SCHOOL BUS SAFETY IN AMERICA

Must our Children be Injured and Die on Public Transportation

The purpose of writing this brochure is to inform the public that school bus manufacturers and the NHTSA are complicit in duping school districts, states and parents about school bus safety. For years, school bus safety has been compromised due to under-reported injury and fatality statistics, manipulation of test data and frivolous claims about the safety of school buses. School bus manufacturers are the self-proclaimed experts on bus safety. As such, they should be held responsible for injuries and deaths to children on school buses just like vehicle manufacturers are held responsible for occupants in passenger vehicles. Parents, school administrators and state officials should band together and demand school bus crashworthiness. A call to arms is necessary to protect children on American school buses.

E. Todd Tracy, Jan. 2008

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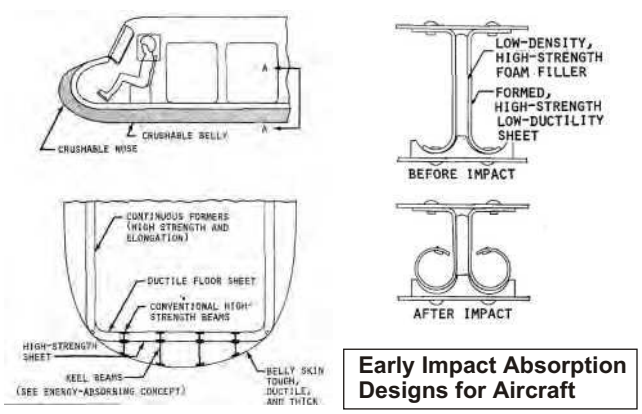
INTRODUCTION

Since 1968, passenger vehicles in the United States have become safer because of a principle known as vehicle crashworthiness. Vehicle crashworthiness is the science of preventing and minimizing injuries following an accident through the use of safety systems. There are five basic principles of crashworthiness:

Crashworthiness:

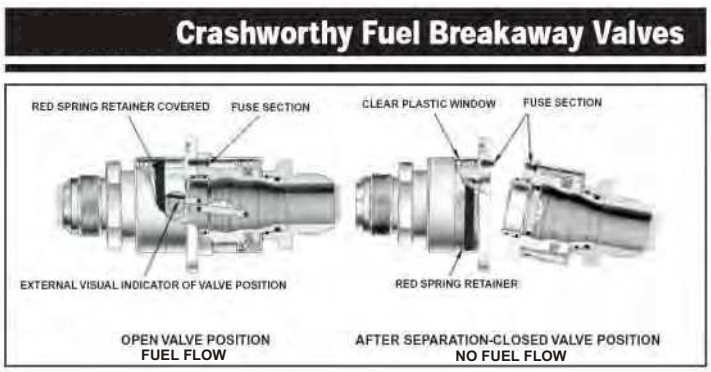
- Restrain the Occupant
- Prevent Ejection
- Maintain Survival Space
- Manage Collision Energy
- Prevent Post Crash Fires

Vehicle crashworthiness principles were initially developed during the Korean War by ***Colonel John Paul Stapp*** and ***Hugh de Haven*** who were losing American soldiers in the field that survived helicopter and airplane crashes, only to die due to crush related and fire injuries. These men later developed and designed aircraft structures that



Early Impact Absorption Designs for Aircraft

protected the survival space of the aviator, used 5-point restraint harnesses that provided maximum restraint and ejection prevention and utilized fuel tank bladders, metal braided fuel lines and break-a-way, quick disconnect attachments to protect against fire.



Ultimately, vehicle crashworthiness safety principles were applied to racing cars. This explains why vehicles traveling close to 200 mph can hit walls and rollover seven or eight times, yet the driver gets out of the vehicle, waves to the crowd and is racing the next weekend.

Unbelievably and sadly, vehicle crashworthiness principles have not been applied to school buses as vigorously as they have to airplanes/helicopters, racing

NASCAR rollover at 200 mph.

cars or passenger vehicles. This of course defies common sense since millions of children each day ride school buses to and from school and to various school-sponsored events.

The United States school bus system is the largest mass transportation system in the world. The national fleet is approximately 482,000 buses, and they travel billions of miles per year. However, most American school buses do not contain seat belts, fail to contain glass that mitigate against ejection risks, have inadequate structural integrity to provide adequate protection in frontal, side and rollover accidents and lack post crash fire protection features. The next time your child gets on that big yellow school bus ask yourself this question: **HOW SAFE ARE SCHOOL BUSES IN THE EVENT OF AN ACCIDENT?**

The answer is simple: buses that transport our children will not protect them if a serious accident occurs because buses are not crashworthy and fail to utilize available and affordable occupant protection safety systems.

HISTORY

History of School Transportation

In 1837, children were taken to school in horse-drawn carriages called school hacks, school trucks or kid hacks. These were often nothing more than wagons or sleds. By 1914, a wooden kid hack was placed onto an automobile chassis that was horse drawn. Ingress and egress was through a door at the rear so the horses would not be startled. In 1927, the first all-steel school bus was built. It contained steel stretched over wood with canvas for windows.

In April 1939, Dr. Frank W. Cyr organized a conference at Teachers College, funded by a grant from the Rockefeller Foundation for transportation. Officials from each of the then 48 states, as well as specialists from school bus manufacturing and paint companies attended the conference.


Dr. Frank W. Cyr

Engineers from Blue Bird Body Co., Chevrolet, International Harvester, Dodge, and Ford Motor Company, as well as paint experts from DuPont and Pittsburgh Paint attended. Together with the transportation administrators, they met for seven days and agreed on 44 standards, including the bus color and some mechanical specifications such as body length, ceiling height, and aisle width for school buses.

The lasting standard from this conference is the familiar yellow school bus design and paint scheme. Dr. Cyr chose the "school bus yellow" with black lettering paint scheme because it was easy to see in the early morning and late afternoon.


1941 Chevrolet/Superior School Bus

For the next 30 years, virtually no safety advances were made in school bus safety, even though researchers in the 1960's were demonstrating that safety improvements were needed to better protect children in frontal, side, rear and rollover accidents.

In 1974, Congress determined that "school transportation should be held to the highest level of safety, since such transportation involves the nation's most precious cargo- the children who represent our future." These amendments finally came in 1977, when the NHTSA adopted school bus safety standards.

The 1977 school bus safety standards have never been revised, even though attempts have been made to improve the crashworthiness of school bus safety to keep up with improved occupant protection technology. Each of these efforts to improve school bus safety has been resisted by the school bus manufacturing industry as well as others.

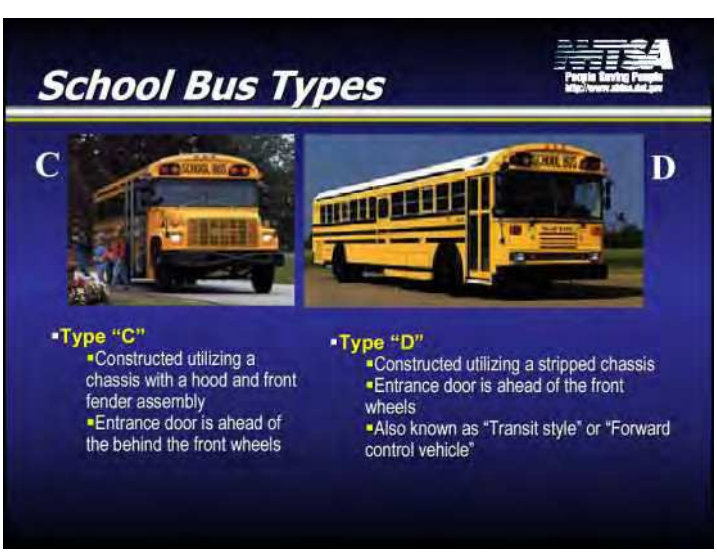
In July 2007, the NHTSA heard oral statements on proposals to make school buses safer by enacting regulations that have been requested since the 1960's. The formal comments ended January 22, 2008. It could be years before any safety rules are finally adopted, since it took 10 years from the 1967 UCLA study to final rule making on the last set of inadequate school bus standards.

