

EXECUTIVE SUMMARY

School buses are the safest form of surface transportation. In 1983, 42,589 people were killed in traffic accidents. Only 17 were school bus occupants. On average for 1981-1983, 11 passengers and 1 driver were killed in school bus accidents and 30 were seriously injured. The subject of occupant protection in large school buses is complex. Based on extensive research and public rulemaking, the National Highway Traffic Safety Administration (NHTSA) concluded by 1977 that the concept of compartmentalization - i.e., strong, well-padded seats with high seat backs and better seat spacing to safely retain and cushion students during a crash - would be an 'automatic' system to protect children effectively in large school buses without requiring safety belts. All available test data and real world accident data indicate that this concept has worked extremely well.

NHTSA believes that the occupant protection required in school buses manufactured after April 1, 1977, plus the inherent safety of a highly recognizable vehicle that travels on a regular route, provide a high level of safety. There is insufficient data available to demonstrate whether safety belts would increase occupant protection. The number of school bus occupant deaths and serious injuries is so low that assessing the extent to which safety belts could either prevent deaths or injury or cause it is not feasible.

In view of the effectiveness of the current safety standards, and the excellent safety record of school buses generally, we do not believe that a Federal requirement for safety belts in large school buses is warranted. The National Transportation Safety Board reviewed this matter in 1983 and found that current NHTSA standards appear to be effective in eliminating or substantially reducing the majority of school bus passenger injuries.

Small, van type school buses (under 10,000 pounds gross weight) are required to have safety belts for all occupants as standard equipment since these vehicles are similar to passenger cars. The agency believes that safety belts are necessary and effective in providing occupant protection in those vehicles, and we encourage all passengers to wear their belts whenever the vehicles are in motion.

It is important to emphasize that the Federal standards specify the minimum safety requirements applicable to school buses. Nothing prohibits a State or local jurisdiction from purchasing buses equipped with safety belts.

SAFETY BELTS IN SCHOOL BUSES

INTRODUCTION

School buses are the safest form of surface transportation, transporting some 21 million children to and from school each weekday. Most fatal injuries relating to school buses occur outside the bus, when children as pedestrians are struck by another vehicle or the bus itself - but not as school bus occupants. In 1983, there were 69 school bus related fatalities: 50 deaths were outside the bus as pedestrians; 2 were school bus drivers; and 17 were on-board school bus passengers.

Because of the greatly increased public discussion on the need for occupant protection in automobiles (i.e., safety belts and automatic protection devices), as a result of many States considering and passing mandatory safety belt use laws, and because all 50 States and the District of Columbia now have mandatory child passenger safety laws, the issue of safety belts on large school buses has become a topic of much discussion. Some parents also feel that children who have been taught to use child safety seats and safety belts in automobiles will get out of the habit if they ride regularly in a school bus that has no safety belts.

This paper provides information for decision-makers at the State and local levels so they can determine for themselves whether safety belts are desirable in large school buses in their areas.

ACCIDENTS, INJURIES, AND FATALITIES

In 1983, 390,000 school buses transported 21,500,000 pupils daily and accumulated three billion miles of travel over the course of the year. Given this tremendous exposure to all types of traffic and weather conditions, it is not surprising that school buses, on occasion, are involved in accidents. Fortunately, the overwhelming majority of these accidents are minor, involving only property damage or minor injury to the bus occupants. For example, from a survey of State departments of education and State traffic authorities, it is estimated that in 1983 there were 48,000 school bus accidents, but 46,000 involved property damage only (Reference #1). Less than half of these accidents were serious enough to warrant a police report, as reported in the table that follows.

From NHTSA's National Accident Sampling System (NASS) and the Fatal Accident Reporting System (FARS), we have estimates of the number of police reported school bus accidents and their injury consequences. FARS gives us absolute counts of the number of people killed in school bus accidents. (See Table 1.)

TABLE I

**AVERAGE ANNUAL ESTIMATES OF THE RESULTS OF SCHOOL BUS ACCIDENTS

1981-83

(Based on HASS and FARS Statistics for 1981-1983, NCSA)

17,000 - 18,000 police reported accidents

5,000 - 6,000 injured passengers, of which

30 seriously injured (requiring hospitalization) passengers, and only

An average of six fatal accidents with at least one passenger fatality

An average of 11 passenger and 1-2 driver fatalities

An additional 50 fatal accidents where the death occurs to a non-bus occupant: pedestrian, 35; motorcycle, 10; other vehicle, 5.

