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Safety Study - Child Passenger Protection against Death, Disability, and Disfigurement in Motor Vehicle Accidents

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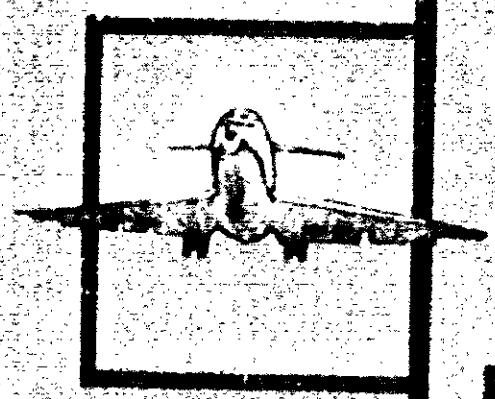

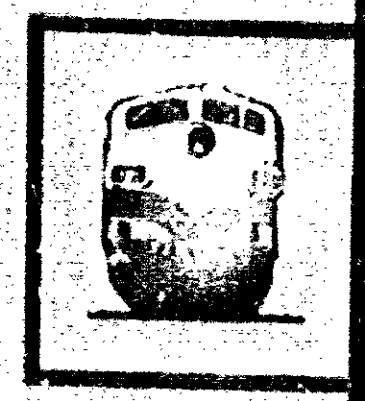

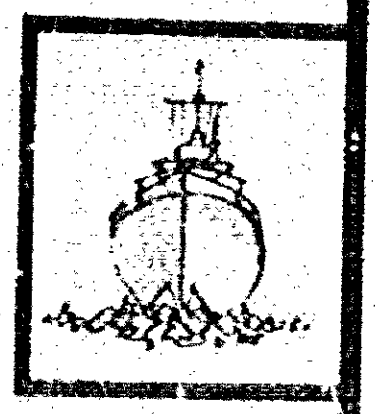

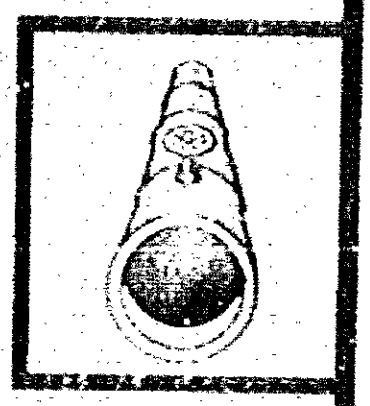

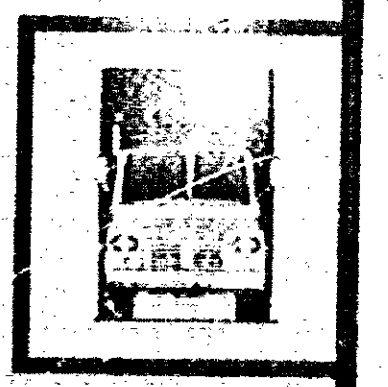

NATIONAL TRANSPORTATION SAFETY BOARD

WASHINGTON, D.C. 20594

SAFETY STUDY

CHILD PASSENGER PROTECTION AGAINST DEATH, DISABILITY, AND DISFIGUREMENT IN MOTOR VEHICLE ACCIDENTS

NTSB/SS-83/01

UNITED STATES GOVERNMENT

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16. Abstract

The National Transportation Safety Board examined the issue of child motor vehicle passenger protection through a series of 53 detailed investigations of accidents involving infants and small children, restrained and unrestrained; through a series of three regional public hearings; and through a review of the child passenger protection laws that had been enacted by 40 States and the District of Columbia as of mid-1983.

The report uses accident cases to highlight crash consequences to unrestrained children and the often dramatic lifesaving and injury prevention benefits of child safety seats. Misuse of child safety seats is identified as a significant problem in accidents, and a need for special efforts to combat the misuse problem is identified. The report identifies limitations and loopholes in child passenger protection laws and concludes that a major problem is that virtually none of the 41 laws were designed to foster the transition of children from safety seat use to safety belt use. The report also calls attention to the need to implement and enforce child passenger protection laws effectively, and identifies areas for further research. Finally, the report identifies major elements for inclusion in effective child passenger protection laws.

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NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C. 20594

SAFETY STUDY

Adopted: September 7, 1983

CHILD PASSENGER PROTECTION AGAINST DEATH, DISABILITY, AND DISFIGUREMENT IN MOTOR VEHICLE ACCIDENTS

INTRODUCTION

Motor vehicle accidents are the number one killer and crippler of children in the United States. Infants and small children riding as passengers in motor vehicles are especially vulnerable to death, disability, and disfigurement, even in minor accidents and noncrash incidents, such as sudden stops. Although it is estimated that most fatalities and injuries to infants and small children in motor vehicles could be prevented by the proper use of child safety seats, 1/ safety seat use remains low, and most children continue to be transported in motor vehicles without proper protection.

In 1982, because of its increasing concern about the continuing high levels of highway fatalities and injuries, the National Transportation Safety Board began a study of child passenger protection as part of an expanded effort to concentrate its highway accident investigations and its other activities on safety problems having high potential for success in reducing fatalities and injuries.

In mid-1982, the Safety Board launched a series of detailed investigations of accidents involving infants and small children. Fifty-three investigations were conducted in 19 States by highway accident investigators in four field offices located in Los Angeles, New York, Kansas City, and Atlanta, and in the Safety Board's Washington, D.C., headquarters. The investigations examined the use and crash performance of child safety seats as well as accident consequences to infants and small children who were not traveling in child safety seats. The accident investigations were not intended to produce statistically representative accident data. The Safety Board selected each accident individually to obtain cases which would permit investigation of potentially significant safety issues in motor vehicle transportation of infants and small children. 2/

The 53 accidents were identified with the assistance of State and local law enforcement agencies, State highway safety agencies, and other organizations, including Physicians for Automotive Safety, the American Academy of Pediatrics, the American Association for Automotive Medicine, the National Child Passenger Safety Association and some of its State and local chapters, the Highway Safety Research Center of the University of North Carolina, the University of Michigan Transportation Research Institute, the Rehabilitation Institute of Chicago, the National Safety Council and some State and local safety councils, and some of the National Accident Sampling System teams of the National Center for Statistics and Analysis of the National Highway Traffic Safety Administration, U.S. Department of Transportation.

1/ In this report, "child safety seat" is used generally to refer to any of a number of types of child restraint systems, which include infant safety seats, toddler safety seats, convertible child safety seats, booster seats, safety harnesses, and handicapped child safety seats. For a complete description of each of these types, see appendix D.

2/ Case summaries of the 53 accidents investigated for the study appear at appendix E. For ease of reference, the case summaries are organized by topic and are numbered 1 through 53.

On December 7, 1982, based on the preliminary results of its initial investigations, the Safety Board issued Safety Recommendations H-82-59 and -60 to the Governors or Governors-elect of 31 States and the Mayor of the District of Columbia. (See appendix A.) Safety Recommendation H-82-59 urged the adoption of child passenger protection laws requiring the proper use of child safety seats, and Safety Recommendation H-82-60 urged the adoption of comprehensive, statewide child passenger safety programs. When the recommendations were issued, 19 States had passed child passenger protection laws requiring safety seat use. In the next 7 months, 22 more laws were enacted, bringing the nationwide total to 41 child passenger protection laws in 40 States and the District of Columbia. (Additionally, Pennsylvania enacted a law on November 1, 1983. Data hereinafter do not reflect this additional law.)

In early 1983, the Safety Board held regional public hearings in Dallas (January 13, 1983), Philadelphia (February 4, 1983), and St. Louis (March 24, 1983), on the problem of child passenger safety. The hearings were held to gather information for the public record and to increase public awareness of the problem of child motor vehicle deaths and injuries and the importance of proper child passenger protection. Testimony was received from 54 witnesses, including families of children involved in crashes, accident investigators and law enforcement officials, pediatricians and other medical personnel, highway safety and accident prevention specialists, and State legislators. (See appendix B.)

This report presents the findings and recommendations of the Safety Board's child passenger protection study. The report presents investigative results; illustrates the problem of deaths and injuries of infants and small children in motor vehicle accidents and the benefits of proper use of child safety seats; identifies misuse of child safety seats as a significant problem in accidents; identifies other problems and issues developed in the accident investigations; identifies a need for improvements in child passenger safety laws and programs; identifies elements for inclusion in an effective child passenger protection law; and includes further recommendations to reduce child passenger fatalities and injuries.

BACKGROUND

In the United States, more infants and small children under 5 years old are killed or crippled while riding as passengers in motor vehicles than the total killed or crippled by the seven common childhood diseases that children are immunized against. Motor vehicle accidents are the number one traumatic cause of epilepsy, and are a major traumatic cause of mental retardation and spinal cord injury in children. In the last 5 years (1978 through 1982), nearly 3,400 child passengers under 5 years old were killed in traffic accidents, 3/ and more than 250,000 more were injured. Most of these deaths and injuries are preventable; up to 90 percent of the fatalities and 67 percent of the disabling injuries could have been prevented by the proper use of child safety seats. 4/

3/ Fatal Accident Reporting System data base, National Center for Statistics and Analysis, National Highway Traffic Safety Administration, U.S. Department of Transportation (See appendix C, "Child Passenger Fatalities by State, Age 0 through 4, 1978-1982").

4/ Robert G. Scherz, M.D., "Summary of Statistics on the Children Age 0-15 Years Who Were Passengers in Motor Vehicles Involved in Accidents," Washington State Seat Belt Study 1970-77, Mary Bridge Children's Health Center, Tacoma, Washington, 1978; and Robert G. Scherz, M.D., "Restraint Systems for the Prevention of Injury to Children in Automobile Accidents," American Journal of Public Health, Vol. 66, No. 5, May, 1976.

Child car seats have been available for some 50 years as a means of keeping children confined, supported, and elevated for better behavior and a better view from windows in motor vehicles. However, it has only been in the last 10 to 15 years that the injury prevention potential of child safety seats has been recognized and more fully developed as a result of the efforts of concerned physicians and engineers, initiatives by individual manufacturers, and the adoption of a Federal safety regulation.

Child safety seats are specially designed to prevent the infants or small children riding in them from striking the vehicle interior during a collision or sudden stop. In a head-on collision into a brick wall or a tree at 30 mph, the car stops almost instantly, but the occupants inside continue traveling forward at 30 mph, or 44 feet per second. Unless restrained by some means, the car's occupants will collide with brutal force into whatever object is in front of them — the instrument panel, windshield, steering wheel, or seatback. Previous accident investigations by the Safety Board have shown that a frontal collision into a tree can be fatal to an unrestrained adult at speeds as low as 19 mph. 5/

Modern child safety seats are designed to provide more protection for infants and small children than a standard vehicle safety belt. They work by using a safety harness or protective shield, or both, to distribute the crash forces over a larger area of the child's fragile body than a safety belt, and to cushion the body to a stop before the child can strike the vehicle interior.

Federal Safety Standard

All child safety seats marketed in this country must meet the requirements established by the National Highway Traffic Safety Administration (NHTSA) in Federal Motor Vehicle Safety Standard (FMVSS) 213, 6/ Child Restraint Systems, which became effective April 1, 1971. Through the efforts of Consumer's Union and concerned health and safety professionals, FMVSS 213 was later upgraded to include stricter requirements for safety seats manufactured on or after January 1, 1981. Currently FMVSS 213 requires that safety seats be dynamically tested in a simulated 30-mph frontal crash using a test dummy representative of a 6-month-old infant or a 3-year-old toddler (convertible safety seats must be tested with both dummies). During the tests, the forward movement of the dummy's head and knees and the amount of force exerted on the head and chest are measured. To pass the test, the seats must not allow such forces to exceed certain limits. Safety seats and booster seats which require use of a tether strap must pass both a 30-mph crash test with the tether strap used and a 20-mph "misuse" test without use of the tether strap. Safety seats designed with a nonprotective front armrest also must pass a misuse test at 20 mph with the harness unfastened and only the armrest in front of the dummy.

FMVSS 213 also requires that safety seat manufacturers label their products with certain basic instructions for use and that they provide a place on the safety seat where the complete, detailed usage instructions may be stored. The label must identify the manufacturer and must contain a statement warning the user that failure to follow the instructions exactly "can result in your child's striking the vehicle interior during a sudden stop or crash."

5/ Special Study of Motor Vehicle Collisions with Trees Along Highways, Roads and Streets: An Assessment, Report No. NTSB-HSS-81-1, May 13, 1981.
6/ Code of Federal Regulations, Title 49, Part 571, Section 571.213, U.S. Government Printing Office, Washington, D.C., 1982.

Although many child restraint systems have been certified under FMVSS 213 for motor vehicle use, few have received the approval of the Federal Aviation Administration (FAA), which specified additional testing requirements for child restraint systems for use in aircraft. 7/ In a February 24, 1983, recommendation letter (Safety Recommendation A-83-1) to the FAA, the Safety Board expressed its concern that the extremely limited availability of FAA-approved child safety seats not only limits the opportunity for children to be protected adequately during air travel, but also discourages families traveling by air from taking their child safety seats with them for motor vehicle use before and after the air travel portion of their trips.

To increase the availability of child safety seats for use before, during, and after air travel, in August 1983 the NHTSA began rulemaking action to combine the existing FMVSS 213 requirements and the separate FAA requirements into a single standard administered by a single agency. 8/ To speed certification of child restraint systems for use in both motor vehicles and aircraft, the NHTSA also began a program to test the ability of current child restraint systems to meet the FAA requirements for aircraft use.

Public Education and Safety Seat Loan Programs

Between the mid-1960's and the late 1970's, efforts to increase public awareness of the problem of child passenger safety spread from individual pediatricians and other concerned physicians to a wide variety of organizations. As early as 1963, two out of five pediatricians were counseling parents on the need to protect their children in motor vehicles; 9/ by 1978, the American Academy of Pediatrics began to expand its ongoing support for these efforts by developing a national "First Ride, A Safe Ride" program. The program, which was developed to encourage child safety seat protection for small children beginning with the newborn's first motor vehicle trip (usually the trip home from the hospital), was officially launched in 1980.

Some of the earliest organized efforts to educate the public about child passenger protection were undertaken by Physicians for Automotive Safety, a national organization now based in Armonk, New York. Through its efforts, child passenger safety education programs for new parents had been established in a number of hospitals throughout the country by the early 1970's, and with its help, concerned parents in Seattle, Washington, founded a national organization, Action for Child Transportation Safety (ACTS), in 1972. ACTS developed educational brochures, pamphlets, films, slides, posters, and bumper stickers; encouraged the development of public education programs in many communities throughout the country; and with funding from the NHTSA, ACTS developed an "Early Rider" educational curriculum for health professionals. After 10 years of active public service, ACTS was dissolved as a national organization due to financial and other reasons.

By the mid-1970's public education programs were being conducted by many hospitals, community volunteer and civic organizations, and State public health and highway safety agencies. Safety seat loan programs also were established by hospitals,

7/ On May 28, 1982, the FAA issued Technical Standard Order (TSO) C-100, Child Restraint Systems. The intent of this TSO is to describe the minimum performance requirements for infant and child restraint devices permissible for use on aircraft as "approved" seats.

8/ NHTSA Notice of Proposed Rulemaking, "Child Restraint Systems for Use in Motor Vehicles and Aircraft," Docket No. 74-09, Notice 13, Federal Register, Vol. 48, No. 158, August 15, 1983, pp. 36849-53.

9/ I.B. Pless, K. Roghmann, and P. Algranati, "The Prevention of Injuries to Children in Automobiles," Pediatrics, Vol. 49, No. 3, March 1972.

community groups, and public agencies to encourage safety seat use by making them widely available at nominal cost. The NHTSA sponsored two series of regional workshops during the 1970's to improve coordination and communication among the various groups involved and to foster the sharing of information about effective approaches to child passenger safety. Public education efforts also were supported at the Federal level by the U.S. Department of Health, Education and Welfare, which had developed printed materials to guide parents in selecting child safety seats as early as 1967. 10/

In 1981, the National Child Passenger Safety Association (NCPSA) was formed as a national non-profit organization dedicated to working with individuals, organizations, and government agencies to ensure the right of every child to protection against death or injury while being transported as a passenger in a motor vehicle. Its national headquarters is located in Ardmore, Pennsylvania, and it is affiliated with State and local child passenger safety associations throughout the country. NCPSA also serves as a central national clearinghouse to assure the uniformity and accuracy of child passenger safety information disseminated to safety and health professionals, legislators, and the public.

Public education and safety seat loan programs were effective in increasing safety seat use, especially when both programs were conducted together, 11/ but these programs alone were unable to bring about usage increases of the magnitude necessary to achieve proper protection for the majority of infants and small children nationally. While programs in some communities achieved significant increases in safety seat use, most children under 5 years old continued to be transported unrestrained even by safety belts, which are found almost universally in automobiles. 12/

Child Passenger Protection Laws

To increase the use of child safety seats and safety belts by infants and small children and reduce child passenger fatalities and injuries more effectively, most States have adopted a legislative approach. As of July 1, 1983, 40 States and the District of Columbia had enacted child passenger protection laws to "immunize" infants and small children against death, disability, and disfigurement in traffic accidents (see figure 1). Twenty-seven were already in effect on that date, and the remainder were scheduled to go into effect on various dates between then and July 1, 1984.

10/ Randy L. Perry, K.W. Heathington, John W. Philpot, C.A. Penty, and Mark Lo, Transportation Center, University of Tennessee, The Impact of A Child Restraint Law and a Public Information and Education Program on Child Passenger Safety In Tennessee, prepared for the National Highway Traffic Safety Administration, U.S. Department of Tranportation, October 1980 (Report No. DOT HS-805 640).

11/ K.S. Reisinger and A.F. Williams, Evaluation of Programs Designed to Increase the Protection of Infants in Cars, Insurance Institute for Highway Safety, Washington, D.C., 1977.

12/ James L. Nichols, Ph.D., Effectiveness and Efficiency of Safety Belt and Child Restraint Usage Programs; The Safety Potential of Safety Belts, Child Restraint and Programs to Promote Their Use, National Highway Traffic Safety Administration, U.S. Department of Transportation, January 1982.

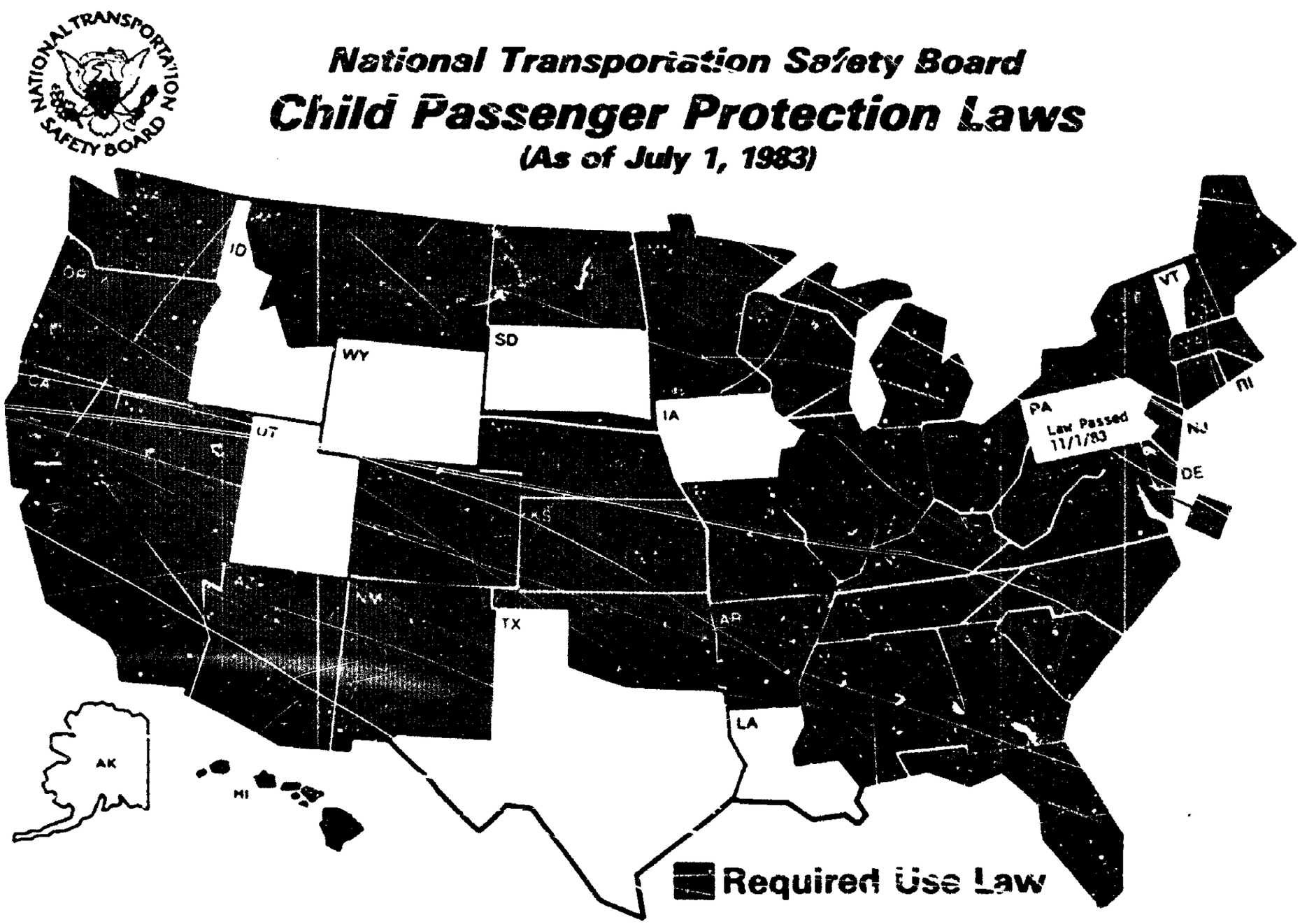

Figure 1.—Child Passenger Protection Laws.

UNRESTRAINED INFANTS AND SMALL CHILDREN—UNSAFE AT ANY SPEED

Case 15: About 6:55 a.m. on April 16, 1983, a 1974 Chevrolet Chevelle sedan was traveling about 25 mph on a four-lane boulevard in Paramount, California, when the driver of a pickup truck approaching from the opposite direction attempted to make a left turn across the path of the Chevelle. The driver of the Chevelle braked sharply but was unable to avoid colliding into the right front of the pickup truck. The Chevelle was occupied by an 18-month-old girl seated on a fold down center front armrest, her mother, who was driving, and her grandmother, who was seated in the right front. All three occupants were unrestrained and were thrown forward and to the left on impact. The mother and grandmother in the Chevelle and the driver of the pickup truck received minor injuries. The 18-month-old girl struck the windshield with her head, the instrument panel with her chest, and the gear selector lever with her neck. She died of multiple injuries within 10 hours after the accident. (NTSB Investigation No. LAX83HCR13)

Accident investigations conducted by the Safety Board show that it is extremely dangerous for an infant or small child to ride without proper protection in a motor vehicle at any time, under any circumstances. In the 23 accidents investigated involving unrestrained infants and small children, 18 children were killed and 9 were injured, including infants as young as 8 days, 5 weeks, and 7 weeks old. 13/ Most of the accidents were not severe, and other (older) occupants of the same vehicle, while injured, survived.

The accidents which killed or injured unrestrained infants and small children included minor accidents and cases of severe braking without a collision on city business or residential streets, as well as more serious crashes on highways. Some of the children were killed or seriously injured on routine trips as little as 50 yards from the family's home while going to or returning from shopping, taking a child to a babysitter's, traveling to a local restaurant, going to visit grandparents or other relatives, driving a friend or relative to work, or taking the children out for ice cream.

The investigations illustrate that, far from being less subject to the risk of death or injury, unrestrained infants and children are more likely to be killed or to suffer severe injuries if they are being held in the arms of an adult or if they are ejected from the vehicle. Virtually all fatal and serious injuries to unrestrained children in the accidents investigated were head or spinal injuries resulting from being propelled into the instrument panel, windshield, or other interior surfaces, and from contacts with other unrestrained occupants. These injuries are common to all unrestrained infants and children. In addition, unrestrained children being held in the arms of an adult are often crushed into the instrument panel or other interior surfaces by the weight and acceleration of the adult holding them. Further, unrestrained infants and children who are ejected from the vehicle suffer collisions with exterior surfaces, such as another vehicle or the pavement, or are crushed by the vehicle's overturning on top of the child (in addition to injuries sustained from contact with the vehicle interior before or during ejection).

13/ The accidents involving unrestrained infants and small children were Cases 1-18, 25, 27, 29, 30, and 38.

The investigations show also that an unrestrained infant or small child is in danger of being killed or injured in certain common, everyday driving incidents even if the vehicle is not involved in a crash. Such noncrash incidents include sudden stops, swerves, turns, and children falling from moving vehicles.

In addition, unrestrained children can cause accidents which endanger not only the children involved and other occupants of the vehicles in which the children are riding, but other motorists, their passengers, pedestrians, and bicyclists.

The Vulnerability of Infants and Small Children to Fatal or Serious Injury

Medical witnesses heard by the Safety Board in the regional public hearings on child passenger safety identified several reasons why infants and small children are more likely to be killed or injured even in minor accidents or noncrash incidents. According to pediatricians and specialists in pediatric surgery and pediatric emergency medicine, infants and small children have less built-in anatomical protection against injury. Muscle mass, which provides some protection in adults, is less well-developed. The skull of an infant or small child is thin and soft, and an infant has an open fontanelle, or boneless area, which does not close until late in the first year of life. The ribcage of an infant or small child is flexible and offers less protection for the chest and upper abdominal organs. The spine also is less protected and susceptible to injury. Consequently, infants and small children are subject to a significantly higher risk of serious head, spine, chest, and abdominal injury in accidents than are older passengers. In infants and small children, the head is also large and heavy in relation to the body, resulting in a higher center of gravity. In an accident, the infant or small child is likely to be catapulted through the air toward the vehicle's point of impact head-first as a helpless "unguided missile" or human torpedo, into a violent collision with the vehicle interior.

When infants and small children are propelled against the vehicle interior, they do not benefit as much as adults from padding and energy-absorbing materials which, if they are provided, are placed in areas more likely to be contacted by adults. Infants and small children also are more likely to contact the protruding controls, knobs, door handles, window cranks, and ashtrays usually found on the instrument panel, doors, and seatbacks. Finally, injured children do not show symptoms of injuries in the way that adults do, and their injuries are more difficult to diagnose and treat effectively.

According to testimony given in Philadelphia by the President of Physicians for Automotive Safety:

> In a crash, children are projected so frequently head-first, helpless missiles striking unyielding interior surfaces, or worse, are ejected from the car, sustaining so frequently irreversible brain damage. More American children have been rendered paralyzed, epileptic, or mentally retarded by car accidents than by any other trauma or crippling disease. Considering the rather delicate aspects of infant and child anatomy -- skin, torso, skeletal weaknesses — the devastating injuries to [unrestrained] children in traffic accidents should be no surprise.

Children Riding in the Arms of Adults--The Most Dangerous Way to Travel

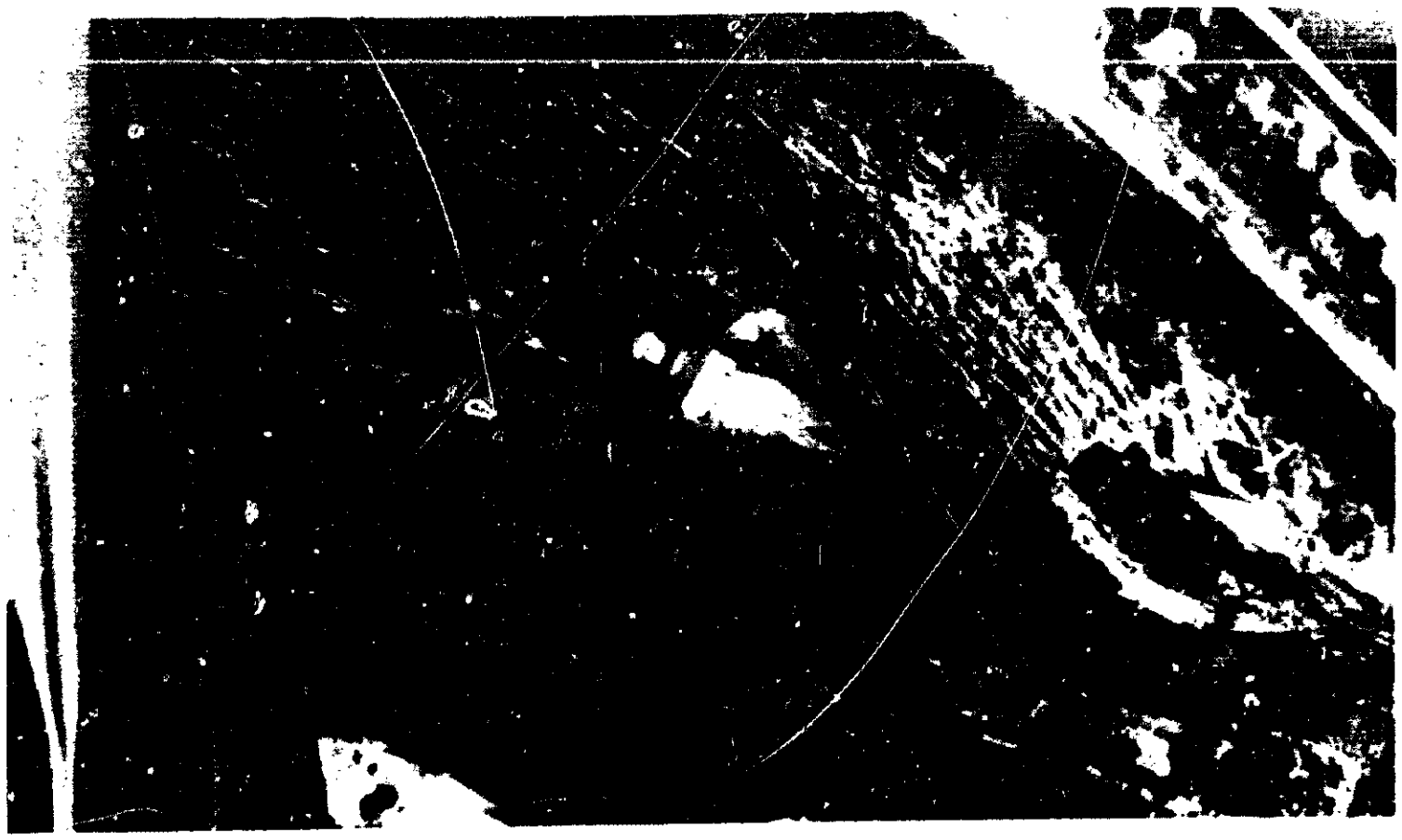

Figure 2.—Head-on Collision on July 27, 1982, near Addison, New York.

Case 1: About 5:15 p.m. on July 27, 1982, a Dodge sedan traveling on a two-lane State Route near Addison, New York, crossed the yellow centerline and collided head-on with a Ford sedan. The Dodge was occupied by three adults and two infants, all of whom were in the front seat unprotected by safety belts or child safety seats. The infants, ages 5 months and 15 months, were riding in the laps of their parents. The two infants were crushed into the dashboard by the weight and acceleration of their parents' bodies and died of massive head injuries. (See figure 2.) The parents and the driver survived with moderate injuries. (NTSB Investigation No. NYC82HCR05)

Case 2: About 5:28 p.m. on November 2, 1982, a Subaru station wagon occupied by a man, his wife, and their 5-week-old baby was traveling about 32 mph on East Riverside Drive in Austin, Texas, when it was struck head-on by a Ford sedan that crossed the centerline traveling about 57 mph. At the time of impact, the infant was being held in the arms of his mother while her husband drove. The mother and father, who were not using safety belts, received minor-to-moderate injuries. The 20-year-old driver of the Ford, who was charged with driving while intoxicated, received bruises on both legs. The baby was crushed into the dashboard by the weight and acceleration of his mother's body and died at the hospital from massive head injuries. (NTSB Investigation No. MKC83HCR02)

Eight of the accidents investigated involving 10 infants held in the arms of adults or of another child passenger illustrate why this is one of the most dangerous ways for infants or small children to travel in a motor vehicle. In these four frontal collisons and four side impact accidents, the 10 adults who were holding infants in their arms were unable to protect them from harm. Nine lap-held infants ranging in age from 5 weeks to 15 months were killed, and one infant survived with head and facial injuries.

The investigations show clearly that a mother's arms (or the arms of any person) are not a safe place for an infant in a motor vehicle. In a 30-mph collision, a 20-pound infant who is unrestrained can generate a propelling force of 300 to 600 pounds. Experiments have shown that even a restrained adult cannot hold onto and protect a lap-held infant in a moderate collision, and that many adults may not be able to protect a lap-held infant even in a minor collision. 14/ If the adult is unrestrained, the lap-held infant is subject to being crushed against the vehicle interior by the adult's body, which, being heavier, can generate a propelling force of several thousand pounds in a moderate accident.

In the frontal collisions, the six adults who were holding infants in their arms not only were unable to protect them, the adults also increased the severity of the injury to the infants. At least four of the infants were crushed into the dashboard or windshield by the bodies of the adults who were holding them, causing massive, fatal head injuries to the infants. In one accident, a lap-held infant was killed, although another infant who was lap-held in the rear seat received relatively minor head and facial injuries from being thrown into the rear of the front seatback. In all four frontal collisions, the lap-held infants who were killed were the only fatalities in the vehicle. None of the adults holding infants who were killed in frontal collisions received more than minor or moderate injuries because the infants cushioned the impact of the adult with the vehicle interior. In two cases, the infant's mother or grandmother reported that the baby was "still in my lap" or they were "still holding" the baby after the crash. Both infants were fatally injured by being crushed into the instrument panel.

In the side impact collisions, infants were propelled from the arms of the persons holding them and received fatal injuries from contact with the vehicle interior (or in one case, from being crushed by the vehicle after ejection).

The accidents investigated did not include any cases of a safety belt being fastened around both the adult and the infant in the adult's lap, although the Safety Board would expect this also to produce very severe crushing forces on the infant in a crash.

Increased Risk of Death for An Unrestrained Child Ejected from the Vehicle

Case 7: About 12:30 a.m. on July 26, 1982, a 1976 Chevrolet sedan occupied by a young couple and their two-year-old daughter who were returning home after a weekend visit to the child's grandmother was traveling on a two-lane State Route in Maddox, Maryland, when the driver failed to negotiate a curve and the vehicle ran off the road. The Chevrolet sideswiped a utility pole, severed a wooden signpost, and descended a 4-foot embankment, sliding on its side until it rolled over completely and came to rest on its wheels in a soybean field. The two unrestrained adults received minor injuries. The 2-year-old girl, who was sleeping unrestrained on the rear seat, was ejected from the vehicle and died of massive head injuries. (NTSB Investigation No. NYC82HCR03)

14/ D. Mohan and L. Schneider, "An Evaluation of Adult Clasping Strength for Restraining Lap-Held Infants," Human Factors, Vol. 21, No. 6, The Human Factors Society, Inc., 1979.

Case 8: About 6:25 p.m. on November 28, 1982, the driver of a 1982 Oldsmobile Custom Cruiser station wagon was cresting a hill on the New York Thruway when he saw the brake lights of vehicles stopping and colliding on icy pavement ahead and attempted to stop. The station wagon skidded first to the left, then to the right on the slight downgrade and struck the rear of a vehicle with its left side, shattering the left rear side window. The Oldsmobile was traveling about 27 mph when the impact occurred, and the vehicle it struck was traveling about 10 mph. The Oldsmobile was occupied by two adults in the front seat and their two children, who were sleeping on top of the folded down rear seatback which formed part of the station wagon's rear cargo area. The two restrained adults received minor injuries. The father, who was wearing a lap/shoulder safety belt in the driver's seat, sustained a strained shoulder and the mother, who was wearing a lap/shoulder safety belt in the right front, sustained a strain of the lower right leg. The two unrestrained children, ages 3 and 5 years old, were ejected from the cargo area through the shattered left rear window of the station wagon, struck the roof and hood of the other vehicle, and collided with the pavement. They slid on the ice and came to rest on the roadway and shoulder about 50 feet ahead of the vehicles' point of rest. Both children sustained multiple injuries, including fatal head injuries probably received when they struck the pavement. (NTSB Investigation No. DCA83HCR03)

A particularly serious hazard to unrestrained infants and small children in accidents, in addition to their being propelled into violent collisions with the vehicle interior and other occupants, is ejection from the vehicle. Ejection increases the potential for additional injury from windshield and window glass and collisions with the pavement, other vehicles, and other exterior objects, thereby compounding injury severity and further reducing the chances of survival. In five accidents investigated by the Safety Board, six unrestrained children under 5 years old and one 5-year-old were ejected from the vehicle during collision impacts or overturn (Cases 7-11). All but one of the children ejected were fatally injured. An additional accident involving a child seated on a safety seat in which he was not restrained by a safety harness or shield resulted in ejection with fatal injury (Case 42).

The only child ejected who was not fatally injured suffered serious injury in a minor accident (Case 9) in which the only other occupant of the vehicle, an adult who also was unrestrained, remained in the vehicle and escaped without injury. The 3-year-old boy who was ejected sustained a concussion and facial and knee abrasions from contact with the vehicle interior, and a fractured elbow. The boy's collision with the pavement probably contributed to the severity of his head injury.

One of the accidents involving ejection (Case 11) was an extremely severe head-on collision with a tractor-semitrailer. Two children who were unrestrained in the rear seat of the case vehicle and one unrestrained adult in the front seat were ejected and fatally injured. The unrestrained driver was thrown into the rear seat and remained in the vehicle, but was fatally injured. While the proper use of child safety seats probably would have prevented ejection and might have enabled the two children to survive, data on the performance of child safety seats under such extremely severe impact forces are insufficient to support a finding as to the probability of the children's survival in this accident had they been properly restrained. In this case, the possibility of the children's survival, even with proper use of child safety seats, was compromised by the unrestrained driver being thrown into the rear seat.

In their testimony in the regional public hearings, doctors and law enforcement officers cited other accidents involving ejection of children with fatal or severe consequences. One mother's testimony described an accident in which her unrestrained 3-year-old son was ejected and killed, while her unrestrained 22-month-old daughter remained in the car and survived, although she was severely injured. (See appendix F.)

Noncrash Incidents — Unrestrained Children Killed or Injured During Swerves, Turns, and Sudden Stops

Case 12: About 2:30 p.m. on October 28, 1982, a mother, her two children, and their grandmother were departing a local convenience grocery store in Mt. Vernon, Kentucky, to return home. The grandmother was driving her 1973 Chevrolet station wagon, and the children's mother was seated in the right front. Her 4-month-old daughter was properly harnessed in a child safety seat in the center front, and her 4-year-old son was in the rear seat. As they drove away from the store, the boy was standing up, leaning over the front seatback and playing with his sister. Suddenly, as the station wagon was negotiating a slight left curve, the 4-year-old boy fell to the pavement through the right rear door when it opened for undetermined reasons. Before his grandmother could stop the station wagon, the boy had been run over and fatally injured by the right rear wheel. (NTSB Investigation No. MKC83HCR01)

Three investigations of noncrash incidents highlight one of the most tragic and least recognized kinds of accidents that can occur to unrestrained child passengers -- the kind that involves no crash or external impact but results in death or injury to an unrestrained child. Each noncrash incident investigated involved a child either falling from a moving vehicle or being propelled into the windshield in a sudden stop.

In Case 43, a 2-month-old infant fell to the roadway when the partially open right front door swung wide as his mother backed the car into the road in back of their house. The infant was run over by the right front wheel of the car and fatally injured. Because the infant had been seated in a child safety seat with the harness not fastened and the safety seat not secured to the vehicle, the infant was considered unrestrained.

Case 13 involved a driver who made a sudden stop to avoid collision with another vehicle that made an unexpected maneuver. Although he was traveling only 25 to 30 mph, the driver was powerless to protect his unrestrained 4-year-old son. The boy was thrown head-first into the windshield and sustained moderate head and facial injuries, although the vehicle was not involved in a collision and no other person was harmed. In each noncrash incident investigated, the proper use of either a child safety seat or a safety belt would have prevented the child's death or injury.

