument panel to seat-back, and to the CRS	Estimated air bag excursion	Vehicle year, make, and model
			Restrained in a child restraint svstem (CRS]						
59	3 mo	Critical	Rear-facing CRS (reclined)	NA	Yes	Middle	29 in, 7 in		1994 Toyota Corolla
87	21 mo	None	Forward-facing CRS (erect)	16.8	No	Middle	34 in		1994 Toyota Corolla
121	3 wks	Fatal	Rear-facing CRS (reclined)	23.3	No	Rear	29 in		1995 Ford Escort
136	5 mo	Fatal	Rear-facing CRS (reclined)	7.4	Yes	Middle	32 in, 8.5 in	23.5 in	1994 Toyota Camry
138	6 mo	Serious	Rear-facing CRS (reclined)	4.6	Yes	Rear	28 in, 9 in	26 in	1995 Ford Escort
140	3 yrs, 41 in	Critical	Lap/shoulder belt with belt-positioning booster seat (erect)	9.9	Yes	Middle	25	20 in	1995 Jaguar XJS
			Restrained by the vehicle belt						
50	4 yrs, 40 in	None	Lap/shoulder belt (semi-reclined)	19.9	Yes	Forward	28.75 in		1994 Toyota Corolla
88	9.5 yrs, 52 in	Minor	Undetermined (leaning forward)	8.7	Yes	Rear	34 in		1994 Ford Thunderbird

Table 3.1-Summary of the 13 accidents in the study sample in which the passenger-side air bag deployed at the seating position occupied by a child younger than age 11 (continued)

Case no.	Child's age and height	Injury severity	Restraint used and pre-crash posture	Delta V (mph)	Pre-crssh braking	Seat track location	Distance from instrument panel to seat-back, and to the CRS	Estimated air bag excursion	Vehicle year, make, and model
95	9.75 yrs, 56 in	Fatal	Lap portion of lap/shoulder belt, shoulder portion undetermined (erect)	17.5	Yes	Rear	28 in	20 in	1995 Plymouth Grand Voyager
124	7 yrs, 48 in	Moderate	Lap/shoulder belt (erect)[a]	14.9	No	Middle	33 in	16 in	1995 Volkswagen Jetta
130	4.5 yrs, 43 in	Minor	Lap/shoulder belt (erect)	25.1	Yes	Rear	37.6 in[b]		1994 Honda Civic DX
137	5 yrs, 41.4 in	Fatal	Lap portion of lap/shoulder belt (leaning forward)	NA	No	Rear	28.75 in		1994 Chevrolet Camaro
139	7 yrs, 51 in	Fatal	Lap portion of lap/shoulder belt (leaning forward)	9.3	Yes	Rear	23	18	1995 Dodge Caravan

NA = not applicable. (In case 59, the vehicle was sideswiped; in case 137, the vehicle hit a curb.)
CRS child restraint system.

[a] There may have been slack in the shoulder portion of the lap/shoulder belt, causing it to be loose.

[b] The distance was provided by Honda Motor Corporation.

Forward-Facing Child Restraint Systems.—In one accident (case 87), a child was in a forward-facing child restraint system; the child sustained no injuries in this accident. The absence of any air bag-related injuries in this accident was probably because of the properly used internal safety harness of the child restraint system and the 34-inch distance between the passenger-side air bag compartment and the child (the vehicle seat track in the 1994 Toyota Corolla was in the middle position).

Belt-Positioning Booster Seats.—The child in case 140 was seated on a belt-positioning booster seat installed in the right front seating position and was properly restrained by the lap/shoulder belt. Also, a foam pad designed to provide head support was placed between the child and the booster seat.[33] This child sustained critical head and neck injuries in the low-speed impact (Delta V of 9.9 mph) and was in a coma for more than 24 hours as a result of injuries sustained in the accident. The Safety Board believes that the 25-inch distance between the passenger-side air bag compartment and the child's seated position was insufficient to allow the air bag to fully inflate without striking the child. In addition, the child probably moved toward the air bag compartment during pre-impact braking, thus increasing the likelihood that the air bag struck the child before it was fully inflated. This scenario is supported by the additional air bag-induced bruises to the restrained child's shoulders, left arm, and left thigh.

Lap/Shoulder Belts.—In six accidents, as previously noted, the children were restrained either by lap/shoulder belts or the lap portions of the belts. Table 3.1 shows for each of these accidents the distance from the instrument panel compartment where the air bag was stored to the child's seated position (vehicle seatback).

In two accidents, the children were restrained by the lap portions of the lap/shoulder belts (cases 137 and 139) and might have been leaning or sitting forward on the vehicle right front passenger seats at the time of impact; the children in both of these accidents died of head and neck injuries caused by contact with the passenger-side air bags. The Delta V for case 137 could not be determined because the vehicle hit a curb and suffered undercarriage damage; however, the impact with the curb was at about 14 mph. The Delta V for case 139 was 9.3 mph.

In one accident (case 95), the child was restrained by the lap portion of the lap/shoulder belt and probably was restrained by the shoulder portion. The child was killed as a result of head and neck injuries caused by impact with the passenger-side air bag. The pre-crash distance between the child's head and the air bag compartment was about 28 inches. The Board could not identify any logical reason for the death of this child other than the force at which the still inflating air bag struck his head. Pre-impact braking in this accident probably caused forward movement by the child prior to impact,

[33] NHTSA believes that the foam pad interfered with the proper use of the shoulder portion of the lap/shoulder belt.

increasing the likelihood that the child's head contacted the air bag before it was fully inflated.

In three accidents, the children were restrained by the lap/shoulder belts. The Safety Board believes that the absence of air bag-induced injuries to the children in two of the accidents (cases 50 and 130) were a result of (a) the proper use of the lap/shoulder belt, (b) use of the adjustable upper shoulder belt anchorage in the bottom position to improve the shoulder belt fit, and (c) the distance between the air bag compartment and the child's seated position. (In case 50, the child was reported to be seated in a partially reclined position prior to the accident; post-crash seatback angle was 60 degrees, but the pre-crash recline angle is unknown. In case 130, the seat track was in the rear-most position.) In effect, the vehicle seatbelts in cases 50 and 130 provided primary protection by restraining the children's forward motion from the moderate and moderately severe crash forces. (The child in case 130 sustained an abdominal contusion from the lap portion of the lap/shoulder belt.) Any interaction with the air bag likely occurred after the air bag had fully inflated and after the occupant's forward motion was slowed by the belt system, thus allowing the air bag to perform as designed—as a supplemental restraint system.

The Safety Board believes that the child in case 124 was wearing the lap/shoulder belt but was likely leaning forward toward the instrument panel at the time of the accident. The child sustained moderate injuries caused by the passenger-side air bag, including a cerebral concussion, and facial and neck lacerations and abrasions. The distance between the air bag compartment and the vehicle seatback was about 33 inches. The Board believes that the child's seated position allowed him to contact the air bag before it was fully inflated.

In one accident (case 88), use of the lap/shoulder belt could not be conclusively determined. The child sustained only minor injuries (corneal abrasions) even though, reportedly, he was leaning forward before the crash occurred. This was a low-speed crash (Delta V of 8.7 mph), there was no pre-crash braking, and the child was seated about 34 inches from the passenger-side air bag compartment. This combination of factors may explain the lack of serious injuries in this accident.

Summary of Air Bag-Induced Injuries.—The head and neck injuries sustained by the children in 9 of the 13 accidents, including 5 fatalities, were directly related to the passenger-side air bag in each vehicle and to the spatial relationship between the inflating air bag and the child. Based on the low to moderate accident severity of most of these accidents and the lack of intrusion into the passenger compartments where the nine children were seated, the Safety Board believes that in each of the accidents, the child would have survived with minor or no injuries had the passenger-side air bag not deployed. The Safety Board believes that the air bag-induced injuries, including fatal injuries, sustained by the nine children in the study sample should not have occurred regardless of restraint use.

Overview of the Regulatory History of FMVSS 208

FMVSS 208, "Occupant Crash Protection," one of the original Federal motor vehicle safety standards, required that passenger cars provide a lap/shoulder belt at every forward-facing designated seating position.[34] The requirement took effect on January 1, 1968. Crash testing to evaluate the protection afforded to vehicle occupants was not required. Shortly thereafter, because of the low usage rate of lap/shoulder belts, NHTSA began exploring the possibility of requiring automatic crash protection in motor vehicles—protection of occupants by means that require no action by the vehicle occupants.

On November 3, 1970, NHTSA published a final rule that required automatic crash protection for all passenger cars as of July 1, 1973, and for most light trucks and vans as of July 1, 1974. In response to many petitions for reconsideration, NHTSA postponed the effective date of the automatic protection requirements from July 1, 1973, until August 15, 1973, to correspond more closely to the manufacturers' changeovers for a new model year's production.

On October 1, 1971, in response to several vehicle manufacturers' concern about unresolved technical problems with automatic restraint systems, NHTSA proposed to postpone the effective date for mandatory automatic protection from August 15, 1973, until August 15, 1975. However, if cars manufactured during that time did not incorporate automatic protection, they were required to be equipped with an interlock system that would prevent the engine from starting if any front seat occupant did not have the manual belts buckled. The interlock option was adopted in a final rule dated February 24, 1972.

Shortly after the automatic protection requirements were published, several vehicle manufacturers filed lawsuits challenging the requirements as (a) not being practicable as required by NHTSA's authorizing legislation because the technology to comply with the protection was not sufficiently developed, (b) not meeting the need for motor vehicle safety because seatbelts offered better protection than automatic protection, and (c) not being objective because the Society of Automotive Engineers (SAE) recommended practice did not adequately specify sufficient details for the construction of the crash test dummy.[35] In a final rule dated June 20, 1974, NHTSA announced that the decision of the court[36] regarding the lawsuits invalidated the automatic protection requirements and that

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[34] The Safety Board issued a safety effectiveness evaluation of the NHTSA rulemaking process in 1979, which described the sequence of events associated with the development and implementation of FMVSS 208. (National Transportation Safety Board. 1979. Safety Effectiveness Evaluation of the National Highway Traffic Safety Administration's Rulemaking Process. Volume 2: Case History of Federal Motor Vehicle Safety Standard 208, Occupant Crash Protection. NTSB-SEE-79-5. Washington, DC.)

[35] The SAE establishes voluntary standards, called recommended practices, that many automobile manufacturers adhere to in the design and development of automobiles.

[36] *Chrysler* v. *DOT*, 472 F.2d 659 (6th Cir. 1972).

additional rulemaking would be required to re-establish an effective date for automatic protection requirements.

However, as of August 15, 1973, all new cars had to be equipped with either automatic protection or an ignition interlock for both front outboard seating positions. General Motors sold over 5,000 of its 1974 model year cars with air bags;[37] all other 1974 vehicles came equipped with the interlock system that prevented the car from being started if the driver or front outboard passenger did not use the manual seatbelt.

There was considerable public dissatisfaction with the interlock option to the extent that on October 27, 1974, the President signed into law a bill that prohibited any Federal Motor Vehicle Safety Standard from requiring an interlock system. On October 31, 1974, NHTSA published a final rule that immediately deleted the interlock option from FMVSS 208.

On July 5, 1977, NHTSA published a final rule reinstating automatic protection requirements for passenger cars effective beginning with some 1982 model year cars. The U.S. Department of Transportation (DOT) determined that automatic protection was necessary because, again, so few vehicle occupants used their manual seatbelts.

On February 12, 1981, a notice signed by the Secretary of Transportation proposed to delay the phase-in of the automatic protection requirement by 1 year. On April 8, 1981, two notices were signed by the Secretary and published in the Federal Register. One notice, a final rule, delayed the phase-in for 2 additional years. The second notice proposed three alternative approaches to the future of automatic occupant protection: (1) retain the new phase-in, but reverse the sequence of vehicles (small cars would now be the first required to meet the automatic protection, followed by mid-size and then large cars); (2) allow 1 additional year of lead time, but eliminate the phase-in; or (3) rescind the automatic protection requirements.

On October 29, 1981, NHTSA published a final rule that rescinded the automatic protection requirements. Following a decision by the District of Columbia District Court[38] that reversed NHTSA's rescission, the U.S. Supreme Court eventually ruled[39] that NHTSA's decision was unlawful because the agency had failed to consider obvious alternatives to rescission and to explain why alternatives short of rescission were not chosen.

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[37] National Highway Traffic Safety Administration, Office of Statistics and Analysis. 1976. Summary of Field Experience Involving Air Bag-Equipped Cars. Washington, DC. September 1.

[38] *State Farm* v. *DOT*, 680 F.2d 206 (D.C. Cir. 1982).

[39] *Motor Vehicle Manufacturers Association* v. *State Farm*, 463 U.S. 29 (1983).

Table 3.2—Phase-in schedules for equipping newly manufactured vehicles with automatic restraints and air bags[a]

Type of vehicle and restraint, and date of phase-in	Percent of vehicles to be equipped
Passenger cars with automatic restraints (air bags or automatic belts):	
September 1, 1986	10
September 1, 1987	25
September 1, 1988	40
September 1, 1989	100
Passenger cars with driver- and passenger-side air bags:	
September 1, 1996	95
September 1, 1997	100
Trucks, buses, and multipurpose vehicles with driver- and passenger-side air bags:	
September 1, 1997	80
September 1, 1998	100

[a] The schedules include the requirements contained in the 1984 FMVSS 208 rule and the 1991 Intermodal Surface Transportation Efficiency Act.

In 1984, FMVSS 208 was amended to require the use of automatic protection in motor vehicles. A phase-in period was established with the objective that all cars by the 1990 model year would have some form of automatic protection, either automatic seat-belts or air bags. The rule also stated that if two-thirds of the U.S. population were covered by adequate mandatory use laws, the automatic protection phase-in schedule would not have to be met. However, a public trend toward safety awareness began in the 1980s and by the end of the 1980s, the public did not want to choose between belt laws and automatic protection; they wanted both.

On December 18, 1991, the President signed into law the Intermodal Surface Transportation Efficiency Act (ISTEA). Among other items, ISTEA required the provision of air bags (as opposed to automatic seatbelts) at the driver and right front passenger positions. Table 3.2 presents the phase-in schedules for equipping newly manufactured vehicles with automatic restraints and air bags.

Efforts By NHTSA to Address the Dangers of Air Bags to Children

NHTSA has been aware of the dangers of placing a rear-facing child restraint system in the front seat of a vehicle with a passenger-side air bag for many years. Previously raised concerns about the force of an air bag deploying on an out-of-position forward-facing child prompted testing for this condition. In a 1976 final report on air bags to the U.S. Department of Transportation, the DOT contractor remarked that the air bag system offered a safer environment for small children at the higher speed tested only if they were seated in a normal position. The report concluded that "if a child is up against the system, which may well be the case during a panic braking situation, the resultant loading on the child is extremely sensitive to the specific geometry of the bolster, vehicle interior, and the method of bag folding."[40]

Since 1989, when passenger-side air bags became available, NHTSA has attempted to address the dangers that air bags pose to children from both a regulatory and public information perspective. (Table 3.3 contains a summary of NHTSA and industry efforts since 1988.) In 1991, before any fatalities of this nature had been reported, NHTSA issued a consumer advisory that warned the public not to use a rear-facing child restraint system in a seating position equipped with an air bag. The agency advised that "rear-facing infant seats used in the front seat of a vehicle extend forward to a point near the instrument panel where they can be struck by a deploying air bag. The force of an air bag is powerful enough to severely injure an infant."

[40] Romeo, David. 1976. Development of an Air Bag-Crushable Dash-Knee Bar Passive Restraint System for Small Cars. Calspan Corp. Final Report, DOT Contract HS-4-00972.

Table 3.3—NHTSA and industry efforts to address the dangers that air bags pose to children (continued)

Date of action	Type of action	Comments
Summer 1988	Industry advisory	Ford Motor Company adds passenger-side air bags to the 1989 Lincoln Continental. Sunvisors and owner's manual warn against placement of rear-facing child restraint systems in the front seat.
Spring 1990	Industry task force formed	The CRABI[a] task force was formed to facilitate industry dialog, technological solutions, and develop guidelines by which to evaluate the interaction of child restraint systems with air bags.
December 10, 1991	Consumer advisory	NHTSA issued a consumer advisory warning owners of rear-facing infant seats not to use them in the front seat of a vehicle equipped with a passenger-side air bag.
February 1992	Petition from MVMA	MVMA[b] petitioned NHTSA to require air bag warning labels in cars regarding the use of the lap/shoulder belt and proper positioning of occupants.
April 1992	Public information brochure	In the revised editions of its public information brochure "Transporting Your Children Safely," NHTSA advised consumers to place rear-facing child safety seats in the rear seat of vehicles equipped with passenger-side air bags.
April 1993	Consumer advisory	The Center for Disease Control published a warning in its *Mobidity and Mortality Weekly Review* about the dangers that air bags pose to infants in rear-facing child restraint systems.
September 2, 1993	Final rule	NHTSA amended its Federal regulations to require air bags with manual lap/shoulder belts in all passenger cars by model year 1998 and in light trucks by model year 1999. This rule also required that sunvisors and owner's manuals include a warning against the use of rear-facing child safety seats in front of air bags (effective September 1, 1994).

Table 3.3—NHTSA and industry efforts to address the dangers that air bags pose to children (continued)

Date of action	Type of action	Comments
February 16, 1994	Final rule	Warning labels regarding the use of rear-facing child restraint systems and air bags must be included on all rear-facing child restraint systems and in the child restraint system printed instructions.
February 16, 1994	Petition from AAMA	AAMA petitioned the NHTSA to explore the feasibility of a cutoff switch to allow rear-facing child safety seats to be used in the right front passenger seat of a vehicle equipped with a passenger-side air bag.
October 7, 1994	Notice of proposed rulemaking	To permit cutoff switches to disable the passenger-side air bag.
May 23, 1995	Final rule	Cutoff switches permitted for certain passenger cars until September 1, 1997.[c]
July 6, 1995	Final rule	Approved additional child-sized dummies for use in compliance testing effective July 6, 1996.
October 27, 1995	Press release	NHTSA issued a warning discussing the dangers that air bags can pose to small children.
November 9, 1995	Request for comments	NHTSA issued a request for comments to gather information on adverse effects of air bags.
January 16-17, 1996	National conference	The NHTSA and the National Safety Council sponsored a conference of industry and passenger safety advocates to develop an action plan to address the problems of injuries to children from air bags.
May 21, 1996	Government/industry effort	The National Automotive Occupant Protection Campaign, also known as the Air Bag Safety Campaign, was launched. This government/ industry effort hopes to increase public awareness of the dangers that air bags can pose to children and the need for proper use of restraints.

Table 3.3—NHTSA and industry efforts to address the dangers that air bags pose to children (continued)

Date of action	Type of action	Comments
August 6, 1996	Notice of proposed rulemaking	NHTSA issued proposed rulemaking to enhance warning labels in vehicles with passenger-side air bags and on child restraint systems, and to permit installation of cutoff switches to deactivate the passenger-side air bag in all vehicles.
August 23, 1996	Petition from AAMA	AAMA petitioned NHTSA to limit air bag inflator output by revising the requirements of FMVSS 208 pertaining to the unbelted crash dummy test and by requiring crash tests with dummies that are not in a typical seated position or are out of position.

[a] CRABI = Society of Automotive Engineers Child Restraint and Air Bag Interaction task force.

[b] MVMA = Motor Vehicle Manufacturers Association (now the American Automobile Manufacturers Association, AAMA).

[c] Manufacturers can install cutoff switches on applicable light trucks until September 1, 1998.

Regulatory Action.—In 1993, NHTSA issued a regulation in response to a petition from the Motor Vehicle Manufacturers Association that requires manufacturers to put notices on sunvisors and to provide information in the vehicle owner's manuals regarding the dangers of using a rear-facing child restraint system in the front seat of a vehicle with a passenger-side air bag.[41] The label states the following:[42]

> For maximum safety protection in all types of crashes, you must always wear your seatbelt.
>
> Do not install rearward-facing child seats in any front passenger seat position.
>
> Do not sit or lean unnecessarily close to the air bag.
>
> Do not place any objects over the air bag or between the air bag and yourself.
>
> See the owner's manual for further information and explanations.

[41] Federal Register, Vol. 58, No. 169, dated September 2, 1993.

[42] 49 CFR Part 571.208 Section 4.5.1.

Although NHTSA requires that the label be on the sunvisor, it allows the manufacturers to decide whether to attach the label so that it is visible at all times or only when the sunvisor is turned down. Most of the manufacturers have opted to place the label so that it is visible when the visor is turned down because a label is difficult to read when the visor is in the stowed position. If the label is placed on the back side of the visor so that it is visible only when turned down, another label is required on the front side to alert occupants of the warning label on the back. In 1994, NHTSA issued similar rules to require warning labels on child restraint systems about the danger of air bags and rear-facing child restraint systems and to include information in the owner's manual for the child restraint system.[43] In its final regulatory analysis of these requirements, NHTSA stated, "Approximately 36 percent of all infants currently traveling in motor vehicles are in the rear-facing mode in the front seat and would be in potential danger from a deploying passenger side air bag."[44]

In May 1995, NHTSA issued regulations that allow manufacturers of vehicles without a back seat and vehicles with a back seat that is too small to accommodate a rear-facing child restraint system to install a manual cutoff switch that would deactivate the passenger-side air bag on passenger cars manufactured before September 1, 1997, and on light trucks manufactured before September 1, 1998.[45] According to NHTSA, this provision allows for the safe use of a rear-facing child restraint system in the front seat of those vehicles.

On November 9, 1995, NHTSA published a request for comments to examine issues related to the adverse effects of air bags.[46] (The Safety Board's comments of January 4, 1996, are contained in appendix G.) This action occurred subsequent to separate investigations by the Safety Board and NHTSA of the accidents involving cases 59, 95, 121, 136, 137, 138, and 139 and subsequent to the Board's urgent safety recommendation H-95-17 (issued to NHTSA on November 2, 1995) regarding the dangers that air bags pose to children.

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[43] Federal Register, Vol. 59, No. 32, dated February 16, 1994.

[44] National Highway Traffic Safety Administration, Office of Regulatory Analysis, Plans, and Policy. 1994. Warning Labels on Rear-Facing Child Restraints for Vehicles with Air Bags. Final Regulatory Analysis. Washington, DC. January.

[45] Federal Register, Vol. 60, No. 99, dated May 23, 1995. At a meeting on April 9, 1996, NHTSA staff advised Safety Board staff that NHTSA had anticipated that other options, such as intelligent air bags, would be available subsequent to these dates.

[46] NHTSA identified the following persons at risk of serious injury caused by an air bag deployment: unrestrained, small statured and/or older persons; infants in rear-facing child restraints; children unrestrained in the front seat; out-of-position occupants; and persons with disabilities. NHTSA also requested information on persons experiencing injuries to their extremities as a result of contact with the air bag.

On August 6, 1996, NHTSA issued a notice of proposed rulemaking (NPRM) that, according to NHTSA, "proposed changes to the Federal air bag standard to encourage the introduction of new air bag technology." NHTSA concluded in the NPRM that air bags can kill or critically injure children. According to the NPRM, manufacturers who do not opt to provide a qualifying "smart" system for the passenger seat of cars and light trucks would be required to have new and more prominent air bag warning labels inside the vehicle. They also would be permitted to install cutoff switches so the passenger-side air bag can be deactivated when a child is positioned in front of it. The NPRM also would require enhanced air bag warning labels on child restraint systems.

Public Information and Education Efforts.—In addition to its regulatory action, NHTSA has also made efforts to inform the public about the proper use of child restraint systems through its child passenger safety training programs, national conferences, and distribution of public information brochures. NHTSA has trained thousands of State and local advocates, health and medical professionals, child care providers, fire and rescue personnel, and law enforcement officers who work within their local communities to educate parents about proper use of child restraint systems. The incompatibility of air bags and child restraint systems is a component of each training program. To support and supplement these efforts, NHTSA has produced numerous public information materials that discuss proper use of child restraint systems and include information on the dangers of using a rear-facing child restraint system in the front seat of a passenger car or light truck equipped with an air bag.[47] These materials are available for distribution through a nationwide network of child passenger safety advocacy groups, health and safety professionals, childcare providers, child restraint system loan programs, and the NHTSA toll-free telephone number.

In October 1995, following investigations by the Safety Board and NHTSA of the accidents that are the Board's study cases 59, 95, 121, 136, 137, 138, and 139, NHTSA issued a press release to warn consumers that children who are not properly restrained by the lap and shoulder belt could be killed or seriously injured by the air bag.[48] NHTSA also advised consumers through the press release that

- infants riding in rear-facing child restraint systems should never be placed in the front seat of a vehicle with a passenger-side air bag;
- all infants and children should be properly restrained in child restraint systems or lap and shoulder belts for every trip; and
- the back seat is the safest place for children of any age.

[47] A photocopy of one information brochure, *Are You Using It Right?*, appears in appendix H. NHTSA printed 100,000 copies of the brochure in November 1995.

[48] National Highway Traffic Safety Administration press release NHTSA 72-95 dated October 27, 1995.

On January 16 and 17, 1996, in conjunction with the National Safety Council, NHTSA sponsored a conference to discuss the problem of injuries caused by air bags and to determine how the government, industry, and advocates should address the problem. The conference was in response to public concern that was raised by the publicity associated with the air bag-involved accidents investigated by the Safety Board and NHTSA and to the Board's urgent recommendations pertaining to the dangers that air bags pose to children. About 200 participants attended the conference, including Safety Board staff. In discussions about measures to ensure that air bags work as supplemental restraint systems, the participants agreed that efforts needed to be focused on strengthening State seatbelt use laws, enforcement of those laws, and overall public information.

At the January conference, NHTSA distributed 2,500 copies of a preliminary version of *Air Bag Alert*, a production copy of a public information portfolio directed to the issue of children being injured by air bags. Changes were made to the *Alert* based on responses from meeting participants and consumer testing. A final version of the *Alert* is scheduled for release in October 1996; NHTSA is printing 250,000 copies for distribution.

Efforts by the Industry and Safety Advocates to Address the Dangers of Air Bags to Children

In addition to NHTSA, the automobile and child restraint system manufacturers, researchers, and child passenger safety advocates have advised the public for several years of the potential dangers that air bags pose to children. Numerous brochures are distributed by the child restraint manufacturers and child passenger safety advocacy groups that warn against the use of rear-facing child restraint systems in the front seat of vehicles with passenger-side air bags. (Appendix I contains a public information flier distributed by the American Academy of Pediatrics in spring 1993 through its *Safe Ride News* newsletter.)

In spring 1990, the Society of Automotive Engineers formed the child restraint and air bag interaction task force (CRABI) to "…bring together expertise in both child restraint design and use and in air bag design and deployment, in order to study concerns associated with child restraint/air bag interaction and to facilitate the resolution of any problems, so that injury risk to the occupant and inconvenience for the user will be reduced."[49] The CRABI task force met regularly between 1990 and April 1994; its chartered task—to develop guidelines for the evaluation of child restraint system interaction

[49] Society of Automotive Engineers, Human Biomechanics and Simulation Standards Committee, Child Restraint and Air Bag Interaction Task Force. 1990. Charter. In: Minutes of the CRABI Task Force meeting, April 11. Warrendale, PA.

with air bags—was completed and the guidelines were published in March 1993. The guidelines, SAE J2189, have formed the basis for an international standard. Another result of the CRABI task force was the development of new, more sophisticated infant-size crash test dummies.[50]

The American Automobile Manufacturers Association (AAMA), formerly the Motor Vehicle Manufacturer's Association, petitioned NHTSA in February 1992, February 1994, and August 1996 to amend the requirements of FMVSS 208 on issues related to air bags. The February 1992 petition asked NHTSA to require consistent consumer information labeling regarding the proper positioning of occupants in front of air bags; the February 1994 petition asked NHTSA to permit the use of cutoff switches in vehicles that could not accommodate a child restraint system safely in the front seat of a vehicle with passenger-side air bags, such as two-passenger vehicles. As discussed earlier in this chapter, NHTSA implemented rulemaking in response to both petitions. Prior to the 1992 petition, manufacturers voluntarily added labels on the sunvisors and warnings in the vehicle owner's manuals against use of rear-facing infant seats in the front seat of vehicles with passenger-side air bags.[51] The August 1996 petition requested changes in the air bag certification testing requirements. This petition is discussed in more detail later in this chapter.

Also in February 1992, NHTSA received a petition from a child passenger safety advocate that requested "a stay on the installation of air bags in passenger seats, until or unless it can be shown that a deploying air bag poses no danger to the rear-facing infant."[52] The petition also requested "a recall" of all vehicles sold with passenger-side air bags "to warn owners of the potential dangers, provide them with a warning label, and urge them to affix that label on the air bag housing, even if there is no infant in the family." As an interim measure, the petition asked that the automakers be required to immediately attach a conspicuous warning on or just above the air bag housing. The NHTSA denied the petition on August 25, 1992, stating, "Data available to the agency indicate that the facts do not warrant a rulemaking action to prohibit the installation of passenger-side air bags."[53]

Early in 1996, the AAMA and the Association of International Automobile Manufacturers, Inc. (AIAM), proposed an education campaign in response to the January 1996

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[50] (a) Weber, Kathleen. 1993. Child Restraint and Airbag Interaction: Problems and Progress. In: Child Occupant Protection. SP-986. Warrendale, PA: Society of Automotive Engineers: 121-126. (b) Safety Board staff communication with K. Weber on July 22, 1996.

[51] The first vehicle with such warnings was the 1989 Lincoln Continental.

[52] Letter dated February 26, 1992, from Annemarie Shelness to Barry Felrice, Associate Administrator, National Highway Traffic Safety Administration. NHTSA docket on FMVSS 208. Shelness operates a company that produces educational films on the proper use of child restraint systems.

[53] Federal Register, Vol. 57, No. 165, dated August 25, 1992.

conference sponsored by NHTSA and the National Safety Council.[54] The proposal resulted in the launching of a government/industry coalition for air bag safety, known as the National Automotive Occupant Protection Campaign or the Air Bag Safety Campaign, by the Secretary of Transportation on May 21, 1996. The campaign's organizers plan to

1. conduct an extensive national publication education effort to educate drivers, parents, and caregivers about seatbelt and child restraint system use in all motor vehicles, with special emphasis on those equipped with air bags;

2. direct efforts and resources toward supporting States in upgrading seatbelt and child restraint laws; and

3. conduct activities toward high visibility enforcement of seatbelt and child restraint use laws at the State and local levels.

The $10 million campaign is funded by automobile manufacturers, insurance companies, and occupant restraint manufacturers (appendix J). In-kind donations and existing education efforts will supplement cash donations. NHTSA assisted the campaign organizers in the implementation of the coalition, and the agency's Administrator serves as honorary chair of the coalition. NHTSA actively participates in all coalition activities and is also coordinating its public information efforts to complement and enhance the activities of this industry-sponsored effort.

Experience With Passenger-Side Air Bags

The Safety Board recognizes that air bags are effective for drivers in most severe frontal accident situations. NHTSA estimates that air bags have saved about 1,200 lives between 1987 and 1995 and that injury risk for moderate or worse injuries can be reduced by 59 percent when air bags supplement the use of lap/shoulder belts compared to a 49-percent injury reduction for lap/shoulder belts alone.[55] In testimony before the Senate Commerce Committee on March 7, 1996, NHTSA Administrator Ricardo Martinez reported that almost all of the experience in evaluating air bag effectiveness in crashes has been based on driver-side air bags. In the NPRM issued August 6, 1996, NHTSA stated, "The number of passenger-side air bags has been too small to conduct statistically significant evaluations of their life-saving benefits."

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[54] Testimony of Richard Klimisch, M.D., Vice President of Engineering Affairs of the American Automobile Manufacturers Association, before the Senate Subcommittee on Commerce, Science and Transportation. March 7, 1996.

[55] National Highway Traffic Safety Administration. 1996. Effectiveness of Occupant Protection Systems and Their Use. Second Report to Congress. Washington, DC. February.

NHTSA's General Estimates System (GES)[56] indicated that there were 14,444 frontal accidents involving vehicles with passenger-side air bags in 1993; GES estimated that 2,003 passenger-side air bags deployed (table 3.4). GES also estimated that about 71 percent of the passengers in the sample of police-reported crashes sustained no injuries and that 0.55 percent of the passengers were fatally injured in vehicles equipped with passenger-side air bags. Further, GES estimated that about 75 percent of the passengers in the sample of police-reported frontal accidents involving vehicles not equipped with passenger-side air bags sustained no injuries and that 0.08 percent of the passengers sustained fatal injuries.

NHTSA's FARS database indicates that between 1991 and 1994 there were 281 fatal frontal accidents involving occupants in the right front seat of vehicles with passenger-side air bags. The passenger-side air bag deployed in 227 of these accidents: 26 percent of the passenger-side occupants were fatally injured, and about 14 percent sustained no injury. In vehicles not equipped with a passenger-side air bag, 31 percent of the passenger-side occupants were fatally injured, and about 18 percent sustained no injury.

Other sources of information on the performance of passenger-side air bags include insurance companies. In response to NHTSA's request for comments issued in November 1995, State Farm Insurance Companies indicated that they were

> …investigating large numbers of passenger-side air bag deployments, with right front seated occupants present. Our early results indicate that the passenger-side occupant injury profile, where deployment occurred, includes very few reports of moderate (AIS = 2), or serious (AIS ≥ 3) injuries.
>
> For 63 passenger-side deployments investigated with right front passengers present, 44 percent of the passengers were reported to have no injuries.

The Safety Board has documented that air bags can kill or critically injure children in accidents that would have been survivable had the air bag not deployed. Specifically, infants in rear-facing child restraint systems and children, whether restrained or unrestrained, who collide with an air bag before it is fully inflated are in danger. The insufficient distance between the restraint system and the inflating air bag in combination with the speed and force at which an air bag can inflate can be lethal. Pre-crash braking can also contribute to the occupant's forward movement into the bag before it is fully inflated. Further, the passenger-side air bag strikes the child in the head and neck as opposed to the upper torso where it typically contacts adults.

The distance between the instrument panel and the occupant on the passenger side of the vehicle, where there is often 20 to 30 inches of space for forward motion by the occupant in a frontal crash before contact with the instrument panel occurs, is very

[56] The General Estimates System is a traffic safety database that is used to make statistical projections about the more than 6 million police-reported vehicle accidents that occur each year. These projections are made from a sample of fatal and injury accidents as well as accidents resulting in major property damage.

Table 3.4-Accident experience with passenger-side air bags in passenger cars and light trucks involved in frontal collisions

Item	NHTSA General Estimates System,[a] 1993		NHTSA Fatal Accident Reporting System,[b] 1991-1994	
	Passenger-side air bag available	Passenger-side air bag not available	Passenger-side air bag available	Passenger-side air bag not available
Total number of accidents	14,444	1,004,964	281	42,880
Number of accidents in which the passenger-side air bag deployed	2,003	NA	227	NA
Percentage of front seat passengers fatally injured	0.55	0.08	25.98	30.47
Percentage of front seat passengers uninjured	71	74.46	13.52	18.27

NA = not applicable; NHTSA = National Highway Traffic Safety Administration.

[a] GES is a traffic safety database that is used to make statistical projections about the more than 6 million police-reported vehicle accidents that occur each year. These projections are made from a sample of fatal and injury accidents as well as accidents resulting in major property damage.

[b] The FARS database contains data on fatal traffic accidents.

different from the driver side, where the steering wheel housing the air bag may be only a few inches from the driver's head and chest. The effectiveness of air bags for drivers, therefore, is likely to be quite different from that for passengers, especially for properly restrained occupants. Contact with the passenger-side air bag before it is fully inflated negates the benefit of the ride-down space; this is the space in which a lap/shoulder belt-restrained passenger would have to slow down the body's forward movement without the air bag present.

The Safety Board recognizes that there may not yet be enough crash data available from the 2,000-plus accidents in which an air bag deployed that are listed in FARS and GES to statistically evaluate the performance of air bags for all passengers. There is sufficient empirical information, however, from the 13 accidents investigated for this study, including the 5 in which a child was fatally injured by the passenger-side air bag; from the accidents in Canton, Ohio; Orem, Utah; St. James, Missouri; and Nashville, Tennessee, which were also investigated by the Board; and from the 17 additional fatal accidents investigated by NHTSA for the Safety Board to conclude that passenger-side air bags, as they are currently designed, are not acceptable as a protective device for children. From 1993 through mid-September 1996, 26 children were killed in U.S. accidents by contact with the passenger-side air bag. The number of air-bag related fatalities has increased each year, as shown in the following tabulation:

Children Fatally Injured by Contact With a Passenger-Side Air Bag

1993 (1 fatality)	**1994** (5 fatalities)	**1995** (8 fatalities)	**Through mid-September 1996** (12 fatalities)
Age 6 years	Age 4 years (3)	Age 3 weeks	Age 6 days
	6 years	4 months	3 months
	7 years	5 months	5 months
		5 years (3)	8 months
		7 years	3 years
		9 years	4 years (2)
			5 years (3)
			7 years
			9 years

Appendix C lists the U.S. accidents in which these 26 children were killed. In addition, the Safety Board is aware of one adult who was killed by deployment of a passenger-side air bag.[57]

[57] A 98-year-old female was wearing a lap/shoulder belt in a 1994 Chrysler minivan. The March 1996 accident occurred in Pennsylvania.

NHTSA's NPRM of August 6, 1996, did not provide any evidence that passenger-side air bags are effective in reducing death and injury, and the Board's study raises questions about the benefits of currently designed passenger-side air bags to reduce injuries and fatalities to children. The number of children killed and critically injured in accidents similar to those investigated for this study will continue to increase unless immediate action is first taken to determine the benefits of passenger-side air bags, as currently designed, even though NHTSA's databases and information provided by State Farm to NHTSA suggest there may be some benefits from passenger-side air bags. Therefore, the Safety Board believes that NHTSA should immediately evaluate passenger-side air bags based on all available sources, including NHTSA's recent crash testing. The Board also believes that NHTSA should publicize the findings and modify performance and testing requirements based on the findings of the evaluation.

Current Air Bag Testing Procedures

In the early 1980s, when the air bag testing procedures were being written, only about 15 percent of front seat occupants wore lap/shoulder belts. Accordingly, air bags were originally designed to protect occupants who were not restrained by their lap/shoulder belts. Since the early 1980s, however, there have been concerted efforts to increase the rates of lap/shoulder belt use through public education efforts and the passage of seatbelt use laws by 49 States.[58] Today, according to NHTSA, about 67 percent of front seat occupants wear their lap/shoulder belts. FMVSS 208, however, still requires that vehicle test procedures be based on unrestrained occupants. In essence, air bags are being designed, because of certification testing requirements, primarily to protect unbelted rather than belted occupants even though the air bags are promoted as supplemental restraint systems and the majority of motor vehicle occupants now use seatbelts.

The speed and force at which the air bag inflates need to be higher to protect unrestrained occupants than restrained occupants. FMVSS 208 requires that vehicles be tested at 30 mph with a 50^{th} percentile male crash test dummy. In addition, manufacturers test with a variety of crash test dummy sizes and under various conditions with both restrained and unrestrained occupants. The Ford Motor Company held discussions with NHTSA and the Insurance Institute for Highway Safety to revise FMVSS 208 to permit testing of restrained occupants at a 35-mph impact speed and unrestrained occupants at a 25-mph test speed. This would permit the manufacturer, according to Ford, to reduce the speed and force of the air bag and lower the risk of air bag-induced injuries.

[58] New Hampshire does not have a mandatory seatbelt use law. The State's child restraint use law covers children younger than 12.

On August 23, 1996, the AAMA petitioned NHTSA to "(1) immediately revise the unrestrained dummy performance test, and (2) propose rulemaking to add new requirements for out-of-position occupant criteria."[59] In discussing its concerns about the air bag-induced injuries sustained by children and small adult occupants, the AAMA stated that "these injuries are directly related to the energy level of the air bag during its deployment, with the force generated by an air bag currently being dictated by specific test protocol within FMVSS 208."

The Safety Board believes that there is an inconsistency in NHTSA's efforts to support increased lap/shoulder belt use, but to continue to require that air bags be tested and thus designed first and foremost to protect unrestrained occupants, which requires a more aggressive air bag. The Safety Board is concerned that air bag performance certification testing is not based primarily on belted occupants, that pre-impact braking is not considered in the testing procedures, and that testing is conducted with the seat track only in the middle position. By not using belted child occupants and out-of-position child occupants (belted and unbelted), by not considering the effects of pre-impact braking, and by not placing the seat track in the forward-most position, air bag performance testing is not representative of actual accident environments.

Testing procedures that reflect actual accident environments should result in performance requirements that reduce the speed and force of passenger-side air bag inflation. Consequently, the Safety Board agrees with the AAMA and believes that NHTSA should immediately revise FMVSS 208 to establish performance requirements for passenger-side air bags based on testing procedures that reflect actual accident environments, including pre-impact braking, out-of-position child occupants (belted and unbelted), properly positioned belted child occupants, and with the seat track in the forward-most position.

Reducing the speed and force of the passenger-side air bag alone, however, will not solve the problem of those air bags deploying in low- to moderate-speed crashes in which the additional protection beyond that afforded by lap/shoulder belts is not needed. Therefore, the threshold of the passenger-side air bag deployment (the minimum level of crash severity at which the air bag will deploy) is also of concern to the Safety Board. According to NHTSA, air bags are designed to deploy in "moderate to severe" frontal collisions at speeds of about 10–15 mph into a fixed object or about 20–30 mph into a similar sized vehicle.[60] In 9 of the 13 accidents investigated for this study in which there were collisions with other vehicles and passenger-side air bag deployment, the Delta V was less than 20 mph, yet 5 of the 9 children in the right front passenger seats in these accidents sustained serious, critical, or fatal injuries from contact with the passenger-side air bag (2 of the 5 children were in rear-facing child restraint systems). In addition, both of

[59] Letter dated August 23, 1996, from Richard L. Klimisch, AAMA Vice President of Engineering Affairs, to the Honorable Ricardo Martinez, M.D., Administrator of NHTSA.

[60] National Highway Traffic Safety Administration. 1996. Effectiveness of Occupant Protection Systems and Their Use. Second Report to Congress. Washington, DC. February.

the accidents for which a Delta V could not be determined (cases 59 and 137) involved relatively low-speed accidents; the child in case 59 sustained critical injuries, and the child in case 137 died.

The Board believes that these cases support the need for an increase in the deployment thresholds. NHTSA's proposed rulemaking of August 6, 1996, states, "The Agency believes that an increase in the deployment threshold would yield a decrease in the number of air bag deployments and, therefore, a decrease in the number of air bag-induced injuries." Comments received by NHTSA did not uniformly support this belief; however, the Safety Board believes that an increase in the deployment thresholds of passenger-side air bags deserves serious consideration. Consequently, the Safety Board believes that NHTSA should evaluate the effect of higher deployment thresholds for passenger-side air bags in combination with the recommended changes in air bag performance certification testing, and then modify the deployment thresholds based on the findings of the evaluation.

Current Proposals of NHTSA

NHTSA's proposed rulemaking issued August 6, 1996, would permit manufacturers to install cutoff switches in vehicles without intelligent air bag technology and would require new and more prominent air bag warnings inside the vehicle. The Safety Board agrees with NHTSA's goal of increasing the level of awareness of the dangers that air bags pose to children and, as mentioned earlier, has issued urgent recommendations to NHTSA and the automobile industry to address increased awareness. The Board's specific concerns regarding NHTSA's labeling and education efforts are discussed later in this chapter.

Advanced Air Bag Technology.—The Safety Board agrees with the intent of NHTSA's NPRM to expedite installation of intelligent air bag systems. Technical solutions considered to date include intelligent air bag systems, increased deployment thresholds, less aggressive air bags (reducing the speed and force at which the air bag inflates), and changes in the way the air bag is packaged (folding patterns or the location and number of tethers can affect how the air bag contacts the occupant).

Some intelligent air bag systems under development incorporate one or more functions, including the ability to deactivate or reduce the energy of deployment for the passenger-side air bag by sensing such factors as the occupant's size, weight, and distance from the air bag compartment, whether the lap/shoulder belt is being worn, and the severity of the accident. The intelligent system should then be able to determine whether the air bag should be deployed and, if so, how much inflation is required. This is accomplished by occupant seat sensors, proximity/detection sensing, or multiple-level crash

sensing.[61] Some intelligent air bag designs are considering a two-stage deployment that allows for less inflation for lower speed impacts and a second stage of inflation for a more severe accident, and some designs would address the spatial relationship problems identified in the Safety Board's cases. Mercedes-Benz already uses a pressure sensitive mat on the passenger-side seat of some vehicles to deactivate the passenger-side air bag when the seat is unoccupied. In comments to NHTSA's NPRM, Mercedes indicated that if the recognition threshold for the system were increased to 66 pounds, the passenger-side air bag would not deploy for children up to this weight sitting in that seat or for rear-facing child restraints with infants. Another technology that addresses rear-facing child restraint systems is the use of child seat detection "tag" systems. Such systems would deactivate the air bag when they detect a rear-facing child seat equipped with a special tag.

There appears to be agreement in the industry that any technological solutions for intelligent sensing of occupants, which can also address concerns about occupants who are seated too close to the instrument panel, are at least 5 years or more away. The Board understands the complexity of the efforts to develop technological solutions and the need for thorough research prior to any proposals for change. However, NHTSA and the industry have been aware of the air bag problem for 25 years,[62] and although they have been working to develop better air bag systems for many years, few vehicles incorporate the technology today. The Safety Board is concerned that every year about 13 million new cars with passenger-side air bags will be entering the market with the same dangers to children until new technology is available and in place. In meetings with several automobile manufacturers in preparation for this study, the Safety Board noted the length of time that it takes for the automobile manufacturers to prepare for the design, development, production, and installation of new parts. Although the time varies depending on the complexity of the part to be added, it takes several years to design, test, and certify new safety components. Rulemaking takes additional time. For rulemaking completed in 1995, the average time from publication of the initial notice to publication of the final rule was 16 months. Based on these timeframes, if intelligent air bag technology were available today and FMVSS 208 needed to be modified to accommodate that new technology, it would be a minimum of 3½ years before the technology would be available for purchase by the public. More than 39 million new cars with passenger-side air bags with today's technology will have entered the market during that time period.

The Safety Board is concerned that the vast majority of parents are not receptive to placing infants in rear-facing child restraint systems in the back seats of vehicles because they cannot see the infant nor monitor the infant's actions from the front seat. NHTSA consumer testing in spring 1996 in conjunction with development of its *Air Bag Alert* found that parents were resistant to having children ride in the back seat of the

[61] Multiple-level crash sensors were used in 1973 in General Motors' field tests of the Chevrolet Impala.

[62] U.S. General Accounting Office. 1979. Report to Congress. CED-79-93. Washington, DC. July 27.

vehicle.[63] Although the back seat is generally the safest place for children of all ages, some parents will continue to ignore the warnings not to use the rear-facing child restraint system in the front seat of the vehicle with a passenger-side air bag, and others will put the child restraint system in the back seat but will turn the child restraint system to face forward. Because an infant's neck muscles are not well developed, an infant in a rear-facing child restraint system that is turned to face forward could sustain serious neck injuries as the head moves forward in a frontal accident.

The Safety Board is also concerned that, in spite of the educational efforts planned and already underway, children will continue to be positioned in the front seats of vehicles equipped with passenger-side air bags and that these children will continue to be in danger whether they are restrained or unrestrained. A November 1995 survey by the Insurance Institute for Highway Safety (IIHS) found that even when parents knew that they should not place their children in the right front seat of a vehicle equipped with a passenger-side air bag, 8 percent still placed their child in front of the air bag compartment when they were traveling alone with the child.[64] The Safety Board believes that permitting the installation of cutoff switches for vehicles manufactured in the future will not enhance the safety of children for several reasons: (1) drivers may choose not to have the switch installed; (2) as the cars are passed down and sold to the second and third owners, the importance of the switch may be overlooked because as new technology enters the marketplace, activities to make the public aware of the dangers that air bags pose to children will likely be reduced; and (3) drivers who choose to install the switches are likely to be more safety conscious and to place their children in the back seat. The Safety Board believes that a solution that requires action on the part of the driver is not likely to be effective and that a more technical requirement is needed.

Further, as noted earlier, NHTSA's proposed rulemaking issued on August 6, 1996, would require vehicle manufacturers to install new, more prominent air bag warning labels if they do not provide intelligent air bag systems. The intent of the requirement is to encourage the manufacturers to provide such systems. However, NHTSA did not indicate how and the Safety Board is not confident that the additional labeling requirements, by themselves, provide sufficient encouragement for automakers to install intelligent air bag systems. The Board believes that establishing a date by which the automobile manufacturers must begin implementing intelligent air bag technology would be far more effective. Therefore, the Safety Board believes that NHTSA should establish a timetable to implement intelligent air bag technology that will moderate or prevent the

[63] NHTSA docket for FMVSS 213. NHTSA's *Air Bag Alert* includes information to reassure parents that they do not need to observe their child at all times in the vehicle.

[64] Insurance Institute for Highway Safety. 1996. Survey of parents of infants. Presentation by Susan A. Ferguson, Ph.D., at the conference "Safety Belts, Airbags, and Passenger Safety: A Call to Action"; January 16-17, 1996; Washington, DC. The survey was conducted following increased media attention to the dangers that air bags can pose to children; consequently, the Safety Board believes that this may be a conservative estimate.

air bag from deployment if full deployment would pose an injury hazard to a belted or unbelted occupant in the right front seating position, such as a child who is seated too close to the instrument panel, a child who moves forward because of pre-impact braking, or a child who is restrained in a rear-facing child restraint system.

However, of immediate concern to the Safety Board is the large number of vehicles on the road that are equipped with passenger-side air bags. There are no provisions in the proposed rulemaking for these vehicles or the vehicles that will be sold with current technology pending the effective date of a new standard. (NHTSA estimates that by the end of 1996 there will be 22 million vehicles on the road with passenger-side air bags and that this number will increase by about 13 million vehicles each year.) Because of the large number of vehicles that are not included in the proposed rulemaking, the Board is concerned that the number of fatalities to children from deploying air bags will continue to increase. Technical solutions that are being considered for advanced air bag systems include increasing deployment thresholds, depowering the passenger-side air bag, and installing weight sensors. Consequently, the Safety Board believes that NHTSA should determine the feasibility of applying technical solutions for vehicles not included in NHTSA's proposed rulemaking to prevent air bag-induced injuries to children in the passenger-side seating position. NHTSA should consider such solutions as increasing the deployment thresholds of passenger-side air bags, depowering the passenger-side air bag, installing weight sensors in the passenger-side vehicle seat, or deactivating the passenger-side air bag for families who choose to do so.

The Adequacy of Public Information.—The Safety Board is aware that NHTSA and the industry have attempted to inform the public about the problem of air bags relative to child restraint systems. However, the accidents described in this study raise concerns about the effectiveness of educational efforts alone to resolve this problem.

Although all four of the accident vehicles involving rear-facing child restraint systems had (a) a warning on the passenger-side sunvisor advising against using a rear-facing child restraint system in the right front passenger seat, (b) cautionary information in the vehicle owner's manual, and (c) in two cases, warnings on the child restraint system and on the seatbelt, none of the parents reported seeing the warnings. In addition, the investigations revealed that public information and education efforts had reached the parents of only one of these children. In that specific case, a warning label on the vehicle seatbelt[65] and the written information received from the birth hospital that addressed the dangers of using rear-facing child restraint systems in the front seat of vehicles with passenger-side air bags had less impact than a videotape viewed by the parents at the birth hospital that emphasized the need to place a child next to an adult for supervision and to

[65] The parents in this case (case 121) placed a locking clip next to the label on the vehicle seatbelt that warns against placing a rear-facing child restraint in front of an air bag.

never leave a child alone in the back seat.[66] These accidents indicate that a more direct and wide-reaching approach is needed to ensure that the public is aware of the dangers that current passenger-side air bags can pose to children.

The Safety Board is concerned that many of the educational materials given to parents do not include warnings about the dangers that air bags pose to children. Several of the urgent recommendations issued by the Safety Board on November 2, 1995, to health and safety organizations addressed this concern (see Safety Recommendations H-95-23 through -26 in appendix F). To address this problem, NHTSA is planning a campaign to "recall" out-of-date educational films, videotapes, and brochures. The Safety Board supports NHTSA's efforts in this area.

One of the urgent recommendations issued by the Safety Board on November 2, 1995, asked NHTSA to take the following action:

> Immediately develop and implement, in cooperation with the National Association of Broadcasters and the Advertising Council Inc., a highly visible nationwide multi-media campaign to advise the public about the dangers of placing a rear-facing child restraint system or an unrestrained or improperly restrained small child in the front seat of a vehicle equipped with a passenger-side air bag. (H-95-17)

NHTSA responded on January 5, 1996, that it was working with the Advertising Council to produce both a public service announcement and a video news release that will specifically address the dangers that air bags can pose to small children. The Safety Board classified the recommendation "Open—Acceptable Response" on February 28, 1996, pending distribution of the announcement and video. Subsequent to the Board's letter, Safety Board staff was informed that the video news release had been distributed on January 16, 1996, in conjunction with the NHTSA/National Safety Council conference. On April 30, 1996, the Safety Board added this recommendation to the Highway Vehicle Occupant Protection category of its "Most Wanted" list of safety recommendations stating that a nationwide multimedia campaign is essential to raise public awareness about the dangers that air bags can pose to children.[67] The public service announcement was distributed to major media markets in July 1996. The Safety Board believes that NHTSA's video news release, the public service announcement, and its involvement in the Air Bag Safety Campaign are positive steps in meeting the intent of the recommendation. Pending the Safety Board's review of these distribution efforts, Safety Recommendation H-95-17 remains classified "Open—Acceptable Response."

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[66] The Safety Board is aware that NHTSA is developing a new video, "Protecting Your Newborn," that will address several child protection issues, including the dangers that air bags pose to children.

[67] In October 1990, the Safety Board adopted a program to identify the "Most Wanted" safety improvements. The purpose of the Board's "Most Wanted" list, which is drawn up from safety recommendations previously issued, is to bring special emphasis to the safety issues the Board deems most critical. The Highway Vehicle Occupant Protection category also includes recommendations on the need for States to enact primary seatbelt enforcement laws.

The Air Bag Safety Campaign should contribute substantially to efforts to raise public awareness. The Safety Board encourages the coalition, as part of its efforts to better inform motor vehicle users of air bag-related injury risks and the precautions to be taken to reduce those risks, to focus public information on (a) the proper use of rear-facing child restraint systems in the back seat of passenger vehicles, (b) the proper use of lap/shoulder belts for children who have outgrown child restraint systems and booster seats, and (c) the importance of placing all children in the back seat of a vehicle equipped with a passenger-side air bag.

In addition to recommending to NHTSA a highly visible, multimedia campaign, the Safety Board issued two urgent recommendations to the 20 domestic and international automobile manufacturers on November 2, 1995, asking them to take immediate action:

> Conduct a mail campaign to all registered owners of vehicles equipped with passenger-side air bags that warns of the dangers of placing a rear-facing child restraint system and an unrestrained or improperly restrained small child in the front seat of the vehicle. (H-95-19)
>
> Develop and attach to all new vehicles with passenger-side air bags a visible warning regarding the dangers of placing a rear-facing child restraint system and an unrestrained or improperly restrained small child in the front seat of the vehicle. This warning should be permanent and visible to front seat passengers at all times. (H-95-20)

On April 30, 1996, the Safety Board added these recommendations to its "Most Wanted" list of safety recommendations.

In response to these safety recommendations, the AIAM, writing on behalf of 17 international manufacturers, noted in its letter of February 9, 1996, that NHTSA has "regulations that are very specific with respect to message content, location, and other features. As part of NHTSA's multi-faceted, broad-based public education campaign, we believe NHTSA will propose revisions to existing air bag information labeling requirements." The Safety Board classified Safety Recommendations H-95-19 and -20 "Open—Acceptable Response" on March 12, 1996, pending further action by the automobile industry. (Additional responses to Safety Recommendations H-95-19 and -20 have been received from the AAMA and General Motors. See appendix F.)

Mercedes-Benz, in a separate letter to the Safety Board dated April 24, 1996, responded that it supported regulatory action on labeling by NHTSA, but that "in the interim, however, beginning this week Mercedes-Benz of North America, Inc., will install on all new cars a new warning label on the inside of the right front passenger door." The label will also be made available, free of charge, to car owners.[68] Mercedes-Benz's response to Safety Recommendation H-95-20 was classified "Closed—Acceptable Alternate Action" on June 13, 1996. NHTSA's proposal to require new and more

[68] Mercedes-Benz advises current owners of the availability of these labels through a press release, dealer notification when the cars are brought in for service, and the Mercedes-Benz Club magazine.

prominent air bag warning labels inside the vehicle (illustrated in appendix K) is in line with the intent of the Board's recommendation. Consequently, if the proposed rule is adopted, the manufacturers' compliance with the rule will also satisfy the goal of the Board's recommendation. Pending publication of a final rule, Safety Recommendation H-95-20 will be classified "Open—Acceptable Response."