***These are only ESTIMATES. In 1983, there were 3,300 ESTIMATED injuries, according to National Safety Council. once they began using actual reported injuries, the number jumped drastically to 8,400 in 1984 - and NOT ALL INJURIES are reported. Many states do not*

require an accident to be reported if there are only "minimal" injuries or property damage. Countless injuries go unreported every year. Many states do not report accidents which occur on field trips or sports trips. Accidents involving these "activity" buses are responsible for 50% of all fatal bus accidents

What these statistics illustrate so dramatically is that very few school bus passengers are killed or seriously injured. In 1983, 42,589 people were killed in traffic accidents (17 were school bus occupants) (Reference #2). In 1983, approximately 166,000 people were seriously injured in traffic accidents, 30 were school bus occupants (Reference #3). For a wide variety of reasons (protective laws, size of the bus, driver selection and training, etc.) school bus transportation is very safe. In the very few accidents where there are bus occupant fatalities, it is often the result of a bus being struck by a much larger vehicle (a heavy truck or a train) or the bus going off the road and striking a large fixed object.

NHTSA's AUTHORITY AND POSITION

AUTHORITY

There are two sets of regulations issued under different Acts of Congress that relate to the safety of school buses. The first of these, the motor vehicle safety standards issued by the National Highway Traffic Safety Administration (NHTSA) under the National Traffic and Motor Vehicle Safety Act of 1966 (Public Law 89-563; U.S.C. 1381-1426), apply to the manufacture and sale of new motor vehicles. In a 1974 amendment to the Act (P.L. 93-492), Congress expressly directed NHTSA to issue standards on specific aspects of school bus safety, including emergency exits, seating systems, windows and windshields, and bus structure.

[These NHTSA standards became effective April 1, 1977 and apply to each school bus manufactured on or after that date. In addition, a number of special requirements were made in existing standards. The new standards issued were: "Bus Window Retention and Release" (FMVSS No. 217); "School Bus Rollover Protection" (FMVSS No. 220); "School Bus Body Joint Strength" (FMVSS No. 221); and "School Bus Passenger Seating and Crash Protection" (FMVSS No. 222) (Reference #4).]

NHTSA also administers recommended guidelines for the use of State highway safety funds referred to as "section 402 funds," under the authority of the Highway Safety Act (Public Law 89-564; 23 U.S.C. 401-408). These guidelines cover a wide range of subjects, including pupil transportation. Unlike the motor vehicle standards, which impose requirements directly on manufacturers, these guidelines apply to the State highway safety programs, particularly those funded with Federal highway safety grants. The intent of these guidelines is to give the States the latest thinking and state-of-the-art materials on specific highway safety issues.

Highway Safety Program Standard 17 (HSPS 17), "Pupil Transportation Safety," sets forth guidelines for a State highway safety program for pupil transportation, including the identification, operation, and maintenance of school buses; training of personnel; and administration (Reference #5) The intent of guidelines is to provide the latest state-of-the-art thinking on specific highway safety issues rather than place requirements on a program.

NHTSA's POSITION

Federal Motor Vehicle Safety Standard (FMVSS) 222, "School Bus Passenger Seating and Crash Protection," sets requirements for the interior of large school buses which provide children a high level of protection without the need to "buckle up." The standard requires high and strong seats and seat backs, seat back padding, and seat spacing that reduces the chance of the occupant being thrown over the seat in front. The approach taken to bus safety is commonly referred to as compartmentalization. Compartmentalization, as outlined in the standard, requires strength in the entire seating system which includes the floor, the seat frame and the fastening of the frames to the floor while at the same time providing seat system padding and flexibility to absorb energy in a crash. The specific compartmentalization requirements are summarized in the Appendix.

The NHTSA compartmentalization position is based on extensive research, crash testing, and performance history for over 20 years. References 6 thru 11 in the bibliography provide the supporting technical documentation for this policy.

NHTSA believes that the occupant protection required in school buses manufactured after April 1, 1977, plus the inherent safety of a highly recognizable vehicle that travels on a regular route, provides a high level of safety protection.

There is no body of data available to definitively demonstrate whether safety belts in large school buses would increase occupant protection. The number of school bus occupant deaths and serious injuries is so low that assessing the extent to which adding safety belts could prevent death or injury (or cause it) is not feasible.

It is important to emphasize that FMVSS No. 222, 'School Bus Passenger Seating and Crash Protection,' specifies the minimum safety requirements applicable to school buses. Nothing prohibits a State or local jurisdiction from purchasing buses equipped with safety belts. School districts that want to provide safety belts in their large school buses are free to do so.

