

Log H-371

NATIONAL TRANSPORTATION SAFETY BOARD  
WASHINGTON, D.C.

ISSUED:

November 30, 1983

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Forwarded to:

Honorable Diane K. Steed  
Administrator  
National Highway Traffic Safety  
Administration  
Washington, D.C. 20590

SAFETY RECOMMENDATION(S)

H-83-53 through -59

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On September 7, 1983, the National Transportation Safety Board completed a safety study of child motor vehicle passenger protection. <sup>1/</sup> For the purpose of the study, the Safety Board conducted 3 regional public hearings and investigated 53 accidents involving infants and small children, restrained and unrestrained, in 19 States. In 32 of the accidents investigated, 34 child safety seats were involved, including seats of 16 different designs made by 7 different manufacturers. (In 21 accidents there were no child safety seats involved.) 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. Also, the investigative findings underscored the importance of the proper use of child safety seats and indicated a need for special efforts to combat what appears to be a significant misuse problem.

All child safety seats marketed in this country must meet the requirements of Federal Motor Vehicle Safety Standard (FMVSS) 213, Child Restraint Systems. 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 of 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 must not 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 the tether strap.

Widespread misuse of safety seats was found in the accidents investigated. Only 6 of the 34 child safety seats in which children were riding when the accident 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 generally is consistent with the extensive incidence of misuse identified by the Physicians for Automotive Safety in observational surveys of child safety seats in normal everyday use.

<sup>1/</sup> For more detailed information, see Safety Study--"Child Passenger Protection Against Death, Disability, and Disfigurement in Motor Vehicle Accidents" (NTSB/SS-83/01).

In the accidents involving the 28 safety seats that were misused, the misuse conditions, the accident circumstances, and the impact severity varied. Nineteen safety seats provided sufficient protection under certain misuse conditions to prevent or minimize injury to 19 children 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; eight of those accidents resulted in five children being killed and three being injured. In six of the eight accidents, proper use of the safety seats probably would have prevented the deaths or prevented or minimized the injuries to the children.

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 situations 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 16 safety seat models involved.

The most common usage error in the accidents investigated was nonuse or misuse of a tether strap when its use was required. In 12 cases, the required tether strap was not used at all, and in 2 cases, the tether strap was misused (either tied to a vehicle seatback or to a door latch). Surveys by the Physicians for Automotive Safety 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.

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. On December 11, 1980, the National Highway Traffic Safety Administration (NHTSA) issued a rulemaking notice to facilitate the proper use of the tether straps, 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 holes at all rearmost seating locations. 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, the date the Safety Board completed its report.

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, the use of booster seats is expanding rapidly, and 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 Safety Board believes that NHTSA should expedite the issuance of a final rule requiring that newly-manufactured vehicles be equipped with tether anchorages at all rearmost seating positions.

Further, the Safety Board is concerned that child safety seats which rely on the use of a tether strap to demonstrate adequate crash performance are used almost universally 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.

FMVSS 213 also requires that child safety seat manufacturers attach an instruction label to the safety seat itself and provide a detailed instruction booklet. However, on some of the safety seats in the accidents investigated, labels 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 the detailed 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. In some cases, the seats were incomplete (part of the harness missing) at the time they were acquired. Families did not have detailed usage instructions and did not realize that the safety seats were not complete.

In one fatal accident, the effect of incompatibilities among the child, the child safety seat, and the vehicle belt system could not be determined. The accident was a moderately severe head-on collision into a utility pole. The 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. In addition, 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 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 experimental, one-time only, crash tests have been conducted by the University of Michigan Transportation Research Institute, under a NHTSA contract, to attempt to measure roughly both relative neck load and relative abdominal load levels in crash tests of several different types of safety seats. Although tests were developmental, they suggest that there may be differences in both load levels in crash tests of different safety seats. The Safety Board believes that this area should be further explored through research and crash testing to determine the feasibility and desirability of developing neck and abdominal load criteria and testing procedures for child restraint systems.

Another accident investigated by the Safety Board involved a lateral right side impact to the vehicle with secondary impact in the right front. A 4-year-old girl, restrained by a lap-type safety belt in the left rear, sat next to a 2-year-old boy 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 facial abrasions from contact with the side of the safety seat. The unrestrained driver sustained severe injuries. 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 belt-restrained occupant contacting a safety seat installed in the vehicle.

Testimony received in the Safety Board's public hearings and other research and accident data from several countries indicate that children at 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.

The limitations of safety belts for use by small 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). Medical research has identified anatomical differences between adults and children which make adult safety belts less effective in protecting children than adults, and this research led to the development of better restraint systems to provide more effective protection for children. Although some safety belt-induced injuries can occur (and the risk of these appears to be significantly greater for infants), the risk is less than the risk of transporting children unrestrained.

Parents and other persons transporting infants and small children need to be encouraged at least to 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 to the public, legislators, and others 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. Current data are inadequate to answer questions about the relative degree of safety provided by safety belts to children at various ages, what the limitations are, and the kinds of results that can be expected in crashes. More information is needed, especially for a greater understanding of the interaction of safety belts with the body regions where they can be expected to localize crash forces — the pelvis, abdomen, spine, chest, and neck — at different stages of children's anatomical development.

Therefore, 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 recommends that 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)

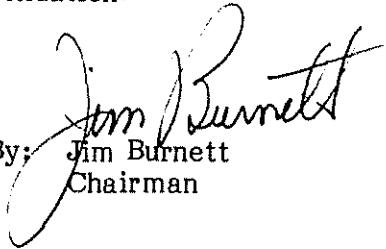
Amend Federal Motor Vehicle Safety Standard 213, Child Restraint Systems, to require that child safety seats and other child restraint systems include on their certification labels, information for obtaining a replacement copy of the manufacturer's detailed instructions for use. (Class II, Priority Action)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

BURNETT, Chairman, GOLDMAN, Vice Chairman, McADAMS, BURSLEY, and ENGEN, Members, concurred in this recommendation.

By:   
Chairman

