National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

Date: NOV 2 1999

In reply refer to: H-99-45 through -54

Ms. Rosalyn G. Millman
Acting Administrator
National Highway Traffic Safety Administration
Washington, D.C. 20590

School bus and motorcoach travel are two of the safest forms of transportation in the United States. Each year, on average, nine school bus passengers and four motorcoach passengers are fatally injured in bus crashes, according to National Highway Traffic Safety Administration (NHTSA) and motorcoach industry statistics. In comparison, NHTSA statistics show that in 1998, over 41,000 people were fatally injured in highway crashes. Although much has been done to improve the safety of school buses and motorcoaches over the years, the safe transportation of bus passengers, especially students and senior citizens, continues to be a national safety priority. Children and seniors are predicted to be the fastest growing segments of our society, and these groups are the primary users of bus transportation. Therefore, the National Transportation Safety Board initiated a special investigation to determine whether additional measures should be taken to better protect bus occupants.

To address crucial questions on bus safety, the resulting special investigation[1] examined school bus and motorcoach issues, evaluated the Federal Motor Vehicle Safety Standards (FMVSS) that govern the design of school buses and motorcoaches, and addressed data collection issues that are hampering effective accident study.

Since August 1996, the National Transportation Safety Board has investigated six school bus accidents[2] in which passenger fatalities or serious injuries occurred away from the area of vehicle impact. In these accidents, the Safety Board found that school bus passengers who remained within the seating compartment but not within the intrusion area during the accident sequence were less likely to have been seriously injured than passengers who were out of the compartment before the collision or who were propelled from the compartment during the collision. This represents a departure from the circumstances of the accidents discussed in the

[1] For additional information, read *Bus Crashworthiness Issues*, Highway Special Investigation Report, NTSB/SIR-99/04 (Washington, D.C.: National Transportation Safety Board, 1999).

[2] Refer to Accident No. WRH-96-F-H014, Flagstaff, Arizona, August 14, 1996; Accident No. CRH-97-F-H004, Monticello, Minnesota, April 10, 1997; Accident No. HWY-98-M-H005, Easton, Maryland, October 31, 1997; Accident No. HWY-98-M-H022, Buffalo, Montana, March 10, 1998; Accident No. HWY-98-F-H043, Holyoke, Colorado, September 1, 1998; and Accident No. HWY-98-F-H045, Holmdel, New Jersey, September 18, 1998.

Safety Board's 1987 Large School Bus Study,[3] in which intrusion caused all but 2 of the 13 fatalities and caused most of the moderate or greater injuries. In addition, the more recent accidents were unlike the accidents in the 1987 Large School Bus Study. These accidents involved lateral (side) impacts with vehicles of large mass, lateral (side) impacts with vehicles of large mass and rollover, and single-vehicle rollover.

As a result of its analysis[4] of these recent accidents, the Safety Board determined that current compartmentalization, although an effective means of protecting passengers in school bus accidents, because of its design, does not protect all passengers during lateral impacts with vehicles of large mass and during rollovers, especially passengers seated outside the impact area. Occupant motion analysis of these accidents found that these passengers were being thrown from the seating compartment toward the area of impact. Therefore, the Safety Board investigated the issue of passenger restraints, using computer simulation and injury analysis to determine whether additional forms of restraint would better protect the passengers in lateral impacts and rollovers.

Simulated occupants restrained by lap and lap/shoulder belts were compared with unrestrained simulated occupants to determine the effectiveness of current restraint systems in large school bus accidents. For example, three simulations were performed for the Monticello accident restraint analysis: unrestrained, lap belt-restrained, and lap/shoulder belt-restrained. In the unrestrained condition, three simulated occupants[5] were predicted to sustain head injuries. In the lap belt-restrained condition, four simulated occupants were predicted to sustain head injuries. In the lap/shoulder belt-restrained condition, five simulated occupants were predicted to sustain head injuries.