Small, van-type school buses (under 10,000 lbs cross vehicle weight) are required, the same as passenger cars, to have safety belts. These small school buses respond in a crash in a similar manner as cars because of their weight and design. [*Type III vehicles*]

EFFECTIVENESS OF BELTS

There are several technical considerations that have entered the debate of protecting school bus passengers in accidents. These considerations include the effectiveness of safety belts; installation requirements for belts on new buses; and, retrofitting belts on buses. Also, the possibility of belt use on buses increasing belt use in passenger cars has been raised. The discussion in this section will focus on large school buses, as small school buses are already required to have safety belts.

Because there are very few school bus passenger fatalities or serious injuries in a typical year, there is very little information available to determine the effectiveness of restraint systems. This is especially true of safety belts because less than one percent of all large buses currently

are equipped with belts. To attempt to explore the question of effectiveness in greater detail, it is useful to examine the types of accidents in which buses are involved.

***Table 2 shows that 50 percent of the occupant fatalities in school buses occur in rollover accidents and 14.7 percent of the occupant fatalities occur in side impact accidents. It is in these types of accidents that safety belts might be most likely to provide additional safety benefits to school bus occupants. One reason for this is ejections, which could be prevented by belts, represent one-fourth of all fatalities. However, some school bus accidents that involve fatalities are catastrophic so that it is unlikely that any type of occupant protection would make a difference. The National Transportation Safety Board (NTSB) investigation of the Jonesboro crash mentioned In Section VII is one example. On the other hand, there is a significant body of automobile accident data that demonstrates that lap belts save lives and reduce injuries. Overall, because of the limited accident data on school buses and extremely sparse data on belted occupants, estimates of how much additional protection might be provided by safety belts on buses in rollover and side impact accidents are, of necessity, conjectural.

**** Seat belts could increase protection in 50% of all accidents. Seat belts may not have prevented the fatalities in the Jonesboro accident, but NTSB points out in their report: "Those seated in the window seats ... might have suffered less serious injuries if they had been restrained in seatbelts. Some, if not all of the remaining bus occupants probably would have been injured less severely if they had been restrained in seatbelt. All but two ... suffered only minor or moderate injuries ... many of which resulted from being tumbled about during the impact and rollover."*

Even if the introduction of safety belts would benefit some school bus occupants, especially in side impact or rollover accident situations, it is possible that a few of the occupants of buses involved in accidents would be at greater risk of injury as a result of wearing belts. Current compartmentalization countermeasures are most effective in frontal crashes that still account for 55.9 percent of all school bus fatalities. The high, well-padded seats absorb the crash forces across the occupant's entire body. With lap belts, the midsection of the occupant's body remains at the seat while the head and upper portion of the body rotates forward. As a result, the head and face may strike the seat the occupant is facing with greater force than would have occurred in the absence of belts. Also, correct belt position over the pelvis is important as injuries could be caused by the belt being positioned over the abdomen.

TABLE 2

OCCUPANT FATALITIES BY PRINCIPAL DIRECTION OF IMPACT AND ROLLOVER
PASSENGER CAR | SCHOOL BUS - LARGE

Principal Impact Direction	No Rollover	Rollover	Total	No Rollover	Rollover	Total
	%	%	%	%	%	%
Front	41.5	6.8	48.3	20.6	35.3	55.9
Side	25.3	3.2	28.5	14.7	0	14.7
Rear	2.7	0.6	3.3	0	0	0
Undercarriage	0.3	0.4	0.7	209	0	2.9
Non-Collision						

Rollover	-	7.0	7.0	-	14.7	14.7
No Rollover	1.0	-	1.0	11.8	-	11.8
Other, Unknown	5.3	5.9	11.2	0	0	0
Totals	76.1	23.9	100	50.0	50.0	100
Number of Aver. Annual Ejections			5557			3

PASSENGER CAR – FARS 1981 – 1983 – 72,376 Fatalities

SCHOOL BUS – FARS 1981 – 1983 – 34 Fatalities

Source: NHTSA Fatal Accident Reporting System Data base.

In 1984, Transport Canada (the Canadian Ministry or Department of Transportation) conducted an extensive study of school bus safety which included a frontal crash test program for three different size school buses, comparable to post-1977 buses in the U.S. (Reference #12).

An excerpt from the report summary follows:

"This School Bus Safety Study indicates that careful deliberation must be exercised before deciding whether or not to add lap belts to existing designs of occupant protection systems found in today's school buses. The barrier crash test results showed that the potential for head injury in frontal collisions increased, when lap belts were employed.

This conclusion was reached after the subject of school bus safety was investigated in considerable detail. The investigation included a review of existing literature, discussions with bus manufacturers and operators, and a dynamic barrier crash program. The crash program provided data and photographic evidence, not before available, to compare the reaction of belted and unbelted test dummies in a frontal collision."