TYPES OF BUSES

Types of School Buses

The school bus industry defines four types of school buses. Yet, school buses are constructed very differently. As such, many of the standard rescue tools may not work on certain parts of all buses. This fact alone justifies uniformity in design. However, designs among school buses are not uniform. This must change.

The **Type A** school bus consists of a bus body constructed upon a cutaway front-section vehicle with a left side driver's door, designed for carrying more than 10 persons. This definition includes two classifications: Type A-I, with a gross vehicle weight rating (GVWR) of 10,000 pounds or less, and a Type A-2, with a GVWR of 10,000 pounds or more. Type A school buses meet all Federal Motor Vehicle Safety Standards for school buses.



The **Type B** school bus consists of a bus body constructed and installed upon a front-section vehicle chassis, or stripped chassis. Type B-1 buses have a gross vehicle weight rating less than 10,000 pounds. Type B-2 buses have a gross vehicle weight rating of more than 10,000 pounds. Part of the engine is beneath and/or behind the windshield and beside the driver's seat. The entrance door is behind the front wheels. Type B school buses meet all Federal Motor Vehicle Safety Standards for school buses.

The **Type C** school bus, also known as a "conventional," is a body installed upon a flat-back cowl chassis with a gross vehicle weight rating of more than 10,000 pounds, designed for carrying more than 10 persons. All of the engine is in front of the windshield and the entrance door is behind the front wheels. Type C school buses meet all Federal Motor Vehicle Safety Standards for school buses.

The **Type D** school bus, also known as a "transit-style," is a body installed upon a chassis, with the engine mounted in the front, midship, or rear with a gross vehicle weight rating of more than 10,000 pounds, and designed for carrying more than 10 persons. The engine may be behind the windshield and beside the driver's seat; it may be at the rear of the bus, behind the rear wheels; or midship between the front and rear axles. The entrance door is ahead of the front wheels. Type D school buses meet all Federal Motor Vehicle Safety Standards for school buses.

Federal Motor Vehicle Safety Standards are not the same for all four types of buses. If a bus is considered **Type I**, it has a gross vehicle weight rating of over 10,000 pounds which are Type C and D buses. No seat belts are required on Type I buses. **Type II** buses have a gross vehicle weight rating under 10,000 pounds, thus may be either Type A-1 or B-1 buses. Seat belts are required on all Type II buses.

Of the 482,000 school buses in the United States, 85% are Type I buses which are not required to have a seat belt. Hence, 20,485,000 children (409,700 buses x 50 children) are exposed each day to injuries and death risks that could be prevented simply by adding seat belts.

STANDARDS

Federal Standards for School Buses

School bus safety should focus on one thing: How well does a bus protect our children during an accident? In subsequent chapters you will see some dynamic crash test images. If the big yellow bus were crash rated like a minivan - it wouldn't even get 1 star which is the lowest safety rating given by the NHTSA.

The federal government commissioned UCLA to conduct bus crash testing in 1967 because the "number of injuries and the number of fatalities was considered too high." UCLA found that poor seat design was a major contributor to injuries and fatalities. The UCLA study reached the following conclusions:

- Seat backs should be 28 " high and well padded.
- Left and right interior side panels should be well padded.
- A well padded aisle panel should be installed.
- Lap belts were suggested to keep children within the seating "compartment."

Armed with UCLA's bus safety results, it still took 10 years for the NHTSA to promulgate school bus safety standards. However, the standards were inadequate. For example, FMVSS 222, the most significant of the new bus standards, fell way short of the UCLA recommendations. Seat backs were 8" shorter than recommended, there were no provisions for left and right side padding, no aisle panels were defined and no lap belt restraints were required.

Now the NHTSA proclaims that there are 38 FMVSS provisions that apply to school buses. However, much like their vehicle counterparts, these provisions are inadequate to protect children in the event of an accident. How so? They are outdated. They are inept. They are minimal. They fail to evaluate a dynamic event like a crash. They are unrealistic in their application.

Below is a sampling of the FMVSS regulations that are unique to school buses.

FMVSS No. 217, "Window Retention and Release"

FMVSS No. 220, "School Bus Rollover Protection," which specifies the minimum structural strength of buses in rollover-type accidents;

FMVSS No. 221, "School Bus Body Joint Strength," which specifies the minimum strength of the joints between panels that comprise the bus body and the body structure;

FMVSS No. 222, "School Bus Passenger Seating and Crash Protection," which establishes requirements for school bus seating systems for all sizes of school buses, and provides minimum performance requirements for wheelchair securement/occupant restraint devices and establishes a requirement that wheelchair locations be forward facing; and

FMVSS No. 131, "School Bus Pedestrian Safety Devices," which requires school buses be equipped with an automatic stop signal arm on the left side of the bus to help alert motorists that they should stop their vehicles because children are boarding or leaving a stopped school bus.

Each of these provisions sounds like adequate protection is inevitable to children. But when each standard is analyzed individually, children are at risk. For example, FMVSS 217 does not require the use of laminated glass that can help prevent ejection. This type of glass is critical since most buses do not have seat belts. FMVSS 220 has no requirement to actually test the strength of a roof when rolling or under dynamic conditions. FMVSS 221 and 222 do not require that a crash test be performed. In short, the federal school bus standards fail to protect children. As a consequence, school bus manufacturers are left within their discretion to develop safety features for American children on school buses without oversight from any public agency such as the NHTSA.

STATISTICS

School Bus Accident Statistics

According to the Transportation Research Institute, school buses are involved in more fatal crashes than transit, inter-city or charter buses combined. Yet, one of the primary arguments that opponents against improving school bus safety make is the low numbers of school bus fatalities. In fact, one of the primary culprits of this flawed position has been the NHTSA. For years, the NHTSA has reported that there were only 74 deaths involving students on school buses between 1995-2005. However, the NHTSA fails to accurately report the number of serious injuries to children on school buses. The NHTSA also fails to discuss the medical costs incurred due to these injuries, the lost time from work the parents of the injured student endure or the lost time from school the injured student experiences. Each of these are critical statistical events that must be considered and have not been.

Average Annual Injuries
(per NHTSA powerpoint presentation)

Injury Mechanism	J. Pediatrics* (0-9 y)	J. Pediatrics* (10-19 y)	NASS/GES
Traffic, crash	1808	5398	~ 6500
Traffic, non-crash	316	544	N/A
Boarding/alighting	1109	2947	N/A
Slip/fall	18	544	N/A
Other/unknown	1504	2245	N/A

* Published November 2006

NHTSA's presentation of the Journal of Pediatrics findings under-reports the numbers of school bus injuries by 63%.