In the lap belt-restrained simulation, the lap belt restrained the simulated occupant's pelvis relative to the seat but did not restrain the upper torso. Due to the unrestrained movement of the upper torso, impact forces were concentrated on small areas of the upper body, such as the head. These concentrated forces resulted in a predicted high risk of head injury. In the lap/shoulder belt-restrained simulation, for the occupants seated on the side of the bus opposite the impact, the simulated occupant's upper torso was predicted to slide out of the shoulder harness laterally. The resulting simulated occupant motion was similar to that seen in the lap belt-restrained condition. In the unrestrained condition, impact forces were distributed over a large portion of the simulated occupant's body. The distribution of impact forces resulted in a reduced risk of head injuries. Similar findings were noted for the Holmdel, New Jersey, accident. Thus, the potential exists for an increased risk of injury to occupants restrained using typical seat belt designs. However, because injuries occurred for all restraint conditions in the simulated accidents and because injury levels varied depending upon occupant kinematics and seating location, the Safety Board concluded that it cannot be determined whether the current design of available restraint systems for large school buses would have reduced the risk of injury to the school bus passengers in these

[3] For additional information, read *Crashworthiness of Large Poststandard Schoolbuses,* Highway Safety Study, NTSB/SS-87/01 (Washington, D.C.: National Transportation Safety Board, 1987).

[4] The vehicle dynamics and occupant kinematics for the Monticello, Holmdel, and Holyoke accidents were simulated using a variety of computer programs. For additional information on the computer programs and methodology used to simulate these accidents, read *Bus Crashworthiness Issues,* NTSB/SIR-99/04.

[5] These simulated occupants were seated in the same locations as the actual passengers who sustained head injuries in the actual accident.

accidents. Even though the Safety Board was unable to determine whether current restraint systems would have decreased injury levels in these accidents, potential crash protection systems that would better protect occupants are possible. For example, in the Holmdel simulation, the reduced head injuries seen for the simulated occupants seated on the opposite side of the bus from the impact and restrained in lap/shoulder belts indicate that injuries could possibly be decreased with some form of restraint system. The Safety Board therefore concluded that the potential exists for an occupant crash protection system to be developed that would protect school bus passengers in most accident scenarios.

To determine whether an occupant protection system exists or is under development that could mitigate injuries in accidents involving rollover or high lateral forces, Safety Board staff reviewed information regarding other passenger protection systems for school buses that are available or may be available in the future: a lap/shoulder belt system that can be installed on standard school bus seats, a restraining bar, and a seat with integrated lap/shoulder belts. Because the Safety Board found that the degree of protection afforded by these systems varies and that these protection systems have not been tested against a uniform standard, the Board is concerned that not all alternative school bus occupant protection systems under development provide equal protection. Consequently, the Safety Board concluded that all potential designs for occupant protection systems to be used on school buses should be tested to uniform performance standards developed by NHTSA to ensure occupant safety.

The occupant protection concerns for motorcoaches are somewhat different than those for school buses. Most motorcoaches today are equipped with high-backed passenger seats and have large panoramic windows. Through its investigations, the Safety Board has found that, because motorcoaches are larger in mass and have a lower center of gravity than school buses, they often respond quite differently during collisions. For instance, unlike school buses, the Board has found that fatal injuries in motorcoach accidents are often the result of passenger ejection from the coach.[6]

In the course of investigating three recent, severe motorcoach accidents,[7] the Safety Board became concerned that motorcoach passengers are not adequately protected in collisions. Although standards within the FMVSS exist for large school buses relating to passenger seating, crash protection, and body joint strength, no similar standards apply to other types of large buses, including motorcoaches. In other words, no Federal regulation or standard requires that large buses sold or operated in the United States be equipped with occupant protection systems (other than for the driver).

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[6] The 36 motorcoach accidents investigated by the Safety Board from 1968 through 1997 resulted in 168 occupant fatalities, 106 of which occurred in accidents involving a rollover. Of these 106 fatally injured passengers, 64 were ejected from the motorcoach.

[7] Refer to Accident No. HWY-98-MH-033, Burnt Cabins, Pennsylvania, June 20, 1998; Accident No. HWY-99-MH-007, Old Bridge, New Jersey, December 24, 1998; and Accident No. HWY-99-MH-017, New Orleans, Louisiana, May 5, 1999.

From 1968 through 1973, the Safety Board issued 11 recommendations[8] to the Federal Highway Administration (FHWA), NHTSA, or both, concerning restraints, including requiring that seat belts be installed in buses, none of which have been implemented. The last recommendation made by the Safety Board regarding occupant restraints for motorcoaches (Safety Recommendation H-73-42) was placed in a "Closed—Reconsidered" status, on June 29, 1988, with a provision that the Safety Board continue to monitor motorcoach accidents to determine whether the installation and use of occupant restraints would mitigate injuries. Since this time, the Safety Board has continued to investigate motorcoach accidents in which passengers sustained serious injuries and fatalities from ejections and rollovers.

