

Lgt H-587B



National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

Date: October 16, 1996

In reply refer to: H-96-34 and -35

To the child restraint manufacturers
(mailing list attached)

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. 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 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.

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 4.¹ 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 a study to examine the performance and use of occupant protection systems for children—child restraint systems, vehicle seatbelts, and air bags.² The study also examined the adequacy of relevant Federal Motor Vehicle Safety Standards (FMVSS), 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

¹ 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.

² National Transportation Safety Board. 1996. The performance and use of child restraint systems, seatbelts, and air bags for children in passenger vehicles. Safety Study NTSB/SS-96/01. Washington, DC. Volume 2 of the report, NTSB/SS-96/02, contains the case summaries of the 120 vehicle accidents.

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, analyzed data from 120 vehicle accidents.

Accidents Involving Air Bags

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 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.³ In one accident, restraint use could not be conclusively determined. 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's sample should not have occurred regardless of restraint use.

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 NHTSA's FARS and General Estimates System (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 fatally injured children; from 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 since March 1994, 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.

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

³ 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). Safety Board and NHTSA staff met to discuss these differences.

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 seatbelt⁴ 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 never leave a child alone in the back seat. 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 urgent recommendations issued by the Safety Board on November 2, 1995, to health and safety organizations addressed this concern. 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

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. Subsequent to the Board's letter, Safety Board staff was informed that the video news release had been released 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

⁴ 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.

multimedia campaign is essential to raise public awareness about the dangers that air bags can pose to children.⁵ 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 National Automotive Occupant Protection Campaign⁶ are positive steps in meeting the intent of the recommendation.

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.⁷ 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 and the improper use of a child restraint system.

The Safety Board was able to determine the type of restraint systems that should have been used for 181 of the 194 children.⁸ Only 51 of the children in the Board's sample were in the appropriate restraint system based on the Board's classification system.⁹

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.¹⁰ The Safety

⁵ 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.

⁶ The campaign was launched in May 1996 by a government/industry coalition for air bag safety.

⁷ 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.

⁸ The appropriate restraint system could not be determined for 13 children because the height and/or weight was unknown.

⁹ 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. (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, a Pontiac Sunbird, and Dodge Caravan.)

¹⁰ Although nine children were in appropriate restraints, four of them were using the rear-facing restraints in the forward-facing position.

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.

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 was not only improperly secured in the restraint system, but the restraint system was also improperly installed in the vehicle. Hence, the total number of improper uses exceeded the number of improperly used child restraint systems. 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.

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

The child restraint system harness was too loose on 11 children and was completely missing for one 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,¹¹ (c) not threading the harness straps properly,¹² 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 injured, and 1 sustained severe injuries. The child in the child restraint system with the missing harness was also ejected.

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

¹¹ 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.

¹² 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.

lap/shoulder belt, and one was equipped with a lap-only belt. Supplemental seatbelt hardware was needed at the child's seating position in two cases.

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.

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 fared very well, even those improperly restrained; five children in high severity accidents were improperly restrained yet sustained either no or only minor injuries.

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 is either 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.¹³ 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.¹⁴ 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: 75 percent in 1983, 64 percent in 1984,¹⁵ 80 percent in 1995,¹⁶ and 62 percent in the Board's current study. These

¹³ National Highway Traffic Safety Administration. 1979. EarlyRider Educational Curriculum. DOT HS 805 060. Washington, DC. November.

¹⁴ (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.

¹⁵ (a) Shelness, Annemarie; Jewett, Jean. Observed Misuse of Child Safety Seats. 1983. 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.

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?” and NHTSA’s eight child passenger safety tips are clearly written and explain many of the problems that parents and caregivers encounter in choosing and using child restraint systems.¹⁷ 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, 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.

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).¹⁸ All were primarily funded by membership dues and worked on limited budgets.¹⁹ Only SafetyBeltSafe USA exists today; it has a part-time staff of

¹⁶ 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.