NHTSA has analyzed the results of the Canadian test and found them to be in general agreement with laboratory testing conducted within the United States. It should be recognized that the "compartmentalization" countermeasure was specifically designed to protect the occupant in frontal barrier tests, similar to those conducted by the Canadians. The low head injury readings for the unbelted dummies is indicative that compartmentalization performs as well in production buses as it did in the research tests which perfected the concept. The lap belted dummies also performed in a predictable manner in the Canadian tests. In NHTSA sponsored research on lap belted dummies in the automobile environment, lap belted dummies typically have higher head injury measurements than unbelted dummies.

****In examining the Canadian tests, several factors must be considered. A 30 mph barrier crash force for a large bus is an unlikely occurrence. For example, a head-on-crash between a large school bus and a full-size car, both traveling at 55 mph, would be less severe to bus occupants than the 30 mph barrier test. Also, only one size dummy was used which typically represents a junior high school student. The geometry for younger children would be

significantly different with likely different results. Taken together, the results of the Canadian tests should be viewed with caution.

EQUIPPING NEW BUSES WITH SAFETY BELTS

The major school bus body companies offer safety belts in their new buses. Manufacturers report the cost for the addition-of lap belts is in the range of \$18 to \$30 per seating position. * The question of how many lap belts to install for a standard 39" bench seat depends on whether large or small children are being transported. The user makes this decision when ordering and manufacturers require that the purchaser specify the number of belts per seat. Consideration should be given to ordering belts equipped with refractors as this encourages proper fit of the lap belt. Alternatively, providing bus monitors would assure correct belt positioning. Because a child's body is less developed than an adult, abdominal injuries could occur if the belt is worn across the stomach, rather than low on the pelvis. An incorrectly installed and positioned safety belt may do more harm than good in low speed crashes.

**Retractable belts for large school buses have not yet been perfected.
Medical endorsements are ignored by the authors of this report.*

NHTSA has been petitioned by the Wayne Corporation to amend FMVSS 222, to require that safety belts, when ordered on large school buses, conform to the requirements of FMVSS 208 (Occupant Crash Protection), report. FKVSS 209 (Safety Belts) and FMVSS 210 (Safety Belt Anchorages) as in passenger cars and small buses. Although FMVSS 222 does not require safety belts in large school buses, purchasers desiring safety belts often have no guidance concerning the installation and manufacturers have been reluctant to quote estimates without definitive specifications. Most manufacturers who install belts and anchorages, when ordered by the purchaser, voluntarily comply with these Standards, although not required to do so. A decision by NHTSA on whether to initiate rulemaking on the Wayne petition is expected this summer.

RETROFITTING SCHOOL BUSES WITH SAFETY BELTS

Seven major companies manufacture large school buses for public, private and parochial schools and for school bus contractors. They are: AmTran, Bluebird, Carpenter, Crown, Superior, Thomas, and Wayne. These companies do not believe it is advisable to retrofit a school bus (pre-1977 or post-1977 construction) with a two point lap belt, nor do they recommend that their dealers do so. The National Coalition for Seat Belts on School Buses supports this industry position.

****Several problems prevent successful retrofitting of pre-1977 manufactured buses. Seats may not be well anchored to the floor and, in many cases, have no padding to cover the metal seat frame. Also, the seat construction may be inadequate to withstand the forces generated by lap belts and could collapse with pupils belted to them.**

**** Per seat, NOT per child.**

Guidelines for the installation of lap belts in any large school buses, regardless of age, are not provided by the bus dealers or manufacturers. In addition, none of the manufacturers is willing to retrofit post-1977 buses with lap belts.

Industry officials state the primary reason for not retrofitting buses is because the strength of a bus floor is subject to deterioration due to hostile weather conditions and varied maintenance. After only a few years of use, it is possible that the bus floor strength would be less capable of withstanding the forces of the bus seat with belted passengers in a crash situation. If retrofitting is to take place all systems, and especially the floor, must be of the same strength and condition as a new bus.

***The National Coalition for Seat Belts on School Buses does not recommend retrofitting post-1977 built buses but does, however, provide some guidelines for those wishing to do so (Reference #13). NHTSA recommends that school districts wanting to retrofit school buses manufactured after 1977, should first make sure that they purchase lap belts that meet FMVSS 209. Also, if the manufacturer sells buses with a lap belt option, school districts should check to see how they are installed and, if possible, follow the manufacturer's installation method. Competent engineering advice should be sought prior to retrofitting safety belts in post-1977 manufactured buses.

*** *No longer true.*

RELATED STUDIES

School bus safety issues have been reviewed by a number of other Federal, State, and local government agencies.