Based upon the Safety Board's investigations of motorcoach accidents and the dynamics of rollovers and occupant ejection, the Safety Board concluded that one of the primary causes of preventable injury in motorcoach accidents involving a rollover, ejection, or both is occupant motion out of the seat during a collision when no intrusion occurs into the seating area. Thus, the Safety Board concluded that the overall injury risk to occupants in motorcoach accidents involving rollover and ejection may be reduced significantly by retaining the occupant in the seating compartment throughout the collision.

Australia and the European Union (EU) now require seat belts on motorcoaches. The EU's regulation[9] requires that motorcoaches be fitted with lap belts or lap/shoulder belts at each passenger position. Australia's regulation[10] requires lap/shoulder belts at all passenger positions. Although crash testing was not performed in support of these regulations, a limited number of frontal and rollover motorcoach crash tests have been performed in Germany by DEKRA,[11] a private-sector vehicle monitoring organization. The data available from these tests indicate that the lap belts (two-point restraints) used in these tests could increase the potential for injury in frontal collisions for certain seat spacing or if the seatback in front of the occupant were incorrectly designed. In addition, both NHTSA[12] and Safety Board[13] studies have found that automobile passengers wearing lap belts in rear seats do not receive any positive safety benefits from usage.

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[8] These safety recommendations (Safety Recommendations H-68-18; H-70-4; H-71-10 and -11, H-71-34, -35, and -87; and H-73-1, -7, -18, and -42) are summarized in appendix E of *Bus Crashworthiness Issues*, NTSB/SIR-99/04.

[9] EU member states (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Italy, Ireland, Luxembourg, the Netherlands, Portugal, Spain, Sweden, and the United Kingdom) require either lap belts (two-point belts) and an energy-absorbing seat or lap/shoulder belts (three-point belts). The seat belt directive that became effective October 1, 1997, specifies that a member state can require motorcoaches to meet national legislation on seat belts. However, the directive further specifies that unless the vehicle is a new design, it does not have to meet the legislation's requirements until October 1, 1999, and that a member state can set different standards until that date.

[10] Lap/shoulder belts have been required on newly manufactured motorcoaches since 1994 in accordance with Australian Design Standard No. 68.

[11] *DEKRA* stands for Deutscher Kraftfahrzeug-Überwachungs Verein (loosely translated, "German Vehicle-Monitoring Association").

[12] For additional information, read NHTSA Technical Report, *Effectiveness of Lap/Shoulder Belts in the Back Outbound Seating Positions*, DOT HS 808945 (Washington, D.C.: U.S. Department of Transportation, June 1999).

[13] For additional information, read *Performance of Lap Belts in 26 Frontal Crashes*, Highway Safety Study, NTSB/SS-86/03 (Washington, D.C.: National Transportation Safety Board, 1986).

To ensure that new occupant protection systems are beneficial and to guard against possible negative effects, such as those that have occurred in frontal collisions, the Safety Board concluded, to ensure occupant safety, new occupant crash protection systems for motorcoaches should be tested to uniform performance standards developed by NHTSA that are based upon actual crash testing of motorcoaches.

In addition to examining active occupant protection such as seat belts, the Safety Board also examined passive protection measures designed to reduce injuries of motorcoach passengers and to prevent passenger ejections, such as requiring window glazing, reducing window size, and improving roof strength.

NHTSA, in its ongoing research concerning mitigating ejection through advanced glazing,[14] estimated that advanced glazing composed of glass and plastic could save 1,313 lives and prevent 1,297 serious injuries per year in passenger cars. The Safety Board has also found that glazing may mitigate injury during a bus overturn. In its investigation of a 1988 accident,[15] the Safety Board determined that because the bus' acrylic windows did not break, passengers may have been prevented from contacting the road surface and sustaining more serious or even fatal injuries. Because of these findings, the Safety Board concluded that equipping motorcoach side windows with advanced glazing may decrease the number of ejections of unrestrained passengers during motorcoach accidents and decrease the risk of serious injuries to restrained passengers during motorcoach accidents.

Other factors affecting motorcoach ejections include roof strength and window size. No FMVSS exist that either limit a window's maximum size in any type of bus (including school buses) or, except in the case of large school buses, address rollover strength in motorcoaches. The relationship between roof strength and window size is important because as window size increases, the number of vertical supports between windows decreases. Thus, in a rollover accident, fewer vertical supports must carry a larger load.