Pediatricians and surgeons testified in the public hearings that in their professional experiences, cases of unrestrained children injured in noncrash incidents are common. One doctor described the case of a 6-month-old infant riding in his mother's lap, who was fatally injured in a sudden stop when his head was crushed against the instrument panel by his mother's body. No one else was injured in the incident. Evidence suggests that at least one out of every four or five children injured while riding as passengers in motor vehicles is injured in a noncrash incident. Moreover, because nonfatal, noncrash incidents typically are not reported to or investigated by police, more than 20 percent of all injuries to child passengers may not be included in motor vehicle injury statistics. 15/

15/ Phyllis F. Agran, M.D., M.P.H., "Motor Vehicle Occupant Injuries in Noncrash Events," Pediatrics, Vol. 67, No. 6, American Academy of Pediatrics, June 1981.

HOUSEHOLD INFANT CARRIERS AND HOME BOOSTER CHAIRS UNSAFE FOR MOTOR VEHICLE USE

Case 18: About 8 a.m. September 7, 1982, a 1975 Chevrolet pickup truck driven by a father who was taking his 2-month-old and 3-year-old sons to the babysitter was traveling through an intersection in Appleton, Wisconsin, when it was struck on the left front side by a transit bus. The driver of the pickup truck and the 3-year-old boy, both unrestrained, sustained minor injuries. The infant was lying in a household infant carrier placed on the center of the pickup truck seat. The infant was not in his infant safety seat, which the family had borrowed from a Red Cross safety seat loan program, because his parents were leaving late for work and had not taken the time to transfer him from the household infant carrier to the infant safety seat. On impact, the infant and carrier were propelled into the instrument panel. The infant sustained fatal injuries including multiple skull fractures with brain damage. (NTSB Investigation No. MKC83HCR06)

Four accidents investigated involved the use of a household infant carrier or a home booster chair, devices which are not designed for motor vehicle crash protection and which are not safe for motor vehicle use.

In Cases 18 and 19, the carrier was placed on the front seat with both the carrier and the infant unrestrained. Case 18 resulted in an infant fatality under relatively minor to moderate impact forces in a side impact. In Case 19, a 23-day-old infant lying in a household infant carrier wedged between the front seatback and instrument panel sustained minor head and facial injuries in a minor frontal collision when the carrier was dislodged and the infant slipped out. (This was one of about six instances in which this infant was placed in the household infant carrier in order to be fed in the car. At other times, the infant traveled unrestrained.)

In two accidents, children riding in a household infant carrier or home booster chair were uninjured. One accident (Case 20) was a minor to moderate rear-end impact in which the carrier was reclined in a rear-facing position, the carrier's lap strap was fastened around the infant, and the vehicle's safety belt was secured around both the carrier and the baby. Two unrestrained adults received minor injuries. The infant carrier remained secured, and the infant remained in the carrier uninjured. Although the infant carrier in this accident bore a warning label stating, "Not for Use as a Car Seat," it was being used (in conjunction with a safety belt) for the purpose of protection. The family found it less expensive than a child safety seat and believed it would perform just as well. Following contact with a Safety Board accident investigator, the family involved obtained a child safety seat designed for motor vehicle crash protection.

Case 40 involved a small child riding in a home booster chair. A safety belt was routed through the sides of the booster chair and across the child's lap. The chair was being used (in conjunction with a safety belt) for the purpose of protection because the child was an "escape artist" who would not stay in a safety seat, according to his mother. The child, restrained by the safety belt, was uninjured in a moderate collision in which the vehicle overturned onto its roof and slid on its roof along the pavement before coming to rest.

In both cases in which the child was uninjured, the crash forces were not severe and the use of a safety belt around both the home infant carrier or home booster chair and the child provided some restraint and prevented injury under the circumstances of the accidents. However, even when used in conjunction with a safety belt, home products not designed to withstand crash forces possess a significant potential for collapse or structural failure, which can result in serious or fatal injury to the child riding in it.

THE USE AND CRASH PERFORMANCE OF CHILD SAFETY SEATS

The Safety Board investigated the use and crash performance of 34 child safety seats, including 16 different designs by 7 different manufacturers, in 31 accidents. These investigations showed clearly, and in some cases dramatically, that child safety seats can save lives and prevent or minimize injury to infants and small children in motor vehicle accidents. In the accidents investigated, safety seats which were used properly demonstrated excellent performance in crashes and, in many cases, safety seats provided protection in some crash circumstances even when they were misused. 16/ In some cases, however, misuse of the safety seat reduced or totally negated its protective function, and without proper restraint, the child was killed or injured.

The accidents investigated provided substantial evidence that the use of child safety seats can be effective in saving children's lives and in preventing or minimizing injuries in accidents. At the same time, the investigative findings underscore the importance of proper use of child safety seats and indicate a need for special efforts to combat what appears to be a significant misuse problem.

How Safety Seats Save Children's Lives and Prevent or Reduce Injuries

Case 21: About 8:10 p.m. on August 17, 1982, the driver of a 1982 Subaru occupied by a family group en route to a local restaurant at Shawnee, Oklahoma, lost control of the vehicle and crashed into the brick wall of a building at a speed of about 30 mph. (See figure 3.) It took rescue crews about 30 minutes to cut through the car and extricate the four unrestrained, seriously-injured adults. After the adults were removed, the rescuers discovered a 3-month-old baby contentedly playing in a child safety seat in the right front bucket seat of the car. The baby's father suffered brain contusions, extensive facial fractures and lacerations, and a crushed chest with all ribs fractured. The mother suffered a ruptured spleen, and both arms and one wrist were broken. One of the baby's uncles, a 21-year-old man who was studying to be a pianist, suffered two broken arms and a fractured vertebra which left him paralyzed from the shoulders down. The other uncle suffered a fractured skull, a compound fracture of one arm with nerve damage, and a dislocated ankle. The only injury to the baby was a small bruise. (NTSB Investigation No. MKC83HCR03)

16/ The safety seat was considered properly used if it was installed in the vehicle and adjusted exactly as the manufacturer's instructions specified and if the child was properly restrained within the safety seat according to the instructions. The safety seat was considered misused if any instruction for motor vehicle use was not followed, or was not followed exactly as specified, with regard to: the use of a tether strap (when required); the use of a vehicle safety belt to secure the safety seat to the vehicle; the use of a harness and/or protective shield, as required, to restrain the child; the orientation of the safety seat (forward- or rear-facing); or the upright or reclined adjustment of the safety seat.

Figure 3.—Thirty-mph impact with brick building on August 17, 1982, at Shawnee, Oklahoma.
(Photo by Tracy Farley, courtesy of the Shawnee News-Star, Shawnee, Oklahoma)

Case 22: About 4:45 p.m. on November 1, 1982, a 1969 Chevrolet Camaro sedan, occupied by a 21-year-old driver and her 3-week-old son, was traveling southbound on a two-lane road in Florida. It was raining lightly and the roadway was wet. The driver was negotiating an S-curve when an oncoming 1981 Chevrolet Z28Z sedan negotiating the curve northbound crossed the centerline at about 40 to 45 mph and collided head-on with the Camaro. The mother, who was unrestrained, sustained moderate injuries, including a fractured nose, shattered knee, head and facial cuts and bruises, and bruises on the chest, lower legs, and elbow. The 3-week-old infant, properly secured in a child safety seat in the right front seat of the Camaro, escaped without injury. This was the infant's first trip in the safety seat, which had been purchased 2 days before the accident. (NTSB Investigation No. NYC83HCR02)

In 24 accidents investigated, 25 child safety seats provided sufficient protection to prevent or minimize injuries to infants and small children. In the majority of cases, the safety seats provided excellent protection, and the children did not contact the vehicle interior and did not receive any impact injuries, although the crashes killed or injured other restrained or unrestrained passengers in the same vehicle.

Six safety seats were being used properly when the accident occurred, including four which demonstrated excellent performance in moderate to severe crashes and two which were involved in noncrash incidents. In 18 accidents, 19 safety seats which were misused provided sufficient protection to prevent or minimize injury under the specific accident circumstances and misuse conditions involved.

In the four crashes involving proper safety seat use, the consequences were substantially more severe for other passengers than for the children who were riding in safety seats. (See table I.) Other restrained passengers in the same vehicle received minor to moderate impact injuries, and unrestrained passengers received moderate to severe impact injuries. Of the four children who were properly protected by child safety seats, one received a minor impact injury (a bruise), and three did not receive any impact injury (although one received a moderate facial cut from being struck by broken window glass). If the children had not been properly protected by child safety seats, they probably would not have survived. The four crashes involved moderate impact forces, with the exception of Case 21, in which the crash forces in the 30-mph impact with a brick building were moderately severe (closely approximating the conditions of the 30-mph frontal crash test required by FMVSS 213). According to written testimony prepared for the regional public hearing in Dallas by the mother of the 3-month-old boy involved in the crash:

> A baby is absolutely not safe in its mother's arms. Anyone who saw how badly crushed and open my forearm was would realize full well that my baby would not have survived had I been holding him. 17/

Two cases in which safety seats were used properly were noncrash incidents in which the safety seats were not subjected to crash forces. However, the incidents illustrate the effectiveness of proper restraint in preventing noncrash injuries to children. In both cases, the children remained properly secured in their safety seats during the negotiation of a curve or turn, while in each case an unrestrained child fell from the vehicle and was struck by a wheel and fatally injured.

17/ Statement of Mrs. Barbara Moore (see appendix F).

Table I.—Crashes involving proper use of child safety seats.

CASE NO.	ACCIDENT TYPE	ACCIDENT SEVERITY	SAFETY SEAT			INJURIES	
			MAKE/MODEL	ORIENTATION	POSITION	CHILD	OTHER OCCUPANTS
21	FRONTAL	MODERATELY SEVERE	BOBBY-MAC CHAMPION	REAR-FACING	RIGHT FRONT	3-MONTH-OLD BOY MINOR (BRUISE)	4 UNRESTRAINED ADULTS: 2 SEVERE 2 SERIOUS
22	FRONTAL	MODERATE	GM INFANT LOVE SEAT	REAR-FACING	RIGHT FRONT	3-WEEK-OLD BOY NO INJURY	1 UNRESTRAINED ADULT: 1 MODERATE
23	LATERAL	MODERATE	STROLEE WEE CARE 597	FORWARD-FACING	LEFT REAR	2-YEAR-OLD BOY NO INJURY	1 RESTRAINED ADULT: 1 MINOR
24	LATERAL (NEAR SIDE)	MODERATE	GM CHILD LOVE SEAT	FORWARD-FACING	RIGHT FRONT	2-YEAR-OLD GIRL MODERATE INJURY (FROM FLYING GLASS ONLY)	1 UNRESTRAINED ADULT: 1 MODERATE

In 18 accidents (Cases 25 through 42) —including 9 accidents in which one or more other passengers in the same vehicle were killed or seriously injured — 19 safety seats which were misused still provided sufficient protection to prevent or minimize injury to 19 children. Fifteen children riding in safety seats that were misused received no impact injuries in the accidents. 18/ The other four children received minor or moderate injury from side intrusion, or in one case, from contact with the side of the safety seat (resulting in a facial abrasion). In Case 42, the child's moderate injury due to side intrusion probably would not have occurred if the safety seat had been used properly; nevertheless, the safety seat provided sufficient protection to prevent potentially far more serious, and possibly fatal, injury.

Three accidents in which safety seats provided protection, although the safety seats were misused, were remarkable. Case 26 was a severe frontal collision involving crash forces approximately equivalent to a frontal collision into a concrete wall at 40 to 45 mph. The driver of the car, restrained by a lap/shoulder safety belt, was severely injured. An 8-month-old boy in a rear-facing child safety seat in the right front seat received no visible injury, although the family reported that the infant "acted like he was sore" for about a week after the accident. Although the safety seat should have been installed facing forward according to the manufacturer's instructions, it probably prevented fatal injury to the infant in a crash that was substantially more severe than the crash test required by FMVSS 213.

Two accidents involved a sharp contrast between the consequences to a restrained child and an unrestrained child in the same vehicle. In Case 30, a 15-month-old boy riding in a child safety seat in the center rear seating position was uninjured in a head-on collision which resulted in serious injury to an unrestrained 3-year-old boy in the center front seating position, who was thrown into the instrument panel. The safety seat, which was misused, had been used by the 3-year-old boy until the younger child was born, and then was used exclusively by the younger child.

Case 27 involved a car that was sideswiped by a motorcycle. Two children, both about 2 years old, were riding in the rear seat of the car. One child was riding in a child safety seat, the required tether strap for which was not being used, and the other child was unrestrained. Their mothers were riding in the front seat, unrestrained. One mother was uninjured, and the other received a cut on her arm. The unrestrained child, seated on the side of impact, was thrown sideward, then into the rear window, and was fatally injured, probably from contact with the vehicle interior or the motorcycle handlebar. The child riding in the safety seat was not injured.

Misuse of Safety Seats—A Significant Problem

Misuse of safety seats was found to be widespread in the accidents investigated. Only 6 of the 34 child safety seats in which children were riding when the accidents occurred were being used properly. The remaining 28 safety seats involved in the accidents were being misused. Although the accidents investigated were not selected to provide a statistically representative sample, the widespread incidence of safety seat misuse with respect to the 34 safety seats involved in the accidents investigated is

18/ Four children received nonimpact injuries: two received minor and moderate injuries, respectively, from flying glass; one received moderate injury from being struck by an unrestrained passenger; and one received minor injury from biting her tongue.

generally consistent with the extensive incidence of misuse identified by Physicians for Automotive Safety and by the NHTSA in observational surveys of child safety seats in normal everyday use. 19/

In the accidents involving the 28 safety seats that were misused, the misuse conditions, the accident circumstances, and the impact severity varied. (See table II.) As described above, 19 safety seats provided sufficient protection under certain misuse conditions to prevent or minimize injury under the circumstances of the accidents in which they were involved. However, the remaining nine safety seats that were misused did not provide sufficient protection to prevent fatality or minimize injury. The accidents resulted in five children being killed and three injured in safety seats that were misused. In six cases, proper use of the safety seat probably would have prevented the death or prevented or minimized the injury to the child involved.

The safety seats that were misused in the accidents represent more than one-half of the current safety seat manufacturers or brand names and nearly one-half of the models currently on the market (excluding booster seats). The misuse conditions identified in the accidents were not limited to certain manufacturers or models, but extended to at least one model of every manufacturer or brand name represented and to 15 of the 17 safety seat models involved in this study.

For the 28 safety seats that were misused, 49 usage errors were detected. The misuse situations that were found covered a broad range of usage errors, and in 16 cases, multiple usage errors were found. Multiple misuse situations usually involved two or three separate usage errors, although the extreme case involved five errors. Any one of the individual usage errors identified could potentially result in degradation of the protective function of the safety seat in an accident. However, in the accidents investigated, the actual effect of a particular usage error varied depending on the specific circumstances of the accident.

The most common usage error in the accidents investigated was the nonuse or misuse of a tether strap when its use was required. In 12 cases, the required tether strap was not used, and in 2 cases, the tether strap was misused (tied to a vehicle seatback or door latch). Surveys by Physicians for Automotive Safety and by the NHTSA have found that the incidence of nonuse of a required tether is between 70 and 80 percent, and with misuse (incorrect tether attachment) included, this figure rises to between 80 and 90 percent. 20/

A major obstacle to the proper use of tether straps is the difficulty of installing a tether anchor in most vehicles. Installation requires the user to determine the proper anchorage location and drill a hole or have the anchor installed by an automobile dealer or garage. To facilitate the proper use of the tether straps, on December 11, 1980, the NHTSA issued a rulemaking notice which proposed that FMVSS 210, Seat Belt Assembly Anchorages, be amended to require that manufacturers of vehicles having a Gross Vehicle Weight Rating of 10,000 pounds or less install tether anchorages or predrilled anchorage

19/ Annemarie Shelness and Jean Jewett, Physicians for Automotive Safety, "Observed Misuse of Child Safety Seats," a paper prepared for the Society of Automotive Engineers Child Injury and Restraint Conference, San Diego, California, October 17-18, 1983 (to be published by the Society of Automotive Engineers in Proceedings of 27th Stapp Car Crash Conference).
20/ Ibid.

Table II.--Misuse conditions identified for 28 child safety seats in 27 accidents.

	Accident Case Number	Child Safety Seat	Tether Not Used	Tether Anchored Improperly	Safety Belt Not Fastened	Safety Belt Not Snug	Safety Belt Routing Error	Safety Belt for 2 Seats	Substitute Attachment Used	Harness Not Fastened	Harness Not Snug	Harness Incomplete	Harness Routing Improper	Straps Severely Twisted	Forward-Facing With Infant	Rear-Facing With Toddler	Reclined in Forward Mode	Recline Position Incorrect	Injury to Child
Protection Adequate	25	Strolee Wee Care No. 597													X				No Injury
	26	Cosco-Peterson Model 81 A														X			Minor (Appeared Sore)
	27	Bobby-Mac Super	X																Minor (Flying Glass Only)
	28	Peterson Safety Shell	X																No Injury
	29	Strolee Wee Care No. 599		X															No Injury
	30	Bobby-Mac Deluxe			X							X							No Injury
	31	Bobby-Mac Super	X								X								No Injury
	32	Strolee Wee Care No. 597		X							X		X		X		X		Moderate (Occupant Contact Only)
	33	Strolee Wee Care No. 598	X																Minor (Fron Intrusion Only)
	34	Strolee Wee Care No. 598	X																Moderate (Flying Glass Only)
	35	Strolee Wee Care No. 599	X																No Injury
	36	Strolee Wee Care No. 597					X			X									No Injury
	37	Strolee Wee Care No. 597								X									No Injury
	38	Strolee Wee Care No. 597	X						X				X						Minor (Bit Tongue Only)
	39	Strolee Wee Care No. 599	X							X									No Injury
	40	Century Model 4448						X											No Injury
	40	GM Infant Love Seat						X				X							No Injury
	41	Strolee Wee Care No. 595	X				X							X					Minor (Side Of Seat)
Protection Inadequate	42	Bobby-Mac Champion											X						Moderate
	43	GM Infant Safety Carrier			X					X									Fatal
	44	Strolee Wee Care No. 597	X							X									Fatal (Ejection)
	45	Questor Kantwet One-Step	X								X								Fatal
	46	Cosco-Peterson Model 81A				X													Fatal
	47	Century Model 300					X								X				Fatal
	48	Questor Dyn-O-Mite				X												X	Fatal (Occupant Contact)
	49	Bobby-Mac Two-in-One								X									Moderate
	50	Bobby-Mac Deluxe			X							X							Minor
	51	Strolee Wee Care No. 599	X			X				X									Minor

holes at all rearmost seating locations. 21/ Although the proposed effective date of the requirements was September 1, 1981, the NHTSA still had not issued a final rule as of September 7, 1983.

Since the rulemaking notice was issued, most child safety seat manufacturers have changed their product designs to eliminate the need for a tether strap and, as of September 1983, only two conventional safety seat models requiring use of a tether strap to meet the FMVSS 213 30-mph crash test requirements were still being produced. However, the use of a tether strap increases the stability and safety of any forward-facing safety seat, and some manufacturers offer optional tether straps which may be purchased separately to provide greater protection. In addition, virtually all booster seats require the use of a tether strap to secure the booster seat's safety harness when it is used in a rear vehicle seat. Because the lack of tether anchorages in vehicles continues to be a major impediment to the proper use of required tether straps and also obstructs the optional use of tether straps by parents who want to provide their children added protection, the NHTSA should expedite the issuance of a final rule requiring that newly-manufactured vehicles be equipped with tether anchorages.

The Safety Board is concerned that child safety seats which rely on the use of a tether strap to demonstrate adequate crash performance are almost universally used without it. The provision of tether anchorages in vehicles can be expected to substantially reduce tether strap nonuse and misuse in the future, but some level of misuse is likely to continue even when such anchorages are available. In the accidents investigated, none of the injuries to child passengers could be attributed exclusively to nonuse or misuse of a required tether strap. The Safety Board believes that there is a need for the NHTSA to develop additional data on the injury consequences of the nonuse and misuse of required tether straps with conventional safety seats in accidents to determine whether or not the reliance on the use of a tether strap to meet the 30-mph crash test performance requirements should continue to be permitted. Also there is a need to examine the incidence and accident consequences of nonuse and misuse of tether straps with booster seats to determine whether the safety advantages of properly used booster seats outweigh the injury potential associated with the nonuse or misuse of the booster seat tether.

Failure to fasten the safety harness around the child and failure to secure the safety seat to the vehicle had the most critical effect in degrading safety seat performance in the accidents investigated. In three of the nine cases in which a safety seat did not provide protection under misuse conditions, it was evident that the safety seat was being used only as a place for the child to sit, not for protection. In Cases 43, 49, and 50, either the safety harness was not fastened around the child (and there was no armrest or safety shield in front of the child) or the safety seat was not secured by a safety belt, or both.

In two other cases involving fatality or injury, the safety harness was not fastened, but the safety seat's nonprotective armrest was in front of the child. Because the armrest might have been misinterpreted as providing some protection, it was not clear whether or not the safety seat was being used for protection in Cases 44 and 51. However, nonuse of the safety harness in both cases had a critical effect in negating safety seat performance. Because of the potential for misuse of safety seats with nonprotective armrests and the potentially critical effect of misuse in accidents, the extent of misuse of these kinds of safety seats and the adequacy of the 20-mph misuse test specified in FMVSS 213 need to be further reviewed by the NHTSA.

21/ Notice of Proposed Rulemaking, Docket No. 80-18, Notice 1, "Federal Motor Vehicle Safety Standards; Seat Belt Assembly Anchorages; Anchorages for Child Restraint Systems," Federal Register, Vol. 45, No. 240, pp. 81625 - 81632, December 11, 1980.

In the other four cases of misuse, the safety seat was considered used for the purpose of protection because both the safety seat and the child were restrained. In two of the four cases, misuse errors degraded the performance of the safety seat. In Case 45, a 6-month-old infant was ejected from a forward-facing convertible safety seat between the safety harness shoulder straps, which were not adjusted snugly, and he was fatally injured by contact with the vehicle interior. The accident involved substantial rotational forces as the vehicle was spun around after being struck in the side. If the shoulder straps had been adjusted snugly, or if the shoulder straps had been connected across the chest to prevent displacement, the infant probably would have remained secured in the safety seat.

Some safety seats are equipped with a small "bib strap" or plastic harness clip which can be used to hold the shoulder straps in position to prevent a child from slipping his shoulders out of the safety harness during normal use. The circumstances of this accident suggest that the use of a bib strap or harness clip may offer potential safety benefits in accidents as a means of holding safety harness shoulder straps in position to reduce the possibility of the child being ejected between the straps. Maintaining the fit of the shoulder straps may be especially beneficial with infants, whose small size and narrow shoulders make proper positioning and adjustment of the shoulder straps difficult, and may provide some compensation when the safety harness is not fastened snugly.

Case 47 was a near-side lateral impact in which the forward-facing safety seat and the child rotated forward, resulting in fatal injury from contact with intruding sheet metal. The vehicle safety belt was routed improperly through the safety seat frame, and the correct orientation of the safety seat with this infant should have been rear-facing. If the safety seat had been used properly, it probably would have provided sufficient restraint to prevent or minimize contact due to intrusion.

In one accident, because an infant and safety seat were crushed by an unrestrained adult, even proper use of the safety seat probably would not have prevented the fatal injury. Case 48 involved a 3-day-old infant who was being transported home from the hospital. The infant was in a rear-facing infant safety seat in the center front position when the car was struck head-on in the left front by another vehicle. The safety seat was crushed into the steering column by the weight and acceleration of the infant's mother, who was unrestrained in the right front. Although the safety seat was misused, it probably would have provided sufficient protection if other passengers had been restrained.

In another accident (Case 46), the effect of improper use of the child safety seat could not be determined. The accident was a moderately severe head-on collision into a utility pole. A convertible safety seat was secured in the right rear seating position. When used with a child weighing more than 17 pounds, the seat was designed to face forward, with only a protective shield for restraint. The child in this case was a 15-month-old boy who weighed 21 pounds. He was correctly facing forward. However, when a witness removed him after the accident, his arms were below the shield, not above it. The safety seat could not be secured snugly to the vehicle because the vehicle safety belt utilized an emergency locking retractor which "locks up" only when its sensor is activated by impact forces. The child's mother, unrestrained in the driver's seat, survived with serious injuries. The crash caused the child's skull to dislocate from the spine, which caused the spinal cord to be severed. 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 an ironing board that was being carried in the car, or with the shield of the safety seat. FMVSS 213 does not contain neck load

criteria or testing requirements, and the performance of child safety seats in preventing serious neck injuries is largely unknown. Some one-time only, experimental crash tests have been conducted by the University of Michigan Transportation Research Institute, under a NHTSA contract, to attempt to roughly measure both relative neck load and relative abdominal load levels in crash tests of several different types of safety seats. 22/ Although these tests were developmental only, they suggest that there may be differences in both load levels in crash tests of different safety seats. This area should be further explored by the NHTSA through research and crash testing to determine the feasibility and desirability of developing neck and abdominal load criteria, anthropomorphic dummies, and testing procedures for child restraint systems.

Combating the Misuse Problem

The widespread incidence of safety seat misuse warrants urgent attention because, as more child passenger protection laws go into effect and safety seat use increases, the number of safety seats misused can also be expected to increase. Fortunately, safety seats are "forgiving" in the sense that, in many accidents, a safety seat will still provide protection against death or injury under some misuse conditions, and, in some cases, will provide partial protection although some injury may occur. However, unless effective ways are found to combat the misuse problem, accidents involving needless fatalities and injuries to children riding in safety seats that are misused can be expected to increase. To combat and reduce the misuse problem, improvements are needed in the public education programs, the safety seat loan programs, instructions given by safety seat loan organizations, police training, traffic accident data systems, and safety seat design, instructions, and labeling.

Improving Public Education Programs.—Public education programs typically include general information that safety seats must be used properly. Nonetheless, in some accidents involving misuse, the user failed to follow the manufacturer's instructions even after exposure to public education on the subject. There appears to be a need to substantially increase emphasis on the misuse problem in such programs and to include more detailed and specific information about how various kinds of usage errors can degrade safety seat performance in crashes.

Improving Safety Seat Loan Programs.--Safety seat loan programs typically include both general public education information and specific instructions (often including films and a demonstration) for borrowers on using the safety seat properly. These programs could increase emphasis on the misuse problem in both respects, and could provide borrowers with detailed information about the potential effects of misusing the particular safety seat being borrowed.

Improving Police Training and Traffic Accident Data Systems.--For both law enforcement and accident investigation purposes, police need sufficient general familiarity with safety seat use to recognize the most common or obvious usage errors and to use a manufacturer's instructions to determine whether or not a safety seat involved in a crash was used properly. The incorporation of safety seat use/misuse data in accident investigation reports and the statewide traffic accident data compiled from investigative reports also is needed to identify the kinds of problems that are occurring.

22/ Kathleen Weber and John Melvin, "Innovative Solutions to Child Passenger Protection Problems," presentation at the National Highway Traffic Safety Administration, August 16, 1983.

In the course of normal law enforcement activities, law enforcement officers have significant opportunities to identify usage errors, to provide the user information as to how misuse errors can degrade safety seat performance, and to encourage corrective action. Data on safety seat use and misuse in actual crashes, which could be collected in police traffic accident reports and could be included in a State's traffic accident data system, are needed to identify the kinds of problems that are occurring, as a basis for adjusting child passenger safety programs to combat those problems more effectively. Some jurisdictions have conducted training for police on safety seat use, and an increasing number of jurisdictions have tried to improve the occupant restraint data collected in accident investigations and to ensure that limited child safety seat data are collected and reported to the traffic accident data system. Generally, however, these kinds of activities have been limited. In virtually all Safety Board-investigated accidents which involved safety seat misuse, the misuse was not identified in the police report of the accident.

Another reason for police training to identify safety seat misuse is that, in some cases, news reports relying on police-reported information will report that a child was killed in a safety seat in an accident, without reporting, for example, that the safety harness was not fastened around the child and that the child was, in effect, unrestrained. One accident investigated by the Safety Board in North Carolina (Case 3) was originally reported as involving an infant killed in a safety seat. The investigation established that the safety seat was being carried loose and unused in the rear of the car when the accident occurred. The prompt identification of safety seat misuse (or nonuse) in accidents can help to avoid unintentionally misleading media reporting, which may undermine the public education efforts undertaken by State and local jurisdictions.

Improving Safety Seat Design, Instructions, and Labeling.—The misuse problems identified in the accidents investigated by the Safety Board indicate that it is absolutely essential that safety seat design and instructions for use of safety seats be as simple, clear, and precise as possible. However, trained professional highway accident investigators familiar with child safety seats and their use found that instructions accompanying many safety seats involved in the accidents were complex, imprecise, confusing, and not clearly illustrated. This was especially true for convertible models where the thresholds specified for conversion from forward-facing to rear-facing orientation and for changes between infant and toddler harness routing were variously specified in terms of when a child can sit upright by himself, a height or height range, a weight or weight range, or a sitting height (which requires a special measurement exclusively for this purpose). In some cases, two different standards were used, and, in one case, the instructions specified the use of a cushion under the child "if the child sits too low in relation to the shield" without any guidance for determining how low is "too low."

In one study 23/ of factors affecting the acceptance and use of child safety seats, "observations made during the study concerned the role of the marketplace and Federal regulation in adversely affecting the design of child restraints. Marketing reactions to the preferences of ill-informed consumers have sometimes encouraged cumbersome and uncomfortable systems with "something in front," to the exclusion of innovations in the form of harness-only and other systems." The study concluded that child safety seat designers "need to concentrate on obvious, simple systems that accommodate real children."

23/ Kathleen Weber and Nancy Polchik Allen, "Child Restraint Systems: Factors Affecting Their Acceptance and Use," The HSRI Research Review, University of Michigan Highway Safety Research Institute, Ann Arbor, May-June 1982, Vol. 12, No. 6.

Some recent revisions of instructions have resulted in improvements. For example, Questor Juvenile Furniture Company made significant improvements in instructions issued with one of its safety seats, including improvements which were suggested by the findings of one of the Safety Board's first accident investigations for the child passenger protection study (Case 43). The instructions were revised with the assistance of a child passenger safety consultant engaged for that purpose. Some manufacturers also have begun to use labels on the safety seat to identify correct safety belt routing locations. These kinds of initiatives can help to make the correct locations readily identifiable, even when the detailed usage instructions are not available or are not used.

FMVSS 213 requires that child safety seats have an instruction label attached to the safety seat itself, and that a more detailed instruction booklet be furnished with the safety seat. However, in the accidents investigated, labels of some of the safety seats had been torn off or were missing, wrinkled and difficult to read, or abraded. In some cases involving misuse, including cases involving children who were killed or injured, the family did not have any instructions because they were not included with the seat when it was purchased second-hand at a yard or garage sale or when it was handed down by a friend or relative. Misuse appeared to be a prevalent problem in these cases, and some of the seats were incomplete, with part of the harness missing, when they were acquired. The family did not have the detailed usage instructions and did not realize that the safety seat was not complete.

SAFETY BELT USE BY SMALL CHILDREN

Case 52: About 11:45 a.m. on November 25, 1982, a 1979 Ford sedan occupied by a 17-year-old driver and his 18-month-old niece was traveling on a 2-lane U.S. highway near Cynthiana, Kentucky, when the Ford crossed the centerline in a curve and collided head-on with a 1981 Oldsmobile sedan. The unrestrained 17-year-old driver of the Ford sustained fatal head, neck, and chest injuries. The 18-month-old girl, secured by an adult lap safety belt in the center front seating position, sustained minor injuries which included facial abrasions and a laceration of the upper lip. (NTSB Investigation No. ATL83HCR01)

Emphasis on the need for special protection for infants and small children may have led to an incorrect perception that safety belts do more harm than good to children in crashes. 24/ At a time when more children are riding in safety seats than ever before, nearly all infants and small children who are not riding in safety seats are being transported completely unrestrained -- without even the use of available safety belts -- and the use of safety belts by older children is rare. 25/ There appears to be a need to develop a better public understanding of the benefits and limitations of safety belt use by children both to encourage greater use of child safety seats and other child restraint systems for superior protection, and to reduce the incidence of children being transported unrestrained when safety belts are available.

24/ Physicians for Automotive Safety, "Safety Belts OK for Small Children," PAS News, Rye, New York, Fall 1982 - Winter 1982-83.
25/ James L. Nichols, Ph.D., Effectiveness and Efficiency of Safety Belt Usage Programs; the Safety Potential of Safety Belts, Child Restraints, and Programs to Promote Their Use, National Highway Traffic Safety Administration, U.S. Department of Transportation, January 1982.

Testimony at the public hearings and other research and accident data from several countries 26/ indicate that children of all ages (including infants) generally are safer in crashes if they are wearing safety belts, especially in the rear seat, than if they are unrestrained. Pediatricians and surgeons testified that adult safety belts can prevent the ejection of children, which would be likely to result in fatal or severe injury, and can prevent or reduce the occurrence of fatal and serious head injuries, irreparable brain damage, and other serious injuries which may be suffered by unrestrained children who are thrown against the vehicle interior or other passengers in a crash. Safety belt use also can be expected to be virtually 100 percent effective in preventing child fatalities and injuries in noncrash incidents. 27/

The limitations of safety belt use by children are known in a general sense, but have not been fully crash tested in the laboratory, or fully documented in actual crashes (largely because safety belt use by children is rare). Several decades of medical research beginning in the 1920's identified unique anatomical characteristics of infants and small children. In the 1950's and 1960's researchers examining the question of effective crash protection for children emphasized that infant and child anatomy differs from that of adults in a number of ways which make the use of adult safety belts less effective in protecting infants and children than adults. 28/ The increasing recognition of the need for more effective protection designed specifically for children led to the development of child safety seats and other child restraint systems. The medical evidence that is available and limited data on crash injuries to safety-belted children indicate that while safety belts prevent ejection and prevent or reduce impact injuries to children from contact with interior vehicle structures, safety belt-induced injuries can occur. The risk of these kinds of injuries to children appears to be significantly greater for infants, and generally appears to decrease with age. 29/ However, it is important to stress that this risk is less than the risk of transporting children unrestrained.

Parents and others transporting infants and small children need to be encouraged to at least use safety belts to protect child passengers who otherwise would be transported unrestrained. At the same time, crash test studies and further accident research are needed to provide the public, legislators, and others with better information about the benefits and limitations of safety belt use by children at various ages so that informed choices can be made about child passenger protection. Data currently available are inadequate to answer questions about the relative degree of safety provided by a safety belt to a child at various ages, what the limitations are, and the kinds of results that can be expected in crashes. There is a need especially for a greater understanding of the interaction of safety belts with the body regions where they can be expected to localize

26/ Allan F. Williams, Insurance Institute for Highway Safety, "Restraint Use Legislation: Its Prospects for Increasing the Protection of Children in Cars," Accident Analysis and Prevention, Vol. II, Pergammon Press. Ltd., 1979; Allan F. Williams and P. Zador, "Injuries to Children in Automobiles in Relation to Seating Location and Restraint Use," Accident Analysis and Prevention, Vol. 9, 1977; and John W. Melvin, Richard L. Stalnaker and Dinesh Mohan, "Protection of Child Occupants in Automobile Crashes," Proceedings of the 22nd Stapp Car Crash Conference, Society of Automotive Engineers, Warrendale, Pennsylvania, 1978.

27/ Phyllis Agran, M.D., M.P.H., Op. Cit.

28/ A.R. Burdi, D.F. Huelke, R. G. Synder, and G.H. Lowrey, "Infants and Children in the Adult World of Automotive Safety Design: Pediatric and Anatomical Considerations For Design of Child Restraints," Journal of Biomechanics, Vol. 2, Pergammon Press, 1969. (Presented at the American Society of Mechanical Engineers Third Biomechanical and Human Factors Division Conference at the University of Michigan, Ann Arbor, June 12-13, 1969.)

29/ Ibid.

crash forces — the pelvis, abdomen, spine, chest, and neck — at different stages of child anatomical development.

Proper child passenger protection for older children also remains a problem. Motor vehicle accidents are the leading cause of death for children at all ages after the early weeks of life. In 1982, nearly 3,500 children ranging from age 5 to age 17 were killed in traffic accidents in the United States. In passenger cars and trucks only, during the last 5 years nearly 18,500 child passengers from age 5 through age 17 were killed in traffic accidents. (See appendix H.) Although substantial progress is being made in improving the safety of child passengers under age 5, little or no progress has been made in the protection of children age 5 and older. Currently, virtually none of the 41 child passenger protection laws are designed to foster the transition of children from safety seat use to safety belt use. A notable exception is the State of New York, which in 1983 enacted legislation which, in each of the next 4 years, gradually will extend the age requirements for mandatory safety seat or safety belt use until children through the age of 9 years will be covered effective April 1, 1987.

Moreover, there is no evidence that use of child safety seats leads to safety belt use later, after a child outgrows conventional safety seats. In the accidents investigated by the Safety Board, 14 child passengers ranging from age 5 to age 17 were unrestrained, including at least two who had traveled in child safety seats until they had outgrown them. Ten of the older children were injured, two fatally. In two other accidents, two children who outgrew their safety seats at age 3 or 4 also were unrestrained when the accident occurred, and both children were killed. Children, beginning when they are too large to use conventional safety seats, need to be protected by either safety belts or booster seats designed for motor vehicle crash protection.

There is a potential for misuse of both booster seats and safety belts. Virtually all booster seats require the use of a tether strap and safety harness unless the seat is used in conjunction with a lap/shoulder safety belt. Considering the results of surveys indicating that failure to install and use a tether strap with conventional safety seats which require them is a common problem, similar problems may be encountered with the use of booster seats. Crash test results for a booster seat used with a lap belt only, without the required shoulder harness or tether strap, suggest that greater injury can occur in a crash than would occur to a child using a lap belt only, and there may be a greater potential for head injury. 30/

While concern about potential neck injuries to small children using an adult shoulder belt passing across the neck are considered by some researchers to be generally unfounded, 31/ one study of children in crashes found that adult safety belts did not provide adequate protection to children when the safety belt was fastened loosely. 32/ Crash tests have identified significant potential for serious injury when a single lap safety belt is fastened around two children. In the tests, the bodies of the dummies collided with each other. 33/

30/ Kathleen Weber and John Melvin, University of Michigan Transportation Research Institute, "Dynamic Testing of Innovative Solutions to Child Protection Problems," presentation at the National Highway Traffic Safety Administration, Washington, D.C., August 16, 1983.

31/ A. F. Williams and P. Zador, Op. Cit.

32/ B. A. Vazey, Child Restraint Field Study, Traffic Accident Research Unit, Department of Motor Transport, New South Wales, Australia, November 1977.

33/ Kathleen Weber, University of Michigan Transportation Research Institute, presentation at Lifesavers Conference sponsored by the National Safety Council and the National Highway Traffic Safety Administration, U.S. Department of Transportation, Denver, Colorado, April 6, 1983.

In one accident investigated by the Safety Board (Case 53), a 3-year-old girl was sharing a single lap/shoulder safety belt with an adult in the right front seat. The child also was out of position on impact, with her head and shoulders lying across the adult's lap. The child sustained moderate head and facial injuries, including a concussion, contusions and abrasions, from striking the unpadded area of the lower right instrument panel. The adult passenger also received moderate injuries.

Another accident investigated by the Safety Board (Case 41) involved a lateral right side impact to the vehicle with secondary impact in the right front. A 4-year-old girl was restrained by a lap-type safety belt in the left rear, next to a 2-year-old boy seated in a forward-facing convertible child safety seat in the right rear. The 4-year-old girl weighed 32 pounds and was 38 inches tall. On impact, her upper body was propelled toward the right, and her head contacted the tubular steel frame of the safety seat, causing fatal injury. The 2-year-old boy in the safety seat sustained minor facial abrasions from contact with the side of the safety seat. The unrestrained driver sustained severe injuries. In this accident, the 4-year-old girl probably would have survived if she had been properly protected by a child safety seat, which would have restrained the movement of her upper torso and head and probably would have prevented any contact with the safety seat in the right rear. However, the accident indicated that further improvements may be needed in child safety seats through additional padding or other means to minimize the injury potential from an unrestrained or lap-restrained occupant contacting a safety seat installed in the vehicle.