TABLE 1 Estimated Annual Number, Percentage, and Injury Rate Among Persons With Nonfatal School Bus–Related Injuries Treated in Hospital EDs According to Age, Gender, and Race, United States, 2001–2003

Variable	Annual No.[a]	%	Annual Rate[a]	(95% Confidence Interval)
N	17 033	100.0	21.0	(15.4–26.7)
Age, y				
0–4	702	4.1	[b]	[b]
5–9	4654	27.3	23.3	(15.9–30.7)
10–14	7316	43.0	34.7	(25.9–43.6)
15–19	4361	25.6	21.4	(13.7–29.2)
Gender				
Male	8326	48.9	20.1	(13.8–26.3)
Female	8707	51.1	22.1	(16.1–28.0)
Race				
White, non-Hispanic	7884	46.3	—	—
Black[c]	4744	27.9	—	—
Hispanic	1155	6.8	—	—
Other, non-Hispanic	570	3.3	—	—
Unknown	2680	15.7	—	—

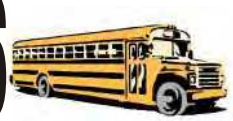
The American Academy of Pediatrics reported in its November 2006 issue that 17,033 children are injured each year in school bus accidents. The study concluded that three times more school bus injuries were occurring than had ever been reported by the NHTSA. Of these hospitalizations, 1,200 involved traumatic brain injury. The authors of the study concluded that seat belts would have prevented the vast majority of these injuries.

In Texas alone, there are seven fatalities and 857 injuries to school children each year in school bus accidents.

What is not shown in these statistics is the long-term consequences and costs associated with a school bus accident. This point can be demonstrated by studying a tragedy involving the Westbrook High School soccer team in Beaumont, Texas whose charter*1 bus rolled over on March 29, 2006. In the accident, Ashley Brown and Alicia Bonura died. Two girls were pinned under the bus for over an hour. One player had her arm amputated, another had permanent disability of an arm and hand. Another suffered extensive facial disfigurement. Combined, this soccer team endured 17 surgeries, eight months of lost school instructional days, hundreds of hours of physical therapy, millions of dollars of medical expenses, and the horror continues because the medical costs continue to increase. The psychological scars of these children may never heal.

The charter bus they were on had no seat belts and glass that failed to mitigate against ejection. If these girls had been belted, the injuries and deaths most likely would have been avoided.

*1 *Charter buses are actually less regulated than school buses in terms of occupant protection requirements.*



Crashworthiness:

Restrain the Occupant

School Bus Restraint

Even though slogans like Buckle Up, It's The law; Buckle Up For Safety; Don't Be A Dummy, Buckle Up; and Click it, or Ticket have been around for years, these slogans do not apply to school buses. In 47 states, there are mandatory seat belt laws for children, but these laws do not apply to school buses. How confusing for our children is this? You can receive a ticket for not buckling your seat belt in a parents' vehicle. However, no tickets can be given to students on school buses. Why not? Because 85% of our nation's school buses do not have seat belts. This simply defies logic since engineers, physicians and crash safety experts all agree that seat belts in vehicles save lives and minimize injuries. The American Automobile Association has written that "restrained occupants are more likely to escape harm by spreading the force of impact and gradually stopping the body, safety belts effectively reduce the severity of injuries." The NHTSA and NTSB must agree since seat belts are mandatory in all vehicles.

The FAA and NTSB must agree that seat belts on aircraft save lives and prevent injuries since you are required to wear a seat belt during takeoff, landings and turbulent air. However, the occupant protection value of seat belts on school buses has been debated for decades.

Advocates for school bus seat belts contend that seat belts would reduce injuries by keeping children within their seating compartment in side impacts, evasive maneuvers and rollovers. Advocates also note that a restrained occupant will improve student behavior and reduce distractions to drivers. Seat belts on school buses have been proposed by the American Medical Association, American Academy of Pediatrics, the American Association of Orthopedic Surgeons, American College of Preventive Medicine, Physicians for Automotive Safety, the National Coalition for School Bus Safety, and the National PTA. European Union countries and Australia have required lap/shoulder belts in school buses for over a decade.

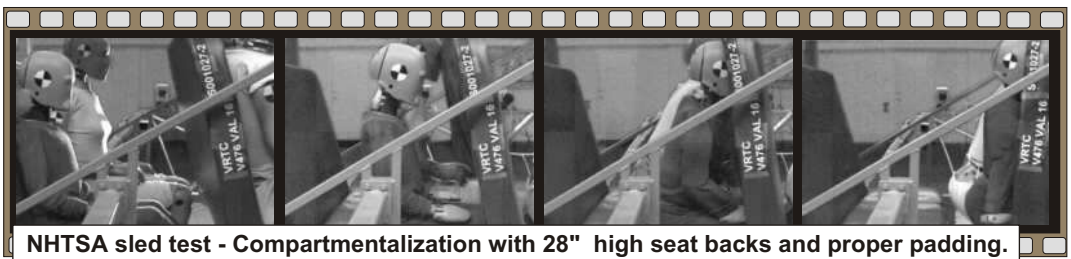
Opponents against requiring seat belts on large school buses contend that studies have shown that adding seat belts is not a cost effective safety improvement over the safety principle known as compartmentalization. They

Compartmentalization Illustrated. **What about side impacts and rollovers? What about children out of position? What about neck injuries? What about brain injuries?**

Crashworthiness:

Restrain the Occupant

note that studies have shown that seat belts might save one life and several serious injuries each year, at an annual cost of hundreds of millions of dollars. They also contend that adding seat belts decreases seating space and would displace some children, forcing additional bus purchases. They have also suggested that children may not use seat belts on school buses. The lobby against seat belts on school buses has been lead by the National Association of State Directors of Pupil Transportation Services, the National School Transportation Association and the bus manufacturers.



NHTSA sled test - Compartmentalization with 28" high seat backs and proper padding. This test was run in 2001.

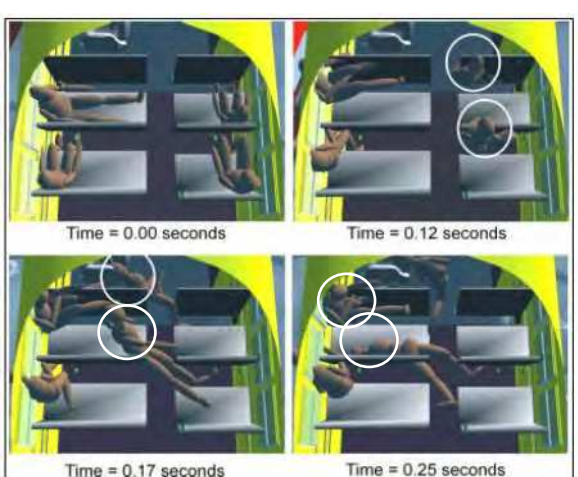
Persuaded by opponents against school bus seat belts, the NHTSA decided in 1976 that seat belts were not required on larger school buses. Instead, occupant protection would be provided by compartmentalization which refers to a system of protecting unrestrained passengers by using high-backed, well padded, and well anchored seats designed to absorb energy from frontal impacts, placed in relatively closely-spaced rows.

Compartmentalization can be potentially beneficial in frontal impacts if the seat is properly padded, high-backed and allows the unrestrained occupant to ride down the crash forces.