As noted earlier, the Safety Board is concerned that there are no provisions in NHTSA's proposed rulemaking for the vehicles currently on the road. The Board believes that the manufacturers should address these vehicles and should install warning labels on all passenger vehicles equipped with passenger-side air bags on the road or to be manufactured prior to the effective date of the requirements proposed by NHTSA on August 6, 1996. The labels should be similar to those to be required for installation in newly manufactured vehicles. Ways that the manufacturers could accomplish this labeling include notifying all vehicle owners through a mail campaign, by installing the labels when the vehicles are serviced at dealerships, by distributing labels at vehicle inspection or service stations, or by including labels in license or insurance renewals. The Safety Board believes that the manufacturers can determine the appropriate mechanism to accomplish this goal. In view of the foregoing, Safety Recommendation H-95-19 is classified "Closed—Acceptable Action/Superseded" by this new recommendation.

The importance of placing children, whether they are in rear- or forward-facing child restraint systems or seatbelts, in the back seat of a vehicle equipped with a passenger-side air bag has been emphasized repeatedly by both NHTSA and the Safety Board. Although the Safety Board did not specifically address the printed information on NHTSA's proposed warning labels, the Board believes that NHTSA and the automobile manufacturers should consider including on the warning labels specific information regarding the placement of children in the back seats of vehicles.

Chapter 4

Accidents Involving Child Restraint and Seatbelt Use

There were 46 children in the Safety Board's sample who were restrained in child restraint systems, 83 who were restrained in seatbelts, and 65 who were unrestrained.[69] The Safety Board examined the accidents involving children younger than age 11 to determine whether the children in the sample were in the appropriate restraint for each child's age, height, and weight, and if those who were restrained were restrained properly. The data were also examined to determine if injury severity was affected by use of an inappropriate restraint, the improper use of a child restraint system, the accident severity, or the seating location of the child.

Most of the children sustained no injuries (n = 39) or minor injuries (n = 92) (figure 4.1). Forty-seven children sustained moderate or worse injuries, and 16 were fatally injured. Injuries by body region are shown in figure 4.2. Many of the children sustained injuries to the head and face.

Use of the Appropriate Restraint System for the Child's Age, Height, and Weight

To determine whether the type of restraint used by each child in the Board's accident sample was appropriate for the child's age, height, and weight, the Board established a system by which to classify the type of restraint system each child in this sample should have been using. For the 46 children in child restraint systems, the Board examined the child restraint manufacturer's instructions to determine if the child was within the manufacturer's height and weight guidelines. For children not in child restraints, the Board used 1996 recommendations of the American Academy of Pediatrics (AAP) and a 1994 NHTSA report that examined lap/shoulder belt fit on 155 children ages 6–12 years.[70] (Appendix L includes the AAP and other guidelines.)

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[69] The 13 children who were seated in the right front seating position of vehicles in which an air bag deployed are not considered in this discussion. Therefore, chapter 4 discusses 194 children.

[70] National Highway Traffic Safety Administration. 1994. Study of Older Child Restraint/Booster Seat Fit and NASS Injury Analysis. DOT HS 808 248. Washington, DC.

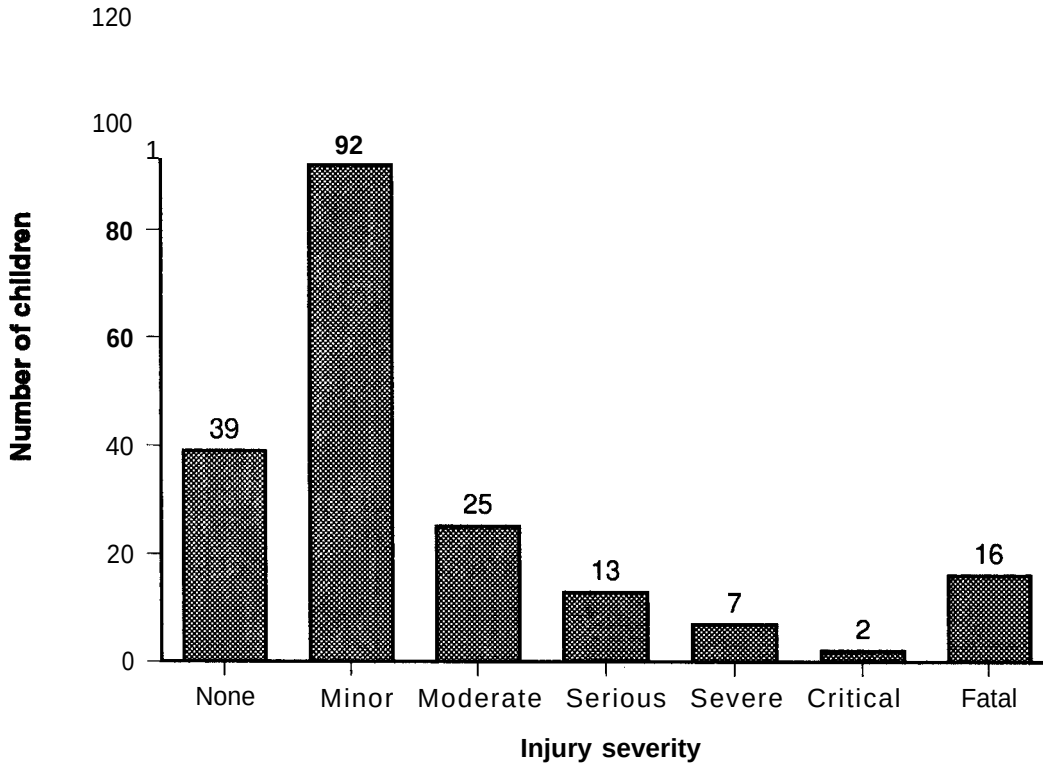


Figure 4.1—injury severity for the 194 children in the sample.

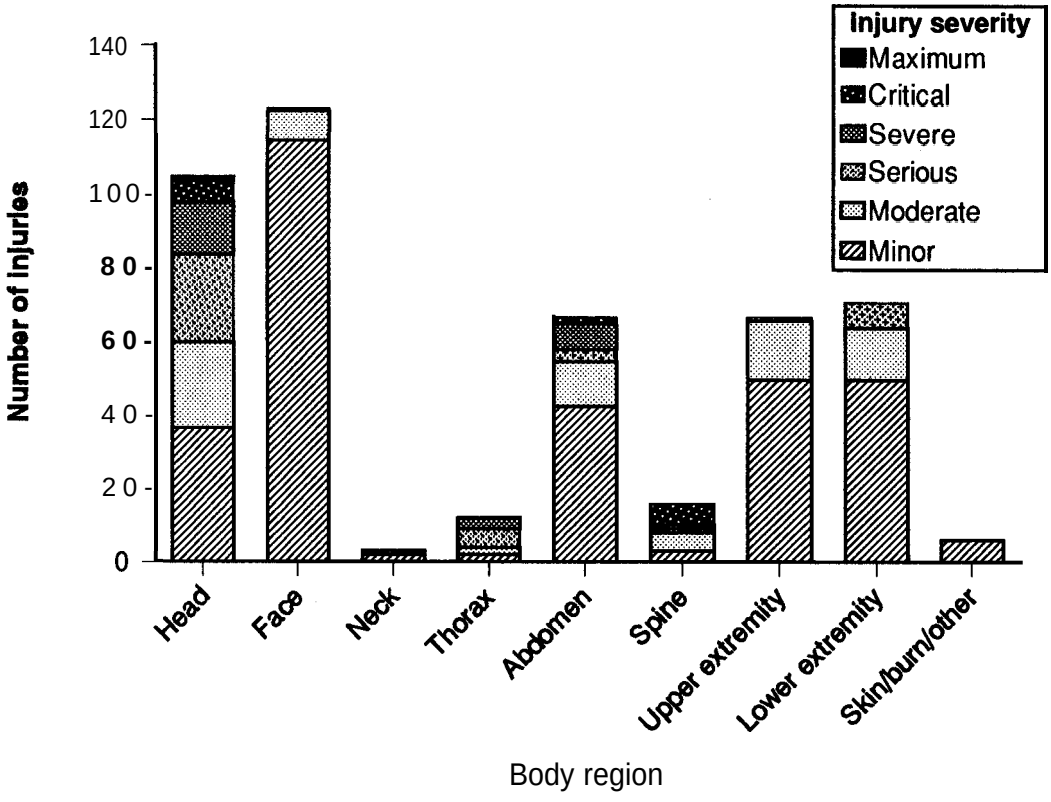


Figure 4.2—Body region of the injuries and the severity of the injuries sustained by the children.

The Safety Board was able to determine the type of restraint systems that should have been used for 181 of the 194 children.[71] Only 51 of the children in the Board's sample were in the appropriate restraint system based on the Board's classification system. Figures 4.3 to 4.6 show the number of children who should have been in a given restraint system and the restraint system actually used.[72]

There were 19 children in the sample who should have been restrained in rear-facing child restraint systems; 9 of those children were in the appropriate type of restraint.[73] The Safety Board determined that 61 children should have been restrained in forward-facing child restraints; however, only 18 children were so restrained. Belt-positioning or shield booster seats should have been used by 73 children; only 11 children used booster seats. Lap/shoulder belts would have been appropriate for 28 children in the Board's sample; however, only 10 children who should have used lap/shoulder belts did so. Three additional children wore lap-only belts because lap/shoulder belts were not available at their seating positions; these three children were considered to be in the appropriate restraint.

The data show that the children tended to be in restraint systems too advanced for their development; 52 children used the vehicle seatbelts but should have been in child restraint systems or booster seats. Of the 15 children who used lap/shoulder belts inappropriately, 14 should have been in booster seats and 1 child should have been in a convertible seat. Of the 39 children who used lap-only belts inappropriately, 37 should have been in some type of child restraint system: either a rear-facing child restraint system (1 child), a forward-facing child restraint (18 children), or a booster seat (18 children). Two had lap/shoulder belts available but used only the lap portions of the belts. There were three additional children who were restrained in child restraints that were too small for them: two children in rear-facing child restraint systems should have been in convertible child restraint systems, and one child who was in a convertible child restraint should have been in a booster seat. Further, there were 22 children who exceeded the 60-pound weight limit for booster seats but were too short (all of these children were less than 59 inches tall) for lap/shoulder belts according to the Board's classification system. For the most part, these children sustained no or minor injuries; 12 wore seatbelts and 10 were unrestrained.

[71] The appropriate restraint system could not be determined for 13 children because the height and/or weight was unknown.

[72] See Volume 2, "Case Summaries," of this report for a table of each child's injury severity, age, height, and weight, appropriate restraint, and restraint actually used.

[73] Although nine children were in appropriate restraints, four of them were using the rear-facing restraints in the forward-facing position. This misuse will be discussed later in the chapter.

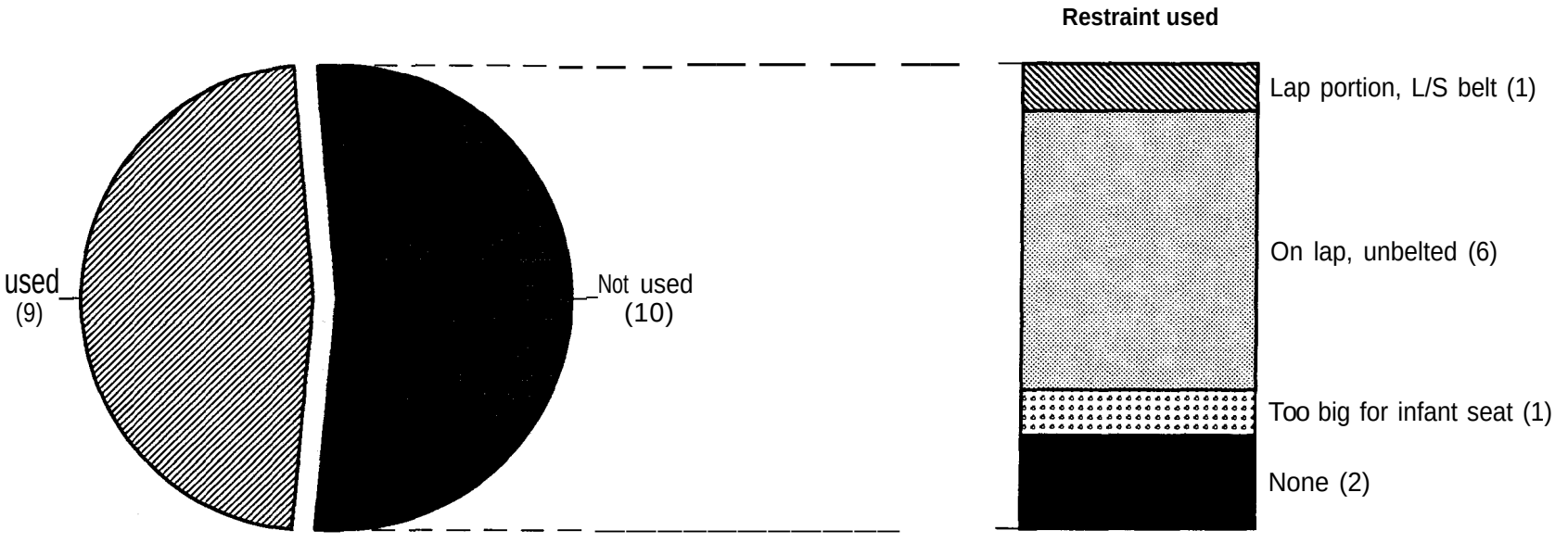


Figure 4.3-Restraints used for the 19 children who should have been placed in rear-facing (RF) child restraint systems based on each child's age, height, and weight. Although nine children were in the correct child restraint system, four were facing the wrong way.

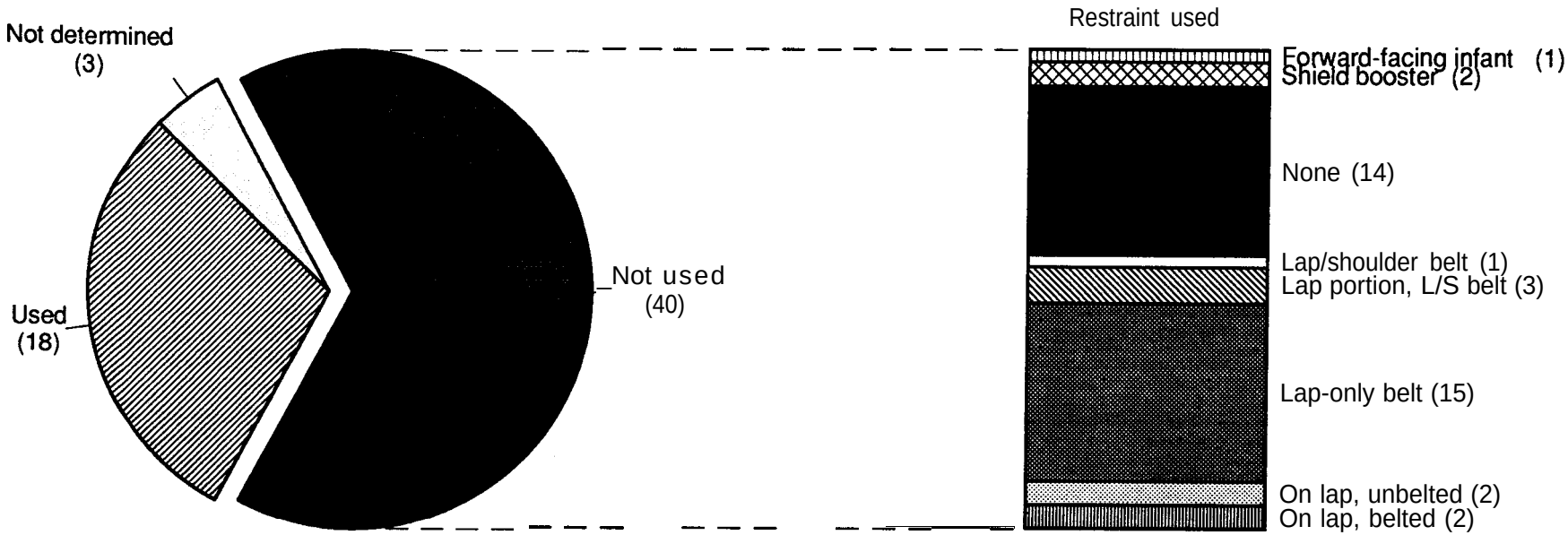


Figure 4.4-Restraints used for the 61 children who should have been placed in forward-facing child restraint systems based on each child's age, height, and weight.

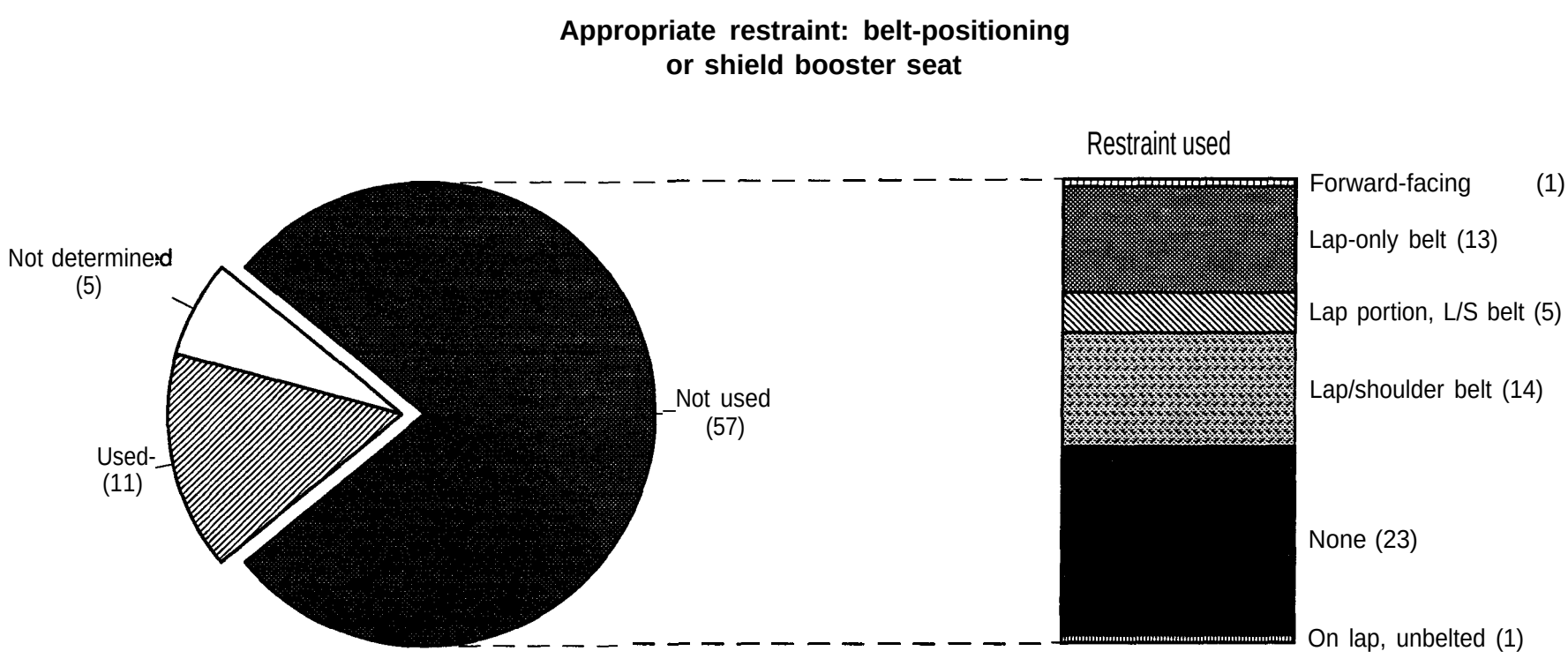


Figure 4.5-Restraints used for the 73 children who should have been placed in booster seats based on each child's age, height, and weight. The child in the forward-facing child restraint system (CRS) exceeded the height and weight limitations for the seat.

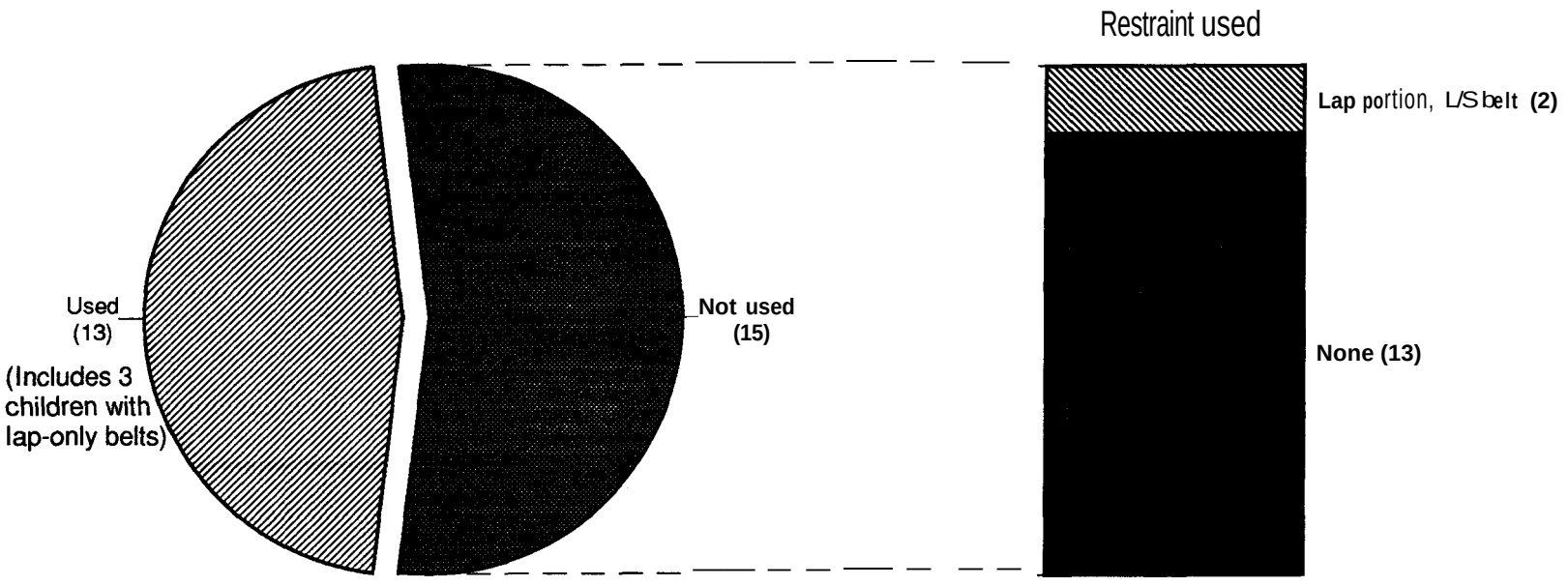


Figure 4.6—Restraints used for the 28 children who should have been using lap/shoulder belts (L/S) based on each child's age, height, and weight. There were three children who wore lap-only belts because lap/shoulder belts wre not available in their seating positions; these three children were considered as being in the appropriate restraint.

The child restraint manufacturers' height and weight limitations sometimes are below those recommended by the AAP. Therefore, each of the 46 child restraint systems used in the sample was evaluated for appropriateness based on the recommendations of the AAP. This evaluation revealed that eight children who weighed between 30 and 40 pounds and were between 30 to 40 inches in height were using shield booster seats appropriately according to the manufacturers' weight limitations; however, the AAP recommendations indicate that these children should have been in convertible child restraints (a convertible child restraint can accommodate a child up to 40 pounds and the harness of a convertible child restraint provides better upper torso restraint than a shield booster).[74] A discussion of booster seats is provided in chapter 5.

Effect of Using the Inappropriate Restraint System

The Safety Board examined the effect on injury severity of not being in the appropriate restraint. Overall, the data show that there were not large differences in injury severity for those children in inappropriate restraints (n = 133) compared to those in the appropriate restraints (n = 51) (see figure 4.7). Thirty-two of the 51 children in appropriate restraints sustained no or minor injury compared to 92 of the 133 children in inappropriate restraints. Five children who were in appropriate restraints and 10 children who were not in appropriate restraints were fatally injured.

However, when the data are examined by accident severity, differences appear. The children in low to moderate severity accidents who were in appropriate restraints sustained less serious injuries than the children who were in inappropriate restraints; six children in low to moderate severity accidents and who were not in the appropriate restraint system were fatally injured (figure 4.8).

The Safety Board also examined injury severity and use of an appropriate/ inappropriate restraint by the specific type of restraint used at the time of the accident (figure 4.9). There were 65 unrestrained children in this analysis, and although most of these children sustained minor or no injuries (n = 47), many (n = 13) sustained moderate or worse injuries and 5 died.

[74] None of the eight children sustained more than moderate injuries.

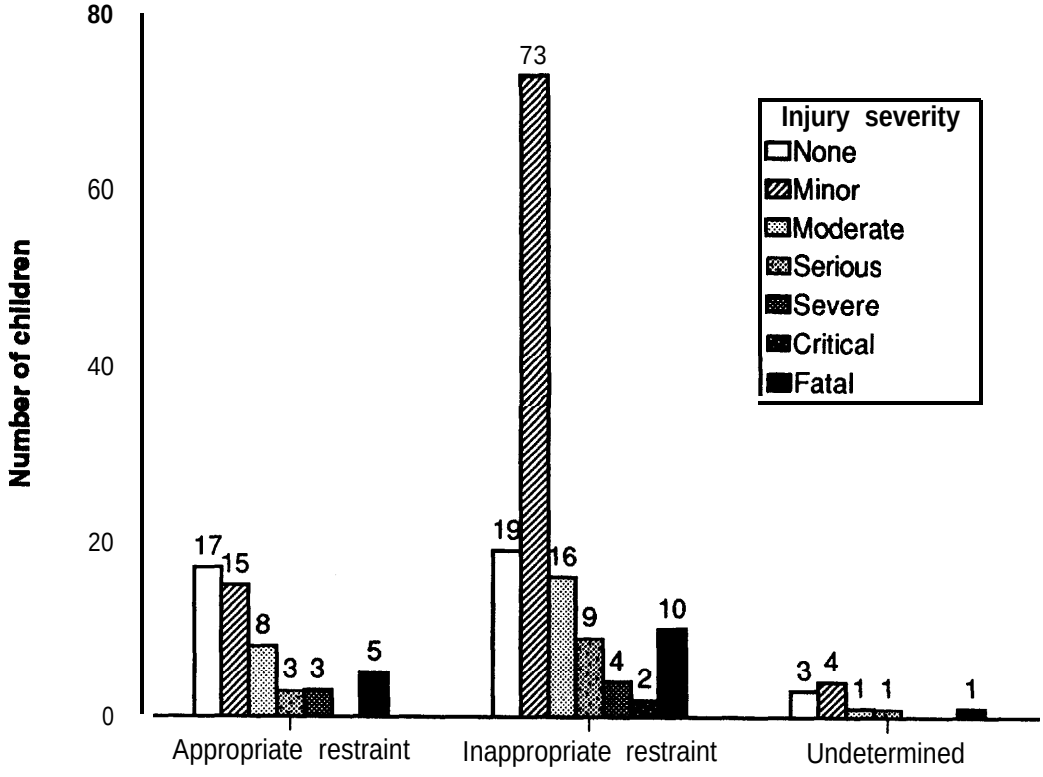


Figure 4.7—injury severity of the children in the appropriate or inappropriate restraint systems, and the children for whom an appropriate/inappropriate restraint status could not be determined.

Because so many children (n = 56) were using seatbelts but should not have been (they should have been in an appropriate type of child restraint system), it is important to highlight differences in the injuries sustained by these children with the injuries sustained by the children who were appropriately restrained in seatbelts (n = 13). The children who were appropriately restrained in seatbelts had a lower overall injury severity---only one with a serious or worse injury-than the children who were inappropriately restrained in seatbelts: 12 with serious or worse injuries, including 5 fatally injured. Two of the fatalities occurred in low to moderate severity accidents.

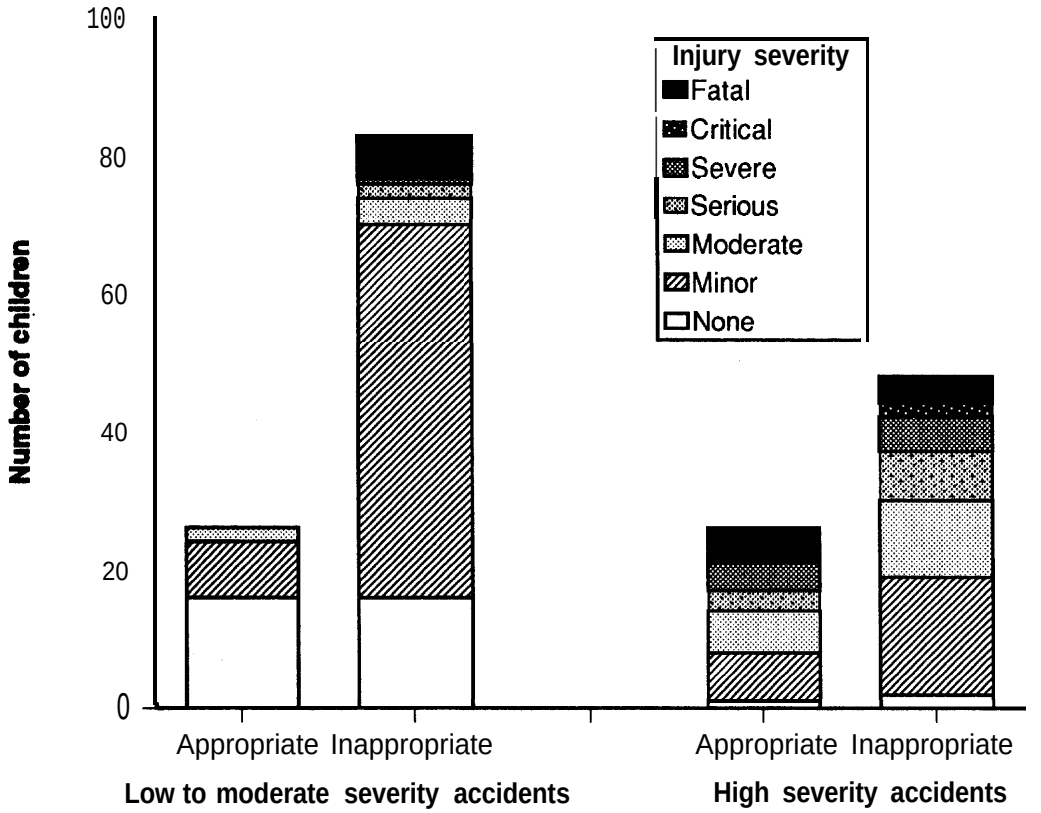


Figure 4.8—Injury severity of the children in the appropriate or inappropriate restraint systems by accident severity.

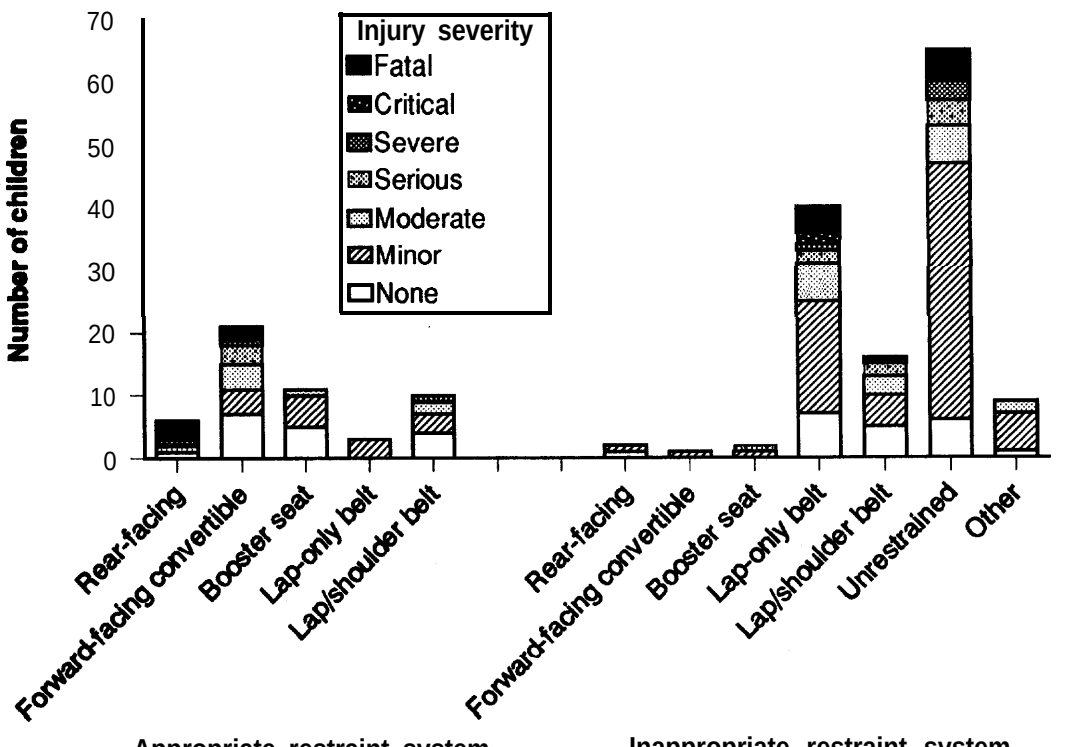


Figure 4.9—injury severity of the children in the appropriate or inappropriate restraint systems by the type of restraint system used at the time of accident.

Proper Use of Child Restraint Systems

In addition to determining whether the children were in the appropriate restraint for each child's age, height, and weight, the Board examined whether the restraints used were used properly. Investigators were able to collect sufficient information to determine whether 42 of the 46 child restraint systems used were properly used. Proper use of a child restraint system was defined as (a) securing the child in the child restraint system according to instructions of the child restraint system manufacturer, and (b) securing the child restraint system to the vehicle according to instructions of the child restraint system manufacturer and the vehicle manufacturer. Based on the definition, the Safety Board determined that 16 child restraint systems were used properly and 26 were used improperly. Of the 26 used improperly, 21 were not properly installed in the vehicle, and in 14 cases the child was not properly secured in the child restraint system. In nine of these cases, the child not only was improperly secured in the restraint system, but also the restraint system was improperly installed in the vehicle. Hence, the total number of improper uses exceeded the number of improperly used child restraint systems. Table 4.1 shows the types of errors made in using the 26 child restraint systems.[75] The errors will be discussed in detail in the following three sections of this chapter. Even when parents or caregivers had received some instruction or information, either written or verbal, on the use of child restraint systems, more than half still made errors in securing the child in the restraint and/or securing the child restraint system in the vehicle. (See appendix D.)

Securing the Child in the Child Restraint System.—Fourteen children were not properly secured in the child restraint system and more than one error was made in four cases in securing the child in the child restraint system.

The child restraint system harness was too loose on 11 children and was completely missing for 1 child. Reasons for the harness being too loose include (a) leaving too much slack in the harness, (b) lack of a harness clip or placement of the harness clip too low on the child,[76] (c) not threading the harness straps properly,[77] and (d) using the wrong harness slots. Two of the 11 children with loose harnesses were totally or partially ejected from the restraint system as a result of the loose harness; 2 children were fatally

[75] The table includes the five children in a child restraint system who were seated in front of an air bag that deployed so that the reader can see that errors were also made securing these children in the child restraint systems; these cases are not included in the analysis in this chapter.

[76] A harness clip is provided for use in some child restraints to hold the shoulder straps tight over the shoulders of an infant or small child. Most, but not all, child restraint system manufacturers provide harness clips with their seats.

[77] Many child restraint systems have harness straps that attach in the back of the child restraint system by a strap adjustment slide. The harness straps must be rethreaded or "doubled back" through the strap adjustment slide to prevent the harness straps from loosening under force, such as force on impact. The harness was not doubled back through the strap adjustment slide on two child restraint systems. (See appendix A, tip #7, for a diagram of a properly used strap adjustment slide.)

Table 4.1—Improper use of child restraint systems (CRS)

Case number, seat position	Maximum AIS	Delta V, and direction of force (o'clock)	Ejected from restraint system	Securing CRS in vehicle		Securing child in CRS			Other
				Vehicle belt	Type of locking clip needed	Facing wrong direction	Too reclined	No harness or reason harness was too loose	
Rear-facing CRS									
Case 5, seat 6	0	49.8 mph, 12	Total		Standard				
Case 7, seat 2	6	25.3 mph, 12						Harness retainer clip too low	CRS extended over vehicle seat
Case 12, seat 4	1	NA, NA			Standard	✓		Wrong slots	
Case19, seat 3	6	46.4 mph, 12	Partial	Too loose			✓		
Case 52, seat 2	4	20.8 mph, 8	Total	None used				No harness	
Case 61, seat 6	1	34.8 mph, 9			Heavy-duty				
Case 105, seat 3	6	30.8 mph, 12	Total		Standard, used heavy-duty			Slack in harness	Foam cushion used
Case 110, seat 4	2	13.5 mph, 2		None used		✓		Too loose; not doubled back; harness retainer clip too low	

Table 4.1—improper use of child restraint systems (CRS) (continued)

Case number, seat position	Maximum AIS	Delta V, and direction of force (o'clock)	Ejected from restraint system	Securing CRS in vehicle		Securing child in CRS			Other
				Vehicle belt	Type of locking clip needed	Facing wrong direction	Too reclined	No harness or reason harness was too loose	
Forward-facing CRS									
Case 9, seat 4	6	53.5 mph, 12	Partial					Not doubled back	Child seat base repaired with tape
Case 15, seat 3	0	9 mph, 12		L/S belt misrouted		✓		Harness retainer clip missing	
Case 25, seat 6	2	48.4 mph, 12			Standard	✓		Wrong slots	
Case 39, seat 3	2	27.6 mph, 12		Supplement belt needed					Automatic belt used
Case 41, seat 4	6	38.3 mph, 12			Standard, used but bent			Threaded wrong	
Case 41 seat 6	2	38.3 mph, 12			Standard, used two (correctly located one worked)		✓		
Case 42, seat 3	0	13.6 mph, 12		Too loose					
Case 48, seat 6	1	34.9 mph, 2			Standard				
Case 71, seat 6	1	19.9 mph, 11		Supplement buckle needed					

Table 4.1—improper use of child restraint systems (CRS) (continued)

Case number, seat position	Maximum AIS	Delta V, and direction of force (o'clock)	Ejected from restraint system	Securing CRS in vehicle		Securing child in CRS			Other
				Vehicle belt	Type of locking clip needed	Facing wrong direction	Too reclined	No harness or reason harness was too loose	
Case 107, seat 5	1	21.1 mph, 11		Too loose (hump)				Slack in harness	Too heavy for rear-facing mode according to CRS manufacturer, but too young developmentally to face forward.
Case 119, seat 4	3	29.5 mph, 12		L/S belt misrouted				Harness retainer clip too low	
Case 123, seat 6	0	8.9 mph, 2						Slack in harness	
Shield booster									
Case 20, seat 6	0	18.8 mph, 11			Standard				
Case 26, seat 3	2	44.6 mph, 12			Standard				
Case 40, seat 6	0	12.7 mph, 1			Standard				
Case 54, seat 4	1	17.2 mph, 3			Standard				

Table 4.1—improper use of child restraint systems (CRS) (continued)

Case number, seat position	Maximum AIS	Delta V, and direction of force (o'clock)	Ejected from restraint system	Securing CRS in vehicle		Securing child in CRS			Other
				Vehicle belt	Type of locking clip needed	Facing wrong direction	Too reclined	No harness or reason harness was too loose	
Case 130, seat 4	1	25.1 mph, 12			Standard				
Case 136, seat 6	0	7.4 mph, 1			Standard				
CRS in front of a deployed air bag									
Case 59, seat 3	5	NA, NA	Partial		Standard			Not doubled back	Carry handle not stored in lock position
Case 87, seat 3	0	16.8 mph, 12			Standard				
Case 121, seat 3	6	23.3 mph, 12			Heavy-duty; wrong place			Slack in harness	
Case 136, seat 3	6	7.4 mph, 1			Standard			Not doubled back	Canopy should not have been used
Case 138, seat 3	3	4.6 mph, 12			Heavy-duty				

NA = not applicable. (In case 12, the vehicle rolled over; in case 59, the vehicle was sideswiped.)
L/S= lap/shoulder belt.

injured, and 1 sustained severe injuries. The child in the child restraint system with the missing harness was also ejected.

Four children younger than 1 year were improperly placed in child restraint systems that had been installed forward-facing in the vehicles rather than rear-facing as recommended for children their size and age.[78] Three weighed less than 20 pounds, and one weighed more than 20 pounds but was only 5 months old and too young developmentally to ride forward-facing as positioned in the accident vehicle (case 107). Two of these four children who were facing the wrong direction were in high severity accidents (Delta V > 20 mph); one child sustained a moderate injury and the other sustained a minor injury. One additional infant-only restraint, which was designed to be rear-facing only, was incorrectly installed forward-facing; the child was 1 year old and weighed more than 20 pounds and should have been in a convertible restraint positioned forward-facing (case 12). The child sustained minor injuries.

Securing the Child Restraint System in the Vehicle.—Of the 21 child restraint systems not properly installed in the vehicle, 16 were not compatible with the vehicle seatbelt at the child's seating position. A locking clip was needed on the vehicle seatbelt at 14 seating positions; 13 of these seating positions were equipped with a lap/shoulder belt, and one was equipped with a lap-only belt. (Appendix A, tip #6, contains diagrams of locking clips and information on how they are to be used.) Supplemental seatbelt hardware was needed at the child's seating position in two cases.

Thirteen of the 14 vehicle seatbelts needed a standard locking clip to secure the child restraint system tightly; at 10 positions, no locking clip was used, at two positions a standard locking clip was used, and at 1 position a heavy duty locking clip was used instead of a standard locking clip.[79] A standard locking clip was used in two cases (cases 22 and 48) where it was not needed.[80] There was evidence in 5 of the 14 accidents that the child restraint system moved, but the lack of a locking clip affected injury severity in only one accident (case 5). Of the 14 accidents, 8 involved pre-crash braking and 11 were

[78] FMVSS 213 does not provide an age guideline for child restraint system use. According to the American Academy of Pediatrics Policy Statement, children should face the rear of the vehicle until they are at least 20 pounds and 1 year old to reduce the risk of cervical spine injury in the event of a crash (Pediatrics, Vol. 97, No. 5, May 1996).

[79] A heavy duty locking clip can be used in place of a standard locking clip, but a standard locking clip cannot be used in place of a heavy duty locking clip.

[80] The child restraint in case 22 was secured with a lap/shoulder belt that had a locking latch plate; therefore, the locking clip was not necessary. Use of the locking clip in this case would not have had a negative effect. The child restraint in case 48 was a belt-positioning booster seat; instructions of the booster seat manufacturer say to use a locking clip for a lap/shoulder belt with an emergency locking retractor. However, recent information in a Technical Report by *Safe Ride News*, winter 1996 edition, indicates that a locking clip is neither necessary nor beneficial and could negatively affect the child in a crash by changing the function of the belt or the relative positions of belts, latch plate, and buckle. The child in this case sustained minor injuries attributed to the lapbelt.

high severity accidents. In case 41, however, a properly used locking clip bent under crash forces and allowed the child restraint system to move forward. The child in this seating position died of a brain stem injury caused by hyperextension of the neck. This was a high severity accident (Delta V of 38.3 mph).

Two child restraint systems were secured with the wrong seatbelt hardware: in both cases the restraints moved during the accident sequence. One child restraint system (case 39) was secured with an automatic lap/shoulder belt rather than the special lapbelt and hardware specified in the vehicle owner's manual. The child sustained a moderate closed head injury when the child and the child restraint struck the glove box during the moderately severe front-end collision (Delta V of 27.6 mph). The other child restraint system (case 71) was installed at a seating position with a seatbelt buckle that was forward of the seat cushion/seatback intersection; this design keeps the lapbelt from riding up onto the abdomen of an adult but makes it impossible to tightly secure a child restraint system. A special belt buckle was needed to secure the child restraint system as specified in the vehicle owner's manual. Although the restraint system moved during the accident sequence, the child in case 71 sustained only minor injuries in the low to moderate front-end collision (Delta V of 19.9 mph).

Problems with use of the vehicle seatbelt to secure the child restraint system were identified in an additional seven cases. Two child restraint systems were not secured at all with the vehicle seatbelt, three were secured with a loose seatbelt,[81] and two had the vehicle seatbelt threaded through the wrong belt path on the child restraint. Four of the seven children involved in these accidents sustained moderate or worse injuries.

Another Problem Related to Securing the Child Restraint System in the Vehicle.—In one accident (case 7), the depth of the base of the rear-facing infant seat was longer than the front bench seat of the vehicle. The child restraint system extended beyond the edge of the vehicle seat and, as a result, pitched forward and downward. The child sustained fatal injuries in this high severity frontal impact collision (Delta V of 25.3 mph) because of the instability of the child restraint system.

[81] In one of the three cases (case 107), a forward-facing child restraint system was installed over a raised hump at the center rear position of a vehicle with a seatbelt buckle that was at the end of a 4-inch plastic sleeve. The hump caused the child restraint system to be unstable, and the long buckle stalk caused the vehicle seatbelt to be too loose. The child in this accident sustained minor injuries from the moderately severe side-impact collision.

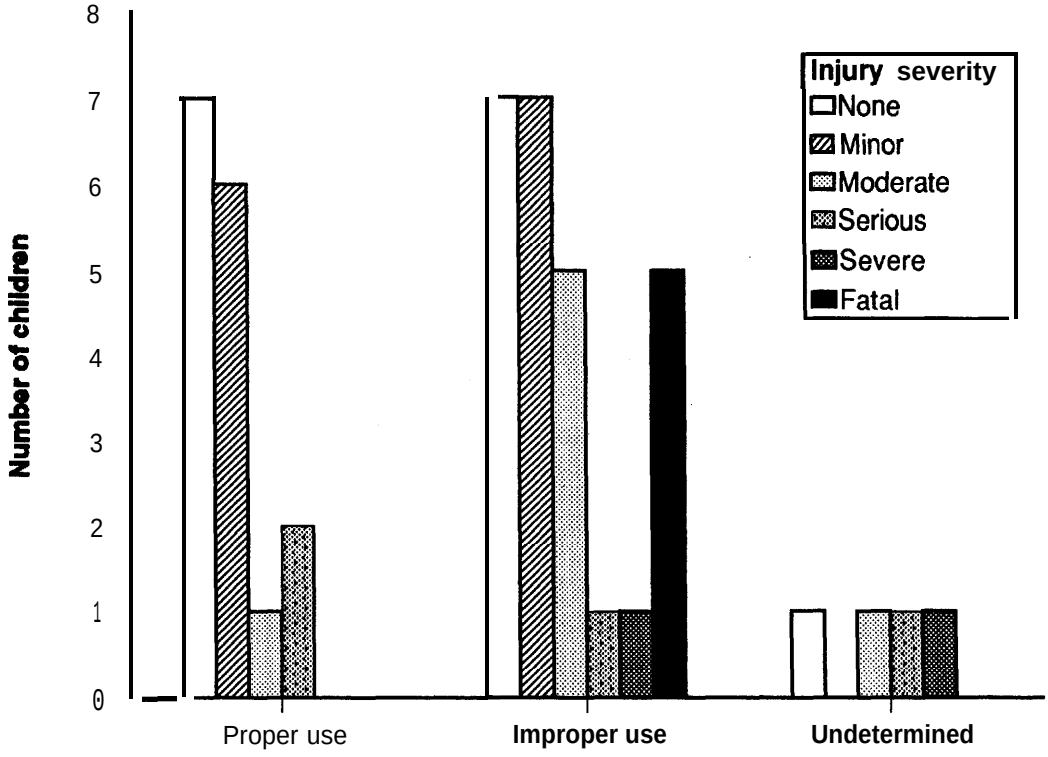


Figure 4.10—Injury severity of children in child restraint systems that were used properly and improperly, and in child restraint systems for which proper or improper use could not be determined.

Effect of Improper Use of Child Restraint Systems on Injury Severity

Regardless of whether the child restraint systems were used properly or improperly, most of the children (28 of 46) sustained no or minor injuries. Only one child in a child restraint system that was used properly sustained a moderate injury, and two children sustained serious injuries. Even when child restraint systems were used improperly, they still provided some level of protection to the children. Of the 26 children in improperly used child restraint systems, 14 sustained either no or minor injury. Injury severity by proper and improper use of child restraint systems is shown in figure 4.10.

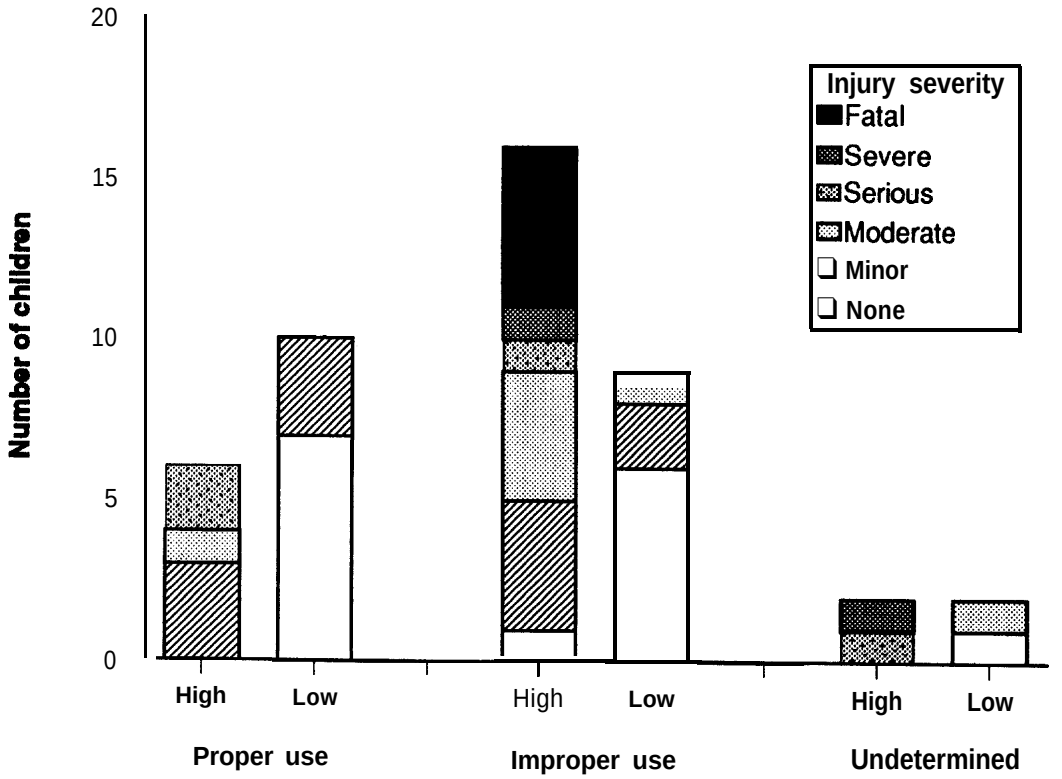


Figure 4.1 I—Injury severity of the children in child restraint systems that were used properly and improperly, and in child restraint systems for which proper or improper use could not be determined, by accident severity.

All of the children in low to moderate severity accidents, regardless of proper or improper use of the child restraint systems, sustained no injury worse than a moderate injury. The children who sustained serious or worse injuries (AIS 3 or greater) were involved in high severity accidents. The five fatally injured children in child restraint systems were improperly restrained and all were involved in high severity accidents. However, even in high severity accidents, some children in child restraint systems faired very well, even those improperly restrained; five children in high severity accidents were improperly restrained yet sustained either no or only minor injuries (figure 4.11).

Proper Use of Seatbelts

Proper and improper use of seatbelts was also examined. Improper use was defined as the lap-only or lap/shoulder belt being worn too loose, or the shoulder portion of the belt being under the child's arm, behind the back, or disconnected so that only the lap portion of the lap/shoulder belt was used. Improper use does not include the 43 children who did not use the restraint available at the seating position. A distinction was made between improper use and improper seatbelt fit; it was assumed that lap and shoulder belts that came across the neck or rode too high on the abdomen or neck were a result of poor fit from belt geometry and the child's size rather than a result of improper use. There is one exception to this distinction between improper use and poor seatbelt fit, and that applies to the children in case 25. Although the lap-only belts were too high on these children, the high position may not have been solely the result of poor fit but also a result of improper use because each child shared the seatbelt with another occupant in the same seat. For these children, the seatbelt being too high is counted as improper use. Table 4.2 shows the cases involving improper use and poor seatbelt fit.

Of the 126 children who had seatbelts available, 51 restrained by the seatbelts wore them properly and 20 of the children restrained by either lap-only belts or lap/shoulder belts wore the belts improperly (figure 4.12).

Lap-Only Belts.—Twenty nine children had lap-only belts available and wore them properly, and six children wore their lap-only belts improperly. The lap-only belts were too loose on three of the children and too high on the two children who shared their seatbelts with another occupant. Of the six children in lap-only belts who used them improperly, one sustained a serious injury, and two children who shared their seatbelts were fatally injured. These three children were in high severity accidents.

Lap/Shoulder Belts.—Of the 36 children who used the available lap/shoulder belts, 22 wore them properly and 14 wore them improperly. Proper or improper use could not be determined for six children. Of the 14 children who were known to have improperly used the lap/shoulder belt, 8 children wore the shoulder portion of the belt behind the back, 2 children wore it under the arm, 1 child wore the shoulder portion of the belt improperly but the type of improper use could not be determined, for 2 children the shoulder belt was disconnected, and 1 child shared the lap/shoulder belt with an adult at the same seating position. Poor shoulder belt fit was reported in eight of these cases as the reason for wearing the shoulder belt under the arm or behind the back.[82] Moderate to severe injuries were sustained by 9 of the 14 children; all but 1 were involved in high severity accidents. The five children who sustained no or minor injuries were involved in low to moderate severity accidents.

[82] Investigators determined that the shoulder portion of the lap/shoulder belt did not properly fit an additional four children, but these children wore the lap/shoulder belt regardless of poor fit.

Table 4.2—improper use and poor vehicle belt fit of lap-only and lap/shoulder belts on child occupants and reasons of poor vehicle belt fits

Case number, seat position	Injury severity	Child's weight, height	Proper belt use	Type of improper belt use					Poor belt fit	
				Under arm	Behind back	Too loose	Disconnected shoulder belt	Type of improper use undetermined	Across neck	Too high
Lap-only belt available										
Case 2, seat 2	Minor	30 lb, 36 in				✓				
Case 10, seat 8	Minor	70 lb, 50 in				✓				
Case 25, seat 4	Fatal	35 lb, 34 in								✓[a]
Case 25, seat 5	Moderate	38 lb, 40 in								✓[a]
Case 25, seat 5	Fatal	51 lb, 43 in						✓[a]		
Case 51, seat 6	Minor	33 lb, 37.5 in								✓
Case 83, seat 5	Serious	44 lb, 44.3 in				✓				
Lap/shoulder belt available										
Case 24, seat 3	Moderate	40 lb, 37 in	L		S					
Case 31, seat 3	Moderate	45 lb, 36 in	S							L
Case 44, seat 3	Severe	43 lb, 39 in	L		S					

Table 4.2—improper use and poor vehicle belt fit of lap-only and lap/shoulder belts on child occupants and reasons of poor vehicle belt fits (continued)

Case number, seat position	Injury severity	Child's weight, height	Proper belt use	Type of improper belt use					Poor belt fit	
				Under arm	Behind back	Too loose	Disconnected shoulder belt	Type of improper use undetermined	Across neck	Too high
Case 49, seat 3	Moderate	26 lb, 28 in					✓	L		
Case 58, seat 4	None	18 lb, 24 in			S			L		
Case 66, seat 3	Minor	60 lb, 54 in	L		S					
Case 72, seat 3	Moderate	78 lb, 48 in	L	S						
Case 77, seat 3	Minor	62 lb, 48 in	L						S	
Case 85, seat 3	None	65 lb, 50 in	L							S
Case 89, seat 3	Minor	37 lb, 41 in	L						S	
Case 90, seat 6	Minor	40 lb, 45.5 in	L		S					
Case 92, seat 3	Minor	49 lb, 44.5 in		S				L		
Case 95, seat 6	Minor	40 lb, 42.5 in	L					S[b]		
Case 101, seat 3	Moderate	42 lb, 40 in	L		S					

Table 4.2—improper use and poor vehicle belt fit of lap-only and lap/shoulder belts on child occupants and reasons of poor vehicle belt fit[a] (continued)

Case number, seat position	Injury severity	Child's weight, height	Proper belt use	Type of improper belt use					Poor belt fit	
				Under arm	Behind back	Too loose	Disconnected shoulder belt	Type of improper use undetermined	Across neck	Too high
Case 103, seat 3	Critical	35 lb, 36 in	L		S					
Case 105, seat 5	Moderate	25 lb, 32 in						L/S[c]		
Case 119, seat 3	Moderate	75 lb, 49 in	L				✓			
Case 119, seat 6	Critical	77 lb, 50 in	L		S					

L = lap portion of lap/shoulder belt; S = shoulder portion of lap/shoulder belt.