THE ECONOMIC COSTS OF CHILD PASSENGER DEATHS AND INJURIES

In addition to the tragic human costs of crash consequences to unrestrained children and their families in terms of fatalities, pain and suffering, physical and mental disabilities, psychological trauma, and the loss of human potential, significant economic costs are paid not just by the families involved, but by virtually all Americans. The total bill for these costs (and the share paid by each citizen) is not well documented because there is no system for collecting these cost data on any broad scale. However, there are indications that the costs are considerable. Moreover, the expenses are paid, directly or indirectly, by every State and Federal taxpayer; everyone who pays premiums for automobile, health, or life insurance; and everyone who pays a hospital bill.

Testimony presented at the Safety Board's public hearings included some indications of the kinds of costs that can be involved when a child is killed or injured in a motor vehicle accident. Doctors and other health professionals from several parts of the country testified that the cost of a single emergency room visit for a child with very minor injuries who is treated and released immediately typically would be about $50 (less than the cost of most safety seats), or up to about $200 if a few x-rays or routine tests are necessary. For minor injuries requiring hospitalization, the cost would run several hundred dollars for each day in the hospital, with additional costs for tests, x-rays, medications, and followup examinations after discharge.

One review 34/ examined the cases of 12 children between 12 months old and 4 years old who were injured in motor vehicle accidents and treated at St. Louis Children's Hospital in Missouri during one 6-month period. The average hospital stay was 2 weeks, and the costs incurred during their hospitalization alone ranged from $936 to $26,839,

34/ Greg Echele, Director of Community Services Development, St. Louis Children's Hospital, "Case Examples: Cases Treated at St. Louis Children's Hospital Who Were Involved in Automobile Accidents and Survived," unpublished summary.

with an average cost of $6,226. It was estimated that the medical costs for 20 percent of the children were paid by Medicaid funds from Missouri and Federal tax dollars.

In a typical example of a seriously injured child with a broken neck, witnesses testified that the injury would require approximately 21 days in an acute care hospital at a cost of about $600 per day, and an additional 4 months care in a rehabilitation hospital at a cost of approximately $78,000, for a total cost of more than $90,000 (not counting any additional costs which might be expected following hospitalization).

As an indication of the kinds of costs that can be incurred for treatment of children severely injured and disabled in auto accidents, one witness cited an actual case of a patient treated at the Rehabilitation Institute of Chicago and Northwestern Children's Memorial Hospital, which together constitute the largest of the 17 spinal cord injury treatment centers in the United States. 35/ The patient, an 18-day-old girl, was injured in a low-speed collision while taking her second car ride with her grandparents. She was cradled in the arms of her grandmother and on impact was crushed by her grandmother's body, resulting in a brain stem contusion. Three years after the accident, the child was still believed to be cortically blind, and she had not been able to ingest food or breathe for herself.

From the time of her injury to her first birthday, the baby was kept alive by life support systems in the intensive care unit of Children's Memorial Hospital. When she was discharged, the hospital costs were $450,000. At that time she was brought home, where she receives continuous nursing care and must be on a ventilator most of the day.

Before she was 3 years old, the child's care had cost $700,000. Her parents raised more than $15,000 of that amount and their insurance company paid the rest. At an annual cost of more than $100,000 for the child's continuing medical care and rehabilitation, the $1 million limit on the insurance policy was expected to be reached before the child's sixth birthday.

Although this is an extreme example, it is not an isolated case. Another medical witness cited the case of a child who has now been hospitalized for nearly 10 years as a result of a spinal cord injury suffered in a motor vehicle accident, and whose care has cost more than $1 million. 36/ These kinds of cases, and many others involving medical costs of hundreds of thousands of dollars, occur annually.

Besides the economic costs of injuries to children in crashes and noncrash incidents, other evidence suggests that substantial additional costs result from accidents caused by unrestrained children. One study of a majority of the reported accidents which occurred

35/ Testimony of Ms. Mary Beth Berkoff, Director of Accident Prevention, Rehabilitation Institute of Chicago, before the National Transportation Safety Board, Public Hearing on Child Motor Vehicle Passenger Safety, St. Louis, Missouri, March 24, 1983.
36/ Testimony of William A. Anderson, M.D., Director of Emergency Services, The Children's Mercy Hospital, Kansas City, Missouri, before the National Transportation Safety Board, Public Hearing on Child Motor Vehicle Passenger Safety, St. Louis, Missouri, March 24, 1983.

in North Carolina during a 5-year period identified 748 accidents caused by unrestrained children. 37/ The accidents occurred when the children either interfered physically with the driver or the vehicle controls, or distracted the driver by falling onto the floor or by moving around the car, etc. Besides the occupants of the vehicles in which the unrestrained children were riding, the accidents involved 562 other persons (other motorists, their passengers, bicyclists, or pedestrians) and resulted in 1 fatality, 572 injuries, and costs of at least $4.1 million. The study found that all the accidents could have been prevented if the children had been properly restrained. In 309 other accidents which resulted in costs of $1.5 million, the information about the accidents was insufficient to determine whether or not the accidents were preventable.

CHILD PASSENGER PROTECTION LAWS—BENEFITS, LIMITATIONS, AND LOOPHOLES

The first child passenger protection law in the United States was enacted in Tennessee in 1977 as the result of a campaign led by pediatricians. Effective January 1, 1978, the law required that children through age 3 be properly protected by a child safety seat when transported by the child's resident parent or legal guardian in a vehicle owned by the parent or legal guardian. The law established a fine of $2 to $10 for violation. The Tennessee law also included an amendment which permitted a child to be held in the arms of an older passenger in lieu of being protected by a child safety seat. The amendment was known as the "Babes in Arms Amendment," but later became known as the "Child Crusher Amendment" after some 13 infants and small children were killed in accidents in Tennessee while riding in the arms of other passengers. The amendment was repealed in 1981. 38/

After enactment of the law, a 3-year public information and education program was begun with funding from the Governor's Office of Highway Safety and the NHTSA. The purpose of the program was to inform the public about the requirements of the law and to provide public education through a campaign which included brochures, billboards, posters, public service announcements, and news media reporting. A child safety program was conducted by the Tennessee Department of Public Health with the goal of establishing safety seat loan programs throughout the State in all 95 county health departments.

Initially, oral warnings were given to violators, then law enforcement officers began to issue citations; aggressive enforcement did not actually begin until September 1979. The Tennessee Highway Patrol in the Department of Safety also developed a positive enforcement policy under which all 800 Highway Patrol cruisers were equipped with child safety seats for troopers to loan to violators on-the-spot. The seats were to be returned at the time of the court appearance, and if the violator could show at that time that a safety seat had been acquired, the law enforcement agency would ask the court to waive the fine and court costs. Although thousands of citations were issued, virtually all

37/ William L. Hall and Forrest M. Council, Highway Safety Research Center, University of North Carolina, "Warning: In Cars, Children May Be Hazardous to Their Parents' Health: The Role of Restraints in Preventing Collisions," Proceedings of the Twenty-Fourth Conference of the American Association for Automotive Medicine, AAAM, Morton Grove, Illinois, 1980.

38/ Testimony of Robert S. Sanders, M.D., before the National Transportation Safety Board, Public Hearing on Child Motor Vehicle Passenger Safety, Dallas, Texas, January 13, 1983; and Robert S. Sanders, M.D., "Legislative Approach to Auto Safety: The Tennessee Experience," in A.B. Bergman, ed., Preventing Childhood Injuries, Report of the Twelfth Ross Roundtable on Critical Approaches to Common Pediatric Problems, Ross Laboratories, Columbus, Ohio, 1982.

violators appeared in court with the required proof, and the assessment of a fine was extremely rare. When given a citation, violators frequently thanked Highway Patrol Troopers for their concern and assistance. In terms of fostering good law enforcement-community relations, the enforcement policy was considered the most effective public relations activity in the history of the Tennessee Highway Patrol. 39/

Child safety seat usage rates in Tennessee began to increase after enactment of the child passenger protection law. After the public information and education and safety seat loan programs were established to support the law, usage rates reached 29 percent, or more than triple the prelaw average of 9 percent. However, the impact of the law and the support programs on usage was considered to have been weakened to some extent because for the first 3 years citizens could also comply with the law without safety seat use by having children ride in the laps of their parents or other passengers. 40/

Before the Tennessee law was enacted, 20 to 25 child passenger fatalities occurred yearly in the State in the 3-and-under age group covered by the law. After the law's enactment and the supporting enforcement, public information and education, and safety seat loan programs were put in place, child passenger fatalities in that age group dropped to 15 in 1980, 10 in 1981, and 6 in 1982. While the reductions may have been affected somewhat by other factors (such as changes in the accident exposure of this age group), the reductions are considered to be attributable primarily to the child passenger protection law and support programs.

In the 5 years following enactment of the Tennessee law, other States gradually began to enact similar legislation, and those States are beginning to report similar results. For example, during the first 10 months after the North Carolina law went into effect child safety seat use by children under age 2 increased from 30 percent to 46 percent and an estimated 8 deaths and 23 serious injuries were prevented. 41/ Since the Rhode Island law became effective on April 1, 1981, Rhode Island has not reported a single child passenger death in the 3-and-under age group covered by the law. During the first 9 months the Michigan law was in effect, total child passenger casualties (fatalities and injuries combined) in the 3-and-under age group covered dropped by 31 percent compared to the same period the previous year, while adult motor vehicle occupant fatalities dropped only 10 percent.

All 41 child passenger protection laws which had been enacted in the United States by mid-1983 contain provisions which define and limit their applicability. While some limitations are necessary, others have the effect of excluding children from the

39/ Testimony of Sgt. Marion Ramsey, Tennessee Highway Patrol, before the National Transportation Safety Board, Public Hearing on Child Motor Vehicle Passenger Safety, Dallas, Texas, January 13, 1983; and Gene Roberts, Commissioner, Tennessee Department of Safety, "Child Passenger Safety: The Tennessee Enforcement Strategy," paper presented at the International Forum on Occupant Restraint, Toronto, Ontario, Canada, June 1-3, 1981.

40/ Randy L. Perry, et al., op. cit., and Allan F. Williams, "Evaluation of the Tennessee Child Restraint Law," American Journal of Public Health, Vol. 69, American Public Health Association, 1979.

41/ University of North Carolina Highway Safety Research Center, The North Carolina Child Passenger Protection Law: Summary of First Year Experience, Interim Report to the General Assembly, June, 1983.

protection of the law unnecessarily. Consequently, the laws fail to place a clear prohibition on transportation of children unrestrained. Accident investigations illustrate the gaps created by four kinds of limitations: those on the adults responsible for complying with the law; those on the children who must be protected; those based on "personal needs" exemptions; and those which restrict the enforcement of the law. (See Summary of Child Passenger Protection Laws at appendix G.)

Adults Responsible for Compliance

On September 4, 1982, in an accident near Winston-Salem, North Carolina, a 9-month-old girl riding in her grandmother's lap was killed, along with her grandparents (Case 3). A child safety seat that was being carried loose and unused in the rear of the car was ejected during impact and was found lying next to the car after the accident. If the baby had been riding properly secured in that safety seat, rather than riding in her grandmother's lap, she probably would have survived the accident. North Carolina's child passenger protection law had been in effect for 2 months when this accident occurred. The law applies to every driver required to have a North Carolina driver's license when transporting his or her own child under age 2 in his or her own motor vehicle; it does not apply to transportation of children by any other person, including grandparents, other relatives, or friends.

Laws in 33 States, expressly or indirectly, restrict the applicability of the law to residents of the State, or to drivers of vehicles registered in the State, or both. In 16 jurisdictions, the law applies to the child's parent or legal guardian only, and 11 of those laws are further limited to motor vehicles owned by the parent or legal guardian. Three laws are limited to drivers who regularly and customarily transport a small child, and two provide exceptions for use of a temporary or a substitute vehicle.

The effect of these limitations in many cases is to exclude infants and small children from the protection of the law because the person transporting them is not subject to the law. The limitations may have been made for reasons that seemed valid at the time of enactment -- for example, out of concern that having to purchase a child safety seat would be an unreasonable financial burden for persons other than a child's parent or guardian, or for nonresidents who were not subject to similar requirements in their own State. Now, however, four out of five States either already have a child passenger protection law in effect or will have one in effect by mid-1984, and more laws are expected to be enacted by the remaining States. Rather than excluding from the coverage of the law children in nonparental driving situations and allowing them to be transported with no protective restraint, some States, such as California, provide a safety belt option. Under the California law, the child passenger protection requirement may be met by use of either a safety seat or a safety belt in a nonparental driving situation or when a parent is driving someone else's vehicle.

Children Not Required to be Protected

Many children also are excluded from the protection of the law by provisions which limit applicability only to certain children based on age, weight, height, or some combination thereof. The laws vary considerably, with 3 covering children through 1 year old only, 2 extending through age 2, 20 through age 3, 10 through age 4, 4 through age 5, 1 through age 9, and 1 which applies to children 40 inches or less in height. Some laws provide exemptions for children whose weight meets or exceeds 40 pounds or who obtain a physician's certificate indicating that safety seat use is impracticable due to the child's size or weight, or medical reasons. Others provide a safety belt option, rather than an outright exemption, based on age, size, or weight.

In some of the accidents investigated, children who were not covered by an existing child passenger protection law were not using any protective restraint and were killed or injured. For example, in Mt. Vernon, Kentucky (Case 11), an unrestrained 4-year-old boy who was fatally injured in a noncrash incident when he fell from a moving vehicle was 42 inches tall — 2 inches taller than the maximum height specified by the Kentucky law for mandatory safety seat use. This law requires the superior protection provided by a safety seat until a child outgrows it, and then does not require any protection at all.

In an accident in Herkimer, New York (Case 8), a 3-year-old girl and her 5-year-old brother, both unrestrained, were ejected from the family station wagon, collided with another vehicle and the pavement, and were fatally injured. Both children almost certainly would have survived, probably with little or no injury, if they had been wearing safety belts. However, the New York child passenger protection law in effect at that time covered children only through age 4, and, thus, did not apply to the 5-year-old boy. The law did apply to his 3-year-old sister; however, she was 42 inches tall and had outgrown her safety seat. The New York law was amended in 1982 to include a safety belt option for 4-year-old children, but the option was not extended to 3-year-olds too large to use conventional safety seats. In other accidents investigated by the Safety Board involving infants and small children, 10 other unrestrained children over 4 years old were killed or injured. Safety belt options provide a means of extending child passenger protection requirements to older children who are not covered by existing laws as well as to children who cannot use conventional safety seats because of their size or weight.

Exemptions for Nursing, Diapering, or Other "Personal Needs"

An accident which occurred November 2, 1982, in Austin, Texas, involved a young mother who was nursing her 5-week-old son in the front seat of their 1974 Subaru while her husband was driving. All three occupants were unrestrained. A drunk driver traveling in the opposite direction in a 1968 Ford sedan suddenly veered across the centerline and collided head-on with the Subaru. The baby's father was seriously injured and the mother sustained moderate injuries. The 5-week-old baby was crushed into the instrument panel by the weight and acceleration of his mother's body and died of massive head injuries.

Since Texas had not enacted a child passenger protection law, it was not unlawful for the baby not to be properly protected by a child safety seat while he was being nursed by his mother. This practice also would not have been unlawful in five of the States that do have child passenger protection laws. In the five States —Georgia, Michigan, North Carolina, Tennessee, and South Carolina — a child does not have to be properly protected when the child is being nursed, and some of the exemptions extend to situations when an adult is attending to a child's "personal needs" or when a child "has any distress which makes it impractical to use a child restraint system."

"Personal needs" exemptions are based largely on convenience and do not adequately protect the child's health and safety. The exemptions may encourage or perpetuate a false notion that it is somehow "safe" to transport a child without proper protection if the child is being nursed or diapered. However, the Austin, Texas, accident shows that it is dangerous for a child to travel without proper protection while personal needs are being accommodated, even for a brief period. If a child has a personal need which cannot be attended to while the child is properly restrained, it should not be attended to while traveling in a moving vehicle.

Enforcement Limitations

The intent of child passenger protection laws is positive, rather than punitive. As one witness testified in the public hearings, child passenger protection laws are "education with teeth." 42/ Their purpose is to encourage the safe transportation of children and, especially, to encourage families to obtain and use child safety seats to protect infants and small children properly. Consequently, most laws provide that the fine specified for violations either must or may be waived upon showing proof that a child safety seat has been obtained. While the existence of a child passenger protection law in itself serves an educational function, the law must be enforced to be fully effective.

The child passenger protection laws of two States — Arizona and New Mexico -- do not permit law enforcement officers to stop a vehicle solely for the purpose of enforcing child passenger protection requirements. In effect, law enforcement officers in those States are prevented from enforcing the child passenger protection law even when a particularly hazardous situation, such as a child riding in the lap of a driver or passenger or standing in a moving vehicle, is observed, unless the officer has another reason for making a stop (such as a violation of another law). The child passenger protection laws of three other States — Kansas, Kentucky, and Oklahoma — do not provide any penalty for violations, and instead restrict enforcement action to the issuance of an oral or written warning which may be accompanied by printed educational materials provided to violators.

Even in States which do not have such restrictions, law enforcement agencies in many cases may not be conducting an active enforcement campaign. While much of the focus of child passenger safety efforts has been concentrated on the passage of legislation and the development of public information and education programs, there is a growing recognition that the implementation of the laws, and especially their enforcement, has not received sufficient attention. An increasing number of jurisdictions are finding that the passage of a child passenger protection law is just the beginning, and that a considerable amount of effort is required for effective planning and coordination of its implementation.

In addition to the law enforcement training discussed previously, a critical element of implementation is the training and education of law enforcement officers in the positive role that they have in enforcing a child passenger protection law. It cannot be assumed that individual officers and their superiors will automatically be supportive and committed to enforcing a child passenger protection law in the absence of such training and of a written enforcement plan.

The National Child Passenger Safety Association is concerned about the implementation of child passenger protection laws and is in an excellent position to assist the States in identifying implementation problems and developing effective implementation programs which would address the need for effective law enforcement plans and training, public information, education and safety seat loan programs, the evaluation of the effectiveness of such laws and programs, and efforts to combat safety seat misuse.

42/ Testimony of Robert S. Sanders, M.D., before the National Transportation Safety Board, Public Hearing on Child Motor Vehicle Passenger Safety, Dallas, Texas, January 13, 1983.

TOWARD FURTHER ADVANCES IN CHILD PASSENGER SAFETY: ELEMENTS OF AN EFFECTIVE CHILD PASSENGER PROTECTION LAW

Based on the foregoing analysis, the Safety Board believes that to prevent or reduce more effectively the needless death, disability, and disfigurement of children in motor vehicle accidents and noncrash incidents, child passenger protection laws should incorporate the following major elements.

A. Age and Type of Protection

1) For infants and children through 4 years old whose height does not exceed 40 inches and whose weight does not exceed 40 pounds, require use of a child safety seat or other child restraint system; for a child 1 year old or older transported by a person other than his or her parent or legal guardian, or in a vehicle which is not owned by the parent or legal guardian, permit use of a safety belt, preferably in the rear seat, in lieu of a child safety seat.

2) For infants and children through 4 years old whose height exceeds 40 inches or whose weight exceeds 40 pounds, require use of a safety belt, preferably in the rear seat, or a child restraint system, such as booster seat, which is appropriate for the child's height and weight.

3) For all children age 5 and older, require use of a vehicle safety belt or a child restraint system, such as a booster seat.

4) Exceptions: a) when restraint use would be inappropriate for medical reasons or during an emergency; or b) when the number of passengers exceeds the number of seating positions equipped with safety belts, if all safety belts are in use and if preference in use of restraints is given to children.

B. Person Responsible for Child's Protection

The driver is responsible, except when the child's parent or legal guardian is present in the vehicle.

C. Vehicles Subject to Child Passenger Protection Requirements

All vehicles equipped with safety belts at the time of manufacture or currently equipped with safety belts.

D. Specific Prohibitions

1) Temporarily unrestraining a child for nursing, feeding, or diapering.

2) Using household infant carriers or home booster chairs not designed for motor vehicle crash protection.

3) Leaving a child under age 5 secured in a child safety seat or child restraint device in a vehicle that is unattended by an adult.

E. Acceptable Child Safety Seats and Child Restraint Systems

Those which meet applicable Federal Motor Vehicle Safety Standards in effect at the time of manufacture.

F. Proper Use Required

1) A child safety seat or other child restraint system must be used exactly in accordance with the manufacturer's instructions.

2) A safety belt must be used properly, according to the instructions of the vehicle manufacturer.

G. Penalty for Noncompliance

1) An appropriate fine, which may be waived for the first violation upon provision of proof that a child safety seat or other appropriate child restraint system has been acquired within a period of time established by the law.

H. Enforcement

Evidence of violation is sufficient cause for enforcement without the occurrence of a separate violation of law or other prerequisite.

I. Evaluation

Ongoing or periodic evaluations of effectiveness of State law, including measurements of the degree of compliance, the degree of misuse of child safety seats, the degree of enforcement, and accident consequences to restrained and unrestrained child passengers.

CONCLUSIONS

1. It is extremely dangerous for an infant or child to be transported in a motor vehicle without proper protection at any time, under any circumstances.

2. An infant or child in a moving vehicle cannot be restrained and protected properly by being held in the arms of another passenger, which adds the danger of the child being crushed against the vehicle interior by the weight and acceleration of the body of the holder in an accident, and increases the risk of fatal or serious injuries to the child.

3. Ejection of an unrestrained child from a vehicle increases the danger of fatal or serious injury from striking the pavement, other vehicles, or other exterior objects, in addition to the danger of injuries resulting from contact with the vehicle interior before and during ejection.

4. Children riding unrestrained in a motor vehicle are in danger of being killed or injured even if the vehicle is not involved in a crash; death or injury can result from common driving maneuvers, such as sudden stops, turns, swerves, or from the unrestrained child falling from a moving vehicle.

5. Household infant carriers and home booster chairs are not designed to provide any protection for children in motor vehicle accidents and cannot be relied upon to do so.

6. Child safety seats, when used properly according to the manufacturer's instructions, can provide excellent protection against the death or serious injury of children in motor vehicle accidents.

7. A second essential element of child passenger protection is that all other vehicle occupants be properly restrained to prevent fatal or serious injury to a child from violent contact with unrestrained occupants propelled by crash impact forces.

8. Misuse of child safety seats appears to be a significant and widespread problem. While in some kinds of accidents, a misused safety seat may still provide some protection, misuse can reduce or totally negate the protection provided by a safety seat.

9. The most prevalent misuse problem encountered in the Safety Board investigated accidents was the failure to use or to correctly anchor the tether on safety seats which require a tether and which rely on its use for effective crash performance. In almost every case where a tether was required, it was not used, and when it was used, it was sometimes tied to some part of the vehicle, rather than being properly secured to an anchor installed for that purpose.

10. Two of the most safety-critical misuses uncovered in the accidents investigated were the failure to fasten the safety seat harness around the child (or not securing it snugly) and the failure to use the vehicle safety belt (or failure to fasten it in the correct place on the safety seat) to secure the safety seat tightly to the vehicle. In the accidents investigated, these errors allowed infants and small children to be propelled from the safety seat, or both the safety seat and the child to be propelled together, against the vehicle interior.

11. Additional safety seat design improvements may be needed to prevent injury to a restrained or unrestrained vehicle occupant resulting from contact with a safety seat installed in the vehicle.

12. The possibility of developing abdominal load and neck load criteria, anthropomorphic dummies, and dynamic test procedures for certification of child safety seats should be explored by the National Highway Traffic Safety Administration through further research and developmental crash testing.

13. To combat the problem of misuse of child safety seats, additional action is needed to place special emphasis on the misuse problem in child passenger safety public education programs and in safety seat loan programs, to train law enforcement officers to identify misuse in their enforcement and accident investigation activities, to identify through accident data the kinds of misuse problems that are occurring in accidents, to determine their magnitude, and to simplify safety seat design and improve manufacturers' usage instructions and labels.

14. Many children are cut off from the benefits of child passenger protection laws by statutory provisions which unnecessarily limit the scope of the law in terms of the adults responsible for compliance, the children covered by the law, and the circumstances in which the law applies.

15. Virtually none of the child passenger protection laws enacted as of mid-1983 are designed to foster the transition of children from safety seat use to safety belt use; the vast majority of the laws require that a child be provided the superior protection of a safety seat until age 1, 2, 3, 4, or 5 (often with a safety belt option at the upper end of that age range), but permit a child to be transported without any protection whatsoever after the maximum age specified.

16. The proper use of safety belts by infants and small children, although not as effective as the proper use of safety seats in preventing death or injury, should be encouraged for those driving situations in which a child at any age would otherwise be transported unrestrained.

17. Crash test studies and accident data are needed to evaluate the use and crash performance of safety belts by small children, to better identify injury prevention benefits and limitations, and to provide guidance to legislators and the public.

18. The economic costs of motor vehicle deaths and injuries to unrestrained children (and adults) in the United States are paid by all American citizens through higher taxes for police services, emergency medical services, medical care and rehabilitation, public health and highway safety programs to reduce child fatalities and injuries, and special education for the handicapped; through higher hospital costs; and through higher insurance premiums.

19. Accidents caused by unrestrained children endanger the health and safety of other motorists and their passengers, pedestrians, bicyclists, and others, and result in substantial additional costs to taxpayers and consumers.

RECOMMENDATIONS

As a result of its Safety Study of Child Passenger Protection Against Death, Disability, and Disfigurement in Motor Vehicle Accidents, the National Transportation Safety Board made the following recommendations:

--to the Governors and legislative leaders of Alaska, Idaho, Iowa, Louisiana, South Dakota, Texas, Utah, Vermont, Wyoming, American Samoa, Guam, Puerto Rico, and the Virgin Islands:

> Enact legislation requiring the proper protection of children traveling in motor vehicles, following as closely as possible the elements set forth by the National Transportation Safety Board in its Safety Study, "Child Passenger Protection Against Death, Disability, and Disfigurement in Motor Vehicle Accidents." (Class II, Priority Action) (H-83-49)
>
> Include, as part of a statewide child passenger safety program, public information and education activities specifically aimed at combating misuse of child safety seats. (Class II, Priority Action) (H-83-50)

--to the Governors and legislative leaders of Alabama, California, Connecticut, Delaware, Florida, Illinois, Kansas, Kentucky, Massachusetts, Michigan, Minnesota, New York, North Carolina, Ohio, Rhode Island, Tennessee, Virginia, West Virginia, and Wisconsin:

> Include, as part of a statewide child passenger safety program, public information and education activities specifically aimed at combating misuse of child safety seats. (Class II, Priority Action) (H-83-51)

--to the Governors and legislative leaders of Arizona, Arkansas, Colorado, Georgia, Hawaii, Indiana, Maine, Maryland, Mississippi, Missouri, Montana, Nebraska, Nevada, New Hampshire, New Jersey, New Mexico, North Dakota, Oklahoma, Oregon, South Carolina, Washington, and the Mayor and Chairman of the Council of the District of Columbia:

Include, as part of a statewide child passenger safety program, public information and education activities specifically aimed at combating misuse of child safety seats. (Class II, Priority Action) (H-83-52)

--to the National Highway Traffic Safety Administration:

Expedite the issuance of a final rule requiring that newly-manufactured vehicles under 10,000 pounds gross vehicle weight be equipped with tether anchorages or predrilled holes for the installation of such anchorages at all rearmost seating locations. (Class II, Priority Action) (H-83-53)

Examine the consequences in accidents of nonuse and misuse of tether straps with safety seats requiring use of tether straps to determine whether such safety seats should be required to meet all the requirements of Federal Motor Vehicle Safety Standard 213, Child Restraint Systems, without the tether strap attached. (Class II, Priority Action) (H-83-54)

Examine the incidence of nonuse and misuse of a tether strap with child safety booster seats when used in a rear vehicle seat and the consequences in accidents of such nonuse or misuse to determine whether the advantages offered by such booster seats outweigh the disadvantages. (Class II, Priority Action) (H-83-55)

Amend Federal Motor Vehicle Safety Standard 213, Child Restraint Systems, to require that child safety seats and other child restraint systems include on their certification labels, information for obtaining a replacement copy of the manufacturer's detailed instructions for use. (Class II, Priority Action) (H-83-56)

Conduct research and developmental crash testing to explore the feasibility and desirability of developing abdominal and neck load criteria, anthropomorphic dummies, and test procedures for child safety seats and other child restraint systems. (Class II, Priority Action) (H-83-57)

Conduct research to examine the potential for other restrained or unrestrained vehicle occupants to sustain injuries in accidents from contact with a child safety seat when used in a motor vehicle and to determine whether additional safety requirements may be necessary and practicable to prevent or minimize potential injuries. (Class II, Priority Action) (H-83-58)

Conduct crash tests and accident research to examine the use and accident performance of safety belts with children at various ages to better identify the benefits and limitations of such use. (Class II, Priority Action) (H-83-59)

--to Child Safety Seat Manufacturer:

Review and revise instructions for use of child safety seats and other child restraint devices as needed to improve the clarity of the instructions and to establish specific height, weight, or other thresholds for required actions which depend on a child's physical characteristics (such as conversion between forward and rear-facing modes and harness rerouting on convertible child safety seats). (Class II, Priority Action) (H-83-60)

Attach permanent labels to safety seats to identify correct safety belt routing points, harness routing points, and correct recline positions for use in motor vehicles. (Class II, Priority Action) (H-83-61)

--the International Association of Chiefs of Police:

Coordinate and promote the development of training programs for State and local law enforcement officers on the use and misuse of child safety seats and safety belts for law enforcement and accident investigation purposes. (Class II, Priority Action) (H-83-62)

Promote the use of statewide traffic accident data systems to collect and analyze specific data identifying the use and misuse of child safety seats and safety belts in motor vehicles involved in accidents and the consequences of such use and misuse. (Class II, Priority Action) (H-83-63)

—to the National Child Passenger Safety Association:

Assist the States in developing effective programs to implement child passenger protection laws. (Class II, Priority Action) (H-83-64)

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

/s/ JIM BURNETT
Chairman

/s/ PATRICIA A. GOLDMAN
Vice Chairman

/s/ FRANCIS H. McADAMS
Member

/s/ G. H. PATRICK BURSLEY
Member

/s/ DONALD D. ENGEN
Member

September 7, 1983

APPENDIXES

APPENDIX A

SAFETY RECOMMENDATIONS H-82-59 and -60

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: December 7, 1982

Forwarded to:
To the Governors or Governors-elect of Alaska, Arizona, Arkansas, Colorado, Georgia, Hawaii, Idaho, Indiana, Iowa, Louisiana, Maine, Maryland, Mississippi, Missouri, Montana, Nebraska, New Hampshire, New Jersey, New Mexico, Nevada, North Dakota, Oklahoma, Oregon, Pennsylvania, South Carolina, South Dakota, Texas, Utah, Vermont, Washington, and Wyoming

SAFETY RECOMMENDATION(S)

H-82-59 and -60

The National Transportation Safety Board recommends that you include in your 1983 legislative program a requirement for the mandatory use of child safety seats for the protection of young children riding in motor vehicles and that you adopt a Statewide child passenger safety program. The Safety Board believes, as a result of its findings in accident investigations and its review of the experience of States which have enacted such legislation and undertaken such a program, that these measures can be used effectively to bring about a significant reduction in deaths and injuries to young children involved in motor vehicle accidents.

Motor vehicle accidents are the leading killer and crippler of children in this country. Children from infancy through age 4 are especially vulnerable to death, disability, and disfigurement, even in minor crashes. In the last 2 years, infants and toddlers through age 4 who were riding in motor vehicles were killed in crashes at a rate of 1 every 13 hours. More than 1,300 were killed during these 2 years, and over 10,000 were seriously injured or permanently disabled. The most tragic aspect of these losses is that they are needless; an estimated 90 percent of the fatalities and the great majority of the injuries could have been prevented by the proper use of child safety seats.

As part of a study of child motor vehicle passenger protection, the Safety Board is conducting a concerted program of in-depth investigations of crashes involving children from infancy through age 4. Enclosed for your information are brief summaries of three accidents. These accidents illustrate crash risks to children unprotected by child safety seats, including the risk of ejection, the danger to children riding in the laps of adults and, in one case, the dramatic difference in crash consequences for two children in the same vehicle, one protected by a child safety seat and one unrestrained. We also are investigating four other crashes in which infants between the ages of 3 weeks and 1 year, who were protected by child safety seats, escaped unharmed (or in one case, with minor injury) when adult occupants in the same vehicle were killed or seriously injured. Other investigations in progress include cases in which young children who were unprotected by child safety seats received facial or other injuries in minor accidents where other restrained or unrestrained vehicle occupants were uninjured.

Motor vehicle accidents are now being recognized as a major public health problem and a proper subject of public health policy. A growing number of States have found that just as State health laws are appropriate to require immunization of children against life-threatening and crippling diseases, young children must be "immunized" by legislation against the consequences of crashes—which kill and cripple more children in this country than any major disease. To date, 23 States have enacted child passenger safety laws, and in 19 of these States the laws include provisions requiring use of child safety seats by the general public. While these laws vary to some extent from State to State, they are consistent in their basic philosophy that new and more effective public programs are needed to deal with this serious safety problem.

The best example to illustrate what can be achieved by such a program is the experience of Tennessee, the first State to undertake a broad-scale child passenger safety program including a law requiring the use of child safety seats. The results now being reported are impressive: since Tennessee began implementing its program in 1978, child safety seat usage rates have tripled and crash fatalities of children in the age group affected by the law have been cut by more than 50 percent. Before the 1977 law, fatalities of child passengers averaged 20 to 25 annually. That number was reduced to 10 in 1981, and the number of fatalities reported for the first 9 months of 1982 was 5. The experience reported in Tennessee indicates that this kind of program can significantly reduce child passenger fatalities in crashes. A brief description of some of the activities undertaken in Tennessee, which have been found valuable there and elsewhere, is enclosed for your information.

The Safety Board believes that in addition to enacting a law requiring use of child safety seats, each State should develop a program of activities to encourage compliance and enhance the effectiveness of the law. These activities should include visible and aggressive enforcement; dissemination to the public of information to assure that the requirements are fully understood; education of the public (both adults and children) to explain the problem and the need for crash protection, as well as to emphasize the importance of proper use of child safety seats; sufficient public and/or private child safety seat loan programs or similar activities to assure the availability of seats in the community and to meet the special needs of low-income families (some of them with two or more children in the affected age group), who would otherwise be unable to comply with the law; and ongoing evaluation of such activities to analyze and measure the results and identify the need for action to further improve child passenger safety policies and programs.

Given the magnitude of the child passenger safety problem and the number of fatalities and injuries that are being incurred by children not protected by child safety seats in crashes, the Safety Board strongly encourages and supports the adoption of public policies and programs which have been demonstrated to be effective in reducing these tragic losses.

Therefore, the National Transportation Safety Board recommends that the Governors or Governors-elect of Alaska, Arizona, Arkansas, Colorado, Georgia, Hawaii, Idaho, Indiana, Iowa, Louisiana, Maine, Maryland, Mississippi, Missouri, Montana, Nebraska, New Hampshire, New Jersey, New Mexico, Nevada, North Dakota, Oklahoma, Oregon, Pennsylvania, South Carolina, South Dakota, Texas, Utah, Vermont, Washington, and Wyoming:

> Include in your 1983 legislative program, legislation to require use of child safety seats for child passengers from infancy through age 4 to reduce the likelihood of death, disability, or disfigurement in motor vehicle crashes. (Class II, Priority Action) (H-82-59)

Develop a Statewide child passenger safety program including aggressive enforcement of laws requiring use of child safety seats, public information and education programs on their need and proper use, child safety seat loan or similar programs, and ongoing evaluation of such activities. (Class II, Priority Action) (H-82-60)

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." (P.L. 93-633). The Safety Board is vitally interested in any actions taken as a result of its safety recommendations. Therefore, we would appreciate a response from you regarding action taken or contemplated with respect to the recommendations in this letter.

BURNETT, Chairman, GOLDMAN, Vice Chairman, and McADAMS, BURSLEY, and ENGEN, Members, concurred in these recommendations.