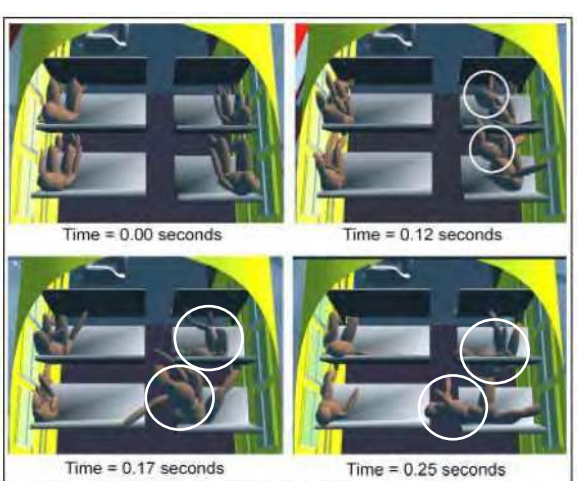
Testing by the NHTSA in 2001 using 28" high, well padded seats which were properly anchored to the floor, adequately protected children in frontal impacts.

NHTSA sled tests - Compartmentalization with 20" high seat backs.

However, most school bus seats are not properly padded and are not reinforced adequately to the floor. Further, most bus seat backs are only 20 inches tall. The 20 inch bus seat allows the striking occupant to override its head or torso over the top of the struck seat back. Compartmentalization provides no safety protection in side impacts as seen during NHTSA's sled test program. However, seat belts do provide protection in side impacts and rollovers based on NTSB's accident simulations.



Side Impact Simulation (Compartmentalization). No safety protection

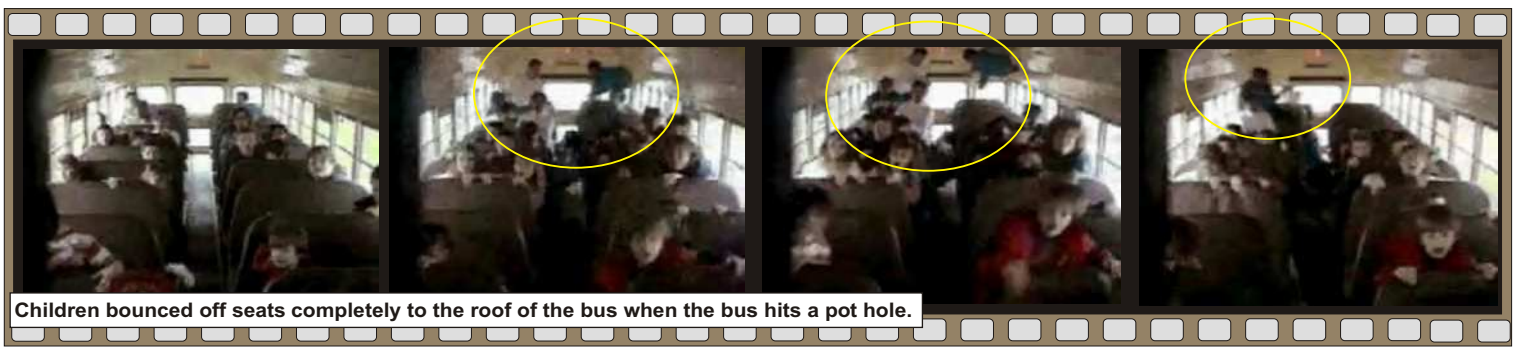


Side Impact Simulation (Lap and Shoulder Belt Harnesses). Substantial safety protection.

Crashworthiness:

Restrain the Occupant

Compartmentalization offers no safety to students who are out-of-position because the driver has swerved or the student bounces off the seat when the bus hits a bump.



Children bounced off seats completely to the roof of the bus when the bus hits a pot hole.

The NHTSA finally concluded in 2002 that "compartmentalization fails to provide adequate protection in rollover and side impacts which account for one-third of all accidents." They failed to mention out-of-position children. The NHTSA's conclusion is three decades too late.

Rollover Test Aparatus

Testing by UCLA researchers in 1967 revealed that seat belts on buses increased safety. In 1986, the NHTSA reported that student behavior improved on buses equipped with seat belts. Opponents of school bus seat belts argue that children will not wear a seatbelt on school buses. They forget that children of this generation have grown up using seat belts. The importance of wearing a seat belt is preached by caregivers each day to children. Children oftentimes remind their own parents to buckle up. The National Academy of Sciences in 1987 found that seat belts would reduce fatalities by 20 percent and serious injuries by 40 percent. In 1989, the Transportation Research Board determined that seat belts would prevent one fatality and minimize several dozen serious injuries each year. However, the study concluded that a federal mandate requiring mandatory school bus installation was not necessary. In 1999, the NTSB found that compartmentalization was an incomplete occupant protection system. In fact, the NTSB found that the "potential exists for an occupant protection system to be developed that would protect school bus passengers by retaining them with the seating compartment in most accident scenarios." The NTSB directed the NHTSA to develop standards that protect passengers in all accident directions, including rollover. A 2002 NHTSA study found that lap/shoulder belts have the potential to be effective in reducing fatalities and injuries in non-frontal crashes.

Rollover test conducted with lap/shoulder belted and unbelted child test dummies.

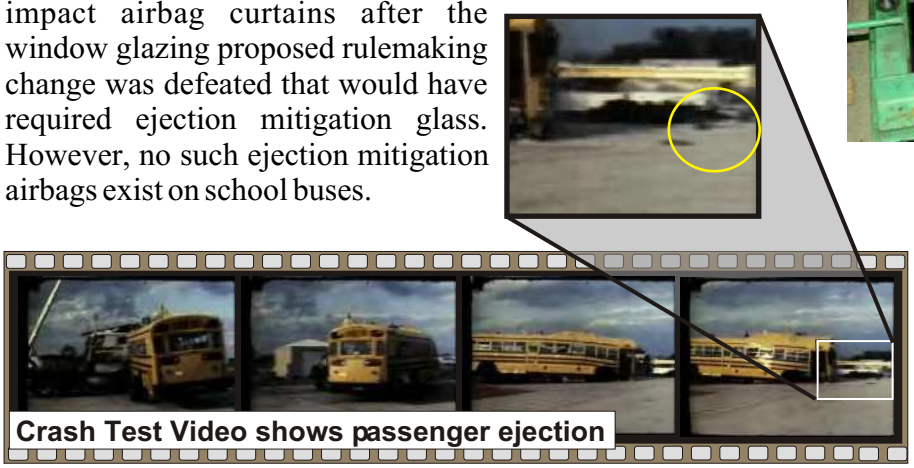
Despite overwhelming safety data, only six states currently require seat belts on new buses. (California, Florida, Louisiana, New Jersey, New York, and Texas). In hearings before the NHTSA in July 2007 regarding seat belts on school buses, the school bus industry spokesman testified that only two percent of America's school buses were equipped with lap/shoulder belts.

Crashworthiness:

- Prevent Ejection

Ejection

The NHTSA has determined that there is a 13 times greater chance of serious injury if an occupant is ejected during an accident. Lap/shoulder belts will help prevent complete ejection but they cannot prevent partial ejection. Partial ejection through window openings has been addressed in passenger vehicles with rollover airbag curtains and side impact airbag curtains after the window glazing proposed rulemaking change was defeated that would have required ejection mitigation glass. However, no such ejection mitigation airbags exist on school buses.



Crash Test Video shows passenger ejection

To prevent or minimize the risks of partial ejection through a school bus window, bus manufacturers should use ejection mitigation glass rather than tempered glass. Ejection mitigation glass is commonly referred to as laminated, plastic or bi-layer glass. Ejection mitigation glass is far less likely to shatter in a crash than tempered glass and is therefore more likely to prevent passengers from being ejected from the bus in a crash. There is no federal standard mandating ejection mitigation glass on school buses. As such, school bus manufacturers continue to use tempered side glass rather that the safer ejection mitigation glass.

