

Log H-372

# NATIONAL TRANSPORTATION SAFETY BOARD WASHINGTON, D.C.

ISSUED: November 30, 1983

Forwarded to:  
  
Child Safety Seat Manufacturers  
See distribution list

SAFETY RECOMMENDATION(S)

H-83-60 and -61

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 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 when they were misused. In some cases, however, misuse of the safety seat reduced or negated its protective function and, without proper restraint, the child was killed or injured.

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.

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.

<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).

The misuse situations that were found covered a broad range of usage errors, and in 15 of the 28 cases of misuse, multiple usage errors were found. Multiple misuse situations usually involved two or three separate usage errors, although in one case five errors were involved. 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.

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, and not for protection. In these three cases, either the safety harness was not fastened around the child (and there was no armrest or 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. However, nonuse of the safety harness in both cases had a critical effect in negating safety seat performance.

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 cases, misuse errors degraded the performance of the safety seat. In one of these cases, 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 the infant 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's shoulders from slipping 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 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.

Another misuse case involved a near-side lateral impact in which the forward-facing safety seat and the child rotated forward, resulting in fatal injury to the child from contact with intruding sheet metal. The vehicle safety belt was routed improperly through the safety seat frame and, according to the manufacturers' instructions, the orientation of the safety seat with this child 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.

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 16 safety seat models involved in this study.

Federal Motor Vehicle Safety Standard (FMVSS) 213 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 any instructions because they were not included with the seat when it was purchased second-hand at a yard or garage sale or handed down by a friend or relative. Misuse appeared to be a prevalent problem in these cases. In other cases, the seats were incomplete, with part of the harness missing, when they were acquired. Families which did not have the detailed usage instructions did not realize that the safety seats were not complete.

In one study <sup>2/</sup> 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."

The misuse problems found in the accidents investigated 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 routings, were variously specified in terms of when a child can sit upright, 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."

Some recent revisions of instructions have resulted in improvements. For example, Questor Juvenile Furniture Company made significant improvements in instructions issued with one safety seat model, including improvements which resulted from one of the Safety Board's first accident investigations for the child passenger protection study. 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 safety seats to identify correct safety belt routing locations. These kinds of initiatives can help to make the correct routing locations readily identifiable even when the user does not have, or does not use, the printed instructions.

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 each child safety seat manufacturer:

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<sup>2/</sup> 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.

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 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, McADAMS, BURSLEY, and ENGEN, Members, concurred in this recommendation.

  
By: Jim Burnett  
Chairman

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