[a] in case 25, the child in seat 4 shared the available iapbelt with an adult at the same seating position. The two children in seat 5 shared the available lapbelt at that position.

[b] The child and parent stated that the shoulder portion of the belt was behind the child's back, but loading marks on the shoulder portion of the belt indicate that it could have been in front of the child.

[c]The child shared the lap/shoulder belt with an adult at the same seating position.

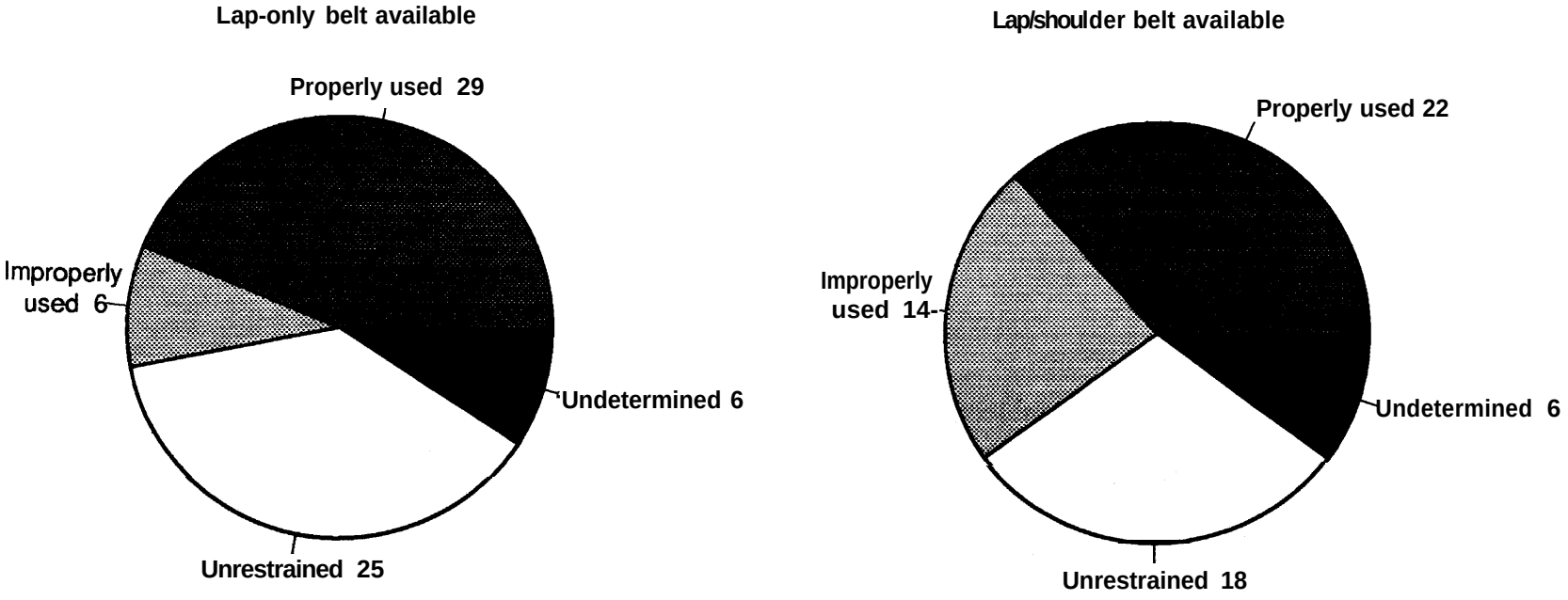


Figure 4.12-Proper and improper use of the restraints for the 126 children who had seatbelts

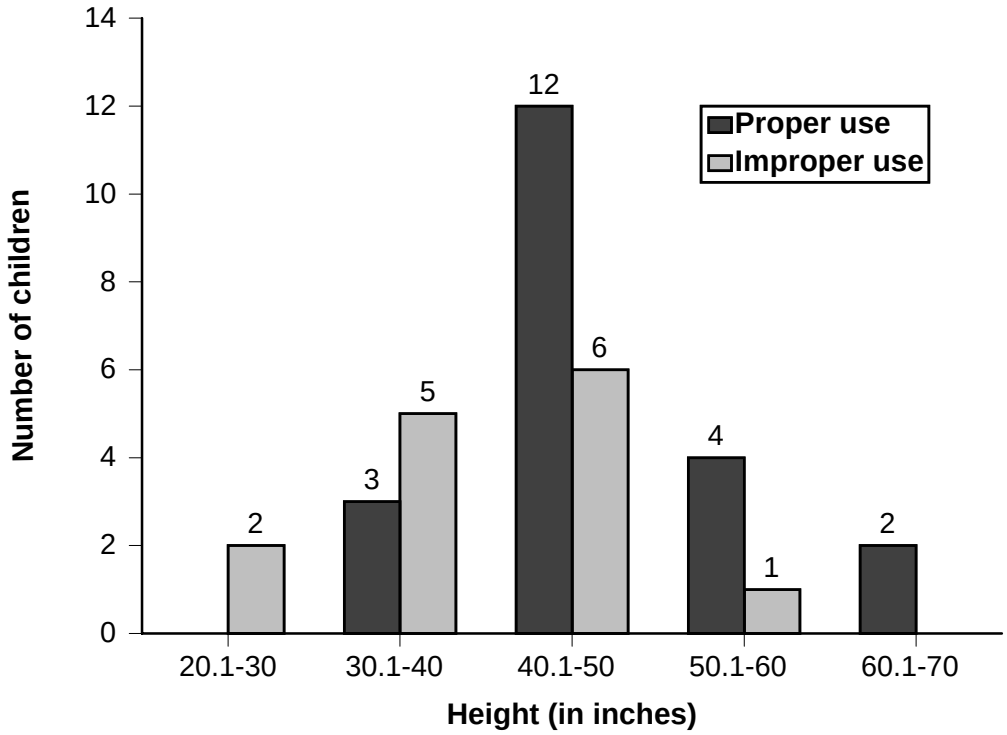


Figure 4.13—Proper and improper use of the lap/shoulder belt by height categories for the 35 children for whom the data were known.

Proper and improper use of the lap/shoulder belt and the child's height was known for 35 of the 60 children for whom a lap/shoulder belt was available. Improper use of the lap/shoulder belt decreased as the child's height increased above 50 inches, resulting in a better fit of the shoulder portion of the belt (figure 4.13). One child in the 50.1- to 60-inch category wore the shoulder portion improperly; that child was 54 inches tall. Weight did not influence proper use.

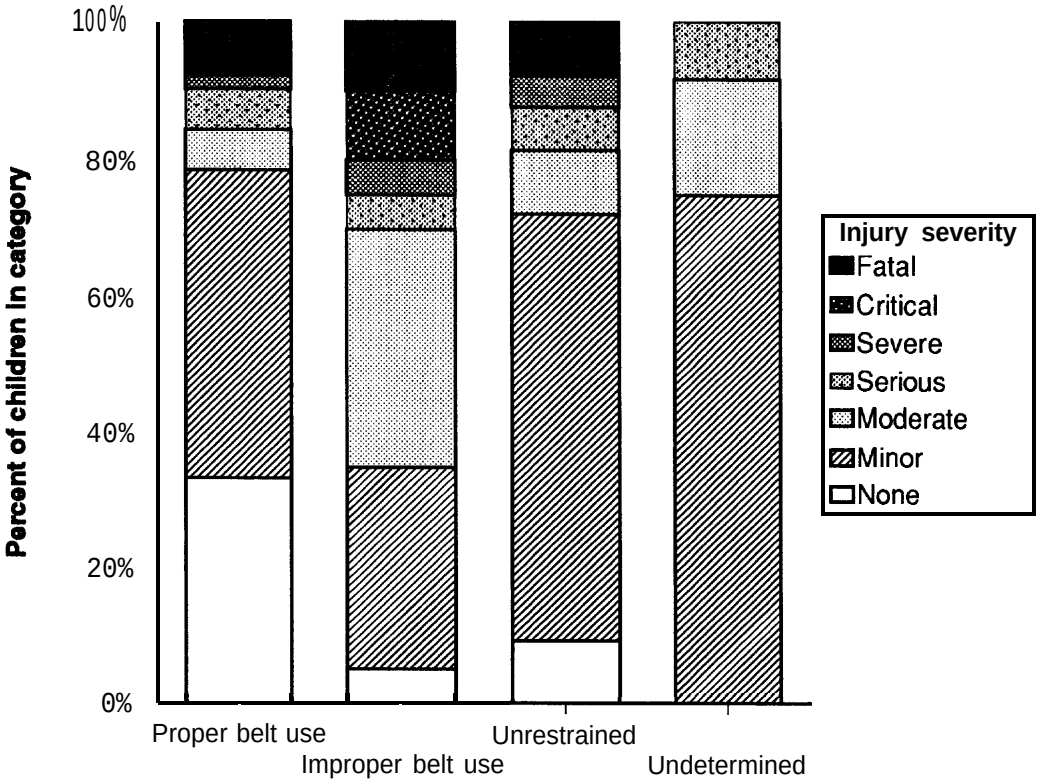


Figure 4.14—injury severity of the children who were using their vehicle seatbelts properly and improperly, those who were unrestrained, and those for whom proper or improper use could not be determined.

Effect of Improper Seatbelt Use on Injury Severity

The Safety Board examined the effect of improper seatbelt use on injury severity (figure 4.14). Most of the properly belted children sustained no or minor injuries. There were, however, four fatally injured children who were using their seatbelts properly. Two of these children were in high severity accidents, 53.5 mph and 40.7 mph. Although the other two fatally injured children were using their belts properly, they should have been in booster seats based on the Safety Board's classification system. In general, the children using their belts improperly and involved in low to moderate severity accidents did not sustain any injuries more serious than moderate injuries. All the improperly belted children involved in high severity accidents sustained some level of injury.

Effect of Inappropriate Restraint and Improper Use on Injury Severity

The Board was also interested in examining the combined effects of using the appropriate (or inappropriate) restraint and using it properly (or improperly) on injury severity. Therefore, the Board looked at four combinations of appropriate/inappropriate restraint and proper/improper use of the restraint:

Appropriate restraint and proper use—The child was in the appropriate restraint based on age, height, and weight and the manufacturer's instructions, and the restraint was used properly.

Appropriate restraint and improper use—The child was in the appropriate restraint based on age, height, and weight and the manufacturer's instructions, but either the child was not properly secured in the restraint or the child restraint was not properly secured in the vehicle.

Inappropriate restraint and proper use—The child was not in the appropriate restraint based on age, height, and weight, and the manufacturer's instructions, but the child was secured in the restraint properly and the child restraint was properly secured in the vehicle.

Inappropriate restraint and improper use—The child was in the inappropriate restraint based on age, height, and weight, and manufacturer's instructions, and the child was improperly secured in the restraint or the child restraint was improperly secured in the vehicle.

The Safety Board also included unrestrained children in these analyses. Twenty-two children were grouped together in a category called *Other* because either appropriate/inappropriate restraint or proper use could not be determined for these children.

Only 23 of the 49 children who were in the appropriate restraint used the restraint properly.[83] Nineteen children who were in the inappropriate restraint also used it improperly. (See figure 4.15.)

[83] Proper use was not known for two children who were in the appropriate restraint for their age, height, and weight.

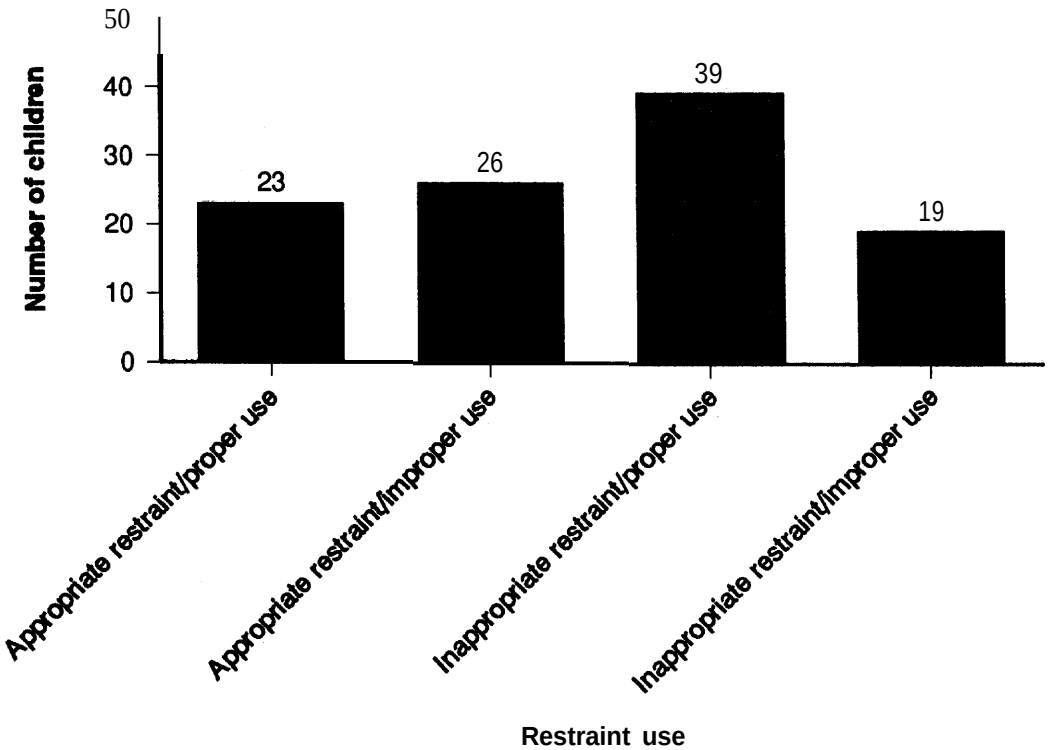


Figure 4. 15-Appropriate/inappropriate restraint used in combination with proper/improper use of the restraint. There were 65 unrestrained children and 22 children for whom appropriate/inappropriate restraint used or proper/improper restraint use could not be determined.

Figure 4.16 shows the number of children in each category of appropriate/ inappropriate restraint and proper/improper restraint use by the actual restraint system used. The children in lap-only or lap/shoulder belts usually used the restraint properly even if they should not have been using a seatbelt based on their age, height, and weight. There were, however, nine children who should not have been using a seatbelt (because of their age, height, and weight) and who also improperly used only the lap portion of the lap/shoulder belt. Improper use of child restraint systems was common. Even if children were in the appropriate child restraint systems, the child restraints were often used improperly.

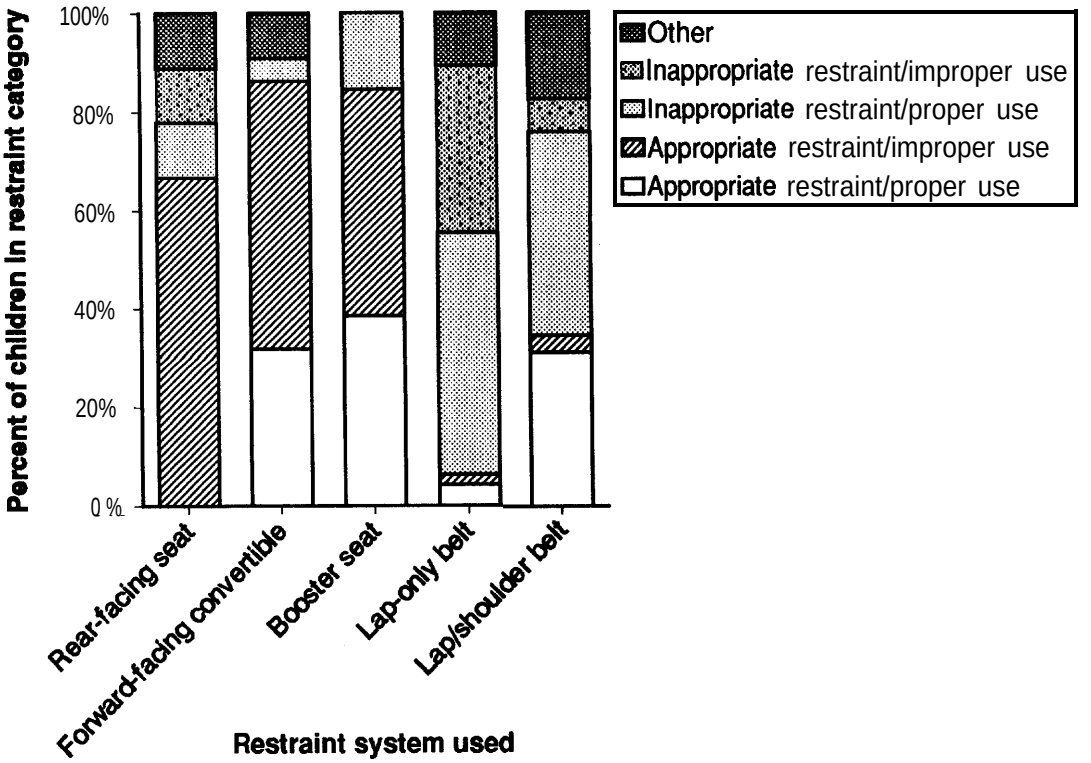
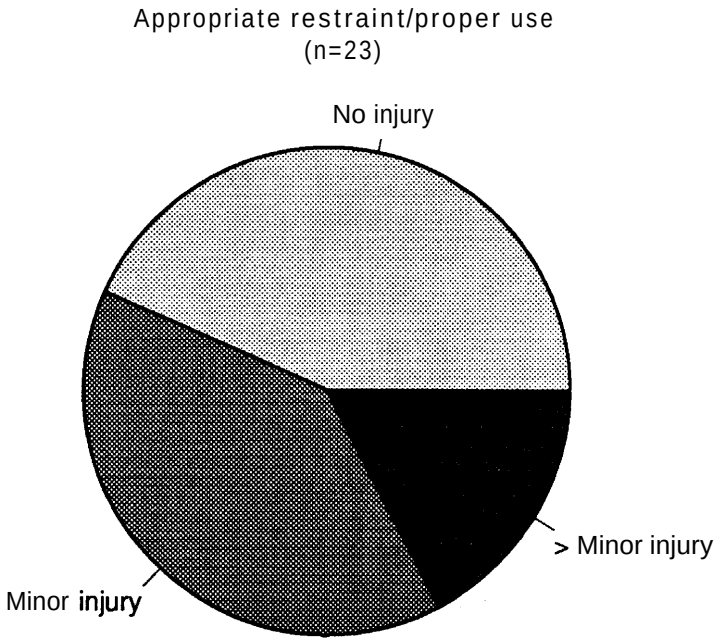


Figure 4. 16—Appropriate/inappropriate restraint used and proper/improper use by actual restraint used. There were 65 unrestrained children and 9 children for whom restraint use could not be determined.

Only 4 of the 23 children who were in the appropriate restraint and properly used the restraint sustained more than a minor injury; none was fatal. Of the 19 children who were in the inappropriate restraint and improperly used the restraint, only 7 sustained no or minor injuries; 2 were fatally injured (see figure 4.17). Overall, there were 16 fatalities; none of the fatally injured children were children who were in the appropriate restraint and who used it properly.[84] Figure 4.18 shows injury severity by appropriate/ inappropriate restraint used in combination with proper/improper use of the restraint.

[84] Five children were in the appropriate restraint but used it improperly, another five were in the inappropriate restraint (three used it properly and two used it improperly), five were unrestrained, and appropriate/inappropriate restraint was undetermined for one child.



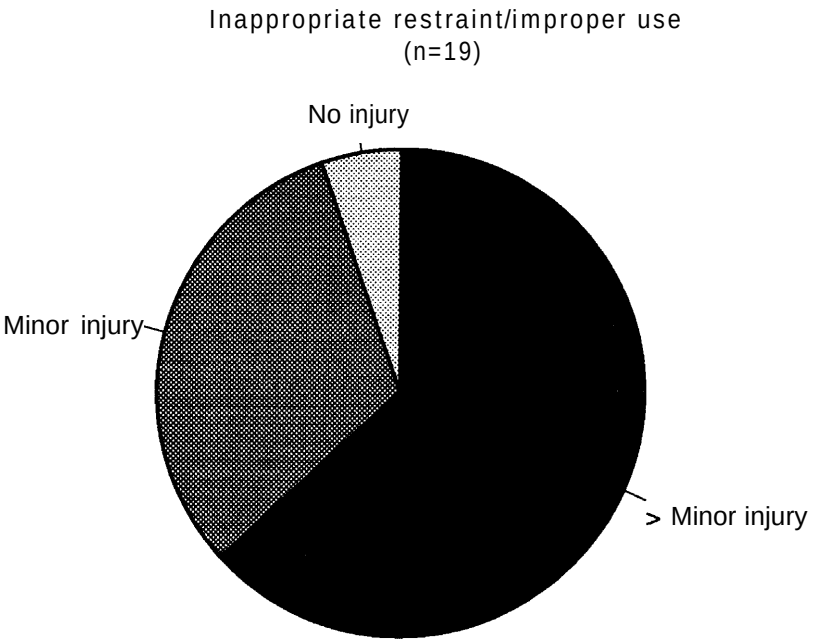


Figure 4.17—injury severity by restraint use.

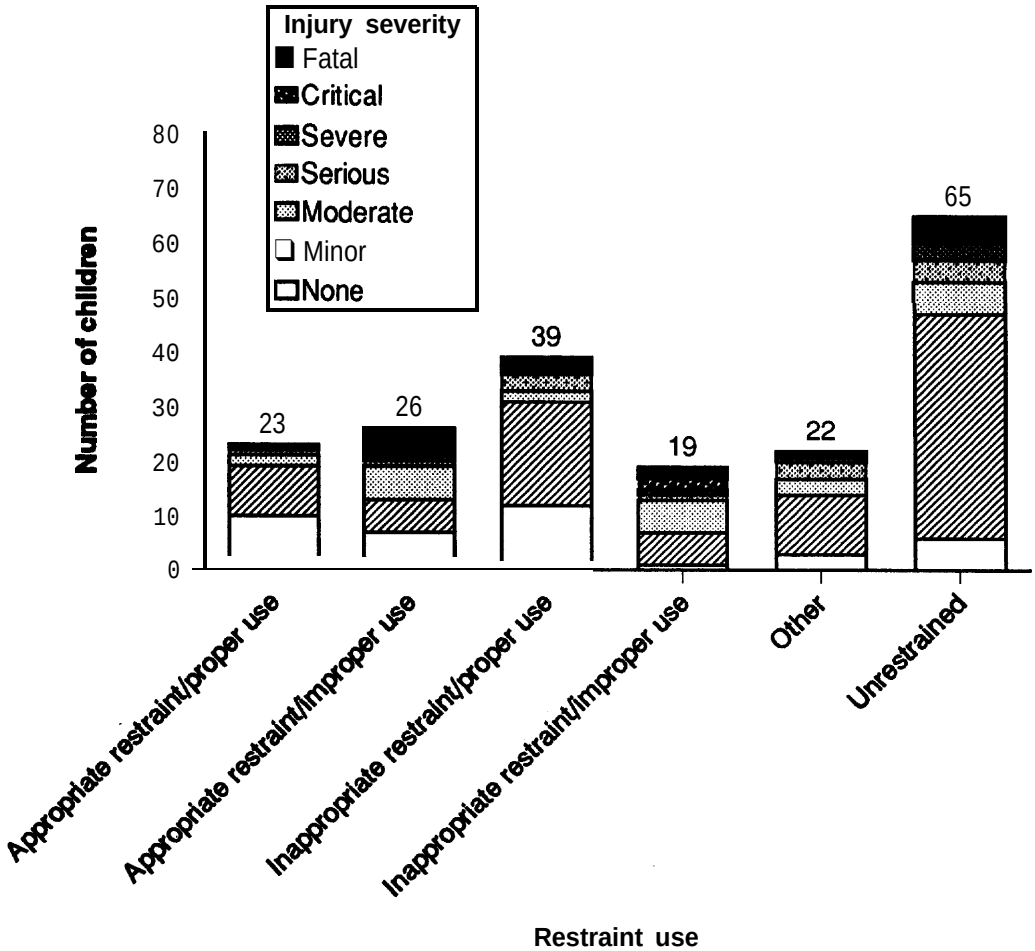


Figure 4. 18—injury severity by appropriate/inappropriate restraint used in combination with the proper/improper use of the restraint. ("Other" comprises the children for whom appropriate/inappropriate restraint used or proper/improper restraint use could not be determined.)

Effect of Accident Severity on Injury Severity

As would be expected, children generally sustained fewer injuries in the low to moderate severity accidents compared to children in high severity accidents (figure 4.19). There were 114 children involved in low to moderate severity accidents (Delta V $\leq$ 20 mph) and 74 children in high severity accidents (Delta V > 20 mph). All the children in low to moderate severity accidents who were in child restraints sustained no or minor injuries with the exception of one child who sustained moderate injuries.

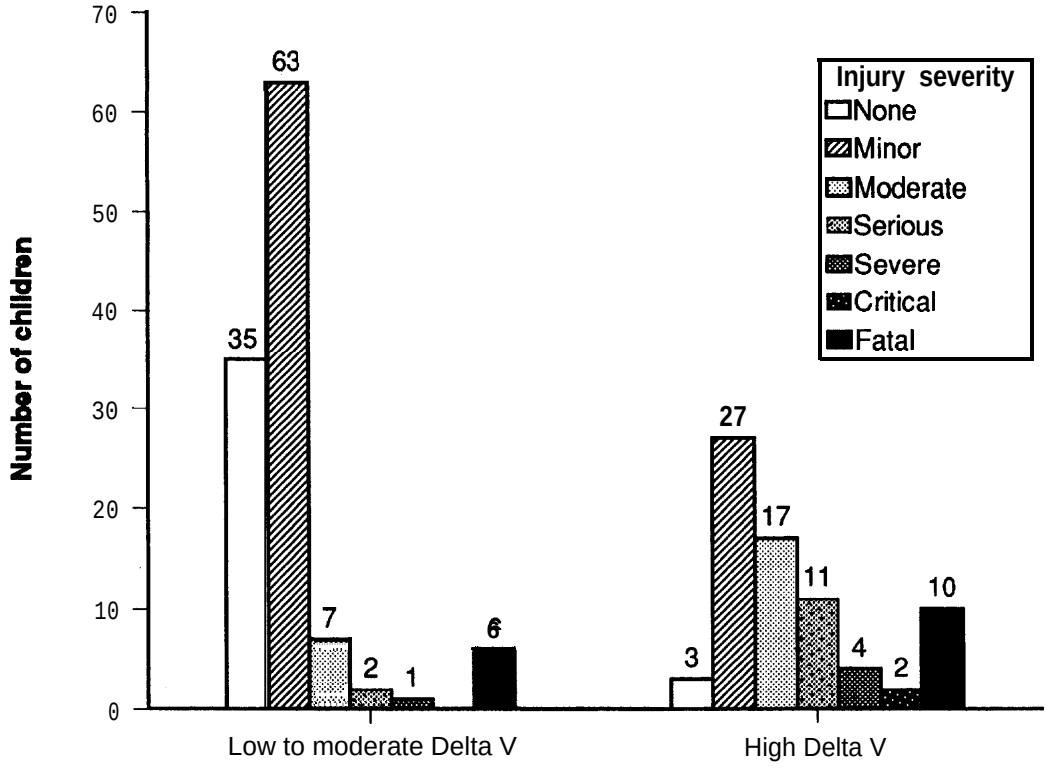


Figure 4. 19—injury severity of children in low to moderate severity accidents (Delta V ≤ 20 mph) and high severity accidents (Delta V > 20 mph).

There were six children in low to moderate severity accidents who were fatally injured. All these children were in inappropriate restraints or were unrestrained (one used a lap-only belt, one used a lap/shoulder belt, and four were unrestrained). Based on the Safety Board's classification system, these six children should have been in some type of child restraint system (five in booster seats and one in a convertible seat).

Children in high severity accidents tended to sustain injury. Only 3 of the 74 children in high severity accidents sustained no injury. All but 1 of the 10 fatally injured children in the high severity accidents were either in the inappropriate restraint system or used the restraint system they were in improperly. The one child who used the restraint system (lapbelt) properly was in a very high severity accident (Delta V of 53.5 mph).

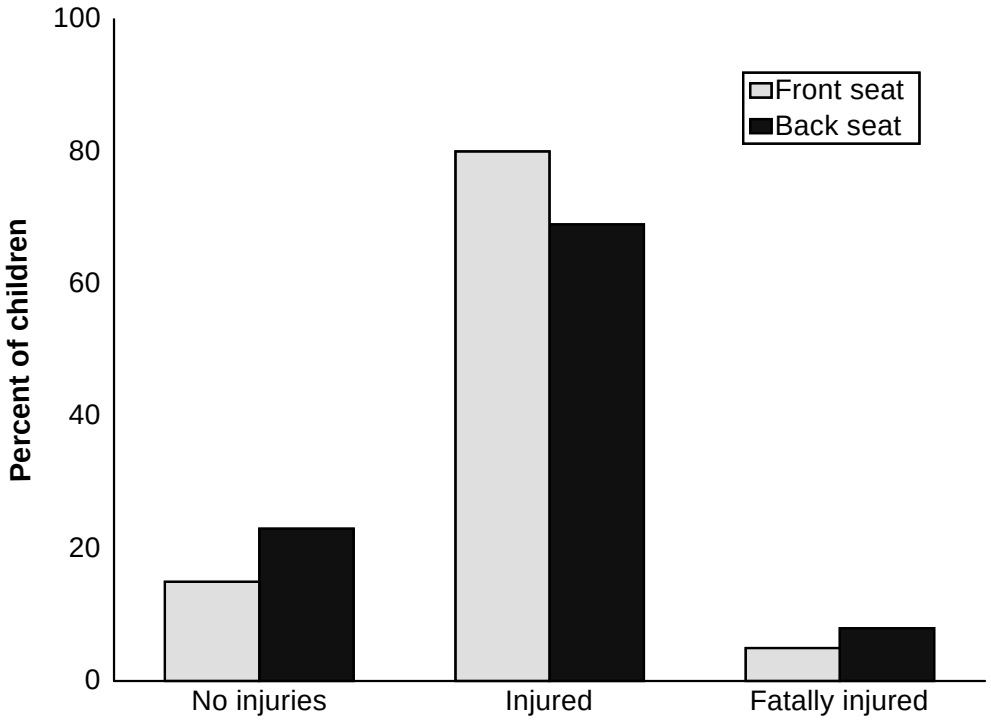


Figure 4.20—Injury status of children seated in the front and back seats of the accident vehicles.

Effect of Seat Location on Injury Severity

Front Seat Versus Back Seat.—Most of the children were seated in the back seats of the vehicles; 133 children were in the back seats compared to 55 in the front seats. The children in the back seats were less likely to sustain injury: 23 percent (n = 31) sustained no injury compared to 15 percent (n = 8) in the front seats. Children in the back seats were also less likely to sustain minor to critical injuries: 68 percent (n = 91) in the back seats compared to 80 percent (n = 44) in the front seats (figure 4.20).

Eleven children seated in back seats sustained fatal injuries. All but one of the children were either in the inappropriate restraint and/or the restraint was used improperly. The Board could not determine the type of recommended restraint for a 5-year-old, lapbelted child seated in the back seat because height and weight data for this child were not available (case 9). Based on age, however, this child should have been restrained in a booster seat rather than a lapbelt.

Center Rear Seating Position.—There were 28 children in the center rear seating positions of passenger cars or in the center of the middle seat of station wagons or minivans; 5 of the children were in child restraint systems, 15 used the available lap-only belts, 1 used a lap/shoulder belt, 6 were unrestrained, and restraint use could not be determined for 1 child. Fifteen of the 28 children were in low to moderate severity accidents; none sustained more than a minor injury regardless of restraint use. The only child in the Board's sample who used the center lap/shoulder belt available at the center rear seating position (case 139) sustained no injuries in a low severity accident (Delta V of 9.3 mph).

Twelve children in center rear seats were in high severity accidents; the four children who sustained serious or fatal injuries all wore lap-only belts (cases 9, 25, 30, and 83). One fatally injured child (case 25), who sat in front of another child in the same seating position and shared the available lap-only belt, sustained extensive belt-induced abdominal injuries in addition to head and spinal injuries. The other child at the same seating position sustained only moderate injuries, including abdominal bruising from the lap-only belt. One child (case 83) sustained serious facial fractures as a result of a loose lap-only belt. The remaining eight children in high severity accidents sustained minor or moderate injuries; three were in forward-facing child restraint systems, three were in lap-only belts, and two were unrestrained.

Chapter 5

Measures to Improve Child Protection

The Safety Board's study found that more than two-thirds of the children in the sample were not in the appropriate restraint for their age, height, and weight; over half of the children who used child restraint systems were improperly restrained; and about one-quarter of the children who used seatbelts were improperly restrained. The Board examined various measures to improve child restraint and seatbelt use, including educational outreach, improvements to design and installation, and State legislative initiatives.

Education

Because of the large number of children who were not in the appropriate restraint and who were improperly restrained, the Safety Board is concerned that educational information about proper restraint use either is not reaching parents and caregivers or the consequences of not properly using child restraint systems, booster seats, and seatbelts apparently are still often misunderstood or ignored. As early as 1979, when child restraint use was mandatory in only one State (Tennessee), NHTSA publications were addressing the importance of using child restraints properly.[85] The Safety Board has addressed the issue of improper use in several reports: in its 1983 study on child restraints, in a 1985 symposium on ways to decrease misuse, and in its 1988 study on the performance of lap and shoulder belts.[86] In its 1983 study, the Board concluded that "misuse of child restraint systems appears to be a significant and widespread problem. While in some kinds of accidents, a misused child restraint system may still provide some protection, misuse can reduce or totally negate the protection provided by a child restraint system." Improper use of child restraints continues today at the same high levels:

[85] National Highway Traffic Safety Administration. 1979. EarlyRider Educational Curriculum. DOT HS 805 060. Washington, DC. November.

[86] (a) National Transportation Safety Board. 1983. Child Passenger Protection Against Death, Disability, and Disfigurement in Motor Vehicle Accidents. Safety Study NTSB/SS-83/01. Washington, DC. (b) National Transportation Safety Board. 1985. Child Passenger Safety Symposium: Ways To Increase Use and Decrease Misuse of Child Restraints. Safety Study NTSB/SS-85/03. Washington, DC. (c) National Transportation Safety Board. 1988. Performance of Lap/Shoulder Belts in 167 Motor Vehicle Crashes (Volume 1). Safety Study NTSB/SS-88/02. Washington, DC.

75 percent in 1983, 64 percent in 1984,[87] 80 percent in 1995,[88] and 62 percent in the Board's current study. These continued high misuse rates suggest that it is difficult to educate parents and caregivers about child passenger protection (child restraints, seatbelts, and air bags), especially about these important points:

- air bags were not designed to protect children;
- seatbelts can injure children who should be in child restraint systems;
- children should be properly secured in the appropriate restraint system for their age, height, and weight;
- child restraint systems must be properly secured in the vehicle; however, seatbelts may not be compatible with child restraints; and
- children should be positioned, whenever possible, in the back seat of vehicles.

The NHTSA brochure *Are You Using It Right?* (see appendix H) and NHTSA's eight child passenger safety tips (see appendix A) are clearly written and explain many of the problems that parents and caregivers encounter in choosing and using child restraint systems.[89] The Safety Board believes that NHTSA has made comprehensive and continuous attempts to address the improper use problem through educational efforts.

However, many of the organizations working with NHTSA to promote proper use of child restraint systems do not focus exclusively on child passenger safety nor do they all have permanent funding to do so. Further, the number of organizations and the personnel involved change from year to year. For example, in 1984, there were 33 national organizations involved in promoting child passenger safety. However, as table 5.1 shows, only 11 national organizations that were involved in promoting child passenger safety in 1984 are still involved today, according to NHTSA's 6th Quarterly Safe & Sober Planner.

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[87] (a) Shelness, Annemarie; Jewett, Jean. 1983. Observed Misuse of Child Safety Seats. Child Injury and Restraint Conference Proceedings Pap. 207-215. Warrendale, PA: Society of Automotive Engineers. (b) National Highway Traffic Safety Administration. 1984. The Incidence and Factors Associated With Misuse. Prepared by Goodell-Grivas, Inc. Washington, DC. December.

[88] Knoebel, K.Y.; Decina, L.E. 1995. Patterns of Misuse of Child Safety Seats: Final Statistical Analysis. Report to NHTSA. Malvern, PA: Bionetics Corporation, KETRON Division. October 2.

[89] The set of eight safety tips about using child restraint systems was part of NHTSA's 6th Quarterly Safe & Sober Planner (DOT HS 808 303) issued in 1995. An example of NHTSA's efforts to promote proper use through the Planner and a list of child passenger safety advocates who currently work with NHTSA on this issue are contained in appendix M of this report.

Table 5.1—Agencies and organizations that have been or are currently involved in promoting child passenger safety (continued)

Government agency or organization	Involved in 1984	Involved in 1996	Have remained involved from 1984 through 1996
National Highway Traffic Safety Administration	✔	✔	✔
U.S. Department of Health and Human Services	✔	✔	✔
Action for Child Transportation Safety	✔		
American Academy of Family Physicians	✔		
American Academy of Pediatrics	✔	✔	✔
American College of Obstetricians and Gynocologists	✔		
American Dental Association and Auxiliary	✔		
American Hospital Association	✔		
American Nurses Association	✔		
American Public Health Association	✔		
American Red Cross	✔		
American Trauma Association	✔		
Automotive Safety for Children	✔	✔	✔
Boy Scouts of America	✔		
Center for Injury Prevention		✔	
Children's Safety Network		✔	
CSN Economics and Insurance Resource Center		✔	
DANA Foundation		✔	
EK & Company		✔	
Future Farmers of America	✔		
General Federation of Women's Clubs	✔		
Girl Scouts of America	✔		
Healthy Mothers/Healthy Babies	✔		
Insurance Institute for Highway Safety	✔	✔	✔
International Association of Chiefs of Police	✔		
Mary Greely Medical Center		✔	
Midas "Project Safe Baby"		✔	

Table 5.1—Agencies and organizations that have been or are currently involved in promoting child passenger safety (continued)

Government agency or organization	Involved in 1984	Involved in 1996	Have remained involved from 1984 through 1996
National Association of Elementary School Principals	✔		
National Center for Health Education	✔		
National Association of State Directors of Law Enforcement Training	✔		
National Association for the Education of Young Children	✔	✔	✔
National Association of Secondary School Principals	✔		
National Child Passenger Safety Association	✔		
National Easter Seals Society		✔	
National Extension Homemakers Council	✔		
National Parent & Teachers Association	✔		
National Safe Kids		✔	
National Safety Belt Coalition		✔	
National Safety Council	✔	✔	✔
National Sheriff's Association	✔		
Physicians for Automotive Safety	✔		
Safe America Foundation		✔	
Safe Ride News	✔	✔	✔
SafetyBeltSafe USA (formerly the Los Angeles Child Passenger Safety Association	✔	✔	✔
Shelness Productions	✔	✔	✔
Shinn and Associations, Inc.	✔	✔	✔
U.S. Fire Administration		✔	
Wisconsin Information Network for Safety		✔	

Sources: (a) National Highway Traffic Safety Administration. 1995. 6th Quarterly Safe & Sober Planner. DOT HS 808 303. Washington, DC. September. (b) National Child Passenger Safety Association. 1985. Child Passenger Protection Report. Fall issue.

Over the past 20 years, four organizations dedicated exclusively to child passenger safety were founded: Physicians for Automotive Safety (1966–1989), Action for Child Transportation Safety (1971–1983), the National Child Passenger Safety Association (1983–1990), and SafetyBeltSafe USA (1990–present).[90] All were primarily funded by membership dues and worked on limited budgets.[91] Only SafetyBeltSafe USA exists today; it has a part-time staff of about 15 and an annual budget of about $300,000.[92] In addition, Federal funding of *Safe Ride News*, the national newsletter for child passenger safety advocates, is being phased out, and the newsletter is in jeopardy if it cannot sustain itself on membership subscriptions. Although many efforts have been initiated at the national, State, and local levels to educate parents and caregivers about why and how to use child restraints and seatbelts for children, these efforts are often short lived, vary in quality and frequency, and are limited by resources. The Safety Board is concerned that the lack of a stable, cohesive approach may adversely affect efforts to educate parents and caregivers about how to properly use child restraints; why to use the appropriate restraint for the child's age, height, and weight; and how to reduce the risk of injury severity by placing children in the back seat of a vehicle. The Safety Board is aware that millions of dollars are spent on advertising for the sale of automobiles and child restraint systems. The Safety Board believes that given the amount of money allocated to promote these products and the harm that can result from using the inappropriate child restraint system and using it improperly, providing stable funding for child passenger protection education should not be the problem that it has been in the past. Accordingly, the Board believes that NHTSA should review, through its Blue Ribbon Panel[93] comprising child passenger safety advocates, automobile and child restraint manufacturers, and automobile insurance providers, the various efforts that promote child passenger safety, and then develop and implement a plan to ensure coordinated, comprehensive, continuing programs and stable funding for these programs.

General Motors (GM) and the National Safe Kids Campaign announced on June 13, 1996, a $10 million, 5-year partnership to reduce misuse of child restraint systems. The campaign will include technical training for GM dealership personnel in the proper use of child restraint systems, promotional events at dealerships to provide parents and caregivers with information on proper use, health education efforts, and a national media

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[90] SafetyBeltSafe USA was originally founded in 1980 as a local advocacy group named the "Los Angeles Child Passenger Safety Association." The group changed its focus to national issues in 1990.

[91] The National Child Passenger Safety Association was originally funded by a NHTSA grant of $100,000 for 2 years. When the grant money ended, the organization could not sustain itself on membership dues.

[92] Safety Board staff communication with Stephanie Tombrello, Executive Director of SafetyBeltSafe USA, July 26, 1996.

[93] On February 13, 1995, NHTSA announced the creation of a Blue Ribbon Panel on child restraint and vehicle compatibility to explore options for communicating the current issues of compatibility and for improving the compatibility between child restraint systems and vehicle seating positions and seatbelt systems.

campaign.[94] The Safety Board commends GM and the National Safe Kids Campaign on this effort and believes that other automobile manufacturers should provide similar efforts at their dealerships.

Improvements to the Design and Installation of Child Restraint Systems

The Safety Board is concerned that education alone will not resolve the problems associated with child restraint use. Further, the Safety Board believes that the responsibility for ensuring that child restraint systems are used properly should not rest entirely with the parent or caregiver. A child restraint system should be easy to use with simple and straightforward instructions. When purchasing or using most child restraint systems currently available, the parent or caregiver needs specific answers to the following questions:

Purchasing:

- What type and size restraint is appropriate for my child and my vehicle?
- What are the differences between restraints with a harness only, t-shield, or tray-shield?

Securing the child in the restraint system:

- Is the harness in the proper slots?
- Is the harness doubled back?
- Is a harness clip needed and how is it to be used?
- Is the harness tight enough on my child?

Securing the child restraint system in the vehicle:

- What direction should the child restraint system be facing?
- Which seat in the vehicle is best to use for the child restraint system?
- Is a locking clip needed and how is it to be used?
- Is the angle of the vehicle seat cushion appropriate for the rear-facing child restraint system?

[94] Press release dated June 13, 1996, and press package from General Motors and the National Safe Kids Campaign.

- Is the length of the vehicle seat cushion appropriate?
- Is a supplemental seatbelt needed?
- Is there an air bag?

Many of the mistakes parents or caregivers make in securing the child in the child restraint system may be a result of the numerous steps that must often be taken just to secure the child in the restraint system. Manufacturers' instructions are often lengthy and complicated. In the Safety Board's study, over half of the parents or caregivers reported that they had read the child restraint manufacturer's instructions and/or vehicle owner's manual, yet more than half made errors securing the children in their restraints or the restraints in the vehicles. Currently, there are 50 different models of child restraint systems on the market, and the steps and instructions for securing a child in these restraints vary. Because there are so many different models, public information materials cannot possibly address the steps and instructions for each unique design. More uniformity in the design of child restraint systems than currently exists would make it easier for parents and caregivers to properly secure the child in the restraint system. Therefore, the Safety Board believes that the child restraint manufacturers, in conjunction with NHTSA, should evaluate the design of child restraint systems, with the goal of simplifying placement of a child in a restraint system. Further, the Safety Board believes that the child restraint manufacturers should also simplify the written and visual instructions provided to consumers regarding the installation of child restraint devices.

Securing a child restraint system properly in the vehicle is also complicated by a number of incompatibilities related to the design of child restraint systems and vehicles and vehicle seatbelts. The child restraint manufacturers have, in the past, attempted to reduce installation problems associated with child restraint systems and vehicle seatbelts through modifications to child restraint systems. Tethers, which were utilized on child restraint systems in the 1970s and early 1980s and extensively misused, were eliminated, and child restraint system frames were redesigned to eliminate errors in routing the vehicle seatbelt.

Despite the modifications, compatibility between vehicle seatbelts and child restraint systems has posed problems since the mid-1980s. In 1984, a Children's Restraint Systems Task Force of the Society of Automotive Engineers (SAE) met to discuss these problems. The problems at the time, as identified in the Rationale Statement for the SAE Recommended Practice J1819,[95] were (a) seatbelts that did not hold a child restraint tightly, (b) automatic belts that require supplemental hardware, and (c) vehicle seats with rounded corners that did not provide firm support for a child restraint. The reasons for the seatbelts not holding a child restraint tightly included (a) lapbelts with emergency locking retractors

[95] Society of Automotive Engineers. 1990. J1819 Recommended Practice Securing Child Restraint Systems in Motor Vehicle Rear Seats. Warrendale, PA. November. The practice issued in 1990 related to rear seating positions. The practice was revised in 1994 to address front seating positions.

that give adults freedom of movement but do not hold child restraint systems tightly, (b) seatbelts anchored forward of the seat cushion/seatback intersection that allow forward motion of the child restraint no matter how tight the seatbelt is pulled, and (c) the length and design of certain lapbelt buckles and belts that cause them to be in a position to loosen as they bend around the frame of the child restraint system to follow the belt path for the vehicle seatbelt. SAE J1819 covers specifications related to seatbelt adjustment hardware, webbing length, and contact points and is a voluntary practice for the automobile and child restraint manufacturers to use. SAE J1819 has resolved some of the problems of compatibility such as the location of the belt path for the vehicle seatbelt and the length and size of the vehicle seatbelt buckle. All manufacturers, however, do not adhere to this voluntary practice.

In July 1991, NHTSA issued a request for comments on possible upgrades to FMVSS 213, "Child Restraint Systems."[96] Items under consideration included test dummy size and weights, vehicle test seat characteristics, proper labeling of allowable child weights and heights, crash test performance measures, lap/shoulder belt test procedures, and air bag/child restraint interaction. The Safety Board's comments to NHTSA are contained in appendix G.

In December 1991, NHTSA issued a supplemental notice and request for comments on whether lapbelts or the lap portion of lap/shoulder belts should be capable of tightly securing a child restraint system; this issue was referred to as "lockability."[97] The Safety Board supported the need for such action (see appendix G for the Board's comments). The Board's current study highlights the need for that action: there were 21 cases in which the vehicle seatbelts would not tightly secure the child restraint systems. NHTSA issued a final rule on October 13, 1993, requiring that seatbelts be capable of tightly securing a child restraint system without the need for any supplemental hardware. Vehicles manufactured after September 1, 1995, must meet this requirement.[98]

Although there has been repeated dialogue regarding the issue of incompatibility since 1984, the fact that many of the problems still exist 12 years later raises concern about the efforts of NHTSA, the child restraint manufacturers, and the automobile industry to resolve this issue in a timely manner. Although the concern that vehicle seatbelts could not tightly secure a child restraint system was formally raised in 1984, it took NHTSA 7 years to issue a supplemental notice of proposed rulemaking, another 2 years to issue a final rule, and then 2 additional years for the rule to become effective (September 1995). In the interim 11 years, parents continued to have problems properly securing child restraint systems in the vehicle. Because the lockability rule only became effective on September 1, 1995, problems securing child restraint systems in vehicles will

[96] Federal Register, Vol. 56, No. 137, dated July 17, 1991.

[97] Federal Register, Vol. 56, No. 235, dated December 6, 1991.

[98] Federal Register, Vol. 58, No. 196, dated October 13, 1993.

continue until all of the pre-1995 vehicles are out of service. The Safety Board estimates that it will take roughly 20 years for this to occur.

The Board's study provides evidence that children in the back seat of the vehicle are less likely to sustain injury than children in the front seat. The Board's study found about an 8 percent difference in the frequency of injuries between the front and back seat in accidents: 23 percent of the children in the back seat sustained no injury compared to 15 percent of the children in the front seat. A review of 1993 data from the NHTSA General Estimates System (GES) showed that about 56 percent of child occupants involved in police-reported accidents were in the back seat. Additional analysis of the GES showed that children in the back seat are less likely to sustain injury. Other research supports this finding.[99] Further, the current design of air bags makes it essential for children to ride in the back seat of the vehicle. The Safety Board believes that several immediate design changes should be considered by NHTSA, the vehicle manufacturers, and child restraint system manufacturers that will encourage placing children in the rear seat of vehicles, thus improving child passenger protection.[100]

Integrated Restraints.—Integrated restraints eliminate the need for supplemental hardware, eliminate restraint system availability problems, encourage use of the back seat where the integrated restraint is installed, and provide restraint systems specifically designed for children. Chrysler and Volvo introduced integrated restraints in their vehicles in the early 1990s: Chrysler offered an integrated toddler and belt-positioning booster seat in its model year 1992 minivan, whereas Volvo offered an integrated belt-positioning booster seat for use with the lap/shoulder belt at the center rear seating position beginning in model year 1991.[101] Currently, 7 automobile manufacturers offer integrated restraints in 31 vehicle models (see appendix N), thus encouraging parents and caretakers to transport children in the back seat. The Safety Board believes all automobile manufacturers should offer integrated restraints in their passenger vehicles for sale in the United States.

Universal Anchorage System.—On May 30, 1995, the Blue Ribbon Panel issued 27 recommendations directed at government, industry, and consumer groups to facilitate the proper and secure installation of child restraint systems in vehicle seating positions (see appendix O).[102] The Panel determined that the best long-range resolution to the compatibility problem was probably a separate anchorage system for installing child restraint systems in

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[99] Huelke, Donald F. 1995. Rear Seat Occupants in Frontal Crashes—Adults and Children: The Effects of Restraint Systems. In: Proceedings, 1995 IRCOBI [International Research Council on the Biomechanics of Impact] Conference; 1995 September 13-15; Brennen, Switzerland. Bron, France: IRCOBI: 421-427.

[100] Design changes related to child restraint systems are discussed here. Additional design changes related to vehicle seatbelts are discussed later in this chapter.

[101] Safe Ride News. 1991. Product Notes. Elk Grove, IL: American Academy of Pediatrics; Summer 10(3).

[102] American Coalition for Traffic Safety, Inc. 1995. Blue Ribbon Panel on Child Restraint & Vehicle Compatibility Recommendations. Arlington, VA. May 30.

vehicles not equipped with an integrated child restraint system. This anchorage system has been in development by the International Standards Organization Working Group on Child Restraint Systems for more than 5 years.[103] The Blue Ribbon Panel recommended that NHTSA thoroughly evaluate a universal anchorage system, including appropriate crash modes and child comfort issues.

On June 28, 1996, six automobile manufacturers, five child restraint manufacturers, and one seatbelt supplier jointly petitioned NHTSA to promulgate rulemaking that would require vehicle manufacturers to provide a uniform child restraint anchorage.[104] The petition also requested NHTSA to promulgate rulemaking that would require the child restraint manufacturers to provide child restraint designs that are compatible with the universal anchorage system and existing vehicle seatbelts.

On July 1, 1996, Cosco, a major manufacturer of child restraint systems, petitioned NHTSA to promulgate regulations requiring that vehicle manufacturers install a universal child restraint anchorage system that consists of a Type 1 vehicle belt (a lap-only belt) anchored to the floor or frame of the vehicle or the vehicle seat at two attachment points. According to the petition, vehicle manufacturers would be required to install this anchorage system at the center and one of the outermost forward-facing second row designated seating positions in vehicles that have second row seats; in vehicles without second row seats or second row seats that cannot accommodate a rear-facing child restraint system, the anchorage system would be installed in at least one forward-facing front designated seating position. NHTSA has informed the Safety Board that it intends to take action on the June 28 and July 1 petitions by the end of 1996.

Because integrated restraints do not accommodate the group of children who need to be rear-facing (infants up to 1 year old), uniformity in the installation of child restraint systems is also needed. In addition, each vehicle may not have an integrated restraint installed in every seat position where a child for whom an integrated restraint would be appropriate needs to be positioned, thus requiring use of a forward-facing child restraint system. More uniformity in the installation of child restraint systems than presently exists will eliminate many of the problems that parents and caregivers encounter when installing currently designed child restraint systems. Therefore, the Safety Board believes that NHTSA should revise the necessary Federal Motor Vehicle Safety Standards to provide for the secure and uniform installation of child restraint systems.

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[103] The International Standards Organization (ISO) establishes voluntary standards on the international level in a variety of areas. Its counterpart in the United States for automotive and child restraint matters is the SAE.

[104] Letter to the Honorable Ricardo Martinez, M.D., Administrator of NHTSA, dated June 28, 1996, from the following companies: Chrysler, Ford, General Motors, Honda, Isuzu, Subaru, Century, Evenflo, Fisher Price, Gerry, Indiana Mills and Manufacturing, and Kolcraft.

Improvements to Seatbelt Fit for Children

The age at which a child has the bone structure and pelvic shape to support a lap-only or lap/shoulder belt is 5 years old. According to Dr. Richard Stalnaker, a recognized authority on highway safety and biomechanics, "By the age of 5 years, most of the bone structure and shape have developed. So, except for the effects of size, the bone shapes of a 5-year old are very close to those of an adult."[105] A 1977 anthropometric study of children conducted by the University of Michigan reported that a 50th percentile, 5-year-old child would weigh about 40 pounds, stand about 42 inches tall, and have a seated height of about 23.6 inches.[106] Current age, height, and weight guidelines of the American Academy of Pediatrics are comparable (a 50th percentile, 5-year-old boy would be about 40 pounds and 43 inches tall). A child who is only 42 inches tall, however, is too small to be restrained properly in a lap/shoulder belt according to evidence from the Safety Board's study cases (not less than 54 inches tall) and other research.[107]

It is important that lap/shoulder belt users sit back against the vehicle seat to keep the lap portion of the lap/shoulder belt low on the hips. This is difficult for small children to do because "…the thigh length of most children under 7 years is less than the seat base length in most cars. Straight legs are not comfortable for a sustained period of time, and to place the feet on the floor automatically induces a slouched position and interference of the shoulder belt with the neck."[108]

In 1994, NHTSA examined lap/shoulder belt fit on 155 children ages 6 to 12 positioned in the rear seat of three different vehicles that represented an intermediate-size car, a compact car, and a minivan.[109] NHTSA reported the following:

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[105] Stalnaker, Richard D. 1993. Inconsistencies in State Laws and Federal Regulations Regarding Child Restraint Use in Automobiles. In: Child Occupant Protection. SP-986. Warrendale, PA: Society of Automotive Engineers: 51-62 (p. 51).

[106] Society of Automotive Engineers. 1980. Anthropometry of Infants, Children, and Youths to Age 18 for Product Safety Design. SP-450. Warrendale, PA. [Originally published by the Highway Safety Research Institute, University of Michigan, May 1977, Final Report UM-HSRI-77-17.]

[107] (a) National Highway Traffic Safety Administration. 1994. Study of Older Child Restraint/Booster Seat Fit and NASS Injury Analysis. DOT HS 808 248. Washington, DC. (b) Stalnaker, Richard D. 1993. Inconsistencies in State Laws and Federal Regulations Regarding Child Restraint Use in Automobiles. In: Child Occupant Protection. SP-986. Warrendale, PA: Society of Automotive Engineers: 51-62 (p. 51).

[108] MacKay, Murry, Ph.D., D.Sc. 1989. Problems With Adult Seat Belts for Restraining Children. Proceedings, IRICOBI [International Research Council on the Biomechanics of Impact]/NHTSA Workshop on the Future in Child Restraints. September.