Opponents against improved school bus glass may argue that ejection is rare. In 1999, the NTSB wrote that FARS (fatal accident reporting service) data is not a reliable source for identifying the number of fatal occupant ejections in buses. Rather than improve data retrieval methods to determine how prevalent the ejection problem is in school bus crashes, nothing was done.

Ejection is a Prevalent Issue

On December 1, 2004, the NTSB released its "Most Wanted" transportation improvement devises to better protect bus passengers from being ejected. To date, no standard has been proposed requiring ejection mitigation

glass on school buses including the latest bus changes proposed in 2007. Ejection mitigation glass used on vehicles today has proven effective in protecting against ejections.

ETG (enhanced technology glass) is an advanced glazing system that incorporates the Safeflex K series high security interlayer which was derived from PPG's experience with hurricane impact glazing technology which provides increased tear strength and penetration resistance during 150 mph wind tests.

Vehicle glazing has evolved from its original task of keeping bugs out of our teeth to the multi-functionality of Enhanced Technology Glass which protects against ejection.

According to General Motors "all 12 and 15 passenger vans have Enhanced Technology Glass to help protect passengers during a crash. This specialty glass is located in the rearmost side window positions next to the fourth- and fifth- row passengers. The glass is designed to help mitigate the risk of ejection for passengers seated next to the ETG windows who do not have the benefit of side curtain airbags."

If this glass is safe enough for 12/15 passenger vans, it would be safe in Type I school buses and should be used immediately as a much needed safety feature.

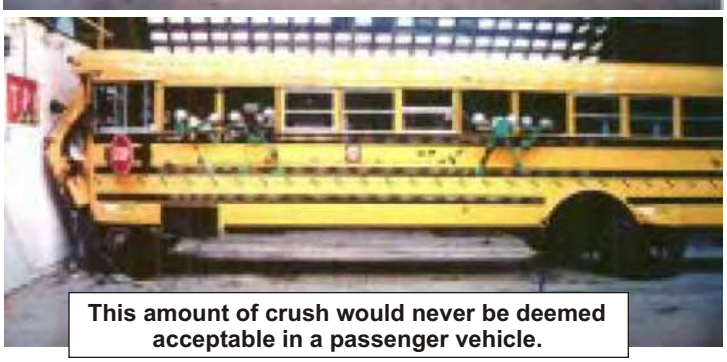
Enhanced Technology Glass (ETG)

Crashworthiness:

Maintain Survival Space

Structural Integrity

On August 31, 2007, the Congressional Research Service reported that large school buses have energy-absorbing designs for front ends. These authors must not have reviewed the crash tests where the entire front structure of a Type C bus crushed into the bus's survival space. There was no controlled crush like is seen when a properly designed vehicle is evaluated under the same test.



This amount of crush would never be deemed acceptable in a passenger vehicle.

The authors of the congressional report also wrote that school children are protected because they are positioned above the level of most other vehicles on the road which provides protection from side-impact crashes. Sadly, they must not have reviewed the side impact tests where school buses literally tore apart.

The authors also failed to consider that the NHTSA has never conducted a single rollover test to evaluate the occupant protection capabilities of school buses. Roof testing by American bus manufacturers has revealed that the roof structure of buses is incapable of protecting the survival space during a roll-over.

Had these authors searched deeper, they would have found records dating back to the 1940's, where school bus designers always feared that the points where panels and pieces were fastened together called joints were prone to structural failure. In 1967, the Ward Body Company subjected one of their school bus bodies to a rollover test, and noted separation at the joints due to rivet, screw and huckbolt (fastener) failures. Other tests revealed that simply increasing the number, size and quality of fasteners did not prevent joint separation. As a result, designers created continuous longitudinal interior and exterior panels for sides and roofs. This design was called the Lifeguard design and reduced overall body weight, the number of fasteners used and man-hours for assembly. However, the Lifeguard design required very large roll-form presses and special equipment to handle the panels. Also, the panels had to be cut to exact length for each bus order which created marketing difficulties. After 1973, the Lifeguard design was not widely used by the bus manufacturers.

One school bus manufacturer has begun to use adhesive bonding techniques that has been used by the aeronautical industry for years. The adhesive bonding has proven to be much stronger than other fastening techniques. In fact, the actual material fails before the adhesive bonding separates. Despite this new bonding technology, antiquated body fastener techniques continue to be used extensively among most American bus manufacturers.

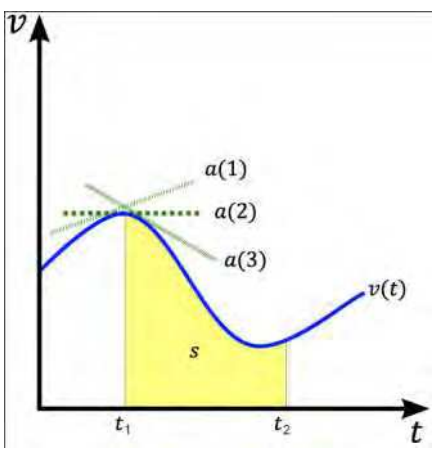
Crashworthiness:

- **Manage Collision Energy**

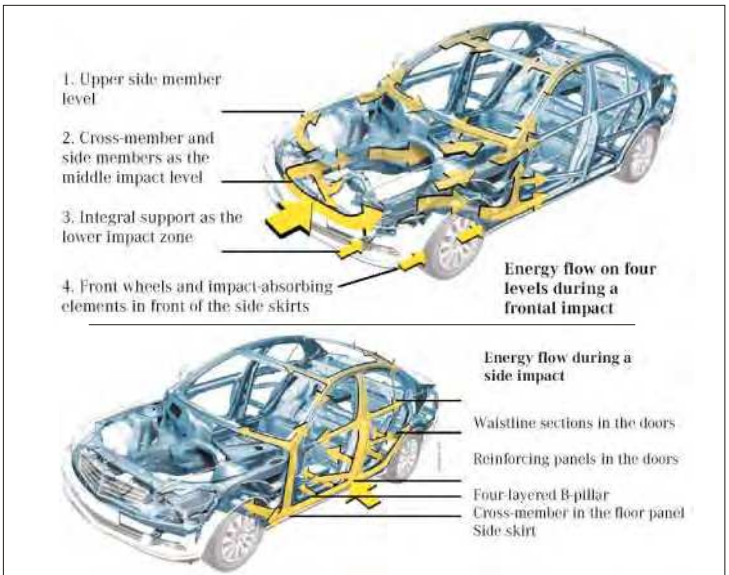
Distribute Energy/Crash Forces

One of the ways a crashworthy vehicle provides occupant protection is by controlling energy that is transmitted into the survival space. For years, the school bus industry

argued that the size of the school bus offered a greater degree of protection from injury because a bus is so large that it will absorb energy and the children will not be hurt. This position actually violates Newtonian physics. If a vehicle weighs 3,000 pounds or 24,000 pounds (weight of a large school bus) and experiences a delta velocity of 30 mph, the unrestrained objects inside both vehicles experience the same delta velocity, no matter the weight of the object. Amazingly though, the NHTSA has stated as late as October 2007, that since school buses are larger and heavier than their impacting partners, lower crash forces will be imparted on bus occupants. This is technically accurate in that lower G's will be experienced on the bus, but delta velocity is what causes the injury and the delta velocity is the same regardless of weight.

