



Motorcoach and School Bus Fire Safety Analysis

BACKGROUND

In 2009, the Federal Motor Carrier Safety Administration (FMCSA) published findings from a study entitled “Motorcoach Fire Safety Analysis.” The objective of this study was to gather and analyze information regarding the causes, frequency, and severity of motorcoach fires. Based on study findings, analysts developed a number of recommendations for improved motorcoach fire safety in the areas of data quality, operational training and outreach, vehicle design and equipment development, and inspection and enforcement standards.

To update and expand upon the 2009 analysis, FMCSA sponsored a new study that encompasses both motorcoach and school bus fires. The updated analysis includes all motorcoach fires (i.e., spontaneous, intentional, or the result of a collision or rollover) that occurred from 2004 to 2013. Additionally, the study evaluates school bus fire risk, estimates the impacts of recent technology changes on motorcoaches and school buses, and expands on the evaluation of the effectiveness of automatic fire detection and suppression systems. A summary of key findings is presented in Table 1.

Table 1. Key findings based on U.S. motorcoach and school bus fire analysis, 2004–13.

Research Category	Motorcoach Fires	School Bus Fires
Fire Frequency	<ul style="list-style-type: none"> • Occur slightly less than daily. • General downward frequency trend, 2004–13. 	<ul style="list-style-type: none"> • Occur slightly more than daily. • General downward frequency trend, 2004–13.
Most Frequent Cause of Ignition	<ul style="list-style-type: none"> • Failure of equipment or heat source. 	<ul style="list-style-type: none"> • Failure of equipment or heat source. • Significant number classified as intentional.
Most Frequent Area of Origin of Fire (of fires with known area of origin)	<ul style="list-style-type: none"> • 77 percent of fires originated in the engine area, running gear, or wheel area. 	<ul style="list-style-type: none"> • 68 percent originated in the engine area, running gear, or wheel area.
Most Frequent Contributing Factors	<ol style="list-style-type: none"> 1. Mechanical failure or malfunction. 2. Electrical failure or malfunction. 	<ol style="list-style-type: none"> 1. Mechanical failure or malfunction. 2. Electrical failure or malfunction.
Model Year of Fire-Involved Vehicles	<ul style="list-style-type: none"> • 50 percent of the motorcoach fire incident records involved vehicles with model years ranging from 1998 to 2003. • Evidence suggests that the implementation of advanced technologies (e.g., fire suppression systems) may have a positive effect on fire prevention and mitigation of reportable fires. 	<ul style="list-style-type: none"> • Fire records by model year were more evenly distributed than motorcoach fire records, but also had a period of higher frequency for model years 1996–2001.
Geographic Distribution (based on the ratio of fires to billion highway vehicle miles traveled)	<ul style="list-style-type: none"> • Greatest number of motorcoach fires occurred in the Eastern and Southern regions of the United States. 	<ul style="list-style-type: none"> • Greatest number of school bus fires occurred in the Southern and Midwestern regions of the United States.
Out-of-Service (OOS) Rates	<ul style="list-style-type: none"> • Vehicle OOS rates for fire-involved motorcoaches are generally higher than OOS rates for all buses inspected. 	<ul style="list-style-type: none"> • N/A
Carrier Safety Ratings	<ul style="list-style-type: none"> • Carriers involved in fires have a higher rate of operational or vehicle-related compliance problems than those without fire involvement. 	<ul style="list-style-type: none"> • N/A
Behavior Analysis and Safety Improvement Categories (BASICS)	<ul style="list-style-type: none"> • Fire-involved carriers are more likely to have exceeded the safety intervention threshold in the “Vehicle Maintenance” BASIC than non-fire-involved carriers. 	<ul style="list-style-type: none"> • N/A

DATA DEVELOPMENT AND ANALYSIS

Primary data sources for this study included the U.S. Fire Administration's (USFA's) National Fire Incident Reporting System (NFIRS) and FMCSA's Motor Carrier Management Information System. Other supplemental sources included insurance and media records, the National Highway Traffic Safety Administration's State Data System for selected States, and the Federal Highway Administration's *Highway Statistics*. Motorcoach and school bus population and characteristics data were obtained from R.L. Polk and Co. Data collection for this study involved the following:

- Querying the national public and industry data sources listed above for motorcoach and school bus fires.
- Verifying and classifying the query results.
- Determining vehicle population and mileage counts from which to normalize the counts of fire-involved vehicles, by make, model, and geographic location.
- Finding inspection and investigation histories pertaining to each vehicle and carrier represented in the data.

Collected data included incidents spanning the years 2004–13. These data were analyzed in an attempt to identify trends and common factors characterizing motorcoach and school bus fire safety risk. Data attributable to each record were examined to:

- Identify the age, make, model, and other characteristics of each motorcoach and school bus.
- Characterize each vehicle's geographic location and its maintenance and inspection history.
- Describe each fire's ignition factors, property damage, and resultant injuries and fatalities.

FINDINGS AND RECOMMENDATIONS

Key findings are outlined in Table 1. Based on study findings, the following recommendations have been developed for consideration by FMCSA and the industry.

Data Quality and Reporting

- Improve the quality, consistency, and completeness of the input of fire data.
- Identify and address reasons that fires are underreported or characterized as undetermined.
- Identify and link all relevant existing data systems.

- Develop a strategy for long-term maintenance of and future updates to NFIRS.
- Collaborate with USFA to enhance NFIRS data reporting structure and data element definitions relevant to highway vehicle fires.

Operational Training and Outreach

- Enhance safety procedures and training requirements for drivers, mechanics, and other maintenance personnel.
- Increase stakeholder commitment to prioritizing fire safety, avoidance, and prevention over other non-safety-related performance measures.
- Encourage companies to continually re-evaluate and incorporate into training the most up-to-date information relating to fire precursors, especially that which is associated with OOS criteria or recalls.
- Promote an industrywide culture of safety that prioritizes the role of drivers and mechanics relative to the frontline role they play in fire prevention and mitigation.

Vehicle Design and Equipment Development

- Consider design changes that could improve the fire safety of brakes, turbochargers, tires, electrical systems, and wheel/hub bearings.
- Include automatic failure warning systems and fire detection and suppression systems as standard on motorcoaches and school buses.
- Adopt a baseline standard for testing fire suppression systems to ensure a minimum level of protection.
- Support research and development in technologies for wheel area fire detection and suppression systems.

Inspection Standards

- Expand collaborative efforts to identify critical inspection items associated with fire risk.
- Increase inspection frequency.
- Increase training for inspectors.

To read the complete report, please visit:
http://ntl.bts.gov/lib/60000/60500/60502/16-016_School_Bus_Fire_Safety_Analysis-FINAL-508C.pdf.