Jim Burnett

By: Jim Burnett
Chairman

APPENDIX B

NATIONAL TRANSPORTATION SAFETY BOARD
REGIONAL PUBLIC HEARINGS ON CHILD MOTOR VEHICLE PASSENGER SAFETY
LIST OF WITNESSES

Dallas, Texas - January 13, 1983

Patricia A. Goldman, Vice Chairman, Presiding

Witnesses

Investigations of Crashes Involving Young Children

Mr. Jimmie Sutton
Highway Accident Investigator
National Transportation Safety Board
Atlanta, Georgia Field Office

Lt. Ray Ward
Service Commander, Dallas Region
Safety Education Division
Texas Highway Patrol
Texas Department of Public Safety

Trooper Tom Purvis
Texas Highway Patrol
Texas Department of Public Safety
Canton, Texas Area Office

Families of Children Involved in Crashes

Mrs. Laura Bagneud
Port Neches, Texas
(Accompanied by daughter, April, age 4)

Mrs. Gaye Polan
Austin, Texas
(Accompanied by son, Parker, age 1)

Mr. Dennis Miles
Hiawassee, Georgia

Ms. Cory Williams
Oklahoma Highway Safety Office
Presenting prepared statement for:
Mrs. Barbara Moore
Shawnee, Oklahoma

Traumatic Injuries to Children in Crashes

Dale Coln, M.D.
Chairman, Division of Pediatric Surgery
University of Texas Health Sciences Center
Director, Pediatric Trauma Center
Parkland Memorial Hospital
Dallas, Texas

Ms. Becky Glass, R.N., M.S.
Nurse Coordinator, Pediatrics
Parkland Memorial Hospital
Dallas, Texas

John Anthony Herring, M.D.
Chief of Staff
Texas Scottish Rite Hospital for Crippled Children
Dallas, Texas

Child Passenger Protection Laws--The Tennessee Experience

Robert S. Sanders, M.D.
Director, Rutherford County Health Department
Murfreesboro, Tennessee
Vice President, National Child Passenger Safety Association

Sgt. Mayford Ransey
Tennessee Highway Patrol
Knoxville, Tennessee

Pending Child Passenger Protection Legislation

Honorable Carl Parker
Texas Senate

Honorable Anita Hill
Texas House of Representatives

Child Passenger Safety Programs

Ms. Cory Williams
Program Manager
Oklahoma Highway Safety Office
Oklahoma City, Oklahoma

Ms. Mary Jane Dowey
Director, Child Safety Program
Tennessee Department of Public Health
Nashville, Tennessee

Ms. Sandy Richardson
Assistant Programming Manager
Arkansas Highway Safety Program
Little Rock, Arkansas

Ms. Sharon Kohout
Co-Founder, Kids 'N' Cars Loan-A-Seat Program
Midland, Texas

Philadelphia, Pennsylvania - February 4, 1983

Patricia A. Goldman, Vice Chairman, Presiding

Witnesses

Investigations of Crashes Involving Young Children

Mr. Frank Ghiorsi
Highway Accident Investigator
National Transportation Safety Board
New York, New York Field Office

Sergeant Raymond Cotton
Field Operations Bureau
Maryland State Police
Pikesville, Maryland

Lieutenant Larry Kopko
Conewango Township Police Department
Warren, Pennsylvania

Families of Children Involved in Crashes

Mrs. Lisa Willis
Manassas, Virginia
(Accompanied by son, Robert, age 2)

Mr. Patrick Brewer and Mrs. Barbara Brewer
Lebanon, Pennsylvania
(Accompanied by son, Benjamin, age 2 1/2)

Mr. Dale Heller and Mrs. Diane Heller
Fallston, Maryland
(Accompanied by son, Matthew, age 4)

Mr. Thomas Kaye
Burlington, New Jersey

Traumatic Injuries to Children in Crashes

Seymour Charles, M.D.
President, Physicians for Automotive Safety (Rye, New York)
Chairman, Committee on Accident Prevention and Decrease of Trauma
New Jersey Academy of Pediatrics
Irvington, New Jersey

Susan Aronson, M.D.
Health Service Plan
Havertown, Pennsylvania
Alternate Pennsylvania Chapter Chairman
American Academy of Pediatrics

Kenneth Roberts, M.D.
Associate Pediatrician-in-Chief
Sinai Hospital
Baltimore, Maryland
Co-Founder and Vice President, Maryland Child Passenger Safety Association

Child Passenger Protection Laws—The North Carolina and New York Experience

Mr. Forrest N. Council
Deputy Director, Highway Safety Research Center
University of North Carolina
Chapel Hill, North Carolina
President, National Child Passenger Safety Association (1982-83)

Mr. William G. Rourke
Executive Director
Governor's Traffic Safety Committee
Albany, New York

Legislative Initiatives: Pennsylvania, New Jersey

Honorable George W. Gekas
17th Pennsylvania Congressional District
U.S. House of Representatives

Honorable Mary Ann Arty
Pennsylvania House of Representatives

Honorable Raymond J. Zane
New Jersey Senate

Child Passenger Safety Programs

Ms. Maureen Griffin
Child Safety Coordinator
Program Manager, Public Information and Education
Bureau of Safety Programs and Analysis
Pennsylvania Department of Transportation
Harrisburg, Pennsylvania

Ms. Herberta Smith, R.N.
Nursing Coordinator
Pediatric Outpatient Clinic
Medical College of Pennsylvania
Philadelphia, Pennsylvania

Ms. Andrea gielen
Supervisor, Project KISS (Kids in Safety Seats)
Assistant Chief, Health Education Center
Maryland Department of Health and Mental Hygiene

Ms. Sharane Orendas
New Jersey Office of Highway Safety
Trenton, New Jersey

Mr. James F. Hughes
Director, General Education Division
New Jersey Safety Council

St. Louis, Missouri - March 24, 1983

Patricia A. Goldman, Vice Chairman, Presiding

Witnesses

Investigations of Crashes Involving Young Children

Mr. William Klassen
Highway Accident Investigator
National Transportation Safety Board
Kansas City, Missouri Field Office

Lieutenant Larry Baucom
Traffic Division
Missouri Highway Patrol

Mr. R.J. Miller
Superintendent, Illinois State Police

Families of Children Involved in Crashes

Mrs. Perry Isaak
Kirksville, Missouri
(Accompanied by son, Jacob, age 3)

Mrs. Connie Frasier
Kirksville, Missouri
(Accompanied by children Joe, age 5; Michael, age 3; and Ryan, age 8 months)

Traumatic Injuries to Children in Crashes

Paul Simons, M.D.
Pediatrician, Medical Care Group of St. Louis
Associate Professor of Pediatrics
Washington University Medical School and St. Louis Children's Hospital
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Chicago, Illinois
President, Illinois Child Passenger Safety Association
Vice President, National Child Passenger Safety Association

Child Passenger Protection Legislation in Missouri

Honorable Sandra Reeves
Missouri House of Representatives

Honorable James L. Mathewson
Missouri Senate

Child Passenger Safety Programs

Mr. R. Norris Orme
Managing Director
Safety Council of Greater St. Louis
St. Louis, Missouri

Mr. Edward D. Daniel
Director, Missouri Department of Public Safety
Jefferson City, Missouri

Staff Sergeant Jack A. Wolfe
Ground Safety Office
375th Aeromedical Airlift Wing
Scott Air Force Base, Illinois

APPENDIX C

CHILD MOTOR VEHICLE PASSENGER FATALITIES BY STATE, AGES 0 THROUGH 4, 1978-1982

Accident Jurisdiction	Year 1978	1979	1980	1981	1982*	5-year Total
NATIONWIDE.....	726	698	698	634	629	3,385
Alabama.....	13	21	15	14	15	78
Alaska.....	1	2	1	2	--	6
Arizona.....	13	23	9	8	12	65
Arkansas.....	12	7	9	4	8	40
California.....	94	65	56	66	60	341
Colorado.....	9	12	10	9	12	52
Connecticut.....	2	5	—	3	4	14
Delaware.....	--	1	3	2	1	7
District of Columbia..	--	--	--	--	--	—
Florida.....	24	34	45	26	28	157
Georgia.....	25	20	17	25	3	100
Hawaii.....	1	4	1	3	3	12
Idaho.....	8	12	9	4	6	39
Illinois.....	29	28	15	25	26	123
Indiana.....	25	16	20	17	18	96
Iowa.....	14	10	12	10	6	52
Kansas.....	10	5	5	16	15	51
Kentucky.....	22	11	18	23	15	89
Louisiana.....	15	23	16	14	17	85
Maine.....	2	2	2	2	2	10
Maryland.....	2	8	7	15	4	36
Massachusetts.....	7	5	4	2	3	21
Michigan.....	20	20	24	18	13	95
Minnesota.....	13	8	11	7	12	51
Mississippi.....	13	12	20	11	18	74

CONTINUED

--Data not available

* 1982 data preliminary

Accident Jurisdiction	Year 1978	1979	1980	1981	1982*	5-Year Total
Missouri.....	21	20	20	16	14	91
Montana.....	4	6	4	2	3	19
Nebraska.....	5	3	4	3	5	20
Nevada.....	1	8	5	3	4	21
New Hampshire.....	--	5	4	--	2	11
New Jersey.....	10	6	12	13	10	51
New Mexico.....	10	7	18	9	18	62
New York.....	20	12	22	12	23	89
North Carolina.....	29	25	21	23	20	118
North Dakota.....	1	3	--	1	1	6
Ohio.....	26	33	28	30	20	137
Oklahoma.....	25	14	17	15	17	88
Oregon.....	11	9	8	7	13	48
Pennsylvania.....	16	28	23	16	19	102
Rhode Island.....	--	1	1	--	--	2
South Carolina.....	11	11	12	15	6	55
South Dakota.....	8	7	3	1	3	22
Tennessee.....	17	27	19	14	8	85
Texas.....	74	65	87	68	88	382
Utah.....	18	9	3	9	8	47
Vermont.....	1	2	2	2	--	7
Virginia.....	9	12	9	12	8	47
Washington.....	13	9	19	10	10	61
West Virginia.....	4	10	8	6	6	34
Wisconsin.....	16	6	14	16	8	60
Wyoming.....	2	6	6	5	4	23
NATIONWIDE.....	726	698	698	634	629	3,385

--Data not available

* 1982 data preliminary

Prepared by Bureau of Safety Programs, National Transportation Safety Board

Based on data compiled by the Fatal Accident Reporting System, National Highway Traffic Safety Administration, U.S. Department of Transportation

APPENDIX D

TYPES OF CHILD RESTRAINT SYSTEMS

Infant Safety Seat

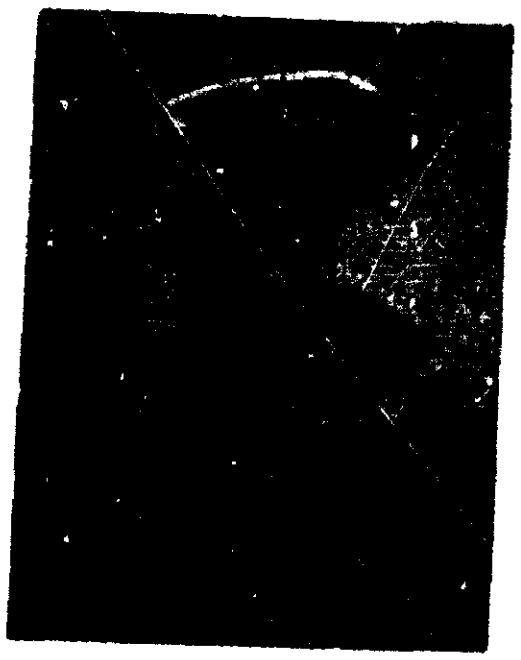
- Infant safety seats are designed exclusively for use by infants from birth until they reach around usually 18 to 20 pounds, depending on the model. Infant safety seats are installed so that the infant is in a semi-reclined position facing the rear of the vehicle so that crash forces are distributed over a broad area of the baby's shoulders, back, and the back of the head.

Toddler Safety Seat

- Toddler safety seats are designed for use by children who weigh more than 17 pounds and can sit up by themselves. The two styles of toddler safety seats include a seat with a large, U-shaped protective shield which does not require use of a safety harness, and an upright seat with either a five-point harness, or a harness and partial protective shield. In both styles of toddler safety seats, the child faces forward. Some toddler safety seats require the use of a top tether strap which provides stability to the seat in a crash; the tether strap must be secured to a rear safety belt if used in the front seat, or to a specially-installed anchor if used in the rear seat. To install the anchor, a hole must be drilled through the rear window shelf and a metal support below the shelf (station wagons or hatchbacks require installation of the anchor in the rear cargo area). If the safety seat manufacturer's instructions require the use of a top tether strap, it must be properly anchored and used or the safety seat may not function effectively to protect the child in a crash.

Convertible Safety Seat

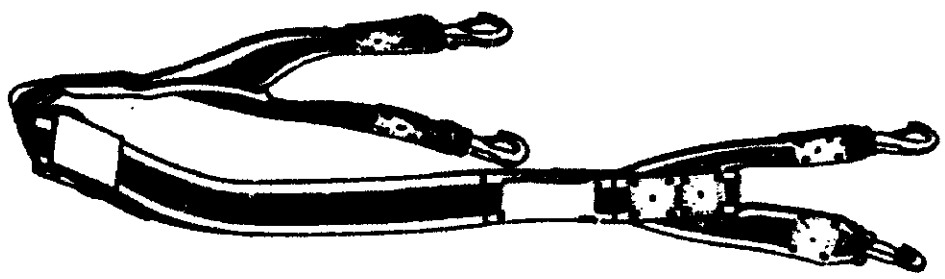
- Convertible child safety seats are designed for use by children from birth up to about 40 pounds. Users must make changes to convert the seat from infant use to toddler use. Convertible safety seats are equipped with a harness, or a protective shield, or both to restrain the child. For infant use, the convertible safety seat is installed with the safety seat adjusted in a proper reclined position facing the rear of the vehicle. For toddler use, the safety seat faces forward. Normally the seat is installed in a full upright position, unless the manufacturer's instructions specify the use of a semi-reclined position for toddlers. With most convertible models, the location for routing the vehicle safety belt through the safety seat frame also must be changed when converting between infant and toddler use, and the safety harness must be rerouted through the correct slots in the seatback near the child's shoulders. Some convertible models require the use of a top tether strap when the seat is used in the toddler configuration.



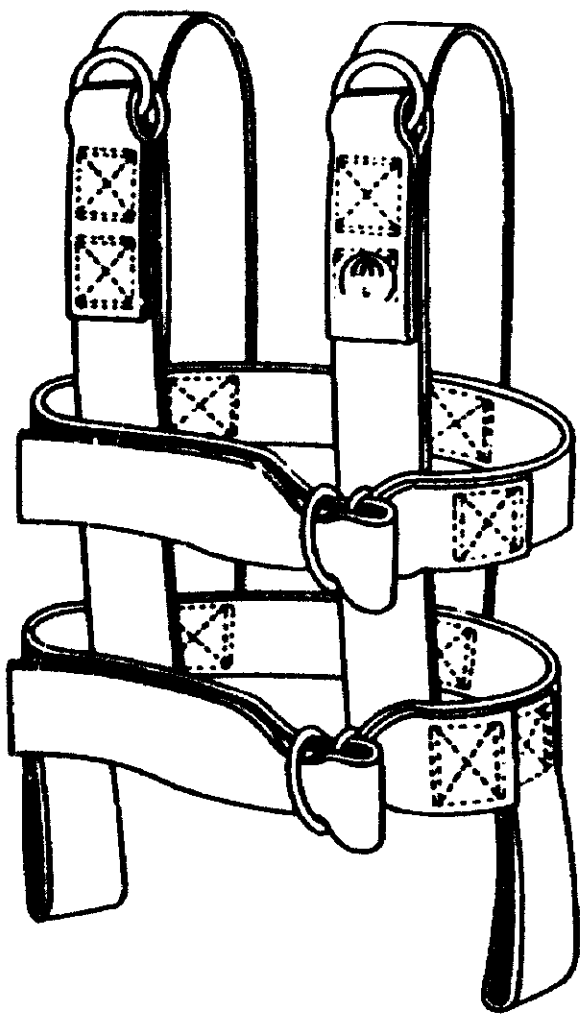
Booster Seat

- Booster seats are designed primarily for use by children who have outgrown conventional safety seats and who weigh as much as 65 pounds, although some booster seats can be used for children weighing as little as 20 pounds. Booster seats are constructed as a raised platform for the child to sit on, and are designed to permit placement of an adult lap belt over the child's thighs, rather than around the waist or abdomen. A booster seat also permits proper placement of an adult shoulder belt across a child's chest, rather than across the neck or face when used in the front seat of the vehicle. Booster seats may be used in the rear seat with both a lap-type safety belt and a special safety harness provided by the manufacturer. The safety harness must be anchored to the vehicle in the same manner as a top tether strap to function effectively. Some booster seat models may also have an adjustable back support; one booster seat model is equipped with a detachable safety shield (rather than a safety harness) which must be used.

- The safety harness is designed for use by toddlers. It was designed originally for handicapped children, but is now available for general use. The safety harness must be anchored to the vehicle in the same manner as a booster seat harness or a top tether strap. It is used in conjunction with a vehicle safety belt and is worn with the child seated on the vehicle seat cushion.



- Handicapped child safety seats are designed much like toddler models but are larger, to accommodate children weighing up to 80 pounds. These safety seats are designed for use by handicapped children who cannot sit up unaided. Some models are equipped with adjustable head pads for use with children who have a muscle control disability.



Safety Harness

APPENDIX E

CASE SUMMARIES

Investigations of 53 Accidents Involving Infants and Small Children
(Case Summary Organization)

I. **Investigations of Accidents Involving Unrestrained Infants and Small Children**

- A. Accidents Involving Lap-Held Children
- B. Accidents Involving Ejection
- C. Noncrash Incidents
- D. Other Accidents Involving Unrestrained Children

II. **Investigations of Accidents Involving a Household Infant Carrier or Home Booster Chair Not Designed for Motor Vehicle Crash Protection**

III. **Investigations of the Use and Crash Performance of Child Safety Seats**

- A. Accidents Involving Proper Use of Child Safety Seats
- B. Accidents Involving Misuse of Child Safety Seats
  - 1. Protection Adequate Under Specific Misuse Conditions and Accident Circumstances
  - 2. Protective Function Reduced or Negated by Misuse

IV. **Investigations of the Use and Crash Performance of Safety Belts By Infants and Small Children**

2. Investigations of Accidents Involving Unrestrained Infants and Small Children

A. Accidents Involving Lap-Held Children

Case 1

NTSB Investigation No.: NYC82HCR05
Accident Date: July 27, 1982
Accident Location: Addison, New York

Circumstances: About 5:15 p.m., a 1971 Dodge Polaris sedan occupied by three adults and two infants was traveling about 51 mph on a two-lane State Route during rain when it crossed the centerline while negotiating a curve on the wet pavement and collided head-on with an oncoming 1981 Ford Futura sedan traveling about 40 mph. All five occupants of the Dodge were riding in the front seat, unrestrained. The two infants, ages 5 months and 15 months, each were being held in the lap of one of their parents in the center front and right front seating positions.

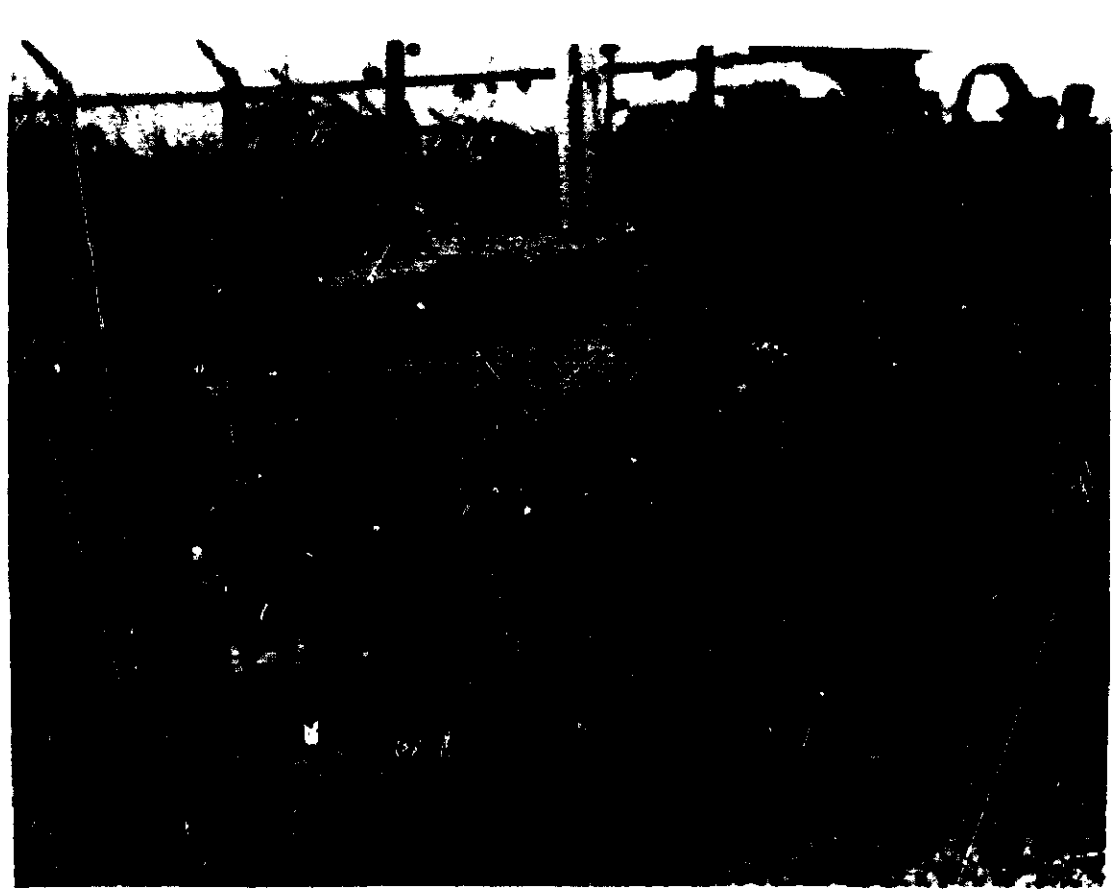
Impact Severity: Severe (ΔV - 34 mph long.)

Consequences: On impact, all occupants of the Dodge were propelled forward. The two infants were crushed into the dashboard by the weight and acceleration of their parents' bodies and received massive, fatal head injuries. The three unrestrained adult occupants survived with moderate injuries. The two unrestrained adult front seat occupants of the Ford were fatally injured and one unrestrained adult rear seat occupant survived with serious injuries.

Survivability: Proper use of child safety seats probably would have prevented fatal injuries to the two infants.

Note: The parents of the two infants were in the low-income bracket, did not own a motor vehicle, and did not hold a driver's license. They traveled in a motor vehicle only occasionally, with friends, and did not own child safety seats. They were not aware of any safety seat loan programs in their vicinity.

Case 2



NTSB Investigation No.: MKC83HCR02
Accident Date: November 2, 1982
Accident Location: Austin, Texas

Circumstances: About 5:30 p.m., a 1974 Subaru station wagon was traveling about 37 mph on a four-lane street when an oncoming 1968 Ford LTD sedan traveling about 57 mph in the 35-mph speed zone crossed the centerline and collided head-on with the Subaru. The Subaru was occupied by a young couple and their 5-week-old son, all of whom were unrestrained in the front seat. At the time of the accident, the mother was in the right front seat, semi-reclined toward the center of the vehicle, and was holding and nursing the infant.

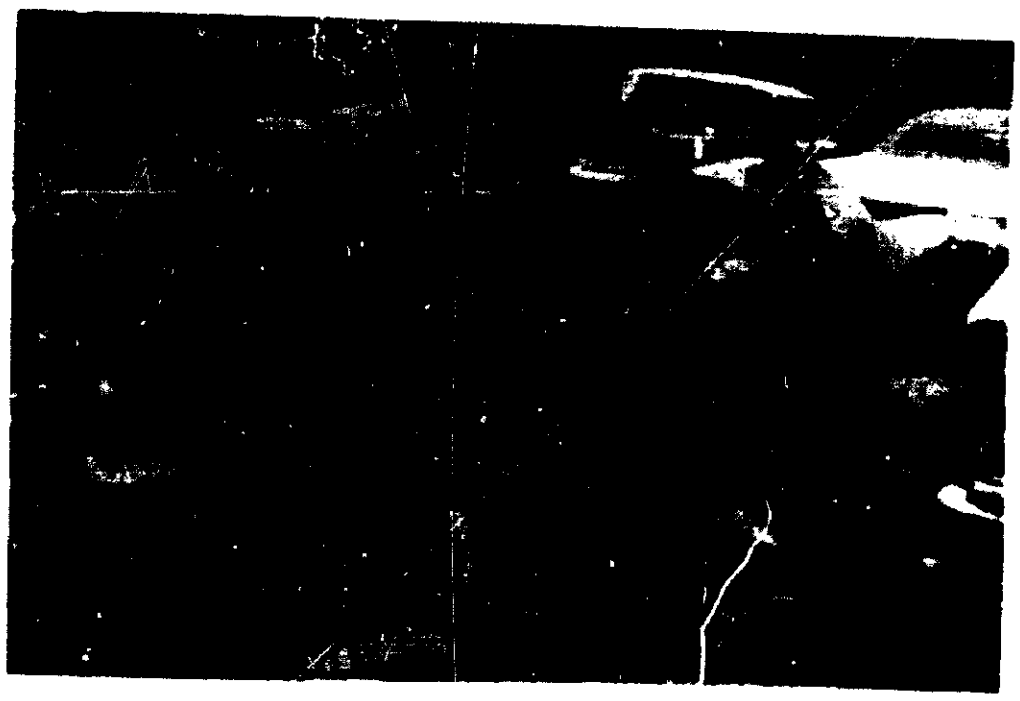
Impact Severity: Moderately severe.

Consequences: On impact, the occupants of the Subaru were thrown forward and the infant was crushed into the instrument panel by the weight and acceleration of his mother's body. The infant sustained massive, fatal head injuries. The unrestrained father was seriously injured and the unrestrained mother received moderate injuries. The unrestrained 20-year-old driver of the Ford, who was tested and found to have a blood alcohol level of .12 percent and was charged with negligent manslaughter, received bruises on both lower legs.

Survivability: Proper use of a child safety seat probably would have prevented fatal injury to the infant. However, the infant's safety would have depended upon his remaining properly secured in a safety seat and his feeding either being delayed, or accomplished with both mother and infant properly restrained, or accomplished with a bottle feeding in the safety seat.

Note: The parents of the infant change residence frequently. They considered obtaining a safety seat from a loan program in their previous State of residence, but they did not because they were moving to Austin. They said that since they had not been able to find a loan program in Austin they were going to purchase a safety seat, but had not gotten around to doing it before the accident occurred. The investigation found three hospitals in the Austin area which operate State-funded infant safety seat loan programs and a fourth hospital that had plans to start a loan program. Eligibility to participate in the loan programs was restricted to families of infants born in the maternity wards of the hospitals operating the programs.

Case 3



NTSB Investigation No.: NYC82HCR07
Accident Date: September 4, 1982
Accident Location: Winston-Salem, North Carolina

Circumstances: About 4:10 p.m., a 1979 Pontiac Bonneville sedan occupied by a middle-aged couple and their 8-month-old granddaughter was traveling on a 2-lane State Route approaching an intersection with a U.S. Route. At the same time, a 1971 Oldsmobile Cutlass sedan was traveling on the U.S. Route and was approaching the same intersection from the Pontiac's left side. Although the intersection was controlled by traffic signals, both vehicles entered the intersection simultaneously and the Oldsmobile struck the left side of the Pontiac. The three occupants of the Pontiac were unrestrained. The grandfather was driving and the grandmother was in the right front seating position holding the infant on her lap.

Impact Severity: Moderate ($\Delta V = -7$ mph long., + 18 mph lat.)

Consequences: On impact, the occupants of the Pontiac were thrown leftward and forward. The infant was thrown from her grandmother's arms and collided violently with the instrument panel, causing fatal head injuries. The grandmother received fatal head injuries from contact with the gear selector lever, and the grandfather received fatal chest injuries from contact with the steering wheel and with the driver's door as it intruded inward under impact. The 23-year-old driver of the Oldsmobile escaped with minor injuries. Police cited him for driving while intoxicated, speeding, and failure to obey a traffic signal, and he was charged with three counts of manslaughter. The accident occurred moments after the Oldsmobile driver collided with a motorcycle approximately 800 feet west of the intersection.

Survivability: Proper use of a child safety seat probably would have prevented fatal injury to the infant resulting from contact with the vehicle interior, especially in the center rear seating position recommended for infants and small children. However, in the front seat, the movement of the unrestrained adult occupants probably would have presented an additional injury hazard even if the infant were properly restrained.

Notes: A Questor Juvenile Furniture Co. "Dyn-O-Mite" infant safety seat that was being carried loose and unused in the rear seat area of the Pontiac was found lying on the ground near the left side of the Pontiac, where it was ejected during the accident.

The North Carolina child passenger protection law had been in effect for more than 2 months when this accident occurred. The law requires that every driver required to have a North Carolina driver's license, when transporting his or her own child under 2 years old and operating his or her own motor vehicle, have such child properly secured in a child safety seat (with a safety belt option for children who are 1 year old). Although the grandparents involved in this accident had a child safety seat in their car, they were not required by law to use it with their infant granddaughter since she was not their child.

There was no damage to the unused safety seat in the accident. However, the instruction label was missing; only a residue of glue remained where the label had been located. The parents also owned another safety seat (a Strolee convertible model) which was missing the instructions when they purchased it second-hand; they had never used it with the infant because it looked "too big" and they were not aware that the seat is designed to convert for use by either an infant or a toddler.

Case 4

NTSB Investigation No.: NYC82HCR08
Accident Date: September 27, 1982
Accident Location: Clinton, Maryland

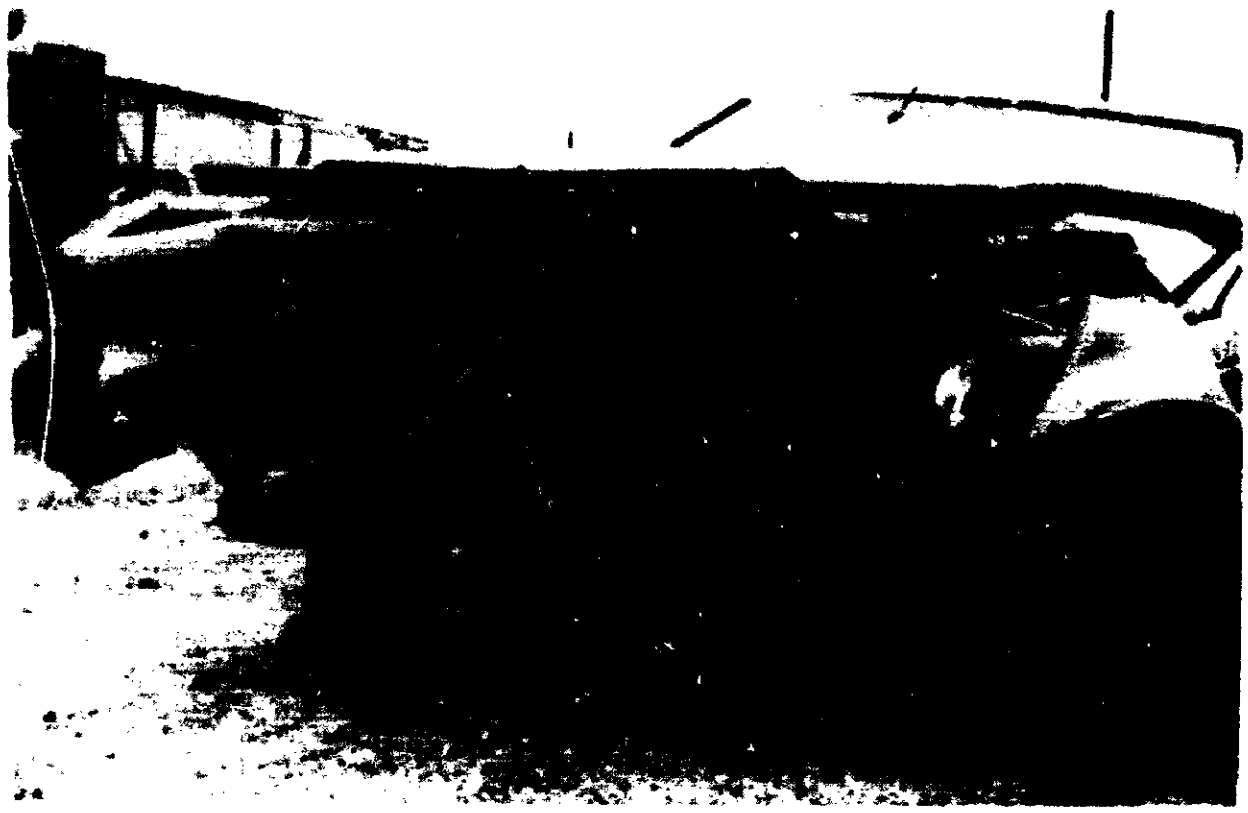
Circumstances: About 6:55 p.m., a 1977 Pontiac Grand Prix sedan occupied by two adults and a 1-year-old child was traveling southbound on a four-lane State Route in Clinton, Maryland. The child's mother was holding the child on her lap in the right front seating position and none of the three occupants was restrained. When the driver of the Pontiac began to make a left turn at an intersection, the driver of an approaching northbound 1982 Ford Fairmont sedan traveling about 79 mph attempted to stop, but the Ford began skidding and crashed into the Pontiac's right side.

Impact Severity: Severe (Δ V = +28 mph lat.)

Consequences: On impact, the mother and child were struck by the intruding right side door and were propelled leftward while the driver was simultaneously propelled to the right, toward the point of collision impact. The three occupants collided with each other and with the vehicle's interior, causing multiple fatal injuries to all three. (Injuries to the driver of the Pontiac also included noncontact injuries from impact forces.) The driver of the Ford, who was wearing a lap/shoulder safety belt, received moderate injuries (a fractured nose and facial lacerations from contact with the steering wheel).

Survivability: The right front seating position of the Pontiac was nonsurvivable due to severe intrusion. Proper use of a child safety seat in the recommended center rear seating position probably would have prevented serious or fatal injury to the child. The right rear seating position was affected by intrusion but the accident may have been survivable for a properly restrained occupant based on accidents involving similar intrusion in which a child in a safety seat survived.

Case 5



NTSB Investigation No.: ATL83HCR02
Accident Date: December 25, 1982
Accident Location: Houston, Texas

Circumstances: Shortly before 9 p.m., a family group of seven people (four adults and three children) were traveling in an automobile from a relative's home in Houston en route to their home in Hitchcock, Texas, about 50 miles away. It was dark and raining, and the roadways were wet. The family had traveled to Houston earlier in the day to have Christmas dinner with relatives. About 9 p.m., the vehicle was traveling on an eight-lane section of an Interstate Freeway in Houston when the driver lost control of the vehicle on wet pavement. The car began rotating clockwise, striking a guardrail first with the front end, then with the rear bumper, before coming to rest. The occupants of the 1978 Buick LeSabre sedan included the driver, an 8-month-old infant riding in her grandmother's lap in the right front, a 9-month-old infant seated on her mother's lap in the right rear, a 2-year-old in the center front, and the mother of the 8-month-old infant in the left rear.

Impact Severity: Minor to moderate.

Consequences: On impact the occupants were thrown forward and to the right. The adult in the left rear and the 2-year-old in the front center were not injured. The driver received minor injuries. The lap-held infant in the right rear was propelled into the rear of the front seatback and received minor injuries, and her mother received moderate injuries probably from contact with the rear of the front seatback and the interior side of the right rear door. The lap-held 8-month-old infant in the right front was crushed into the instrument panel by the weight and acceleration of his grandmother's body and received fatal head injuries. The grandmother was cushioned by the infant and received only minor injuries.

Survivability: Proper use of child safety seats probably would have prevented any injury to the two infants; however, in this case, the vehicle was loaded beyond its occupant seating capacity. Under these conditions, only six of the seven occupants could have been restrained.

Note: The grandmother who was holding the infant in the right front said that the fatally-injured infant was still in her arms when the vehicle came to rest.

Case 6

NTSB Investigation No.: DCA83HCR05
Accident Date: November 28, 1982
Accident Location: Beach Lake, Pennsylvania

Circumstances: Shortly after 5 p.m., a family of four was traveling in a 1979 Jeep CJ7 eastbound on a two-lane State Route, returning to their home in Beach Lake after a weekend visit with relatives in Maryland. The father was driving the Jeep about 40 to 45 mph in moderate rain. The mother, who was in the right front seat, had recently removed their 5-month-old daughter from her child safety seat as they neared home, and was holding her against her chest. Their 5-year-old son was in the rear seat. About 5:15 p.m., when the family was within a mile or two of home, a 1970 Plymouth Duster traveling westbound about 50 mph lost traction on the wet pavement in a curve and slid broadside across the centerline, into the front of the Jeep.

Accident Severity: Moderate

Consequences: All of the Jeep occupants were unrestrained and were thrown forward on impact. The mother, father, and the 5-year-old boy received minor-to-moderate injuries. The 5-month old infant was crushed into the dashboard by the weight and acceleration of her mother's body and sustained fatal injuries. Two unrestrained passengers in the Plymouth were fatally injured due to severe intrusion at their seating positions, and the driver of the Plymouth was injured.

Survivability: If the 5-month-old infant had been properly protected by a child safety seat, she probably would have survived with little or no injury. However, the consequences to the infant probably would have been the same if she had not been removed from the safety seat just before the accident because the safety seat's protective function had been negated by misuse. It was in a forward-facing position instead of the correct rear-facing position for the infant, and it was wedged between the two front seats and not secured by a safety belt. During the time the seat was in use before the accident, the harness was not fastened and the infant was unrestrained within the seat.

B. Accidents Involving Ejection

Case 7

NTSB Investigation No.: NYC82HCR03
Accident Date: July 26, 1982
Accident Location: Maddox, Maryland

Circumstances: About 12:30 a.m., a 1976 Chevrolet Monte Carlo sedan occupied by a young couple and their 2-year-old daughter, who were returning home from a weekend visit to the child's grandmother, was traveling on a two-lane State Route when the driver failed to negotiate a curve and the vehicle ran off the road. As it left the road, the Chevrolet sideswiped a utility pole and severed a wooden sign post. It then descended a 4-foot embankment and slid on its side before overturning and coming to rest on its wheels in a soybean field.

Impact Severity: Moderate

Consequences: The two unrestrained adults received minor injuries. The 2-year-old girl, who was sleeping unrestrained in the rear seat, was ejected from the vehicle and died of massive head injuries.

Note: The family owned a child safety seat but left it at home when they went to visit the grandmother. The mother said that she probably would have used the safety seat on this trip if the law had required it. (In early 1983, Maryland enacted a child passenger protection law with an effective date of January 1, 1984.)

Case 8

NTSB Investigation No.: DCA83HCR08
Accident Date: November 28, 1982
Accident Location: Herkimer, New York

Circumstances: About 6:25 p.m., a 1982 Oldsmobile Custom Cruiser station wagon was cresting a hill on the New York Thruway when the driver saw the brake lights of

vehicles stopping and colliding on icy pavement ahead and attempted to stop. The station wagon skidded on ice first to the left and then to the right on the slight downgrade and struck the rear of a 1971 Chevrolet Kingswood station wagon with its left side, shattering the Oldsmobile left rear side window. The Oldsmobile was traveling about 27 mph when it struck the Chevrolet which was traveling about 10 mph. The Oldsmobile was occupied by two adults wearing lap/shoulder safety belts in the front seat and their two children, ages 3 years and 5 years, who were sleeping on top of the folded-down rear seatback which formed part of the station wagon's rear cargo area.

Impact Severity: Minor to moderate.

Consequences: The mother and father, wearing lap/shoulder safety belts in the front seat, sustained minor injuries (a strained shoulder for the father and a lower leg strain for the mother). The two children in the cargo area were ejected through the shattered left rear side window, struck the roof and hood of the Chevrolet station wagon, and collided with the pavement. The children slid on the icy downgrade and came to rest on the roadway and shoulder about 50 feet ahead of the vehicles' point of rest. Both children received multiple injuries, including fatal head injuries probably caused when they struck the pavement. The five occupants of the Chevrolet station wagon were uninjured.

Survivability: The two children probably would have survived if they had been properly protected by safety belts in the rear seat, with the seatback locked in its upright position. The 3-year-old girl was 42 inches tall, exceeding by 2 inches the maximum height limitation specified by virtually all child safety seat manufacturers for use of their products (excluding booster seats).

Notes: The family owned a convertible child safety seat which had been used by both children until they had outgrown it.

The New York child passenger protection law went into effect April 1, 1982. At the time of the accident, the law required that all children under 4 years old be properly secured in a child safety seat when transported in passenger motor vehicles registered in New York (except certain excluded vehicles), and that children 4 to 5 years old be properly secured in either safety seats or safety belts. Because of her height, it was virtually impossible for the unrestrained 3-year-old girl who was killed in this accident to be restrained in compliance with the law in a conventional safety seat; the requirements could have been met only by use of a booster seat or by the single safety seat model manufactured at that time which is designed for use by children over 40 inches tall. Her 5-year-old brother, who also was killed in the accident, had used a safety seat until he had outgrown it. He was not restrained, and he was not required by law to be restrained.

Case 9

NTSB Investigation No.:	NYC83HCR10
Accident Date:	July 30, 1983
Accident Location:	Pisgah, Maryland

About 2:55 a.m., a 1979 Ford Mustang, occupied by a 33-year-old driver and her three children, ages 5 months, 13 years, and 15 years, was eastbound on Poor House Road in a rural area of Pisgah, Maryland, when the driver lost control. The Ford swerved off the right side of the road, struck a wood utility pole with the left rear side, and overturned, coming to rest on its left side.

Consequences: The driver and the two teenagers remained in the vehicle; the driver sustained serious injuries, and the teenagers sustained moderate injuries. The 5-month-old girl, who was riding in the arms of the 13-year-old in the right front, was ejected through a side window and was fatally crushed by the vehicle when it overturned.

Impact Severity: Moderate

Survivability: The infant probably would have survived with little or no injury had she been properly protected by a child safety seat.

Note: Shortly before the accident, the baby began crying and was removed from a Questor Juvenile Furniture Co. "Infanseat" household infant carrier in the center rear. The household infant carrier was not designed for motor vehicle crash protection, and neither the carrier nor the infant were restrained by any means during the time she was lying in it.