Safety Board staff measured the passenger windows of motorcoaches manufactured by Thomas Built, Dina, Motor Coach Industries, Van Hool, Setra, and Prevost to determine the current average size of motorcoach passenger windows. Staff found that the average window area is now 2,040 square inches, 10 times larger than is required to meet the emergency exit standard under FMVSS 217. The size difference does not include allowances for framing and/or gaskets in the motorcoach windows. In addition, the size of the opening would increase if the window framing or gasket were ejected or if the window were an emergency exit and came open during a rollover. The Safety Board therefore concluded that because the increased size of passenger windows in motorcoaches may affect roof strength, rollover strength standards must be developed to take into account the effect of typical window dimensions.

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[14] For additional information, read *Ejection Mitigation Using Advanced Glazing*, Status Report (Washington, DC: National Highway Traffic Safety Administration, November 1995).

[15] For additional information, read *Intercity-Type Buses Chartered for Service to Atlantic City, New Jersey*, Highway Accident Summary Report, HAR-89/01/SUM (Washington, D.C.: National Transportation Safety Board, 1989).

The Safety Board issued its last recommendations[16] on roof strength and window size in 1973, as the result of a 1971 accident[17] in which the Safety Board determined that the availability and use of seat belts or another form of restraint by the passengers would have reduced the numbers of injuries and fatalities. In addition, the investigation determined that during the rollover, gross downward and sideward deflection of the roof occurred and the roof support design caused the side-window posts to fail due to concentrated loads. The Safety Board also concluded that the strength of the roof support structure for "picture-window" type buses are inadequate. To date, almost 30 years after these recommendations were issued, rollover testing on motorcoaches has yet to be performed.

In addition to examining bus crashworthiness issues, this special investigation also addressed a number of data collection issues hampering effective accident study, including the discrepancies between Federal bus definitions. As a result of its investigation, the Safety Board made recommendations to the U.S. Department of Transportation, the National Association of Governors' Highway Safety Representatives, and the bus manufacturers regarding developing standard bus definitions and classifications and incorporating them into the FMVSS and the Minimum Model Uniform Crash Criteria.

Another data collection issue that the special investigation examined was the accuracy of school bus injury data, which has been debated by the pupil transportation community. According to testimony from a NHTSA representative at the Safety Board's August 1998 public hearing on bus crashworthiness, the agency believes that the General Estimates System (GES) is reliable for estimating injuries in passenger cars. However, the representative also stated that bus classification in the system is inaccurate and that additional school bus injury information needs to be collected. Inconsistent reporting by the States of school bus injury data has also been a problem, according to the National Safety Council, which recently announced that it will no longer estimate the number of school bus injuries during the year, because of inadequate data.[18] The Safety Board therefore concluded that school bus accident injury data are incomplete, and, therefore, injuries cannot be reliably estimated.

The Safety Board also investigated on-board recording devices, which represent an available technology that could be implemented to facilitate bus classification and data collection. On-board devices that record accident data, including crash pulses and other vehicle parameters, are now being used on highway vehicles in Europe. This recording technology has recently been introduced in the U.S. market and offers an effective means for NHTSA to gather crash pulse data on school buses and motorcoaches. By the end of 1999, an estimated 200 accident recorders will be installed on commercial vehicles in the United States.

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[16] For additional information on Safety Recommendations H-73-3 and -4, read *Bus Crashworthiness Issues*, NTSB/SIR-99/04.

[17] For additional information, read *Bus/Station Wagon Collision Followed by Bus Overturn, U.S. Route 66, Near Marshfield, Missouri, October 10, 1971*, Highway Accident Report, NTSB-HAR-73-1 (Washington, DC.: National Transportation Safety Board, 1973).

[18] The National Safety Council's *Accident Facts*, an annual report, states that variations exist among the States in several areas, including operations, definitions of terms, and lack of comparable reporting.