[109] National Highway Traffic Safety Administration. 1994. Study of Older Child Restraint/Booster Seat Fit and NASS Injury Analysis. DOT HS 808 248. Washington, DC. The vehicles used in the analysis were a Ford Taurus, Pontiac Sunbird, and Dodge Caravan.

> When older children sit up straight, the widest part of their calves rests on the edge of the seat [see figure 5.1A]. This puts pressure on their legs and causes discomfort. Instead of sitting like this, they will scoot forward to let their legs hang more comfortably as shown in [5.1B]. This makes them slouch, often causing the lapbelt to slide up onto their abdomens and their faces to become closer to the shoulder belt. One of the reasons why booster seats work is that they discourage this slouching. As figure [5.1C] illustrates, the booster lifts them up so their legs rest more comfortably on the edge of the seat. Very small children do not have this problem…because they can comfortably rest their entire legs on the seat; neither do adults…because their legs are long enough to reach the floor comfortably.

NHTSA further concluded that "the minimum size child in this study who could use three-point belts alone had a sitting height of 74 cm [29.6 inches], standing height of 148 cm [59.2 inches], and weight of 37 kg [82 pounds]."

The Safety Board's current study found that small children are not likely to use adult seatbelts (lap-only belts and lap/shoulder belts) properly. (In the Board's sample, 37 children who wore lap-only belts or the lap portion of a lap/shoulder belt and 15 children who wore lap/shoulder belts should have been in a child restraint system or booster seat.) The Board found that 12 of 37 children who wore lap-only belts sustained injuries of moderate or worse severity. These children typically sustained head, abdominal, and spinal injuries. The abdominal and spinal injuries were lapbelt-induced; the head injuries were the result of not having upper torso protection. The Board's cases also provide evidence that shoulder belts do not properly fit children shorter than 54 inches (standing height) and that lap/shoulder belts can also produce abdominal injuries. These findings are consistent with the Safety Board's previous studies on the performance of lap-only belts and lap/shoulder belts and with highway safety research.[110] Consequently, in this study, the Board examined several measures to improve seatbelt fit for children.

Belt-Positioning Booster Seats.—The use of booster seats is one method to improve seatbelt fit for children. The Safety Board study suggests, however, that booster seats, and in particular belt-positioning booster seats, are not recognized or understood by the public as the next step in child passenger protection after a child outgrows a child restraint system. Rather, once a child outgrows a child restraint system, the child often uses the vehicle seatbelts. This is clearly shown in the Board's study by the number of children who used the vehicle seatbelts, yet according to their height and weight should have been in booster seats. Further, the Board's study shows that the children who should have been in booster seats often misused the shoulder portion of the lap/shoulder belt because it did not fit comfortably.

[110] Society of Automotive Engineers. 1993. Child Occupant Protection. SP-986. Warrendale, PA.

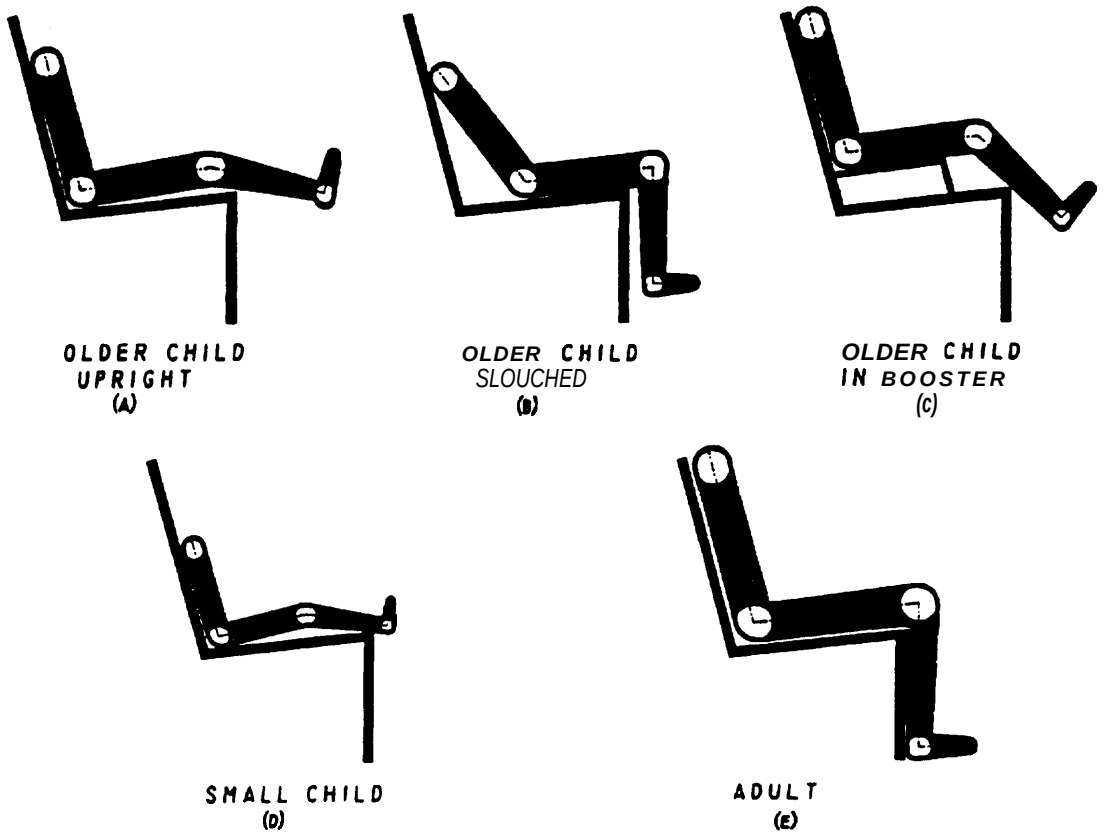

Figure 5.1—Differences in sitting height of various vehicle occupants. (Source: National Highway Traffic Safety Administration. 1994. Study of Older Child Restraint/Booster Seat Fit and NASS Injury Analysis. DOT HS 808248. Washington, DC.)

The American Academy of Pediatrics (AAP) and NHTSA guidelines for parents and caregivers, on the size child that can appropriately use booster seats, conflict with NHTSA's FMVSS 213 and child restraint system manufacturers' instructions (see appendix L). Most belt-positioning booster seats are labeled by the manufacturer for use by children up to 60-65 pounds (the average weight of an 8-year-old child is about 60 pounds). However, guidelines of the AAP and NHTSA recommend that children up to 70 pounds use booster seats, and some belt-positioning booster seats can fit children who weigh up to 80 pounds, according to NHTSA.[111] Fit would be dependent on the child's height and weight. Current FMVSS 213 requirements, however, apply only to child restraints that can restrain children up to 50 pounds. The need for booster seats that fit children above 60 pounds was shown in the Board's study: there were 19 children in the Board's sample who exceeded the 60-pound manufacturer-recommended weight limit for

[111] National Highway Traffic Safety Administration. 1994. Study of Older Child Restraint/Booster Seat Fit and NASS Injury Analysis. DOT HS 808248. Washington, DC.

booster seats but were too short for lap/shoulder belts. The Safety Board is concerned that booster seats that restrain children who weigh more than 50 pounds are not subject to any performance standards; however, booster seats are necessary for some children above that weight. Therefore, the Safety Board believes that NHTSA should revise FMVSS 213 to establish performance standards for booster seats that can restrain children up to 80 pounds.

Adjustable Upper Anchorages.—Adjustable upper anchorages allow an occupant to adjust the height of the shoulder belt anchor upward or downward to better position the shoulder belt on the occupant's shoulder. If the shoulder belt fits comfortably, the occupant is more likely to wear it properly and to obtain the full benefit of the upper torso protection. In its 1988 study on the performance of lap/shoulder belts, the Safety Board concluded that passenger vehicles should provide occupants with the opportunity to adjust the shoulder strap to an angle compatible with the occupant's body size. Accordingly, the Board asked NHTSA to take action:

> Evaluate the possibility of requiring an upper adjustable anchorage point for the shoulder portion of lap/shoulder belts in newly manufactured motor vehicles. (Safety Recommendation H-88-10)

NHTSA did not agree that adjustable upper anchorages should be regulated and took no action on the recommendation. In December 1990, the Safety Board asked the manufacturers of passenger vehicles to take voluntary action:

> Provide in all newly manufactured passenger vehicles an adjustable upper anchorage for the shoulder portion of the seatbelt. (Safety Recommendation H-90-111)

Most automobile manufacturers voluntarily complied with this recommendation which was classified "Closed—Acceptable Action" on May 4, 1996. Safety Recommendation H-88-10 to NHTSA was classified "Closed—No Longer Applicable" on April 17, 1991.

The Intermodal Surface Transportation Efficiency Act of 1991 required NHTSA to address the matter of improved design for safety belts. In response, NHTSA issued a final rule,[112] amending FMVSS 208, to require that Type 2 safety belts installed for adjustable seats in vehicles with a gross vehicle weight rating of 10,000 pounds or less either be integrated with the vehicle seat or be equipped with a means of adjustability to improve the fit and increase the comfort of the belt for a variety of different size occupants. NHTSA's decision to make the requirement applicable only to adjustable seats and to exclude fixed seats has, in effect, excluded back seats. NHTSA's decision to exclude fixed seats is not, in the Safety Board's opinion, consistent with the desire to have children positioned in the back seats of vehicles. Because NHTSA has not required adjustable lap/shoulder belts in back seats, children may be encouraged to sit in the front

[112] Federal Register, Vol. 59, No.148, dated August 3, 1994.

seat where lap/shoulder belts can be adjusted to allow for a proper fit but where they are more likely to sustain injury in accidents. Consequently, the Safety Board believes that to further promote use of the back seat by children, NHTSA should revise FMVSS 208 to require adjustable upper anchorages at all outboard rear seating positions of a vehicle. The Board also believes that the automobile manufacturers should voluntarily install adjustable upper seatbelt anchorages at all outboard rear seating positions in all newly manufactured passenger vehicles for sale in the United States.

Seatbelt Adjusters.—A number of devices known as seatbelt adjusters are available that reposition the lap/shoulder belt away from the child's neck. The Safety Board's sample had only one accident (case 69) in which a child used a seatbelt adjuster. The 5-year-old child sustained serious (AIS 3) injuries including pulmonary and hepatic contusions that were caused by the lap/shoulder belt. NHTSA recently tested a number of seatbelt adjusters with crash test dummies representing a 3-year-old, 6-year-old, and 5th percentile female and found that they "produced some degradation in the performance of the lap/shoulder belt system as compared to baseline conditions, depending on the size of the occupant and the impact orientation."[113]

Currently, no Federal agency regulates seatbelt adjusters, and they are not subject to any performance requirements. One seatbelt adjuster was being marketed as "meeting NTSB Standard 213." There is no such standard and the Safety Board wrote to the company on May 17, 1996 advising it of this fact (see appendix P).

On January 31, 1996, the American Academy of Pediatrics petitioned NHTSA to begin rulemaking on the topic of aftermarket, add-on seatbelt positioners. The petition stated the following:

> Although these products, in some cases, may help shoulder harnesses fit as they were designed, the add-on products are not usually tested by anyone other than the manufacturers of the product. This limited testing is problematic, for it allows manufacturers to make claims that whether true or not, cannot be substantiated by independent means.
>
> Because these products are generally marketed as child occupant protection devices, it is believed by the American Academy of Pediatrics that the add-on products should be subject to the same scrutiny and testing that the other child occupant protection devices, notably child safety seats, must undergo. We believe that FMVSS 213 should be expanded to include regulation of these products, and independent testing should be initiated to prove the products' safety.

NHTSA has indicated to the Safety Board that it hopes to take action on the petition by the end of 1996.

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[113] National Highway Traffic Safety Administration. 1994. Evaluation of Devices to Improve Shoulder Belt Fit. DOT HS 808 383. Washington, DC.

The Safety Board is concerned that seatbelt adjusters, as they are currently designed, can negatively influence the injury severity of children in automobile accidents. Although the Safety Board prefers that children who do not fit properly in lap/shoulder belts use belt-positioning booster seats, the Board recognizes that seatbelt adjusters will continue to be marketed and used by children. Accordingly, the Safety Board agrees with the American Academy of Pediatrics and believes that seatbelt adjusters should be subject to testing to determine their performance in reducing injury severity in automobile accidents. Therefore, the Safety Board believes that NHTSA should establish performance requirements for seatbelt adjusters and revise FMVSS 213 accordingly.

Center Rear Lap/Shoulder Belts.—In NHTSA's safety tips for using child restraint systems, the agency indicates that the back seat is usually safer than the front seat and that the middle of the back seat is the safest location because it "is the farthest from danger" (see appendix A, tip #2). In the Safety Board's 1986 study on the performance of lapbelts in 26 frontal collisions,[114] the Board asked NHTSA to take the following action:

> Determine the feasibility of requiring that 3-point lap/shoulder belts be provided at every seating position in newly manufactured passenger vehicles manufactured for sale in the United Sates; if found technically feasible, undertake rulemaking to require such lap/shoulder belts. (Safety Recommendation H-86-47)

In a letter dated March 18, 1994, NHTSA stated that "on balance, we believe that the minimal safety benefits and the greater costs associated with the engineering development of lap/shoulder belt installations in the center positions do not warrant a new regulation." The reasons provided by NHTSA for this conclusion were that fewer than 1.5 percent of all fatalities occur to center rear occupants, and less than 2 percent of all fatalities occur in both front and rear center seats. NHTSA also concluded that engineering problems associated with belt routing and placement of anchor points make installation of lap/shoulder belts at center positions difficult. The Safety Board classified this recommendation "Closed—Reconsidered" on May 3, 1994, with the caveat that if the findings of the current study reveal a problem with injuries to children caused by center lap-only belts at center rear seating positions, the Board may revisit the issue of center rear lap/shoulder belts.

The Safety Board believes that this study continues to support the need for center rear lap/shoulder belts. Unrestrained children in the center rear seating position in the Board's sample sustained less severe injuries than children restrained by lap-only belts in the center rear seating position. Abdominal bruising of moderate or worse severity and head injuries were typical of the injuries sustained by the children using lap-only belts. Although NHTSA expressed concerns about the engineering problems associated with belt routing and placement of anchor points for lap/shoulder belts at center rear positions,

[114] National Transportation Safety Board. 1986. Performance of Lap Belts in 26 Frontal Collisions. Safety Study NTSB/SS-86/01. Washington, DC.

the Safety Board is aware that 13 different automobile manufacturers are offering center rear lap/shoulder belts in 26 different model 1996 vehicles (see appendix Q). The engineering concerns expressed earlier by NHTSA no longer appear to be a problem. According to NHTSA, 1.4 percent of injured occupants are seated in the center rear seating position, 3.8 percent in the left rear seating position, and 5 percent in the right rear seating position.[115] The Safety Board believes that occupants seated in the center rear seat should be afforded the same level of protection as other occupants of the rear seat, who have been afforded lap/shoulder belts since January 1, 1990. Further, belt-positioning booster seats, which are designed to be used with lap/shoulder belts, are an important, easy-to-use, and markedly underutilized safety device for children. A center rear lap/shoulder belt provides an additional seating position for a belt-positioning booster seat. Therefore, the Safety Board believes that NHTSA should require installation of center rear lap/shoulder belts in all newly manufactured passenger vehicles for sale in the United States. The Board also believes that the automobile manufacturers should voluntarily install center rear lap/shoulder belts in all newly manufactured passenger vehicles for sale in the United States.

Legislative Measures to Ensure That Children are Secured in the Appropriate Restraint

Although all 50 States require children under a specified age to be in a child restraint system and 49 States require occupants to use seatbelts,[116] the ages of the occupants covered under these laws vary considerably among States. Only 12 States and 2 U.S. Territories (referred to as States for the remainder of this discussion) require all occupants in all seating positions to be restrained under the State's seatbelt use law (see appendix B).

Forty-three States and the District of Columbia allow substitution of a seatbelt for a child restraint system;[117] in some States, children age 1 year or younger can use a seatbelt rather than a child restraint system if they are in rear seating positions (figure 5.2 and appendix B). In addition, 26 States have gaps in their laws that permit children to be unrestrained: 21 States permit children younger than 8 years—who should be in some type of child restraint system—to be unrestrained (figure 5.3). Drivers of out-of-State vehicles are exempt from restraining 3- to 6-year-old children in six States, and four States exempt

[115] National Highway Traffic Safety Administration. 1994. Traffic Safety Facts, 1993. DOT HS 808 169. In addition to the injured occupants in the rear seating positions, 65.8 percent of injured occupants are drivers, and 22.8 percent are right front seat passengers.

[116] New Hampshire, the only State without a mandatory seatbelt use law, has a child restraint law that requires children under the age of 12 to be restrained.

[117] Information on seatbelt substitution was not available for the Northern Mariana Islands.

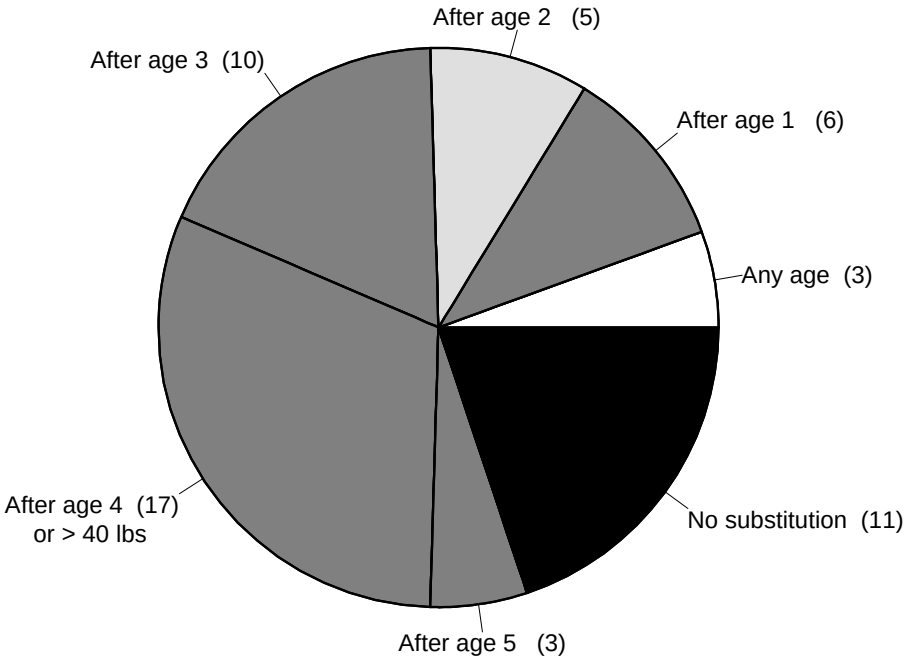

Figure 5.2—Age at which States, U.S. Territories, and the District of Columbia allow substitution of seatbelt use for child restraint systems, and the number of States with such provisions. Nine States permit the seatbelt to be substituted only if the child is in the back seat. Information on the Northern Mariana Islands was not available.

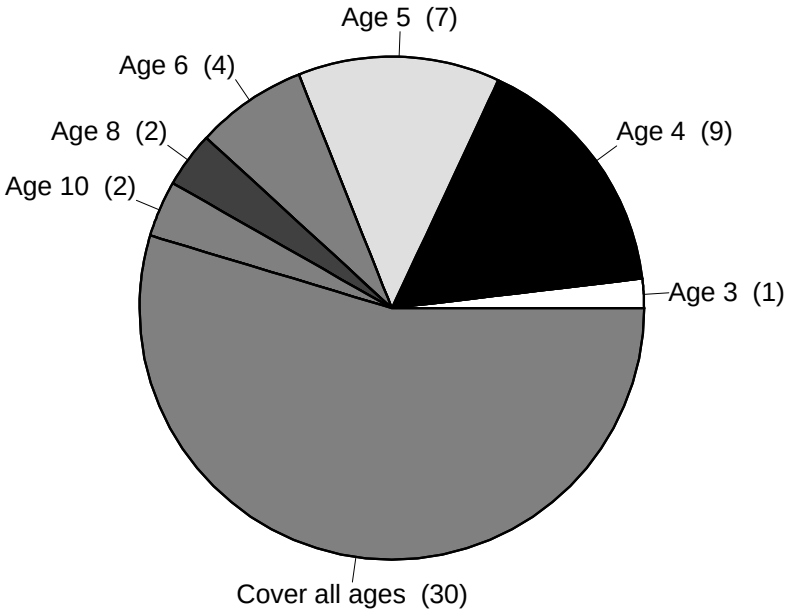

Figure 5.3. Age at which children are not covered by the child restraint or seatbelt use laws of their State, U.S. Territory, or the District of Columbia.

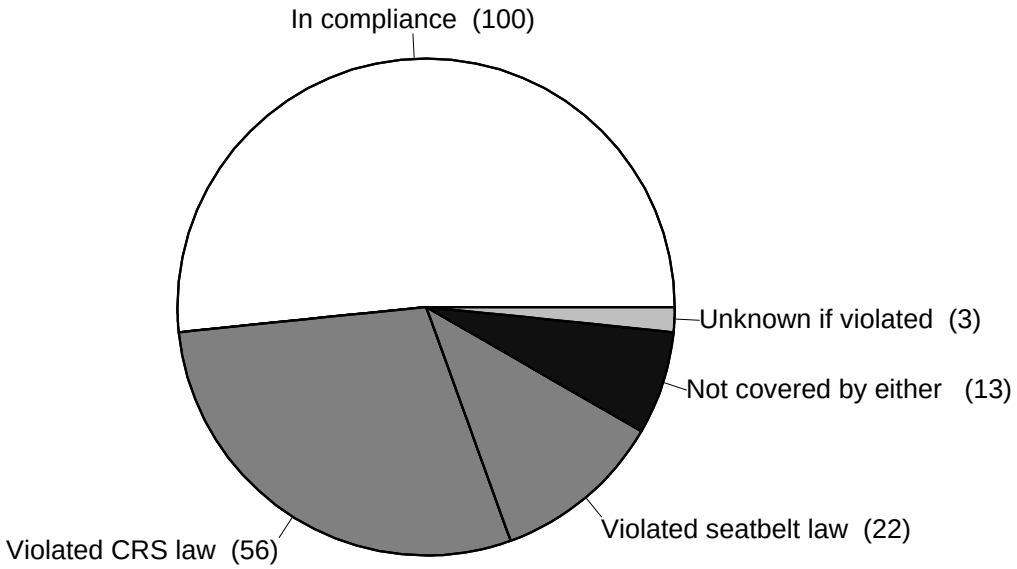

Figure 5.4—Compliance of children in the study sample with the child restraint system (CRS) or seatbelt use law of their State, U.S. Territory, or the District of Columbia.

the driver from restraining the child if the driver is not the child's parent/guardian. More importantly, few State laws encourage or require the use of booster seats for children between 40 and 60 pounds.

In the Board's sample of 194 children, 138 children were covered by their State's child restraint use law and 43 were covered by their State's seatbelt use law. Thirteen children were not covered by either law. (See figure 5.4.) Many of the children in the sample were not in compliance with their State's laws (n = 78). Fourteen children were inappropriately restrained by a seatbelt instead of a child restraint system, but their State's law did not permit the substitution, and 21 additional children under age 5 substituted seatbelts in accordance with their State's law.

Children of all ages need to be properly restrained and should be covered by State child restraint and seatbelt use laws. Analysis of the Board's sample indicates that child restraint and seatbelt use laws need to be strengthened and enforced in several ways. The Safety Board believes that the legislatures of the 50 States, the U.S. Territories, and the District of Columbia should review existing laws and enact legislation, if needed, that would (a) ensure that children up to 8 years old are required by the State's mandatory child restraint use law to use child restraint systems and booster seats; (b) eliminate

exemptions for children to substitute seatbelts in place of child restraint systems; and (c) require children 8 years or older to use seatbelts in all vehicle seating positions.

Finally, the Safety Board believes that many of the problems related to child passenger safety, such as the dangers that air bags pose to children, can be resolved by ensuring that children are in the back seats of vehicles. The Board has made several recommendations to NHTSA that would promote use of the back seat for children through improvements in the design and installation of child restraint systems and seatbelt fit for children. Therefore, the Board believes the Governors should emphasize the importance of transporting children in the back seat of passenger vehicles through educational materials disseminated by the State. Further, the States should consider setting aside one-tenth of 1 percent from all motor vehicle insurance premiums for policies written to establish a highway safety fund to be used for this and other safety efforts.

In 1994, nearly $114 billion in automobile insurance was written nationally. If only one-tenth of 1 percent were set aside from each policy, about $110 million could be made available to States for highway safety education and enforcement. Nominal contributions from other entities using highways or contributing to highway accidents could also be considered. Possible sources include 25 cents for every registered vehicle, $5 for each new car sold, one-tenth of a cent for each gallon of fuel, or 5 cents for each gallon of alcohol sold.

These contributed funds should be viewed as investments rather than as taxes or user fees. Research has shown that for every dollar spent on highway safety programs, impressive gains have been made. In British Columbia, insurance claims were reduced by $8 for each $1 spent.[118] In the United States, the benefit derived from traffic and highway safety programs exceeds their costs by a ratio of 31 to 1.[119]

Insurance industry contributions amounting to $4.5 million over 5 years helped fund the North Carolina highway safety education, enforcement, and checkpoint program named “Booze It and Lose It” and “Click It or Ticket.” Results have been impressive in that seatbelt use increased to 83 percent; 10,000 child restraint system violations were issued; alcohol-impaired driving was reduced by 50 percent at the checkpoints; and over 3,000 drug, fugitive, and other criminal arrests have been made.[120] From 1993 through 1995, alcohol-related traffic fatalities declined from 33.9 percent to 27.2 percent. At the same time, insurance rates were reduced by 6 percent. In addition, for the first time in

[118] (a) Insurance Corporation of British Columbia. 1986. Traffic Safety Education: Cost Effectiveness Measurement. Vancouver, BC. February 24. (p. 5). (b) McCarthy, Michael B. [Insurance Corporation of British Columbia]. 1987. Presentation in Anaheim, CA. May 7.

[119] Bischoff, Donald C. 1994. Information: Benefit-Cost Ratios for NHTSA Programs. Washington, DC: National Highway Traffic Safety Administration. October 19.

[120] Long, Jim. 1996. Address to Trauma Conference, Chapel Hill, NC. May 3.

State insurance rate filings, auto insurers recognized a $34 million savings over the first 2 years of this program, and researchers identified a $165 million societal cost savings in the first year of the program.[121]

Insurance premium support for safety is not a new idea in the United States. In Illinois, $1 is set aside from private passenger vehicle comprehensive insurance policies to combat vehicle theft. The program has generated over $31 million in grants since 1992 and has reduced auto theft substantially (24 percent in Chicago).[122] Eight other States have similar programs.[123] Most of these States have established governing boards that include gubernatorial appointments to ensure that the funds received are applied appropriately. In Massachusetts, fire insurance companies reimburse the State for a $100,000 State budget line item under the Division of Fire Services for the Arson prevention program in Suffolk County (Boston). This fund operates the Massachusetts Fire Incident Reporting System and the State Burn Registry.[124]

Many existing mandatory seatbelt use laws lack a provision for primary enforcement. (Only 11 States and 5 U.S. Territories permit a vehicle to be stopped solely for a violation of the seatbelt use law.) On June 20, 1995, the Safety Board issued Safety Recommendation H-95-13 to the Governors of the 39 States that have secondary enforcement of mandatory seatbelt use laws, the two States that, at the time, had no mandatory seatbelt use laws, and the Mayor of the District of Columbia asking that legislation be enacted to provide for primary enforcement of mandatory seatbelt use laws.[125] Because of the importance of enforcement of these laws, the Board's recommendation urged the States to consider provisions such as adequate fine levels and the imposition of driver license penalty points. States with primary enforcement laws average about a 13 percent higher seatbelt use rate than States with secondary enforcement (75 percent versus 62 percent). States with primary enforcement also have a lower fatality rate.[126] On April 30, 1996, the Safety Board added Safety Recommendation H-95-13 to its "Most Wanted" list of safety recommendations. The Board reiterates this recommendation because of the importance of enforcement in ensuring mandatory seatbelt use.

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[121] Press release dated February 14, 1996, from the North Carolina Insurance Commission, Raleigh, NC.

[122] State of Illinois. 1996. Illinois Motor Vehicle Theft Prevention Council Annual Report, 1995. Chicago.

[123] Theft prevention programs that are at least partially funded from insurance policies have been established in Arizona, Florida, Maryland, Michigan, Minnesota, Pennsylvania, Texas, and Utah.

[124] Safety Board staff communication with Jennifer Meith, Commonwealth of Massachusetts, Division of Fire Services, September 1996.

[125] Following the Safety Board's recommendation, the State of Maine enacted a safety belt use law that contains a secondary enforcement measure.

[126] Wagenaar, A.C.; Maybee, R.C.; Sullivan, K.P. 1988. Mandatory Seat Belt Use Laws in Eight States: A Time Series Evaluation. Journal of Safety Research. 19: 51-70.

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Conclusions

1. Children (especially those properly restrained) in the back seats of vehicles are less likely to sustain injury than those seated in the front seats.

2. Children of all ages need to be properly restrained and should be covered by the States' child restraint and seatbelt use laws.

3. Passenger-side air bags, as they are currently designed, are not acceptable as a protective device for children positioned in front of them and can kill or critically injure these children in accidents that would have been survivable had the air bag not deployed.

4. The number of children killed and critically injured in accidents similar to those investigated for the Board's study will continue to increase unless immediate action is first taken to determine the benefits of passenger-side air bags, as currently designed, even though the National Highway Traffic Safety Administration's databases and information provided to NHTSA by an automobile insurance provider suggest there may be some benefits from passenger-side air bags.

5. Air bags are being designed, because of certification testing requirements, primarily to protect unbelted rather than belted vehicle occupants even though the air bags are promoted as supplemental restraint systems and the majority of motor vehicle occupants now use seatbelts.

6. By not using belted child occupants and out-of-position child occupants (belted and unbelted), by not considering the effects of pre-impact braking, and by not considering the seat track in the forward-most position, the National Highway Traffic Safety Administration's air bag performance certification testing is not representative of the actual accident environments.

7. In 9 of the 13 accidents investigated for this study in which there were collisions with other vehicles and passenger-side air bag deployment, the change in velocity was less than 20 mph, yet 5 of the 9 children in the right front passenger seats in these accidents sustained serious, critical, or fatal injuries from contact with the passenger-side air bag (2 of the 5 children were in rear-facing child restraint systems).

8. The additional labeling requirements in the National Highway Traffic Safety Administration's proposed rulemaking of August 6, 1996, by themselves, do not provide sufficient encouragement for automakers to install intelligent air bag systems.

9. The number of fatalities to children from deploying air bags will continue to increase because the National Highway Traffic Safety Administration's proposed rulemaking of August 6, 1996, does not include the nearly 22 million vehicles that will be on the road by the end of 1996 with passenger-side air bags and the estimated 13 million additional vehicles that will be sold each year until the new standards are in effect. Technical solutions that are being considered for advanced air bag systems—such as increasing deployment thresholds, depowering the passenger-side air bag, and installing weight sensors—should also be considered for vehicles on the road.

10. More than two-thirds of the children in the Safety Board's study sample were not in the appropriate restraint for their age, height, and weight; over half of the children who used child restraint systems were improperly restrained; and about one-quarter of the children who used seatbelts were improperly restrained.

11. Over half of the parents or caregivers in the Safety Board's study sample who reported that they had read the child restraint manufacturer's instructions and/or vehicle owner's manual made errors securing the children in their restraints or the restraints in the vehicles.

12. Securing a child restraint system properly in the vehicle is complicated by several incompatibilities related to the design of child restraint systems and vehicles and vehicle seatbelts.

13. Children tended to be in restraint systems too advanced for their development, such as moving from child restraint systems to seatbelts rather than using booster seats.

14. Many of the organizations working with the National Highway Traffic Safety Administration to promote proper use of child restraint systems do not focus exclusively on child passenger safety nor do they all have permanent funding to do so.

15. Integrated restraints eliminate the need for supplemental hardware, eliminate restraint system availability problems, encourage use of the back seat where the integrated restraint is installed, and provide restraint systems specifically designed for children.

16. Booster seats that restrain children who weigh more than 50 pounds are not subject to any performance standards; however, booster seats are necessary for some children above that weight.

17. Because the National Highway Traffic Safety Administration does not require adjustable lap/shoulder belts in back seats of vehicles, children may be encouraged to sit in the front seat where lap/shoulder belts can be adjusted to allow for a proper fit but where they are more likely to sustain injury in accidents.

18. Because seatbelt adjusters, as they are currently designed, can negatively influence the injury severity of children in automobile accidents, they should be subject to performance requirements.

19. Vehicle occupants seated in center rear seating positions should be afforded the same level of protection as other occupants of the back seat, who have been afforded lap/shoulder belts since January 1, 1990. Further, a center rear lap/shoulder belt provides an additional and preferable seating position for a belt-positioning booster seat.

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Recommendations

As a result of this safety study, the National Transportation Safety Board made the following safety recommendations:

To the Governors and Legislative Leaders of the 50 States and U.S. Territories, and to the Mayor and Chairman of the Council of the District of Columbia—

Emphasize the importance of transporting children in the back seat of passenger vehicles through educational materials disseminated by the State. Consider setting aside one-tenth of 1 percent from all motor vehicle insurance premiums for policies written to establish a highway safety fund to be used for this and other safety efforts. (Class I, Urgent Action) (H-96-13)

Review existing laws and enact legislation, if needed, that would:

(a) Ensure that children up to 8 years old are required by the State's mandatory child restraint use law to use child restraint systems and booster seats. (Class II, Priority Action) (H-96-14)

(b) Eliminate exemptions for children to substitute seatbelts in place of child restraint systems. (Class II, Priority Action) (H-96-15)

(c) Require children 8 years or older to use seatbelts in all vehicle seating positions. (Class II, Priority Action) (H-96-16)

To the National Highway Traffic Safety Administration—

Immediately evaluate passenger-side air bags based on all available sources, including National Highway Traffic Safety Administration's recent crash testing, and then publicize the findings and modify performance and testing requirements, as appropriate, based on the findings of the evaluation. (Class I, Urgent Action) (H-96-17)

Immediately revise Federal Motor Vehicle Safety Standard 208, "Occupant Crash Protection," to establish performance requirements for passenger-side air bags based on testing procedures that reflect actual accident environments, including pre-impact braking, out-of-position child occupants (belted and unbelted), properly positioned belted child occupants, and with the seat track in the forward-most position. (Class I, Urgent Action) (H-96-18)

Evaluate the effect of higher deployment thresholds for passenger-side air bags in combination with the recommended changes in air bag performance certification testing, and then modify the deployment thresholds based on the findings of the evaluation. (Class II, Priority Action) (H-96-19)

Establish a timetable to implement intelligent air bag technology that will moderate or prevent the air bag from deployment if full deployment would pose an injury hazard to a belted or unbelted occupant in the right front seating position, such as a child who is seated too close to the instrument panel, a child who moves forward because of pre-impact braking, or a child who is restrained in a rear-facing child restraint system. (Class II, Priority Action) (H-96-20)

Determine the feasibility of applying technical solutions to vehicles currently on the road equipped with passenger-side air bags, and those to be manufactured until new standards become effective, to prevent air bag-induced injuries to children in the passenger-side seating position. (Class II, Priority Action) (H-96-21)

Review, through your Blue Ribbon Panel comprising child passenger safety advocates, automobile and child restraint manufacturers, and automobile insurance providers, the various efforts that promote child passenger safety, and then develop and implement a plan to ensure coordinated, comprehensive, continuing programs and stable funding for these programs. (Class II, Priority Action) (H-96-22)

Evaluate, in conjunction with the child restraint manufacturers, the design of child restraint systems with the goal of simplifying placement of a child in a restraint system. (Class I, Urgent Action) (H-96-23)

Revise the necessary Federal Motor Vehicle Safety Standards to provide for the secure and uniform installation of child restraint systems. (Class I, Urgent Action) (H-96-24)

Revise Federal Motor Vehicle Safety Standard 213, "Child Restraint Systems," to establish performance standards for booster seats that can restrain children up to 80 pounds. (Class II, Priority Action) (H-96-25)

Revise Federal Motor Vehicle Safety Standard 208, "Occupant Crash Protection" to require adjustable upper anchorages at all outboard rear seating positions of a vehicle. (Class II, Priority Action) (H-96-26)

Revise Federal Motor Vehicle Safety Standard 213, "Child Restraint Systems," to include performance requirements for seatbelt adjusters. (Class II, Priority Action) (H-96-27)

Require installation of center rear lap/shoulder belts in all newly manufactured passenger vehicles for sale in the United States. (Class II, Priority Action) (H-96-28)

To the domestic and international automobile manufacturers—

Install enhanced warning labels on all passenger vehicles equipped with passenger-side air bags on the road or to be manufactured prior to the effective date of the requirements proposed by the National Highway Traffic Safety Administration (NHTSA) on August 6, 1996. The labels should be similar to those to be required by NHTSA for installation in newly manufactured vehicles. (Class II, Priority Action) (H-96-29) (Supersedes H-95-19)

Develop and implement a program to reduce the misuse of child restraint systems that would include elements such as technical training for dealership personnel in the proper use of child restraint systems and promotional events at dealerships to provide parents and caregivers with information on proper use. (Class II, Priority Action) (H-96-30)

Offer integrated restraints in passenger vehicles for sale in the United States. (Class II, Priority Action) (H-96-31)

Voluntarily install adjustable upper seatbelt anchorages at all outboard rear seating positions in all newly manufactured passenger vehicles for sale in the United States. (Class II, Priority Action) (H-96-32)

Voluntarily install center rear lap/shoulder belts in all newly manufactured passenger vehicles for sale in the United States. (Class II, Priority Action) (H-96-33)

To the child restraint manufacturers—

Evaluate, in conjunction with the National Highway Traffic Safety Administration, the design of child restraint systems, with the goal of simplifying placement of a child in a restraint system. (Class I, Urgent Action) (H-96-34)

Simplify the written and visual instructions provided to consumers regarding the installation of child restraint devices. (Class II, Priority Action) (H-96-35)

Also as a result of this safety study, the National Transportation Safety Board reiterated the following recommendation to the Governors of the 39 States that have secondary enforcement of mandatory seatbelt laws, the State of New Hampshire that has no mandatory seatbelt use law, and the Mayor of the District of Columbia:

Enact legislation that provides for primary enforcement of mandatory safety belt laws. Consider provisions such as adequate fine levels and the imposition of driver license penalty points. (H-95-13)

On November 2, 1995, while the safety study was being conducted, the National Transportation Safety Board issued the following urgent safety recommendations:

Immediately develop and implement, in cooperation with the National Association of Broadcasters and the Advertising Council, Inc., a highly visible nationwide multi-media campaign to advise the public about the danger of placing a rear-facing child safety seat or an unrestrained small child in the front seat of a vehicle equipped with a passenger-side air bag. (H-95-17, to the National Highway Traffic Safety Administration. The companion safety recommendation, H-95-18, was issued to the Advertising Council and the National Association of Broadcasters.)

Conduct a mail campaign to all registered owners of vehicles equipped with passenger-side air bags that warns of the dangers of placing a rear-facing child safety seat and an unrestrained or improperly restrained small child in the front seat of the vehicle. (H-95-19, to the domestic and international automobile manufacturers.)

Develop and attach to new vehicles with passenger-side air bags a visible warning regarding the dangers of placing a rear-facing child safety seat or improperly restrained small child in the front seat of the vehicle. This warning should be permanent and visible to the front seat passengers at all times. (H-95-20, to the domestic and international automobile manufacturers.)

Conduct a mail campaign to all registered owners of child safety seats that are designed to face rearward that warns of the dangers of placing a rear-facing child safety seat in the front seat of a vehicle equipped with a passenger-side air bag. (H-95-21, to the child restraint system manufacturers.)

Develop and attach to all new child safety seats designed to be used in the rear-facing position a visible flier that warns of the dangers of placing a child safety seat facing rearward in the front seat of a vehicle equipped with a passenger-side air bag. (H-95-22, to the child restraint system manufacturers.)

Conduct a mail campaign to all users and purchasers of the 1990 video "Getting It Right" to advise them that supplemental information regarding the dangers of placing a rear-facing child safety seat in the front seat of a vehicle equipped with a passenger-side air bag needs to be provided to viewers of this video. (H-95-23, to Shinn and Associates, Inc.)

Modify the video "Getting It Right" to ensure that any future distribution of this video includes the appropriate warnings to parents about the dangers of placing rear-facing child safety seats in the seat of a vehicle equipped with a passenger-side air bag. (H-95-24, to Shinn and Associates, Inc.)

Conduct a mail campaign to all persons who have had babies at the hospital in the past year to warn them of the dangers of placing a rear-facing child safety seat in the front seat of a vehicle equipped with a passenger-side air bag. (H-95-25, to the Reading Hospital and Medical Center.)

Ensure that the childbirth education programs and other new parenting classes offered by the hospital include information that warns of the dangers of placing a rear-facing child safety seat in the front seat of a vehicle equipped with a passenger-side air bag. (H-95-26, to the Reading Hospital and Medical Center.)

Ensure that all hospitals with obstetrics units conduct a mail campaign to all persons who have had babies in the past year that warns of the danger of placing a rear-facing child safety seat in the front seat of a vehicle equipped with a passenger-side air bag. (H-95-27, to the Department of Health and Human Services, the American Hospital Association, and the Association of State and Territorial Health Officials.)

Ensure that the childbirth education programs and other new parenting classes include information that warns of the dangers of placing a rear-facing child safety seat in the front seat of a vehicle equipped with a passenger-side air bag. (H-95-28, to the Department of Health and Human Services, the American Hospital Association, and the Association of State and Territorial Health Officials.)

Urge members to contact all persons who have had babies in the past year to warn them of the dangers of placing a rear-facing child safety seat in the front seat of a vehicle equipped with a passenger side air bag. (H-95-29, to the Academy of Certified Birth Educators, American Academy of Family Physicians, American Academy of Pediatrics, American College of Nurse Midwives, International Childbirth Education Association, and American College of Obstetricians & Gynecologists.)

Urge members to ensure that information provided to new parents warns of the dangers of placing a rear-facing child safety seat in the front seat of a vehicle equipped with a passenger-side air bag. (H-95-30, to the Academy of Certified Birth Educators, American Academy of Family Physicians, American Academy of Pediatrics, American College of Nurse Midwives, International Childbirth Education Association, and American College of Obstetricians & Gynecologists.)

Advise parents, through the Newborn Channel and Lamaze Magazine, of the dangers of placing a rear-facing safety seat in the front seat of a vehicle equipped with a passenger-side air bag. (H-95-31, to the Lamaze Publishing Company, Inc.)

By the National Transportation Safety Board

James E. Hall
Chairman

Robert T. Francis II
Vice Chairman

John A. Hammerschmidt
Member

John Goglia
Member

George W. Black, Jr.
Member

Adopted: September 17, 1996

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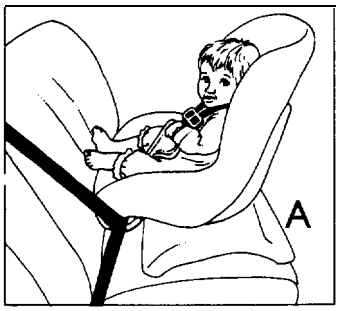
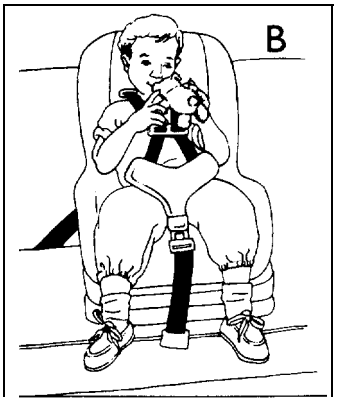
Appendix A

NHTSA Safety Tips for Using Child Restraint Systems



Baby under 20 pounds and one year faces the rear.

The safety seat harness holds the child In place, and the vehicle belt holds the seat in the car



Child from 20 to 40 pounds faces the front

Tip #1
quick safetyseat checkup

Does your child ride in the back seat of your vehicle?

- The back seat is generally the safest place in a crash.

Does your child ride facing the right way?

- Babies up to 20 pounds and about age one ride facing the rear (A).
- Children over 20 pounds and about age one ride facing forward (B).

Does the safety belt hold the seat tightly in place?

- Put the belt through the right slot, If your safety seat can be used facing either way, use the correct belt slot for each direction.

Is the harness buckled snugly around your child?

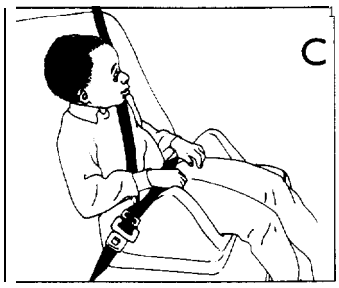
- Keep the straps over your child's shoulders.

Do safety belts fit your older child right?

- Children outgrow regular safety seats at about age four and 40 pounds, but they may be too small for auto belts to fit correctly for good protection.
- The lap belt must fit low and tight across the upper thighs. The shoulder belt goes over the shoulder and across the chest - never under the arm.
- A booster seat can help make belts fit better on your child.

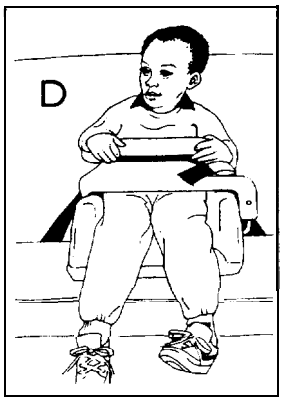
Are you using the right type of booster seat?

- A booster seat without a shield (C) can only be used with both lap and shoulder belts.
- A booster seat with a shield (D) is for use If your car only has lap belts in back.



Booster with no shield for use with both lop and shoulder beits

Booster seats are for children over about 40 pounds



Boaster with a shield works with)ust a lap belt

For more information, read Child Auto Safety Tips #2 to ##8 and call your local safety group or the Auto Safety Hotline: 1-800-424-9393.

Even the 'safest' seat may not protect your child if it isn't used correctly.

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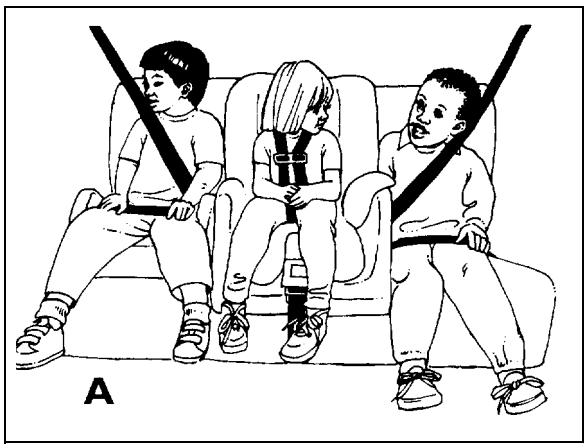
Tip #2
where should your**child ride?**

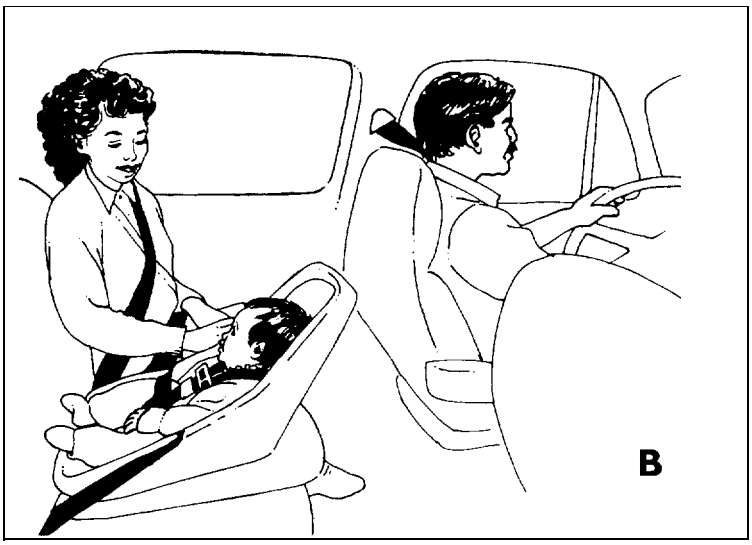
Everybody riding in a vehicle needs a safety belt or safety seat!



The back seat is safer than the front The center belt works best for a safety seat Older children should use lap/shoulder belts for best protection.

Basic Safety Facts to Remember

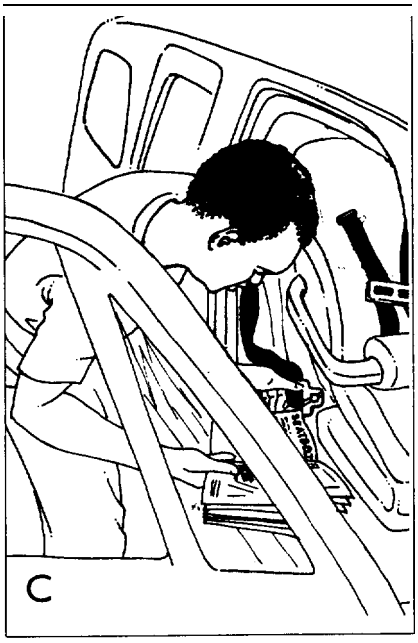
- Anyone who rides loose can hurt those who are buckled up by being thrown against them. People riding without belts or safety seats can be hurled out of the car and be seriously hurt.
- There must be one belt for each person. Buckling two people, even children, into one belt could Injure both.
- A lap or lap/shoulder belt holds your child's safety seat in the vehicle.
- If no shoulder belt is available, it's much safer for anyone (except small babies who can't sit up) to use just a lap belt than to ride loose. Keep the lap belt low and snug across the thighs.
- The back seat usually is safer than the front. Head-on crashes are the most serious and the most common. The middle of the back seat is the safest spot because it is farthest from danger (A).
- Children who have outgrown safety seats are better protected by lap/shoulder belts than by lap belts alone. So if several children are tiding In back, and there are shoulder belts there, let the older ones use the shoulder belts, Put the child riding In the car seat In the middle where there is only a lap belt (A).



Everyone in the family buckles up. Mother sits in back beside her baby to watch and play with him

- A newborn baby should ride where an adult can keep an eye on him, especially If the baby was premature or has a medical problem (B). If you are driving and there isn't anyone else in the car, your new baby may ride safely in the front seat, but not if there is an air bag for that seat.

What if your car has an air bag for the front passenger seat? Turn this sheet over...



Always read the car owner's guide for advice on air bags for infants and small children.

Passenger-side air bags could injure infants riding facing the rear of the car.

Many new cars will have air bags for the right front seat. Air bags work with lap/shoulder belts to protect older children and adults who ride facing the front of the car. But air bags do not work with rear-facing safety seats.

In a crash, the air bag inflates very quickly. It could hit anything close to the dashboard very hard. A rear-facing safety seat could be struck hard enough to hurt your baby seriously Therefore, infants must ride in the back seat, facing the rear (B). Never turn your baby to face forward in the front or back seat until he/she is over 20 pounds and one year of age.

If there is no room in back, a child over 20 pounds in a forward-facing child safety seat can be placed in the front with the vehicle seat as far back as possible. Read your vehicle owner's guide about the air bags in your car (C).

WARNING: If the front right seat has an air bag, a baby in a rear-facing safety seat must ride In the back seat.

Remember: One Person - One Belt

- Never hold a child on your lap because you could crush him In a collislon. Even if you are using a safety belt, the child would be torn from your ams in a crash
- Never put a belt around you and a child on your lap
- Two people with one belt around them could injure each other.
- The cargo area of a station wagon or van is a very dangerous place for anyone to ride.
- Do not let anyone ride in the bed of a pickup truck, even one with a camper shell.

Parents who buckle up show their children that it is important to ride safely

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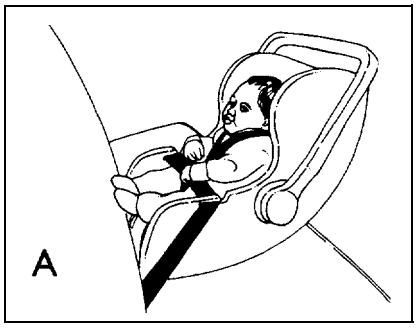
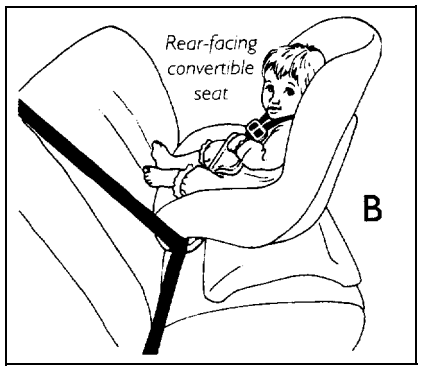
Tip #3
how to protect your**new baby in the car**

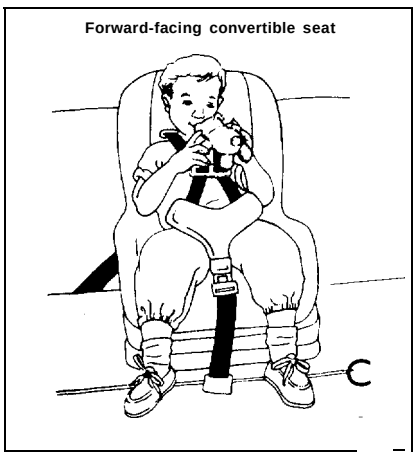


This kind of seat fits babies under 17-20 pounds only and always faces the rear.



▲ *This seat fits an infant, facing the rear, and a toddler, facing the front.* ▼

Forward-facing convertible seat



Everybody would be safest sitting backward in a car, Babies are lucky to have seats that work this way, So, whichever kind of seat you choose, your baby should ride rear-facing until at least 20 pounds and one year of age.

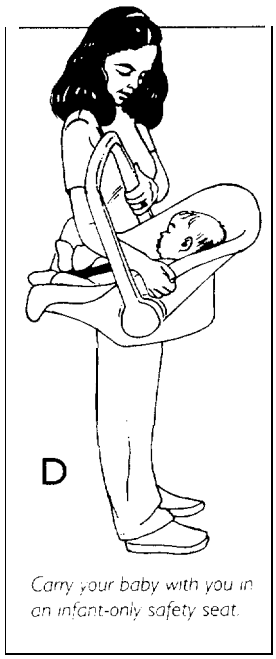
Two kinds of safety seats are made for babies:

1. Small, lightweight "infant-only" safety seats are designed for use rear–facing only. This kind can be used only as long as the baby's head is enclosed by the top rim of the seat (A). The label on the seat gives the upper weight limit (I7 to 20 pounds).
2. Larger "convertible" seats usually fit children from birth to four years of age and 40 pounds. This kind is used facing the rear while your baby is under a year (B). It may be turned around to face the front when the baby is about one year old and over 20 pounds (C).

Which seat is best for a new baby?

Think about these points before you decide:

- You'll save a little money if you buy one seat to do the job from birth to 40 pounds, but an Infant-only seat may be easier for you to use and may fit your newborn baby better.
- An Infant-only seat can be carried with you wherever you go (D). Many attach to supermarket carts. All make sturdy seats for use at home.

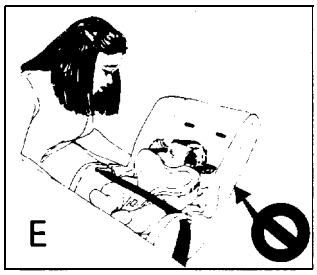


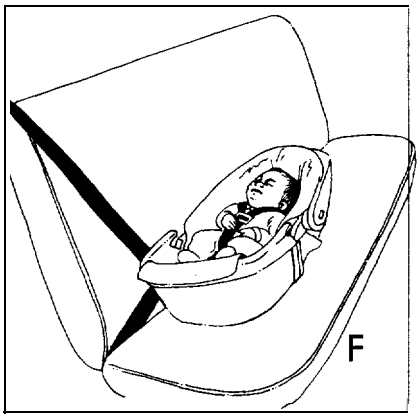
Carry your baby with you in an infant-only safety seat.

- Some Infant-only seats come in two parts. The base stays buckled in the vehicle, and the seat snaps in and out. You may find these convenient to use.
- If you want to use a convertible seat for a newborn baby, choose one without a shield. Shields usually do not tit small or newborn babies properly. They come up too high, often hiding the baby's face, and make proper adjustment of the harness difficult (E).

Is one seat safer than another?

Turn this sheet over...





Your baby must rtde facing the back of the car

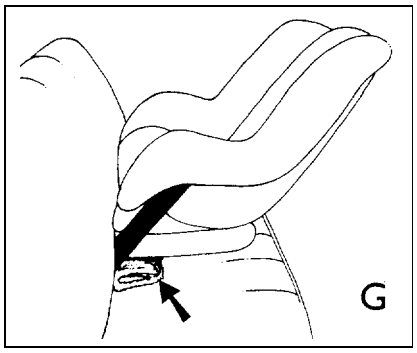
In this crash-tested car bed, the newborn baby can ride lying flat.