Case 10

NTSB Investigation No.: LAX83HCR08
Accident Date: December 8, 1982
Accident Location: West Los Angeles, California

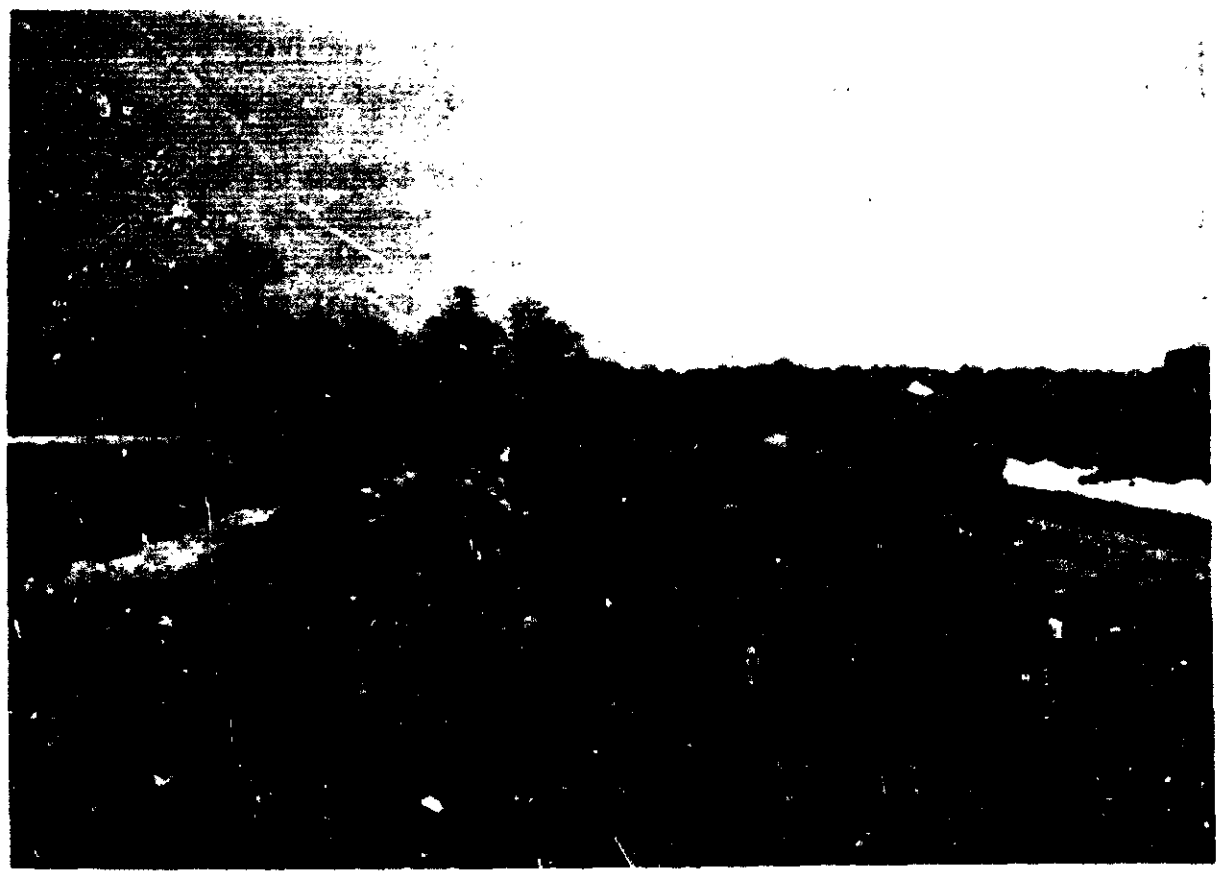
Circumstances: About 3:50 p.m., a 1972 Toyota pickup truck had began negotiating a U-turn on a four-lane boulevard when it was struck in the right rear side by a 1978 Buick sedan and then collided broadside into a parking meter with the point of impact at the center of the pickup's right door. The pickup truck was occupied by the driver and his 3-year-old son, who was seated on the right side of the pickup truck's bench seat.

Impact Severity: Minor

Consequences: The unrestrained driver of the pickup truck, which was not equipped with safety belts, was uninjured. The 3-year-old boy was thrown head-first into the windshield, and then was ejected through the open right window of the pickup truck and collided with the pavement. He sustained serious injuries, including a concussion, a fractured elbow, and facial and lower leg abrasions.

Survivability: If the pickup truck had been equipped with safety belts, proper use of a child safety seat or a safety belt probably would have prevented the ejection of the 3-year-old boy and would have prevented injury or substantially reduced the severity of his injuries.

Case 11



NTSB Investigation No.: MKC83HCR11
Accident Date: March 4, 1983
Accident Location: Mankato, Minnesota

Circumstances: About 10:57 a.m., a 1981 Subaru GLF sedan occupied by two adults in the front seat and two children, ages 2 and 3, in the rear was traveling westbound on a two-lane State Route when it veered onto the right shoulder, then suddenly veered sharply back onto the highway, and crossed the centerline into the opposing lane, colliding head-on with an eastbound tractor-semitrailer.

Impact Severity: Extremely severe (Δ V = -80 mph long., +9 mph lat.)

Consequences: All of the occupants of the Subaru were unrestrained. On impact, the right front passenger and the two children were ejected from the vehicle and the driver was thrown forward, and then rearward into the rear seat. All four occupants were fatally injured.

Survivability: Unknown. Data on the performance of child safety seats in such extremely severe accidents are lacking. The proper use of child safety seats probably would have prevented ejection of the two children and might have enabled them to survive. However, the possibility of survival even if safety seats had been used was compromised by the unrestrained driver being thrown into the rear seat.

See also Case 44.

C. Noncrash Incidents

Case 12

NTSB Investigation No.: MKC83HCR01
Accident Date: October 28, 1982
Accident Location: Mt. Vernon, Kentucky

Circumstances: About 2:30 p.m., a mother, her two children, and their grandmother were returning home after shopping at a local convenience grocery store. The grandmother was driving her 1973 Chevrolet station wagon, the children's mother was seated in the right front, her 4-month-old daughter was properly secured in a child safety seat in the center front, and her 4-year-old son was in the rear. As they drove away from the store, the 4-year-old boy was standing up in the rear and leaning over the front seat, playing with his sister in the safety seat. As the station wagon negotiated a slight left curve just after leaving the store, the 4-year-old boy suddenly fell to the pavement through the right rear door, which opened for undetermined reasons.

Impact Severity: None - noncrash incident.

Consequences: Before the grandmother could stop the station wagon, the 4-year-old boy was run over by the right rear wheel and was fatally injured.

Survivability: The boy, who was fatally injured, was 42 inches tall, 2 inches taller than the maximum height specified by virtually all child safety seat manufacturers for safe use of their products (except booster seats). The use of either a safety belt or a child safety seat would have prevented this accident, in which no other person was injured.

Note: The Kentucky child passenger protection law, which became effective July 15, 1982, requires the proper use of a child safety seat for children 40 inches in height or less when transported by a parent or legal guardian in a vehicle owned by that parent or legal guardian. In this case, the law did not apply because the boy's height exceeded the limit specified by the law and, although the children's mother was present, the vehicle was owned and operated by the children's grandmother.

Case 13

NTSB Investigation No.: LAX83HCR11
Accident Date: December 1, 1982
Accident Location: San Pedro, California

Circumstances: About 7:10 p.m., a 1969 Oldsmobile 98 sedan was traveling southbound about 20 to 25 mph on a two-lane street behind and to the right of another vehicle approaching a stop sign at an intersection. Just before the

intersection, the vehicle ahead began to move across the Oldsmobile's path, toward the right curb. The Oldsmobile driver braked suddenly and successfully avoided a collision.

Impact Severity: None - noncrash event

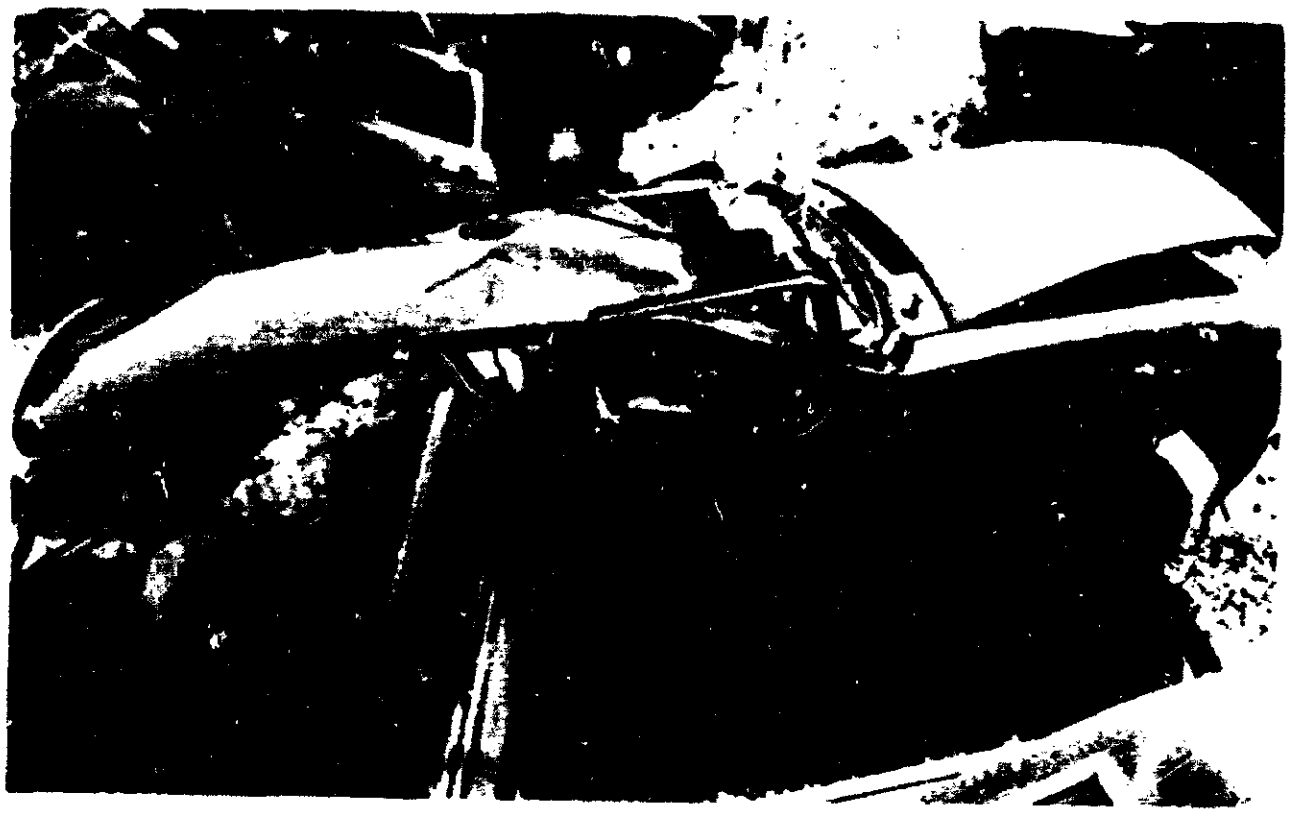
Consequences: Although the Oldsmobile was traveling at a relatively low speed and no crash occurred, the sudden braking and deceleration of the vehicle caused an unrestrained 4-year-old boy in the right front to be propelled into the windshield. The child sustained moderate injuries, including a concussion and multiple cuts and bruises on his forehead. The child's father, also unrestrained, was not injured.

Survivability: Proper use of a child safety seat probably would have prevented any injury to the child.

See also Case 43.

D. Other Accidents Involving Unrestrained Children

Case 14



NTSB Investigation No.: ATL83HCR05
Accident Date: July 20, 1983
Accident Location: Louisville, Kentucky

Circumstances: About 4:17 p.m., a 1966 Datsun occupied by a 22-year-old female driver, her 25-year-old husband in the right front seat, and their 4-year-old son, who was standing on the floorboard in front of the father, was traveling northbound on U.S. Interstate Route 65. The father was changing the child's clothes; none of the occupants was restrained. The 4-year-old boy suddenly fell toward the driver, and the driver lost control of the vehicle. The Datsun ran off the left pavement edge,

crossed a grass median, struck a concrete curb, and vaulted through the air into the southbound lanes, where it collided with a pickup truck and then was struck by a tractor-semitrailer.

Impact Severity: Moderate.

Consequences: The mother, who was ejected from the Datsun, was fatally injured. The father, the child, and the drivers of the pickup truck and the tractor-semitrailer received moderate injuries.

Case 15

NTSB Investigation No.: LAX83HCR13
Accident Date: April 16, 1983
Accident Location: Paramount, California

Circumstances: About 6:55 a.m., a 1974 Chevrolet Chevelle sedan was traveling about 25 mph on a four-lane boulevard when a 1962 Ford pickup truck approaching from the opposite direction attempted to make a left turn across the path of the Chevelle. The driver of the Chevelle braked sharply but collided with the right front of the pickup truck.

Impact Severity: Minor to moderate

Consequences: The Chevelle was occupied by an 18-month-old girl seated in the front seat on the fold-down center armrest, her mother (driving), and her grandmother in the right front. All three occupants were unrestrained and were thrown forward and to the left on impact. The 18-month-old girl struck the windshield with her head, the instrument panel with her chest, and the gear selector lever with her neck, severing the carotid artery. She died within 10 hours after the accident. Her mother, her grandmother, and the driver of the pickup truck received minor injuries.

Note: The California child passenger protection law had been in effect for 3 1/2 months when the accident occurred. The mother and child had traveled by airplane to visit the child's grandmother and had left the child's safety seat at their home. The mother said that she did not anticipate motor vehicle travel for her daughter during their visit, but she decided to drive the grandmother to work on the morning of the accident and brought her daughter with her.

Case 16

NTSB Investigation No.: LAX83HCR06
Accident Date: November 1, 1982
Accident Location: Hollywood, California

Circumstances: About 2:15 p.m., a 1965 Chevrolet pickup truck occupied by a mother and child returning from an outing was descending an 8 to 10 percent grade on a two-lane road when the brakes failed due to rapid loss of brake fluid resulting from sudden failure of deteriorated seals in the brake fluid reservoir. Without braking capability, the pickup truck accelerated downhill to a speed of about 45 mph, and the driver lost control of the vehicle. The truck ran off the right side of the road, knocked down a 35-foot fence adjacent to the road, and collided head-on into a utility pole.

Impact Severity: Moderate

Consequences: The unrestrained 2-year-old girl in the right seating position was thrown into and submarined under the instrument panel. She received moderate facial injuries, including multiple facial cuts, scrapes and bruises, multiple fractures of her upper teeth, and a through-and-through laceration of her upper lip. The unrestrained mother also struck and submarined under the instrument panel, sustaining serious injuries.

Survivability: A Strolee child safety seat was being carried on the pickup truck seat next to the child, but was not used (the pickup truck was not equipped with safety belts). Had a safety belt been available and the safety seat properly used, the child probably would have sustained little or no injury.

Note: The mother, child, and safety seat had been involved in a previous accident investigated by the Safety Board less than 4 weeks before this accident (see Case 51).

Case 17

NTSB Investigation No.: MKC83HCR05
Accident Date: November 27, 1982
Accident Location: Hartford, Kansas

Circumstances: About 11 a.m., a 1973 Oldsmobile Cutlass sedan was traveling on a two-lane State Route when the driver lost control of the vehicle on an icy bridge and it crossed the centerline and was struck in the left side by an oncoming 1978 Ford pickup truck. The Oldsmobile was occupied by three adults in the left front, right front, and left rear seating position, a 1-week-old infant lying on the center of the front seat, and a 3-year-old girl in the right rear. All occupants were unrestrained.

Impact Severity: Moderately Severe (Δ V -25 mph long., +12 mph lat.)

Consequences: On impact, all five occupants of the Oldsmobile were thrown forward and to the left. The unrestrained 1-week-old infant collided with the instrument panel and sustained a fatal head injury. The driver and the left rear occupant received fatal injuries due to intrusion on the left side from impact. The right front occupant received serious facial, abdominal, and knee injuries from contact with the instrument panel and other interior surfaces. The 3-year-old in the right rear received minor to moderate facial and wrist injuries when she was thrown into the rear of the front seatback. The driver of the pickup truck sustained minor injuries.

Survivability: Proper use of child safety seats probably would have resulted in little or no injury to the infant and 3-year-old in this accident.

Notes: This was the 1-week-old infant's first trip in a motor vehicle since his trip home from the hospital 4 days earlier. The local Lyon County Health Department operates an infant safety seat loan program using safety seats provided by the

Kansas Department of Transportation. The Health Department makes the safety seats available at the local hospital where the infant was born through the Department's child home visitors, who visit the patients on the maternity ward on a regular basis.

The parents own a Strolee child safety seat which they had used with their 3-year-old daughter and intended to use with their infant. The safety seat was in storage and the family had not yet taken it out. A household infant carrier was present in the car at the time of the accident but was not being used.

Other accidents involving unrestrained children: See Cases 18, 25, 27, 29, 30, 38.

II. Investigations of Accidents Involving A Household Infant Carrier or Home Booster Chair Not Designed For Motor Vehicle Crash Protection.

Case 18

NTSB Investigation No.: MKC83HCR06
Accident Date: September 7, 1982
Accident Location: Appleton, Wisconsin

Circumstances: About 8 a.m., a 1975 Chevrolet Custom pickup truck driven by a man who was taking his two sons, ages 3 months and 2 years, to the babysitter was struck in the front left side by a transit bus at an intersection. Both vehicles were traveling about 25 mph.

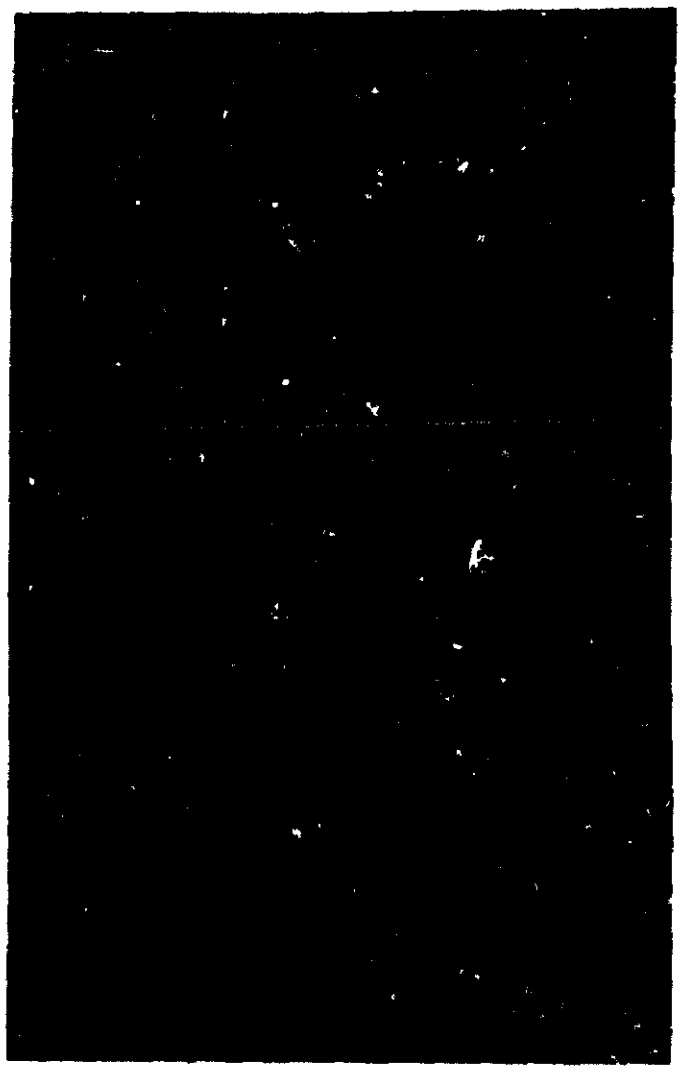
Impact Severity: Moderate

Consequences: The 3-month-old infant was lying in a household infant carrier not designed for motor vehicle crash protection. Both the carrier and the infant were thrown into the instrument panel on impact, resulting in fatal injuries, including multiple skull fracture and brain damage. The 2-year-old boy, unrestrained in the right front, received a minor cut on the chin from contact with the instrument panel. The father, the busdriver, and one bus passenger received moderate injuries and the two other bus passengers were uninjured.

Survivability: Proper use of child safety seats probably would have prevented injury to the infant and 2-year-old.

Note: The family had an infant safety seat which they had borrowed from a safety seat loan program operated by the local Red Cross. The mother and father, who are both employed, had overslept the morning of the accident and, in their hurry to get to work, they did not take the time to transfer the infant from the household carrier to the safety seat.

Case 19



NTSB Investigation No.: DCA83HCR06
Accident Date: December 13, 1982
Accident Location: Reston, Virginia

Circumstances: About 4:15 p.m., a 1970 Pontiac Catalina occupied by a young couple and their 23-day-old baby was traveling on a two-lane State Route when the driver suffered a sudden coronary occlusion and was incapacitated. The Pontiac veered out of control off the right side of the road into a drainage ditch and struck two trees adjacent to the ditch before coming to rest.

Impact Severity: Minor to moderate

Consequences: The infant was seated in the center front in a household infant carrier that was wedged between the front seatback and the instrument panel. During the impact, the carrier was dislodged, and the infant was ejected from the carrier, received minor facial injuries from contact with the instrument panel, and was found lying on the floor under the glove compartment. The unrestrained mother in the right front sustained minor injuries. The unrestrained driver received minor impact injuries but died as a result of the coronary occlusion he suffered immediately before the accident.

Survivability: Proper use of a child safety seat designed for motor vehicle crash protection probably would have prevented any injury to the infant.

Case 20

NTSB Investigation No.: MKC82HCR01
Accident Date: July 28, 1982
Accident Location: Kansas City, Missouri

Circumstances: About 11:20 a.m., a 1974 Chevrolet Monte Carlo occupied by a young couple and their 2-month-old baby was stopped in the left southbound lane of a four-lane avenue, waiting to make a left turn, when a 1972 Oldsmobile Vista station wagon collided into the rear end of the Chevrolet.

Impact Severity: Minor

Consequences: The 2-month-old infant was strapped into a rear-facing household infant carrier with the carrier's lap strap, and the carrier was in the center front seating position with the vehicle's safety belt fastened around both the carrier and the infant within it. The carrier remained in place, and the infant remained in the carrier and was not injured. His mother and father, both unrestrained in the right front and left front seating positions, respectively, received minor injuries. The driver of the Oldsmobile station wagon also received minor injuries.

Survivability: Although the carrier's use in this case left a potential for ejection and/or failure of the carrier structure and lap strap, under the relatively minor forces involved in this accident, with the front seatback partially restraining the carrier, and with the safety belt providing restraint to both the carrier and the infant, this combination of circumstances provided minimal but sufficient protection against injury to the infant under the conditions involved in this accident. Under other accident conditions, such as a frontal or lateral impact, or greater impact forces, there would be significant potential for failure or collapse of the carrier under stress.

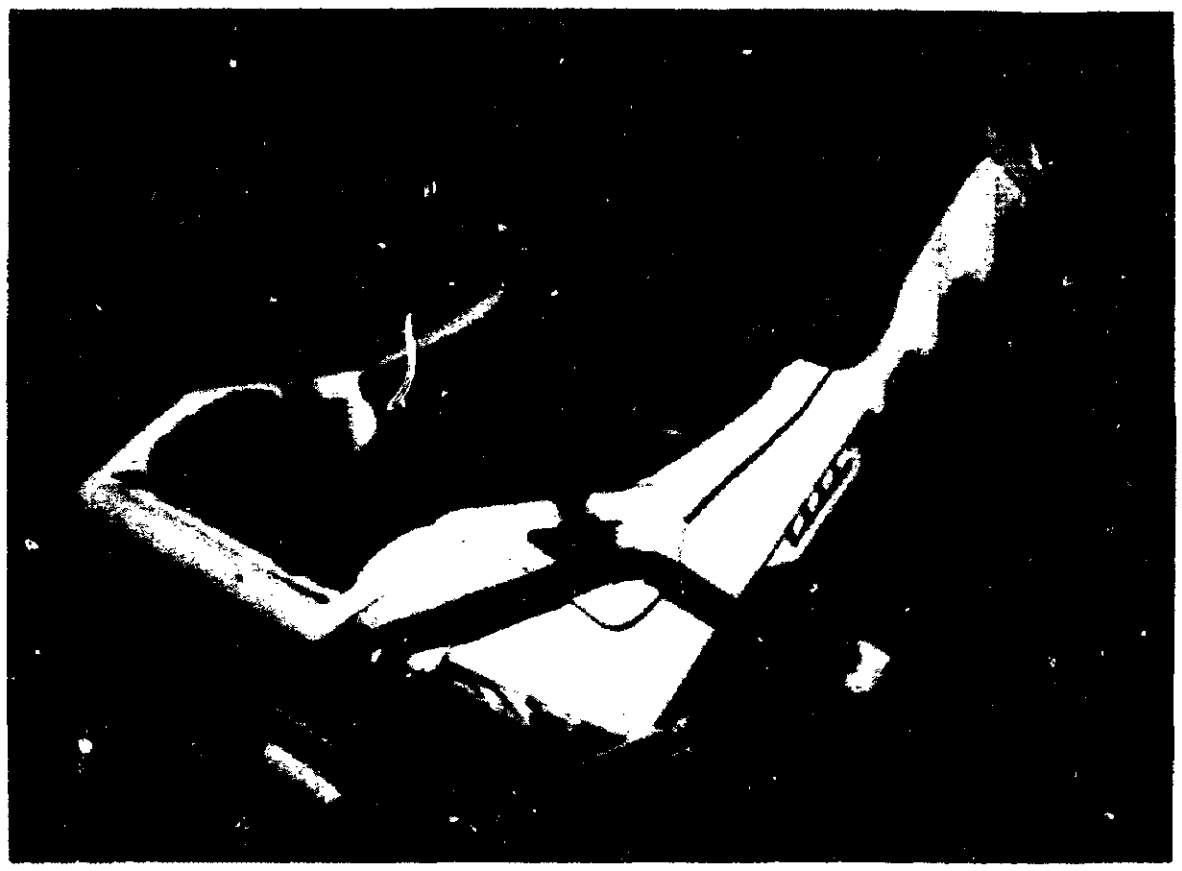
Note: The infant carrier involved bore a warning label that stated: "Not for Use as a Car Seat." As a result of contact with a Safety Board accident investigator during the investigation of this accident, the family obtained a child safety seat designed for proper motor vehicle crash protection.

See also Case 40.

III. Investigations of the Use and Crash Performance of Child Safety Seats

A. Accidents Involving Proper Use of Child Safety Seats

Case 21



NTSB Investigation No.: MKC83HCR03
Accident Date: August 17, 1982
Accident Location: Shawnee, Oklahoma

Circumstances: About 8:10 p.m., the driver of a 1982 Subaru GL station wagon occupied by a family group en route to a local restaurant lost control of the vehicle, and it crashed into the brick wall of a building at a speed of approximately 30 mph. The driver and three adults in the rear seat were unrestrained; a 3-month-old boy was properly restrained in a rear-facing child safety seat in the right front bucket seat.

Impact Severity: Moderately Severe ($\Delta V = -23$ to -28 mph long.)

Child Safety Seat: Bobby-Mac Champion (Collier-Keyworth Co., 4/29/82)

Consequences: Rescue crews took approximately 30 minutes to cut into the car and extricate the four seriously injured adults. After the adults were removed, rescue personnel discovered a 3-month-old boy contentedly playing in a child safety seat in the right front. The baby's father, who was driving, received severe injuries, including brain surface contusion, extensive facial fractures and lacerations, a

crushed chest with all ribs fractured, and the collapse of both lungs. The baby's mother, in the center rear, received severe injuries, including a ruptured spleen, compound fractures of the left forearm, a fractured elbow, and a fractured wrist. The baby's 27-year-old uncle in the left rear received serious injuries, including a fractured skull, a compound fracture of the right arm with nerve damage, and a dislocated ankle. The baby's 21-year-old uncle in the right rear, who was studying to be a pianist, received serious injuries, including fractures of both arms and a fractured vertebra, which left him paralyzed from the shoulders down. The only injury to the baby in the child safety seat was a small bruise on the forehead which disappeared the morning after the accident.

Survivability: As a result of the proper use of a child safety seat, the 3-month-old boy was virtually uninjured. If he had not been restrained, he probably would not have survived the crash.

Note: As a result of the rear of the safety seat contacting the dashboard during impact, the top of the child safety seat was displaced slightly to the left, the rear adjustment bar was bent, and a right locking hook for the rear adjustment bar was broken off.

Case 22

NTSB Investigation No.: NYC83HCR022
Accident Date: November 1, 1982
Accident Location: Apopka, Florida

Circumstances: About 4:45 p.m., a 1969 Chevrolet Camaro sedan occupied by a 21-year-old driver and her 3-week-old son was traveling southbound on Piedmont-Wekiwa Road negotiating an S-curve during light rain, when an oncoming 1981 Chevrolet Z28 sedan crossed the centerline in the curve and struck the Camaro head-on. The mother was unrestrained; the 3-week-old boy was properly secured in a rear-facing child safety seat in the right front of the Camaro.

Impact Severity: Moderately Severe ($\Delta V = -23$ mph long.)

Child Safety Seat: General Motors Infant Love Seat (3/81)

Consequences: The unrestrained mother received moderate injuries, including a fractured nose, shattered kneecap, contusions of the head, chest, and lower leg and facial lacerations. The unrestrained driver of the Z28 also received moderate injuries. The 3-week-old boy in the child safety seat was not injured.

Survivability: The proper use of a child safety seat prevented any injury to the 3-week-old boy. If he had not been restrained, he probably would not have survived the crash.

Note: This was the infant's first trip in the child safety seat, which was purchased 2 days before the accident.

Case 23

NTSB Investigation No.: LAX83HCR03
Accident Date: October 9, 1982
Accident Location: Woodland Hills, California

Circumstances: About 10:10 a.m., a 1975 Datsun F-210 occupied by a 34-year-old driver and her 2-year-old son was traveling northbound on Corbin Avenue at about 35 mph and was approaching the intersection with Roscoe Boulevard, where the traffic signals were not functioning due to a power outage. As the Datsun proceeded into the intersection, it was struck in the left front by an eastbound vehicle. The driver of the Datsun was restrained by a lap/shoulder safety belt and the 2-year-old boy was properly secured in a forward facing child safety seat in the left rear.

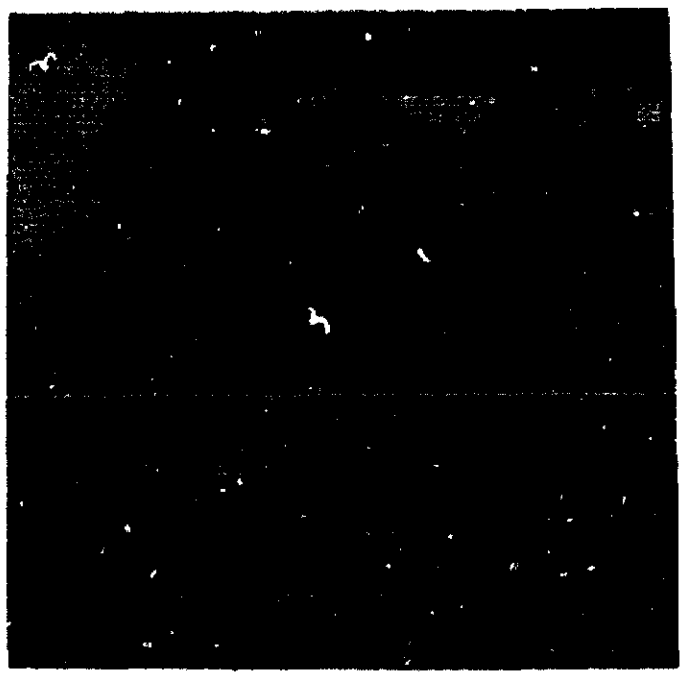
Impact Severity: Moderate

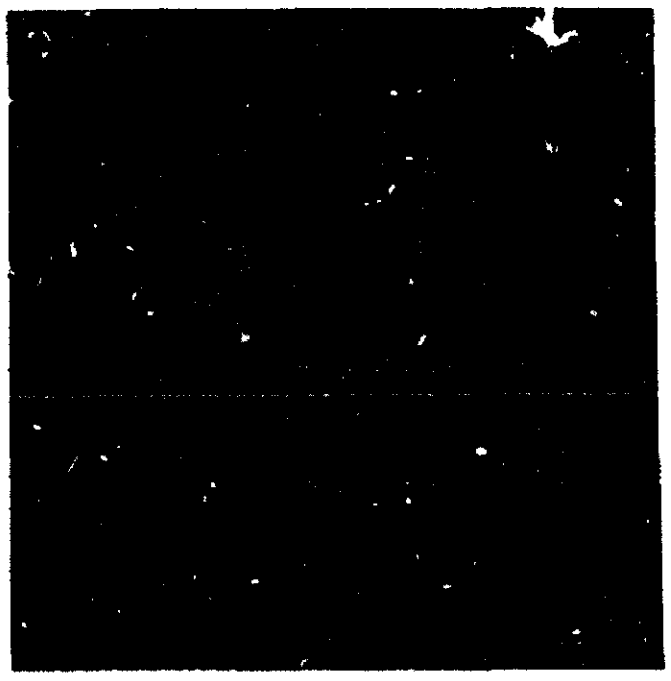
Child Safety Seat: Strolee Wee Care Model 597 (November 1979)

Consequences: The restrained driver of the Datsun received minor injuries. The 2-year-old child in the child safety seat was not injured.

Survivability: The proper use of a child safety seat prevented any injury to the 2-year-old boy. If he had not been restrained, he probably would have received serious and potentially fatal injuries.

Case 24





NTSB Investigation No.: MKC83HCR09
Accident Date: January 18, 1983
Accident Location: Muskegon, Michigan

Circumstances: About 4:20 p.m., a 1978 Datsun F-10 sedan occupied by a 33-year-old driver and her 2-year-old daughter entered an uncontrolled intersection and was struck in the right side by a 1974 Chevrolet Chevelle. The 2-year-old girl was properly secured in a forward facing child safety seat in the right front of the Datsun; the driver was unrestrained.

Impact Severity: Moderate (ΔV = -1.3 mph long., -14.8 mph lat.)

Child Safety Seat: General Motors Child Love Seat (4/8/81)

Consequences: The 2-year-old girl in the child safety seat did not receive any impact injuries, although she was seated at the point of impact. However, she received moderate injury (a deep facial laceration) from broken side window glass. Her unrestrained mother received minor injury. One of the two unrestrained adults in the Chevrolet received minor injury and the other was uninjured.

Survivability: The proper use of a child safety seat prevented any impact injury to the child. If she had not been restrained, she probably would have received serious impact injuries.

Note: The mother had just picked up her daughter from the babysitter after work and was driving to their home, a short distance away when the accident occurred.

See also Cases 12 and 43.

B. Accidents Involving Misuse of Child Safety Seats

1. Protection Adequate Under Specific Misuse Conditions and Accident Circumstances

Case 25

NTSB Investigation No.: MKC83HCR12
Accident Date: February 19, 1983
Accident Location: Near Defiance, Missouri

Circumstances: About 6 p.m., a 1982 Mazda 626 sedan occupied by two adults in the front seat and one adult, a 3-year-old girl, and a 9-month-old infant in the rear seat was traveling northbound on State Highway 94 when the driver saw an oncoming car begin crossing the centerline; the driver of the Mazda steered to the right to avoid a collision. The Mazda, traveling about 45 to 50 mph, ran into a ditch adjacent to the road and rolled over in a cornfield. The two adults in the front of the Mazda were restrained by lap/shoulder safety belts. The 9-month-old infant was riding in a forward-facing child safety seat in the right rear, with the required tether strap missing, and the 3-year-old girl was seated in the center rear position, which was not equipped with a safety belt. As the car left the roadway, a lap-belted adult in the left rear seat reached in front of the child in the center and grasped the frame of the child safety seat in the right rear, thus restraining the center child with her body.

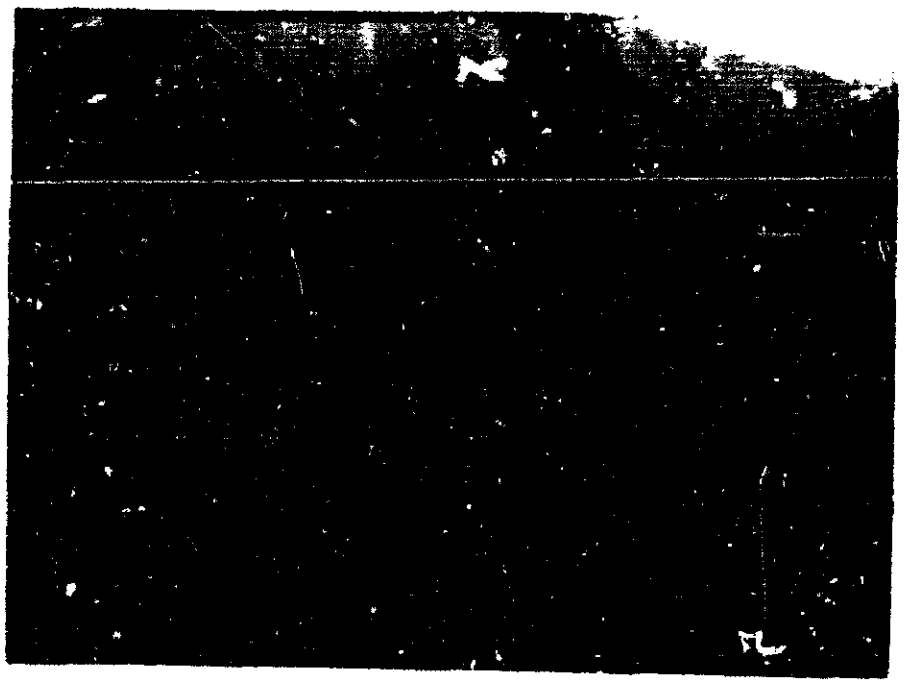
Impact Severity: Moderate

Child Safety Seat: Strolee Wee Care Model 597 (9/79)

Consequences: The two restrained adult front seat occupants received moderate injuries and the lap-belted adult and the 3-year-old girl in the rear seat received minor injuries. The 9-month-old boy in the child safety seat was not injured.

Survivability: Although the child safety seat was misused, it provided sufficient protection under the circumstances of this accident to prevent serious and potentially fatal injury to the infant. The 3-year-old girl was, in effect, restrained by her mother's body, preventing serious injury. The use of safety belts prevented serious injuries to the three adults.

Case 26



NTSB Investigation No.: DCA83HCR04
Accident Date: September 23, 1982
Accident Location: Near Front Royal, Virginia

Circumstances: About 5:20 p.m., a 1976 Chevrolet Corvette occupied by a 36-year-old driver and her 8-month-old son was traveling northbound on U.S. Route 522 at about 50 to 65 mph when the driver lost control in a curve. The Corvette drifted off the right edge of the road, veered back onto and across the roadway, ran off the left edge, then swerved onto the road and collided head-on with a southbound 1973 Dodge pickup truck. The driver of the Corvette was restrained by a lap/shoulder safety belt and the 8-month-old boy was riding in a child safety seat in the right front. The safety seat was rear-facing, although technically the manufacturer's instructions state that a child over 17 pounds should be facing forward.

Impact Severity: Very Severe (ΔV = -39 to -40 mph long.)