¹⁷ 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.

¹⁸ 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.

¹⁹ 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.

about 15 and an annual budget of about \$300,000. 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 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 is recommending that NHTSA review, through its 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.

The National Automotive Occupant Protection 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.

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?
- What direction should my child be facing?

Securing the child restraint system in the vehicle:

- 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?
- 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 manufacturers' instructions and/or vehicle owners' manuals, 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 will 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 summarized in the Rationale Statement for the SAE Recommended Practice J1819,²⁰ 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 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."²¹ 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.

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."²² The Safety Board supported the need for such action. 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

²⁰ 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.

²¹ Federal Register, Vol. 56, No. 137, dated July 17, 1991.

²² Federal Register, Vol. 56, No. 235, dated December 6, 1991.

securing a child restraint system without the need for any supplemental hardware. Vehicles manufactured after September 1, 1995, must meet this requirement.²³

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 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 (especially properly restrained 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 NHTSA's 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.²⁴ 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.

Integrated Restraints.—Integrated (built-in) 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 1991.²⁵ Currently, 7 automobile manufacturers offer integrated restraints in 31 vehicle models, thus encouraging parents and caretakers to transport children in the back seat. The Safety Board is recommending that the automobile manufacturers offer integrated restraints in passenger vehicles for sale in the United States.

²³ Federal Register, Vol. 58, No. 196, dated October 13, 1993.

²⁴ 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.

²⁵ *Safe Ride News*. 1991. Product Notes. Elk Grove, Illinois. American Academy of Pediatrics; Summer 10(3).

Universal Anchorage System.—On February 13, 1995, NHTSA established a Blue Ribbon Panel on child restraint and vehicle compatibility to address the “range of child restraint system-vehicle compatibility issues that make the secure installation of a child restraint system in some vehicle seating positions difficult and, in some circumstances, impossible. The need for supplemental attachment hardware (like auxiliary buckles, locking clips, seatbelt extenders) further complicates the task.”²⁶ On May 30, 1995, the Blue Ribbon Panel issued 27 recommendations. 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 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. 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.²⁷ 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.

Because integrated restraints do not accommodate the group of children who need to be rear-facing, 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

²⁶ American Coalition for Traffic Safety, Inc. 1995. Blue Ribbon Panel on Child Restraint & Vehicle Compatibility Recommendations. Arlington, VA. May 30.

²⁷ 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.

Board is recommending that NHTSA revise the necessary Federal Motor Vehicle Safety Standards to provide for the secure and uniform installation of child restraint systems.

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."²⁸

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.

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:

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.

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

²⁸ National Highway Traffic Safety Administration. 1994. Evaluation of Devices to Improve Shoulder Belt Fit. DOT HS 808 383. Washington, DC.

believes that seatbelt adjusters should be subject to testing to determine their performance in reducing injury severity in automobile accidents. Consequently, the Safety Board is recommending that NHTSA establish performance requirements for seatbelt adjusters and revise FMVSS 213 accordingly.

Therefore, as a result of this study, the National Transportation Safety Board recommends that [insert name of child restraint manufacturer]:

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 the study, the Safety Board issued safety recommendations to the Governors and legislative leaders of the 50 States, the U.S. Territories, the Mayor of the District of Columbia, the National Highway Traffic Safety Administration, and the domestic and international automobile manufacturers.

The National Transportation Safety Board is an independent Federal agency with the statutory responsibility "...to promote transportation safety by conducting independent accident investigations and by formulating safety improvement recommendations" (Public law 93-633). The Safety Board is vitally interested in any actions taken as a result of its safety recommendations and would appreciate a response from you regarding action taken or contemplated with respect to the recommendations in this letter. Please refer to Safety Recommendations H-96-34 and -35 in your reply.

Chairman HALL, Vice Chairman FRANCIS, and Members HAMMERSCHMIDT, GOGLIA, and BLACK concurred in these recommendations.

By:


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