Is one seat safer than another?

The simplest and least expensive model usually will work as well as one with fancy features, Choose a seat that you find easy to use.

- For a premature baby or one with medical problems, the doctor may suggest using a crash-tested car bed so the baby can lie flat for a few weeks or months (F). The baby's head must be placed toward the center of the car.
- Infant-only seats that come with shields are not safer than those with harnesses only. The shield may not fit well on a tiny baby.
- Babies who gain a lot of weight early need to use rear-facing convertible seats once they outgrow infant-only seats.

WARNING: Convertible seats must face the rear until the baby weighs at least 20 pounds and is one year old. Infants are safer tiding facing the rear, because the back of the safety seat would support the child's back, neck, and head in a crash.



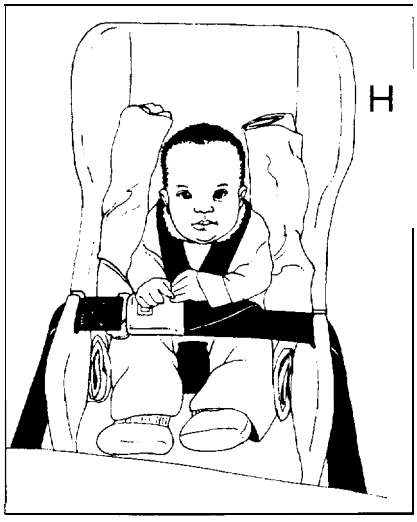
The rolled towel under the safety seat makes it tip back just enough so the baby's head lies back comfortably.

Does your baby's head flop forward?

It's important for an infant to ride sitting about halfway up, You may find that the safety seat stands too upright for a new baby who can't yet hold up his head. You may put a tightly rolled bath towel under the front edge of the safety seat to tilt it back a little so your baby's head lies back comfortably (G).
Do not recllne it too far.

Harness straps must fit snugly on the body.

- It is very important for harness straps to fit properly over the shoulders and between the legs. Dress your baby In clothes that keep legs free. If you want to cover your baby, buckle the harness around him first, then put a blanket over him.
- To fill empty spaces and give support, roll up a cou ple of small blankets and tuck them in on each side of your baby's shoulders dnd head (H). If he still slumps down, put a rolled diaper between his legs and behind the crotch strap. Blankets should rot be put underneath the baby.
- Use the lowest harness slots for a newborn infant. Keep the straps in the slots at or below your baby's shoulders for the rear-facing posltlon.



If the baby needs support, put rolled-up towels or blankets on each side

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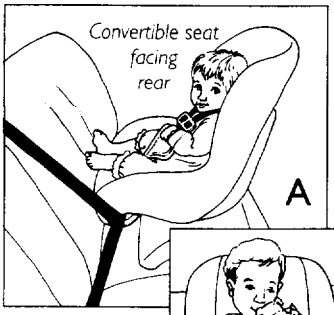
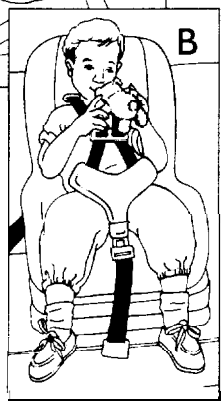
Tip #4

what to use for a big**baby or toddler?**

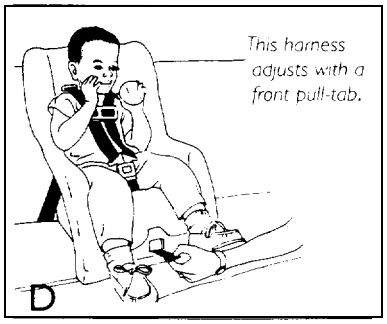




Convertible *safety seats con* be used for b(g babies ond toddlers

Some convertible seat facing forward ➤

Vest has shoulder, hip, and crotch straps. Vehicle belt goes through the back of the vest.



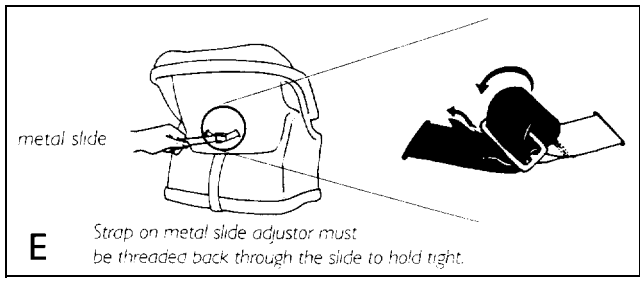
When your baby grows too tall or too heavy for an infant-only seat, you'll need a safety seat that fits toddlers.

There are three kinds of safety seats:

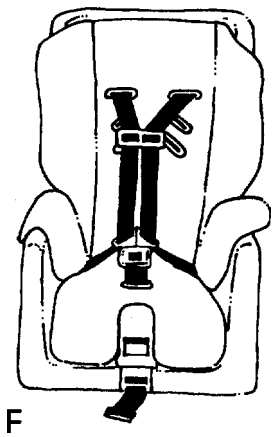
1. The familiar convertible safety seat, which fits babies riding rear-faclng (A) and toddlers rldlng front-facing (B), has a padded shell and harness straps.
2. A built-in toddler safety seat with harness, found in some cars and vans.
3. A safety vest, which has a harness but no stiff shell around the child (C). A toddler over one year of age, weighing 20 to 40 pounds, is not big enough for a booster seat in the car. He needs the extra protection for hls upper body and head that a harness with hip and shoulder straps can give.

When choosing a safety seat, remember:

- A seat that is easy for you to use will be the best for you and your child, Find and read the instruction booklet,
- Try locking and releaslng the buckle in the store. In the car, you'll have to reach In and do that from the side. All car seat buckles are stiff to keep children from undoing them, but some are harder to work than others.
- Try changing the length of the straps. Some adjust automatically to fit the child. Many can be adjusted easily from the front or the side (D). Others have a metal adjustment slide through which you must pull the straps. Make sure the metal slide is in a spot you can reach once the seat is Installed in the car and your child is in the seat.
- If the seat has a metal sllde adjustor, you must thread the strap back over the side (E) to "lock" it when you adjust the harness, If you don't, the strap could pull out In a crash, allowlng your child to be thrown out of the seat and seriously injured.
- If the seat does not fit well in your vehicle, return it to the store right away and try another model

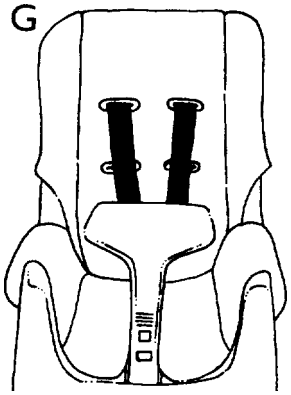


***Tip 4, Page** /*



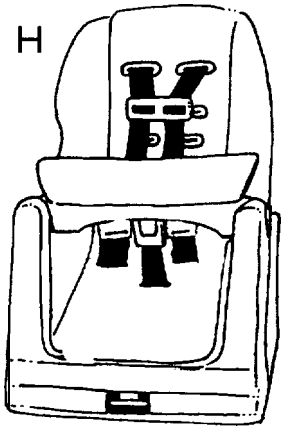
F

Harness-Only Seat



G

Seat with T-Shaped Shield



H

Seat with Shelf-Type Shield

Which kind of harness is best?

There are three kinds. The basic harness type has shoulder hip, and crotch straps. It will give your child excellent protection, A shield takes the place of hip straps to hold the lower body in the seat.

Special features to consider:

Harness Only

A harness-only type is preferred by many safety experts because the lap part of the harness fits over the child's strong upper thighs and hips. It can be adjusted to fit snugly. But the straps may twist and tangle, which doesn't happen with shields. If the straps are not kept flat, the harness won't work as well (F).

T-Shaped Shield

Shoulder straps are attached to a flat pad which rests as low as possible against the child's body. The shield can be buckled quickly with just one hand. Some have straps that adjust automatically to fit (G).

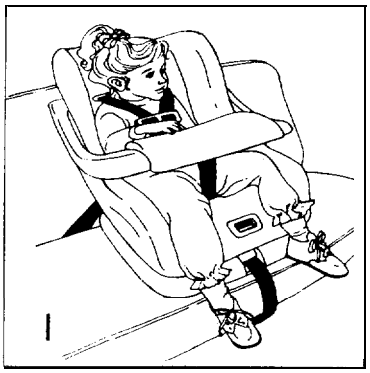
Shelf-Type Shield

Shoulder straps are attached to a wide, shelf-like shield that swings up or to the side, Some shields may not fit over the child's head without adjusting the straps each time, In some cars, the roof may be too low to allow you to raise the shield completely (H).

If you use a convertible seat, remember:

- Keep it facing the rear until your baby weighs 20 pounds and is about one year old. Then turn it around.
- Adjust It to sit upright when it is used facing forward.
- Move harness straps to the top-most slots when the seat is faced forward,

Keep your child In a safety seat with a harness for as long as possible, up to about 40 pounds and four yearn (1). When the harness IS too short when fully extended, or the child's ears reach the top of the safety seat, then move him to a car booster seat or a safety belt that fits.



I

This 4-year-old girl still fits in her safety seat.

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Tip #5
how should preschool and school**children ride?**

Your child should stay in a regular car safety seat until it's outgrown. Although many children fit well up to about age four and 40 pounds, yours may not. When that happens, he's ready for a car booster seat.

Why use a booster seat instead of a safety belt?

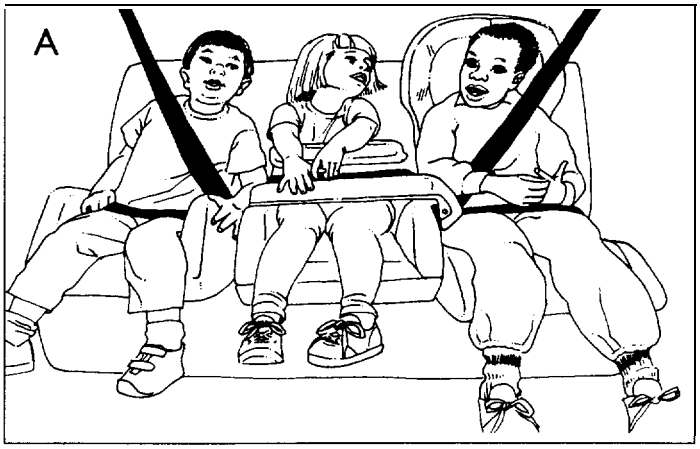
- Most 40-pound children are not tall enough for combination lap and shoulder belts to fit properly.
- Many young children will not sit still enough to keep lap belts low on their hips. Belts that ride up on their tummies can be hazardous.
- Boosters are comfortable for children because they allow their legs to bend normally.

Booster seats should be used until the vehicle belts fit correctly when used alone (see the back of this sheet).

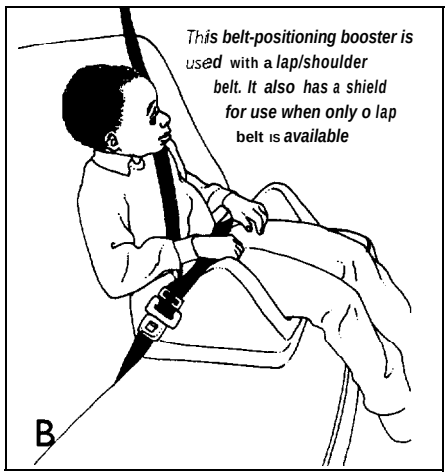
Three kinds of booster seats (A):

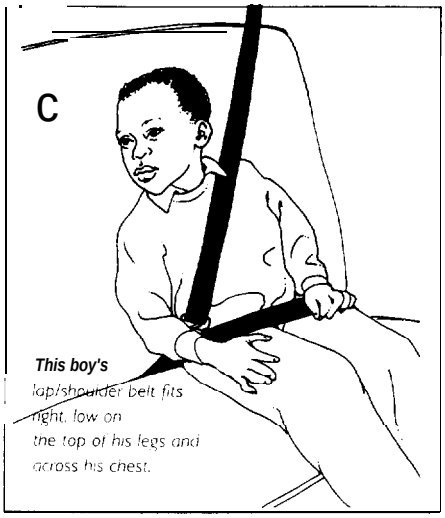
1. Boosters with shields, for use with lap belts alone (center).
2. Boosters without shields, for use onlv with the vehicle lap/shoulder belt. (left, right). Because raising the child up improves belt fit, these are called "belt-positionlng boosters.'' These give better protection than boosters with shields.
3. Boosters with removable shields. Use without the shield to make combination lap/ shoulder belts fit right (left). Put the shield back on when only a lap belt is available.

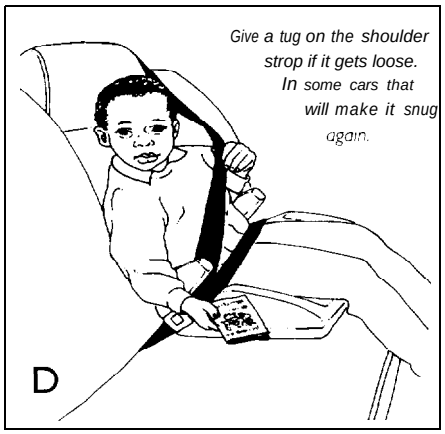
Which booster is best? Turn this sheet over...



All of these children fit in booster seats The one with the shield (in the middle) is used with a lap belt alone. The booster on the right has an optional stiff backrest.







Which booster is best?

- The belt-positioning booster (B) is the best choice, if your car has combination lap/shoulder belts in the rear seat. In a crash, the shoulder belt keeps your child's upper body and head from hitting the inside of the car.
- A booster with a removable shield can be used in two ways. Use the shield if your car has lap belts only. Use the booster without the shield if you have lap/shoulder belts.

How long to use the booster?

- Try on the vehicle belts from time to time as your child grows taller. When the lap belt stays low on the hips and the shoulder belt crosses the shoulder, use the belts without the booster.
- When your child's ears come above the top of the vehicle seat back, you may wish to move him to the safety belt Instead. But if the lap belt doesn't fit right, you may decide to keep him in the booster a bit longer, Some belt-positioning boosters have a high back and offer better protection for a taller child.

(A, first page, right)

How should a lap belt fit?

The lap belt should fit low over a child's upper thighs (C). Make sure the child sits straight against the seat back, Keep the belt snug, It could cause serious injuries if your child slouches so It rides up onto his tummy.

How can you make a shoulder belt fit better?

The shoulder belt should stay on the shoulder and be close to the child's chest.

- If the shoulder belt rubs against the neck, it's uncomfortable for the child but not harmful. Try these suggestions to improve belt fit.
  a. Fold a soft cloth over the belt or use a special belt cover you can buy from an auto supply or children's store.
  b. If you have the kind of shoulder belt that stays slack when pulled out, put a very small amount of slack in it. This may help keep the belt away from the neck. But more than one Inch of looseness would prevent the belt from working well. Teach your child to tug at the shoulder belt if it loosens (D).
- If the shoulder belt fits so badly that it hooks under the child's chin or goes across the face, raise the child up on a belt-positioning booster.
- Don't put a shoulder belt behind the child's back unless none of the other suggestions work and you don't have a booster seat.
- NEVER put a shoulder belt under the child's arm, so it crosses the lower chest. This could cause serious injury. The belt must go over the shoulder.
- Devices are advertised to improve fit for older children and adults. Some may work, but they are not covered by government standards.

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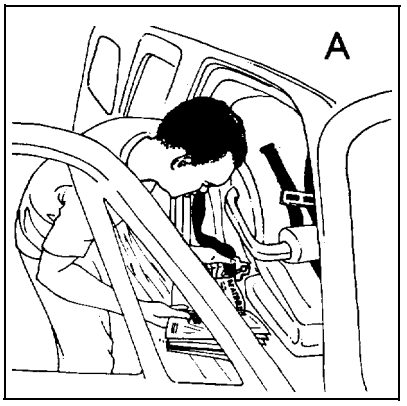
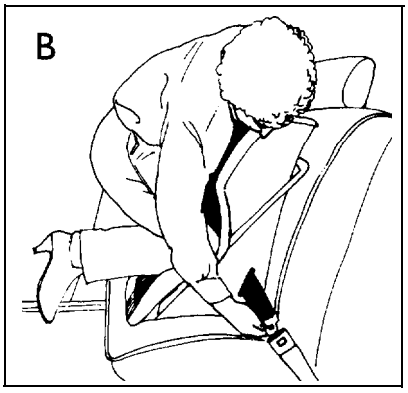
Tip #6

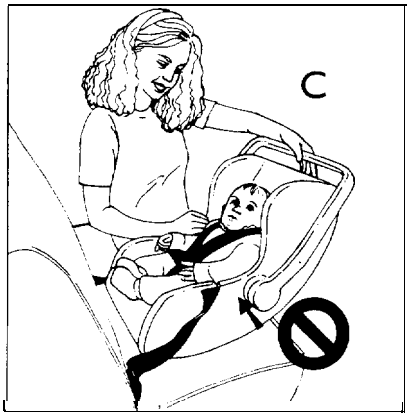
does your safety**belt stay tight around your car seat?**



Be sure to read your car owner's booklet for information on using the vehicle belts correctly with safety seats



To make your child's safety seat secure, push down on it while you tighten the belt.



See how loose this belt gets when you pull on the safety seat. The belt needs to be made tight!

To do its job well, a child safety seat must be held tightly to the seat of the vehicle with a safety belt. If the belt is loose, the safety seat may not protect your child properly. Always read the instructions on child restraints in your car owner's booklet (A).

How Tight Should a Safety Belt Be?

The belt must hold the safety seat firmly in place. To make it tight, push the safety seat down into the seat padding while you tighten the belt around it. Pushing down on it with your knee will help to get a really tight fit.

How Can You Test Your Safety Belt?

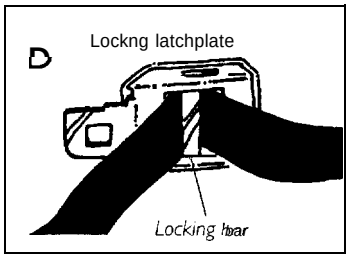
To find out if the belt is holding tight, pull on the seat and push it hard from side to side. If the belt loosens (C) and lets your safety seat move, your child may not be protected well.

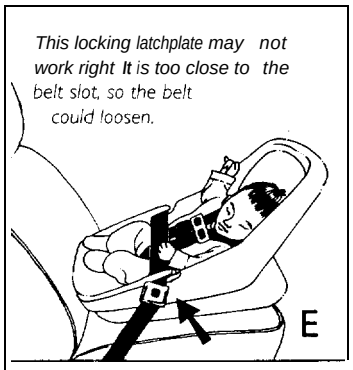
First, try another seat location in your vehicle. It may have a different kind of belt, The one in the middle of the back seat has a locking latchplate. Once tightened, this kind of belt usually will stay tight and keep your safety seat in place.

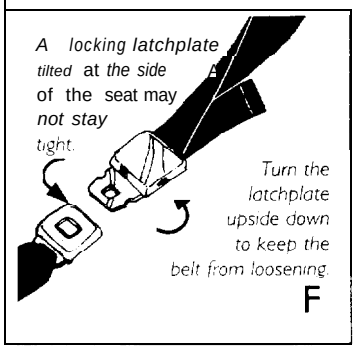
How to Check If Your Lap Belt Locks

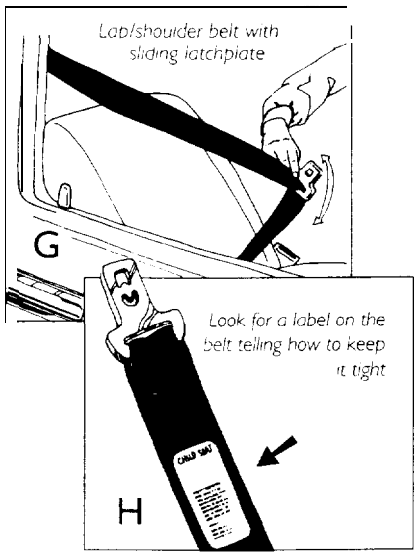
If your belt does not have a latchplate that locks (picture D, page 2), it may have a locking retractor. To check it pull the belt out and let it go back sllghtly. Then pull it out gently. If it locks, you have a retractor that will take up belt slack and hold the safety seat tightly, If you do not have a locking latchplate or a locking retractor, you have to find a way of keeping the belt tight.

For tips on this, read pages 2 to 4,









Which Kinds of Belts Are in Your Vehicle and How Do They Tighten?

There are many different kinds of belts, and they work in different ways. Some stay loose while you drive but are designed to lock up in a crash. These are safe and comfortable for adults and older children but do not work well with child safety seats. Most, however, can be made to stay tight, if you know how.

Belts with Locking Latchplates (D)

This is the easiest to lock around a child safety seat. Locking latchplates can be found on:

- lap belts in center rear seats and;
- some combination lap/shoulder belts.

To snug up the belt, pull on the end of the lap belt or the shoulder part of the lap/shoulder belt. The belt will stay tight.

To loosen it, the latchplate must be tilted. This could cause problems. The belt may loosen if the latchplate tilts at the spot where the belt goes through the slot in the safety seat (E). Test it as explained on page 1.

If it loosens, this is what you must do:

1. Snug up the belt around the seat; then unbuckle it.
2. Make a half turn in the end that has the latchplate (F).
3. Buckle the belt again.

Turning the latchplate over will keep the belt tightly locked in most vehicles.

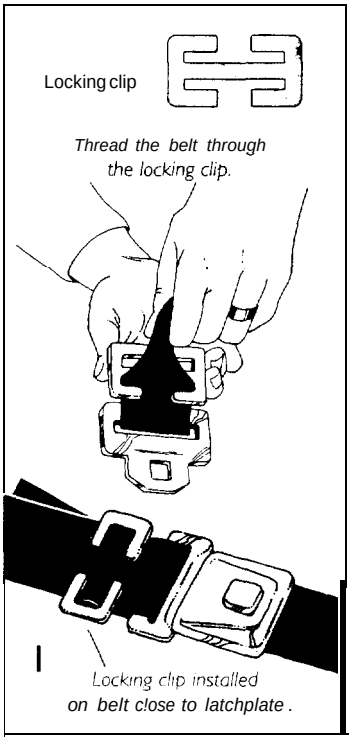
One-Piece Lap/Shoulder Belt with Free-Sliding Latchplate

This kind of belt (G) stays loose except in a crash or sudden stop, but it is easy to fix. You need a metal "locking clip" to keep the lap part secured (see next page). But first check to see if the belt has a special "switching" feature that allows you to lock it.

Some Vehicles Have "Switchable" Belts

You may find that the belt in your car has a special feature that lets you switch it from one that stays loose to one that can be locked. The belt itself may have a label telling you this (H), and you can read about it in your vehicle owner's booklet. Pull the belt all the way out until it goes no farther. You may hear a cllck. When you let the belt roll back, you wlll find that it now locks every inch or 50 and will hold a safety seat tightly.

For more about locking belts, turn to the next page. .



How to Install a Locking Clip on a Belt with a Free-Sliding Latchplate

If the belt (G) does not have a switchable feature to lock it around a child safety seat, you should use a metal "locking clip" (1) to keep this kind of seat belt tight. You will find this clip attached to the side or underneath most new safety seats. If you do not have one, you can buy one in stores that sell safety seats or order it from a car safety seat manufacturer. Here is how to install the locking clip (1).

1. Put the beit through the correct path on the safety seat and buckle the belt.
2. Push down on the safety seat.
3. Pull up on the shoulder end of the belt until the lap belt is pulled tight.
4. Hold the two parts of the bett together at the latchplate and unbuckle the belt.
5. Thread the belt through the locking clip as shown. Put it close to the latchplate.
6. Buckle the belt again. If you put the clip on right, the belt will now stay tight around the safety seat.

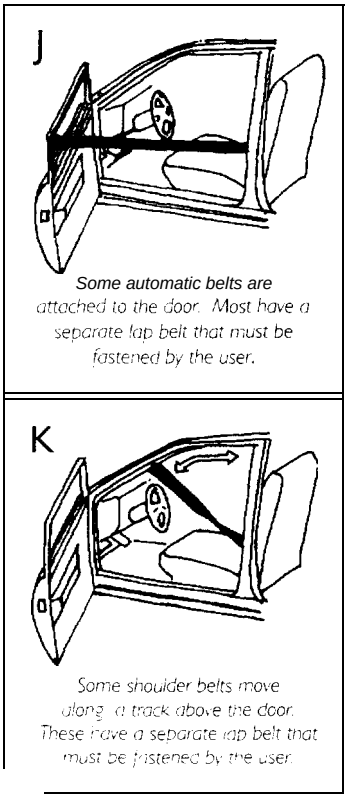
The locking clip that comes with a child safety seat is Intended to be used in this way only.

Other Belts That May Not Lock

Not all lap belts lock. Some stay loose and are not "switchable" (see page 2). You may find such belts:

- In front seats of cars that have automatic shoulder belts:
- In back seats of some older cars and;
- In front or rear seats as part of a lap/shoulder belt system.

These belts can be made to work with safety seats (see page 4).



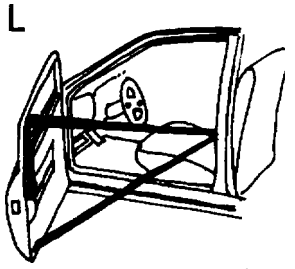
Automatic Safety Belts with Separate Lap Belts

Some "automatic" shoulder belts are attached to the door. They wrap around you when you close the door (J). Others have a motor which moves them along a track above the door (K) when you turn on the ignition.

Most automatic shoulder belts have separate lap belts Some of these lap belts lock, most do not; and some are "swltchable" (see page 2).

NEVER use a child safety seat in the front seat of a car if there is no lap belt. The safety seat cannot be secured with a shoulder belt alone.

For more on belts that may not lock, turn to page 4 . . .



Some cars have both the lap and shoulder belt attached to the door.

More on Belts That May Not Lock . .

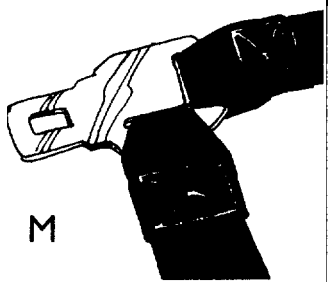
Front Seat Lap/Shoulder Belts Attached to the Door

When the lap belt is attached to the door (L), it will not secure a child safety seat easily. It is highly recommended that you get your car dealer to install a lap belt specially designed for securing a safety seat.

Lap and Shoulder Belts Sewn to the Latchplate

On belts that have the lap and shoulder parts sewn separately to the latchplate (M), the lap belt may not hold a safety seat tightly. First, check to see if the lap belt "switches" to one that locks, as explained on page 2. If not, keep on reading.

Lap and shoulder belt sewn to the latchplate

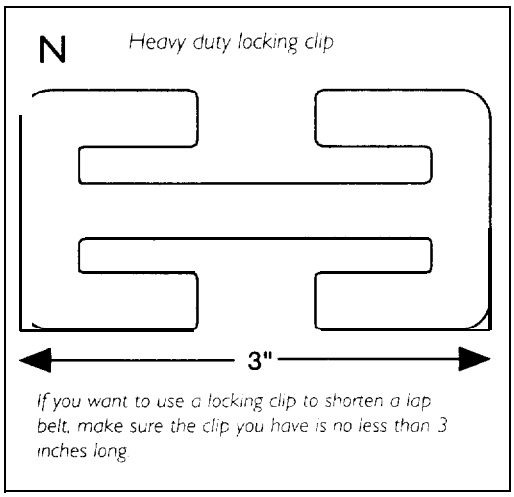


What to Do about Lap Belts That Do Not Lock

If a lap bettor lap part of a lap and shoulder beit does not lock and cannot be "switched," them is a way to fix it. You do it by shortening the belt to make it the right length to hold your safety seat tightly. Your vehicle owner's booklet may explain how.

You will need a special "heavy-duty" locking clip (N). This special clip is available only from Ford, Toyota, and Nissan dealerships.

This heavy-duty cllp look just like a regular locking cllp, but it is made from extra-strong metal and IS a little bigger. To make sure you have the right clip, try yours on the outline below (N). It must be no smaller than three inches. Do not use a locking clip that came with your safety seat or from a store or the child safety seat manufacturer. Only car dealers carry this kind of extra-strong clip.



If you want to use a locking clip to shorten a lap belt, make sure the clip you have is no less than 3 inches long

Use ONLY a heavy-duty locking clip to shorten a lap belt. Using a regular locking slip to do this would put your child in serious danger in a crash. The regular cllp could bend and release the belt.

What can you do if your owner's booklet does not mention using the heavy-duty clip but you think you need one? What If your heavy-duty clip does not come with Instructions for shortening a lap belt? If you have any questions about using locking clips, call the Auto Safety Hotline: 1-800-424-9393.

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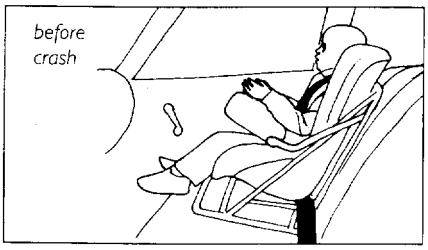
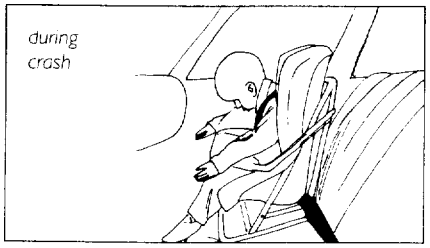
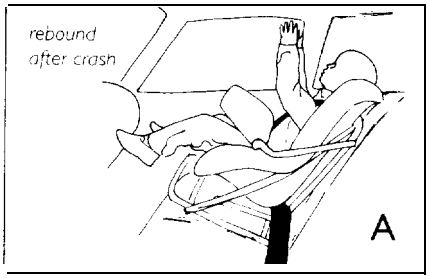
Tip #7

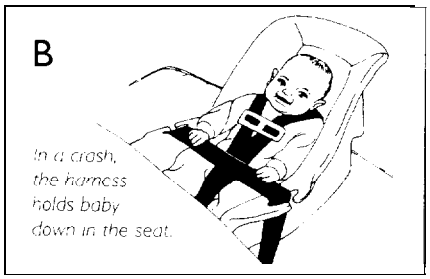
harness straps are your**child's link to safety**

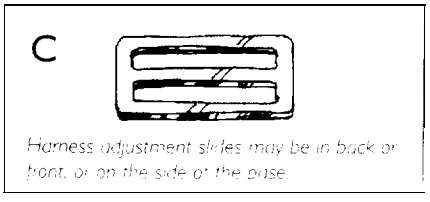






Harness straps hold your child in his safety seat in a crash.





The harness that holds your child in his seat protects him in a crash (A). Some safety seats have just a harness; others have a harness attached to a shield,

Three points to remember about the harness

1, The straps must fit on strong parts of the body the shoulders and hips.
2. It must be adjusted for a snug fit.
3. The shoulder straps must be in the lowest slots for rear-facing seats and in the highest slots for forward-facing seats.

Using Infant-Only Safety Seats

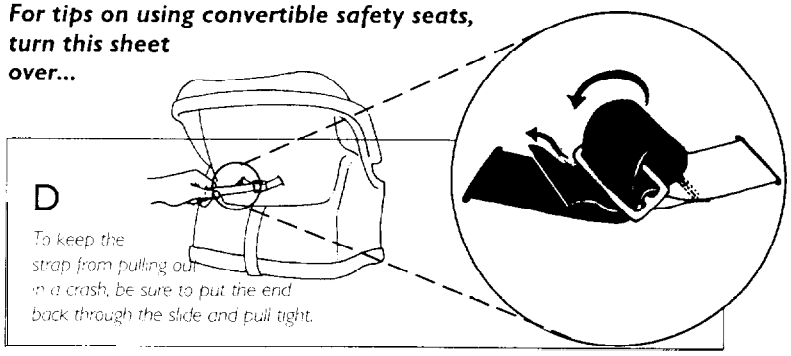
Infants ride facing rearward until they are about one year old and weigh at least 20 pounds. A snug harness is Important in this position. In a crash, the shoulder straps hold your baby down in the safety seat.

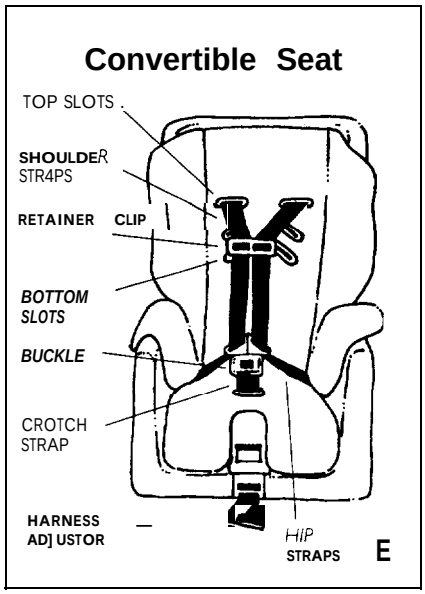
Infant-only seats usually have just two straps which go over the shoulders and form a "V" when buckled between the legs (B). There may be one or two sets of harness slots. Shoulder straps must be in the lowest slots, below your baby's shoulder, if possible. For a newborn baby, even the lowest slots may be above the shoulders at first.

Use a plastic or fabric harness retainer cllp to keep straps on your baby's shoulders, Put the cllp at mid-chest, armpit level.

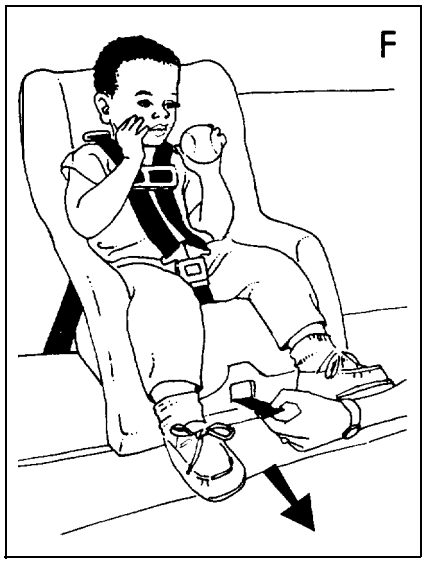
WARNING: When adjusting harnesses or-changing strap positions. take extra care! A metal slide (C) on the straps of most infant safety seats (and some convertible models) is used to shorten or lengthen the straps. The end of the strap must be threaded back through it after adjustment (D). If you don't do that the violent force ofa crash could pull the strap out of the slide and allow your child to be thrown out of the seat.

For tips on using convertible safety seats, turn this sheet over...





This convertible seat has a full harness to hold your child securely



The harness on this seat is tightened by pulling on the strap between the child's feet.

Using Convertible Child Safety Seats

Remember that if your baby weighs under 20 pounds and is less than a year old, the convertible safety seat must be installed in the car facing the rear.

When your child is over 20 pounds, three adjustments must be made.

1. The seat is turned around to face forward,
2. The seat is put in the upright position, which gives the best protection for a forward-facing child.
3. The shoulder straps must be moved to the top set of slots (E), (The middle setting on many convertible seats should not be used when the seat faces forward.)

When moving the straps up, be sure to thread them completely through the shell, not just behind the pad. Some must go over or around a metal bar on the frame, so check the manufacturer's Instructions carefully.

Harness straps are adjusted in different ways. Some tighten automatically to fit the child. Others have a wheel on the side which must be turned or have a strap to pull in the front (F). A few have a metal adjustment slide pictured for the Infant-only seat. The strap must be doubled over the slide to prevent it from slipping in a crash (see side one, C and D).

If there is an adjustable crotch strap, keep it as short as possible to hold the harness or shield down low. And put the shoulder strap retainer cllp at armpit level.

The way you install and use a safety seat can make the difference between your child being seriously hurt in a crash or coming out of it with only cuts and bruises or totally uninjured.

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National Highway Traffic Safety Administration

Tip #8

what are safety**seat recalls?**

Just like automobiles and many other products, including children's toys, a car safety seat maybe "recalled" because of a defect which could cause injury to your child, Manufacture are required to fix the problem free of charge.

When you hear about a seat being recalled:

- Find out which models and manufacturing dates are involved. Remember, the date of manufacture is the "birthday" of your seat. It helps you know if yours is one being recalled.
- Call the toll-free number of the company for more Information.
- If you are not sure that your seat has been recalled or you don't know the correct telephone number, call the free Auto Safety Hotline: 1-800-424-9393,

Does the seat have to be sent back?

Not usually, Most problems can be fixed by replaclng a part that the manufacturer will send you for free. Sometimes, with an older seat or when the company is out of business, you may be told to get rid of the seat.

Hove the seat in front of you when you call the manufacturer or the Hotline. Find the model number and date on the label.

Before you call:

Write down this information about your child's seat

Manufacturers Name_____

Model Number/Name_____

Manufacture Date _____

This is printed on a label attached underneath the seat, on the side. or the back Some of the information may be in number codes. Bring the seat to the telephone so you can answer questions about it.

This seat meets all applicable Federal Motor Vehicle Safety Standards
Manufacture- _____
Model # _____
Date of manufacture ___

Should I go on using a recalled seat?

Many defects are minor, but-some are serious. All problems should be corrected as soon as possible.

- Unless you have another seat, you should go on using the recalled one while you are waiting for the repair kit. Using a recalled car safety seat is almost always safer than letting your child ride in a safety belt only.

Register any new seat. Newer safety seats come with registration cards If your seat has one, be sure to fill it out and send it back to the manufacturer. That way, the manufacturer can let you know by mail if your child's seat has been recalled.

How do I destroy an unsafe seat?

If you throw it in the trash, someone else probably will take it and use it. To make sure it is not reused, take it apart completely, break it up with a sledge hammer, or take it to an auto wrecker. You should report problems you have with your seat. If you think your seat has a problem that could be a safety defect, call the Auto Safety Hotline to report it. Also call the safety seat manufacturer. Many serious problems are discovered from reports by parents.

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Appendix B

States With Laws Relevant to Child Restraint and Seatbelt Use

Table B.1—State laws pertaining to child restraint systems (CRS) and seatbelt use, and gaps in the laws for children younger than age 11 (continued)

State	Provisions of child restraint law			Gaps in the laws	
	Age of child covered	Age/size for which a CRS is required	Age/size when seatbelt can be substituted	Age of child not covered by the CRS or seatbelt use law	Vehicle seat not covered by seatbelt use law
Alabama	<6 yrs	<6 yrs	4 or 5 yrs	6+ yrs	Rear
Alaska[a]	<16 yrs	<4 yrs	4-15 yrs		
Arizona	<16 yrs	Through 4 yrs or <40 lbs	4-15 yrs		
Arkansas	<14 yrs	<4 yrs or <40 lbs	4-14 yrs		
California[a]	<4 yrs	<4 yrs or <40 lbs	No provision		
Colorado	<15 yrs	<4 yrs or <40 lbs	No provision		
Connecticut	<16 yrs	<4 yrs	1-4 yrs in rear seat		
Delaware	<16 yrs	<4 yrs	No provision		
Florida	<16 yrs	<4 yrs or <40 lbs	5-16 yrs		
Georgia	<16 yrs	Through 4 yrs	3 or 4 yrs		
Hawaii	<4 yrs	<3 yrs	3-4 yrs	4+ yrs	Rear
Idaho	<4 yrs	<4 yrs or <40 lbs	No provision	4+ yrs	Rear
Illinois	<6 yrs	<4 yrs	4-6 yrs	6+ yrs	Rear
Indiana	<5 yrs	<3 yrs	3-5 yrs	5+ yrs	Rear
Iowa	<6 yrs	<3 yrs	3-6 yrs	6+ yrs	Rear
Kansas	<14 yrs	<4 yrs	4-13 yrs		
Kentucky[a]	<40 in	<40 in	No provision		
Louisiana	<5 yrs	<5 yrs	3-5 yrs in rear seat	5+ yrs	Rear
Maine[a]	<19 yrs	Through 4 yrs	1-4 yrs, when not in parent's vehicle		
Maryland	<16 yrs (effective 10/1/96)	<4 yrs or <40 lbs	4-10 yrs	10+ yrs	
Massachusetts[a]	Through 12 yrs	<5 yrs	<5 yrs		
Michigan	Through 15 yrs	Through 4 yrs	1-4 yrs in rear seat		

Table B.1—State laws pertaining to child restraint systems (CRS) and seatbelt use, and gaps in the laws for children younger than age 11 (continued)

State	Provisions of child restraint law			Gaps in the laws	
	Age of child covered	Age/size for which a CRS is required	Age/size when seatbelt can be substituted	Age of child not covered by the CRS or seatbelt use law	Vehicle seat not covered by seatbelt use law
Minnesota	<11 yrs	<4 yrs	4-10 yrs in rear seat		
Mississippi	<4 yrs	<4 yrs	No provision	4+ yrs	Rear
Missouri	<4 yrs	<4 yrs	No provision	4+ yrs	Rear
Montana[a]	<4 yrs	<2 yrs	2-4 yrs		
Nebraska	<5 yrs	<4 yrs or <40 lbs	4-5 yrs	5+ yrs	Rear
Nevada[a]	<5 yrs	<5 yrs	<5 yrs in rear seat		
New Hampshire	<12 yrs	<5 yrs	5-12 yrs		
New Jersey	<5 yrs	<5 yrs	1.5-5 yrs in rear seat	5+ yrs	Rear
New Mexico	<11 yrs	<5 yrs	1-5 yrs in rear seat		
New York	<10 yrs	<4 yrs	4-10 yrs	10+ yrs	Rear
North Carolina	<12 yrs	<4 yrs	4-12 yrs		
North Dakota	Through 10 yrs	<3 yrs	3-10 yrs	10+ yrs	Rear
Ohio	<4 yrs	<4 yrs or <40 lbs	>4 yrs and/or >40 lbs	4+ yrs	Rear
Oklahoma	<5 yrs	<4 yrs	<4 yrs in rear seat	5+ yrs	Rear
Oregon[a]	<16 yrs	<4 yrs or < 40 lbs	>4 yrs and/or >40 lbs		
Pennsylvania	<4 yrs	<4 yrs	>4 yrs	4+ yrs	Rear
Rhode Island[a]	Through 12 yrs	Through 3 yrs	No provision		
South Carolina	<6 yrs	<4 yrs	1-6 yrs in rear seat	6+ yrs	Rear[c]
South Dakota	<5 yrs	<2 yrs	2-5 yrs	5+ yrs	Rear
Tennessee	<12 yrs	<4 yrs	No provision		
Texas	<4 yrs	<2 yrs	2-4 yrs	4+ yrs	Rear
Utah	<8 yrs	<2 yrs	2-8 yrs	8+ yrs	Rear
Vermont[a]	Through 12 yrs	Through 5 yrs	No provision		
Virginia	>4 yrs	<4 yrs	4-16 yrs in front seat	4+ yrs	Rear

Table B.1—State laws pertaining to child restraint systems (CRS) and seatbelt use, and gaps in the laws for children younger than age 11 (continued)

State	Provisions of child restraint law			Gaps in the laws	
	Age of child covered	Age/size for which a CRS is required	Age/size when seatbelt can be substituted	Age of child not covered by the CRS or seatbelt use law	Vehicle seat not covered by seatbelt use law
Washington[a]	<16 yrs	<2 yrs	>40 lbs		
West Virginia[b]	<9 yrs	<3 yrs	3-5 yrs		
Wisconsin	<8 yrs	<4 yrs	5-8 yrs	8+ yrs	Rear[c]
Wyoming	<3 yrs	<3 yrs or <40 lbs	No provision	3+ yrs	Rear
District of Columbia	Up to 16 yrs	<3 yrs	3-6 yrs		
American Somoa[a]	<4 yrs	<3 yrs	3 yrs		
Guam	<12 yrs	<2 yrs	2-12 yrs		
Northern Mariana Islands[a]	<2 yrs	<2 yrs	Not available		
Virgin Islands	<5 yrs	<5 yrs	3-5 yrs	5+ yrs	Rear
Puerto Rico	<4 yrs	<4 yrs	>40 lbs	4+ yrs	Rear

[a] The State seatbelt use law applies to all occupants in all seating positions.

[b] The State seatbelt use law applies to occupants 18 yrs and younger in rear seating positions.

[c] The State seatbelt use law applies to all occupants except those in the rear seating positions that are equipped with lap-only belts.

KEY PROVISIONS OF SAFETY BELT USE LAWS

September 1996

State	Effective Date	Enforcement	Fine	Seats	Vehicle and Coverage by Law	* Usage Rate %
Alabama	July 18, 1992	Secondary	$25	Front	Passenger car from model year 1965.	52
Alaska	September 12, 1990	Secondary	$15	All	Motor vehicle. Over age 16.	69
American Samoa	January 1, 1989	Primary	$25	All	Passenger car, truck, and van.	81
Arizona	January 1, 1991	Secondary	$10	Front	Passenger car and van from model year 1972.	60
Arkansas	July 15, 1991	Secondary	$30	Front	Passenger car, truck, and van.	51
California	January 1, 1986	Primary	$20	All	Passenger car, van, and small truck.	85
Colorado	July 1, 1987	Secondary	$15	Front	Passenger car, van, taxi, ambulance, RV and small truck.	56
Connecticut	January 1, 1986	Primary	$37	Front	Passenger car, van, and truck.	72
Delaware	January 1, 1992	Secondary	$20	Front	Passenger car.	60
Dist. of Columbia	December 12, 1985	Secondary	$15	Front	Vehicle seating 8 or less people.	63
Florida	July 1, 1986	Secondary	$20	Front	Motor vehicle and pickup truck.	59
Georgia	September 1, 1988	Primary	$15	Front	Passenger vehicle for under 10 people and pickup for under age 18	53
Guam	November 20, 1986	Primary	$70	Front	Passenger car, truck, and van.	94
Hawaii	December 16, 1985	Primary	$20	Front	Vehicle registered in state.	80
Idaho	July 1, 1986	Secondary	$5	Front	Motor vehicle under 8 thousand pounds.	59
Illinois	July 1, 1985	Secondary	$25	Front	Motor vehicle to carry under 10 people and RV.	69
Indiana	July 1, 1987	Secondary	$25	Front	Passenger car, bus, and school bus.	64
Iowa	July 1, 1986	Primary	$10	Front	Passenger car, van, and truck 10 thousand pounds or less.	76
Kansas	July 1, 1986	Secondary	$10	Front	Passenger car and van.	54
Kentucky	July 13, 1994	Secondary	$25	All	Motor vehicles from model year 1965.	52
Louisiana	July 1, 1986	Primary	$25	Front	Passenger car, van, and truck under 6 thousand pounds.	59
Maine	December 27, 1995	Secondary	$25	All	Passenger vehicles.	50
Mariana Islands	April 20, 1990	Primary	$25	All	Passenger car and truck.	80
Maryland	July 1, 1986	Secondary	$25	Front	Passenger/multi-purpose vehicle, truck, tractor, and bus.	70
Massachusetts	February 1, 1994	Secondary	$25	All	Passenger car, van, and truck.	53
Michigan	July 1, 1985	Secondary	$25	Front	Motor vehicle.	67
Minnesota	August 1, 1986	Secondary	$25	Front	Passenger car, pickup truck, van, and RV.	65
Mississippi	March 20, 1990	Secondary	$25	Front	Passenger car and van.	46
Missouri	September 28, 1985	Secondary	$10	Front	Passenger car to carry under 10 people.	71
Montana	October 1, 1987	Secondary	$20	All	Motor vehicle.	70
Nebraska	January 1, 1993	Secondary	$25	Front	Motor vehicle.	64
Nevada	July 1, 1987	Secondary	$25	All	Passenger car under 6 thousand pounds.	71
New Jersey	March 1, 1985	Secondary	$20	Front	Passenger car.	61
New Mexico	January 1, 1986	Primary	$25	Front	Motor vehicle under 10 thousand pounds.	86
New York	December 1, 1984	Primary	$50	Front	Passenger car.	72
North Carolina	October 1, 1985	Primary	$25	Front	Passenger motor vehicle to carry under 10 people.	81
North Dakota	July 14, 1994	Secondary	$20	Front	Motor vehicle.	42
Ohio	May 6, 1986	Secondary	$25	Front	Passenger/commercial car, van, tractor, and truck.	63
Oklahoma	February 1, 1987	Secondary	$10	Front	Passenger car, van, and pickup truck.	46
Oregon	December 7, 1990	Primary	$95	All	Motor vehicle.	80
Pennsylvania	November 23, 1987	Secondary	$10	Front	Passenger car, truck, and motor home.	71
Puerto Rico	January 19, 1975	Primary	$10	Front	Passenger car. Over age 4.	62
Rhode Island	June 18, 1991	Secondary	No	All	Passenger car. Over age 12.	58
South Carolina	July 1, 1989	Secondary	$10	Front	Passenger car, truck, van, RV, and taxi.	64
South Dakota	January 1, 1995	Secondary	$20	Front	Passenger car, truck, van, RV, and taxi.	40
Tennessee	April 21, 1986	Secondary	$25	Front	Vehicle under 8.5 thousand pounds.	64
Texas	September 1, 1985	Primary	$25	Front	Passenger car, van, and certain trucks.	72
Utah	April 28, 1986	Secondary	$10	Front	Motor vehicle.	56
Vermont	January 1, 1994	Secondary	$10	All	Passenger car.	67
Virgin Islands	October 1, 1991	Primary	$50	Front	Passenger car.	92
Virginia	January 1, 1988	Secondary	$25	Front	Motor vehicle.	70
Washington	June 11, 1986	Secondary	$25	All	Passenger/multi-purpose vehicle, bus, and truck.	83
West Virginia	September 1, 1993	Secondary	$25	Front	Passenger car. Age 18 and under in rear seat.	58
Wisconsin	December 1, 1987	Secondary	$10	All	Motor vehicle.	64
Wyoming	June 8, 1989	Secondary	No	Front	Passenger car, van, and pickup truck.	NA

Total Use Laws: 49 States + D.C., Puerto Rico, and the Territories. *Reported December 1995

U.S. Dept. of Trans., National Highway Traffic Safety Admin., Traffic Safety Programs Office (202) 366-2672, Washington D.C. 20590

CHILD PASSENGER PROTECTION LAWS

September 1996

State	Effective Date	Restraint Age	Safety Seat Age	May Substitute Safety Belt	Penalty*
Alabama	July 1982	Under 6	Under 6	Either 4 or 5	$10
Alaska	June 1985	Under 16	Under 4	4 thru 15	$50, 2 points
Arizona	August 1983	Under 16	Thru 4[2]	No	$50
Arkansas	August 1983	Under 14	Under 4[2]	Between 4 & 14	$30
California	January 1983	Under 4[2]	Under 4[2]	No	$100
Colorado	January 1984	Under 15[2]	Under 4[2]	No	$25
Connecticut	May 1982	Under 16	Under 4	Between 1 & 4 in rear seat	$60
Delaware	June 1982	Under 16	Under 4	No	$25
Dist. of Columbia	July 1983	Up to 16	Under 3	Between 3 & 6	$55, 2 points
Florida	July 1983	Under 16	Under 4[2]	Over 4 up to age 16	$150, 3 points
Georgia	July 1984	Under 16	Thru 4	3 or 4 years of age	$25-$100
Hawaii	July 1983	Under 4	Under 3	Between 3 & 4	$100 maximum
Idaho	January 1985	Under 4[2]	Under 4[2]	No	$100 maximum
Illinois	July 1983	Under 6	Under 4	Between 4 & 6	$25-$50
Indiana	January 1984	Under 5	Under 3	Between 3 & 5	$50-$500
Iowa	January 1985	Under 6	Under 3	Between 3 & 6	$10
Kansas	January 1982	Under 14	Under 4	Between 4 & 13 all seat positions	$20
Kentucky	July 1982	40" & Under	40" & Under	No	$50
Louisiana	September 1984	Under 5	Under 5	Between 3 & 5 in rear seat	$25-$50
Maine	September 1983	Under 19	Thru 4	Between 1 & 4 if not in parent's vehicle	$25-$50
Maryland	January 1984	Under 10	Under 4[2]	Between 4 & 10	$25-$50
Massachusetts	January 1982	Thru 12	Under 5	Under 5	$25
Michigan	April 1982	Thru 15	Thru 4	1 thru 4 in rear seat	$10
Minnesota	August 1983	Under 11	Under 4	4 thru 10 in rear seat	$50
Mississippi	July 1983	Under 4	Under 4	No	$25
Missouri	January 1984	Under 4	Under 4	No	$25
Montana[1]	January 1984	Under 4[2]	Under 2	Between 2 & 4	$10-$25
Nebraska	August 1983	Under 5[2]	Under 4[2]	Between 4 & 5	$25
Nevada	July 1983	Under 5	Under 5	Under 5 in rear seat	$35-$100
New Hampshire	July 1983	Under 12	Under 5	5 thru 12 all seating positions	$500 maximum
New Jersey	April 1983	Under 5	Under 5	Between 1½ to 5 in rear seat	$10-$25
New Mexico	June 1983	Under 11	Under 5	Between 1 & 5 in rear seat	$25
New York	April 1982	Under 10	Under 4	Over 4 up to age 10	$100 maximum
North Carolina	July 1982	Under 12	Under 4	Between 4 & 12	$25
North Dakota	January 1984	Thru 10	Under 3	3 thru 10	$20
Ohio	March 1983	Under 4[2]	Under 4[2]	Over 4, and/or over 40 pounds.	$100 maximum
Oklahoma	November 1983	Under 4[2]	Under 5	Under 4 in rear, 4-5 in front or rear	$25 maximum
Oregon	January 1984	Under 16	Under 4[2]	Over 4, over 40 pounds.	$95 maximum
Pennsylvania	January 1984	Under 4	Under 4	Over 4	$25
Puerto Rico	January 1989	Under 4	Under 4	Over 40 pounds	$10
Rhode Island	July 1980	Thru 12	Thru 3	No	$150 maximum
South Carolina	July 1983	Under 6	Under 4	Between 1 & 6 in rear seat	$25
South Dakota	July 1984	Under 5	Under 2	Between 2 & 5	$20
Tennessee	January 1978	Under 12	Under 4	No	$25-$50
Texas	October 1984	Under 4	Under 2	Between 2 & 4	$25-$50
Utah	July 1984	Under 8	Under 2	Between 2 & 8	$20
Vermont	July 1984	Thru 12	Thru 5	No	$25
Virginia	January 1983	Over 4	Under 4	Over 4 in front seat	$50, 3 points
Washington	January 1984	Under 16	Under 2	Over 40 pounds	$66
West Virginia	July 1981	Under 9	Under 3	Between 3 & 5	$10-$20
Wisconsin	November 1982	Under 8	Under 4	Between 5 & 8	$10-$200
Wyoming	April 1985	Under 3[2]	Under 3[2]	No	$25

[1]Law applies only to parents and legal guardian [2]Or less than 40 pounds. *Most States waive fines upon proof of safety seat acquisition.