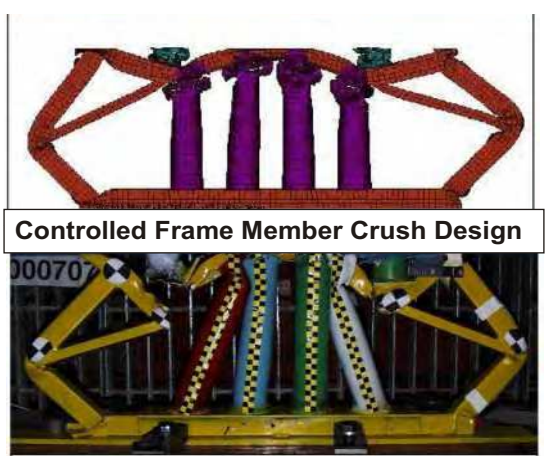


School buses are not tested with test devices inside the vehicle to evaluate loads on the body. Further, no dynamic test standards exist to evaluate what type of loads are experienced inside the survival space following frontal, side, rear and rollover tests to instrumented dummies.



Vehicle manufacturers channel energy by design.

Testing conducted by manufacturers has shown that the structure of school buses fails to allow for ride down of the crash pulse. Instead, the force loads are not dissipated in a controlled manner. This energy that is not absorbed by controlled crush, ends up being delivered into the survival space and into the occupant's body.



Controlled Frame Member Crush Design

The interior of the school bus must also absorb energy so as not to transmit injurious forces to an occupant. However, the NTSB concluded in 2001 that "overhead storage racks, seat frames and sidewalls were not designed to be energy absorbing."

Crashworthiness:

- **Prevent Fires**

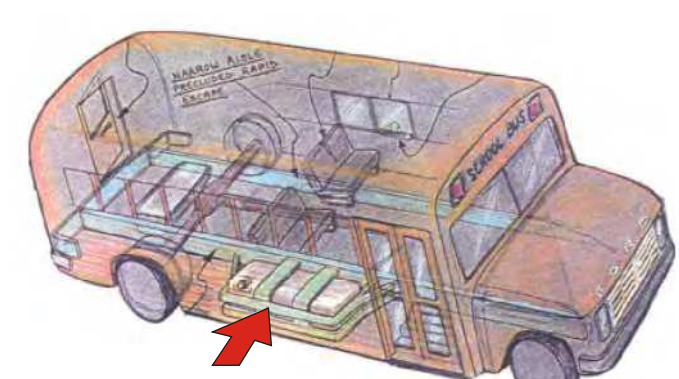
Prevent Post Collision Fires

Protecting the fuel system from fire is not the only kind of fire that should be protected against. However, the 13% of all school bus accidents involve some type of fire.

NHTSA argues that fuel fed fires in school bus accidents are statistically insignificant. This position is misplaced since the school bus test to evaluate fuel tank and line fires is conducted in such a way that no fire could ever result because the test is outdated, unrealistic and lacks any semblance of what actually happens in the real world.

In 1990, the NHTSA evaluated whether FMVSS 301 has improved school bus safety. The authors concluded that "data on fires in school buses were insufficient to permit relevant conclusions on the effect of FMVSS 301."

In October 1995, the NHTSA refused to provide additional protection for school buses by relocating the fuel tank and providing additional structure around the fuel tank.



A fuel tank guard should be required under FMVSS 301 but no such design is required.

The NHTSA's myopic view about school bus fires also overlooks fires from other accelerant sources in the engine compartment. When total school bus fires are researched, the numbers are alarming. In fact,

States are now fighting back and demanding that post collision fires be prevented with passive designs.

ASSEMBLY, No. 2616

STATE OF NEW JERSEY

212th LEGISLATURE

INTRODUCED FEBRUARY 23, 2006

A2616 STENDER
2

AN ACT requiring the installation of fire suppression systems in school buses and special paratransit vehicles.

BE IT ENACTED *by the Senate and General Assembly of the State of New Jersey:*

School Bus Safety Has Been Achieved Internationally

International Bus Manufacturers Have Achieved Occupant Safety

European bus manufacturers have been rolling buses over since the 1930's. Some of the most advanced roof testing and roof design has come out of Hungary where engineers have studied ways to build bus roof structures that are resistant to crush.

After the fullsteal structural automobile's rollover tests in 1930, Hungary was the first to carry out real rollover test with complete bus in 1972. The test was accomplished with different reinforced compartments of IK 255 type bus on a 6/4 (33,6°) slope.

In Europe, buses must be subjected to either a complete rollover or evaluated using a tilting platform and articulated vehicle. The goal for either scenario is the preservation of the survival space. Many European bus companies use both tests to evaluate bus structure.

Volvo Bus is one of the world's biggest manufacturers of large buses. Volvo Bus's safety philosophy is the same as its parent company Volvo Corporation:

Safety is, and must always be, the basic principle for all engineering design.

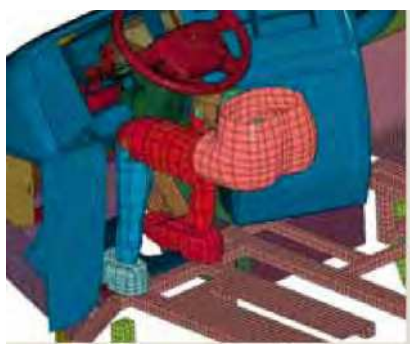
Volvo Bus Utilizes Crashworthiness Principles to Provide Occupant Protection

Survival space must be maintained. A Volvo bus must withstand rolling over without crushing the roof. The front structure utilizes a front impact protection design which spreads the force of an impact into the entire frame structure. Actual crash testing into the side of Volvo buses is also conducted to evaluate the total side structure, restraint, ejection mitigation and energy channeling systems.

School Bus Safety Has Been Achieved Internationally

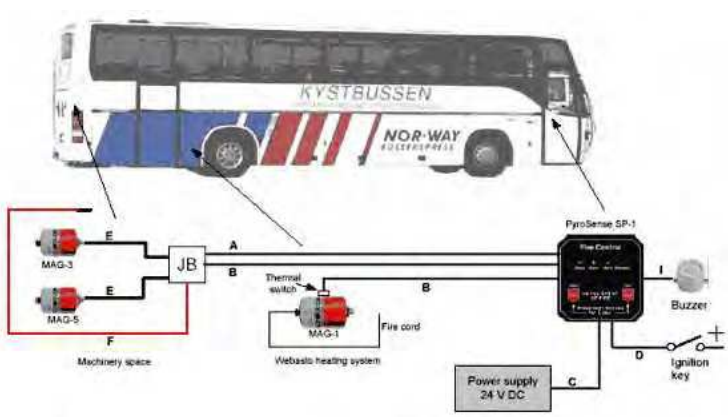
Restraint must be provided so that ejection is minimized. All Volvo buses use lap/shoulder belts because Volvo believes that seat belts save lives. Testing is then conducted with instrumented dummies so that total bus protection can be evaluated. Laminated glass is used to serve as an ejection barrier. Rollover testing with dummies is conducted to evaluate restraint performance.

Energy must be controlled. Volvo also uses a front underride protection system that helps eliminate the disparity in height and weight. A steel structure is located behind the bus bumper that prevents the oncoming vehicle from becoming wedged under the bus. This protects the vehicle's occupants and allows energy to be channelled throughout the bus's frame.



Knee Impact Protection reduces the risk of injury to the driver's knees and legs in a frontal collision. The system consists of energy-absorbing panels positioned at knee height behind the instrument panel.