On-board recorders have been commonly used for as many as 6 years by over 100 U.S. jurisdictions to manage their school bus fleets. The jurisdictions using on-board recorders include Montgomery County, Maryland; Washington County, Maryland; Los Angeles, California; Cherryvalley-Springfield, New York; Dryden, New York; Guilderland, New York; and Newark, New York. European[19] and U.S. studies[20] have found the use of on-board recorders to have had a positive impact on operational safety for vehicle fleets. In one case, Laidlaw, Inc.,[21] prompted by the comparatively high accident rate in a school bus fleet in Bridgeport, Connecticut, commissioned a study[22] of the effect on safety following installation of fleet management on-board recorders. The study, which took place from December 1, 1996, to May 30, 1997, consisted of fitting 65 of the 150 school buses in the Bridgeport fleet with fleet management recorders. During the study, driver speeding was monitored and those drivers who spent over 25 percent of their trip miles at speeds over a set threshold were required to participate in counseling sessions. At the end of the trial period, those buses not equipped with on-board recording systems accounted for 72 percent of the fleet's accidents.[23] In light of these results, Laidlaw installed on-board fleet management recorders in the remainder of the Bridgeport fleet. After a year, officials were able to identify a contributing factor to the high accident rate that related to driver training. Laidlaw subsequently evaluated and accordingly modified its training program.

Although the fleet management recorders used in this study and in other U.S. school bus fleets do not provide data such as crash pulses, the combination of fleet management information and limited data such as speed made improvements in safety possible for Laidlaw's Bridgeport fleet. Further, the presence of on-board recorders for fleet management in over 100 school bus fleets shows that many jurisdictions are already taking advantage of the tools that on-board recorder systems can provide. Because of the safety improvements that have resulted from using on-board recorders, both for accident data and fleet management, the Safety Board concluded that the use of on-board recorders may help reduce the accident rates of vehicle fleets.

On-board recorders can also provide important crash pulse data and other vehicle information during frontal impacts, side impacts, rollovers, and other dynamic vehicle events. To date, much of the debate regarding bus occupant protection has been fueled by the lack of available crash pulse data. On-board recorders constitute the most thorough method of obtaining bus accident data; moreover, the collection of crash data will be necessary for the continuing development of bus occupant protection systems. Because of these factors, the Safety Board concluded that on-board recorders are needed to provide quantitative data to evaluate the dynamics of bus crashes. The Safety Board also believes that to enhance the accuracy of school

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[19] For additional information, read Lehmann, Gerhard, and Reynolds, Tony, "The Contribution of On-board Recording Systems to Road Safety and Accident Analysis," *Transportation Recording: 2000 and Beyond*, Proceedings, International Symposium on Transportation Recorders, May 3-5, 1999, Arlington, Virginia (Washington, D.C.: National Transportation Safety Board, and The Hague, Netherlands: International Transportation Safety Association) 243-5.

[20] For additional information, read *Final Report for Bridgeport, CT Facility*, ARGO Fleet Systems, VDO North America LLC, June 12, 1997.

[21] Laidlaw, Inc., is the largest contract operator of school bus fleets in the United States.

[22] ARGO Fleet Systems, VDO North America LLC, *Final Report for Bridgeport, CT Facility*, June 12, 1997.

[23] ARGO Fleet Systems *Bridgeport* report, 1997.

bus and motorcoach investigations, parameters in addition to crash pulse or acceleration data, such as vehicle speed, engine speed, heading, and the status of different lights and vehicle systems, are needed. Further, the parameters should be recorded at a sampling rate that is sufficient to define vehicle dynamics. In addition, the resulting data should be preserved in the event of a vehicle crash or an electrical power loss.

Through years of experience with on-board recording devices in the aviation, rail, and marine modes of transportation, the Safety Board and the transportation industry have learned a great deal about the effective introduction of recording technology. Establishing industry standards for recording in these modes has been critical to effective implementation of on-board recorders. Industry standards ensure consistency in recorded data and prevent the proliferation of multiple formats and configurations. They also foster the efficient introduction of new recording system technology. The Safety Board therefore concluded that establishing on-board recording standards for highway vehicles will provide a necessary foundation for the future use of on-board recorders.

As a result of this special investigation, the Safety Board recommends that the National Highway Traffic Safety Administration:

> In 2 years, develop performance standards for school bus occupant protection systems that account for frontal impact collisions, side impact collisions, rear impact collisions, and rollovers. (H-99-45)
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> Once pertinent standards have been developed for school bus occupant protection systems, require newly manufactured school buses to have an occupant crash protection system that meets the newly developed performance standards and retains passengers, including those in child safety restraint systems, within the seating compartment throughout the accident sequence for all accident scenarios. (H-99-46)
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> In 2 years, develop performance standards for motorcoach occupant protection systems that account for frontal impact collisions, side impact collisions, rear impact collisions, and rollovers. (H-99-47)
>
> Once pertinent standards have been developed for motorcoach occupant protection systems, require newly manufactured motorcoaches to have an occupant crash protection system that meets the newly developed performance standards and retains passengers, including those in child safety restraint systems, within the seating compartment throughout the accident sequence for all accident scenarios. (H-99-48)