U.S. Department of Transportation, Washington, DC 20590

NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION, *Traffic Safety Programs* (202) 366-2672

CHILD PASSENGER PROTECTION LAWS					July 1996
Territory	Effective Date	Restraint Age	Safety Seat Age	May Substitute Safety Belt	Penalty*
American Samoa	October 9, 1988	Under 4	Under 3	Age 3 to under 4.	$50
Guam	November 26, 1987	Under 12	Under 2	Age 2 to under 12.	$50
Northern Marianas	April 20, 1990	Under 2	Under 2	Not available	$50
Virgin Islands	October 1, 1991	Under 5	Under 3	Between age 3-5	$200

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Appendix C

U.S. Accidents Involving Air Bag Deployment at the Passenger-Side Seat Occupied by a Child, 1993 Through Mid-September 1996

Table C. 1—U.S. accidents involving air bag deployment at the passenger-side seat occupied by a child, 1993 through mid-September 1996

Date of accident	State	Age of child	Child injury severity[a]	Restraint used	Vehicle year, make, and model	Investigating agency (and NTSB accident or study case no.)
1993:						
April	Ohio	6 yrs	Fatal	None	1993 Volvo 850	NTSB (NRH-93-FH-01 1), NHTSA
1994:						
March[b]	Texas	7 yrs	Fatal	None	1993 Lexus LS400	NHTSA
July[b]	Virginia	4 yrs	Fatal	None	1994 Ford Mustang	NHTSA
July	California	4 yrs	None	Lap/shoulder belt	1994 Toyota Corolla	NTSB (study case 50), NHTSA
September	Utah	4 yrs	Fatal	None	1994 Dodge Caravan	NTSB (WRH-96-FH-003), NHTSA
November	California	3 mo	Critical	Rear-facing child restraint system	1994 Toyota Corolla	NTSB (study case 59), NHTSA
December[b]	Mississippi	6 yrs	Fatal	None	1995 Toyota Avalon	NHTSA
December[b]	Virginia	4 yrs	Fatal	None	1994 Ford Aspire	NHTSA
1995:						
February	California	21 mo	None	Forward-facing child restraint system	1994 Toyota Corolla	NTSB (study case 87)
February	California	9½ yrs	Minor	Undetermined	1994 Ford Thunderbird	NTSB (study case 88)

Table C. 1—U.S. accidents involving air bag deployment at the passenger-side seat occupied by a child, 1993 through mid-September 1996 (continued)

Date of accident	State	Age of child	Child injury severity[a]	Restraint used	Vehicle year, make, and model	Investigating agency (and NTSB accident or study case no.)
March	Texas	9¾ yrs	Fatal	Lap portion of lap/shoulder belt used; use of shoulder portion undetermined	1995 Plymouth Grand Voyager	NTSB (study case 95), NHTSA[c]
April	Vermont	5 yrs	Fatal	None	1993 Dodge Intrepid	NHTSA
May	Michigan	5 yrs	Fatal	None	1995 Ford Contour	NHTSA
July	Pennsylvania	3 wks	Fatal	Rear-facing child restraint system	1995 Ford Escort	NTSB (study case 121), NHTSA
July	California	7 yrs	Moderate	Lap/shoulder belt	1995 Volkswagen Jetta	NTSB (study case 124)
August	Georgia	4½ yrs	Minor	Lap/shoulder belt	1994 Honda Civic	NTSB (study case 130)
September	California	5 mo	Fatal	Rear-facing child restraint system	1994 Toyota Camry	NTSB (study case 136) NHTSA
October	Utah	5 yrs	Fatal	Lap portion of lap/shoulder belt	1994 Chevrolet Camaro	NTSB (study case 137), NHTSA[c]
October	California	6 mo	Serious	Rear-facing child restraint system	1995 Ford Escort	NTSB (study case 138), NHTSA
October	Maryland	7 yrs	Fatal	Lap portion of lap/shoulder belt	1995 Dodge Caravan	NTSB (study case 139), NHTSA
October	Pennsylvania	3 yrs	Critical	Lap/shoulder belt with belt-positioning booster seat	1995 Jaguar XJS	NTSB (study case 140), NHTSA[c]

Table C. 1—U.S. accidents involving air bag deployment at the passenger-side seat occupied by a child, 1993 through mid-September 1996 (continued)

Date of accident	State	Age of child	Child injury severity[a]	Restraint used	Vehicle year, make, and model	Investigating agency (and NTSB accident or study case no.)
October	Louisiana	4 mo	Fatal	Rear-facing child restraint system	1995 Saturn	NHTSA
November	Wisconsin	7 wks	Critical	Rear-facing child restraint system	1995 Chrysler Minivan	NHTSA
1996:						
January	Michigan	9 yrs	Fatal	None	1995 Chrysler Minivan	NHTSA
February	New Jersey	5 mo	Fatal	Rear-facing child restraint system	1995 Isuzu Trooper	NHTSA
April	Florida	3 mo	Fatal	Rear-facing child restraint system	1995 Hyundai Accent	NHTSA
April	Maryland	3 yrs	Fatal	None, on lap of occupant in right front passenger seat	1994 Geo Metro	NHTSA
April	North Carolina	4 yrs	Fatal	None	1994 Chrysler Minivan	NHTSA
May	Florida	8 mo	Fatal	Carrier	1994 Toyota Camry	NHTSA
May	New York	7 yrs	Fatal	None	1995 Ford Contour	NHTSA
June	Kansas	5 yrs	Fatal	Undetermined	1995 Chevrolet Lumina	NHTSA
June	Illinois	6 days	Fatal	Carrier, on lap	1995 Ford Escort	NHTSA

Table C. 1—U.S. accidents involving air bag deployment at the passenger-side seat occupied by a child, 1993 through mid-September 1996 (continued)

Date of accident	State	Age of child	Child injury severity[a]	Restraint used	Vehicle year, make, and model	Investigating agency (and NTSB accident or study case no.)
June	Missouri	4 yrs	Fatal	None	1995 Dodge Caravan	NTSB (CRH-96-FH-011), NHTSA
July	Oklahoma	5 yrs	Fatal	None	1996 Mitsubishi Galant	NHTSA
September	Tennessee	5 yrs	Fatal	Lap/shoulder belt	1995 Dodge Caravan	NTSB(CRH-96-FH-015)

NTSB = National Transportation Safety Board; NHTSA = National Highway Traffic Safety Administration.

[a] All of the children sustained head and neck injuries as a result of the air bag deployment. The Safety Board is also aware of one accident in Canada in which a 5-year-old wearing the lap portion of the lap/shoulder belt was fatally injured; the child was seated in the right front seat of a vehicle in which the passenger-side air bag deployed. The Board is also aware of an accident in Georgia in which a child lying with its head in the driver's lap was killed when the driver-side air bag deployed.

[b] Information about these accidents was obtained from existing NHTSA files. No special investigation was conducted.

[c] NHTSA's conclusion on restraint use differs from that of the Safety Board. NHTSA concluded that the child inNTSB study case 95 was restrained only by the lap portion of the lap/shoulder belt, that the child in NTSB case 137 was unrestrained, and that the child in NTSB case 140 had the shoulder portion of the restraint system off the shoulder.

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Appendix D

General Information About the Accidents and Vehicles in the Study Sample

Accident Information

The majority of the accidents occurred in clear weather (70.8 percent), during daylight hours (73.3 percent), with good visibility (70.8 percent), and with dry road surface conditions (81.7 percent). Most of the accidents (59.2 percent) occurred on roadways with a minimum of four lanes. Most of the roadways had a posted speed limit of 35 mph. The roadway surface was usually of asphalt (95.8 percent). The roadway was usually at grade (91.7 percent) and straight and level (50 percent). At a minimum, the roadways usually had some sort of lane marking (85 percent). Traffic was usually moderate (42.5 percent).

Most of the vehicles involved in the accidents were passenger cars (includes station wagons) (n = 98). The model years of the vehicles ranged from 1971 to 1995; the median year was 1988.

The primary impact point for 76 of the 124 vehicles (61.3 percent) was at the front of the vehicle. Forty vehicles were involved in side impact crashes, and three were hit in the rear-end. Three case vehicles were involved in rollovers, one vehicle was in a sideswipe accident, and one hit a curb in a parking lot and sustained only minor damage to the undercarriage.

The data shown in table D.1 refer to the 120 accidents and 124 case vehicles. The information regarding vehicle seats and belts pertains to the seats occupied by the 207 children younger than age 11.

Vehicle Seats

Most of the seats were in a fixed seat track position (52.7 percent) or were adjusted to a middle track position (23.2 percent). Most of the vehicle seats were forward-facing; one was side-facing.

Seatbelts

More lap/shoulder belts were available in the occupant seating positions (48.3 percent) than lap-only belts (40.1 percent). Thirty-seven of the 100 lap/shoulder belts had adjustable upper

anchorage points: 3 were found in the top position, 4 in the middle position, and 6 in the bottom position. Windowshade retractors were present on six of the lap/shoulder belts.

The lapbelt latch plates were either fixed (63 percent) or cinching (37 percent), and the latchplates for the lap/shoulder belts were mostly free sliding (65 percent). The lapbelts had either emergency locking retractors (ELR) (8.2 percent), automatic locking retractors (ALR) (19.3 percent) or manual retractors (16.9 percent). Most of the lap/shoulder belts had ELRs (39.1 percent). The majority of the belt anchors were behind the seat bight (77.8 percent).

Instructions on the Use of Child Restraint Systems

Even when parents or caregivers had received some instructions or information—either written or verbal—about the proper use of child restraint systems, more than half still made errors in securing the child in the restraint and/or securing the child restraint system in the vehicle. Additional details are presented in table D.2.

Table D.1—Information about the accident scenes, vehicles, and vehicle seats occupied by children younger than age 11 in the study sample[a] (continued)

Item	Number of
Weather:	Accidents:
Clear	85
Cloudy	15
Rainy	9
Fog	2
Rainy and cloudy	9
Light conditions:	Accidents:
Daylight	88
Dawn	2
Dusk	2
Darkness	13
Lighted	15
Proposed speed limit (mph):	Accidents:
25	6
30	5
35	35
40	21
45	25
50	1
55	19
65	3
Undetermined	5
Primary impact point:	Vehicles:
Front	76
Back	3
Left	15
Right	25
Vehicle model year:	Vehicles:
1971–1975	1
1976–1980	6
1981–1985	20
1986–1990	49
1991–1995	48

Table D.1—Information about the accident scenes, vehicles, and vehicle seats occupied by children younger than age 11 in the study sample[a] (continued)

Item	Number of
Vehicle type:	Vehicles:
Passenger car/station wagon	98
Pickup truck	12
Van	9
Utility	5
Direction of vehicle seat:	Seats occupied by children:
Forward facing	201
Side facing	1
Undetermined	5
Belt anchor location:	Seats occupied by children:
Behind seat bight	161
Forward of seat bight	27
Asymetric	3
Not applicable	16
Seat track position:	Seats occupied by children:
Forward	12
Middle	48
Rearward	33
Fixed	111
Undetermined	3
Latch plate type:	Seats occupied by children:
Fixed—	
Lap-only belt or lap portion of lap/shoulder belt	52
Lap/shoulder belt	16
Free sliding—	
Lap-only belt or lap portion of lap/shoulder belt	0
Lap/shoulder belt	65
Cinching—	
Lap-only belt or lap portion of lap/shoulder belt	31
Lap/shoulder belt	19
Not applicable	24

Table D.1—Information about the accident scenes, vehicles, and vehicle seats occupied by children younger than age 11 in the study sample[a] (continued)

Item	Number of
Retractor type:[b]	Seats occupied by children:
Emergency locking retractor (ELR)—	
Lap-only belt or lap portion of lap/shoulder belt	17
Lap/shoulder belt	76
Shoulder portion of lap/shoulder belt	7
Automatic locking retractor (ALR)	
Lap-only belt or lap portion of lap/shoulder belt	40
Lap/shoulder belt	1
Shoulder portion of lap/shoulder belt	0
Dual ELR—	
Lap-only belt or lap portion of lap/shoulder belt	0
Lap/shoulder belt	7
Shoulder portion of lap/shoulder belt	0
Switchable ALR/ELR—	
Lap-only belt or lap portion of lap/shoulder belt	0
Lap/shoulder belt	7
Shoulder portion of lap/shoulder belt	0
Manual—	
Lap-only belt or lap portion of lap/shoulder belt	34
Lap/shoulder belt	1
Shoulder portion of lap/shoulder belt	1
Not applicable	24

[a] The Safety Board's study sample comprised 120 accidents, 124 vehicles, and 207 children younger than age 11.

[b] The lap/shoulder belts at eight seats had a retractor for the lap portion and a retractor for the shoulder portion. Each retractor is included in this list.

Table D.2—Source of instructions or information on the use of child restraint systems received by parents or caregivers of the children in the Safety Board's study sample[a]

Source	Child restraint system used properly at the time of the accident	Child restraint system used improperly at the time of the accident
For parents/caregivers who installed the child restraint system in the vehicle:		
Only the child restraint system owner's manual	4	7
The child restraint system owner's manual and the vehicle owner's manual	7	9
Neither manual	1	4
For parents/caregivers who secured the child in the child restraint system:		
The child restraint system owner's manual[b]	11	17
Something other than the child restraint system owner's manual[c]	1	1
No instructions/information	0	2

[a] There were 46 children in the Safety Board's study sample who were in child restraint systems that were not placed in front of a passenger-side air bag. The data in this table are based on information provided to the investigators by the parents or caregivers of 32 of those children.

[b] In some cases, included additional sources of information, such as other literature or a demonstration.

[c] Sources of information identified were a book, magazine, pamphlet, or demonstration.

Appendix E

Summary of the Accidents Involving Air Bag Deployment in Front Seats Occupied by Adults

The focus of this safety study is on children in passenger vehicles. Because of the current interest in the performance of air bags, however, the Board also examined the 29 accidents in the sample that involved air bag deployment in front seats occupied by adults; there were 29 drivers and 1 adult passenger in these accidents (table E.1). Only 2 drivers sustained no injuries, 15 drivers and the adult passenger sustained minor injuries, 11 drivers sustained moderate or severe injuries, and 1 driver was fatally injured. Figure E.1 shows the injury severity by restraint use and by accident severity for the 30 adults. The injury outcome in at least five of the accidents should be considered "success" stories (cases 18, 26, 31, 41, and 83): these drivers survived very severe accidents. In cases 18, 31, and 83, the Board concluded that the air bag contributed to a reduction in the severity of the drivers' injuries and may have saved their lives.

Table E.1—Summary of the 29 accidents in which adults were seated in front of an air bag that deployed (continued)

Case number	Age of driver	Injury severity	Belt restraint used and pre-crash posture	Delta V	Direction of force (o'clock)	Pre-crash braking	Vehicle year, make, model	Seat track position
12	22	Minor	Lap/shoulder (other)	NA	NA	N	1994 Ford Mustang	Middle
	29[a]	Moderate	None (lying down)					Middle
13	45	Serious	Lap/shoulder (erect)	31.5	12	Y	1992 Plymouth Acclaim	Forward
18	34	Serious	None (erect)	41.2	12	Y	1993 Mazda 626	Middle
20	31	Minor	Lap/shoulder (erect)	18.8	11	N	1991 Ford Taurus	Middle
21	23	Minor	None (erect)	22.1	12	N	1995 Ford Windstar	Rear
26	36	Serious	Lap/shoulder (leaning forward)	44.6	12	N	1993 Dodge Dynasty	Rear
31	23	Moderate	Lap/shoulder (erect)	42.0	12	Y	1992 Honda Accord	Middle
34	41	Fatal	Lap/shoulder (erect)	27.9	10	Y	1992 Mercury Grand Marquis	Middle
40	25	Minor	Lap/shoulder (erect)	12.7	1	Y	1992 Toyota Camry	Forward
41	35	Serious	None (erect)	38.3	12	Y	1990 Toyota Celica	Middle
50	35	Minor	Lap/shoulder (erect)	19.9	12	Y	1994 Toyota Corolla	Forward
54	29	Minor	Lap/shoulder (erect)	17.2	3	Y	1990 Toyota Celica	Rear
58	26	Moderate	Lap-only (erect)	12.9	1	Y	1994 Dodge Spirit	Rear
59	26	Moderate	None (erect)	NA	NA	Y	1994 Toyota Corolla	Middle
66	31	Minor	None (erect)	10.8	12	N	1992 Dodge Shadow	Middle
82	28	Moderate	Lap/shoulder (undetermined)	15.0	12	N	1992 Honda Accord	Middle
83	36	Moderate	Lap/shoulder (erect)	48.2	12	N	1991 Honda Accord	Middle
87	26	Minor	Lap/shoulder (leaning sideways)	16.8	12	N	1994 Toyota Corolla	Forward

Table E.1—Summary of the 29 accidents in which adults were seated in front of an air bag that deployed (continued)

Case number	Age of driver	Injury severity	Belt restraint used and pre-crash posture	Delta V	Direction of force (o'clock)	Pre-crash braking	Vehicle year, make, model	Seat track position
88	37	Minor	Lap/shoulder (erect)	8.7	1	Y	1994 Ford Thunderbird	Forward
95	38	Minor	Lap/shoulder (erect)	17.5	11	Y	1993 Plymouth Grand Voyager	Rear
113	33	Minor	Lap/shoulder (erect)	9.8	12	N	1995 Ford Taurus	Middle
119	27	Moderate	Lap/shoulder (erect)	29.5	12	N	1994 Plymouth Acclaim	Middle
121	33	Moderate	Shoulder-only (erect)	23.3	12	N	1995 Ford Escort	Middle
124	43	Minor	Lap/shoulder (erect)	14.9	10	N	1995 Volks-wagen Jetta	Forward
130	26	Minor	Lap/shoulder (erect)	25.1	12	Y	1994 Honda Civic	Forward
136	26	Minor	Lap/shoulder (erect)	7.4	1	Y	1994 Toyota Camry	Forward
137	42	Minor	None (erect)	NA	NA	N	1994 Chevrolet Camaro	Forward
138	21	None	Lap/shoulder (erect)	4.6	12		1995 Ford Escort	Forward
139	45	None	Lap/shoulder (erect)	9.3	2	Y	1995 Dodge Caravan	Rear

[a] Of the accidents investigated for this study, the 29-year-old in case 12 was the only adult occupant seated in the right front position at which a passenger-side air bag deployed.

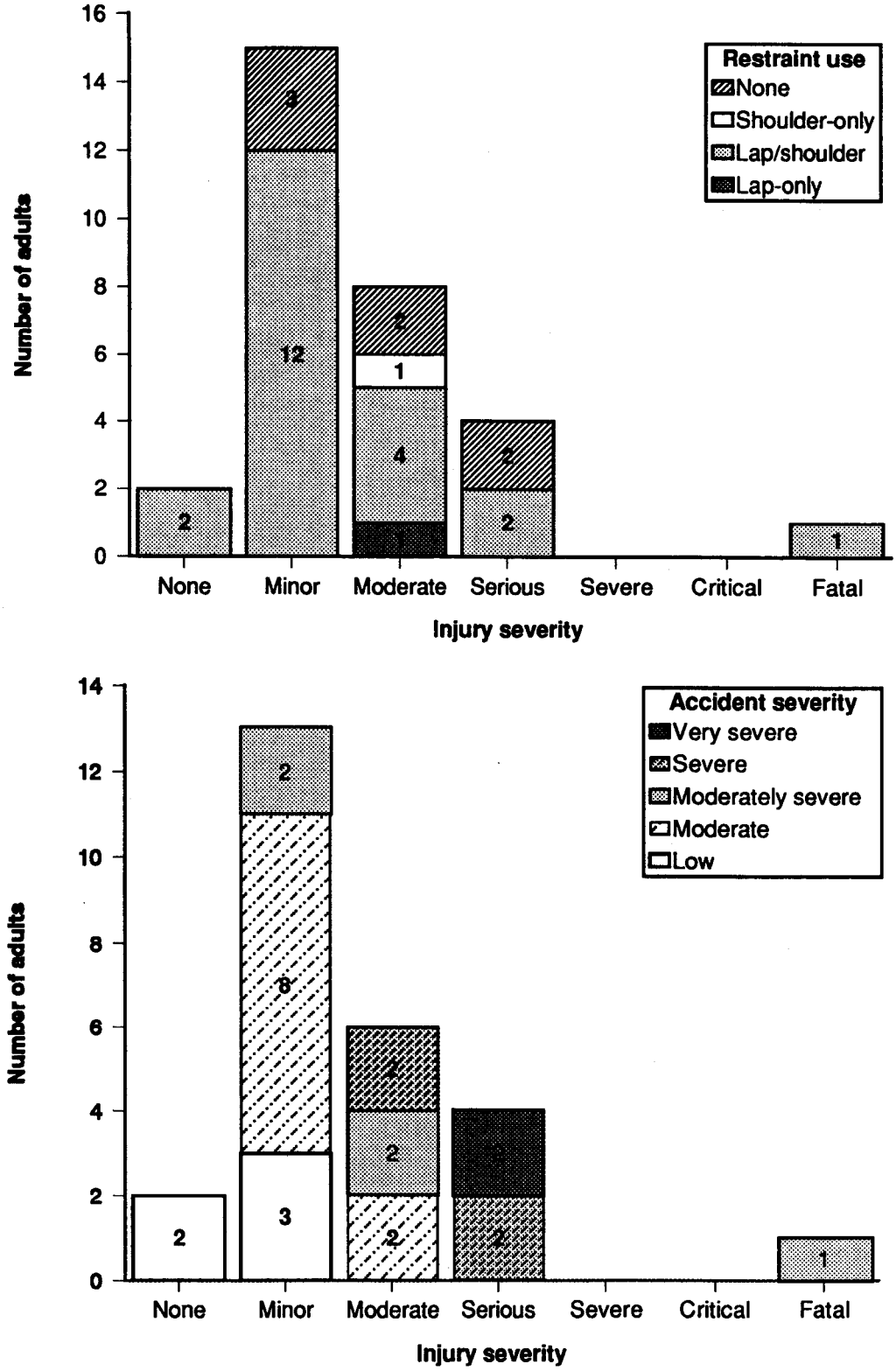

Figure E.1—Injury severity by restraint use (top) and accident severity (bottom) for the 29 drivers and the adult passenger in accidents in which the air bag deployed. Accident severity (Delta V) could not be determined in four cases.

Appendix F

Status of Safety Recommendations H-95-17 through H-95-31

Safety Recommendation No.: H-95-17
Date Issued: November 2, 1995
Recipient: National Highway Traffic Safety Administration
Status: Open—Acceptable Response

Subject:

Immediately develop and implement, in cooperation with the National Association of Broadcasters and the Advertising Council, Inc., a highly visible nationwide multi-media campaign to advise the public about the dangers of placing a rear-facing child safety seat or an unrestrained or improperly restrained small child in the front seat of a vehicle equipped with a passenger-side air bag.

Brief Narrative of Status Assignment:

In a letter from NHTSA on 1/5/96, Administrator Ricardo Martinez stated that NHTSA is working with the Ad Council to produce both a public service announcement and a video news release that specifically addresses the dangers that air bags can pose to children.

In a letter dated 2/28/96, the NTSB commended NHTSA for the actions that had been taken to address the recommendations, stating that numerous and varied outreach efforts initiated by NHTSA all contribute to increasing public awareness of the issue.

Safety Recommendation No.: H-95-18
Date Issued: November 2, 1995
Recipient: Advertising Council, Inc. (ACI)
National Association of Broadcasters (NAB)
Status: Open—Acceptable Response (for ACI and NAB)

Subject:

Immediately develop and implement, in cooperation with the National Highway Traffic Safety Administration, a highly visible nationwide multi-media campaign to advise the public about the dangers of placing a rear-facing child safety seat or an unrestrained or improperly restrained small child in the front seat of a vehicle equipped with a passenger-side air bag.

Brief Narrative of Status Assignment:

In a letter dated 11/21/95 for the Ad Council and the NAB, the Ad Council responded that it is currently under contract with the NHTSA to provide public service announcements on safety belts and related issues. The Board's letter of 1/4/96 acknowledged efforts that are being made. Pending further action, the recommendation was classified "Open—Acceptable Response."

Safety Recommendation No.: H-95-19
Date Issued: November 2, 1995
Recipient: Foreign and Domestic Automobile Manufacturers
Status: Closed—Reconsidered (Peugeot)
Closed—Acceptable Alternate Action (Mercedes-Benz)
Closed—Acceptable Response/Superseded by H-96-29 (Alfa Romeo, BMW, Chrysler, Fiat, Ford, General Motors, Honda, Hyundai, Isuzu, Mazda, Mitsubishi, Nissan, Saab, Subaru, Toyota, Volkswagen, Volvo)
Closed—Await Response/Superseded by H-96-29 (Jaguar, Suzuki)

Subject:

Conduct a mail campaign to all registered owners of vehicles with passenger-side air bags that warns of the dangers of placing a rear-facing child safety seat and an unrestrained or improperly restrained small child in the front seat of the vehicle.

Brief Narrative of Status Assignment:

In a letter dated 11/17/95, Alfa Romeo reported that it will discontinue the sales in the U.S. market effective 12/31/95 and that distributors would conduct a mailing to dealers and to owners of all registered 1995 vehicles. The Board was also informed that Peugeot no longer imports vehicles for sale in the U.S. market.

A Mercedes-Benz letter of 4/24/96 informed the Board that as of April, the manufacturer was installing warning labels on all new cars and that current owners would be advised of the availability of labels through press releases, dealer notifications, and club magazines. The Board subsequently classified the recommendation to Mercedes-Benz "Closed—Acceptable Alternate Action."

In a letter dated 2/1/96, the American Automobile Manufacturers Association (AAMA) responded to the NTSB recommendations on behalf of its members—Chrysler, Ford, and General Motors—indicating that it would work with NHTSA on this issue. This recommendation was classified "Open—Acceptable Response" pending further action from AAMA or the manufacturers. Correspondence from General Motors dated 7/30/96 informed the Board of actions taken to address passenger protection issues and enhance child restraint system effectiveness. The information is being reviewed by the Board.

In a letter dated 2/9/96, the Association of International Automobile Manufacturers (AIAM) responded on behalf of its members—Alfa Romeo, Fiat, Hyundai, BMW, Honda, Mitsubishi, Peugeot, Subaru, Volvo, Mercedes-Benz, Nissan, Saab, Toyota, Mazda, and Volkswagen. AIAM stated that its member companies are striving to address this issue as quickly as possible and that it was generally committed to participate with other stake holders in a campaign that has been discussed with NHTSA. This recommendation was classified "Open—Acceptable Response" pending further action from the AIAM or the individual manufacturers. Additional information from AIAM, dated 7/22/96, is being reviewed by the Board.

On October 16, 1996, upon completion of the current safety study, the Safety Board reclassified H-95-19 "Closed/Superseded" by H-96-29 issued to the domestic and international automobile manufacturers.

Safety Recommendation No.: H-95-20
Date Issued: November 2, 1995
Recipient: Foreign and Domestic Automobile Manufacturers
Status: Open—Acceptable Response (BMW, Chrysler, Fiat, Ford, General Motors, Honda, Hyundai, Isuzu, Mazda, Mitsubishi, Nissan, Saab, Subaru, Toyota, Volkswagen, Volvo)
Open—Await Response (Jaguar, Suzuki)
Closed—Acceptable Alternate Action (Mercedes-Benz)
Closed—Reconsidered (Alfa Romeo, Peugeot)

Subject:

Develop and attach to new vehicles with passenger-side air bags a visible warning regarding the dangers of placing a rear-facing child safety seat or improperly restrained small child in the front seat of the vehicle. This warning should be permanent and visible to the front seat passengers at all times.

Brief Narrative of Status Assignment:

In a letter dated 2/1/96, the American Automobile Manufacturers Association (AAMA) responded to the NTSB recommendations on behalf of its members—Chrysler, Ford, and General Motors—indicating that it would work with NHTSA on this issue. This recommendation was classified "Open—Acceptable Response" pending further action from AAMA or the manufacturers. Correspondence from General Motors, dated 7/30/96, informed the Board of actions taken to address passenger protection issues and enhance child restraint system effectiveness. This information is being reviewed by the Board.

In a letter dated 2/9/96, the Association of International Automobile Manufacturers (AIAM) responded on behalf of its members—Alfa Romeo, Fiat, Hyundai, BMW, Honda, Mitsubishi, Peugeot, Subaru, Volvo, Mercedes-Benz, Nissan, Saab, Toyota, Mazda, and Volkswagen. AIAM stated that its member companies are striving to address this issue as quickly as possible and that it was generally committed to participate with other stake holders in a campaign that has been discussed with NHTSA. AIAM believes that NHTSA will propose revisions to existing air bag informational labeling requirements and expects to be involved directly with this activity. This recommendation has been classified "Open—Acceptable Response" pending further action from AIAM or the manufacturers. Additional information from AIAM, dated 7/22/96, is being reviewed by the Board. A Mercedes-Benz letter of 4/24/96 informed the Board that as of April, the manufacturer was installing warning labels on all new cars and that current owners would be advised of the availability of labels through press releases, dealer notifications, and club magazines. The Board subsequently classified the recommendation "Closed—Acceptable Alternate Action."

In a letter dated 11/17/95, Alfa Romeo reported that it will discontinue the sales in the U.S. market effective 12/31/95. It was stated that distributors would conduct a mailing to owners of all registered 1995 vehicles and dealers. The Board was also informed that Peugeot no longer imports vehicles for sale in the U.S. market.

Safety Recommendation No.: H-95-21
Date Issued: November 2, 1995
Recipient: Child Safety Seat Manufacturers
Status: Closed—Reconsidered

Subject:

Child safety seat manufacturers (Babyhood Industries, Century Products, Chrysler Corporation, Cosco Inc., Evenflo, Fisher-Price, Gerico Inc., Kolcraft, and Nissan Motor Corporation) should conduct a mail campaign to all registered owners of child safety seats that are designed to face rearward. Provided information will warn of the dangers of placing a rear-facing child safety seat in the front seat of a vehicle equipped with a passenger-side air bag.

Brief Narrative of Status Assignment:

In a letter dated 1/8/96, Jonathan Reynolds, chairman of the Car Seat Committee of the Juvenile Products Manufacturing Association, Inc., responded to the NTSB recommendation, writing that the committee did not feel that a mail campaign would be effective. He stated that such mass mailings have historically proven ineffective in reaching the target audience.

Safety Recommendation No.: H-95-22
Date Issued: November 2, 1995
Recipient: Child Safety Seat Manufacturers
Status: Open—Acceptable Response

Subject:

Develop and attach to all new child safety seats designed to be used in the rear-facing position, a visible flier that warns of the dangers of placing a child safety seat facing rearward in the front seat of a vehicle equipped with a passenger side air bag.

Brief Narrative of Status Assignment:

In a letter dated 1/8/96, Jonathan Reynolds, chairman of the Car Seat Committee of the Juvenile Products Manufacturing Association, Inc., responded to the NTSB, writing that the committee felt the recommendation was worthy of consideration, but that they felt the flier would be effective only for initial purchasers of child seats, and then only in a small percentage of those purchasers. He also stated that the NTSB's recommendations as well as other options would be considered by the committee.

Safety Recommendation No.: H-95-23
Date Issued: November 2, 1995
Recipient: Shinn & Associates, Inc.
Status: Open—Acceptable Response

Subject:

Conduct a mail campaign to all users and purchasers of the 1990 video "Getting It Right" to advise them that supplemental information regarding the dangers of placing a rear-facing child safety seat in the front seat of a vehicle equipped with a passenger-side air bag needs to be provided to viewers of this video.

Brief Narrative of Status Assignment:

The Board issued H-95-23 and -24 to Shinn & Associates on 11/2/95. The response letter from Shinn & Associates, dated 6/26/96, indicated that some information needed to compile a list of the organizations that received copies of the video is not available nor are there resources to comply with the recommendation. Shinn & Associates is providing information about the dangers of air bags when the company has contact with the users of the video.

Safety Recommendation No.: H-95-24
Date Issued: November 2, 1995
Recipient: Shinn & Associates, Inc.
Status: Closed—No Longer Applicable

Subject:

Modify the video "Getting It Right" to ensure that any future distribution of this video includes the appropriate warnings to parents about the dangers of placing rear-facing child safety seats in the seat of a vehicle equipped with a passenger-side air bag.

Brief Narrative of Status Assignment:

The Board issued H-95-23 and -24 to Shinn & Associates on 11/2/95. The response letter from Shinn & Associates, dated 6/26/96, indicated that the company is no longer distributing the video. The Board subsequently classified H-95-24 "Closed—No Longer Applicable."

Safety Recommendation No.: H-95-25
Date Issued: November 2, 1995
Recipient: Reading Hospital and Medical Center
Status: Open—Await Response

Subject:

Conduct a mail campaign to all persons who have had babies at that hospital in the past year to warn them of the dangers of placing a rear-facing child safety seat in the front seat of a vehicle equipped with a passenger-side air bag.

Brief Narrative of Status Assignment:

The Board issued H-95-25 and -26 to Reading Hospital and Medical Center on 11/2/95. No response has been received despite the Board's followup letter of 5/10/96.

Safety Recommendation No.: H-95-26
Date Issued: November 2, 1995
Recipient: Reading Hospital and Medical Center
Status: Open—Await Response

Subject:

Ensure that the childbirth education programs and other new parenting classes offered by the hospital include information that warns of the dangers of placing a rear-facing child safety seat in the front seat of a vehicle equipped with a passenger side air bag.

Brief Narrative of Status Assignment:

The Board issued H-95-25 and -26 to Reading Hospital and Medical Center on 11/2/95. No response has been received despite the Board's followup letter of 5/10/96.

Safety Recommendation No.: H-95-27
Date Issued: November 2, 1995
Recipient: Department of Health and Human Services (HHS)
American Hospital Association (AHA)
Association of State and Territorial Health Officials (ASTHO)
Status: Open—Await Response (for AHA, ASTHO)
Closed—Acceptable Alternate Action (for HHS)

Subject:

Ensure that all hospitals with obstetrics units conduct a mail campaign to all persons who have had babies in the past year that warns of the danger of placing a rear-facing child safety seat in the front seat of a vehicle equipped with a passenger-side air bag.

Brief Narrative of Status Assignment:

In letters dated 11/20/95 and 1/26/96, Assistant Surgeon General Audrey Nora stated that the Department is aware of the current air bag issue and that staff has worked with both NHTSA and the NTSB to identify organizations that will help to assure widespread circulation of this information. She also noted that HHS has alerted several national organizations of this issue and has included this information in its Emergency Medical Services for Children (EMSC) newsletter that goes to 1,200 EMSC and maternal and child health professionals.

The AHA and ASTHO have not yet responded despite the Board's followup letters of March 1996. The current status is "Open—Await Response" for these organizations.

Safety Recommendation No.: H-95-28
Date Issued: November 2, 1995
Recipient: Department of Health and Human Services (HHS)
American Hospital Association (AHA)
Association of State and Territorial Health Officials (ASTHO)
Status: Open—Acceptable Response (for HHS)
Open—Await Response (for AHA, ASTHO)

Subject:

Ensure that the childbirth education programs and other new parenting classes include information that warns of the dangers of placing a rear-facing child safety seat in the front seat of a vehicle equipped with a passenger-side air bag.

Brief Narrative of Status Assignment:

In letters dated 11/20/95 and 1/26/96, Assistant Surgeon General Audrey Nora stated that the Department is aware of the current air bag issue and that staff has worked with both NHTSA and the NTSB to identify organizations that will help to assure widespread circulation of this information. She also noted that HHS has alerted several national organizations of this issue and will distribute the materials developed by NHTSA personnel to the HHS regional offices and to State-level personnel. The HHS will also include the message in its Children's Safety Network newsletter.

The AHA and ASTHO have not yet responded despite the Board's followup letters of March 1996. The current status is "Open—Await Response" for these organizations.

Safety Recommendation No.: H-95-29
Date Issued: November 2, 1995
Recipient: Academy of Certified Birth Educators (ACBE)
American Academy of Family Physicians (AAFP)
American Academy of Pediatrics (AAP)
American College of Nurse Midwives (ACNM)
International Childbirth Education Association (ICEA)
American College of Obstetricians & Gynecologists (ACOG)
Status: Open—Acceptable Response (for ACOG)
Open—Acceptable Alternate Response (for AAP)
Closed—Acceptable Alternate Action (for AAFP)
Open—Response Received (for ACBE, ACNM)
Open—Await Response (for ICEA)

Subject:

Urge members to contact all persons who have had babies in the past year to warn them of the dangers of placing a rear-facing child safety seat in the front seat of a vehicle equipped with a passenger-side air bag.

Brief Narrative of Status Assignment:

ACOG responded with plans to include the subject in newsletters and patient education materials. AAFP also included information in their newsletter to 80,000 members. AAP News (10/95) included an article on the dangers of rear-facing child seats in vehicles with passenger-side air bags. AAP is also developing a flier for pediatricians to give parents. Responses from both ACBE (6/19/96) and ACNM are being reviewed by the Board. The Board has not yet received a response from ICEA.

Safety Recommendation No.: H-95-30
Date Issued: November 2, 1995
Recipient: Academy of Certified Birth Educators (ACBE)
American Academy of Family Physicians (AAFP)
American Academy of Pediatrics (AAP)
American College of Nurse Midwives (ACNM)
International Childbirth Education Association (ICEA)
American College of Obstetricians & Gynecologists (ACOG)
Status: Open—Await Response (for ICEA)
Open—Acceptable Response (for ACOG)
Closed—Acceptable Alternate Action (for AAFP, AAP)
Open—Response Received (for ACBE, ACNM)

Subject:

Urge members to ensure that information provided to new parents warns of the dangers of placing a rear-facing child safety seat in the front seat of a vehicle equipped with a passenger-side air bag.

Brief Narrative of Status Assignment:

ACOG indicated that the subject was forwarded to the appropriate committee and would be included in the organization's newsletter. The status remains "Open" until the newsletter is distributed. Both AAFP and AAP took action to include the information in their newsletters. Responses from both ACBE (6/19/96) and ACNM are being reviewed by the Board. The Board has not yet received a response from ICEA.

Safety Recommendation No.: H-95-31
Date Issued: November 2, 1995
Recipient: Lamaze Publishing Company, Inc.
Status: Closed—Acceptable Action

Subject:

Advise parents, through the Newborn Channel and Lamaze Magazine, of the dangers of placing a rear-facing safety seat in the front seat of a vehicle equipped with a passenger-side air bag.

Brief Narrative of Status Assignment:

In a letter to NTSB dated 5/16/96, Lamaze responded that the information will be included in its update of Parents Magazine, circulated to 2.2 million. The section "Buckle Up" will include a specific segment on car seats/child passenger safety.

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Appendix G

Safety Board Comments to NHTSA Concerning Occupant Crash Protection Issues

JAN - 4 1996

Docket 74-14; Notice 97
Docket Section, Room 5109
National Highway Traffic
Safety Administration
400 7th Street, S.W.
Washington, D.C. 20590

The National Transportation Safety Board supports the efforts of the National Highway Traffic Safety Administration to examine the adverse effects of air bags in certain situations (Docket 74-14; Notice 97), Although the Safety Board recognizes the effectiveness of air bags in most accident situations and the number of lives that have been saved as a result of air bags, the Board has investigated a number of accidents in which the air bag was the cause of death or injury in otherwise survivable accidents. Although the Safety Board has provided NHTSA with the results of its accident investigations through previous correspondence, for the convenience of the docket, the Board is resubmitting information on the accidents that it has investigated.

Accordingly, enclosed for the docket files is a report that contains the case summaries of 41 accidents involving driver side air bags investigated by the Board between 1990 and 1992. (Highway Accident Cases; Automatic Restraints, September 1990- May 1992) Also enclosed is a copy of Safety Recommendation H-95-17 issued to the NHTSA on November 2, 1995. The recommendation addresses 8 accidents investigated by the Board involving small children killed or injured by air bags. The recommendation asks the NHTSA to develop and implement a highly visible nationwide multi-media campaign to advise the public about the dangers of placing a rear-facing child safety seat or an unrestrained or improperly restrained small child in the front seat of a vehicle equipped with passenger side air bags.

The Board commends the NHTSA's efforts to address this problem on a long-term basis in addition to the important short term action recommended by the Board. The complete docket on each accident will be available in January if you would like to review each case in more detail. For more information on accessing these dockets please contact our Public Inquiries Branch at 202-382-6735.

Sincerely,

ORIGINAL SIGNED BY
JIM HALL

Jim Hall
Chairman

Enclosures

JAN 2 1 1992

Docket Section
National Highway Traffic
Safety Administration
Room 5109
400 Seventh Street, S.W.
Washington, D.C. 20590

Dear Sir:

The National Transportation Safety Board has reviewed the supplementary notice of proposed rulemaking on Federal Motor Vehicle Safety Standards; Occupant Crash Protection (Docket No. 87-08; Notice 8). The Safety Board is pleased that the National Highway Traffic Safety Administration (NHTSA) is considering a requirement that lap belts or the lap belt portion of lap/shoulder belts should be capable of tightly securing child safety seats.

In its safety study "Child Passenger Protection Against Death, Disability, and Disfigurement in Motor Vehicle Accidents" (NTSB/SS-83/01), the Safety Board investigated one accident in which a child safety seat was improperly secured by a seatbelt with an emergency locking retractor. In this accident (case 46), a 15-month-old boy was fatally injured when the 1980 Toyota Corolla in which he was riding ran off the road and struck a wooden utility pole. The effect of the misuse of the safety seat with an emergency locking retractor could not be determined. The investigation identified four possible neck load sources of the child's fatal neck injury: head contact with the rear of the front seatback, with the right interior side of the vehicle, with the ironing board also being carried in the car, or with the shield of the safety seat.

In this safety study, the Board found that misuse of safety seats was widespread, including several cases of misuse of the vehicle seatbelt. In these cases either the vehicle safety belt was not secured or was not tightly fastened around the child safety seat. Perception that a seatbelt might not properly secure a child safety seat, such as is the case with seatbelts using emergency locking retractors, could result in nonuse of the seatbelt. Therefore, the Board agrees that "lockability" is an important issue in encouraging proper use of child safety seats.

The Safety Board also believes that although parents should be encouraged to put children in child safety seats in the rear seats of cars for safety reasons, parents do not choose to do so. Therefore, the Board supports the NHTSA's proposal that all seating positions, other than the driver's, be subject to the lockabil ity requirement. This requirement should also pertain to passenger vehicles with automatic restraints because it may be necessary to secure a child safety seat in a seating position with an automatic seatbelt.

The Safety Board appreciates this opportunity to comment on NHTSA's efforts to improve child passenger safety.

Sincerely,

Original Signed By
James L. Kolstad

James L. Kolstad
Chairman

AUG 23 1991

Docket Section
National Highway Traffic
Safety Administration
Room 5109
400 Seventh Street, S.W.
Washington, D.C. 20590

Dear Sir:

The National Transportation Safety Board has reviewed the "Planning Document on Potential Standard 213 Upgrade; Federal Motor Vehicle Safety Standards; Child Restraint Systems" (Docket No. 74-09; Notice 21). We commend the National Highway Traffic Safety Administration's (NHTSA) effort to explore ways to improve the testing and performance of child restraint systems.

The Safety Board is pleased to learn from the request for comments that the NHTSA intends to amend FMVSS 213 to include the use of lap/shoulder belts to test belt positioning booster seats, pending positive findings from the research activities planned to review this issue. Belt positioning booster seats have been used successfully in Australia and Sweden since 1978 and the Safety Board believes they should be available to the American consumer. As stated in the Board's letter dated February 22, 1991, to NHTSA, which issued Safety Recommendations H-91-1 and -2, the recent proliferation of lap/shoulder belts in the rear seat of passenger cars makes the use of belt positioning booster seats simple and logical.

The Safety Board investigated two accidents involving belt positioning booster seats in conjunction with its study on the performance of lap/shoulder belts in 167 motor vehicle accidents (NTSB/SS-88/02). In both cases the combination of the lap/shoulder belt with the belt positioning booster seat provided an acceptable level of protection for the children riding in them.[1]

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[1] Case 5: **1980 Volkswagen Vanagon struck a 1983 Ford Ranger pickup truck in the rear. Delta V 10.8 mph. A 5-year-old child was seated in the right front passenger seat of the Volkswagen in a belt positioning booster seat with the Lap/shoulder belt in use (injury severity--uninjured) .**

Case 71: 1983 Ford Escort station wagon struck the left side of a 1975 Chevrolet Chevelle. Delta V 14.1 mph. A 4-year-old child seated in the right front passenger seat of the Ford in a belt positioning booster seat with the lap/shouider belt in use sustained a laceration/abrasion from the shoulder portion of the belt (injury severity- -AIS 1).

2

The NHTSA notes in its proposed plan that the agency will consider the testing of child restraint systems under both lapbelt and lap/shoulder belt conditions. It may be necessary, according to the planning document, to conduct a series of test to determine which test condition represents the "worst case," if it is decided that only one of the two test conditions is necessary. The Safety Board is concerned that if a lapbelt-only test is selected as representing the worst case and is the single performance test conducted, this could preclude evaluation of the upper torso protection that belt positioning booster seats (or any other seat designed to be used with a lap/shoulder belt) can provide.

The Safety Board is also concerned about proper use of belt positioning booster seats and urges the NHTSA to coordinate distribution of belt positioning booster seats with proper labeling, proper marketing, and public information and education programs. The testing of various child-sized anthromorphic dummies in belt positioning booster seats would establish upper and lower weight limits for use of a belt positioning booster seat. The test results would enable manufacturers to label their seats according to the size and weight restrictions, and would enable child restraint education materials and programs to advise parents of the size child that can use a belt positioning booster seat. Such education and labeling should contribute to the proper use of belt positioning booster seats.

The Safety Board also believes that attention must be paid to the performance of mini-shield booster seats. The Board is concerned that the small shields on the mini-shield booster seats may not provide adequate upper torso restraint to control head and neck excursion. The Safety Board is completing its investigation of an accident that occurred on March 22, 1991, in Glendale, Illinois, in which a 2-year-old child, riding in a Gerry Voyager mini-shield booster seat, was fatally injured. The lack of upper torso restraint on the mini-shield booster seat allowed the child's head to hit his legs and then jam into the seatback in front of him. The child died as a result of a ruptured heart and subluxation of the spine into the skull.

The Glendale accident also raises two other concerns identified by the NHTSA in the planning document--excursion distances, and size and weight compatibility. The Nissan Sentra, in which the fatally injured child was riding, may not have had enough distance between the front and rear seats to allow for the head excursion limit considered acceptable by the current FMVSS 213 performance standards. The child in this case was 38 inches tall. A taller child would likely have had less head excursion room. The Board believes that the NHTSA should reexamine the head and knee excursion limits, especially in light of the effect of downsizing of automobiles.

The size and weight of children using mini-shield booster seats were also issues in the Glendale case; the child using the booster seat was 2 years old, 38 inches tall, and weighed about 30 pounds. The Board is concerned that children do not always use a safety seat designed for their size and weight. The NHTSA should require testing of child restraint devices with anthromorphic dummies of varied sizes and weights to enable manufacturers to provide labels that would advise parents of the true upper and lower size and weight limits of the safety seat.

The Board is not commenting, at this time, on the section related to air bag/child restraint interaction. However, accidents in which air bags were involved are a priority area for the Board's highway accident investigations. To date, we have not investigated any accidents involving air bag/child restraint interaction. Should such a case be investigated, the Board will share the information with the NHTSA.

The Safety Board appreciates the opportunity to provide comments on Federal Standard 213.

Sincerely,

Original Signed By
James L. Kolstad

James L. Kolstad
Chairman

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Appendix H

NHTSA Information Brochure on the Proper Use of Child Restraint Systems

ARE ***YOU*** USING IT RIGHT?

*As many as **half** of the child car seats in use today are installed **incorrectly** without parents realizing it.*

WHY?

Vehicle seats and seat belts are built for the comfort of adults, not to secure a child car seat correctly.

Some seat belts need a different buckle or a special locking clip to safely secure a child car seat.

Some child car seats cannot be used safely in certain seating positions.

Air bags can cause serious injury or death to infants in REAR-FACING child car seats.

This booklet shows you how to solve problems you may have installing your child car seat correctly and securing your child safely in the car seat.

WHAT SHOULD**YOU DO?**

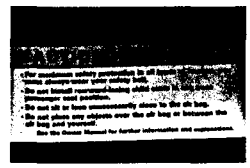
Read this booklet to learn how to correct common mistakes.

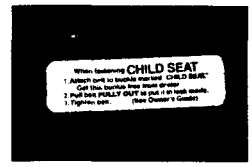
Read your vehicle owner's manual and the instructions that come with your child car seat.

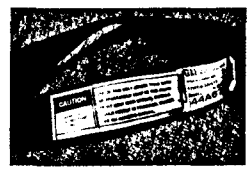
Try the child car seat in your vehicle, moving it to a different seating position if necessary.

READ**LABELS**

Look for and read labels on seat belts and sun visors and follow instructions. The information could save your child's life...

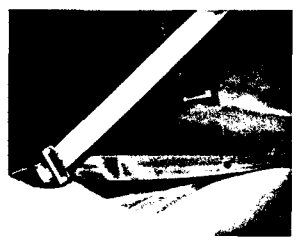






CHILD RESTRAINT DOESN'T FIT SCOOPED**OUT SEAT**

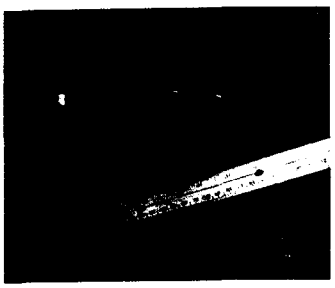
Scooped out seat cushions and belts forward of the seat crack...



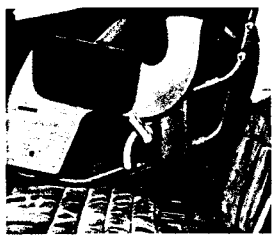
...can make it difficult or even impossible to install a child restraint...

...seat belt fit is also poor on this five-year-old. Lap belt crosses over stomach, shoulder belt is under chin.

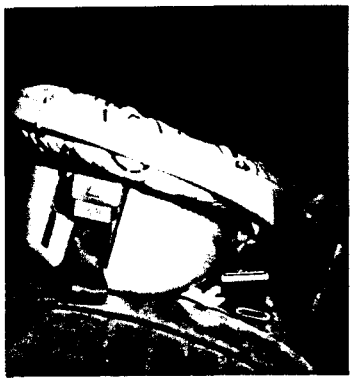
SEAT BELTS**FORWARD OF SEAT CRACK**



Even if the seat of the car is flat, seat belts that come out forward of the seat crack...

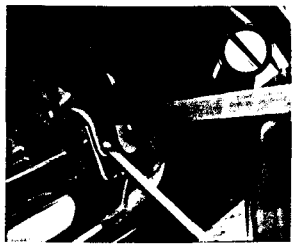


...can make it difficult to secure a child restraint tightly...

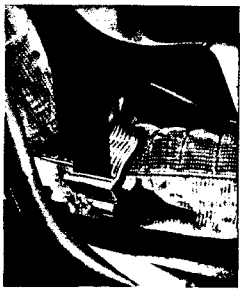


...a car bed should not be used at all with this type of seat belt.

DOOR-MOUNTED**BELTS**

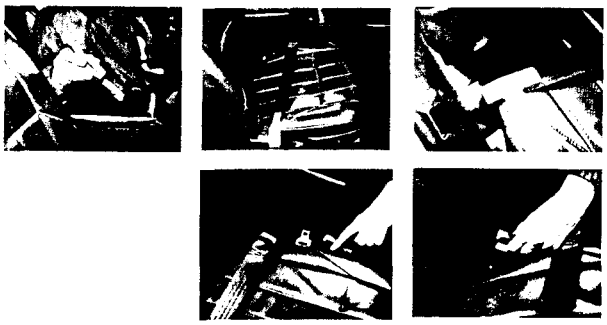


Door-mounted seat belts should not be used to anchor child restraints...



...your auto dealer can install a special lap belt designed to lock the child restraint in place.

ADD-ON**BUCKLE**



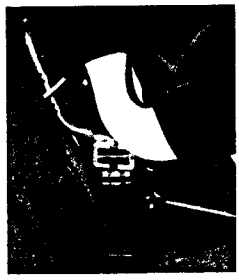
In the front seats of some cars, the inboard buckle is too far forward. A special add-on buckle, obtainable from the dealership, corrects a serious compatibility problem.

LOCKING**CLIP USE**

This is a "free-sliding" latch plate. A locking clip is required to keep the lap belt tightly secured.

...this is a "locking" latch plate; once the belt is tightened it will keep the lap belt tightly secured without a locking clip.

This is the end of the belt that has the latch plate. The latch plate locks into the buckle...



...a locking clip should be installed just above the latch plate as shown here...

...NOT on the other side. Using the clip as shown here would not hold the child restraint in a crash.

SEAT BELTS THAT CAN **BE LOCKED**

As the label explains, some seat belts can be locked...

...by pulling the shoulder belt all the way out and then releasing it.

INFANTS AND **AIRBAGS DON'T MIX**

A rear-facing infant must NOT ride in a seat that has a airbag...

...at nine months, this baby is NOT old enough to ride facing forward...

...when an airbag is present, a baby must be placed rear-facing in the back seat.

SELECTING SEAT FOR **BEST FIT**

A shield is a poor choice for a newborn. Straps don't fit...

...a five-point harness provides a far better fit...

...for the first few months, an infant-only safety seat is a good choice.

COVERING BABY **CORRECTLY**

Don't wrap the baby up before putting on the harness...

...straps must go on first, covering must go on last.

CORRECT CAR **SEAT ANGLE**

Child restraint is too upright for newborn. Baby's head flops forward...

...a rolled towel tucked under the front of the restraint tips it back a little.

HARNESS **SLOT LEVEL**

Rear-facing, use harness slots below shoulder level...

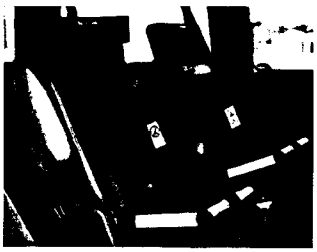
...NOT above shoulder level.

TWISTED HARNESS**STRAPS**

Twisted straps and missing harness retainer clip downgrade protection...

...straps must lie flat and be held on shoulders with a harness retainer clip.

BUILT**IN SEATS**



Built-in child safety seats do away with installation problems...

...the seat on the far side is used here as a booster, because this child weighs over 40 pounds.

WHEN TO**CHANGE**

At age two, this child is too young for a booster...

...a regular child restraint should be used until outgrown.

SHOULDER**BELT FIT**

This shoulder belt comes across the throat...

...but tucking it under the arm isn't the answer; it could cause life-threatening injuries in a crash...

...for a better fit of the lap and the shoulder belt, raise the child up on a belt-positioning booster.

HEAD**POSITION IN CAR BED**

In a car bed, infant's head must be in the center of vehicle, away from the door.

SEAT**BELT FIT**

This 11-year-old is slouching; the lap belt goes over his stomach. In a crash, this could lead to serious or fatal internal injuries...

...sitting upright against the seat back keeps the lap belt below hip bones, touching the upper thighs.

DOT HS 808 302
September 1995

USE OF SEAT**BELT WITH BOOSTER**

A shield booster should be used when only a *lap* belt is available...

Do not use locking clip with belt positioning booster

...but if your car has combination lap *and* shoulder belts, and the shield is detachable, the booster base should be used *alone*.

BOOSTER**SEAT FIT**

If the child's ears are above the top of the seat back...

...a booster with a high back should be used...

...this booster ensures perfect fit of both lap and shoulder belt and provides comfort and support for the sleeping child.

IF YOU STILL HAVE **PROBLEMS:**

Call the Auto Safety Hotline toll-free number, 1-800-424-9393. Be sure you have the make, model number and year or date of manufacture of both your vehicle and child car seat when you call.

US Department of Transportation
National Highway Traffic Safety Administration

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Appendix I

American Academy of Pediatrics Flier, "Babies and Air Bags Don't Mix!"

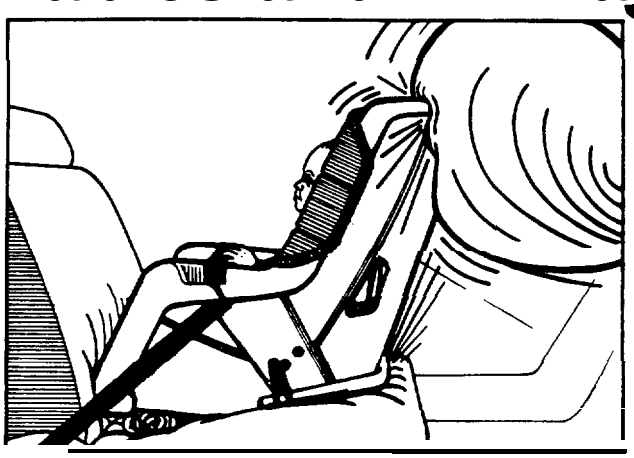
The illustrations in the American Academy of Pediatrics flier were provided by the Center for Disease Control.

Does your car have a passenger-side air bag?
Do you have a baby under 20 pounds?

MAKE EVERY RIDE
A SAFE RIDE
American Academy of Pediatrics

If you answer "yes" to both questions, watch out!
" Never carry your baby in the front seat.
•*He* or she could be in danger in a crash - or even a low-speed collision.

Babies and Air Bags Don't Mix!



A passenger air bag could strike tbe back of the safety seat extremely hard. This could seriously injure a baby's head.

Why?

The back of the rear-facing safety seat (car seat) is located very close to the dashboard, where the air bag is housed.

The air bag is designed to inflate in any head-on collision over about 12 mph. When it begins to open, it has tremendous force.

The air bag could hit the back of the safety seat very hard, as you see here (left). This impact could seriously injure the baby's head and brain.

What can you do?

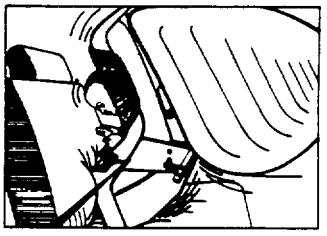
Always put your baby in tbe back seat, still facing the rear until he or she is old enough and large enough to face forward (20 pounds or age 1). In some vehicles, mirror accessories may aid the driver in seeing a rear-facing infant in the back seat.

If possible, have an adult ride in back with a very young baby or any infant who has special medical problems.