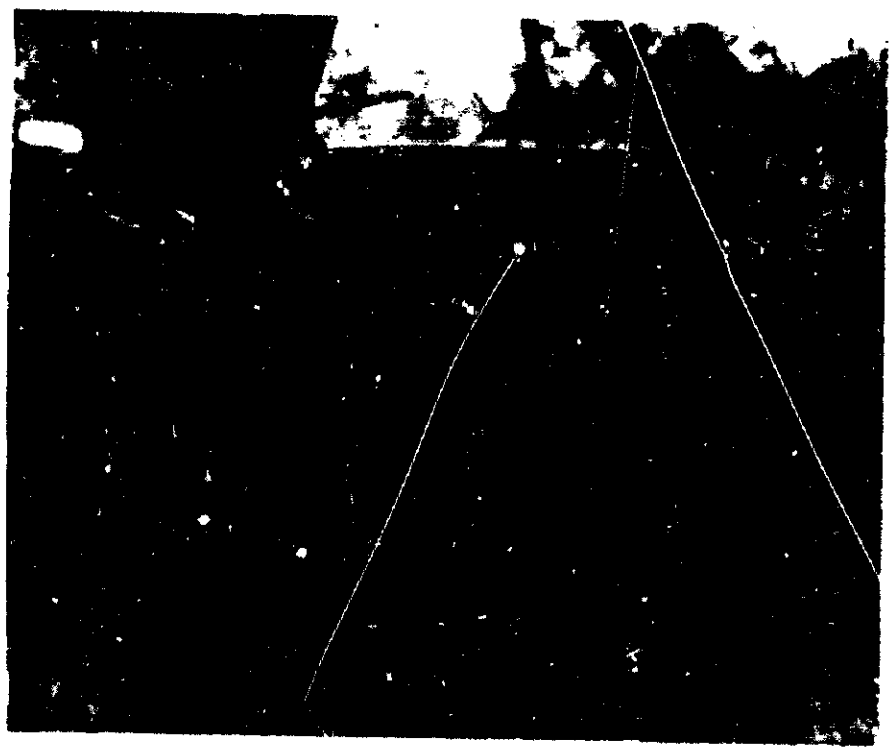
Child Safety Seat: Cosco-Peterson Safe-T-Shield Model 81 A (12/8/80)

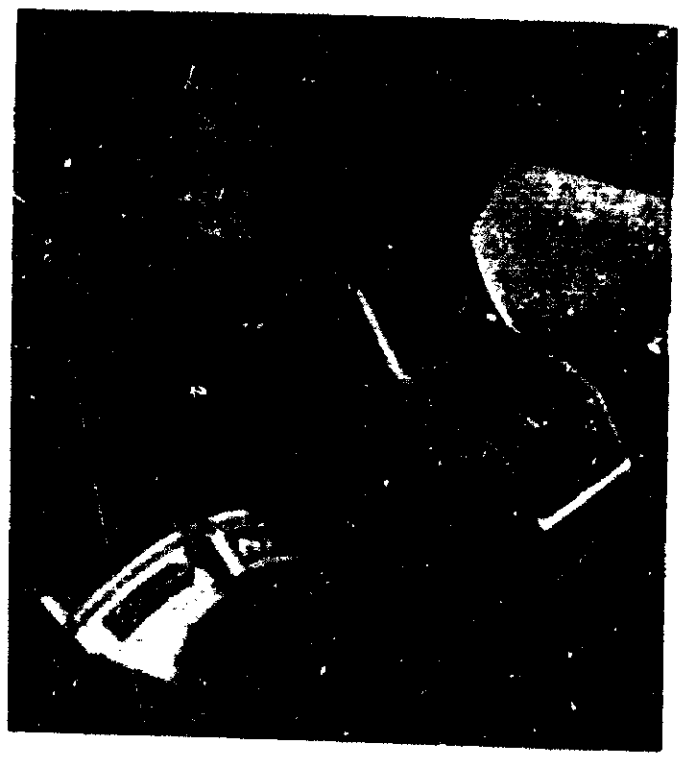
Consequences: The lap/shoulder belted driver of the Corvette received severe injuries. The 8-month-old infant in the child safety seat had a glass fragment in his eye, but no visible injury. Based on a report from relatives that the infant "acted like he was sore" for about 1 week after the accident, he was considered to have received minor injury. The driver of the pickup truck, who was restrained by a lap safety belt, received serious injuries.

Survivability: Although the 8-month-old boy exceeded the maximum weight specified by the manufacturer for use of the safety seat in the rear-facing mode, the safety seat provided excellent protection in this very severe head-on crash. If the infant had not been restrained, he almost certainly would not have survived. The use of safety belts also prevented fatal injury to the drivers of the two vehicles involved.

Note: The baby's mother had 17 years of safety experience as an airline employee and flight attendant, and because aft-facing airline jump seats provide greater safety than forward-facing jump seats, she believed her baby would be safer if the safety seat was used in the rear-facing mode as long as possible. For maximum safety, she always kept the safety seat harness straps adjusted for a snug fit, and 2 days before the accident she had readjusted them to fit very tightly.

Case 27





NTSB Investigation No.: NYC82HCR02
Accident Date: June 28, 1982
Accident Location: Rensselaer, New York

Circumstances: About 1 p.m., a 1974 Volkswagen Dasher sedan occupied by two adults in the front seat and two children in the rear seat was making a left turn to enter the parking lot of a restaurant when it was struck in the right side by a motorcycle. The two adults were unrestrained. A 2-year-old boy was unrestrained in the right rear and a 22-month-old girl was riding in a child safety seat in the left rear. Although the safety seat required the use of a tether strap, a tether anchor was not installed in the vehicle and the tether strap was not used.

Impact Severity: Minor

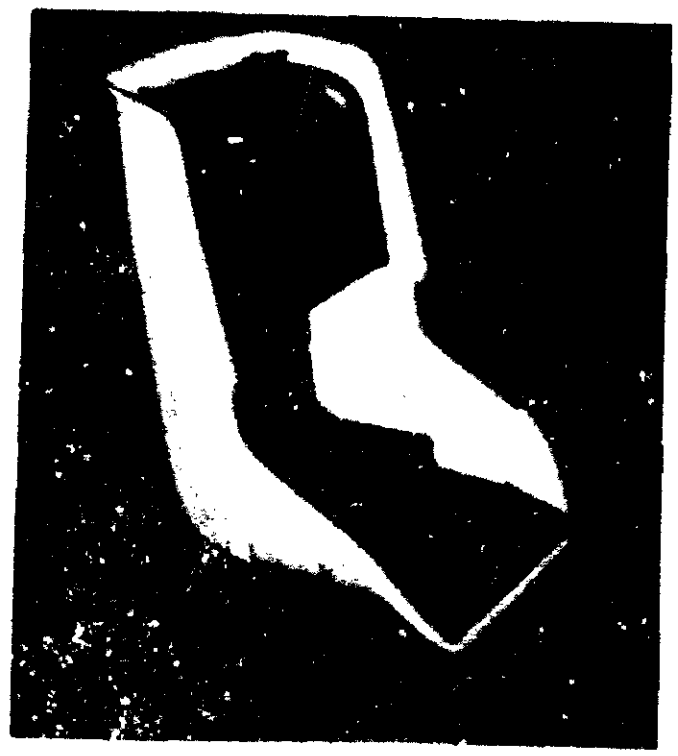
Child Safety Seat: Bobby-Mac Super, Collier-Keyworth Co. (8/1980)

Consequences: The unrestrained driver was not injured and the unrestrained adult front seat passenger received a small cut on the right arm. Although the required tether strap was not used, the 22-month-old girl in the child safety seat received minor cuts from flying glass only. The unrestrained 2-year-old boy in the right rear was found lying across the rear window ledge with fatal injuries, including a broken neck. On impact, he apparently was propelled against the interior right side of the vehicle and then was either thrown into the rear window or was propelled into it by the motorcycle, whose handlebar may have penetrated the right rear window, striking the child.

Survivability: Although the safety seat was misused, it provided adequate protection against impact injury to the 22-month-old girl in the circumstances of this accident. The fatally-injured, unrestrained child probably would not have been injured (except by flying glass) if he had been properly protected by a child safety seat.

Note: The only damage to the child safety seat was a small puncture in the padding from a fragment of flying glass.

Case 28



NTSB Investigation No.: NYC83HCR04
Accident Date: November 19, 1982
Accident Location: Nanuet, New York

Circumstances: About 2:30 p.m., a 1981 Pontiac sedan occupied by a mother and her 2 1/2-year-old son traveling northbound on Route 304 en route to a local toy store was making a left turn when it was struck in the right side by a schoolbus occupied by a driver and 17 high school students. The Pontiac spun and was deflected in a southeasterly direction and struck a median guardrail, where it came to rest. The driver of the Pontiac was unrestrained and her 2 1/2-year-old son was riding in a child safety seat in the left rear. The required tether strap was not used.

Impact Severity: Moderately Severe (ΔV = -15 to -20 mph long., +20 to +25 mph lat.)

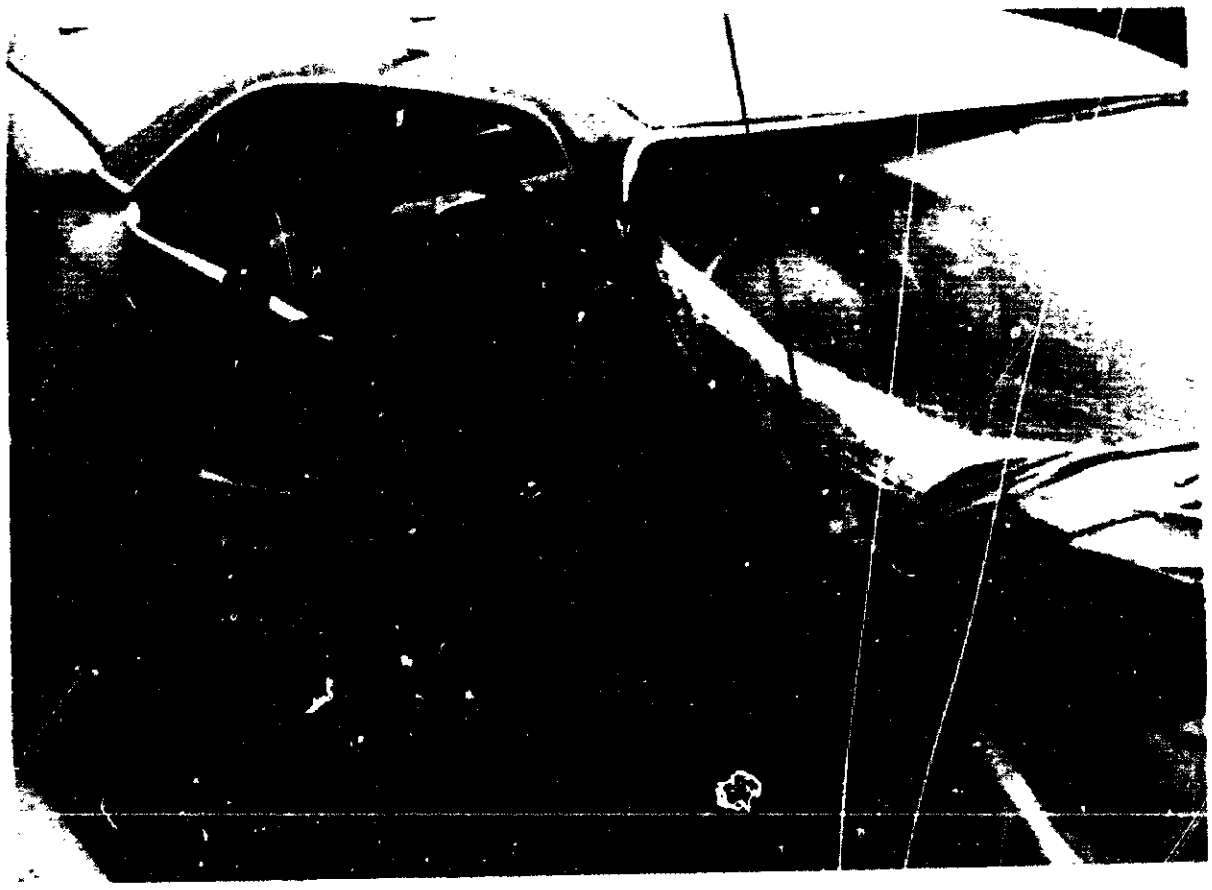
Child Safety Seat: Peterson Safety Products, Safety Shell Model 74 (11/78)

Consequences: Although the safety seat was misused, the child was not injured. The unrestrained mother received fatal head injuries, probably from being propelled across the car into the pillar between the windshield and the right front window. None of the occupants of the schoolbus were injured.

Survivability: Although misused, the child safety seat provided adequate protection in preventing any injury to the child. The nonuse of the type of side tether required with this safety seat had no impact under the circumstances of this accident. When the safety seat is installed in the left rear position, use of the tether strap restrains leftward movement of the safety seat; in this accident, the impact forces would have tended to force the safety seat to the right, toward the point of impact. If the child's mother also had been restrained, she probably would have survived.

Note: The plastic shell of the safety seat was split at the junction of the bottom and left side of the seat due to lateral stress exerted during the collision. At the time of the accident, the safety seat was 4 years old, and most of the instruction label had been torn or worn away.

Case 29



NTSB Investigation No.: LAX83HCR10
Accident Date: January 2, 1983
Accident Location: National City, California

Circumstances: About 4:30 p.m., a 1977 Ford Pinto hatchback occupied by a young couple, their 14-month-old son, and their 51-day-old daughter was traveling about 20 to 25 mph on a two-lane street. The family was en route home from a shopping trip

when, about 150 feet from their home, the Pinto was struck on the right side by a 1981 Toyota pickup truck as the pickup exited an alley at about 45 to 50 mph. The father, who was driving the Pinto, the mother, seated in the right front, and the infant, held in her mother's arms, were unrestrained. The 14-month-old boy was riding in a forward-facing child safety seat in the left rear with the required tether strap tied to the latch of the rear hatchback door instead of being secured properly to a tether anchor installed for that purpose.

Impact Severity: Moderately Severe

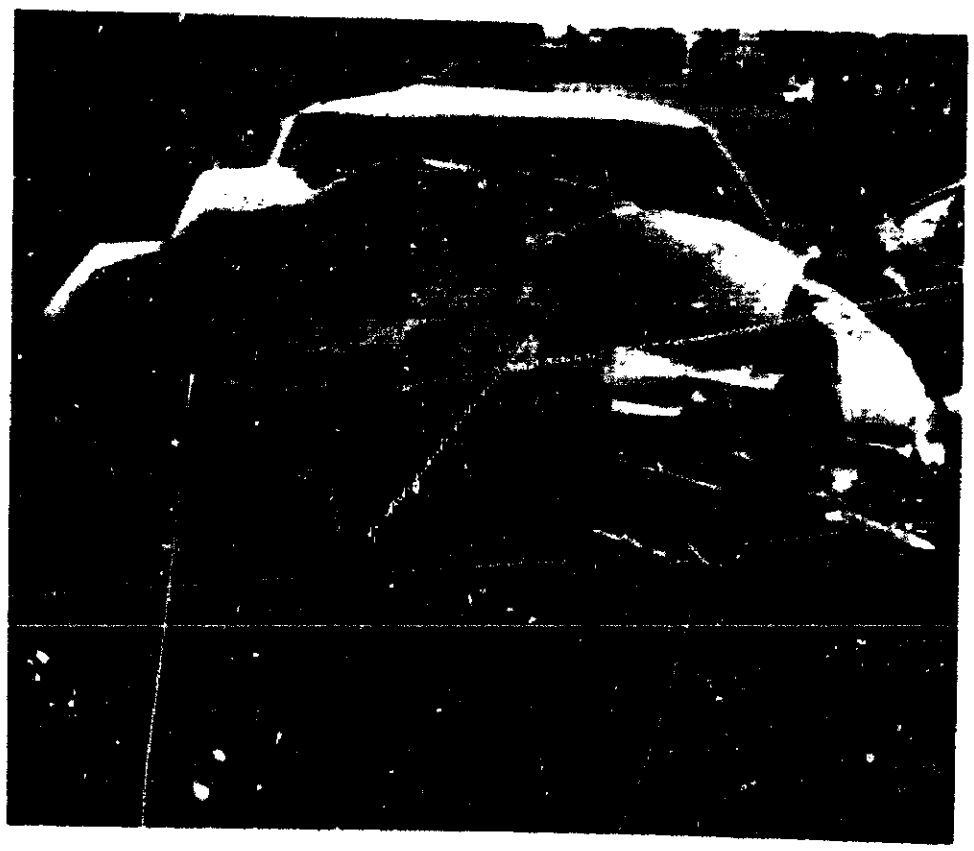
Child Safety Seat: Strolee Wee Care, Model 599 (2/82)

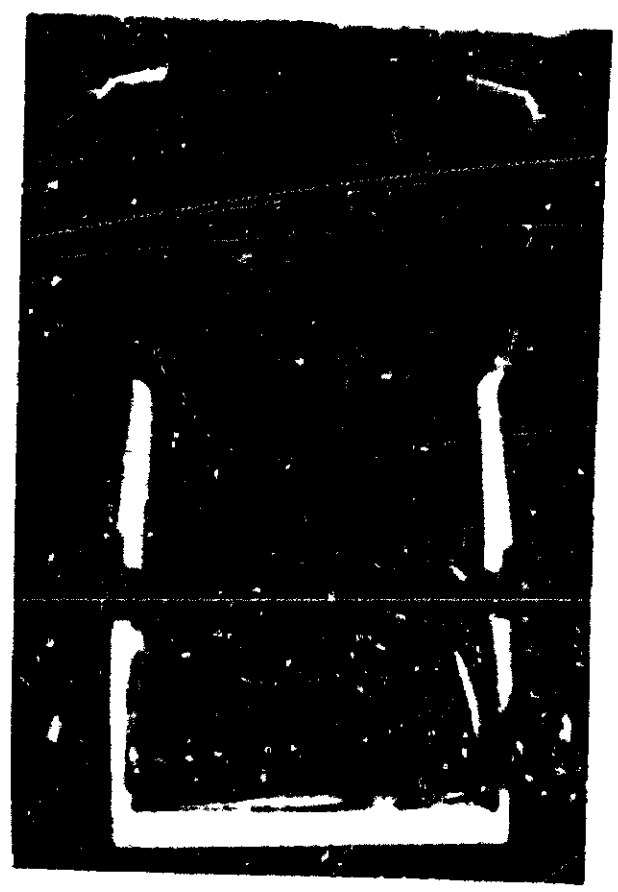
Consequences: The unrestrained father received minor injuries. The passenger compartment was intruded to a depth of 16 inches at the right front seating position, where the unrestrained mother and infant were located. The mother survived with serious head, pelvic, and other injuries. The 51-day-old girl sustained massive head injuries, including multiple skull fractures with severe brain damage, and she died less than 20 hours after the accident. The 2 1/2-year-old boy in the child safety seat was not injured.

Survivability: Although misused, the child safety seat provided sufficient restraint to protect the 2 1/2-year-old boy against any injury in the circumstances of this accident. The 51-day-old girl probably would have survived if she had been properly protected by a child safety seat, especially in the rear seat.

Note: This was the infant's second trip from home in an automobile. As a result of the accident, the driver of the pickup truck was convicted of felony vehicular manslaughter.

Case 30





NTSB Investigation No.: ATL83HCR03
Accident Date: June 5, 1983
Accident Location: Near Bossier City, Louisiana

Circumstances: About 5:40 p.m., a 1966 Chevrolet sedan occupied by a young couple and their 15-month-old and 3-year-old sons was traveling westbound on a two-lane road. The family was returning from a brief Sunday drive about 5 miles away to buy ice cream for the children. At the same time, a 1976 Ford Maverick, occupied by a 25-year-old female driver and a 13-year-old female passenger in the right front returning from a shopping trip to celebrate the driver's birthday, was traveling eastbound on the same road. It was raining heavily and the Ford's windows were fogged, except for a 3-inch strip at the bottom of the windshield that had been cleared by the defroster. As the Ford was negotiating a 90° right curve, it crossed the centerline and struck the Chevrolet head-on. All six occupants of the two vehicles were unrestrained, except for the 15-month-old boy who was riding in the center rear of the Chevrolet in a forward-facing child safety seat. The safety seat was not secured to the vehicle by a safety belt and the required safety shield and most of the safety harness were missing; only the lap strap portion of the harness was in use. A horizontal tubular steel bar running along the width of the safety seat at the bottom rear was extended rearward and wedged between the vehicle seatback and seat cushion to a depth of approximately 5 3/4 inches.

Impact Severity: Moderately Severe

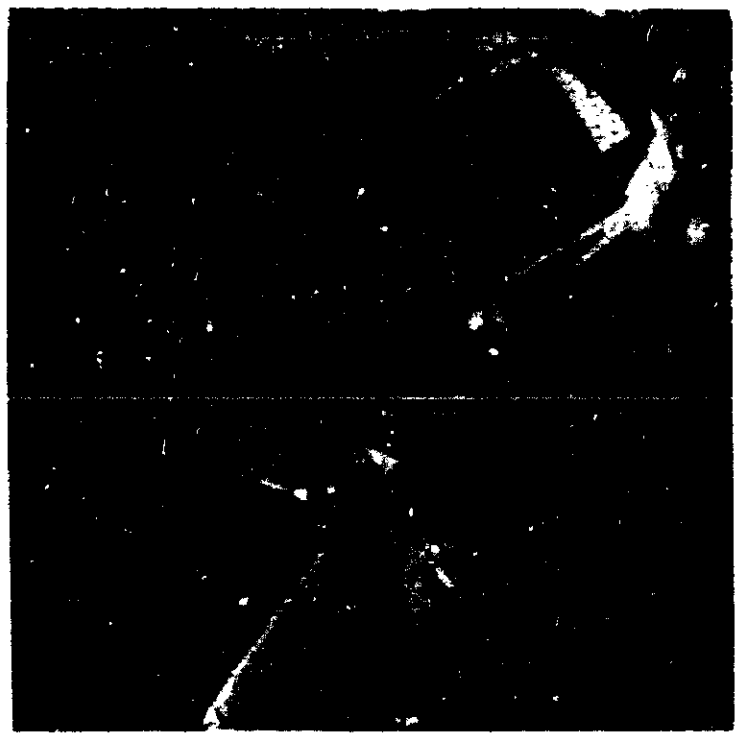
Child Safety Seat: Bobby-Mac Deluxe, Collier-Keyworth Co. (c. 1980)

Consequences: The 15-month-old boy in the child safety seat in the Chevrolet was uninjured. His 3-year-old brother, unrestrained in the center front, was propelled into the instrument panel on impact and received serious injuries, including facial fractures and lacerations. Both parents received serious injuries and the two Ford occupants received moderate injuries.

Survivability: Although the child safety seat was misused, it provided sufficient protection under the accident circumstances to prevent any injury to the 15-month-old boy. The safety seat apparently was held in place during impact by the tubular steel bar extended between the vehicle seatback and seat cushion. Proper use of a child safety seat probably would have prevented injury to the 3-year-old in the Chevrolet, and the use of safety belts probably would have prevented or minimized the injuries received by the unrestrained 13-year-old and the three unrestrained adults involved in the collision.

Note: The child safety seat was purchased new when the 3-year-old boy was an infant and had used by him until the second child was born. It then was used exclusively by the younger child, and the older boy traveled unrestrained. The safety shield and the shoulder strap and crotch strap of the safety harness had been removed and were lost. The instruction label was missing from the rear of the safety seat; the family believed that it came off after being soaked by rain during camping trips.

Case 31



NTSB Investigation No.: DCA83HCR01
Accident Date: November 9, 1982
Accident Location: Manassas, Virginia

Circumstances: About 5:30 a.m., a 1972 Ford Pinto occupied by two adults and a 2-year-old boy was traveling on a two-lane drive when the driver steered to the right to avoid collision with an oncoming vehicle that was crossing the centerline. The right wheels went onto the shoulder, which was 4 inches lower than the pavement edge. On return to the pavement, the Pinto swerved hard to the left. The driver steered hard right and the Pinto ran off the right side of the road at about 37 to 40 mph, vaulted a ditch, struck some bushes, and rolled onto its roof in a ditch 51 feet from the road. The driver and an adult passenger in the right front were unrestrained. A 2-year-old boy was riding in a child safety seat in the left rear. The required tether strap was not used and the safety harness was adjusted loosely.

Impact Severity: Moderate

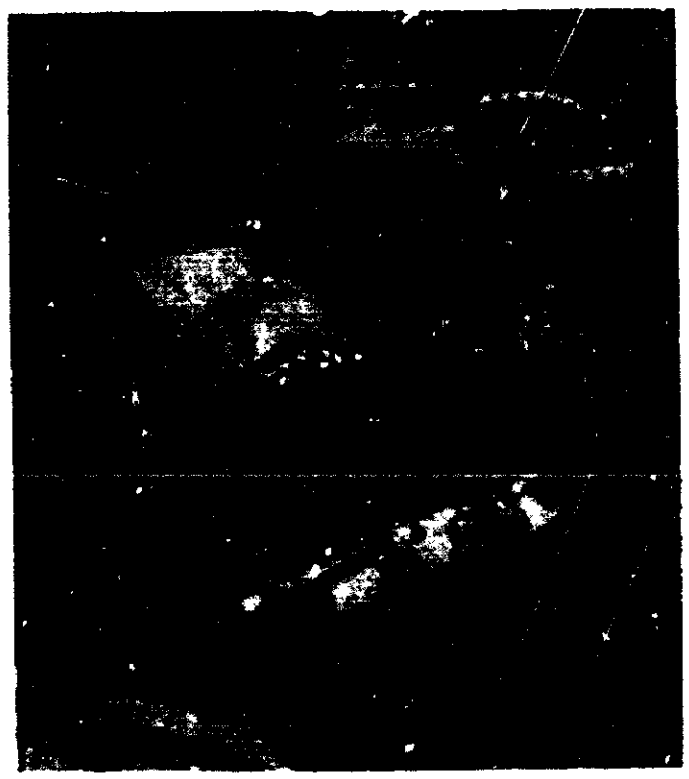
Child Safety Seat: Bobby-Mac Super, Collier-Keyworth Co. (2/80)

Consequences: The two unrestrained adults received moderate injuries. The 2-year-old boy was hanging upside down, still secured in the safety seat in the overturned car after the accident. He was not injured.

Survivability: Although the child safety seat was misused, it provided sufficient protection to prevent any injury to the child. If the child had not been restrained, he probably would have received at least moderate injuries.

Note: The mother purchased the child safety seat after being exposed to public education materials in childbirth classes. She said that the tether anchor was installed in her previous car, and in that car the tether strap was always used. The instruction label cemented to the safety seat was severely wrinkled and difficult to read.

Case 32



NTSB Investigation No.: NYC82HCR06
Accident Date: September 12, 1982
Accident Location: Brentwood, New York

Circumstances: About 1:30 a.m., a 1977 Toyota sedan occupied by two adults and their 9-month-old daughter was traveling southbound about 33 mph on a two-lane County Route en route to their home when a northbound 1970 Chevrolet sedan traveling about 53 mph swerved across the centerline and collided head-on with the Toyota. The infant's father was driving the Toyota, and her mother was in the left rear; both were unrestrained. The infant was riding in a forward-facing child safety seat in the right front. The safety seat was used improperly in a forward-facing reclined position, when it should have been reclined facing rearward based on the infant's weight and height. The safety harness was fastened around the child, but was improperly routed through the upper slots in the safety seat shell, and one shoulder strap was attached to the shield arm with the bib strap. The required tether strap was wrapped around the Toyota's right front seatback, which also was reclined.

Impact Severity: Severe

Child Safety Seat: Strolce Wee Care Model 597 (2/78)

Consequences: The infant's father was fatally injured, the mother was seriously injured, and the unrestrained driver of the Chevrolet received moderate injuries. The infant received moderate injuries, including fractures of the left arm, wrist, and elbow, and a laceration of the forehead.

Survivability: Although the child safety seat was misused, it provided sufficient restraint to prevent more severe injuries to the infant. If the child safety seat had been used properly, the infant probably would have received little or no injury. If she had been unrestrained, she probably would not have survived the crash.

Note: The safety seat was either given by or purchased from a relative without the instruction booklet, and there was no instruction label on the safety seat.

Case 33

NTSB Investigation No.: MKC83HCR07
Accident Date: December 24, 1982
Accident Location: Forest Lake, Minnesota

Circumstances: About 11:08 a.m., a 1969 Ford Thunderbird sedan, occupied by a 25-year-old driver and her 1-year-old daughter, who were en route home after doing some shopping, attempted to make a left turn from 8th Avenue onto U.S. Route 61 when it was struck in the left rear side by a 1972 Oldsmobile 88 sedan. The Ford driver was unrestrained, and her 1-year-old daughter was riding in a forward-facing child safety seat in the left rear seating position, with the required tether strap not used.

Impact Severity: Moderate (ΔV = 1.4 mph long., -16.4 mph lat.)

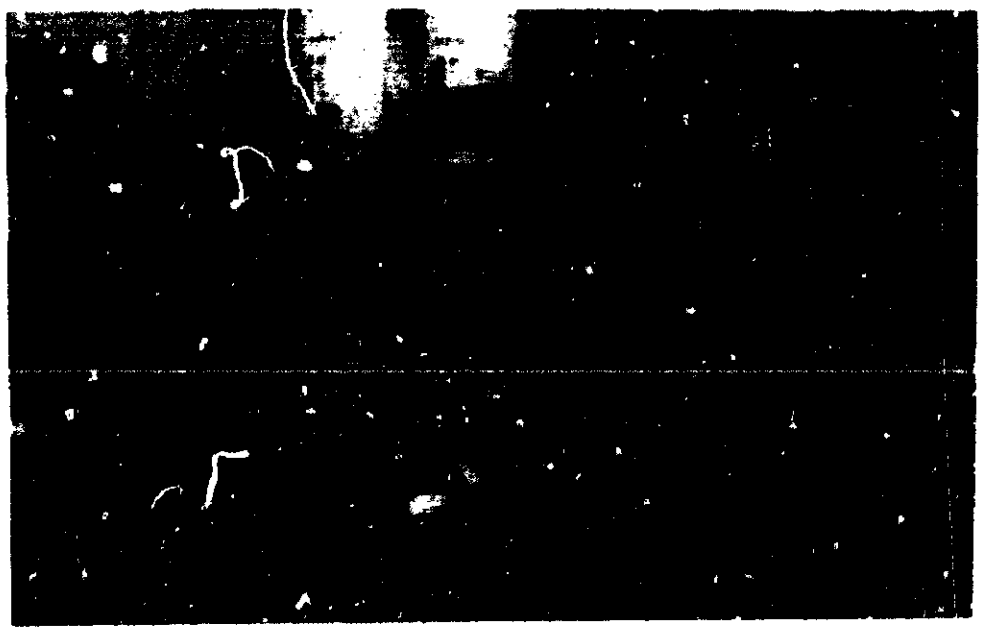
Child Safety Seat: Strolee Wee Care Model 598 (10/79)

Consequences: The unrestrained Ford driver received severe injuries and her 1-year-old daughter in the child safety seat received minor injuries, including a shallow laceration of the gum and abrasions of the left side, left knee, and left foot.

Survivability: Although the child safety seat was misused, it provided substantial protection to the child, even though there was significant intrusion at the child's seating position (intruding sheet metal was wrapped around the safety seat).

Note: The entire safety seat frame was displaced to the right, with the top displaced 3 inches and the front armrest displaced 7 inches, due to the intruding interior left side of the vehicle.

Case 34



NTSB Investigation No.: LAX83HCR01
Accident Date: September 22, 1982
Accident Location: Reseda, California

Circumstances: About 9:05 a.m., a 1973 BMW sedan was traveling northbound on Roscoe Boulevard through the intersection with Sherman Way when the driver of a 1961 Rambler American sedan traveling eastbound on Sherman Way attempted to stop for a red traffic signal. The driver of the Rambler accidentally applied the accelerator instead of the brake, accelerated into the intersection, and collided into the left rear side of the BMW, which was occupied by a 33-year-old driver who was restrained by a lap/shoulder safety belt and her 2-year-old daughter who was riding in a forward-facing child safety seat in the right rear. The required tether strap was not used (the tether anchor was not installed in the vehicle). The safety seat was attached to the vehicle extremely tightly by the right rear safety belt.

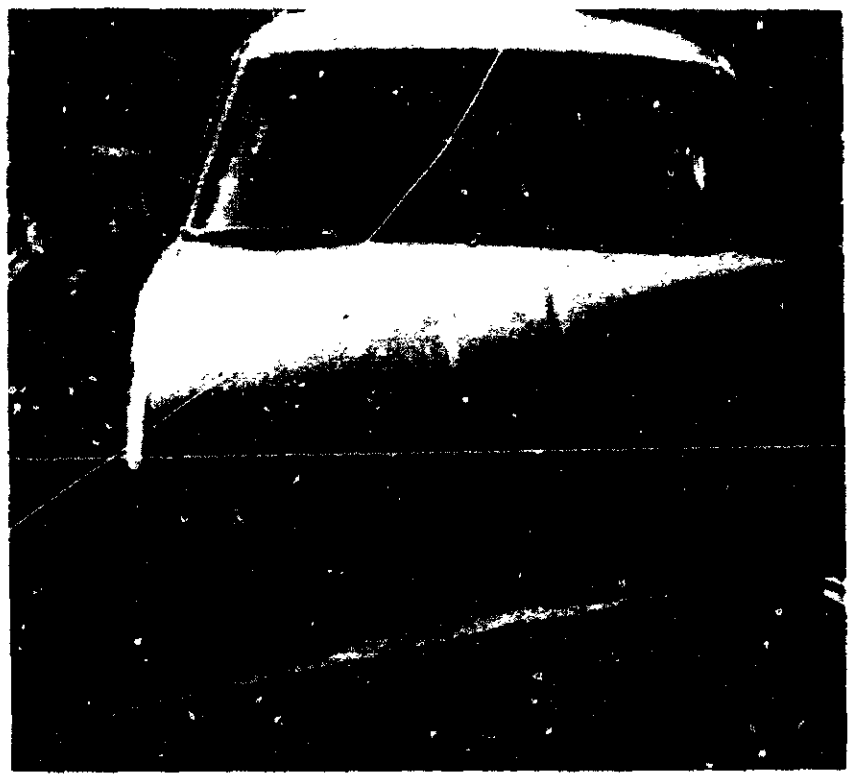
Impact Severity: Moderate (with 21-inch intrusion of left side)

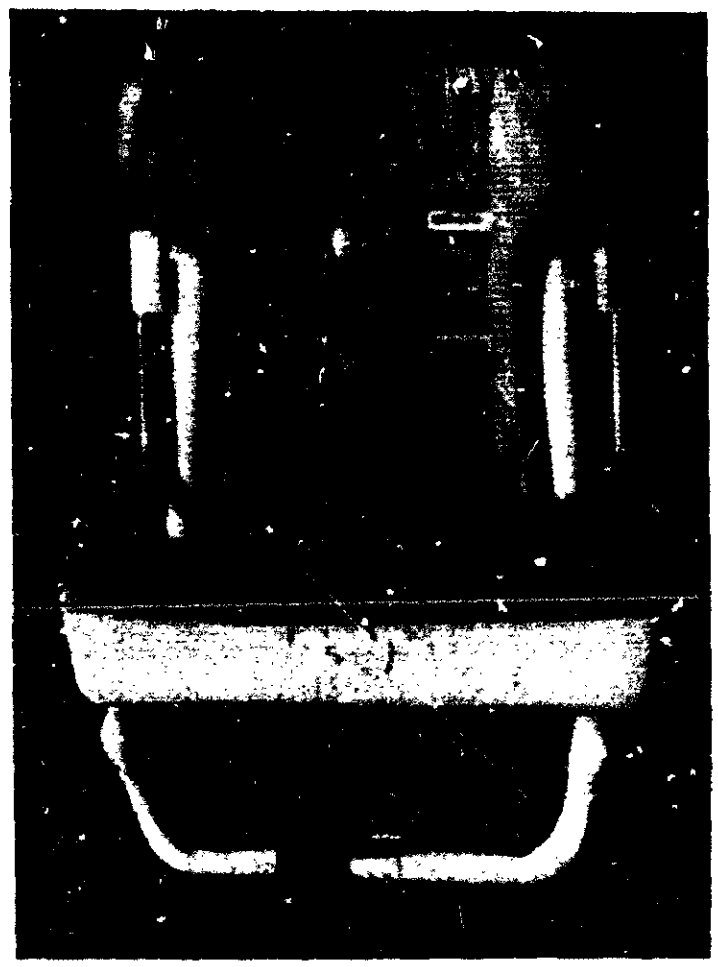
Child Safety Seat: Strolee Wee Care Model 598 (8/78)

Consequences: The lap/shoulder belted driver of the BMW received moderate injuries. The 2-year-old girl did not contact the vehicle interior but received moderate facial lacerations from flying glass.

Survivability: Although the safety seat was misused, it provided adequate protection to prevent the child's contacting the vehicle interior. Considering the 21-inch intrusion of the left rear seating position, the child probably would have been severely injured if she had been unrestrained.

Case 35





NTSB Investigation No.: NYC83HCR01
Accident Date: October 10, 1982
Accident Location: Westbury, New York

Circumstances: About 5:30 p.m., a 1978 Subaru sedan occupied by a young couple and their 10-month-old son was traveling westbound about 50 to 55 mph on the Northern State Parkway en route to their home after spending the afternoon picnicking. The 29-year-old father, who was driving, was wearing a lap/shoulder safety belt, his wife was wearing a lap safety belt in the right rear, and the infant was secured in a forward-facing child safety seat in the left rear. The required tether strap was not used. As the Subaru was approaching a curve, the driver of an eastbound Dodge sedan ran off the left side of the eastbound lanes, crossed the grass median, and collided head-on with the Subaru at a speed of about 57 mph. Both the safety harness restraining the infant and the safety belt securing the safety seat to the vehicle were very snugly adjusted.

Impact Severity: Severe ($\Delta V = -36$ mph long.)

Child Safety Seat: Strolee Wee Care Model 599 (1/82)

Consequences: Both drivers received serious injuries; the infant's mother was killed; and the infant in the child safety seat was uninjured.

Survivability: Although the child safety seat was misused, it provided sufficient protection to the 10-month-old boy, who was the only person to escape this fatal accident without any injury whatsoever.

Note: The Dodge driver was arrested and charged with driving while intoxicated.

Case 36

NTSB Investigation No.: MKC83HCR04
Accident Date: November 28, 1982
Accident Location: Lakeville, Minnesota

Circumstances: About 12:35 p.m., a 1976 Oldsmobile sedan was traveling northbound on U.S. Interstate Highway 35 when the driver of a southbound 1971 Chevrolet Impala sedan lost control on the icy pavement, and the Chevrolet ran off the left pavement edge, crossed the median, and collided head-on with the Oldsmobile. The Oldsmobile was occupied by a 32-year-old driver, his 28-year-old wife in the right front, their 10-year-old son in the left rear, their 12-year-old daughter in the right rear, and their 5-week-old son in the center front. Both parents and the two older children were unrestrained; the 5-week-old boy was riding in a rear-facing child safety seat. Because the infant was wrapped in blankets, the crotch strap portion of the safety seat harness could not be fitted between his legs and the harness could not be fastened. The unused safety harness was routed incorrectly through the upper (toddler) slots of the safety seat and the vehicle safety belt was routed over and around both the safety seat and the infant, instead of through the safety seat frame.

Impact Severity: Moderate (ΔV = -21.6 mph long., + 7.9 mph lat.)

Child Safety Seat: Strolee Model 597 (1977).

Consequences: The driver of the Oldsmobile received minor injuries; his wife received moderate injuries; the two older children received minor injuries; and the 5-week-old boy in the safety seat was not injured. The unrestrained 74-year-old driver of the Chevrolet was fatally injured and her unrestrained right front passenger sustained serious injuries.

Survivability: Although the safety seat was misused, the safety seat in conjunction with the vehicle safety belt provided sufficient protection to prevent injury to the 5-week-old boy.

Note: The detailed usage instructions were not received when the safety seat was purchased used from a neighbor.

Case 37

NTSB Investigation No.: LAX83HCR07
Accident Date: November 11, 1982
Accident Location: Albuquerque, New Mexico

Circumstances: About 6 p.m., the driver of a 1980 Chevrolet station wagon parked the vehicle with the engine running and the gear selector lever in park, and left the vehicle to pick up a child from school. Her 2-year-old daughter was left in the unattended vehicle, seated in a child safety seat in the center front seat with the harness unfastened and only a nonprotective armrest in front of the child. The girl apparently grabbed the gear selector lever and moved it to neutral, and the station wagon rolled backward down a slight grade, struck two parked cars, and came to rest against a building.

Impact Severity: Minor

Child Safety Seat: Strolee Model 597 (8/79)

Consequences: The 2-year-old in the safety seat was not injured; the three vehicles and the building received minor damage.

Survivability: Although the child safety seat was misused, it provided sufficient restraint to prevent injury to the 2-year-old girl during multiple minor collisions.

Note: The child had a 13-inch reach, and with the safety seat harness unfastened and the safety seat in the center front seating position, she could lean forward and reach the gear selector lever when the front vehicle bench seat was adjusted to any position except its rearmost position.

Case 38

NTSB Investigation No.: LAX83HCR09
Accident Date: December 17, 1982
Accident Location: Reseda, California

Circumstances: About 7:30 a.m., a 1966 Volkswagen sedan occupied by a 25-year-old driver, her 3-year-old son, and her 1-year-old daughter, was traveling about 25 mph westbound on Bullock Street en route to a babysitter's home. An eastbound 1977 Ford LTD station wagon attempted to make a left turn in front of the Volkswagen to enter a private drive and collided into the left front side of the Volkswagen, which was not equipped with safety belts. The 3-year-old boy was unrestrained in the right rear and the 1-year-old girl was riding in a forward-facing child safety seat which was tied to the right front seat with a 1/4-inch cotton clothesline rope. The required tether strap was not used and the harness was incorrectly routed through the lower seatback slots.