Expand your research on current advanced glazing to include its applicability to motorcoach occupant ejection prevention, and revise window glazing requirements for newly manufactured motorcoaches based on the results of this research. (H-99-49)

In 2 years, develop performance standards for motorcoach roof strength that provide maximum survival space for all seating positions and that take into account current typical motorcoach window dimensions. (H-99-50)

Once performance standards have been developed for motorcoach roof strength, require newly manufactured motorcoaches to meet those standards. (H-99-51)

Modify your methodology to collect accurate, timely, and sufficient data on passenger injuries resulting from school bus accidents so that thorough assessments can be made relating to school bus safety. (H-99-52)

Require that all school buses and motorcoaches manufactured after January 1, 2003, be equipped with on-board recording systems that record vehicle parameters, including, at a minimum, lateral acceleration, longitudinal acceleration, vertical acceleration, heading, vehicle speed, engine speed, driver's seat belt status, braking input, steering input, gear selection, turn signal status (left/right), brake light status (on/off), head/tail light status (on/off), passenger door status (open/closed), emergency door status (open/closed), hazard light status (on/off), brake system status (normal/warning), and flashing red light status (on/off) (school buses only). For those buses so equipped, the following should also be recorded: status of additional seat belts, airbag deployment criteria, airbag deployment time, and airbag deployment energy. The on-board recording system should record data at a sampling rate that is sufficient to define vehicle dynamics and should be capable of preserving data in the event of a vehicle crash or an electrical power loss. In addition, the on-board recording system should be mounted to the bus body, not the chassis, to ensure that the data necessary for defining bus body motion are recorded. (H-99-53)

Develop and implement, in cooperation with other Government agencies and industry, standards for on-board recording of bus crash data that address, at a minimum, parameters to be recorded, data sampling rates, duration of recording, interface configurations, data storage format, incorporation of fleet management tools, fluid immersion survivability, impact shock survivability, crush and penetration survivability, fire survivability, independent power supply, and ability to accommodate future requirements and technological advances. (H-99-54)

The Safety Board also issued Safety Recommendations to the U.S. Department of Transportation, the National Association of Governors' Highway Safety Representatives, and the bus manufacturers. Please refer to Safety Recommendations H-99-45 through -54 in your reply. If you need additional information, you may call (202) 314-6169.

Chairman HALL, Vice Chairman FRANCIS, and Members HAMMERSCHMIDT, GOGLIA, and BLACK concurred in these recommendations.

Original Signed

By: Jim Hall
Chairman

Safety Recommendation Reiteration List

SR Number	Reiteration Number	Report Number	Report Date	Accident Description	Accident City	Accident State	Accident Date
H-99-045	1	HAR-00-02	11/14/2000	School Bus and Dump Truck Collision	Central Bridge	NY	10/21/1999

Safety Recommendation Reiteration List

SR Number	Reiteration Number	Report Number	Report Date	Accident Description	Accident City	Accident State	Accident Date
H-99-046	1	HAR-00-02	11/14/2000	School Bus and Dump Truck Collision	Central Bridge	NY	10/21/1999

Safety Recommendation Reiteration List

SR Number	Reiteration Number	Report Number	Report Date	Accident Description	Accident City	Accident State	Accident Date
H-99-047	1	HAR-01-01	8/28/2001	Motorcoach Run-Off-The-Road	New Orleans	LA	5/9/1999
H-99-047	2	HAR-04-03	6/22/2004	Motorcoach Run-off-the-Road and Overturn	Victor	NY	6/23/2002
H-99-047	3	HAR-08-01	7/8/2008	Motorcoach Override of Elevated Exit Ramp Interstate 75	Atlanta	GA	3/2/2007
H-99-047	4	HAR-09-01	4/21/2009	Motorcoach Rollover	Mexican Hat	UT	1/6/2008
H-99-047	5	HAR-09-02	10/27/2009	Motorcoach Run-Off-The-Bridge and Rollover	Sherman	TX	8/8/2008
H-99-047	6	HAR-12-01	6/5/2012	Motorcoach Run-Off-the-Road and Collision With Vertical Highway Signpost,	New York City	NY	3/12/2011