In 1983, the National Transportation Safety Board (NTSB), an independent Federal agency which investigates accidents and other transportation safety issues, reviewed the issue of occupant protection in school buses. The Board agreed with a NHTSA analysis, which found that the safety standards for post-1977 buses appeared to be effective in eliminating or substantially reducing the majority of school bus occupant injuries. The NTSB report stated:

“...the Safety Board does not believe there is sufficient justification at this time to recommend extending the mandatory passenger restraint system requirements to large school buses” (Reference #14).

The Board also recommended that school districts which choose to install safety belts on large buses should demonstrate a “strong and continuing commitment” to educate students on the importance of proper belt usage, and that all passengers on small school buses and school vans be required to wear their safety belts.

In 1983, the Los Angeles County Board of Supervisors requested a study on safety belt effectiveness (Reference #15). An ad hoc committee was established by the County Superintendent of Schools to assist in this investigation. Its findings were that school buses are statistically the safest form of ground transportation in the United States today. The compartmentalization concept protects the greatest number of children, both in the variance of

age and size, and in most types of school bus accidents. California's requirements for school bus driver training and yearly inspection of vehicles also have contributed to the State's low fatality rate for pupil passengers. For the 1983/84 school year there were no school bus fatalities in California. There were 286 injuries: one severe, 86 moderate, and 199 complaints of pain. This is an excellent safety record for a system comprised of 18,680 buses traveling 245,544,885 miles.

As a result of this study, the Los Angeles County Board of Supervisors: (1) supports the federal position not to require safety belts in large school buses; and (2) upholds its current policy not to install safety belts in school buses.

The Legislative Council of Arkansas examined the feasibility of installing safety belts in school buses following a Jonesboro School District accident in 1983, in which nine people were killed. This accident occurred near Newport, Arkansas. The Council said, "It appears that based on the costs, the lack of data indicating a great fatality decline with the installation of seat belts, the possible dangers which could arise from the installation of the seat belts themselves, the outstanding safety record of school buses in general, the issue of seat belts in school buses could be left as a decision to be made by individual school districts and should not be mandated by the legislature" (Reference #16).

NTSB also investigated the Jonesboro accident and concluded "that it is doubtful that seat belts could have prevented any of the deaths in this case, given the nature of the crash impact" (Reference #14). Further, the school bus in that accident was built before FMVSS 222 became effective in April 1977.

Other studies on safety belt effectiveness include those of the Kentucky Legislative Research Commission (Reference #17) and the California Highway Patrol (Reference #18) both of which reached the same general conclusion as cited above in this report. However, the New York State Legislative Commission on Critical Transportation Choices has recommended that all school buses manufactured after July 1, 1986 for use in New York State be equipped with safety belts (Reference #9).

EXPERIENCE OF DISTRICTS WITH BELT EQUIPPED BUSES

There are about 62 school districts nationwide with large school buses equipped with safety belts. The table that follows presents information on the number of large buses with belts in each fleet, whether the school district has monitors, the type of belt installation, and buses on order or anticipated.

Two school districts in New York claim 80 percent usage -- with or without bus monitors, as reported by the National Coalition For Seat Belts on School Buses (NCSSB) in 1983 testimony to the New York State Legislative Commission on Critical Transportation Choices (Reference #20). Greenburgh's 36 large buses have no monitors and Ardsley's 11 equipped buses have monitors, yet both report similar belt usage rates.

It should also be noted that this information is anecdotal in nature and is gathered from the small number of school districts with a history of operating belt-equipped large school buses.

LEGISLATION

Congressman Peter Kostmayer (D-Pa.) has introduced a bill (H.R. 749) providing incentive grants to encourage States to adopt and enforce laws requiring the use of safety belts by school children in new school buses. The bill was referred to the House Public Works Committee.

In addition, 25 States have Introduced legislation this year concerning the installation and use of safety belts on school buses. *Suffolk County, New York passed a local ordinance last year (Resolution No. 1008-1984) requiring that all school buses acquired after January 1, 1986, must "contain safety restraints for each space capable of seating a passenger." In addition, all school buses in the county must be in compliance by December 1996.

**This no longer applies. A county cannot dictate to a school board. The ordinance was dropped.*

NY State became the first state to require seatbelts on all newly manufactured school buses after July 1, 1987.

OTHER CONSIDERATIONS

A question exists over school bus belt use and the possible carryover effects of the students' belt-wearing to their use of belts in private vehicles. Little definitive information is available on this issue and research is complicated by the difficulty of finding groups for appropriate comparison. NHTSA is attempting to examine the relationship that belts on school buses have on habit and behavior reinforcement through selected case studies.