Never turn a baby under 20 pounds to f ace the front of the car. This could cause neck injury in a crash.

For an older child riding in a safety sat facing forward, slide the vehicle seat back as far as it will go. He or she will be cushioned by the air bag when it has opened fully .

Air bags can save lives and prevent serious injuries. They are intended to be used with safety belts or forward-facing child safety seats.



After tbe impact, tbe air bag could tbrow tbe safety seat up and into tbe beadrest or between tbe seats.

Read your vehicle owner's manual for instructions about children and air bags.

Appendix J

Government/Industry Coalition for Air Bag Safety

U.S Department of Transportation

News:

Office of the Assistant Secretary for Public Affairs
Washington, D.C. 20590

FOR IMMEDIATE RELEASE
Tuesday, May 21, 1996

NHTSA 24-96
Contact: Barry McCahill
Tel. No.: (202) 366-9550

SECRETARY PEÑA ANNOUNCES GOVERNMENT/INDUSTRY COALITION FOR AIR BAG SAFETY

Secretary of Transportation Federico Peña today announced the formation of an unprecedented coalition of automobile manufacturers, air bag suppliers, insurance companies, safety organizations and the federal government to prevent injuries and fatalities which may be inadvertently caused by air bags, especially to children.

"Safety is President Clinton's top transportation priority, " Secretary Peña said. "Together, business and government will work to alert the public to the proper role of air bags and to ensure that seat belts are always used with an air bag. In addition, we will educate parents about the best way to install a child safety seat in a car that has a passenger side air bag. "

Coalition members have pledged almost $10 million to pursue a three-point program:

- An extensive national effort to educate drivers, parents and care-givers about seat belt and child safety seat use in all motor vehicles, with special emphasis on those equipped with air bags.

- A campaign to convince states to pass "primary" seat belt use laws. Under such a primary law, police officers need no other reason to stop a driver and issue a ticket than failure to use a seat belt. Only 12 states have primary laws. Thirty-seven states currently have "secondary" belt laws, meaning that police may cite belt law offenders only if first stopped for some other violation.

- Activities at state and local levels to increase enforcement of all seat belt and child seat use laws, such as increased public information and use of belt checkpoints.

(more)

Air bags are an important safety advance that have saved some 1,500 lives since the late 1980s, said Secretary Peña. However, NHTSA is aware of at least 19 cases in which a child either in a rear-facing infant seat or riding improperly belted was killed by a deploying air bag.

Secretary Peña saluted the leadership demonstrated by the companies and safety organizations in helping form the coalition. "We can be a powerful voice for educating the public about the correct use of air bags and we can work to promote tougher state seat belt laws and enforcement," said the Secretary.

D. Richard McFerson, CEO of Nationwide Insurance Enterprise, said, "Motor vehicle crashes are the leading risk our children face. As a nation, we need to do a better job of protecting them from these risks as well as the specific risk of air bag injuries."

George A. Peapples, vice president of Corporate Affairs for General Motors Corporation, said, "The fact that groups in the public and private sectors are joining together in this initiative speaks to the seriousness of the problem. We must address it now -- before it gets worse."

Philip A. Hutchinson, president of the Association of International Automobile Manufacturers, said, "Our member companies at AIAM are committed to reducing injuries and loss of life through efforts to pass effective safety belt legislation and this aggressive educational program. We call on responsible motorists and parents to ensure that all occupants in their vehicles are safely and securely buckled in. We have the technology to save lives. But technology will fulfill its mission only if it's used properly and intelligently."

Don Defossett, president of Allied Signal Safety Restraint Systems and chairman of the Automotive Occupant Restraints Council, said, "The council and its member companies are pleased to support the mission of this coalition which is to prevent injuries and fatalities, especially to our children, that result from traffic crashes. Public education and passage of more effective state safety belt use laws are necessary to achieve our mission."

"Infants in rear-facing child safety seats should never be placed in the front seat if the vehicle has a passenger-side air bag, " said Ricardo Martinez, M. D., administrator of the department's National Highway Traffic Safety Administration (NHTSA). Martinez said there have been five infant fatalities because of air bags.

"The safest place for children of all ages is the back seat. If riding in the back seat is not an option, toddlers and older children may ride in the front seat of a vehicle with a passenger-side air bag, but only if buckled up properly and with the seat moved as far back as possible, " he added.

(more)

Air bags have been phased in to the U.S. motor vehicle fleet since the mid-1980s when the Department of Transportation required some form of automatic frontal crash protection for front seat occupants. Manufacturers were free to offer air bags or automatic seat belts, and both technologies were used. The requirement was modified by the Congress in 1991 to an air bag mandate. All passenger cars must offer dual front air bags by Model Year 1998, and light trucks the following year. Virtually every new passenger vehicle sold today comes equipped with at least a driver-side air bag, and many already offer dual air bags in the front seat.

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An electronic version of this document can be obtained via the World Wide Web at: http://www.dot.gov/affairs/index.htm

Coalition Financial Contributors

Insurers:

Allstate Insurance Company
Liberty Mutual Insurance Company
Metropolitan Property and Casualty Insurance Company
Nationwide Insurance Company
Prudential Property and Casualty Insurance Company
State Farm Mutual Insurance Company

American Automobile Manufacturers Association:

Chrysler Corporation
Ford Motor Company
General Motors Corporation

Association of International Automobile Manufacturers:

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Volvo

Automotive Occupant Restraints Council

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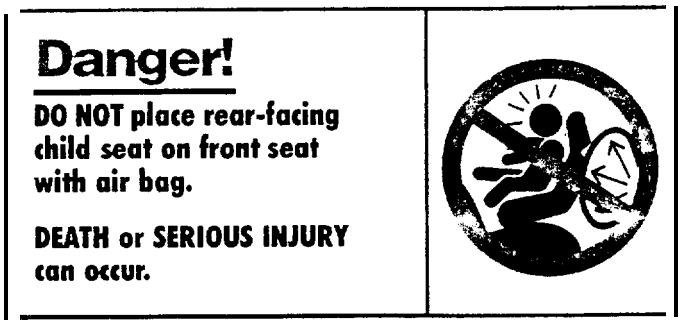
Appendix K

Vehicle Air Bag Warning Labels Proposed by NHTSA

Proposed Air Bag Warning Labels

- **Visor in Up Position**

- **Visor in Down Position**



- **Label on Passenger-Side Dash Between or on Door (Visible When Door is Open)**

AND

- **Same Label on Child Seat Where Child's Head Rests**

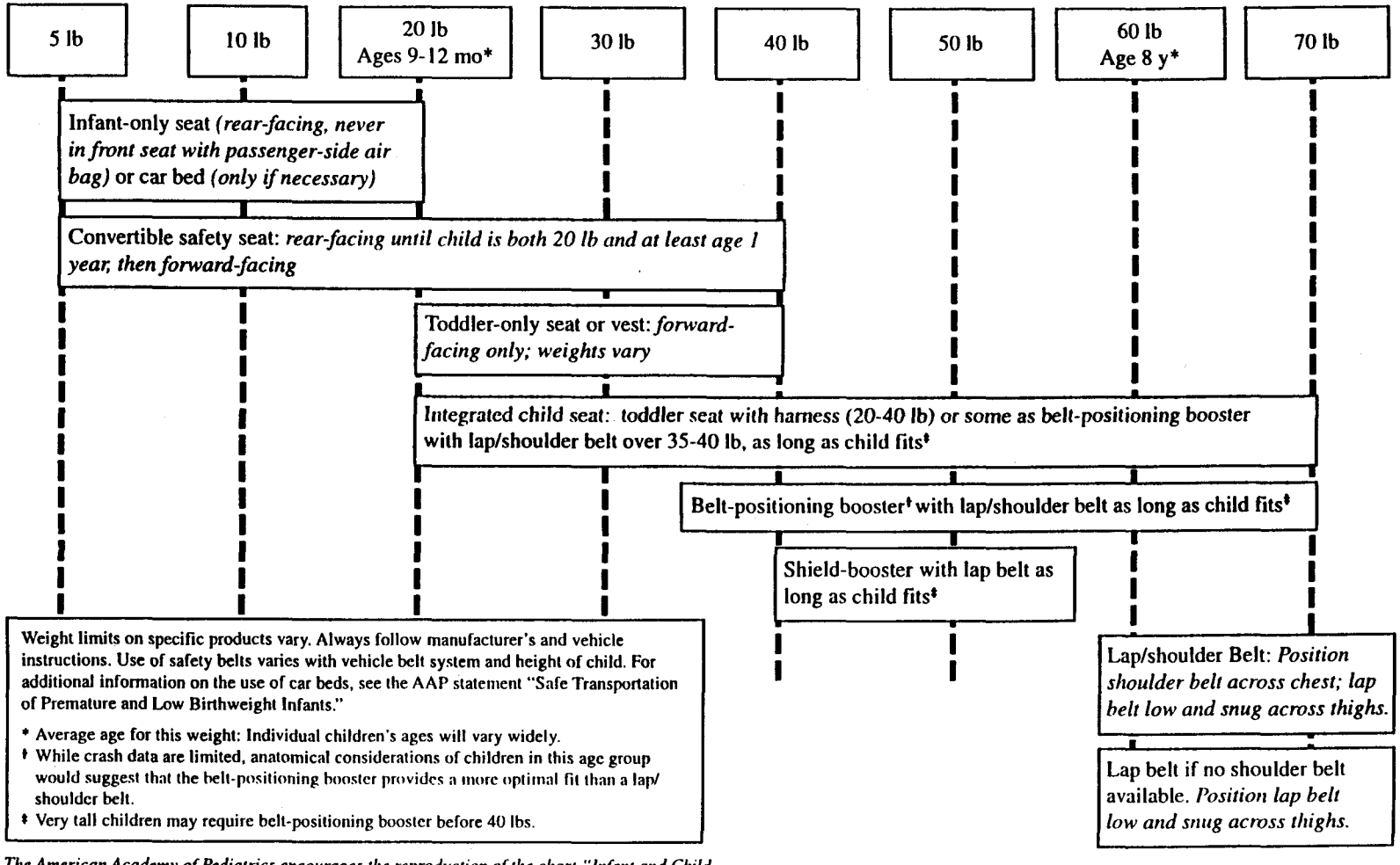
- **Removable Label in Middle of Dash**

Appendix L

Selecting the Appropriate Type of Child Restraint System: Guidelines of the American Academy of Pediatrics, NHTSA, FMVSS 213, and a Child Restraint System Manufacturer

Infant and Child Restraints: Selecting the Appropriate Type

- The safest place in a car for all children is the rear seat.
- Never place a rear-facing infant seat in the front seat of a vehicle with a passenger-side air bag.



Weight limits on specific products vary. Always follow manufacturer's and vehicle instructions. Use of safety belts varies with vehicle belt system and height of child. For additional information on the use of car beds, see the AAP statement "Safe Transportation of Premature and Low Birthweight Infants."

* Average age for this weight: Individual children's ages will vary widely.

† While crash data are limited, anatomical considerations of children in this age group would suggest that the belt-positioning booster provides a more optimal fit than a lap/shoulder belt.

‡ Very tall children may require belt-positioning booster before 40 lbs.

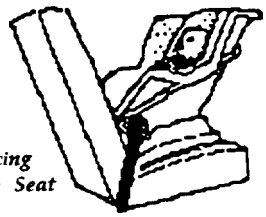
American Academy of Pediatrics, 1996

SIZE AND WEIGHT GUIDE FOR CHILD SAFETY SEATS

From Birth to 9-12 Months or 20 Pounds

Use an infant or convertible seat facing the rear.

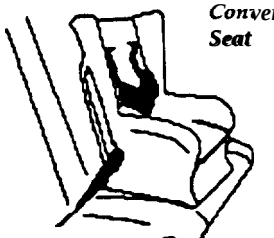
Infant Seat



Rear Facing Convertible Seat

9-12 Months or 20 Pounds to 4 Years or 40 Pounds

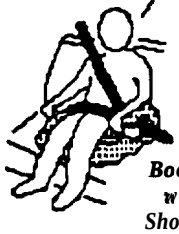
Use a convertible or toddler seat.



Convertible Seat

4 Years or 40 Pounds to 8 Years or 70 Pounds

Keep children in convertible or toddler seats as long as they will fit.



Booster Sent with Lap/ Shoulder Belt

When they have outgrown the convertible or toddler seat,

- ***If the vehicle has a lap/shoulder belt in the rear seat, use a*** booster seat ***that positions the lap/shoulder belt*** correctly--secures the lap belt across the child's hips, and positions the shoulder belt so it does not cross ***the face or the front of the neck.***

OR

- ***Use the*** rear lap/shoulder belt alone ***IF it fits properly—*** does not cross the face or neck and fits across the ***child's hips and does not ride up across the stomach.***
- ***If no rear lap/shoulder belt is available, use a*** shield-type booster seat restrained by the vehicle lap belt.
- If no other type of restraint is available, use the lap belt, ***positioned low on the hips and adjusted snugly.***

Vehicle Lap/ Shoulder Belt

Shield-Type Booster Seat

8 Years and Older or 70 Pounds or More

Use the protection system that is in the vehicle.

Vehicle Lap Belt

NOTE: ***Ages and weights are approximate. Manufacturer's instructions should be consulted for*** exact figures. Use only safety seats labeled "This child restraint system conforms to all applicable Federal motor vehicle safety standards" and has a stamp of manufacturing after January 1, 1981.

The content of Standard No. 212 is not included in this appendix.

§ **S71.219 Standard No. 213; Child restraint systems.**

S1. ***Scope.*** This standard specifies requirements for child restraint systems used in motor vehicles and aircraft.

S2. ***Purpose. The purpose*** of this standard is to reduce the number of children killed or injured in motor vehicle crashes and in aircraft.

S3. ***Application.*** This standard applies to passenger care, multipurpose passenger vehicles, trucks and buses, and to child restraint systems for use in motor vehicles and aircraft.

S4. ***Definitions.***

Add-on child restraint system means any portable child restraint system.

Backless child restraint system means a child restraint, other than a belt-positioning seat, that consists of a seating platform that does not extend up to provide a cushion for the child's back or head and has a structural element designed to restrain forward motion of the child's torso in a forward impact.

Bell-positioning seat means a child restraint system that positions a child on a vehicle seat to improve the fit of a vehicle Type II belt system on the child and that lacks any component, such as a belt system or a structural element, designed to restrain forward movement of the child's torso in a forward impact.

Booster seat means either a backless child restraint system or a belt-positioning seat.

Built-in child restraint system means a child restraint system that is designed to be an integral part of and permanently installed in a motor vehicle.

Car bed means a child restraint system designed to restrain or position a child in the supine or prone position on a continuous flat surface.

Child restraint system means any device except Type I or Type II seat belts, designed for use in a motor vehicle or aircraft to reetrain, seat, or position children who weigh 50 pounds or less.

Contactable surface means any child restraint system surface (other than that of a belt, belt buckle, or belt adjustment hardware) that may contact

any part of the head or torso of the appropriate test dummy, specified in S7, when a child restraint system is tested in accordance with S6.1.

Factory-installed built-in child restraint system means a built-in child restraint system that has been or will be permanently installed in a motor vehicle before that vehicle is certified as a completed or altered vehicle in accordance with part 567 of this chapter.

Rear-facing child restraint system means a child restraint system, except a car bed, that positions a child to face in the direction opposite to the normal direction of travel of the motor vehicle.

Representative aircraft passenger seat means either a Federal Aviation Administration approved production aircraft passenger seat or a simulated aircraft passenger seat conforming to Figure 6.

Seat orientation reference line or ***SORL*** means the horizontal line through Point Z as illustrated in Figure 1A.

Specific vehicle shell means the actual vehicle model part into which the built-in child restraint system is or is intended to be fabricated, including the complete surroundings of the built-in system. If the built-in child restraint system is or is intended to be fabricated as part of any seat other than a front seat, these surroundings include the back of the seat in front, the interior rear side door panels and trim, the floor pan, adjacent pillars (e.g., the B and C pillars), and the ceiling. If the built-in system is or is intended to be fabricated as part of the front seat, these surroundings include the dashboard, the steering mechanism and its associated trim hardware, any levers and knobs installed on the floor or on a console, the interior front side door panels and trim, the front seat, the floor pan, the A pillars and the ceiling.

Torso means the portion of the body of a seated anthropomorphic test dummy, excluding the thighs, that lies between the top of the child restraint system seating surface and the top of the shoulders of the test dummy.

S5. ***Requirements.*** (a) Each motor vehicle with a built-in child restraint system shall meet the requirements in this section when, as specified, tested in accordance with S6.1 and this paragraph.

(b) Each child restraint system manufactured for use in motor vehicles shall meet the requirements in this section when, as specified, tested in accordance with S6.1 and this paragraph. Each add-on system shall meet the requirement at each of the restraint's seat back angle adjustment positions and restraint belt routing positions, when the restraint is oriented in the direction recommended by the manufacturer (e.g., forward, rearward or laterally) pursuant to S5.6, and tested with the test dummy specified in S7.

(c) Each child restraint system manufactured for use in aircraft shall meet the requirement in this section and the additional requirements in S8.

S5.1 ***Dynamic Performance.***

S5.1.1 ***Child restraint system integrity.*** When tested in accordance with S6.1, each child restraint system shall meet the requirements of paragraphs (a) through (c) of this section.

(a) Exhibit no complete separation of any load bearing structural element and no partial separation exposing either surfaces with a radius of less than ¼ inch or surfaces with protrusions greater than ⅜ inch above the immediate adjacent surrounding contactable surface of any structural element of the system.

(b)(1) If adjustable to different positions, remain in the same adjustment position during the testing that it was in immediately before the testing, except as otherwise specified in paragraph (b)(2).

(2)(i) Subject to paragraph (b)(2) (ii), a rear-facing child restraint system may have a means for repositioning the seating surface of the system that allows the system's occupant to move from a reclined position to an upright position and back to a reclined position during testing.

(ii) No opening that is exposed and is larger than ¼ inch before the testing shall become smaller during the testing as a result of the movement of the seating surface relative to the restraint system as a whole.

(c) If a front facing child restraint system, not allow the angle between the system's back support surfaces for the child and the system's seating sur-

face to be less than 45 degrees at the completion of the test.

S5.1.2 ***Injury criteria.*** When tested in accordance with S6.1, each child restraint system that, in accordance with S5.5.2(f), is recommended for use by children whose masses are more than 10 kilograms (kg) shall --

(a) Limit the resultant acceleration at the location of the accelerometer mounted in the test dummy head as specified in part 572 such that the expression:

$$\left[\frac{1}{(t_2 - t_1)}\int_{t_1}^{t_2} a\,dt\right]^{2.5}(t_2 - t_1)$$

shall not exceed 1,000, where a is the resultant acceleration expressed as a multiple of g (the acceleration of gravity), and t_1 and t_2 are any two moments during the impacts.

(b) Limit the resultant acceleration at the location of the accelerometer mounted in the test dummy upper thorax as specified in part 572 to not more than 60 g's, except for intervals whose cumulative duration is not more than 3 milliseconds.

S5.1.3 ***Occupant excursion.*** When tested in accordance with S6.1, each child restraint system shall meet the applicable excursion limit requirements specified in S5.1.3.1–S5.1.3.3.

S5.1.3.1 ***Child restraint systems other than rear-facing ones and car beds.*** Each child restraint system, other than a rear-facing child restraint system or a car bed, shall retain the test dummy's torso within the system.

(a) In the case of an add-on child restraint system, no portion of the test dummy's head shall pass through a vertical, transverse plane that is 810 mm forward of point Z on the standard seat assembly, measured along the center SORL (as illustrated in figure 1B), and neither knee pivot point shall pass through a vertical, transverse plane that is 915 mm forward of point Z on the standard seat assembly, measured along the center SORL.

(b) In the case of a built-in child restraint system, neither knee pivot point shall, at any time during the dynamic test, pass through a vertical, transverse plane that is 305 mm forward of the initial pre-test position of the respective knee pivot point, measured along a horizontal line that passes through the knee pivot point and is parallel to the vertical plane that passes through the vehicle's longitunal centerline.

S5.1.3.2 ***Rear-facing child restraint systems.*** *In* the case of each rear-facing child restraint system. all portions of the test dummy's torso shall be retained within the system and neither of the target points on either side of the dummy's head and on the transverse axis passing through the center of mass of the dummy's head and perpendicular to the head's midsagittal plane, shall pass through the transverse orthogonal planes whose intersection contains the forward-most and top-most points on the child restraint system surfaces (illustrated in Figure 1C).

S5.1.3.3 ***Car beds.*** In the case of car beds, all portions of the test dummy's head and torso shall be retained within the confines of the car bed.

S5.1.4 ***Back support angle.*** When a rear-facing child restraint system is tested in accordance with S6.1, the angle between the system's back support surface for the child and the vertical shall not exceed 70 degrees.

S5.2 ***Force distribution.***

S5.2.1 Minimum head support surface—child restraints other than car beds.

S5.2.1.1 Except as provided in S5.2.1.2, each child restraint system other than a car bed shall provide restraint against rearward movement of the head of the child (rearward in relation to the child) by means of a continuous seat back which is an integral part of the system and which—

(a) Has a height, measured along the system seat back surface for the child in the vertical longitudinal plane passing through the longitudinal centerline of the child restraint systems from the lowest point on the system seating surface that is contacted by the buttocks of the seated dummy, as follows:

Weight [1] (in pounds)	Height [2] (in inches)
Less than 20 lb	18
20 lb or more, but not more than 40 lb	20
More than 40 lb	22

[1] When a child restraint system is recommended under S5.5(f) for use by children of the above weights.

[2] The height of the portion of the system seat back providing head restraint shall not be less than the above.

(b) Has a width of not less than 8 inches, measured in the horizontal plane at the height specified in paragraph (a) of this section. Except that a child restraint system with side supports extending at least 4 inches forward from the padded surface of the portion of the restraint system provided for support of the child's head may have a width of not less than 6 inches, measured in the horizontal plane at the height specified in paragraph (a) of this section.

(c) Limits the rearward rotation of the test dummy head so that the angle between the head and torso of the dummy specified in S7. when tested in accordance with S6.1 is not more than 45 degrees greater than the angle between the head and torso after the dummy has been placed in the system in accordance with S6.1.2.3 and before the system is tested in accordance with S6.1.

S5.2.1.2 The applicability of the requirements of S5.2.1.1 to a front-facing child restraint, and the conformance of any child restraint other than a car bed to those requirements is determined using the largest of the test dummies specified in S7.1 for use in testing that restraint; provided, that the 6-year-old dummy described in subpart I of part 572 of this title is not used to determine the applicability of or compliance with S5.2.1.1. A front-facing child restraint system is not required to comply with S5.2.1.1 if the target point on either side of the dummy's head is below a horizontal plane tangent to the top of—

(a) The standard seat assembly, in the case of an add-on child restraint system, when the dummy is positioned in the system and the system is installed on the assembly in accordance with S6.1.2.

(b) The vehicle seat, in the case of a built-in child restraint system, when the system is activated and the dummy is positioned in the system in accordance with S6.1.2.

S5.2.2 ***Torso impact protection.*** Each child restraint system other than a car bed shall comply with the applicable requirements of S5.2.2.1 and S5.2.2.2.

S5.2.2.1(a) The system surface provided for the support of the child's back shall be flat or concave and have a continuous surface area of not less than 85 square inches.

(b) Each system surface provided for support of the side of the child's torso shall be flat or concave and have a continuous surface of not less than 24 square inches for systems recommended for children weighing 20 pounds or more, or 48 square inches for systems recommended for children weighing less than 20 pounds.

(c) Each horizontal cross section of each system surface designed to restrain forward movement of the child's torso shall be flat or concave and each vertical longitudinal cross section shall be flat or convex with a radius of curvature of the underlying structure of not less than 2 inches.

S5.2.2.2 Each forward-facing child restraint system shall have no fixed or movable surface--

(a) Directly forward of the dummy and intersected by a horizontal line-

(1) Parallel to the SORL, in the case of the add-on child restraint system, or

(2) Parallel to a vertical plane through the longitudinal center line of the vehicle seat, in the case of a built-in child restraint system, and,

(b) Passing through any portion of the dummy, except for surfaces which restrain the dummy when the system is tested in accordance with S6.1.2(a)(2), so that the child restraint system shall conform to the requirements of S5.1.2 and S5.1.3.1.

S5.2.3 ***Head impact protection.***

S5.2.3.1 Each child restraint system, other than a child harness, which is recommended under S5.5.2(0 for chil-

dren whose masses are less than 10 kg, shall comply with S5.2.3.2.

S5.2.3.2 Each system surface, except for protrusions that comply with S5.2.4, which is contactable by the dummy head when the system is tested in accordance with S6.1 shall be covered with slow recovery, energy absorbing material with the following characteristics:

(a) A 25 percent compression-deflection resistance of not less than 0.5 and not more than 10 pounds per square inch when tested in accordance with S6.3.

(b) A thickness of not less than ½ inch for materials having a 25 percent compression-deflection resistance of not less than 1.8 and not more than 10 pounds per square inch when tested in accordance with S6.3. Materials having a 25 percent compression-deflection resistance of less than 1.8 pounds per square inch shall have a thickness of not less than ¾ inch.

S5.2.4 ***Protrusion limitation.*** Any portion of a rigid structural component within or underlying a contactable surface, or any portion of a child restraint system surface that is subject to the requirements of S5.2.3 shall, with any padding or other flexible overlay material removed, have a height above any immediately adjacent restraint system surface of not more than ⅜ inch and no exposed edge with a radius of less than ¼ inch.

S5.3 ***Installation.***

S5.3.1 Each add-on child restraint system shall have no means designed for attaching the system to a vehicle seat cushion or vehicle seat back and no component (except belts) that is designed to be inserted between the vehicle seat cushion and vehicle seat back.

S5.3.2 When installed on a vehicle seat, each add-on child restraint system, other than child harnesses and belt-positioning seats, shall be capable of being restrained against forward movement solely by means of a Type I seat belt assembly (defined in §571.209) that meets Standard No. 208 (§571.208), or by means of a Type I seat belt assembly plus one additional anchorage strap that is supplied with the system and conforms to S5.4. Each belt-positioning seat shall be capable of being restrained against forward movement solely by means of a TYPE II seat belt assembly (defined in §571.209) that meets Standard No. 208 (§571.208).

S5.3.3 ***Car beds.*** Each car bed shall be designed to be installed on a vehicle seat so that the car bed's longitudinal axis is perpendicular to a vertical longitudinal plane through the longitudinal axis of the vehicle.

S5.4 ***Belts, belt buckles, and belt webbing.***

S5.4.1 Performance requirements. The webbing of belts provided with a child restrain system and used to attach the system to the vehicle or to restrain the child within the system shall—

(a) After being subjected to abrasion as specified in S5.l(d) or S5.3(c) of FMVSS 209 (§571.209), have a breaking strength of not less than 75 percent of the strength of the unabraded webbing when tested in accordance with S5.1(b) of FMVSS 209.

(b) Meet the requirement of S4.2 (e) through (h) of FMVSS No. 209 (§ 571.209); and

(c) If contactable by the test dummy torso when the system is tested in accordance with S6.1, have a width of not less than 1½ inches when measured in accordance with S5.4.1.1.

S5.4.1.1 Width ***test procedure.*** Condition the webbing for 24 hours in an atmosphere of any relative humidity between 48 and 67 percent, and any ambient temperature between 70° and 77° F. Measure belt webbing width under a tension of 5 pounds applied lengthwise.

S5.4.2 ***Belt buckle and belt adjustment hardware.*** Each belt buckle and item of belt adjustment hardware used in a child restraint system shall conform to the requirements of S4.3(a) and S4.3(b) of FMVSS No. 209 (5571.209).

S5.4.3 ***Belt Restraint.***

S5.4.3.1 General. Each belt that is part of a child restraint system and that is designed to restrain a child using the system shall be adjustable to snugly fit any child whose height and weight are within the ranges recommended in accordance with S5.5.2(f) and who is positioned in the system in accordance with the instructions required by S5.6.

S5.4.3.2 ***Direct restraint.*** Except for a child restraint system whose mass is less than 4 kg, each belt that is part of a child restraint system and that is de-

signed to restrain a child using the system and to attach the system to the vehicle, and each Type I and lap portion of a Type II vehicle belt that is used to attach the system to the vehicle shall, when tested in accordance with S6.1, impose no loads on the child that result from the mass of the system, or

(a) In the case of an add-on child restraint system, from the mass of the seat back of the standard seat assembly specified in S6.1, or

(b) In the case of a built-in child restraint system, from the mass of any part of the vehicle into which the child restraint system is built.

S5.4.3.3 ***Seating systems.*** Except for child restraint systems subject to S5.4.3.4, each child restraint system that is designed for use by a child in a seated position and that has belts designed to restrain the child, shall, with the test dummy specified in S7 positioned in the system in accordance with S10 provide:

(a) Upper torso restraint in the form of:

(i) Belts passing over each shoulder of the child, or

(ii) A fixed or movable surface that complies with S5.2.2.l(c), and

(b) Lower torso restraint in the form of:

(i) A lap belt assembly making an angle between 45° and 90° with the child restraint seating surface at the lap belt attachment points, or

(ii) A fixed or movable surface that complies with S5.2.2.l(c), and

(c) In the case of each seating system recommended for children whose masses are more than 10 kg, crotch restraint in the form of:

(i) A crotch belt connectable to the lap belt or other device used to restrain the lower torso. or

(ii) A fixed or movable surface that complies with 95.2.2.1(c).

S5.4.3.4 ***Harnesses.*** Each child harness shall:

(a) Provide upper torso restraint, including belts passing over each shoulder of the child;

(b) Provide lower torso restraint by means of lap and crotch belt; and

(c) Prevent a child of any height for which the restraint is recommended for use pursuant to S5.5.2(f) from standing upright on the vehicle seat when the child is placed in the device in accordance with the instructions required by S5.6.

S5.4.3.5 ***Buckle release.*** Any buckle in a child restraint system belt assembly designed to restrain a child using the system shall:

(a) When tested in accordance with S6.2.1 prior to the dynamic test of S6.1, not release when a force of lees than 40 newtons (N) is applied and shall release when a force of not more than 62 N is applied,

(b) After the dynamic test of S6.1, when tested in accordance with the appropriate sections of S6.2, release when a force of not more than 71 N is applied, provided, however, that the conformance of any child restraint to this requirement is determined using the largest of the test dummies specified in S7 for use in testing that restraint when the restraint is facing forward, rearward, and/or laterally;

(c) Meet the requirements of S4.3(d)(2) of FMVSS No. 209 (§671.269), except that the minimum surface area for child restraint buckles designed for push button application shall be 0.6 square inch;

(d) Meet the requirements of S4.3(g) of FMVSS No. 209 (§571.209) when tested in accordance with S5.2(g) of FMVSS No. 209; and

(e) Not release during the testing specified in S6.1.

S5.5 ***Labeling.***

S5.5.1 Each add-on child restraint system shall be permanently labeled with the information specified in S5.5.2 (a) through (m).

S5.5.2 The information specified in paragraphs (a) through (m) of this section shall be stated in the English language and lettered in letters and numbers that are not smaller than 10 point type and are on a contrasting background.

(a) The model name or number of the system.

(b) The manufacturer's name. A distributor's name may be used instead if the distributor assumes responsibility for all duties and liabilities imposed on the manufacturer with respect to the system by the National Traffic and Motor Vehicle Safety Act, as amended.

(c) The statement: "Manufactured in ——," inserting the month and year of manufacture.

(d) The place of manufacture (city and State, or foreign country). How-

ever, if the manufacturer uses the name of the distributor, then it shall state the location (city and State, or foreign country) of the principal offices of the distributor.

(e) The statement "This child restraint system conforms to all applicable Federal motor vehicle safety standards."

(f) One of the following statements, inserting the manufacturer's recommendations for the maximum mass and height of children who can safely occupy the system, except that booster seats shall not be recommended for children whose masses are less than 13.6 kg:

(1) This infant restraint is designed for use by children who weigh _____ pounds (mass _____ kg) or less and whose height is ***(insert values in English and metric units);*** or

(2) This child restraint is designed for use only by children who weigh between _____ and _____ pounds ***(insert metric values)*** and whose height is ***(insert values in English and metric units)*** and who are capable of sitting upright alone; or

(3) This child restraint is designed for use only by children who weigh between _____ and _____ pounds ***(insert metric values)*** and whose height is ***(insert values in English and metric units).***

(g) The following statement, inserting the location of the manufacturer's installation instruction booklet or sheet on the restraint:

WARNING! FAILURE TO FOLLOW EACH OF THE FOLLOWING INSTRUCTIONS CAN RESULT IN YOUR CHILD STRIKING THE VEHICLE'S INTERIOR DURING A SUDDEN STOP OR CRASH.
SECURE THIS CHILD RESTRAINT WITH A VEHICLE BELT AS SPECIFIED IN THE MAUFAC'I'URER'S INSTRUCTIONS LOCATED_.

(h) In the case of each child restraint system that has belts designed to restrain children using them:

SNUGLY ADJUST THE BELTS PROVIDED WITH THIS CHILD RESTRAINT AROUND YOUR CHILD.

(i)(1) Fcr a booster seat that is recommended for use with either a vehicle's Type I or Type II seat belt assembly, one of the following statements, as appropriate:

(i) WARNING! USE ONLY THE VEHICLE'S LAP AND SHOULDER BELT SYSTEM WHEN RESTRAINING THE CHILD IN THIS BOOSTER SEAT; or

(ii) WARNING! USE ONLY THE VEHICLE'S LAP BELT SYSTEM, OR THE LAP BELT PAR OF LAP/SHOULDER BELT SYSTEM WITH THE SHOULDER BELT PLACED BEHIND THE CHILD WHEN RESTRAINIING THE CHILD IN THIS SEAT.

(2)**(i)** Except as provided in paragraph (i)(2)(ii) of this section, for a booster seat which is recommended for use with both a vehicle's Type I and Type II seat belt assemblies, the following statement

WARNING! USE ONLY THE VEHICLE'S LAP BELT SYSTEM, OR THE LAP BELT PART OF A LAP/SHOULDER BELT SYSTEM WITH THE SHOULDER BELT PLACED BEHIND THE CHILD, WHEN RESTRAINING THE CHILD WITH THE insert description of ***the system element provided to*** restrain ***forward movement*** of ***the child's torso when used with a lap belt (e.g., shield),*** AND ONLY THE VEHICLE'S LAP AND SHOULDER BELT SYSTEM WHEN USING THIS BOOSTER WITHOUT THE ***insert above description.***

(ii) A booster seat which is recommended for use with both a vehicle's Type I and Type 11 seat belt assemblies is not subject to S5.5.2(i)(2)(i) if, when the booster is used with the shield or similar component, the booster will cause the shoulder belt to be located in a position other than in front of the child when the booster is installed. However, such a booster shall be labeled with a warning to use the booster with the vehicle's lap and shoulder belt system when using the booster without a shield.

(j) In the case of each child restraint system equipped with an anchorage strap, the statement:

SECURE THE TOP ANCHORAGE STRAP PROVIDED WITH THIS CHILD RESTRAINT AS SPECIFIED IN THE MANUFACTURER'S INSTRUCTIONS.

(k)(1) In the case of each rear-facing child restraint system that is designed for infants only, the following statements---

(i) "PLACE THIS INFANT RESTRAINT IN A REAR-FACING POSITION WHEN USING IT IN THE VEHICLE."

(ii) "WARNING: DO NOT PLACE THIS RESTRAINT IN THE FRONT SEAT OF A VEHICLE THAT HAS A PASSENGER SIDE AIR BAG. (Insert a statement that describes the consequences of not following the warning.)

(2) In the case of a child restraint system that is designed to be used rearward-facing for infants and forward facing for older children, the following statements--

(i) "PLACE THIS CHILD RESTRAING IN A REAR-FACING POSITION WHEN USING IT WITH AN INFANT WEIGHING LESS THAN *(insert a recommended weight that is not less than 20 pounds)."*

(ii) " WARNING WHEN THIS RETRAINT IS USED REAR-FACING, DO NOT PLACE IT IN THE FRONT SEAT OF A VEHICLE THAT HAS A PASSENGER SIDE AIR BAG. (Insert a statement that describes the consequences of not following the warning.)"

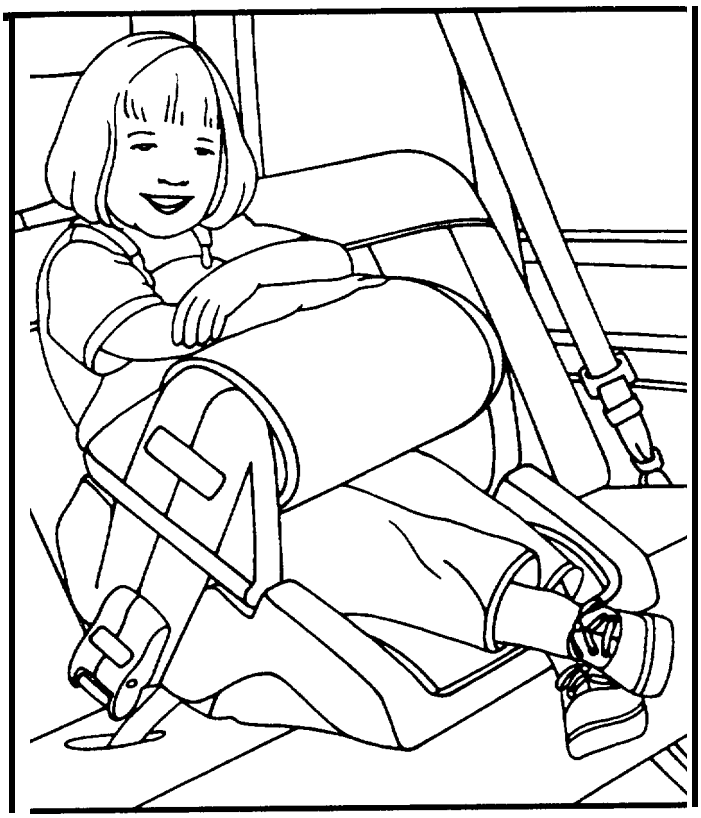
(3) The statements required by paragraphs (k)(I)(ii) and (k)(Z)(ii) shall be on a red, orange or yellow contrasting background, and placed on the restraint so that it is on the side of the restraint designed to be adjacent to the front passenger door of a vehicle and is visible to a person installing the rear-facing child restraint system in the front passenger seat.

(1) An installation diagram showing the child restraint system installed in the right front outboard seating position equipped with a continuous-loop lap/shoulder belt and in the center rear seating position as specified in the manufacturer's instructions.

(m) The following statement, inserting an address and telephone number: "Child restraint could be recalled for safety reasons. You must register this restraint to be reached in a recall. Send your name, address and the restraint's model number and manufacturing date to ***(insert address)*** or call ***(insert telephone number).*** For recall information, call the U.S. Government's Auto Safety Hotline at 1-800-424-9393 (202-366-0123) in DC area)."

(n) Child restraint systems, other than belt-positioning seats, that are certified as complying with the provisions of section S8 shall be labeled with the statement "This Restraint is Certified for Use in Motor Vehicles and Aircraft. " Belt-positioning seats shall be labeled with the statement "This Restraint is Not Certified for Use in Aircraft." The statement required by this paragraph shall be in red lettering and shall be placed after the certification statement required by paragraph (e) of this section.

The remainder of Standard No. 213 is not included in this appendix.



Models 675,676

If you have any questions/problems regarding your Gerry Double Guard Auto Booster Seat, do not return this product to the retailer. Call Gerry Consumer Relations at: 1-800-626-2996

GERRY®

Gerry **Baby** Products Company
Denver, Colorado 80241
A Huffy Company

GERRY® Double Guard Owner's Manual

Auto booster seat for children 30-60 lbs

INSTRUCTIONS

> ⚠ *WARNING!*
>
> ***FAILURE TO READ AND FOLLOW THE INSTRUCTIONS PROVIDED IN THIS MANUAL AND THE INSTRUCTIONS ON THE PRODUCT MAY RESULT IN INJURY TO YOUR CHILD AND OTHERS.***

Read this instruction manual completely before using the Gerry Double Guard. Store the manual for future reference, in the handy pocket located under the booster seat cushion.

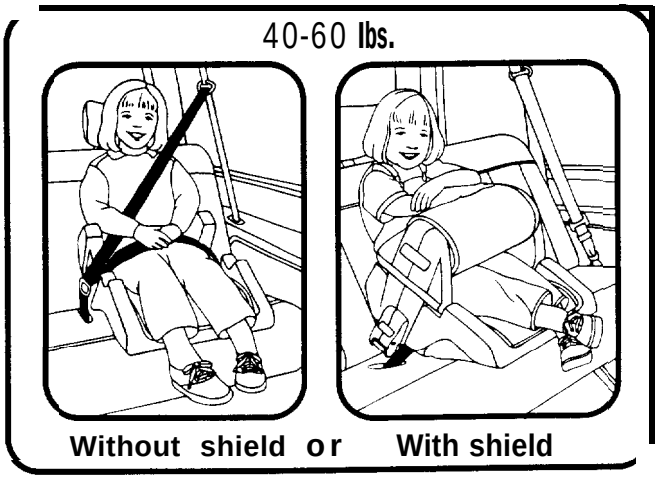
- Proper installation of this child restraint is necessary. Based on the type of seat belts in your vehicle, the instructions may vary slightly. Refer to this manual for the appropr-iate steps to follow.
- Never leave the child unattended.
- € This booster seat must be securely belted to the vehicle, even when unoccupied, since an unsecured child restraint may injure other occupants if a crash occurs.
- To avoid injury to the child or damage to the buckle mechanism, the shield should be lowered and locked by an adult only. DO NOT allow the child to lower the shield at any time.

INDEX

CORRECT USE OF THE DOUBLE GUARD BOOSTER SEAT

No one can predict if a child restraint will prevent injury or death in any given accident. However, proper use can reduce the child's risk of injury or death in most instances.

Turn to page 6 for installation and use for children 30-40 lbs.



Turn to page 8 for installation and use for children 40-60 lbs.

HOW TO USE THIS MANUAL

Read the entire owner's manual before using the auto booster seat. Familiarize yourself with the following instructions that pertain directly and immediately to the safety of the child:

> ⚠ ***WARNING!***
>
> ***VITAL SAFETY INFORMATION: FAILURE TO FOLLOW INSTRUCTIONS WHICH ARE MARKED WITH A "WARNING" BOX CAN CREATE A DANGEROUS SITUATION WHICH MAY RESULT IN A CHILD'S SERIOUS INJURY OR DEATH IN THE EVENT OF A SUDDEN STOP OR IMPACT. ALL INSTRUCTIONS DESIGNATED WITH A "WARNING" BOX MUST BE FOLLOWED EXACTLY.***

> ⚠ ***CAUTION:***
>
> ***IMPORTANT SAFETY INFORMATION: FAILURE TO FOLLOW INSTRUCTIONS LABELED WITH A "CAUTION" HEADING CAN RESULT IN MINOR OR MODERATE INJURY FOR YOUR CHILD OR CAUSE YOUR CHILD DISCOMFORT.***

NOTE: A "NOTE" explains a situation in more detail to help you achieve a better understanding of the use of your booster seat.

This symbol indicates when a locking clip is required to properly install your booster seat.

GENERAL INFORMATION

> ⚠ ***WARNING!***
>
> ***FAILURE TO FOLLOW' EACH OF THE FOLLOWNG INSTRUCTIONS CAN RESULT IN YOUR CHILD STRIKING THE VEHICLE'S INTERIOR DURING A SUDDEN STOP OR ACCIDENT.***

- Secure this booster seat with a vehicle seat belt as specified in this owner's manual on pages 6-16.

€ DO NOT use this booster seat on an aircraft.

€ This booster seat is designed for use only by children who weigh between 30 and 60 pounds and are between 33 and 51 inches in height.

- This booster seat may be used two ways:

  1. Remove the shield and use the car's three-point, shoulder/lap belt system—if the child weighs 30-60 lbs.

  2. With the shield and your vehicle's lap belt system, or lap-shoulder belt system—only when the child weighs 40-60 lbs.

- Securely belt the seat to the vehicle at all times, even when unoccupied. An unsecured child restraint may injure other occupants if a crash occurs.

- DO NOT use this booster seat if the top of the child's ears are above the top of the vehicle's seat back.

- DO NOT use a booster seat that has been involved in an accident. Regardless of its structural appearance, it should be destroyed and replaced. Contact your retailer or Gerry Baby Products Company.

- Use this booster seat only on forward-facing vehicle seats.

- DO NOT use a vehicle belt mounted to a car door—it prevents the door from opening and creates a safety hazard. Move the child restraint to another seating position.

- DO NOT use this booster seat on vehicle seats that:

  1. Have hinged backs which are not equipped with a locking latch.

  2. Have a depth of less than 17 inches.

  3. Are equipped with passive/automatic restraint belts*, when using the Double Guard with the shield attached.

  * Vehicles which have seat belts that automatically surround the driver or passenger when the vehicle door is closed,

- DO NOT use this booster seat in vehicles with lap belts that cannot be tightened securely. To use it in seating positions equipped with vehicle shoulder/lap belts with free sliding latch plates, a locking clip must be used. See page 11.

REGISTER YOUR BOOSTER SEAT

Child restraints could be recalled for safety reasons. You must register this restraint to be reached in a recall. Send your name, address, and the restraint's model number and manufacturing date (found on the label on the back of the base) to:

Gerry Baby Products Company
P. O. Box 52445
Boulder, CO 80323-2445

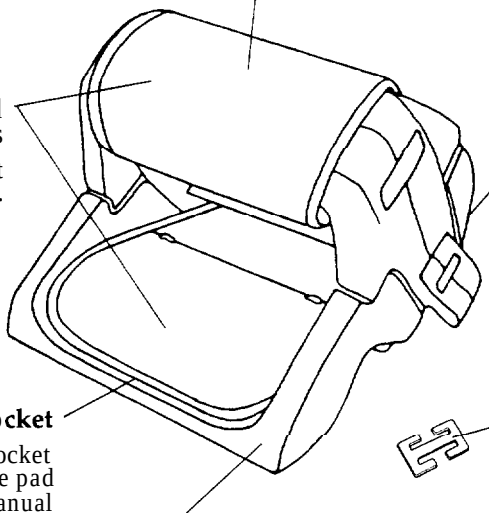
Or, call **1-800-228-8023**

For recall information, call the U.S. Government's Auto Safety Hotline at 1-800-424-9393 (202-366-0123 in the D.C. area).

DOUBLE GUARD'S FEATURES

Removable/Reversible Shield

For use when the child weighs 40-60 lbs. Removable for use when the child weighs 30-40 lbs. Reversible for easy right or left entry and exit by the child. Includes a built-in lap belt.



Soft Fabric Shield and Base Pads

Provide comfort and style.

Locking Clip Storage Clasp

Firmly holds the locking clip in place when not in use (under base).

Plastic Pocket

Convenient storage pocket underneath the base pad holds this Owner's Manual for future reference.

Locking Clip

Eliminates slack when using Free Sliding Shoulder/Lap Belt systems where the latch plate slides freely.

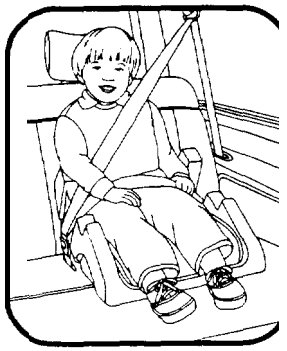
Base

Can be used alone when the child weighs 30-60 lbs. However, it must be secured with a 3-point shoulder/lap seat belt system.

PROPER PLACEMENT OF YOUR BOOSTER SEAT

According to accident statistics, children are safer when properly restrained in the rear seating positions rather than in the front seating positions.

USE YOUR GERRY DOUBLE GUARD ONLY IN VEHICLE SEATS:



€ Where the top of the child's ears are below the top of the car seat's back or headrest, once the child is seated in the booster.

- With lap belt or shoulder/lap belts systems.
- That face forward.
- That are locked in their full upright position (applies to those vehicles with adjustable seat backs).
- In which the lap portion of the vehicle's seat belt may be locked into position during use.

***NEVER* USE THE GERRY DOUBLE GUARD:**

⚠ WARNING!

DO NOT PLACE THE BASE IN A SEATING POSITION* THAT *ONLY PROVIDES A LAP BELT (SUCH AS CENTER REAR). YOU MUST USE BOTH A SHOULDER AND LAP BELT* *WHEN* *USING THE DOUBLE GUARD WITHOUT THE SHIELD.

- In vehicle seats where, once the child is seated in the booster, the top of his/her ears are above the top of the vehicle seat's back or headrest.
- With the shield in a vehicle seating location using automatic/passive restraint systems.
- In vehicle seats that face the sides or rear of the vehicle.
- In vehicle seats that have folding backs that do not lock into an upright position.

⚠ WARNING!

DO ***NOT USE THIS BOOSTER SEAT IN VEHICLES WITH LAP BELTS THAT CANNOT BE TIGHTENED SECURELY TO USE IT IN SEATING POSITIONS EQUIPPED WITH VEHICLE*** **SHOULDER/LAP** ***BELTS WITH FREE SLIDING LATCH PLATES, A LOCKING CLIP MUST BE USED. SEE PAGE 11.***

REMOVING OR REVERSING THE SHIELD

REMOVING THE SHIELD

If the child weighs 30-40 lbs., you must use the booster seat without its shield. When the child reaches 40-60 lbs., you may use the seat with or without the shield. Simply follow these steps for removal:

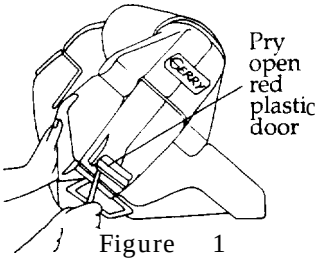


Figure 1

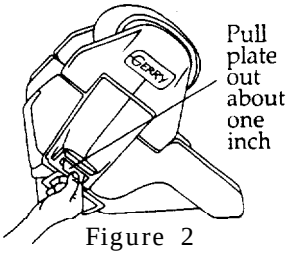


Figure 2

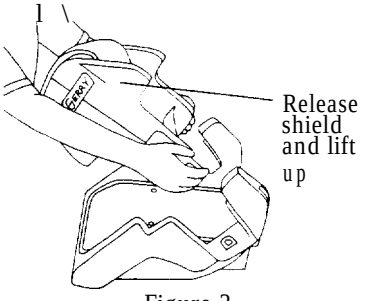


Figure 3

- Locate the red plastic door on the hinged side of the booster.
- Slide a flat-head screwdriver (or a table knife) underneath the bottom of the door. Pry it open. (Figure 1)
- Underneath the red door is a metal plate. Pull this plate out as far as it will go- approximately one inch. (Figure 2)
- Open the shield by lifting up on the red release bar. The entire shield should then lift off easily. (Figure 3)

CAUTION: *DO NOT LEAVE THE UNATTACHED SHIELD IN YOUR CAR. IT CAN INJURE A PASSENGER IN THE EVENT OF A SUDDEN STOP OR IMPACT.*

REVERSING THE SHIELD

The Gerry Double Guard offers a convenient reversible feature for easy entry and exit for the child from either side of the booster seat. Depending on where the seat is placed in the vehicle, the shield may be adjusted to open accordingly.

To reverse the shield, remove it following the steps described above. Once the shield is removed, proceed as follows:

- Turn the shield around so that its hinged side (with the red plastic door) is located on the opposite side of the booster seat.

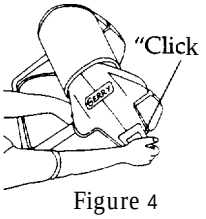


Figure 4

- Lower the shield onto the latch plates on each side of the booster seat. Push in the metal plate and snap the red plastic door closed.
- Gently close the shield. You should hear an audible "click. This indicates that the shield has locked into place. (Figure 4)
- With a firm grip, pull up on both sides of the shield to ensure that they have been securely engaged onto the base.

INSTALLATION AND USE FOR CHILDREN 30-40 LBS.

When the child weighs between 30-40 pounds, use the booster base alone (without the shield) with the vehicle's 3-point shoulder/lap belt system. Store the shield in a safe place for use when the child reaches between 40-60 pounds.

WARNING!

USE ONLY THE VEHICLE'S LAP AND SHOULDER BELT SYSTEM WHEN USING THIS BOOSTER WITHOUT THE SHIELD.

- Following the directions on page 5, remove the shield from the Double Guard base.
- Place the base firmly against the vehicle's seat back.

CAUTION:

IF MORE THAN 2" EXISTS BETWEEN THE BOOSTER AND YOUR CAR'S SEAT BACK, MOVE THE DOUBLE GUARD TO ANOTHER SEATING POSITION WITH A 3-POINT LAP/SHOULDER HARNESS SYSTEM. DO NOT USE THE DOUBLE GUARD BASE ALONE WITHOUT A 3-POINT LAP/SHOULDER HARNESS.

- Place the child in the center of the booster seat. Make sure that the top of his/her ears are below the vehicle's seat back or headrest.
- Pull the shoulder/lap belt system across the child and buckle it as you would if you were wearing the seat belt yourself. DO NOT thread it through the seat belt pathway found in the bottom of the booster.
- Make sure that the lap portion of the belt rests snugly against the child's lap,

WARNING!

WHEN USING PASSIVE/AUTOMATIC RESTRAINT BELTS, <u>DO NOT</u> THREAD THE LAP PORTION OF THE BELT THROUGH THE SEAT BELT PATHWAY IN THE BOOSTER. THE LAP BELT MUST REST SNUGLY AGAINST THE CHILD'S LAP.

- The shoulder portion should extend across the child's shoulder without touching his/her face or neck.

⚠ *CAUTION:*

DO NOT REST THE SHOULDER PORTION OF THE BELT AGAINST THE CHILD'S NECK OR FACE. READJUST IT ACCORDINGLY. IF YOU CANNOT, DO NOT USE THE BOOSTER SEAT. ASK YOUR CAR DEALER FOR ASSISTANCE IN ADJUSTING OR REPLACING THE SYSTEM.

SAFETY CHECKLIST

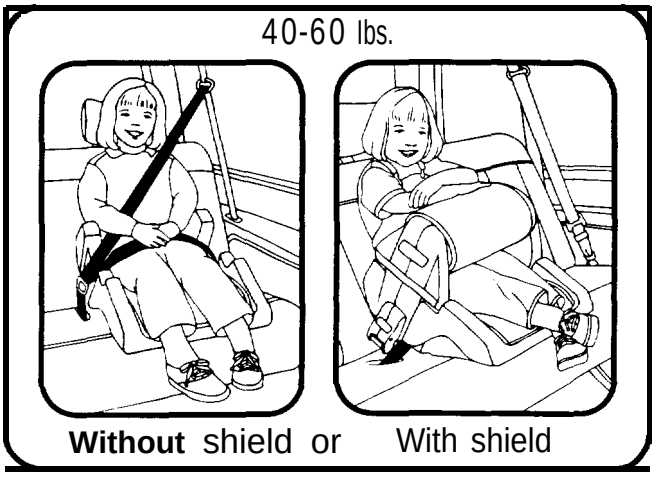
When using the Gerry Double Guard without the shield, be sure to check the following:

- The top of the child's ears should be below the vehicle's seat back or headrest.
- The vehicle's seat back is locked in the full upright position.
- The shoulder portion of the belt extends over the child's shoulder.
- The lap portion of the belt is secured snugly against the child's lap.
- You are using a 3-point shoulder/lap belt system.
- No more than 2" exist between the base and the vehicle's seat back.

⚠ *WARNING!*

CHILDREN CAN MOVE A SHOULDER BELT OUT OF ITS CORRECT POSITION. IF SO, IT MAY RESULT IN AN INJURY DURING A SUDDEN STOP OR IMPACT. IF THE CHILD WILL NOT LEAVE THE SHOULDER BELT IN PLACE, DO NOT USE THE DOUBLE GUARD.

INSTALLATION AND USE FOR CHILDREN 40-60 LBS.



When the child weighs between 40-60 pounds, the booster seat may be used with or without the shield.

FOR USE WITHOUT THE SHIELD:

Follow all steps described on page 6 of "Installation and Use for Children 30-40 lbs."

FOR USE WITH THE SHIELD:

When using the base with the shield, identify your vehicle's seat belt svstem before getting started. Based on the svstem in the vehicle follow the appropriate directions for installation listed below. After properly installing the Double Guard, turn to page 15 for instructions to place the child in the booster seat.

IDENTIFY YOUR VEHICLE'S SEAT BELT SYSTEM

Installation of the booster seat may vary depending on the type of seat belt system you have in your vehicle, the weight of the child and whether or not you are using the shield. Review the following pages carefully to determine your vehicle's seat belt system and the proper installation requirements.

Understanding this information before you install the Double Guard Auto Booster Seat will make the process easier. And, it will ensure maximum safety for the child.

WARNING!