				Interstate 95 Southbound			
H-99-047	7	HAR-12-02	7/31/2012	Motorcoach Roadway Departure and Overturn on Interstate 95	Doswell	VA	5/31/2011

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H-99-048	1	HAR-01-01	8/28/2001	Motorcoach Run-Off-The-Road	New Orleans	LA	5/9/1999
H-99-048	2	HAR-04-03	6/22/2004	Motorcoach Run-off-the-Road and Overturn	Victor	NY	6/23/2002
H-99-048	3	HAR-08-01	7/8/2008	Motorcoach Override of Elevated Exit Ramp Interstate 75	Atlanta	GA	3/2/2007
H-99-048	4	HAR-09-01	4/21/2009	Motorcoach Rollover	Mexican Hat	UT	1/6/2008
H-99-048	5	HAR-09-02	10/27/2009	Motorcoach Run-Off-The-Bridge and Rollover	Sherman	TX	8/8/2008
H-99-048	6	HAR-12-01	6/5/2012	Motorcoach Run-Off-the-Road and Collision With Vertical Highway Signpost,	New York City	NY	3/12/2011

				Interstate 95 Southbound			
H-99-048	7	HAR-12-02	7/31/2012	Motorcoach Roadway Departure and Overturn on Interstate 95	Doswell	VA	5/31/2011

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H-99-049	1	HAR-01-01	8/28/2001	Motorcoach Run-Off-The-Road	New Orleans	LA	5/9/1999
H-99-049	2	HAR-12-02	7/31/2012	Motorcoach Roadway Departure and Overturn on Interstate 95	Doswell	VA	5/31/2011
H-99-049	3	HAR-18-03	12/4/2018	Motorcoach Run-Off-the-Road and Overturn US Highway 83 Laredo, Texas	Laredo	Texas	5/14/2016

Safety Recommendation Reiteration List

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H-99-050	1	HAR-01-01	8/28/2001	Motorcoach Run-Off-The-Road	New Orleans	LA	5/9/1999
H-99-050	2	HAR-09-02	10/27/2009	Motorcoach Run-Off-The-Bridge and Rollover	Sherman	TX	8/8/2008
H-99-050	3	HAR-12-02	7/31/2012	Motorcoach Roadway Departure and Overturn on Interstate 95	Doswell	VA	5/31/2011

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H-99-051	1	HAR-01-01	8/28/2001	Motorcoach Run-Off-The-Road	New Orleans	LA	5/9/1999
H-99-051	2	HAR-09-02	10/27/2009	Motorcoach Run-Off-The-Bridge and Rollover	Sherman	TX	8/8/2008
H-99-051	3	HAR-12-02	7/31/2012	Motorcoach Roadway Departure and Overturn on Interstate 95	Doswell	VA	5/31/2011

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H-99-053	1	HAR-08-01	7/8/2008	Motorcoach Override of Elevated Exit Ramp Interstate 75	Atlanta	GA	3/2/2007
H-99-053	2	SIR-09-02	9/1/2009	Pedal Misapplication in Heavy Vehicles	N/A	N/A	N/A

Safety Recommendation Reiteration List

SR Number	Reiteration Number	Report Number	Report Date	Accident Description	Accident City	Accident State	Accident Date
H-99-054	1	HAR-08-01	7/8/2008	Motorcoach Override of Elevated Exit Ramp Interstate 75	Atlanta	GA	3/2/2007
H-99-054	2	SIR-09-02	9/1/2009	Pedal Misapplication in Heavy Vehicles	N/A	N/A	N/A
H-99-054	3	H-15-01	7/14/2005	Truck-Tractor Double Trailer Median Crossover Collision With Motorcoach and Postcrash Fire on Interstate 5, Orland, California, April 10, 2014	Orland	CA	4/10/2014
H-99-054	4	HAR-15-03	11/17/2015	Truck-Tractor Semitrailer Median Crossover Collision With	Davis	OK	9/26/2014

SR Number	Reiteration Number	Report Number	Report Date	Accident Description	Accident City	Accident State	Accident Date
				Medium-Size Bus on Interstate 35, Davis, Oklahoma, September 26, 2014			
H-99-054	5	SIR-18-02	6/21/2018	Selective Issues in School Bus Transportation Safety: Crashes in Baltimore, Maryland, and Chattanooga, Tennessee	Baltimore Chattanooga	MD TN	11/1/2016 11/21/2016