The bus driver's legs and knees are protected by energy absorbing panels that are designed to deform in a predetermined manner. Bus passengers are protected by energy absorbing material within the entire seating compartment including the storage racks.



Fire must be eliminated. Volvo buses use automatic extinguisher systems in the engine compartment and passenger compartments. Studies have shown that a 72 passenger seat bus will be 100% engulfed in flames in three minutes, even with fire retardant fabrics inside the bus.

School Bus Safety Has Been Achieved Internationally

To demonstrate the distinct safety differences between American school buses and school buses in the United Kingdom, a six member commission was created in the summer of 2007 in the UK to study the safety of the American "big yellow school bus." The Commission concluded that UK children were safer for the following reasons:

- Roofs are stronger
- Structure is stronger
- Testing is more real world
- Window glass is more prone to stay in place and not fracture
- Seatbacks are more padded
- Seatbacks are truly highback, 31" versus 20"
- No luggage rack which prevents escape

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TRANSPORT
REGIONS

The UK's commission for passenger safety

The UK's Commission's findings correlate with forty years of research in the United States that have reached the same conclusions.

Australia is yet another country that provides superior school bus safety to children. The feat has been accomplished because Australian standards require virtually the identical dynamic testing as Europe to evaluate bus safety. Also, the Australian National Road Transport Commission has not allowed the bus industry to manipulate data and research.

NATIONAL ROAD TRANSPORT COMMISSION
PO Box 13105, LAW COURTS VIC 8010, Australia
Telephone (03) 9321 8444 Facsimile (03) 9326 8964
Website: www.nrtc.gov.au email: nrtc@nrtc.gov.au

The French government and Renault Corporation have also been studying bus safety in rollover events for many years.

S10-0-04
Passenger Protection in Single and Double-Decker Coaches in Tipping Over

P. Botto, M.C. Caillieret, A. Patel
Institut de Recherches Orthopédiques
C. Got
Institut de Recherches Biomécanique et Accidentologique
C. Tarrière
Renault

Abstract
This paper is based on the accidentology study of 47 real-world coach accidents. From these 47 accidents, a sub-sample of 11 cases of coach "tip overs" have been chosen to be looked at. We will look at the various causes of bodily injury in coach passengers involved in accidents in relation to their position in the coach. Three types of tip overs are studied. They are:

Abstract from an early French study in rollovers

The international community has forced school bus manufacturers to build safer buses for children. These international organizations that oversee school bus safety have child safety in mind, not the welfare of the bus industry executives or bus lobbyists.

Why European and Australian Buses Provide Better Crash Protection

In Europe, bus manufacturers are required conduct a series of dynamic tests to evaluate side and roof structural integrity. There are no comparable dynamic standards in place in the United States to evaluate school bus safety. Without real world safety compliance testing, school bus crashworthiness will never be achieved in America.

ECE R66 Dynamic Rollover Test

School Bus Safety is Achievable in America

Component Part Manufacturers Can Achieve Bus Safety

One of the most compelling arguments against using seat belts in buses for years has been that seat belts would displace children because of the space needed to add the seat belts on a standard 39 inch bus seat. This argument is no longer valid since the school bus component part suppliers realized that integrated seat belts could be accomplished on a standard 39" bus seat.

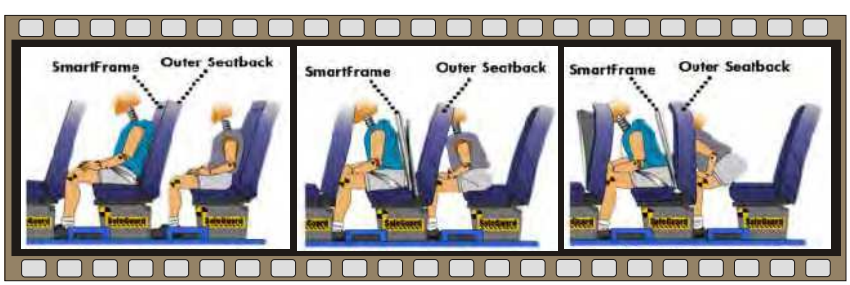
The C.E. White Student Safety Seat with controlled seat collapse capability is another example of a school bus seat that protects children of all sizes while fitting a standard 39 inch bus seat while using the principles of crashworthiness and compartmentalization.

The SafeGuard Seat by IMMI utilizes lap/shoulder belts that fits small children up to high school student sizes in a standard 39 inch bus seat. Further, the SafeGuard Seat actually uses crashworthiness principles to implement compartmentalization.

The Collins DuraStraint Child Restraint Seat fits children up to 50 pounds and their 39 inch seat with integrated lap/shoulder belts fit children of all sizes.

Colleges Are Studying Ways to Protect Our Children on School Buses

Inspired by safety equipment used in roller coasters, two engineering students invented a restraining bar at John Hopkins University that would protect children in frontal impacts and rollovers. The bar would prevent the torso from flexing over into the seat in front of the child and would restrain the pelvis during a rollover.



The SafeGuard seat is padded, high-backed, well anchored and energy absorbing. It is based on UCLA's 1967 research. This design became available in 2001.

Johns Hopkins University Student Concepts

Politics Should NOT Play a Part in Child Safety

Lame Excuses Continue to Delay School Bus Safety Improvements

For years, opponents of seat belts on school buses made the following arguments against adding seat belts:

- **There's not enough fatalities to justify the costs.**
- **There's no data that supports seat belts on buses will make a safety improvement.**
- **There's not enough room to place seat belts on buses without displacing children.**
- **Children will not wear seat belts.**

As data and research doomed each argument, other arguments against improved safety were made that were equally unsupportable by facts. However, the one argument that remains at the forefront of the resistance movement is costs associated with adding seat belts on school buses. The facts do not support this position.

When the 15 year life span of the school bus is factored into the costs of improved safety, the costs of adequately protecting our children is .03 cents per day, per student. Also, school bus seats and floor structures have been required since 1977 to be strong enough to support after-market installation of seat belts. Hence, there is no added costs associated with seat belt retro-fits unless the manufacturers have been violating this FMVSS regulation.

Retrofitting School Buses With Seat Belts Is Necessary Now to Protect Our Children

Texas passed school bus seat belt legislation in the summer of 2007 following a tragedy that claimed the lives of two Beaumont Westbrook High School soccer players and seriously injured several other players following a rollover accident. The Texas statute is an excellent start and those families from Beaumont should be commended for demanding action. In fact, they proved that change can occur when parents, teachers and school administrators demand change.

The Texas statute requires that each new school bus purchased after September 10, 2010, must be equipped with lap and shoulder belts. The legislation should include that all school buses on Texas roads on September 10, 2010 should have lap and shoulder belts. This would require retrofitting existing school buses. This request is not made lightly. The average work life of a school bus in Texas is 15 years. Many school districts use buses for over 20 years. These older school buses without seat belts are then sold to churches or other organizations that transport people. Children on older school buses deserve the same protection as children on newer school buses.

One Texas School District Has Required Seat Belts on Buses For Years

The Austin Independent School District has required seat belt restraints on its school buses for two decades. It is the epitome of hypocrisy that the Texas state capitol school district protects its school district's children far better than a school district in the Texas Panhandle, the Texas Gulf Coast region or one in far East Texas. These other Texas School Districts should not be forced to wait several more years to add school bus seat belts. Safety should always be a present tense subject not a future tense issue.