USE THESE INSTRUCTIONS AND INFORMATION REGARDING SEAT BELT SYSTEMS ONLY WHEN USING THE BOOSTER SEAT WITH THE SHIELD. FOR INSTALLATION AND USE WITHOUT THE SHIELD, REFER TO PAGES 6 AND 7.

MANUALLY ADJUSTABLE LAP BELT (Figure 5)

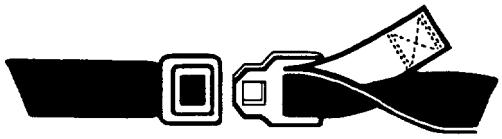


Figure 5

> ⚠ ***WARNING!***
>
> ***MANUALLY ADJUSTABLE LAP BELTS MAYBE USED ONLY WHEN YOU ARE USING THE BOOSTER SEAT WITH THE SHIELD IN PLACE. THIS TYPE OF BELT IS NOT TIGHTENED AUTOMATICALLY BY A RETRACTOR. YOU MUST DO IT MANUALLY.***

Figure 6

- Raise the flip-up seat on the booster's base to locate the seat belt pathway, Place the vehicle's seat belt through this pathway. Buckle it.
- Using your knee, press the base of the booster so that it "sinks" into the vehicle's seat cushion for a tight fit. (Figure 6)
- Tighten the lap belt while sinking the booster seat into the vehicle's seat cushion. (Figure 6)

> ⚠ ***CAUTION:***
>
> - ***IF MORE THAN 2" EXISTS BETWEEN THE BOOSTER AND YOUR VEHICLE'S SEAT BACK, MOVE THE DOUBLE GUARD TO ANOTHER SEATING POSITION.***
> - ***TO PREVENT ANY POSSIBLE ACCIDENTAL UNLATCHING OF THE SEAT BELT BE CERTAIN THAT THE BUCKLE AND LATCH PLATE OF THE VEHICLE'S SEAT BELT DO NOT TOUCH THE BOOSTER SEAT'S FRAME.***
> - ***MAKE CERTAIN THAT THE DOUBLE GUARD IS SECURED TIGHTLY WITH THE VEHICLE'S SEAT BELT SYSTEM. AFTER YOU'VE THREADED THE BELT THROUGH THE BOOSTER'S SEAT BELT PATHWAY AND SECURED IT IN PLACE, YOU MUST TEST THE INSTALLATION BY FORCIBLY TILTING THE UNIT FROM SIDE TO SIDE.***

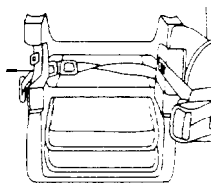


Figure 7

- If the lap belt does not hold the booster seat securely in place, twist its adjustable end so it's upside down before buckling it. (Figure 7) This should prevent it from loosening.
- If the belt still does not hold the booster seat in place, move it to another seating location-one where it can be secured properly.
- If, after repeated attempts, you still cannot firmly secure the booster in any location, contact your local car dealer. Ask your dealer to install a lap belt that will safely secure your booster seat.

> ***CAUTION:***
>
> ***A BOOSTER SEAT MUST ALWAYS BE SECURED WITH A LAP BELT THAT REMAINS TIGHT AND SECURE AT ALL TIMES, UNLESS YOU ARE USING IT WITHOUT THE SHIELD. AT THOSE TIMES THE CHILD MUST BE SECURED BY A 3-POINT SHOULDER/LAP BELT SYSTEM THAT RESTS SNUG ACROSS HIS/HER SHOULDER AND LAP.***

RETRACTABLE LAP BELT *(Figure 8)*

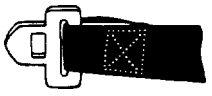


Figure 8

> ⚠ *WARNING!*
>
> ***USE RETRACTABLE LAP BELTS ONLY WHEN YOU ARE USING THE BOOSTER SEAT WITH THE SHIELD IN PLACE. THIS TYPE OF A BELT IS AUTOMATICALLY TIGHTENED BY A RETRACTOR.***

To install your booster seat using a retractable lap belt follow all steps described for a "Manually Adjustable Lap Belt" on page 9.

After threading the belt through the booster's seat belt pathway and securing it in place, be certain that all slack has been taken up.

> ⚠ ***CAUTION:***
>
> ***A BOOSTER SEAT MUST ALWAYS BE SECURED WITH A LAP BELT THAT REMAINS TIGHT AND SECURE AT ALL TIMES, UNLESS YOU ARE USING IT WITHOUT THE SHIELD. AT THOSE TIMES, THE CHILD MUST BE SECURED BYA SHOULDER/ LAP BELT SYSTEM THAT RESTS SNUG ACROSS HIS/HER SHOULDER AND LAP.***

LOCKING SHOULDER/LAP BELT (Figures 9, 10)

Figure 9

Figure 10

(Back side of lap belt is shown t reveal the locking mechanism)

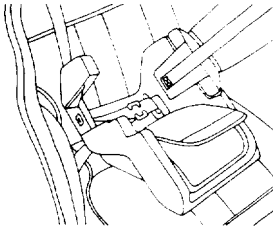


Figure 11

- Follow all steps outlined under "Manually Adjustable Lap Belt" on page 9. Thread both the shoulder and lap portions of the vehicle's seat belt through the seat belt pathway.
- Always thread the shoulder portion behind the booster first (Figure 11) and then through the seat belt pathway.
- To tighten, pull on the shoulder portion of the belt while sinking the restraint into the vehicle's seat cushion with your knee.

NOTE: *Some newer model GM and Chrysler vehicles have locking shoulder/lap belts that look different than those in figures 9 and 10, Looking through this section* of your Owner's *Manual, find the system that* looks most *similar to yours and follow the installation directions explained there,*

- Test installation by forcibly tilting the restraint from side to side. Retighten if necessary.

> ⚠ ***WARNING!***
>
> ***IF THE BOOSTER SEAT IS NOT TIGHT ENOUGH AFTER TESTING, MOVE IT TO ANOTHER SEATING LOCATION WHERE IT CAN BE SECURED PROPERLY OR SEE YOUR LOCAL CAR DEALER. ASK YOUR DEALER TO INSTALL A MANUAL SEAT BELT SYSTEM THAT WILL REMAIN TIGHT AND SECURE WITH A CHILD RESTRAINT.***

FREE SLIDING SHOULDER/LAP BELT (Figures 12, 13)

Figure 12

Figure 13

> ⚠ *WARNING!*
>
> ***FREE SLIDING SHOULDERIMP BELTS HAVE A FREE SLIDING LATCH PLATE THAT MOVES ALONG THE BELT. WHEN PLACING THE BOOSTER SEAT IN SEATING POSITIONS EQUIPPED WITH THIS SYSTEM, YOU MUST USE A LOCKING CLIP TO PREVENT THE SEAT BELT FROM SLIPPING.***

LOCKING CLIP INSTRUCTIONS

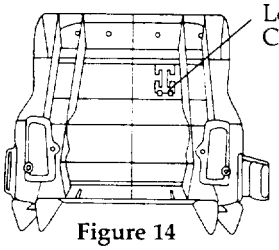


Figure 14

The Gerry Double Guard comes with its own Locking Clip, stored underneath the booster's base. (Figure 14) Special storage snaps hold the clip there when it is not needed.

HOW TO USE YOUR LOCKING CLIP:

- Raise the flip-up seat on the booster's base to locate the seat belt pathway. Place both the shoulder and lap portions of the vehicle's seat belt through this pathway. Buckle it.
- Using your knee, press the base of the booster so that it "sinks into" the vehicle seat's cushion for a tight fit. (Figure 15)

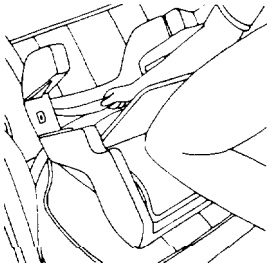


Figure 15

> ! *CAUTION:*
>
> IF MORE THAN 2" ***EXISTS BETWEEN THE BOOSTER AND YOUR VEHICLE'S SEAT BACK, MOVE THE DOUBLE GUARD TO ANOTHER SEATING POSITION.***

- To tighten the lap portion of the belt, pull on the shoulder portion while sinking the booster seat into the vehicle's seat cushion.
- Hold the shoulder and lap belts together in place, release the belt buckle.
- Holding the belts in position, thread both portions of the belt through the Locking Clip so that the clip is positioned 1/2" from the latch plate (Figure 16).
- Click the latch plate back into the vehicle's belt buckle. The lap belt should remain tight with all slack removed.
- Double-check the tightness of the belts. If the seat wobbles, repeat previous steps until the unit is firmly secured. If, after repeated attempts, it still wobbles, move the booster seat to another seating location where it can be secured properly. (Figure 17, found on page 12)

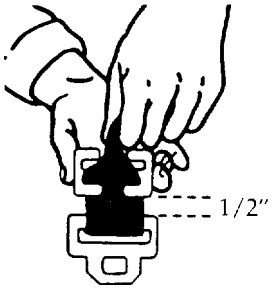


Figure 16

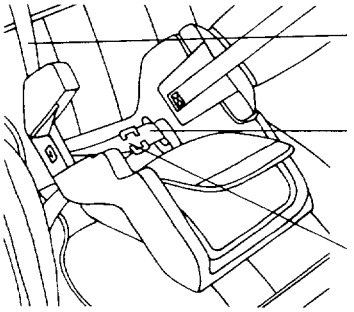


Figure 17

⚠ *WARNING!*

IF THE BOOSTER SEAT 1S NOT TIGHT ENOUGH AFTER TESTING, MOVE IT TO ANOTHER SEATING LOCATION WHERE IT CAN BE SECURED PROPERLY OR SEE YOUR LOCAL CAR DEALER. ASK YOUR DEALER TO INSTALL A MANUAL SEAT BELT SYSTEM THAT WILL REMAIN TIGHT AND SECURE WITH A CHILD RESTRAINT.

SEWN LATCH PLATE SHOULDER/LAP BELT (Figure 18)

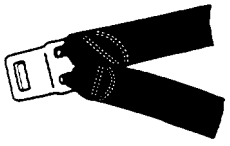


Figure 18

This type of seat belt stays loose during normal driving conditions. It will not hold any child restraint tightly in place. In the event of a sudden stop or impact it will lock, but the belt may move much farther forward than is safe.

⚠ *WARNING!*

DO NOT USE THIS SYSTEM WZTH THE GERRY DOUBLE GUARD UNLESS YOU ARE USING THE BOOSTER BASE ALONE -- WITHOUT THE SHIELD. FOLLOW THE DIRECTIONS ON PAGES 6 AND 7 CAREFULLY

PASSIVE AUTOMATIC RESTRAINT BELT IN FRONT PASSENGER SEAT (Figure 19)

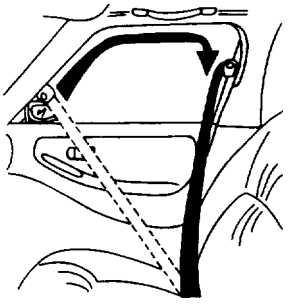


Figure 19

You'll find this type of system in the front passenger's and driver's seats. Engaged in the car door, it automatically moves along a track securing the passenger in place when the car door is closed. It releases upon opening the car door.

⚠ *WARNING!*

DO NOT USE THIS SYSTEM WITH THE GERRY DOUBLE GUARD UNLESS YOU ARE USING THE BOOSTER BASE ALONE -- WITHOUT THE SHIELD. FOLLOW THE DIRECTIONS ON PAGES 6 AND 7 CAREFULLY

PLACING YOUR CHILD IN THE BOOSTER (40-60 LBS)

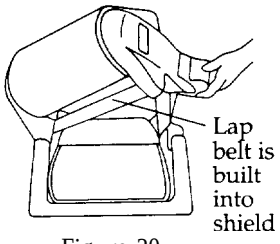


Figure 20

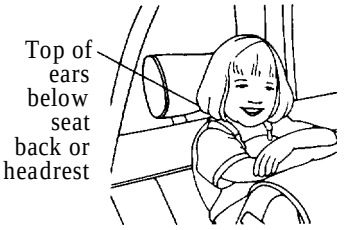


Figure 21

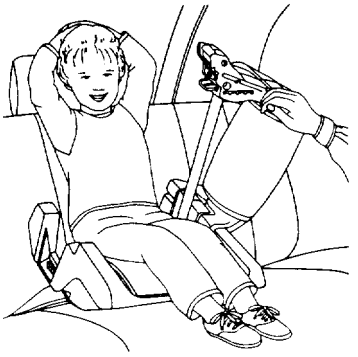


Figure 22

Now that the Double Guard is properly installed, follow these steps to secure the child in the booster seat.

- Squeezing the red release bar while lifting it up, raise the shield to its most upright position. (Figure 20)

NOTE: The booster's lap belt automatically moves with the protective shield each time you raise the shield.

- Place the child in the center of the booster seat. Be sure the top of the child's ears rest below the vehicle's seat back or headrest. (Figure 21)
- Ask the child to sit upright and raise his / her arms in the air. This prevents injury to the child's arms and hands. Double check the latch area to be sure that clothing and other items (i.e. blankets, games, toys, etc.) are not in the **way. They may** interfere with the proper positioning of the booster's lap belt over the child's lap when you lower the shield. (Figure 22)
- Slowly lower the shield and click the buckle into its latch plate. The lap belt built into the shield should be snug against your child's lap.

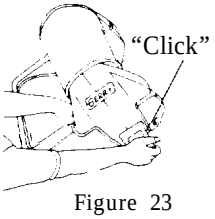


Figure 23

WARNING!

YOU SHOULD HEAR AN AUDIBLE "CLICK" THAT TELLS YOU THE SHIELD 1S LOCKED IN PLACE. DOUBLE CHECK IT BY FIRMLY LIFTING UPON THE SHIELD—YOU SHOULD NOT BE ABLE TO RAISE IT. (FIGURE 23)

WARNING!

TO AVOID INJURY TO THE CHILD OR DAMAGE TO THE BUCKLE MECHANISM, THE SHIELD SHOULD BE LOWERED AND LOCKED BY AN ADULT 0NL% DO NOT ALLOW THE CHILD TO LOWER THE SHIELD.

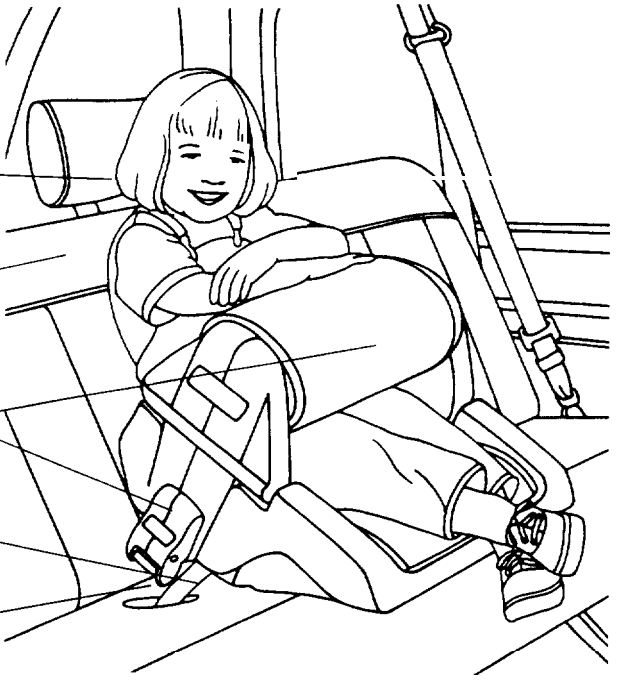
WARNING!

NO CAR RESTRAINT 1S ESCAPE-PROOF! THE SHIELD AND ITS LAP BELT SHOULD ALWAYS BE SECURE WHEN A CHILD 1S TRAVELING IN THE CAR WITH YOU. PLEASE EXPLAIN AND STRESS THE IMPORTANCE OF REMAINING IN THE BOOSTER SEAT TO THE CHILD.

SAFETY CHECKLIST

When using the Gerry Double Guard with the shield, be sure to check the following:

- The top of the child's ears should be below the car's seat back or headrest.
- Your vehicle's seat back is locked in the full upright position.
- The shield is locked in place.
- The booster seat is securely installed following the directions for the type of seat belt found in your vehicle.
- No more than 2" exists between the base and the vehicle's seat back.



⚠ *WARNING!*

WHEN USING THE DOUBLE GUARD IN A SEATING POSITION EQUIPPED WITH FREE SLIDING SHOULDER/LAP BELTS, A LOCKING CLIP MUST BE USED. SEE PAGE 11 FOR INSTRUCTIONS.

TROUBLESHOOTING GUIDE

PROBLEM: When using the booster seat with the shield, the vehicle seat belt is not secure. Booster seat wobbles.

SOLUTION Press down firmly on booster seat base so that it "sinks into" the vehicle seat's cushion. Tighten belt as securely as possible. Be certain all belt slack is taken up. Check your type of seat belt system. The seat belt may need to be twisted or a locking clip required to secure it. See pages 8-12.

PROBLEM: Booster shield buckle does not lock the shield into the base.

SOLUTION: Check to see if the child's clothing is covering the latch plate. You should hear an audible "click" when the buckle is engaged correctly. If you don't hear the "click", pull up on the shield to see if it is latched. See page 13. DO NOT allow the child to lower the shield. Doing so may damage the buckle mechanism.

PROBLEM: Vehicle seat belt buckle prevents vehicle lap belt from holding booster seat in place.

SOLUTION: To prevent belt from loosening, try turning the adjustable end of the vehicle's seat belt upside down before buckling it.

PROBLEM: The vehicle's shoulder/lap belt has a free sliding latch plate so it doesn't tighten securely.

SOLUTION: Requires the use of a locking clip (located under the booster seat base). See page 11.

PROBLEM: Cannot place booster seat firmly against vehicle seat.

SOLUTION: Move the booster to another seating location – one where it is firmly against the vehicle's seat back.

PROBLEM: The shoulder portion of the shoulder/lap belt system rubs against the child's neck or face.

SOLUTION: When you are using the booster seat alone, without the shield, you must use the vehicle's 3-point shoulder/lap belt system. To avoid the possibility of injury, the shoulder portion of the belt should never pass over the child's neck or face. Readjust it as necessary. If vou cannot, DO NOT use the booster seat. Ask your car dealer for assistance in adjusting or replacing your seat belt system.

PROBLEM: The child climbs out of the booster seat.

SOLUTION: No child restraint is escape proof. The shield and its belt should always remain secure and latched when traveling. When using the base alone, without the shield, use the vehicle's 3-point shoulder/lap belt system. Stress the importance of remaining in the booster seat to the child. If the child will not leave the shoulder portion in place, DO NOT use the Double Guard.

PROBLEM: Lumbar support areas of the vehicle's seat interferes with the closing and latching of the shield and/or causes the booster to unlatch.

PROBLEM: The vehicle's 3-point shoulder/lap belt system interfes with the ability to open and close the Double Guard.

SOLUTION: (Try one of the following:)

- Move the Double Guard to another seating position.
- Reverse the shield so that it opens from the other side. (See page 5 for instructions.)
- Use the Double Guard base alone -- without its shield. (See pages 6 and 7.)

CARE AND MAINTENANCE

For quick and easy clean-ups, blot the shield and seat pads with a damp sponge using a mild soap solution and cool water. If necessary, the pads maybe removed and hand washed.

REMOVING THE SHIELD AND SEAT PADS

It is recommended that you sponge the pads clean while they're on the unit. If you want to remove the pads for cleaning:

- Find the hidden plastic strip underneath the fabric of both pads. Each strip has plastic connectors that snap into the booster's plastic shell. Use a blunt object, like a screwdriver, to gently unsnap each connector from its hole.

€ After detaching all the connectors from the shell, store the plastic strips in a safe place while washing the pads.

NOTE: Vinyl seat pads maybe wiped clean with a sponge as described above. They should not be removed for bond washing.

WASHING INSTRUCTIONS

- Fabric pads should be hand washed only. Use COOI water with a mild detergent. DO NOT use chlorine bleach. DO NOT machine wash.

- Rinse each pad thoroughly in cool water to remove any excess soap. Roll them in towels to eliminate excess water. Do not wring or twist pads.

- Dry flat, away from sun and heat. DO NOT machine dry.

SHIELD LAP BELT

- Over time, under normal conditions, some wear is expected. Check the red shield lap belt periodically for any signs of unusual wear.

- If broken threads appear on the belt, DO NOT use the shield.

⚠ *CAUTION:*

DURING NORMAL USE, THE BOOSTER LAP BELT SHOULD NOT BECOME DANGEROUSLY WORN. JUST IN CASE, YOU SHOULD INSPECT IT FROM TIME TO TIME FOR ANY SIGNS OF UNUSUAL WEAR AND TEAR.

If you have any questionslproblems regarding your Gerry Double Guard Auto Booster Seat, do not return this product to the retailer. Call Gerry Consumer Relations at: 1-800-626-2996.

GERRY® Double Guard Owner's Manual

Auto booster seat for children 30-60 lbs

GERRY®

Gerry Baby Products Company
Denver, Colorado 80241
A Huffy Company

PN# 029404281
7/95

Appendix M

Excerpts From NHTSA's 6th Quarterly Safe & Sober Planner

The following excerpts are from the 6th Quarterly Safe & Sober Planner (DOT HS 808 303) issued by the National Highway Traffic Safety Administration in September 1995.

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

Administrator

400 Seventh Street, S.W.
Washington, D.C. 20S90

October 1995

A Message from the Administrator

The focus of the Sixth Quarterly Safe & Sober Planner is Child Passenger Safety, and in particular, Child Safety Seat Use/Misuse. Every day our Auto Safety Hotline receives calls from frustrated parents who can't understand why putting a child in a safety seat has to be so difficult. It's time for real solutions for real people.

In January 1995, I announced the formation of a "Blue Ribbon Panel" to generate recommendations on how to reduce child seat misuse and eliminate incompatibility problems. The work of this panel, consisting of automobile and child seat manufacturer representatives, child passenger safety advocates, researchers and other concerned citizens, was completed and recommendations were published May 30, 1995.

Last fall, I named a special in-house "Child Safety Seat Misuse Team" to study the misuse issue and recommend agency action. This team is looking into several possible solutions, including "ISOFIX," a universal fixture for attaching child seats to vehicle seats. The team is also developing an easy-to-use CD-ROM database containing information on compatibility between child seats and passenger vehicles.

We are equally pleased to announce the establishment of the Child Passenger Safety Bulletin Board System (CPS BBS). Through the CPS bulletin board, agencies, safety advocates, families and others can have instant access to a variety of resources pertaining to child passenger safety issues.

This year, National Child Passenger Safety Awareness Week is February 11-17, 1996, and offers us all an opportunity to work together to continue to save lives, prevent injuries, and reduce health care costs. Together, we can make a difference.

Sincerely,

Ricardo Martinez, 'M.D.

introduction
sixth quarterly planner

introduction

When used correctly, child safety seats can reduce fatal injury by 69 percent for infants and by 47 percent for toddlers. The Campaign Safe & Sober Sixth Quarterly Planner focuses on child passenger safety and activties that can be implemented in your community. As always, community advocates and law enforcement are encouraged to work together using combined enforcement supported by public information.

Our Sixth Quarterly Planner has a new look Focus groups testing resulted in a suggestion to use color coding for different pieces. There is an easy-to-use index on the inside of the portfolio so pieces can be quickly located. Also included in the Planner is an issue of the CPS Today newspaper which contains program and resource information

Additional copies of this planner and single copies of past planners are available from your Governor's Highway Safety Representative Themes of past planners Include: Impaired Driving and Non-Use of Safety Belts (First and Fifth Quarterly), Child Passenger Safety and Occupant Protection (Second Quarterly).Youth (Third Quarterly), and Speed (Fourth Quarterly).

Use these materials to develop new and expand current programs and sties. Share the information with your colleagues andcommunity counterparts. Most of all. use them to continue your excellent work to improve the health and safety of our communities. Planner materials are described below.

CPS TODAY

This "newspaper" contains information on a variety of programs and community efforts. Sections Include: Programs Federal Page, Training, What's New, a Calendar of Events, and Classifieds.

TRAFFIC SAFETY OUTLOOKS

The field of traffic safety is constantly changing. "Traffic Safety Outlooks" feature topical traffic safety issues and provide the latest data and information from across the country. The data in these pieces can be used to strengthen requests for funding, to support legislative testimony and to respond to questions from the public and the media,

- Child Passenger Safety
- Occupant Protectlon
- Alcohol
- Pedestrian
- Bicycle
- School Bus

LEGISLATIVE UPDATE

Legislative Updates describe key traffic safety laws and tell why states should pass them.

- Kids Aren't Cargo

TRAFFIC SAFETY AT WORK

Read about the important role employers can play in traffic safety programs.

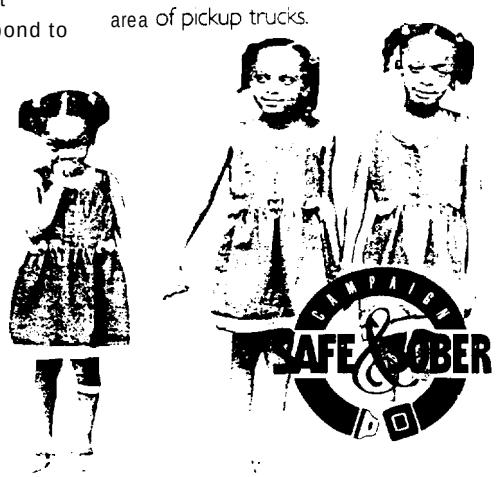
- Child Passenger Safety at WorK

PUBLIC INFORMATION AND EDUCATION

Expand your public information and education activities wrth the following materials

- Kids Aren't Cargo poster. hangtag, and citation holder

Kids Aren't Cargo is the theme for 1996 National Child Passenger Safety Awareness WeekThe aim of the campaign is to Increase awareness that people do not belong in the cargo area of pickup trucks.



● Are You Using It Right?

This full color brochure illustrates how some safety belt systems cannot be used to secure child safety seats and some of the common mistakes parents make when installing and using child safety seats.

● Make the Right Call brochure

This piece describes the Make the Right Call program, which explains to children what 9 l l is, and when to call and when not to call 9 l l.

● Prevent Pedestrian Accidents

This piece describes common myths children believe and offers pedestrian safety messages for parents of preschool children

ENFORCEMENT

Supporting enforcement with public information and education activities Increases voluntary compliance,

€ sTEPS- Put Them To Work In Your Community

This brochure presents convincing results of successful sTEPs,

● Buckling Up On Those Not Buckling Down

This piece presents facts arguments, and evidence to convince members of the judiciary of the Importance of addressing safety belt violations in the courtroom and the community.

CAMERA-READY MATERIALS

We encourage you reprint or photocopy these Planner pieces for distribution to the general public.

● Child Passenger Safety TIPS

€ Babies and Air Bags Don't Mix

● 1995 Child Safety Seat Shopping Guide

● HowTo KeepYour Child in One Piece

● Child Safety Seat Registration Form

● Campaign Safe & Sober Logos (black and white, two-color)

CAMPAIGN SAFE & SOBER BACKGROUND MATERIALS

These materials support general Campaign Safe & Sober activities,

● Campaign Safe & Sober Brochure

● Bounce Back Card

RESOURCES

Use these resources to contact members of organizations that support traffic safety and exchange information with other traffic safety professionals.

● NHTSA Regional Offices and State Highway Safety Offices

€ Child Passenger Safety Advocates

● Automobile and Child Restraint Manufacturers

● FHWA Local Technical Assistance Program

resourcelist
child passenger safety advocates

resource list

AMERICAN ACADEMY OF PEDIATRICS
P.O. Box 927
141 Northwest Point Boulevard
Elk Grove Village, IL 60009-0927
Phone: (708) 228-5005, ext5101
Sells child passenger safety educational materials. Some state chapters have "Make Every Ride A Safe Ride" programs.

AUTOMOTIVE SAFETY FOR CHILDREN PROGRAM
Riley Hospital for Children
575 West Drive
Room 004
Indianapolis, IN 46202
Phone (317) 274-2977
Provides resources and assistance to Indiana consumers. Conducts research and provides technical assistance on special needs issues on special assignment

"BUCKLE UP KIDS" FIRE AND RESCUE PROGRAM
Barbara Patasce
United States Fire Administration
16825 South Seton Avenue
Emmitsburg, MD 21727
Fax: (301) 447- 1102
Provides training for fire and rescue personnel to become community-based resources for education and technical assistance in child passenger safety

CENTER FOR INJURY PREVENTION
1007 Ellis Street
Stevens Point WI 54481
Phone: (715) 344-7583
Toll free [800) 344-7580
Fax: (715) 341-8400
Offers safety education materials for pre-schoolers, Sells' 'Buckle Bear' injury prevention educational materials Provides training and consultation

AUGUST 1995

CHILDREN'S SAFETY NETWORK
National Maternal and Child Health Clearinghouse
8201 Greensboro Drive
Suite 600
McLean, VA 22102
Phone (703) 82 l -8965
Provides a national resource center and clearinghouse on child passenger safety issues for out-of-home child care providers, their licensing agencies, parents, children, and the Maternal and Child Heatth network

CSN ECONOMICS AND INSURANCE RESOURCE CENTER
National Public Service Research Institute
8201 Corporate Drive
Suite 220
Landover, MD 20785
Phone (301)73 l -9991
Provides cost-benefit analysis on child safety seats

DRIVERS' APPEAL FOR NATIONAL AWARENESS
DANA Foundation
P.O. Box 1050
Germantown, MD 20875
Fax: (301) 601 -9228
Works with advocates and the media to raise awareness of child safety seat/vehicle incompatibility Issues.

E.K. & COMPANY, INC,
1007 Ellis Street
Stevens Point WI 54481 -2935
Phone: (715) 344-7583
CPS BBS phone (202) 785-2546
Fax: (715) 341-8400
A national child passenger safety computer bulletin board system (CPS BBS) Contact CPS BBS for subscription information.

INSURANCE INSTITUTE FOR HIGHWAY SAFETY
Communications Department
1005 North Glebe Road
Arlington,VA 22201
Phone: (703) 247-1500
Fax: (703)214- 1678
Provides highway safety facts and statistics and informational brochures. Has crash test videotapes of restrained and unrestrained passengers

KARS/Special KARS (Kids Are Riding Safe/Special Kids Are Riding Safe)
National Easter Seal Society
230 West Monroe
Suite 1800
Chicago, IL 60606
Phone (3 12) 726-6200
Toll free: (800) 221 -6827
Provides training for a comprehensive hospital-based child passenger safety education program, focusing on children with special needs who cannot use conventional child restraints.

MARY GREELY MEDICAL CENTER
Mobile Intensive Care Services
Attn: Paul Hudson
117 11th Street
Ames, IA 50010
Phone: (515) 239-2109
Sells videos on safe transportation of children in emergency vehicles

MIDAS "PROJECT SAFE BABY"
Midas Headquarters
225 North Michigan Avenue
Chicago, IL 60601
Toll free: (800)-621-0144,ext 7833
Offers child safety seats at cost to any consumer, with a rebate of the same cost upon return of the seat at any time. Local dealers often active in community safety coalitions.

NATIONAL ASSOCIATION FOR THE EDUCATION OF YOUNG CHILDREN (NAEYC)
1509 16th Street. N.W.
Washington, DC 20036-1426
Phone: (202) 232-8777
Toll free: (800) 424-2460
Fax: (202) 328-1846
Develops and sells child passenger and traffic safety (bicycle and pedestrian) educational materials for teachers and young children.

NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION (NHTSA)
Office of Occupant Protection
NTS-13
400 7th Street S.W.
Washington, D.C. 20590
Fax (202) 493-2062
Sets national safety standards for child safety seat manufacturers. Provides statistics, technical assistance, and educational materials on child passenger safety issues.

NHTSA AUTO SAFETY HOTLINE
Toll Free: (800) 424-9393
Washington, DC area: (202) 366-0123
Receives reports on defects (distributes Chid Safety Seat Questionnaire) and provides child seat recall information. Handles consumer inquiries about child safety seat safety problems and recalls.

NATI0NAL SAFE KIDS
111 Michigan Avenue, N.W.
Washington, DC 20010
Phone: (202) 939-4993
Sponsor of nearly 200 state and local child safety coalitions. Responds to consumer calls and provides informational brochures.

NATIONAL SAFETY BELT COALITION
1019 19th Street N.W.
Suite 401
Washington, DC 20036
Phone: (202) 296-6263
Fax: (202) 293-2270
Network of private and public sector organizations dedicated to promoting safety belt and child safety seat awareness. Serves as a clearinghouse for information and materials on occupant protection. Supports efforts to strengthen seat belt and safety seat laws. Encourages support for enforcement efforts

NATIONAL SAFETY COUNCIL
1121 Spring Lake Drive
Itasca, IL 60143-3021
Phone: (708) 285-1121
Responds to consumer calls and distributes informational brochures and statistics.

SAFE AMERICA FOUNDATION'S "OPERATION BABY BUCKLE"
P.O. Box 14145
Atlanta GA 30324-1145
Phone (404) 497-6168
Distributes child safety seats to low-income families. Provides educational resources to encourage greater understanding of car seat safety principles by all parents.

SAFE RIDE NEWS PUBLICATIONS
Deborah Stewart
726 Belmont Place East
Seattle, WA 98102-4425
Phone (206) 328-1424
Publishes national quarterly publication covering child passenger injury Issues in depth.

SAFETYBELTSAFE U.S.A.
Box 553
Altadena, CA 91003
Phone: (310) 673-2666
Fax (310) 677-5777
Offers child passenger safety training, educational materials in many languages, and consulting services.

SHELNESS PRODUCTIONS
Box 326
New Milford, CT 06776
Phone: (203) 355-0323
Fax: (203) 355-8379
Sells videotapes, brochures, and training materials on proper insolation and use of child safety seats

SHINN AND ASSOCIATES, INC.
2154 Commons Parkway
Okemos, MI 48864
Phone: (517) 332-0211
Toll free: (800) 955-8870
Sells child car seats, special needs seats, and bicycle helmets.

WISCONSIN INFORMATION NETWORK FOR SAFETY (WINS)
1007 Ellis Street
Stevens Point, WI 54481
Phone (715) 344-7130
Toll Free (in WI): (800) 261-WINS
Sells resources for occupant protection programs, including t-shirts, parking lot signs, key chains, etc.

Appendix N

Passenger Vehicles With Integrated Restraints

Table N.1—Passenger vehicles with integrated (built-in) restraints as standard or optional equipment

Vehicle make	Model year and model
Chevrolet	1994-96 Lumina van 1996 Lumina sedan
Chrysler	1993-96 Concorde 1994-96 Town & Country 1995-96 Cirrus
Dodge	1992-96 Caravan, Grand Caravan 1993-96 Intrepid 1995-96 Neon, Stratus
Eagle	1993-96 Vision
Ford	1993-96 Aerostar 1994-96 Escort 1995-96 Explorer, Windstar
Geo	1996 Prizm
Jeep	1996 Grand Cherokee
Mercury	1994-96 Tracer 1996 Villager
Nissan	1996 Quest
Oldsmobile	1994-96 Silhouette
Plymouth	1992-96 Voyager, Grand Voyager 1995-96 Neon 1996 Breeze
Pontiac	1994-96 Trans Sport
Saab	1994-96 900 series
Toyota	1996 Corolla sedan
Volvo	1993-96 850, 960 series 1993-95 940 series

Source: Adapted from “Kids & Air Bags” published by the Insurance Institute for Highway Safety.

Appendix O

Recommendations of the Blue Ribbon Panel, 1995

Blue Ribbon Panel on Child Restraint & Vehicle Compatibility

Recommendations

May 30, 1995

BLUE RIBBON PANEL ON CHILD RESTRAINT AND VEHICLE COMPATIBILITY

Mission

The mission of the Blue Ribbon Panel on Child Restraint and Vehicle Compatibility is to explore options for communicating the current issues of compatibility and for improving the compatibility between child restraint systems (CRS) and vehicle seating positions and belt systems. The panel will make recommendations to government, industry, and consumer groups that facilitate the proper and secure installation of CRS in vehicle seating positions.

The panel was announced by Ricardo Martinez, M. D., Administrator of the National Highway Traffic Safety Administration, on February 13, 1995. In his announcement, Dr. Martinez noted that routine safety equipment "should be unequivocally easy to install and convenient to use." Dr. Martinez asked the panel to develop recommendations by June 1, 1995.

Scope of the Problem

Child restraint systems can reduce the chance of serious or fatal injury in a crash by 70 percent or more. The effectiveness of CRS is reduced considerably (or defeated altogether) when CRS are not securely fastened into a motor vehicle.

The cause for concern is the range of CRS-vehicle compatibility issues that make secure installation of a CRS in some vehicle seating positions difficult and, in some circumstances, impossible. The need for supplemental attachment hardware (like auxiliary buckles, locking clips, seat belt extenders) further complicates the task. Many parents and caregivers are unaware that necessary information on CRS installation, including supplemental attachment hardware, is contained in vehicle owner's manuals. These compatibility related issues are the Blue Ribbon Panel's focus of attention.

In addition, CRS misuse occurs when parents or caregivers fail to secure a child in a CRS harness, fail to fasten the CRS to the vehicle, or use a CRS that is inappropriate for the child.

The panel divided compatibility issues into three time-frames of reference with respect to product: Long-Range (future products), Mid-Term (current products in the market and products under development), and Existing (currently owned and past model products).

Long-Range. One reason for incompatibility is that vehicle safety belt systems are expected to provide restraint for different types of "occupants" that have differing needs. Safety belts are primarily designed to restrain adults and older children, with associated geometric, comfort, and regulatory requirements, but also are used to restrain CRS. While advances in safety belt systems over the years have resulted in greater protection against injury for adults, these changes have often made it more difficult to properly restrain CRS. It is becoming increasingly obvious that given the complexity of CRS installation variables, the best long-range solution maybe an entirely

separate anchorage system for CRS installation. The panel has considered whether or not a system of uniform structural attachment points in vehicles and on CRS is an appropriate long-range approach to greatly reducing, if not eliminating, CRS-vehicle incompatibility in vehicles not equipped with integrated CRS.

Mid-Term. The compatibility issue is not a new one, and joint efforts among interested parties have been in progress fora number of years to try to enhance compatibility through communication and voluntary technical practices. The formal result of these efforts is the Society of Automotive Engineers (SAE) Recommended Practice J1819, which initially applied only to rear vehicle seats, but now includes front passenger seats as well. It is generally agreed that, if all manufacturers followed this voluntary practice, compatibility could be much improved although incompatibility would certainly not be eliminated. One feature of SAE J1819, lockability of lap belts, has been incorporated into Federal Motor Vehicle Safety Standard 208 effective September 1, 1995. The panel has considered whether or not SAE J1819 should be more widely implemented and if so, how; and whether or not and how consumers should be alerted to the fact that some seating positions do not comply with SAEJ1819 and could, therefore, make CRS installation more complex.

For new vehicles, the most likely first point of contact for a consumer is the automobile dealer. Anecdotal information suggests that sales, service, and parts personnel are generally unaware of CRS installation problems, techniques, and supplemental hardware needs. The panel has considered how to integrate dealer personnel more effectively into the overall solution to compatibility problems. Beyond that, the panel has considered the best avenues of further recourse for the consumer and ways to ensure that such assistance is timely and accurate.

Other existing sources of information and assistance for the consumer are the printed manuals, instructions, and labels provided by CRS and vehicle manufacturers. Some of this information is mandated by regulation, but much is provided at the discretion of the manufacturer. The panel has considered whether or not this information can be standardized, simplified, and made more understandable and appealing.

Existing. The vast majority of consumers utilizing existing CRS and existing vehicles will not be immediately affected by future technical changes nor revisions to point-of-sale information. Moreover, many of these consumers do not recognize that they have a compatibility problem that must be addressed. The panel has considered how best to alert consumers to the nature and seriousness of the issue, how to provide them with easily accessible and accurate sources of information and assistance, how to enlist the help and cooperation of existing private organizations and public service groups and personnel, and how to ensure that information providers are adequately trained.

The Blue Ribbon Panel agrees to continue to exist as a voluntary working group and will issue a progress report in one year. In addition, the working group will assist in the development of educational materials (such as standardized language for CRS instructions) as requested by manufacturers and/or others.

RECOMMENDATIONS

Long-Range Products

1. The National Highway Traffic Safety Administration (NHTSA) should expeditiously complete a comprehensive evaluation of ISOFIX; including appropriate crash modes and child comfort issues; and should initiate rulemaking that, if NHTSA's evaluation is found acceptable, will permit ISOFIX or a uniform attachment points system that is functionally compatible with ISOFIX under Federal Motor Vehicle Safety Standard 213.

2. The National Highway Traffic Safety Administration should strive to achieve international compatibility of child restraint performance requirements for uniform attachment points.

3. In conjunction with the recommended rulemaking on a uniform attachment points system. vehicle and CRS manufacturers, in accordance with the procedures under 49CFR Part 512 (Confidential Business Information), should advise the National Highway Traffic Safety Administration of their plans concerning the introduction of uniform attachment points capability in their products.

4. Upon completion of rulemaking permitting uniform attachment points, the National Highway Traffic Safety Administration (NHTSA) should convene a cooperative working group comprised of NHTSA, vehicle and CRS manufacturers, child passenger safety advocates, and others in the safety community to develop educational materials promoting the benefits of uniform attachment points hardware.

5. To encourage the early introduction and proliferation of uniform attachment points hardware, any weight additions to the vehicle should be exempted from Corporate Average Fuel Economy (CAFE) testing.

Mid-Term Products

6. Manufacturers should evaluate their products for compatibility using the Society of Automotive Engineers Recommended Practice J1819 and/or other evaluative measures. Vehicle manufacturers should identify in their owner's manuals and sales literature which seating positions can accommodate a CRS.

7. CRS manufacturers should indicate in product literature if their products meet the guidelines of the Society of Automotive Engineers Recommended Practice J1819.

8. Vehicle manufacturers should develop educational materials, for example, videos and other pictorial illustrations, on correct CRS installation in their vehicles for use by dealer sales, service, and parts personnel.

*A system using four uniform attachment points for child restraints and vehicle seating positions currently being developed and evaluated by the International Standards Organization TC 22, Subcommittee 12, Working Group 1.

9. Vehicle dealers should have at least one person on staff trained on correct CRS installation.

10. Vehicle manufacturers should develop educational materials for consumers describing and demonstrating correct CRS installation and warning about CRS installation limitations for each of their vehicle models. Videos, booklets, quick reference cards, or other delivery mechanisms could be utilized.

11 Prominent warnings of incompatibility between vehicle seating positions and CRS should be in owner's manuals and vehicles. Vehicle manufacturers should develop comprehensive, consistent language and illustrations on correct CRS installation for use in vehicle owner's manuals. While specific language would be tailored to individual product lines, messages regarding compatibility issues should be uniform.

12. CRS manufacturers should develop comprehensive, consistent language and illustrations on correct installation of CRS for use in their instructions. While specific language would be tailored to individual product lines, messages regarding compatibility issues should be uniform.

13. The National Highway Traffic Safety Administration should amend Federal Motor Vehicle Safety Standard 213 labeling requirements which contribute to reader confusion and apathy.

14. Vehicle and CRS manufacturers, the National Highway Traffic Safety Administration, child passenger safety advocates, and other organizations should strive to make all instructions and educational materials understandable to people of all reading levels.

15. Designers and developers of new vehicle restraint technologies should consider their interaction with CRS.

16. CRS manufacturers should investigate designs that can take advantage of the shoulder portion of a 3-point belt to improve CRS static stability and crash performance.

17. The Children's Restraint Systems Standards Committee of the Society of Automotive Engineers (SAE) should review and modify SAE Recommended Practice J1819 with respect to seatback, restraint configuration, and seating surface profiles (including, but not limited to dips, humps, and curvature) of seating positions.

Em-sting Products

18. An intensive educational campaign on correct use and installation of CRS should be undertaken by the government, vehicle and CRS manufacturers, and child passenger safety advocates to make the general public aware of emerging incompatibility issues such as air bags and rear-facing CRS; known installation issues such as use of rear-facing CRS forward facing; and their solutions. Reading of CRS instructions and vehicle owner's manuals should be heavily promoted. Groups such as automotive dealers, health care providers, day-care providers, pre-schools, fire departments, emergency medical services, law

enforcement officers, judges, public officials, and employers should be integrated into the campaign.

19. Vehicle manufacturers should develop a chart by make and model of supplemental attachment hardware or procedures required for CRS installation in existing vehicles. Educational materials containing this information should be prepared for use by dealer sales, service, and parts personnel; CRS installation trainers; and CRS manufacturers.

20. Systematic training of manufacturer and child safety practitioner telephone operators should be conducted. This training should include appropriate referrals of incompatibility problems that are difficult to solve.

21. The National Highway Traffic Safety Administration should periodically send out a "Consumer Alert''/News Release with all CRS and vehicle manufacturers' customer service telephone numbers for use in answering compatibility questions.

22. The National Highway Traffic Safety Administration should continue and, when appropriate, expand its programs to train Emergency Medical Services, police and fire personnel, and child safety practitioners to be CRS installation instructors.

23. The National Highway Traffic Safety Administration (NHTSA) should establish an electronic bulletin board system on child passenger safety to enable information on compatibility problems and other CRS issues to be shared among state highway safety offices, CRS trainers, and other users. Congress should provide adequate funding for NHTSA to establish and maintain this system.

24. The National Highway Traffic Safety Administration should establish and continue to support a national CRS information clearing house with phone lines, trained personnel, and written materials.

25. Congress should direct that a portion of State and Community Highway Safety Program (Section 402) funds be used by all recipient states for child passenger safety education. This includes telephone lines for consumers with CRS questions, training for child passenger safety specialists, and access to the National Highway Traffic Safety Administration"s (NHTSA) child passenger safety electronic bulletin board system (CPS-BBS). Recipients of Section 402 funds should be required to be on-line with NHTSA's CPS-BBS. All state highway safety offices should have, at a minimum, one designated staff person fully trained in child passenger safety.

26, Vehicle manufacturers and/or related organizations, such as the American Coalition for Traffic Safety, Inc., should seek media opportunities to advise the public of necessary modifications and/or replacement equipment for specific CRS-vehicle incompatibilities.

27. Given the success of the Insurance Institute for Highway Safety's film "Children and Infants Restrained and Unrestrained" as an educational tool, the panel recommends that the Institute update this film to graphically portray what can happen to a child if no CRS is used, a CRS and vehicle seating position are incompatible, or the CRS is misused.

ONGOING ISSUES

Due to time constraints, the panel was unable to complete discussion of all compatibility issues. Additionally, throughout the panel's discussions of child restraint and vehicle compatibility, certain issues arose that, although not directly related to compatibility, have a significant effect on child passenger protection. In the interest of optimizing child passenger safety, the panel, therefore, encourages industry, the government, and others to address the following issues:

- The need to visibly distinguish heavyduty locking clips for belt shortening from regular locking clips.

- Inclusion of general information about the types of CRS best suited for different types of vehicles in educational material provided by vehicle and CRS manufacturers and in generic point-of-sale information provided by retailers.

- The continued need to evaluate top tethers for use in the U.S.

- Encouragement to consumers to consider installation of CRS and inquire of dealer and/or manufacturer about proper CRS installation before purchasing a vehicle.

- The need for appropriate testing procedures and dummies when developing revisions of Federal Motor Vehicle Safety Standard 213 to provide optimal protection for the range of sizes of children at appropriate stages of neurophysiologic development including infants weighing less than seven pounds and infants less than one year weighing up to 30 pounds. Minimum weight requirements for booster occupants should also be addressed.

- The need for appropriate testing procedures to evaluate use of restraint systems which are compatible and suitable to provide optimal protection for infants and young children transported on school buses.

- Standards on aftermarket accessories to CRS and safety belts, such as foam inserts, play tables, attachments to harnesses, and shoulder belt positioners.

- Strict enforcement of child passenger protection laws.

- Subsidization of CRS distribution and education for Aid to Families with Dependent Children and Medicaid recipients.

- Modification of child passenger protection laws in the fifty states and the District of Columbia to be consistent with and to include the following components:
  - All children under age 16.
  - CRS required up to age four and 40 pounds, with safety belts or CRS allowed over that age.
  - Properly restrained in all seating positions.
  - Primary enforcement.
  - Driver responsible for child passengers under age 16.

- All motor vehicles (in-or out-of-state) equipped with safety belts. Ban on passengers in the cargo areas of pickup trucks,
- A suggested fine of $50-75, the approximate cost of a convertible CRS.
- Portion of the fine earmarked to help support state child passenger safety educational and loaner programs.

- The positive and correct depiction of CRS and safety belt use by the television and motion picture industry and print media.

- Replacement by insurance companies of any add-on CRS which is proven by an accident report to have been used in a crash, and any safety belts or integrated CRS that have been damaged in a crash.

- Methods of ensuring that owner's manuals accompany every vehicle at resale, such as in conjunction with title transfer.

CHILD RESTRAINT SYSTEMS ON AIRCRAFT

The panel met with representatives of the Air Transport Association (ATA) to discuss the use of CRS on commercial aircraft. According to the ATA representatives, air carriers are faced with a dilemma. The Federal Aviation Administration (FAA) recommends the use of CRS, however, recent tests by the Civil Aeronautics Medical Institute suggest that some types of current CRS do not perform well on aircraft seats due to aircraft belt and seat configurations.

Panel members pointed out that seat belt anchorages on some aircraft are placed such that the base of an installed CRS can be pulled forward by hand more than five inches. Current CRS are designed for anchorages at or near the bight and cannot be securely fastened to any vehicle seat, automobile, or aircraft, with anchorages so far forward.

Panel members noted that the issue on aircraft is one of compatibility between the CRS and the aircraft seat and belts, not that CRS are "unsafe" for aviation use as some have suggested. Panel members also described past meetings of the SAE S-9CR Ad Hoc Committee on Child Restraint Systems about CRS use on aircraft. Aviation interests at those meetings were aware of the anchorage location issue, but have not acted to address the issue.

The panel suggests that the SAE S-9CR Ad Hoc Committee on Child Restraint Systems reconvene to conduct meetings of CRS and aircraft manufacturers, along with air carriers, National Highway Traffic Safety Administration and FAA representatives, and child passenger safety advocates to resolve the issue not only of CRS compatibility with seat space on commercial aircraft, but also with aircraft belt systems.

BRIEFINGS

The panel also received briefings and communications from other organizations interested in child passenger safety and CRS-vehicle compatibility issues. This information was helpful to the panel and these items are summarized below:

NHTSA ISOFIX and CRS Compatibility Sled Tests

Ms. Lisa Sullivan, Project Engineer at the National Highway Traffic Safety Administration's (NHTSA) Vehicle Research & Test Center, reported preliminary results of sled tests on rear- and front-facing lSOFIX prototypes. Ms. Sullivan reported that they performed very well. She also informed members of the panel about CRS tests performed with lap belt anchorage points four and ten inches forward of the seat bight. NHTSA has completed a report of the testing program for the Blue Ribbon Panel.

Midas International Project Safe Baby

Mr. Bob Troyer of Midas International made a presentation about Midas' Project Safe Baby at a panel meeting. This project has resulted in the sale, at low cost, of close to 100,000 convertible CRS. Midas franchisees, who sell the seats, also offer financial incentives when the seats are later returned.

Children's National Medical Center Investigation of Children Injured in Vehicle Crashes

Ms. Catherine Gotschall, SC. D., made a presentation to the panel moderator on a National Highway Traffic Safety Administration funded intensive case investigation of restrained children who were injured in motor vehicle crashes. The study has analyzed 108 crashes involving children aged two weeks to 12 years.

Canadian and Australian Interest in Blue Ribbon Panel Deliberations

The panel moderator received telephone communications and two letters from Canadian officials expressing Canada's support for the ISOFIX concept and the proposed Canadian adaptation known as CANFIX, which utilizes two fixed attachment points at the seat bight for rear-facing CRS with the addition of a tether anchorage for forward-facing CRS. A letter was also received from the Australia Roads and Traffic Authority. The letter indicated support for CANFIX. Copies of the letters were distributed to Blue Ribbon Panel members.

MEMBERS OF THE BLUE RIBBON PANEL ON CHILD RESTRAINT AND VEHICLE COMPATIBILITY

Philip Haseltine
Moderator
American Coalition for Traffic Safety, Inc.

Thomas Baloga
Mercedes Benz of North America, Inc.

Paul Butler
Ford Motor Company

W. Randall Edwards
Chrysler Corporation

Lawrence Fleming
Nissan North America, Inc.

Dietmar Haenchen
Volkswagen of America, Inc.

David Raney
American Honda Motor Company

William Scully
BMW

Stephen Kraitz
Volvo Cars of North America

Kenneth Stack
General Motors Corporation

Christopher Tinto
Toyota Motor Corporation Services of North America

Howard Willson
Chrysler Corporation

David Campbell
Century Products

James Lee
Gerry Baby Products

Neil McLachlan
Fisher-Price, Inc.

Jonathan Reynolds
Cosco, Inc.

Gary Christman
Evenflo

Ed Johnson
Kolcraft Enterprises, Inc.

Dr. Marilyn Bull
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Joseph Colella
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DANA Foundation

Deborah Stewart
American Academy of Pediatrics

Lorrie Walker
PA Traffic Injury Prevention Project
PA Chapter American Academy of Pediatrics

Kathleen Weber
University of Michigan

Stephanie Tombrello
SafetyBeltSafe U.S.A.

Annemarie Shelness
Auto Safety Advocate

Wendell Lane
TRW Vehicle Safety Systems, Inc.

Robert Rogers
Takata, Inc.

Appendix P

Safety Board Letter Regarding Absence of Performance Standards for Seatbelt Adjusters

National Transportation Safety Board
Washington, D.C. 20594

May 17, 1996

Mr. Van Betulius
BodyGuard LLC
P.O. Box 102
Oshtemo, Michigan 49077

Dear Mr. Betulius:

It has recently come to my attention that the BodyGuard™ product labeling, printed literature and the 1-800 number message contains incorrect information with respect to the National Transportation Safety Board (NTSB). Specifically, the literature cites that: "National Transportation Safety Board regulation #213 governs the safety restraint system of automobiles. Bodyguard conforms to NTSB standards..." This information is not true; there is no NTSB standard 213.

The NTSB is an independent Federal accident investigation agency. Since its creation in 1967, the Safety Board's mission has been to determine the "probable cause" of transportation accidents and to formulate safety recommendations to improve transportation safety. The Safety Board has no regulatory authority.

The U.S. Department of Transportation, National Highway Traffic Safety Administration has a Federal Motor Vehicle Safety Standard (FMVSS) 213 which regulates child restraint systems, but the standard does not apply to add-on devices such as your product. For more information on FMVSS 213 you should write or call:

Mr. George Mouchahoir
U.S. Department of Transportation, NPS 15
400 Seventh Street, S.W.
Washington, D.C. 20590
(202) 366-4919

The Safety Board played no role in the development or issuance of FMVSS 213 nor does the Safety Board test products for safety. We also do not endorse products. Please correct your product labeling, product literature, and 1-800 message immediately to eliminate any

misrepresentations of this agency. Thank you in advance for your cooperation with this matter. If you have any questions regarding this matter, please contact Mary Eastwood of my staff at (202) 382-6814.

Sincerely,

Vernon S. Ellingstad, Ph.D.
Director
Office of Research and Engineering

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Appendix Q

Vehicles With a Lap/Shoulder Belt at the Center Rear Seating Position

Table Q.1—1996 model year vehicles with a lap/shoulder belt installed at the center rear seating position (continued)

Vehicle make and model	Series
Bentley:	
Azure Convertible	Base
Brooklands 4D	Base
Brooklands LWB 4D	Base
Turbo R 4D	Base
Ford:	
Taurus 4D	GL, LX, SHO
Taurus SW	GL, LX
Honda:	
Passport 4D 4x2	Base
Passport 4D 4x4	Base
Isuzu:	
Rodeo 4D 4x2	Base
KIA:	
Sephia 4D	Base
Lexus:	
LS 400 4D	Base
Lincoln:	
Continental 4D	Base
Mercedes Benz:	
E Class 4D	300D, 320
Mercury:	
Sable 4D	GS, LS
Sable SW	GS, LS
Rolls Royce:	
Silver Dawn 4D	Base
Silver Spur 4D	Base
Touring Limousine 4D	Base
Saab:	
900 2D	S, SE
900 4D	S, SE
900 Convertible	S, SE
Toyota:	
Avalon 4D	

Table Q.1—1996 model year vehicles with a lap/shoulder belt installed at the center rear seating position (continued)

Vehicle make and model	Series
Volvo:	
850 4D	Base/GLT, R, Turbo
850 Wagon	Base/GLT, R, Turbo
960 4D	Base
960 SW	Base

Source: Insurance Institute for Highway Safety.