Impact Severity: Moderate

Child Safety Seat: Strolee Wee Care 597 (8/79)

Consequences: The driver of the Volkswagen sustained minor injuries; the unrestrained 3-year-old boy in the rear seat sustained moderate injury (a brain concussion); and the only injury to the 1-year-old girl in the child safety seat was a minor laceration of her tongue (from biting it). The Ford driver, who was wearing a lap safety belt, was uninjured.

Survivability: The proper use of a child safety seat probably would have prevented injury to the 3-year-old boy if a safety belt had been available to properly secure a safety seat. Although the safety seat occupied by the 1-year-old girl was misused, it provided sufficient protection to prevent serious injury.

Case 39

NTSB Investigation No.: LAX83HCR05
Accident Date: October 30, 1982
Accident Location: Granada Hills, California

Circumstances: About 3:35 p.m., a 1981 Honda Civic station wagon occupied by a woman who was 5 months pregnant and her 1 1/2-year-old son was traveling westbound about 45 mph on Devonshire Boulevard, en route to a shopping center, when another vehicle stopped abruptly in front of the station wagon. The driver of the station wagon braked sharply and steered to the left to avoid a collision. The vehicle skidded on wet pavement across the eastbound traffic lanes, mounted a curb, and crashed into a residential cinder block wall. The mother was wearing a lap/shoulder safety belt, and the child was seated in a forward-facing child safety seat in the right rear. The required tether strap was not secured (there was no tether anchorage installed in the vehicle). The safety seat was covered by a homemade comfort pad which did not have openings for the safety harness to pass through it and which covered the harness straps, which were not fastened around the child.

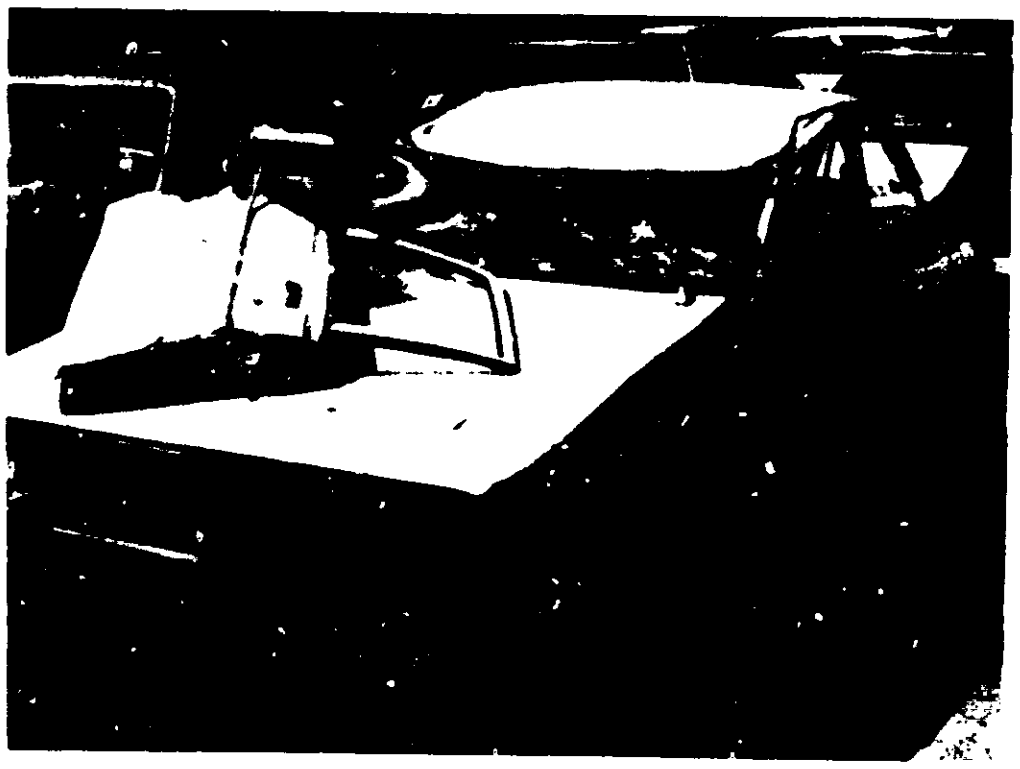
Impact Severity: Moderate

Child Safety Seat: Strolee Wee Care No. 599 (c. 1981)

Consequences: The lap/shoulder belted mother received minor injury. During impact, the safety seat rotated forward, the safety latch controlling the recline position disengaged, and the safety seat orientation changed suddenly from an upright to a reclined position. However, the child remained in the safety seat and was uninjured.

Survivability: Although the safety seat was misused, the 1 1/2-year-old boy remained in the safety seat and did not contact the vehicle interior.

Case 40



NTSB Investigation No.: LAX82HCR02
Accident Date: August 31, 1982
Accident Location: San Francisco, California

Circumstances: About 10:10 p.m., a 1980 Datsun B-210 sedan traveling about 45 mph entered a curve on a freeway offramp when the driver saw an unoccupied vehicle stopped ahead. The Datsun struck the stopped vehicle in the right rear, the driver lost control, and the Datsun overturned onto its roof and slid about 60 feet. All occupants of the Datsun were restrained. The driver was wearing a lap/shoulder safety belt; her 6-month-old daughter was riding in a rear-facing child safety seat in the right rear; her 3-year-old son was riding in a forward-facing infant safety seat in the center rear; and her 2-year-old son was seated in a home booster chair with the vehicle safety belt passed through its sides and over the child's lap. The safety harness of the rear-facing infant safety seat was missing, and the 6-month-old girl was restrained only by the vehicle safety belt fastened around the infant safety seat. The two safety seats and the home booster chair were secured by the two rear seat safety belts.

Impact Severity: Moderate

Child Safety Seats: Century Model 4448 (10/79)
General Motors Infant Carrier (c. 1979)

Consequences: The lap/shoulder belted driver received minor injuries and the three children were uninjured. After the vehicle came to rest on its roof, the 6-month-old girl, who was not harnessed in the infant safety seat, was found rocking gently, suspended upside-down by the vehicle safety belt. Sometime after the vehicle came to rest, the infant slipped out and fell onto the roof of the Datsun.

Survivability: Although the two safety seats were misued, they provided sufficient protection under the circumstances of the accident to prevent injury to the 6-month-old girl and the 3-year-old boy. Although the home booster chair was not designed for motor vehicle crash protection, the use of a safety belt around the booster chair and the 2-year-old child provided sufficient restraint to prevent injury to the child under these accident circumstances.

Note: A health services case worker at a local hospital, who is a member of the California Child Passenger Safety Association, had encountered the family on a routine health checkup and provided information on child passenger protection. The case worker had encouraged the mother to acquire some type of protection for the 2-year-old boy, who, according to the mother, normally traveled unrestrained because he was an "escape artist" who had managed to release himself from every safety seat she had tried. The case worker also helped the mother resolve the problem of restraining three devices with only two safety belts (by looping each outboard safety belt tightly around one leg of the center safety seat before latching them). The mother used the home booster chair because the 2-year-old "escape artist" could be successfully restrained by a safety belt routed through the sides of the booster chair and over the child's lap.

The infant safety seat was acquired second-hand from a relative without the safety harness or any instructions for use. The mother was unaware that a safety harness was required.

Case 41

NTSB Investigation No.: DCA83HCR02
Accident Date: November 19, 1982
Accident Location: Irondale, Alabama

Circumstances: About 4:16 p.m., a 1981 Honda Accord sedan occupied by a 30-year-old woman and her two children, ages 4 years and 2 years, was turning left at an intersection when it was struck in the right side by a 1974 Lincoln Mark IV sedan traveling about 45 to 50 mph. The Honda rotated 300° clockwise as it traveled 43 feet from the point of impact, until its right front corner struck the left front of a 1978 Cadillac sedan that was stopped for a red traffic signal at the intersection. The driver of the Honda was unrestrained. Her 2-year-old son was riding in a forward-facing child safety seat in the right rear seating position. The safety belt was routed incorrectly around the forward safety seat legs, and the required tether strap was missing. The 4-year-old girl was wearing a lap safety belt in the left rear seating position.

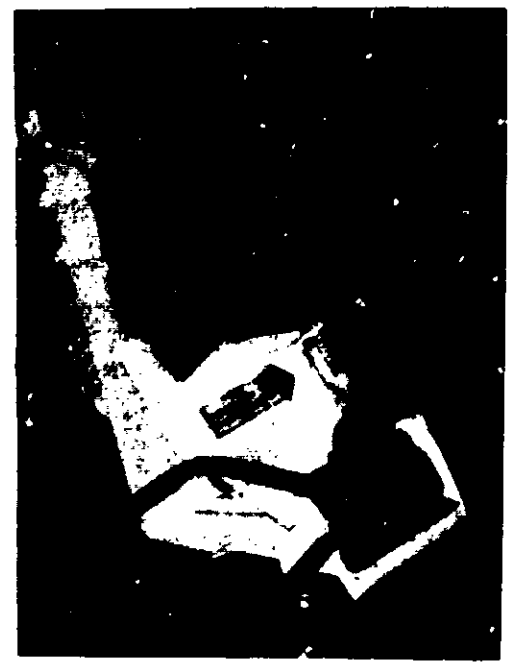
Impact Severity: Moderately Severe (ΔV = -27.7 mph lat.)

Child Safety Seat: Strolee Wee Care 595 (6/79)

Consequences: The unrestrained driver of the Honda suffered severe injuries, including a concussion, four fractured ribs, and contusion and lacerations when she struck the windshield with her head, the instrument panel with her chest, and the gear selector lever with her right thigh. Her 2-year-old son in the child safety seat received a minor abrasion on his forehead from striking the side of the safety seat. The lap-belted 4-year-old girl in the left rear received fatal head injury, probably from striking her head on the child safety seat.

Survivability: Although the safety seat was misused, it provided sufficient protection to prevent serious injury to the 2-year-old. The lap safety belt did not provide upper torso restraint to the 4-year-old, and did not prevent fatal head contact with the child safety seat.

Case 42



NTSB Investigation No.: MKC83HCR10
Accident Date: January 29, 1983
Accident Location: Pine County, Minnesota

Circumstances: About 6:45 p.m. a 1974 Ford Mustang sedan was traveling southbound on County Road 61 approaching an intersection when a 1980 Ford Ranger pickup truck traveling eastbound on State Highway 18 entered the intersection and crashed into the Mustang at the right front fender. The Mustang was occupied by a 20-year-old woman, who was unrestrained, and her 8-month-old daughter, who was riding in a forward-facing child safety seat in the right front seating position. The safety seat harness was routed through the upper seatback slots instead of the lower slots specified for the child's size and weight.

Impact Severity: Moderately Severe (ΔV = -15.5 mph long., +27.5 lat.)

Child Safety Seat: Bobby-Mac Champion (12/17/81)

Consequences: The unrestrained driver received serious injuries from contact with the windshield, steering wheel, and instrument panel. The infant in the child safety seat did not contact the vehicle interior but sustained a serious whiplash injury -- a contusion of the spinal cord resulting in paralysis.

Survivability: The misuse of the safety seat partially degraded its performance; the misrouting of the harness straps resulted in a loose harness fit, which permitted the infant to be accelerated forward and to the right, then suddenly decelerated, causing serious injury. However, although the safety seat was misused, it provided sufficient protection to prevent the infant from contacting the vehicle interior, which probably would have resulted in fatal injury.

2. Protective Function Reduced or Negated by Misuse

Case 43

(Photo courtesy of Ogdensburg Police Department.)

NTSB Investigation No.: NYC82HCR04
Accident Date: July 27, 1982
Accident Location: Ogdensburg, New York

Circumstances: About 8:27 a.m., a 30-year-old woman who was going to drive her 8-year-old daughter to a day camp bus stop got into her car with her three children. The 8-year-old girl was seated in the right front, a 2 1/2-year-old girl was seated in a forward-facing child safety seat in the right rear, and a 2-month-old boy was seated in a rear-facing infant safety seat in the center front, between the mother and the 8-year-old. The toddler in the right rear was properly secured in a child safety seat with a tether strap secured to an anchorage installed in the rear window shelf. The 2-month-old boy in the front center was seated in the infant safety seat with the safety harness not fastened and the safety seat not secured to the vehicle (the front center seating position was not equipped with a safety belt). Before departing, the 8-year-old got out of the car, leaving the right front car door open, and returned to the house to retrieve something that had been left behind. While waiting for her daughter to return to the car, the mother decided to back the car from behind their house, where it had been parked, on the road. As she backed the vehicle at a speed of less than 5 mph and turned left into the road, the unsecured infant safety seat toppled to the right, spilling the unrestrained infant through the open right front door onto the roadway.

Impact Severity: None - Noncrash Incident

Child Safety Seats: (1) General Motors Infant Safety Carrier (8/73)
(2) General Motors Child Safety Seat (6/74)

Consequences: Before his mother could stop the car, the infant was run over by the right front wheel and was fatally injured. No other person was harmed.

Survivability: Although the infant was seated in an infant safety seat, neither he nor the safety seat were restrained. If the infant had been properly restrained in the vehicle, this fatal noncrash incident would not have occurred. Although subjected to the same cornering forces, the 2 1/2-year-old remained properly secured in her safety seat.

Note: The vehicle, a 1967 Chevrolet Malibu 4-door sedan, originally was equipped with safety belts at the driver's and right front seating positions only. After locating and buying two used child safety seats by placing an advertisement in the local "Penny Saver" want ads, the mother had two safety belts installed in the rear seat and had a tether anchorage installed in the rear window shelf. She preferred to have the baby seated next to her when she drove the car, and intended to have a safety belt installed at the center front seating position to secure the baby's safety seat, but had not yet done it. The day before the accident, the mother had new brakes and an engine mount installed on her car. When she was interviewed by a Safety Board investigator after the accident, the mother said that she decided to back the car into the road because she was in a hurry. "I guess I was trying to save a little time because we were cutting the time close," she explained. "The day before I was a little late for the bus and it pulled away before I got there. I'm so safety conscious and protective of my children that I still can't believe this could happen."

Case 44

NTSB Investigation No.: NYC83HCR03
Accident Date: November 19, 1982
Accident Location: Queens, New York

Circumstances: About 10:15 a.m., a 1981 Oldsmobile sedan occupied by a young married couple and their 3-year-old daughter was northbound on the Cross Island Parkway, en route from their nearby home to a resort area in the Catskill Mountains, about 100 miles away. The 31-year-old father was driving; his 29-year-old wife, who was 3 months pregnant, was in the right front; and their daughter was seated in a forward-facing child safety seat in the right rear. The required tether strap was not secured (there was no anchorage installed in the vehicle), and the safety harness was not fastened. The two adults were unrestrained. As the Oldsmobile was negotiating a right curve in the left lane of the six-lane Parkway, the left wheels went off the left edge of the roadway and climbed a raised median, where the left side of the car sideswiped a concrete railroad bridge pier located on the median. The Oldsmobile then veered sharply to the right, traveled diagonally across the northbound lanes, and ran off the right pavement edge where it struck and vaulted over a guardrail, overturned, and came to rest on its roof on a paved path adjacent to the highway.

Impact Severity: Moderate

Child Safety Seat: Strolee Wee Care, Model 597 (c. 1979)

Consequences: The father and the 3-year-old girl were ejected and were found lying on the ground next to the overturned car. The father received serious injuries and the child received fatal head injuries. The mother remained in the vehicle and received minor injuries.

Survivability: Although the 3-year-old girl was riding in a child safety seat, she was not restrained by the safety harness at the time of the accident. If she had been properly restrained in the safety seat, she probably would have survived the accident with little or no injury.

Note: When she was interviewed by a Safety Board investigator after the accident, the mother stated: "Although this was an unfortunate accident and a personal tragedy, I'm still realistic enough to know that child car seats are good and are necessary when transporting children in a car. What happened to us was a freak accident and will not discourage me from using a child seat."

Case 45

NTSB investigation No.: NYC82HCR01
Accident Date: June 30, 1982
Accident Location: Kingsbury, New York

Circumstances: About 5:10 p.m., a 1976 Honda Civic sedan occupied by two adults and their 6 1/2-month-old son was traveling eastbound about 30 mph on State Route 32 en route to their home in a nearby community. As the Honda was traveling through the intersection of County Route 35, a 1970 Ford Maverick sedan traveling southbound about 51 mph on Route 35 entered the intersection against a red light and crashed into the left side of the Honda. The Honda rotated counterclockwise and came to rest facing west on a lawn adjacent to the intersection, about 45 feet from the point of impact. The two adults in the Honda were unrestrained, and the infant was seated in a forward facing child safety seat with the safety harness secured loosely around the infant. The required tether strap was missing, and tether anchorage was installed in the vehicle.

Impact Severity: Moderately Severe (ΔV = -10 mph long., + 22 mph lat.)

Child Safety Seat: Kantwet One-Step, Model 401 (9/25/81)

Consequences: The unrestrained driver of the Honda was ejected and fatally injured. His wife, unrestrained in the right front, was partially ejected through the left side door opening and was seriously injured. During the impact and vehicle rotation the infant was forced forward and to the left and was ejected from the safety seat between the loosely-adjusted safety harness shoulder straps. He was found on the floor of the storage area behind the rear seat, fatally injured.

Survivability: Proper use of the safety seat, with the safety harness adjusted snugly and the tether strap properly secured, probably would have prevented the ejection of the infant from the safety seat and probably would have resulted in little or no injury to the infant.

Note: The driver of the Ford, who sustained a minor knee injury, was arrested by the New York State Police and charged with two counts of criminally negligent homicide, passing a red traffic signal, and intoxicated driving. A breath test indicated that his blood alcohol level was .17 percent. The Safety Board's accident investigation found that the safety seat harness was properly routed through the upper seatback slots for the infant's size and weight. However, although the safety seat had been used by the infant since birth, the lower harness routing slots specified for use by smaller infants apparently had never been used because they were factory sealed and had not been punched out. The safety seat manufacturer, Questor Juvenille Furniture Co., was contacted during the investigation and changed its factory assembly procedures for its convertible safety seat models to route the safety harness through the lower slots (the infant configuration), and improved the instructions for use of the safety harness.

Case 46

NTSB Investigation No.: NYC83HCR05
Accident Date: March 25, 1983
Accident Location: Waretown, New Jersey

Circumstances: About 4:05 p.m., a 1980 Toyota Corolla sedan occupied by a 25-year-old driver and her 15-month-old son was traveling northbound on U.S. Route 9 when the driver fell asleep and the vehicle veered across the southbound lane, ran off the pavement edge, and struck and severed a 12-inch-diameter wooden utility pole. The child's mother, unrestrained in the driver's seat, survived with serious injuries. According to the manufacturer's instructions, the safety seat should not be used with a vehicle safety belt that cannot be fastened securely. The safety belt at the right rear seating position of the Toyota uses an emergency locking retractor, which "locks up" only when its sensor is activated by crash forces. Safety seats are not designed for use with this type of safety belt. An ironing board also was being carried in the car.

Impact Severity: Moderately Severe

Child Safety Seat: Cosco-Peterson Safe-T-Shield, Model 81A (7/14/81)

Consequences: The unrestrained mother received serious injuries. The 15-month-old boy in the child safety seat received a fatal neck injury when the atlanto-occipital joint between the spine and skull was dislocated and his spinal cord was severed.

Survivability: The effect of the misuse of the safety seat with a vehicle safety belt that could not be fastened securely 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, or with the shield of the safety seat, which is designed to be used by a toddler with the safety shield only, without need for a safety harness.

Case 47

NTSB Investigation No.: MKC83HCR13
Accident Date: March 11, 1983
Accident Location: Hutchinson, Minnesota

Circumstances: About 4:31 p.m., a 1982 Pontiac T-1000 sedan was traveling eastbound on State Highway 22 when an oncoming 1974 Ford LTD sedan crossed the centerline in a curve and struck the Pontiac head-on. The Pontiac was occupied by a young couple and their 2-month-old daughter, who were returning home from visiting relatives. The 23-year-old father, who was driving, was wearing a lap/shoulder safety belt; the 21-year-old mother was unrestrained in the right front; and the 15-pound infant was seated in a child safety seat in the left rear that was installed forward-facing, instead of rear facing as specified by the manufacturer's instructions for use with infants weighing less than 17 pounds. The vehicle safety belt was fastened to secure the child safety seat, but was routed through the safety seat frame at the wrong location, which placed it lower on the frame than the design routing position.

Impact Severity: Severe (ΔV = -31.4 mph long. + 5.5 mph lat.)

Child Safety Seat: Century 300 (5/82)

Consequences: The unrestrained mother received fatal injuries and the lap/shoulder belted father survived with serious injuries. The incorrect routing of the safety belt through the safety seat frame permitted the safety seat to rotate forward during impact and the infant received a fatal head injury from contact with sheet metal as the vehicle's left side deformed during impact and intruded into the passenger space.

Survivability: The misused safety seat did not provide sufficient protection in this accident. If the safety seat had been installed in the proper rear-facing orientation with the vehicle safety belt routed properly, the forward rotation of the safety seat would have been minimized and contact with intruding sheet metal probably would have been prevented or minimized, preventing or reducing injury.

Case 48

NTSB Investigation No.: NYC83HCR06
Accident Date: April 2, 1983
Accident Location: Near Omaha, Nebraska

Circumstances: About 10:45 a.m., a young couple and their 3-day-old daughter were traveling northbound in their 1983 Ford Fairmont sedan on Nebraska State Route 133 en route home from the hospital where the infant was born. About 2 miles from their home, the Ford was crossing the intersection of State Street when an approaching 1973 Ford Maverick sedan was struck in the rear by another vehicle and was propelled into the northbound lane where it collided head-on with the Fairmont. The infant's father, who was driving the Fairmont, and his mother in the right front, were unrestrained. The 3-day-old girl was seated in a rear-facing infant safety seat in the center front. The vehicle safety belt was secured around the safety seat but was not snugly adjusted, and the safety seat was adjusted to the upright position instead of the reclined position.

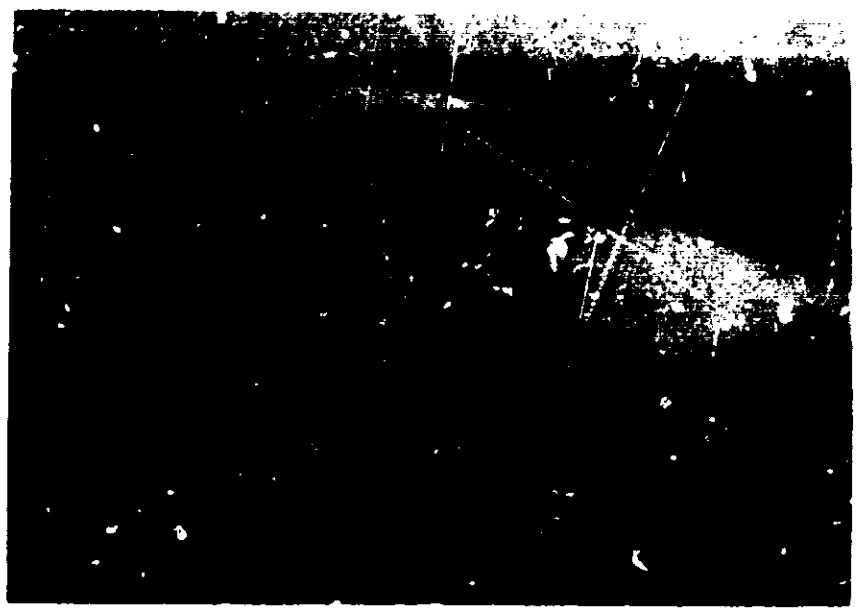
Impact Severity: Moderately Severe (ΔV = 19 to -24 mph long., +23 mph lat.)

Child Safety Seat: Questor Juvenile Furniture Co. Dyno-O-Mite (12/10/81)

Consequences: The unrestrained mother and father received moderate injuries. During impact the infant's mother in the right front was propelled forward and to the left, and crushed the infant safety seat against the steering column and gear selector lever, causing fatal injury to the 3-day-old baby.

Survivability: The loose adjustment of the safety belt around the infant safety seat permitted some movement of the safety seat during impact; however, even proper use of the infant safety seat probably would not have prevented the infant and safety seat from being crushed by the weight and acceleration of the unrestrained mother. If the mother had been restrained, the infant probably would have survived without injury.

Case 49



NTSB Investigation No.:	MKC83HCR08
Accident Date:	January 3, 1983
Accident Location:	Austin, Texas

Circumstances: About 8:23 a.m., a 1981 Toyota sedan occupied by a 23-year-old man and his 5-month-old son was negotiating a left turn at an intersection when it was struck in the right side by a 1980 Ford van. The father was unrestrained and the infant was seated in a forward-facing infant safety seat in the right front. The required tether strap was not used and the safety harness was not fastened around the infant. The father was returning home with his son after taking his wife to work.

Impact Severity: Minor to Moderate

Child Safety Seat: Bobby-Mac Two-in-One Chair (date of manufacture unknown)

Consequences: The unrestrained father received minor injury. The 5-month-old boy, who was not restrained in the safety seat, was thrown out of the safety seat during impact and struck the right front door panel, causing moderate head injuries, including two skull fractures

Survivability: Because the safety seat was misused, its protective function was negated. If the safety seat had been used properly, the infant probably would have received little or no injury from contact with the vehicle interior; however, he could have been injured when the unrestrained father was thrown against the safety seat.

Note: The safety seat was borrowed from a babysitter and the father said that he did not understand the need for use of the safety harness.

Case 50

NTSB Investigation No.: MKC82HCR02
Accident Date: August 31, 1982
Accident Location: Lenexa, Kansas

Circumstances: About 5:42 p.m., a 1979 Chevrolet Chevette sedan occupied by a 20-year-old woman and her 1-year-old son was traveling on a four-lane street when it struck a 1973 Ford Maverick sedan that was negotiating a left turn in the path of the Chevette. The mother in the Chevette was unrestrained. The 1-year-old boy was seated in a forward-facing child safety seat in the right front. The safety seat was not secured by a safety belt because the safety belts in the vehicle were too short. The bottom rear of the safety seat frame was wedged between the vehicle seat back and seat cushion. The shoulder and crotch straps of the safety harness were missing; only the lap portion of the safety harness was secured around the child.

Impact Severity: Minor (ΔV = -3.3 mph long., +5.7 mph lat.)

Child Safety Seat: Bobby-Mac Deluxe (11/2/77)

Consequences: The unrestrained mother received moderate injury. During impact, the safety seat and child were propelled together into the instrument panel and the child received minor facial cuts and abrasions.

Survivability: If the safety seat had been used properly, it almost certainly would have prevented any injury to the child in this minor accident.

Note: The usage instructions and the missing harness straps were not provided with the used seat when it was given to the family by a friend.

Case 51

NTSB Investigation No.: LAX83HCR04
Accident Date: October 6, 1982
Accident Location: Hollywood, California

Circumstances: About 6:30 p.m., a 1974 Volvo sedan was traveling about 30 mph eastbound on Hollywood Boulevard when a westbound 1972 Toyota Celica sedan crossed the centerline and collided head-on with the Volvo. The Volvo was occupied by a 31-year-old woman and her 2-year-old daughter. The mother was wearing a lap/shoulder safety belt and the child was seated in a forward-facing child safety seat in the right front of the Volvo. The safety harness was not fastened and the required tether strap was not used.

Impact Severity: Moderate

Child Safety Seat: Strolee Wee Care, Model 599 (c. 1980)

Consequences: During impact, the child was ejected from the safety seat and thrown into the instrument panel, receiving minor injuries, including a broken nose and contusions of the forehead from contact with the glove compartment area of the instrument panel. Her lap/shoulder belted mother received minor injuries, including a neck strain from impact decelerations and a bruised knee from contact with the instrument panel.

Survivability: Because the safety harness of the safety seat was not fastened around the child, the safety seat provided no protection and permitted the child to be ejected from the seat. Proper use of the safety seat probably would have prevented any injury to the child.

Note: Although a tether anchorage was installed in the rear window shelf, the safety seat was being used in the front seat and the tether strap was not secured to a rear seat safety belt as the manufacturer's instructions require for front seat use. The mother reported that 10 to 20 percent of the child's motor vehicle trips are made with the child unrestrained because she becomes restless when harnessed and other passengers sometimes interfere. See case 16 involving the same mother and child.

IV. Investigations of the Use and Crash Performance of Safety Belts by Small Children

Case 52

NTSB Investigation No.: ATL83HCR01
Accident Date: November 25, 1982
Accident Location: Near Cynthiana, Kentucky

Circumstances: About 11:45 a.m., a 1979 Ford sedan occupied by a 17-year-old driver and his 18-month-old niece was traveling on a two-lane U.S. highway en route to pick up a relative for Thanksgiving dinner when the Ford crossed the centerline in a curve and collided head-on with a 1981 Oldsmobile sedan. The 17-year-old driver was unrestrained and the 18-month-old girl was secured snugly in the center front of the car by a lap safety belt.

Impact Severity: Severe

Consequences: The unrestrained Ford driver sustained fatal head, neck, and chest injuries from contact with the windshield, steering wheel, and instrument panel. The lap-belted 18-month-old girl sustained minor injuries, including facial abrasions and a laceration of the upper lip.

Survivability: The lap safety belt provided sufficient protection to prevent fatal injury to the 18-month-old girl. The proper use of a safety seat probably would have provided greater protection which would have prevented even the minor injury she received.

Case 53

NTSB Investigation No.: LAX83HCR12
Accident Date: February 13, 1983
Accident Location: Chatsworth, California

Circumstances: About 12:10 p.m., a 1973 Lincoln Continental sedan was traveling northbound about 25 mph on a three-lane avenue when a southbound 1972 Mercury Montego sedan veered across the centerline and collided into the Lincoln head-on, left front to left front. The Lincoln was occupied by a 63-year-old female driver, who was restrained by a lap/shoulder safety belt, and a 23-year-old woman seated in the right front and her 3-year-old daughter at her left side, both of whom were sharing a single lap/shoulder safety belt.

Impact Severity: Moderate

Consequences: When the mother saw the approaching Mercury cross the centerline, she pulled her daughter's upper body across her lap in an effort to hold and shield the child. However, the mother was unable to restrain the child, who struck the unpadded lower portion of the instrument panel with her head, resulting in moderate injuries, including a brain concussion, abrasions, and contusions. The mother received minor injuries (facial and body pain, possibly due to collision between the mother and child during impact). The lap/shoulder belted driver received minor injuries including a neck strain and bruises of the lower legs.

Survivability: The 3-year-old girl probably would have received little or no injury had she been properly protected by a child safety seat. The child's placement into a horizontal position across her mother's lap immediately before impact allowed her to strike the lower instrument panel. However, if she had remained seated upright, sharing a single lap/shoulder safety belt with her mother, her injuries probably would have been more serious.

See also Case 41.

APPENDIX F

TESTIMONY OF TWO MOTHERS OF CHILDREN INVOLVED IN CRASHES

STATEMENT OF MRS. LAURA BEGNAUD

before the

NATIONAL TRANSPORTATION SAFETY BOARD

PUBLIC HEARING ON CHILD MOTOR VEHICLE PASSENGER SAFETY

Dallas, Texas

January 13, 1983

On Thursday, January 17, 1980 my family and I were in a fatal car wreck in Port Arthur, Texas. The accident killed our 39 month old son Adam, critically injured our 22 month old daughter April and myself and injured my husband, Larry. Our children were seated in the front seat of our car unrestrained.

The accident occurred under clear, dry conditions that Thursday night about 10:30 p.m. A drunk driver ran a stop sign at the intersection of a city street and State Highway 347 at a high rate of speed (estimated to be in excess of 50 m.p.h.). As the other driver tried to negotiate a left turn across the highway to the southbound lane my family was in the unfortunate position of being northbound. My husband was the driver of our car and applied the brakes to avoid collision but the driver continued his left turn into the right side of our car. Both cars upon collision went up into the air - ours turned over then slid into the road dividing curb that catapulated our car into the air where it rolled over again and landed on the roof. The roof of the car collapsed and the car slid for approximately 30-40 feet before coming to a stop blocking both southbound lanes of the highway.

The car we were in was a 1974 Buick Regal - two-door hard top with a listed weight of 4500 pounds and we were hit by a 1976 Lincoln Continental Mark V.

Larry saw the other car as it came through the stop sign and shouted at me to hold April. April was in my lap and Adam was next to Larry. The impact literally pushed the car from under us and all occupants were thrown to the right. The initial impact also shattered the windshield. There was a breakline across the windshield about 6-10 inches from the bottom leaving the top part of the glass intact. When we crashed back to the street all were then thrown forward into the dash. Our car then started to turn over tossing everyone to the left. The driver's door was thrown open. As Larry was thrown out he grabbed onto the steering wheel and pulled himself back in. We then hit the highway dividing

median curb throwing the car into the air. Adam was thrown from the car through the driver's window. The car then turned over in the air and landed on the roof which collapsed. This is the point at which the windshield that was attached to the roof acted like a guillotine and struck April in the face and left arm and me in the head and left arm as we laid near the dashboard. My husband was pinned between the roof and top of the seat backs because the roof did not support the weight of the car. The car then slid diagonally across the opposite southbound land of the highway where it struck Adam who was lying on the road. The car's hood then came to rest on him and pushed Adam along the street 4 to 5 feet. The driver's door had to be pried open and the car had to be elevated by tow trucks for the paramedics to get us out and Adam out from under the hood. I was told that I was also pinned between the seat back and roof of the car. Our wreck happened within a block of a wrecker service company who was able to assist with tow trucks and radio communication that led to quick ambulance service.

Larry was able to remove April from the windshield where she had been impaled when we crashed down on the car roof. He attended to her until the paramedics arrived. The care we received at the scene of the accident and St. Mary's Hospital emergency rooms was the difference in life and death for April.

Next I will describe our injuries. Adam's injuries included a broken right thigh and hip, multiple skill fractures to the right temple area and to the back of his skull. He also had deep lacerations on his back and neck. After revival efforts failed at the hospital he was pronounced dead at 11:15 p.m., Thursday, January 17, 1980.

April's injuries began with an extensive face smash. This occurred when the windshield cut through the bony structure of her face from the left corner of her mouth across and through the upper jaw bone across her face to the outside corner of her right eye. She sustained a broken lower left jaw and the loss of gum and tooth buds to the lower left jaw. Her right eye received a rupture to the retina wall which has resulted in 20-800 vision. This is not correctable at this time with current medical technology. There were multiple lacerations to the right side of her face and forehead. Her left wrist sustained compound fractures of both bones. Also the underside and outside of her forearm was cut away, from the palm of the hand, two thirds of the way to the elbow. The loss of tissue, arteries and nerve bundle caused the deterioration and final death of her left hand. This hand was amputated eight days after the wreck. She also had blood clots and bruises to both frontal lobes of her brain which she overcame. April's hospital stay included a day and a half at St. Mary's Hospital in Port Arthur. She developed fluid in her lungs from blood she had aspirated and had repeated cardiac and respiratory arrests that Saturday morning. She had to be transferred to Texas Children's Hospital in Houston, Texas that morning. Her stay in Houston was for three weeks. She spent two weeks in intensive care and one half week each in intermediate care and private room care. April then underwent 1 month of physical therapy and then celebrated her second birthday. She was fitted with a prosthetic device and obtained occupational therapy in its use.

April must still undergo future surgeries to correct eye muscles, tear duct damage, scar reduction, and a procedure to correct lack of growth to

her upper jaw and repositioning of her nose. April has undergone five surgeries since our wreck. She has two surgeries planned for this year and several more for the future.

My injuries consisted of a severely crushed pelvis. I had seven fractures and three complete breaks to my pelvis. My bladder was also ruptured in two places. My left wrist had a compound fracture to both bones and deep lacerations. I also sustained head injuries and lacerations to my cheek, chin and neck. The results of my head injuries and concussion lasted three weeks. I was in intensive care for nine days and in a private room for two months mainly due to the pelvic injury. Just prior to discharge I had to learn to walk again then underwent physical therapy for one month. It took me about one year to completely regain my strength and endurance.

My husband Larry's injuries are torn ligaments and muscles in his right leg. He has damaged cartilage to his right knee that still requires surgery. He also sustained severe cervical myelities with torn muscles and ligaments in his neck. Larry's face sustained multiple lacerations and contusions.

The affect of this tragedy on our family has been devastating. At one point our family was in hospitals in two cities one hundred miles apart in intensive care not knowing if either would live and our son was at the funeral home. We feel that the injuries the children received could have been eliminated or substantially reduced had they been belted in child restraints. We used our car seats most of the time because we cared for the safety of our children. That night neither of the children

were belted in their car seats because of the light traffic, the time and the nearness to our home. We were less than one and one-half mile from our home when the accident occurred. The rear passenger area of our car was undamaged as were the two car seats located there.

We feel that Adam's death and April's injuries could possibly have been avoided if they had been in their seats which makes this tragedy even more senseless.

Larry and I could not comprehend the loss of control that a body sustains in a wreck such as this one. You have neither the strength nor the ability to control what happens to your person during the violent forces of impact.

If our story can impress the need for child restraint systems that would save just one child's life from the death and terror that our children have suffered, I feel that the effort to tell my story is worth it.

Our children have used their restraints and are acclimated to doing so <u>everytime</u> they get into a car. They are much better behaved in the restraints and enjoy them because they can see out of the windows better. The seats might be troublesome to hook up everytime you put your child in but look at the consequences. We did not put our children in their car seats <u>once</u> and we became "the accident that happens to the other guy."

Laura Begnaud

Pt. Neches, Texas

STATEMENT OF MRS. BARBARA A. MOORE

before the

NATIONAL TRANSPORTATION SAFETY BOARD

PUBLIC HEARING ON CHILD MOTOR VEHICLE PASSENGER SAFETY

Dallas, Texas

January 13, 1983

January 10, 1983

Thank you for the opportunity to offer this testimony for the record on the subject of automobile safety for children.

On a lovely evening in mid-August, 1982, my husband, my two brothers, our son and I were driving to a nearby restaurant for dinner. The conversation was jovial and relaxed as we discussed the trip my son, one brother and I were to make later that week. My husband was driving our Subaru station wagon with our three month old son in the front seat while my brothers and I occupied the rear. Suddenly the car accelerated and, as I looked over at my husband, I saw that he had lost consciousness. Within a matter of milli-seconds, we were collided with a brick wall at 30 M.P.M. When I awoke in the emergency room, I discovered that my husband and one brother had been flown to a major medical center in Oklahoma City. I could hear my other brother groaning in the next room. Although I did not know it until several days later, he had suffered a broken neck and severed spinal cord as well as two broken arms. He is permanently paralyzed from the shoulders down and is still hospitalized. My other brother suffered a fractured skull and multiple fractured arm with nerve damage. An emergency craniatomy saved his life. My husband's injuries were the most lifethreatening---all of his ribs were broken, as was his face. I'm told that no one expected him to live. His lungs had collapsed and he was kept on a respirator for three weeks. He is presently hospitalized for facial reconstructive surgery.

My injuries were relatively minor--a compound fracture of the left forearm and a broken left elbow, with several fractured ribs. One lung collapsed and a week later while awaiting surgery on my arm my spleen ruptured and I underwent emergency surgery. My hospital stay was 28 days and another hospitalization and surgery will be necessary to remove the plates and pins that hold my arms together.

This may seem to be a tragic tale, but it does have one bright spot, an outcome far happier that you will hear from other parents. Our three month old baby was uninjured in this accident except for a slight bruise on his head.