This safety gap must end. Children in poorer school districts should not be exposed to safety risks because their school district cannot afford to purchase new school buses with seat belts. The same can be said for children riding in an older bus that was sold to a church.

Government Funds Are Available

The federal government could provide every school district in the United States with brand new school buses with all the safety technologies discussed in this brochure. How? If politicians chose to divert a few months of the funds we are spending on the war in Iraq, schools could get safe, new school buses. The cost would be a maximum of 38 billion dollars. The time is now to protect American children, not strangers half way around the world.

A Call to Arms to Solve This Public Safety Crisis

Conclusion

Parents and caregivers, school administrators and states have not been accurately informed of the hazards of school buses. Why is that? For years, bus manufacturers and the NHTSA were in collusion together to detract proponents of school bus safety. Together, the bus industry and the entity of the government charged with protecting vehicle safety furnished misleading data and overlooked decades of research that demonstrated that safety improvements in school buses were desperately needed.

Human suffering has brought about much needed changes in vehicle safety over the years. Our children however, should not be subjected to the risks of suffering when they choose to ride the big yellow school bus. This is especially true since there are proven ways to protect children on school buses that have been used by European and Australian bus manufacturers for decades.

Right now we are in a position to make changes to the standards which govern school bus safety. Several of the organizations, whom for decades opposed seat belts on school buses, have now endorsed discretionary use of seat belts on new, large school buses. However, these same organizations are literally begging our government not to require retro-fit seat belts on existing school buses. Why should a child in an older school bus be less protected than a child in a new school bus? All children deserve equal protection. We should all recall that President Bush vowed that "No child shall be left behind in education." No child should be left behind in protection and safety either.

Children are precious and deserve to be protected, especially when they are on their way to learn. Protecting children on school buses is just as important as protecting them in their classroom. It is incumbent on each of us to insure that needless injury and death does not steal the future away from a single child on American school buses. It does not matter if the child rides an old school bus or a new school bus. All school buses should be equally safe today, not 10 or 20 years from today.

Post Script:

NPRM 2007-0014 NHTSA wrote that "in terms of optimum passenger crash protection that can be afforded to an individual passenger on a large school bus, a lap/shoulder belt system together with compartmentalization would afford that optimum protection."

However, the new school bus safety proposals by the NHTSA, does too little, too late to insure adequate school bus safety to American school children for the following reasons:

- Would raise the seat height from 20" to 24." Seat height should be 28" at a minimum based on the 1967 UCLA study. European and Australian seats are 31."
- Merely "encourages providers to ***consider*** lap/shoulder belts on large school buses." The NHTSA made this identical recommendation in 1977. Despite the recommendation over 30 years ago, 98% of American school buses do not have lap/shoulder belts.

The NHTSA's 2007 bus safety proposals actually seem bloated, antiquated and ill-informed. For instance, the NHTSA, influenced by the bus industry, has argued that mandatory lap/shoulder belts will displace 17% of child occupants. However, integrated lap/shoulder belts on standard 39" school bus seats have been available since 2001 by a number of component part manufacturers. The NHTSA performed the certification test on these seats.

To get a better appreciation in the continuing school bus safety debate, you should logon to the website below, read the comments, and determine for yourself if your NHTSA is protecting your child's welfare or the profits of the school bus industry?

www.regulations.gov
enter docket number **2007-0014**

As a parent or caregiver you should take the time to write a comment to this very important docket that concerns the safety of American children. The last docket was 30 years ago; you may never have another chance in your lifetime to affect this critical safety issue.

During the creation of this brochure, I found some enlightening thoughts and comments from individuals who have fought for and continue to fight for school bus safety changes. Safety changes on school buses require persistence, perspiration and painstaking efforts on...

...the use of statistics.

"Kill forty kids in one school bus fire and every school bus in America will have a fuel tank guard.

Kill forty kids, a few at a time over a longer period -- not so bad? -- not something to spend money on?"

...the need for seat belts.

An increasing number of crash experts are blaming a lack of seat belts for the catastrophic injuries (permanent and disabling) and deaths of children flung about the school bus or ejected during a crash.

Several hundred school districts' big yellow buses equipped with seat belts have experienced no occurrences of spinal injury, brain damage or death as a result of a student wearing a seat belt during a bus crash.

A nation of paramedics and doctors -- these are the experts that inspect the kids after a school bus crash -- virtually in unison claim seat belts on the school buses can save lives and substantially reduce catastrophic injuries.

...the costs of school bus safety.

The school bus transportation industry knows seat belts are on the way, some perhaps attempting to measure at what point the cost of losing big settlements in the courts exceeds the cost of installing seat restraints on the buses.

The 1986 Levy Hearings in New York state mentioned that, "If seat belts are mandated statewide, the cost of belts would decrease as a result of increased competition among school bus manufacturers."

"School districts receive up to 90 percent reimbursement in State education aid for state transportation costs which means that, for a school district, the cost for seat belts and improved padding will range from $140 to $180 per bus, a small price for the obvious safety enhancement."

Including factory installed seat restraints on new production big school buses eventually and simply will become the most cost-effective thing to do.

...improved student behavior.

"The bus is definitely safer because the students are not moving around. The seat belts have conditioned the students to stay seated, and it's safer for me as the driver because I'm concentrating on driving rather then disciplining a bus full of kids."

www.vehiclesafetyfirm.com

...the exclusion of injury data to justify no improvements.

Flagstaff, Arizona, decided to forego seat belts on their school buses only to eventually owe $28 million in settlements after permanently disabling two of their students in a 1996 bus crash. One student was thrown from the bus and the other banged around inside, hitting the ceiling then slamming his back onto the padded bar on the front passenger side.

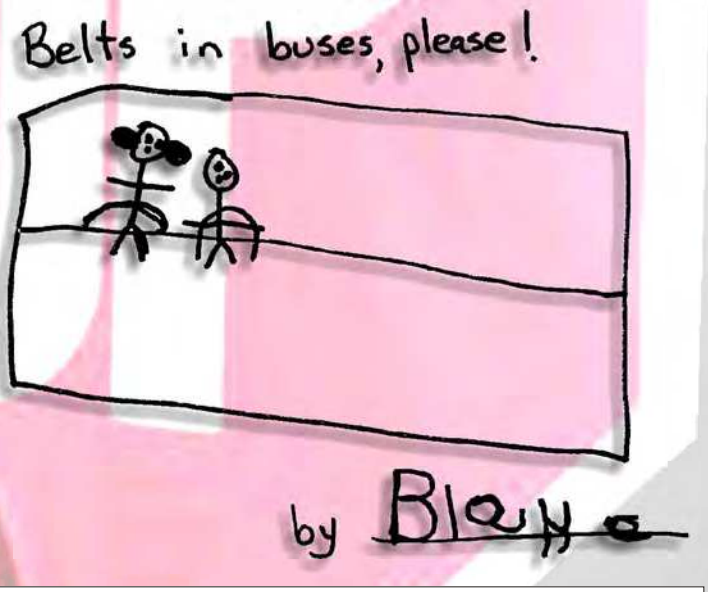
One student, a genius, was reduced to a vegetable. The other student, a star athlete, is now a paraplegic.

Although it can be said these students' potential livelihoods had ended, neither student was counted as killed, because neither student had died.

...the need to install seat belts on the entire school bus fleet.

The best cost and life saving combination overall may be factory installed restraints on new school bus purchases and retro-fitting older buses with seat belts.

But of all the arguments made by doctors, engineers, safety advocates, and concerned citizens to improve bus safety, the most persuasive came from this child.



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