Although we had a front end collision with a brick and masonry building, resulting in such damage to the car that it had to be sawed apart to extricate us, our fifteen pound bundle of joy, who was in the front seat, was spared injury. People tell us how lucky we are and that it was a miracle he was not hurt. But I believe that the reason for his safety was not a miracle, not luck, but rather his presence in a dynamically tested infant

January 10, 1983
Page 2

car seat. We have used such a seat for every car trip starting with his ride home from the hospital at six days of age. In spite of my firm belief in the necessity and value of car seats for young children, I will confess that I had often been negligent in using my son's in that I did not always engage the shoulder harness. Fortunately, my brother insisted on proper use of the restraint. As he said, "Why bother to use it if you don't use it properly?" Jason owes his life to car seats and the concern of his uncle.

Many arguments are made against the mandatory use of car seats for children under the age of four. One of these involves the expense. After fully equipping a nursery for our first child, I can find no other item that gives as many years of use for the amount of money involved. Another argument notes that we have too much governmental interference already. This may be true, but young children, who cannot protect themselves, need and deserve the protection of the law if their parents are unwilling to protect them. A baby is absolutely not safe in it's mother's arms. Anyone who saw my badly crushed and open forearm would realize full well that my baby would not have survived had I been holding him. The argument that strapping a child in is a hassle is valid. It is a hassle to spend an extra few moments buckling up a child in a car seat but changing diapers is a hassle too, and most parents do that more often in a day than anything else. As was made clear to me, the extra minute required to properly restrain a child may be the most important minute of your day.

Accidents happen everywhere and are indiscriminate in their victims. No one ever thinks they will be involved in a traffic accident because of their safe driving habits. Unfortunately, uncontrollable events occur - our car could just as easily hit another car as a brick wall, and we might have injured some other people, who were "driving safely." Fortunately, we did not.

In my opinion, there are no arguments against the use of car seats that are acceptable. Parents who take such good care to feed, clothe and immunize their children must also take care to protect them against a leading cause of death and injury - motor vehicle accidents.

Thank you for the opportunity to comment.

Sincerely,

Barbara A. Moore
Box 873
Shawnee, Oklahoma 74801

APPENDIX G

CHILD PASSENGER PROTECTION LAWS
SUMMARY OF KEY PROVISIONS
(40 STATES AND DISTRICT OF COLUMBIA)

STATE CHILD PASSENGER SAFETY LAWS

State/Effective Date	Requires	Children	Where[1] Seated	To Use[2]	Vehicle	Exceptions	Penalties	Public Education Campaign	Other Provisions
Alabama 6.29.82	Resident Driver	Under Age 3	Not Specified	Approved Child Passenger Restraint System	Motor Vehicle	Non resident drivers, trucks or buses over one ton	Maximum fine $10.00	No	Failure to use child restraint system shall not be considered contributory negligence, violation of law does not nullify or change provisions of insurance contract.
Arizona 7.27.83	Resident Parent or Guardian	Under Age 4 or Under 40 lbs	Not Specified	Approved Child Passenger Restraint System	Noncommercial Motor Vehicle	Non-resident drivers, vehicles originally manufactured without passenger restraint devices, more than one child is transported in vehicle and vehicle size does not provide sufficient area for devices	7.27.83-6.30.84 warning ticket, after 7.1.84 maximum fine $50.00, fine will be waived if proof of acquisition of system is shown	Yes. Requires hospitals to provide parents of newborn with information regarding loaner programs prior to releasing baby from hospital. Fines will be placed in fund for rental program	Prohibits police officer from stopping vehicle solely for enforcing this law, indigent persons are eligible for free loaner seat, use or non-use of system is inadmissible evidence in court
Arkansas 6.1.83	Resident Driver	Under Age 3	Not Specified	Approved Child Passenger Safety Seat System	Passenger Automobile, Van, or Pick-Up Truck	Drivers of for-hire vehicles, children who can't use system due to medical conditions, vehicles driven during emergency situations, all other seats with seat belts are occupied, non resident drivers	8.1.83-6.30.84 warning ticket, after 7.1.84 $10.00-$25.00 fine or proof of acquisition of system	Yes. Law encourages law enforcement agencies and hospitals to conduct public information campaign. Fines will be placed in fund for rental program	Failure to use child restraint system does not constitute comparative or contributory negligence, use or non-use of system is inadmissible evidence in court
		Ages 3-5	Not Specified	Approved Child Passenger Safety Seat System or Seat Belt					
California 1.1.83	Resident Parent or Legal Guardian	Own Children Under Age 4 or Under 40 lbs	Not Specified	Approved Child Passenger Seat Restraint System	Passenger Vehicle or Motor Truck Under 6,001 lbs Owned By Parent or Guardian and Registered in State	Non-resident drivers, children who can't use system due to medical condition or body size	Oral warning system to be developed in first year of campaign, charges dropped if proof of acquisition of system is shown in court. fine $50.00-$200. Charges against resident drivers will be dropped if children parents or legal guardians are present in vehicle at time of violation	Yes. Law includes public information and education campaign on value of use of seat restraints for infants & children up to age 15. Campaign expires 1/1/84	None
	Resident Parent or Legal Guardian	Own Children Under Age 4 or Under 40 lbs	Not Specified	Approved Child Passenger Seat Restraint System or Seat Belt	Passenger Vehicle or Motor Truck Under 6,001 lbs Not Owned by Parent or Guardian But Registered in State				
	Resident Driver	Any Children Under Age 4 or Under 40 lbs	Not Specified	Passenger Seat Restraint or Seat Belt	Passenger Vehicle or Motor Truck Under 6,001 lbs Registered in State				
Colorado 1.1.84	Resident Driver	Under Age 4 and Under 40 lbs	Not Specified	Approved Child Restraint System	Noncommercial Passenger Vehicle	Non-resident drivers	$25.00, fine will be waived if proof of acquisition is shown	Yes. Law includes public information and education campaign to be implemented 7/1/84	Failure to use child restraint device shall not constitute negligence or contributory negligence per se
Connecticut 10.1.82	Driver	Under Age 4	Front Seat	Approved Child Restraint System	Motor Vehicle	Recreational vehicle of truck or van type, truck or bus over one ton	Violation is deemed an infraction, fine will be waived if proof of acquisition of system is shown	No	Failure to use child restraint system shall not be considered contributory negligence, use or nonuse is inadmissible evidence in court
		Under Age 4	Rear Seat	Approved Child Restraint System or Seat Belt					
Delaware 6.2.82	Resident Parent or Legal Guardian	Under Age 4	Not Specified	Approved Child Passenger Restraint System	Motor Vehicle	Non-resident drivers	Maximum fine of $25.00, fine will be waived if proof of acquisition of system is shown	No	Failure to use child restraint system shall not be considered contributory negligence, use or nonuse is inadmissible evidence in court
Florida 7.1.83	Resident Parent or Legal Guardian	Under Age 4	Not Specified	Approved Child Restraint System	Passenger Car, Van or Pick Up Truck	Non resident drivers	$15.00 fine or proof of acquisition of system	Yes. Law specifies that law enforcement agencies should conduct a public education campaign. Agencies are urged to send notice to all registered drivers with delivery of license plates	Failure to use child restraint system does not constitute negligence per se, use or non-use of system is inadmissible evidence in court
		Ages 4&5	Not Specified	Approved Child Restraint System or Seat Belt					

N.A. = Not applicable

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STATE CHILD PASSENGER SAFETY LAWS (continued)

State-Effective Date	Requires	Children	Where[1] Seated	To Use[2]	Vehicle	Exceptions	Penalties	Public Education Campaign	Other Provisions
Georgia 7 1 84	Resident Driver	Under Age 3	Not Specified	Approved Child Passenger Restraint System	Passenger Automobile Van or Pick Up Truck	For hire vehicles non resident drivers children whose personal needs are being attended to car pool drivers	Maximum fine $25 00 fine waived if proof of acquisition of system is shown in court	Yes Law includes public information program Campaign expires 1 1 84	Failure to use child restraint system does not constitute negligence or contributory negligence per se
		Ages 3 4	Not Specified	Approved Child Passenger Restraint System or Seat Belt					
Hawaii 7 1 83	Driver	Under Age 3	Not Specified	Approved Child Passenger Restraint System	Multi Vehicle	For hire vehicles commercial vehicles all other seats with seat belts are occupied school bus	Maximum fine $100 00 for first conviction maximum fine $200 00 for second conviction within one year maximum fine $500 00 for subsequent conviction	No	Failure to use child restraint system shall not be considered contributory negligence comparative negligence or negligence per se
		Ages 3 4	Not Specified	Approved Child Passenger Restraint System or Seat Belt					
Illinois 7 1 83 As Amended 6 27 83	Resident Parent or Legal Guardian	Under Age 4	Not Specified	Approved Child Restraint System	Motor Vehicle or Recreational Vehicle	Non resident drivers	First offense maximum fine $25 00 subsequent offense maximum fine $50 00 Fine will be waived if proof of acquisition of system is shown Allows state police to make arrests for violations	No	Failure to use child restraint device shall not constitute negligence use or non use is inadmissible evidence in court
	Resident Parent or Legal Guardian	Ages 4 6	Not Specified	Approved Child Restraint System or Seat Belt					
Indiana 1 1 84	Resident Driver	Under Age 3	Not Specified	Approved Child Passenger Restraint System	Motor Vehicle	Taxicabs, school bus rental vehicle leased for less than 30 days non resident drivers, motor bus	$25 00 $500 00 court costs Fine will be waived if proof of acquisition of system is shown	Previous public education campaign expires on 9 1 84	Failure to use child restraint system shall not constitute contributory negligence
		Ages 3 5	Not Specified	Approved Child Passenger Restraint System or Seat Belt					
Kansas 1 1 82	Resident Parent or Legal Guardian	Under Age 2	Front Seat	Approved Child Passenger Restraint System	Passenger Vehicle	Non resident drivers, drivers of temporary substitute vehicles	Oral warnings	Yes	Failure to use child restraint system shall not constitute negligence per se
Kentucky 7 14 82	Resident Parent or Legal Guardian	Under 40 Inches in Height	Not Specified	Approved Child Restraint System	Motor Vehicle	Non resident drivers recreational vehicles, trucks over one ton vehicles not owned by parents or guardians	Oral warnings	No	Failure to use child restraint system does not constitute negligence per se use or non use of system is inadmissible evidence in court
Maine 9 23 83	Resident Parent or Legal Guardian	Less Than 4 Years	Not Specified	Approved Child Safety Seat	Motor Vehicle Owned and Operated By Parent or Legal Guardian	Vehicle not equipped with seat belts, not required if number of passengers in vehicle exceeds seat belt capacity, non resident drivers	9 23 83 3 23 84 oral warning After 3 23 84 $25 00 for initial violation $50 00 subsequent violations Fine will be waived if proof of acquisition of system is shown	Yes State had public education campaign that ended 5 1 83	Failure to use child safety seat does not constitute negligence per se use or non use of system is inadmissible evidence in court
	Resident Driver	Ages 1 4	Not Specified	Approved Child Safety Seat or Seat Belt	Motor Vehicle Neither Owned or Operated By Parent or Legal Guardian				
	Resident Driver	Less Than 1 Year	Not Specified	Approved Child Safety Seat	Motor Vehicle Neither Owned or Operated by Parent or Legal Guardian				
Maryland 1 1 84	Resident Driver	Under Age 3	Not Specified	Child Safety Seat	Passenger Motor Vehicle or Multi purpose Motor Vehicle	Children who can't use system due to medical condition or size all other seats with seat belts are occupied	$25 00 fine will be waived if proof of acquisition is shown Points will not be assessed	Yes Law specifies that DOT and Department of Motor Vehicles shall implement an educational program	Prohibits use of safety seat or seat belt by more than one person at a time failure to use child safety seat does not constitute contributory negligence use or non use of system is inadmissible in court
		Ages 3 5	Not Specified	Child Safety Seat or Seat Belt					
Massachusetts 1 1 82	Driver	Under Age 5	Not Specified	Approved Child Passenger Restraint System or Seat Belt	Motor Vehicle	Vehicle used to transport passengers for hire, vehicle not equipped with seat belts, all other seats with seat belts are occupied	Maximum fine of $25 00 or proof of acquisition of system	No	Failure to use child restraint system does not constitute negligence per se
Michigan 4 1 82	Resident Driver	Ages 1-4	Front Seat	Approved Child Restraint System	Motor Vehicle	Non resident drivers child ren being nursed bus & school bus, taxicab or other vehicle not required to be equipped with seat belts	Maximum fine $10 00 plus court costs or proof of acquisition of system points will not be assessed	No	None
		Ages 1 4	Back Seat	Approved Child Restraint System or Seat Belt					
		Under Age 1	Not Specified	Approved Child Restraint System					

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STATE CHILD PASSENGER SAFETY LAWS (continued)

State/Effective Date	Requires	Children	Where[1] Seated	To Use[2]	Vehicle	Exceptions	Penalties	Public Education Campaign	Other Provisions
Minnesota 1 1 82 As Amended 8 1 83	Resident Parent or Legal Guardian	Under Age 4	Not Specified	Approved Child Passenger Restraint System	Motor Vehicle	Non resident drivers vehicles not owned by parent or guardian vehicles not equipped with seat belts	Maximum fine $25 00 fine will be waived if proof of acquisition of system is shown Points will not be assessed	No	None
Mississippi 7 1 83	Resident Parent or Legal Guardian	Under Age 2	Not Specified	Approved Child Passenger Restraint System	Motor Vehicle	Non-resident drivers	Maximum fine $10 00, fine will be waived if proof of acquisition of system is shown	Notice of new law will be sent to registered drivers with delivery of motor vehicle license plates	Failure to use child restraint system does not constitute contributory or comparative negligence. law does not create any new standard of duty on part of parent to child
Missouri 1 1/84	Resident Driver	Under Age 4	Front Seat	Child Passenger Restraint System Approved by Department of Public Safety	Motor Vehicle	Temporary substitute vehicles for-hire vehicles, non-resident drivers	Maximum fine $25 00	Yes Law provides for public information program	Failure to use child restraint system does not constitute negligence or contributory negligence use or non-use of system is inadmissable evidence in court, if all other seats with seat belts are occupied child shall be transported in rear seat
			Rear Seat	Child Passenger Restraint System or Seat Belt Approved by Department of Public Safety					
Montana 1/1/84	Resident Parent or Legal Guardian	Under Age 2	Not Specified	Approved Child Restraint Device	Motor Vehicle	Drivers not required to equip vehicle with more than three child restraint systems, children who can't use system due to medical condition or body size, taxicab, motor bus or school bus, vehicles which only seat two persons and which are transporting over 2 persons over age 4 in vehicle, vehicles not required to be equipped with seat belts, non resident drivers	First violation - $10 00 $25 00 fine will be waived if proof of acquisition of system is shown Subsequent violation within three years $25 00 - $100 00 fine	No	Failure to use child restraint system shall not constitute negligence use or non-use is inadmissable evidence in court
		Ages 2-4 or Under 40 Lbs	Not Specified	Approved Child Restraint Device or Seat Belt					
Nebraska 8/26/83	Resident Driver	Under Age 1	Not Specified	Approved Child Passenger Restraint System	Motor Vehicle	1953 or earlier motor vehicle not equipped with seat belts, taxicabs, children who can't use system due to medical condition or body size, non-resident drivers	$25 00 or proof of acquisition of system		Failure to use system shall not constitute negligence use or non use of system shall not constitute a defense for recovery of medical expenses
		Ages 1-4	Not Specified	Approved Child Passenger Restraint System or Seat Belts					
Nevada 7/1/83	Resident Driver	Under Age 5	Front Seat	Approved Child Restraint Device	Motor Vehicle	Non resident drivers, taxi cab, school bus, rented vehicle, children who can't use system because of medical condition or body size all other seats with seat belts are occupied	$35 00 $100 00 fine, fine will be waived if proof of acquisition of system is shown, points will not be assessed	No	Failure to use child restraint system will not constitute negligence, preference for use of safety belts should be given to children under age three and all unrestrained children under age five should be seated in rear seat
		Under Age 3	Rear Seat	Approved Child Restraint Device					
		Ages 3 5	Rear Seat	Approved Child Restraint Device or Seat Belts					
New Hampshire 6/27/83	Driver	Under Age 5	Not Specified	Child Passenger Seat or Seat Belt	Motor Vehicle	For hire vehicles, vehicle not equipped with seat belt children who can't use system because of medical condition	Maximum fine $30 00, fine will be waived if proof of acquisition of system is shown	No	Failure to use child restraint system shall not constitute contributory negligence

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STATE CHILD PASSENGER SAFETY LAWS (continued)

State Effective Date	Requires	Children	Where[1] Seated	To Use[2]	Vehicle	Exceptions	Penalties	Public Education Campaign	Other Provisions
New Jersey 4 7 83	Driver	Under Age 5	Front Seat	Approved Child Passenger Restraint System	Motor Vehicle	None	$10 00 $25 00, fine will be waived if proof of acquisition of system is shown	Yes Law calls for public information program	Failure to use child restraint system shall not constitute contributory negligence use or non use of system is in admissible evidence in court Where number of children in one family under age 5 in motor vehicle exceeds number of available seat belts children must be seated in rear seat
		Ages 18 Mos - 5 Yrs	Rear Seat	Approved Child Passenger Restraint System or Seat Belt					
New Mexico 6 17 83	Resident Driver	Under Age 5	Front Seat	Approved Child Passenger Restraint Device	Passenger Car, Van, or Pick Up Truck	Non-resident drivers, school bus, all seating positions and seat belts are occupied	$50 00 fine, fine will be waived if proof of acquisition of system is shown	No	Failure to use child restraint system shall not constitute negligence
		Ages 1-5	Rear Seat	Approved Child Passenger Restraint Device or Seat Belt					
New York 4/1/82	Resident Driver	Under Age 4	Not Specified	Approved Child Restraint Seat	Passenger Motor Vehicle	School buses, non resident drivers	Maximum fine $25 00 or proof of acquisition of system	No	Vehicle owner shall not permit use of vehicle unless child passengers are restrained
		Ages 4&5 (as amended 4/2/82)	Not Specified	Approved Child Restraint Seat or Safety Belt Approved by Commissioner of Motor Vehicles					
As Amended 6/28/83									Law has been expanded to require use of seat belts by children as follows After 4/1/84 Under Age 7 After 4/1/85 Under Age 8 After 4/1/86 Under Age 9 After 4/1/87 Under Age 10
North Carolina 7/1/82 -7/1/85	Resident Parent	Under Age 1	Not Specified	Child Restraint System Approved by Commissioner of Motor Vehicles	Motor Vehicles or a Family Purpose Vehicle	Non resident drivers, children whose personal needs are being attended to, all other seats with seat belts are occupied not required if seated in seat not requiring safety belt	7/1/82 - 6/30/84 warning ticket, 7/1/84 - 6/30/85 $10 00 fine, points will not be assessed	No Study is mandated from 7/1/82 - 6/30/85	Legislature not obligated to appropriate funds to implement law failure to use child restraint system does not constitute negligence per se
		Ages 1-2	Not Specified	Child Restraint System Approved by Commissioner of Motor Vehicles or Seat Belt					
North Dakota 1/1/84	Parent or Legal Guardian	Under Age 2	Not Specified	Approved Child Restraint System	Passenger Car	Vehicles manufactured prior to 1966 not equipped with seat belts	Maximum $20 00 fine, fine will be waived if proof of acquisition of system is shown.	No	Failure to use child restraint system does not constitute negligence, use or non-use is in admissible in court
		Ages 2-4	Not Specified	Approved Child Restraint System or Seat Belt					
Ohio 3/7/83	Resident Driver	Under Age 4 or Under 40 lbs	Not Specified	Approved Child Restraint System	Motor Vehicle Owned by Parent or Guardian and Registered in State	Taxi-cabs, vehicles not required to be equipped with seat belts, life threatening emergencies, non resident drivers, Director of Highway Safety to develop other rules on subject	$10 00 fine, fine waived if proof of acquisition of system is shown	No	Failure to use child restraint device does not constitute negligence use or non use is inadmissible in court
	Resident Driver	Under Age 1	Not Specified	Approved Child Restraint System	Motor Vehicle Not Owned by Parent or Guardian and Registered in State				
	Resident Driver	Ages 1-4 or Under 40 lbs	Not Specified	Approved Child Restraint System or Lap Belt or Seat Belt	Motor Vehicle Not Owned by Parent or Guardian and Registered in State				
	Resident Driver	Under Age 4 or Under 40 lbs	Not Specified	Approved Child Restraint System	Motor Vehicle Owned by Nursery School, Day Care Center or Kindergarten and Registered in State				

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STATE CHILD PASSENGER SAFETY LAWS (continued)

State Effective Date	Requires	Children	Where[1] Seated	To Use[2]	Vehicle	Exceptions	Penalties	Public Education Campaign	Other Provisions
Oklahoma 11 1 83	Resident Driver	Under Age 4	Rear Seat	Approved Child Passenger Restraint System or Seat Belt	Motor Vehicle	Non resident driver, school bus, taxi cab, vehicle not required to be equipped with seat belts, all other seats with seat belts are occupied, child ren who can't use system because of medical conditions	Oral warning	Yes Law provides for public education campaign	Use or non-use of system is inadmissible evidence in court, failure to use system shall not be used in mitigation of damages
		Under Age 4	Front Seat	Approved Child Passenger Restraint System					
		Ages 4&5	Not Specified	Approved Child Restraint System or Seat Belt					
Oregon 1 1 84	Resident Driver	Under Age 5	Not Specified	Child Safety System Approved by Division of Motor Vehicles or Seat Belt	Motor Vehicle or Pick Up Truck Under 8,000 lbs	Privately owned commercial vehicle, vehicle manufactured previous to 1966 and not equipped with seat belts, children who can't use systems because of medical condition or body size, all other seats with seat belts are occupied, residents of other states that don't have similar laws	1 1 84 - 6/30 84 warning, after 7 1 84 maximum $20 00 fine fine will be waived if proof of acquisition of system is shown	No	Failure to use system does not constitute negligence, use or non use of system is inadmissible evidence in court
Rhode Island 7 1 80	Driver	Under Age 3	Front & Rear Seat (as amended 4 3/81)	Approved Child Passenger Restraint System	Motor Vehicle	None	Maximum fine of $15 00 or proof of acquisition of system, recorded on driver's record	No	Use or non use of system is inadmissible evidence in court, failure to use child restraint system does not constitute negligence per se
South Carolina 7 1 83	Resident Driver	Under Age 1	Front or Rear Seat	Approved Child Passenger Restraint System	Passenger Car, Pick Up Truck, Van, Recreational Vehicle	taxi, church, day care, and school bus drivers, commercial motor vehicle, children being fed, children who can't use system due to medical conditions	7 1 83 - 6/30/83 warning, after 7 1 84 maximum fine $25 00, fine will be waived if proof of acquisition of system is shown	No	Failure to use system does not constitute negligence per se or contributory negligence, use or non-use of system is inadmissible evidence in court, costs incurred in purchasing child restraint system may be deducted on state income tax, if adequate restraint devices are not available, priority must be given to children under age three
		Under Age 4	Front Seat	Approved Child Passenger Restraint System					
		Ages 1-3	Rear Seat	Approved Child Passenger Restraint System or Seat Belt					
Tennessee 1 1 78 As Amended 1 1/81	Resident Parent or Legal Guardian	Under Age 4	Not Specified	Approved Child Passenger Restraint System	Motor Vehicle	Children being nursed or attended to by mother, vehicle not owned by parents or guardians, non resident drivers	$7 00 - $10 00 fine, no court costs	No	Use or non use of system is inadmissible evidence in court, failure to use child restraint system does not constitute negligence per se
Virginia 1 1 83	Resident Parent or Legal Guardian	Under Age 3 & Under 40 lbs	Not Specified	Child Restraint System Approved by State Police	Motor Vehicle Manufactured After 1 1 68	Public bus or school bus, vehicle which has interior design which makes it impractical to use system if use is deemed impractical for medical reasons non resident drivers, drivers of vehicles manufactured prior to 1 1 68	$25 00 fine ($10 00 under certain circumstances) fine may be waived if non use is due to financial reasons	No However law provides for development of loan program to provide child restraint systems to persons who are financially unable to purchase system	Failure to use child restraint system does not constitute negligence per se, non use of system will not constitute a denial for payment of medical claims
		Ages 3 4 & Over 40 lbs	Not Specified	Child Restraint System Approved by State Police or Seat Belt					
Washington 12 31 83	Resident Parent or Legal Guardian	Under Age 1	Not Specified	Child Passenger Restraint Device Approved by State Commission on Equipment	Motor Vehicle Owned by Parent or Guardian and Registered in State	Non-residents	1 1 84 - 6/30 84, written warning after 7 1/84 minimum fine $30 00 fine will be waived if proof of acquisition of system is shown	No	Failure to use child restraint device does not constitute negligence, use or non use is inadmissible in court
		Ages 1-4	Not Specified	Child Passenger Restraint Device Approved by State Commission on Equipment or Seat Belt					

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STATE CHILD PASSENGER SAFETY LAWS (continued)

State Effective Date	Requires	Children	Where[1] Seated	To Use[2]	Vehicle	Exceptions	Penalties	Public Education Campaign	Other Provisions
Washington, D.C. 7/1/83	Resident Driver	Under Age 3	Not Specified	Approved Child Restraint Seat	Motor Vehicle	Taxicabs, farm purpose vehicle non resident drivers, all other seats with seat belts are occupied	$25 ($10 fine, fine will be waived if proof of acquisition of system is proved, points will not be assessed	Yes. Law specifies that public information programs will be undertaken	Failure to use child restraint system shall not constitute negligence or contributory negligence violation or compliance will not provide basis for civil action for damages
		Ages 3-6	Not Specified	Approved Child Restraint Seat or Seat Belt					
West Virginia 7/9/81	Resident Driver	Under Age 3	Not Specified	Approved Child Passenger Restraint System, Car Bed or Car Seat	Passenger Automobile, Van or Pick Up Truck	For hire vehicles, non resident drivers	Misdemeanor, $10.00 - $20.00 fine or proof of purchase of system	No	Failure to use system does not constitute negligence per se
		Ages 3-5	Not Specified	Approved Child Passenger Restraint System, Car Bed, Car Seat or Seat Belt					
Wisconsin 11/1/82	Resident Parent or Legal Guardian	Under Age 2	Not Specified	Child Safety Restraint System Approved by State Department of Transportation	Motor Vehicle	Children who can't use system because of medical condition or body size, motor bus, school bus, taxi cab, vehicles which only seat 2 persons and which are transporting over 2 persons over age 4 in vehicle, non-resident drivers	$30 - $75 fine for children under age 2, $10 - $25 for first offense and $25 - $200 for second offense for children aged 2-4, fines waived if proof of acquisition of system is shown	No. However, fines will not be assessed until 5/1/83	Failure to use system does not constitute negligence per se, use or non-use of system is inadmissible evidence in court
		Ages 2-4	Not Specified	Child Safety Restraint System Approved by State DOT or Seat Belt					
Pennsylvania 11/1/83	Resident Parent or Legal Guardian	Under Age 1	Not Specified	Approved Child Passenger Restraint System	Passenger Car; Class 1 & 2 Trucks; Classic & Antique Motor Vehicle, Motorhome	Non residents; Medical conditions or size of child	Oral warning thru 1/85, after $25 fine; waived if proof of acquisition is shown	Yes. Hospital Information on loan or rental of Child Seats	Fines will be used to support loan a seat program Must use Child Restraint if transporting child in vehicle cargo area Failure to use system does not constitute negligence; not admissable in court.
		Ages 1-4	Rear Seat	Approved Child Restraint System or Seat Belt					

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APPENDIX H

U.S. CHILD PASSENGER FATALITIES BY STATE, AGES 5 THROUGH 17
1978-1982

(Passenger Cars and Trucks Only)

Accident Jurisdiction And Age Group	1978	1979	1980	1981	1982	5-Year Total
NATIONWIDE						
Ages 5-9	428	433	388	351	301	1,901
Ages 10-14	684	597	571	535	496	2,883
Ages 15-17	3,131	3,064	2,962	2,514	2,023	13,694
TOTAL, Ages 5-17	4,243	4,094	3,921	3,400	2,820	18,478
Alabama						
Ages 5-9	10	5	5	15	12	47
Ages 10-14	14	15	13	6	14	62
Ages 15-17	79	59	60	59	43	300
TOTAL, Ages 5-17	103	79	78	80	69	409
Alaska						
Ages 5-9	--	—	--	—	—	--
Ages 10-14	1	2	—	1	--	4
Ages 15-17	10	4	6	5	2	27
TOTAL, Ages 5-17	11	6	6	6	2	31
Arizona						
Ages 5-9	10	12	15	7	2	46
Ages 10-14	11	16	10	7	8	52
Ages 15-17	56	49	31	35	30	201
TOTAL, Ages 5-17	77	77	56	49	40	299
Arkansas						
Ages 5-9	5	6	3	15	9	38
Ages 10-14	11	7	16	14	8	56
Ages 15-17	38	41	42	28	21	170
TOTAL, Ages 5-17	54	54	61	57	38	264
California						
Ages 5-9	37	51	29	31	29	177
Ages 10-14	57	46	62	45	47	257
Ages 15-17	232	276	251	213	169	1,141
TOTAL, Ages 5-17	326	373	342	289	245	1,575
Colorado						
Ages 5-9	8	8	5	2	4	27
Ages 10-14	7	3	6	7	7	30
Ages 15-17	41	35	40	25	19	160
TOTAL, Ages 5-17	56	46	51	34	30	217
Connecticut						
Ages 5-9	—	—	5	4	4	13
Ages 10-14	2	4	1	4	2	13
Ages 15-17	35	42	30	30	26	163
TOTAL, Ages 5-17	37	46	36	38	32	189

Accident Jurisdiction And Age Group	1978	1979	1980	1981	1982	5-Year Total
Delaware						
Ages 5-9	--	1	1	1	2	5
Ages 10-14	2	--	2	2	--	6
Ages 15-17	15	6	11	2	4	38
TOTAL, Ages 5-17	17	7	14	5	6	49
District of Columbia						
Ages 5-9	--	--	--	--	--	--
Ages 10-14	1	--	2	1	--	4
Ages 15-17	2	1	--	1	--	4
TOTAL, Ages 5-17	3	1	2	2	--	8
Florida						
Ages 5-9	14	18	16	22	9	79
Ages 10-14	34	23	29	24	14	124
Ages 15-17	102	113	137	109	67	528
TOTAL, Ages 5-17	150	154	182	155	90	731
Georgia						
Ages 5-9	19	15	13	16	12	75
Ages 10-14	25	21	31	14	16	107
Ages 15-17	97	121	113	88	70	489
TOTAL, Ages 5-17	141	157	157	118	98	671
Hawaii						
Ages 5-9	3	1	1	1	--	6
Ages 10-14	1	--	4	1	--	6
Ages 15-17	10	7	11	7	2	37
TOTAL, Ages 5-17	14	8	16	9	2	49
Idaho						
Ages 5-9	5	8	4	3	3	23
Ages 10-14	9	1	11	2	12	35
Ages 15-17	25	24	21	16	23	109
TOTAL, Ages 5-17	39	33	36	21	38	167
Illinois						
Ages 5-9	16	17	8	13	16	70
Ages 10-14	33	23	19	17	21	113
Ages 15-17	149	138	114	87	80	568
TOTAL, Ages 5-17	198	178	141	117	117	751
Indiana						
Ages 5-9	10	17	15	17	7	66
Ages 10-14	17	19	27	11	7	81
Ages 15-17	91	101	63	65	48	368
TOTAL, Ages 5-17	118	137	105	93	62	515
Iowa						
Ages 5-9	4	6	5	2	1	18
Ages 10-14	11	11	5	3	5	35
Ages 15-17	48	51	48	36	37	220
TOTAL, Ages 5-17	63	68	58	41	43	273
Kansas						
Ages 5-9	4	5	7	5	1	22
Ages 10-14	11	10	12	9	5	47
Ages 15-17	36	41	36	28	20	161
TOTAL, Ages 5-17	51	56	55	42	26	230

Accident Jurisdiction And Age Group	1978	1979	1980	1981	1982	5-Year Total
Kentucky						
Ages 5-9	7	6	6	4	11	34
Ages 10-14	21	15	12	10	15	73
Ages 15-17	75	70	49	63	50	307
TOTAL, Ages 5-17	103	91	67	77	76	414
Louisiana						
Ages 5-9	11	16	14	3	10	54
Ages 10-14	14	17	16	14	17	78
Ages 15-17	60	52	82	61	36	291
TOTAL, Ages 5-17	85	85	112	78	63	423
Maine						
Ages 5-9	—	4	1	2	2	9
Ages 10-14	6	5	3	2	3	19
Ages 15-17	14	20	23	16	7	80
TOTAL, Ages 5-17	20	29	27	20	12	108
Maryland						
Ages 5-9	4	3	4	3	4	18
Ages 10-14	6	7	4	9	13	39
Ages 15-17	48	27	43	34	32	184
TOTAL, Ages 5-17	58	37	51	46	49	241
Massachusetts						
Ages 5-9	3	3	5	2	1	14
Ages 10-14	8	2	4	6	5	25
Ages 15-17	62	64	63	44	50	283
TOTAL, Ages 5-17	73	69	72	52	56	322
Michigan						
Ages 5-9	19	17	13	9	7	65
Ages 10-14	20	19	17	17	14	87
Ages 15-17	120	124	114	84	62	504
TOTAL, Ages 5-17	159	160	144	110	83	656
Minnesota						
Ages 5-9	6	8	4	5	5	28
Ages 10-14	11	9	10	10	6	46
Ages 15-17	62	61	46	56	22	247
TOTAL, Ages 5-17	79	78	60	71	33	321
Mississippi						
Ages 5-9	7	9	6	5	6	33
Ages 10-14	9	11	10	6	10	46
Ages 15-17	52	47	33	45	37	214
TOTAL, Ages 5-17	68	67	49	56	53	293
Missouri						
Ages 5-9	12	11	14	5	3	45
Ages 10-14	21	15	11	21	11	79
Ages 15-17	87	98	91	67	56	399
TOTAL, Ages 5-17	120	124	116	93	70	523
Montana						
Ages 5-9	2	4	3	2	4	15
Ages 10-14	4	6	1	12	3	26
Ages 15-17	17	28	23	19	20	107
TOTAL, Ages 5-17	23	38	27	33	27	148

Accident Jurisdiction And Age Group	1978	1979	1980	1981	1982	5-Year Total
Nebraska						
Ages 5-9	3	5	4	3	1	16
Ages 10-14	6	7	3	2	2	20
Ages 15-17	33	33	32	30	11	139
TOTAL, Ages 5-17	42	45	39	35	14	175
Nevada						
Ages 5-9	2	4	5	3	2	16
Ages 10-14	5	1	4	5	—	15
Ages 15-17	23	21	19	10	8	81
TOTAL, Ages 5-17	30	26	28	18	10	112
New Hampshire						
Ages 5-9	—	1	—	2	2	5
Ages 10-14	2	3	1	1	2	9
Ages 15-17	20	21	13	8	14	76
TOTAL, Ages 5-17	22	25	14	11	18	90
New Jersey						
Ages 5-9	8	2	3	4	3	20
Ages 10-14	16	7	7	7	17	54
Ages 15-17	62	52	54	64	47	279
TOTAL, Ages 5-17	86	61	64	75	67	353
New Mexico						
Ages 5-9	8	8	2	3	—	21
Ages 10-14	13	12	7	5	6	43
Ages 15-17	21	34	31	28	26	140
TOTAL, Ages 5-17	42	54	40	36	32	204
New York						
Ages 5-9	15	11	15	13	8	62
Ages 10-14	22	14	19	19	23	97
Ages 15-17	121	138	120	97	67	543
TOTAL, Ages 5-17	158	163	154	129	98	702
North Carolina						
Ages 5-9	20	13	7	7	12	59
Ages 10-14	17	23	21	27	14	102
Ages 15-17	91	102	112	90	71	466
TOTAL, Ages 5-17	128	138	140	124	97	627
North Dakota						
Ages 5-9	3	1	—	—	2	6
Ages 10-14	10	1	2	1	—	14
Ages 15-17	14	8	11	7	12	52
TOTAL, Ages 5-17	27	10	13	8	14	72
Ohio						
Ages 5-9	22	19	19	10	12	82
Ages 10-14	32	21	11	22	16	102
Ages 15-17	138	163	143	107	89	640
TOTAL, Ages 5-17	192	203	173	139	117	824
Oklahoma						
Ages 5-9	11	10	15	13	15	64
Ages 10-14	16	12	6	14	17	65
Ages 15-17	74	59	57	63	55	308
TOTAL, Ages 5-17	101	81	78	90	87	437

Accident Jurisdiction And Age Group	1978	1979	1980	1981	1982	5-Year Total
Oregon						
Ages 5-9	8	8	5	4	2	27
Ages 10-14	9	10	8	12	8	47
Ages 15-17	46	30	38	37	25	176
TOTAL, Ages 5-17	63	48	51	53	35	250
Pennsylvania						
Ages 5-9	15	7	9	12	6	49
Ages 10-14	24	27	14	10	8	83
Ages 15-17	136	108	89	113	90	536
TOTAL, Ages 5-17	175	142	112	135	104	668
Rhode Island						
Ages 5-9	—	1	1	—	—	2
Ages 10-14	1	1	1	2	2	7
Ages 15-17	7	13	6	5	6	37
TOTAL, Ages 5-17	8	15	8	7	8	46
South Carolina						
Ages 5-9	12	9	8	9	3	41
Ages 10-14	13	16	14	12	7	62
Ages 15-17	80	46	60	41	42	269
TOTAL, Ages 5-17	105	71	82	62	52	372
South Dakota						
Ages 5-9	3	—	4	—	3	10
Ages 10-14	5	6	7	3	1	22
Ages 15-17	16	17	22	18	5	78
TOTAL, Ages 5-17	24	23	33	21	9	110
Tennessee						
Ages 5-9	8	10	9	11	3	41
Ages 10-14	15	11	16	16	13	71
Ages 15-17	77	60	73	76	62	348
TOTAL, Ages 5-17	100	81	98	103	78	460
Texas						
Ages 5-9	39	39	52	42	33	205
Ages 10-14	53	62	49	60	41	265
Ages 15-17	208	218	210	180	166	982
TOTAL, Ages 5-17	300	319	311	282	240	1,452
Utah						
Ages 5-9	9	2	—	3	5	19
Ages 10-14	8	4	4	2	3	21
Ages 15-17	33	13	21	12	15	94
TOTAL, Ages 5-17	50	19	25	17	23	134
Vermont						
Ages 5-9	1	2	1	—	2	6
Ages 10-14	—	3	—	1	6	10
Ages 15-17	8	10	12	8	5	43
TOTAL, Ages 5-17	9	15	13	9	13	59
Virginia						
Ages 5-9	5	5	8	5	10	33
Ages 10-14	14	18	18	14	15	79
Ages 15-17	66	62	72	55	55	310
TOTAL, Ages 5-17	85	85	98	74	80	422

Accident Jurisdiction And Age Group	1978	1979	1980	1981	1982	5-Year Total
Washington						
Ages 5-9	11	8	7	2	4	32
Ages 10-14	10	13	6	9	16	54
Ages 15-17	60	65	63	58	30	276
TOTAL, Ages 5-17	81	86	76	69	50	362
West Virginia						
Ages 5-9	2	6	5	4	4	21
Ages 10-14	8	4	3	6	4	25
Ages 15-17	37	23	32	19	24	135
TOTAL, Ages 5-17	47	33	40	29	32	181
Wisconsin						
Ages 5-9	5	10	3	6	4	28
Ages 10-14	13	11	12	7	9	52
Ages 15-17	83	62	76	53	56	330
TOTAL, Ages 5-17	101	83	91	66	69	410
Wyoming						
Ages 5-9	2	1	4	1	1	9
Ages 10-14	5	3	—	3	3	14
Ages 15-17	14	6	15	12	9	56
TOTAL, Ages 5-17	21	10	19	16	13	79
NATIONWIDE						
Ages 5-9	428	433	388	351	301	1,901
Ages 10-14	684	597	571	535	496	2,883
Ages 15-17	3,131	3,064	2,962	2,514	2,023	13,694
TOTAL, Ages 5-17	4,243	4,094	3,921	3,400	2,820	18,478

—Data not available

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