Motorcoach Fire Safety Analysis

Department of Transportation

Federal Motor Carrier Safety Administration

Vehicle & Roadside Operations Division

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Agenda item 3 (d))
Motorcoach Fire
Wilmer, Texas

🔥 Evacuation from Hurricane Rita
  – September 23, 2005
  – 1998 MCI motorcoach
  – Wheel fire
  – 23 elderly passenger fatalities
Other Bus Fires

Charles Town, West Virginia
- July 15, 2003
- 989 MCI motorcoach
- Brake fire
- 3 senior citizens injured, 2 while exiting windows
Other Bus Fires

Source: James E. Knott
Other Bus Fires

Source: James E. Knott
Other Bus Fires

🔥 Meriden, Connecticut
- August 16, 2005
- 2002 Van Hool motorcoach with 45 passengers
- Right rear wheel fire
- Non-English-speaking driver
- No injuries
Other Bus Fires

Source: Meriden, CT Fire Dept.
Other Bus Fires

🔥 Bass River, New Jersey
  – October 23, 2005
  – 1998 Dina Motorcoach with 40 passengers
  – Left rear tag axle tire fire
  – No injuries
Other Bus Fires
Other Bus Fires

🔥 Banning, California
- December 6, 2005
- 2001 Van Hool motorcoach with 61 passengers
- Fire in rear of vehicle
- No injuries
Other Bus Fires

Source: California Highway Patrol
Other Bus Fires

🔥 Bass River, New Jersey
  – October 23, 2005
  – 1998 Dina Motorcoach with 40 passengers
  – Left rear tag axle tire fire
  – No injuries
Other Bus Fires
Purpose

🔥 Gather information regarding causes, frequency, and severity of motorcoach fires
🔥 Identify potential ways to prevent, reduce severity, or mitigate consequences of motorcoach fires
  – Assess the adequacy of current motorcoach operational inspection practices for fire prevention
  – Assess the effectiveness of currently available fire detection and suppression systems in common motorcoach fire scenarios
Data sources: 1995 to 2006

- NHTSA Fatality Analysis Reporting System (FARS)
- FMCSA Motor Carrier Management Information System (MCMIS)
- USFA National Fire Incident Reporting System (NFIRS)
- NHTSA State Data System
- Selected passenger carriers
- Selected insurance carriers
- News reports: U.S. only

- Selected states
  - Crash Reports: CA, FL, IL, NC, OH, WI, NJ
  - Bus fire report: NY
- R.L. Polk & Co.
  - In-use vehicle counts by make, model, model year, Dec. 2006
  - Involved vehicle VINs decoded for make, model, MY, engine
Data Collection Challenges

- **Database Queries**
  - Databases not able to identify motorcoach
  - VIN or carrier name not available in all cases
  - Some states: no code for non-collision fire

- **Incident Narratives**
  - Available only in news reports, some crash reports, some NFIRS records
  - Ignition point and location of origin details vary
  - Personal identifiable information issues

- **Inspection Histories**
  - MCMIS VIN field is not well populated
  - No inspections > 4 years old available
Data

- Database: 539 records
- 47 states plus D.C., 1995-2006

Key Analysis Fields
- Vehicle Identification Number (263 records)
- State where fire occurred (388 records)
- Fire origin location (410 records)
- Fire ignition point (289 records)
- Injuries/fatalities (340 records)
- Damage value (236 records)
- Fire detection/suppression systems, identifiable (2 records)
- Inspection histories (83 records)
Analysis: Fire Frequency

Recent years have more sources and thus more fire records than earlier years

![Fire Frequency Chart](chart.png)
Analysis: Fire Origin Location

- Engine compartment: 83 (specified), 45 (unspecified)
- Wheel well: 106 (specified), 6 (unspecified)
- Other area: 12 (specified), 8 (unspecified)
- Passenger compartment: 13 (specified), 2 (unspecified)
- Fuel system: 2 (specified), 2 (unspecified)

Number of fires: 0, 20, 40, 60, 80, 100, 120, 140
Analysis: Fire Ignition Point

![Fire Ignition Point Chart]

- Brakes: 42
- Tires: 38
- Turbochargers: 35
- Electrical - unspecified area: 21
- Wheel/hub bearing: 19
- Fluid lines - unspecified area: 18
- Electrical - engine: 17
- Electrical - interior: 12
- Other cause - other area: 9
- Fluid lines - engine: 9
- Other cause - wheel well: 7
- Exhaust system: 6

Number of records
Analysis: Vehicle Age

![Graph showing vehicle age vs. fires per 1000 vehicles from 1995-2006 and 2004. The graph illustrates a peak in fires around 7-10 years of age, with a decrease thereafter.]
Analysis: Estimated Damage

- Engine Compartment: $102 (Insurance 2), $20 (NFIRS), $36 (Carrier 1)
- Wheel Well: $128 (Insurance 2), $43 (NFIRS), $53 (Carrier 1)
- Bus Interior: $116 (Insurance 2), $29 (NFIRS)
Bus Fire Data

🔥 Most fires start in the engine compartment or wheel well

🔥 Brake, turbocharger, tire, and electrical problems are the top fire causes

<table>
<thead>
<tr>
<th>Fire Origin Location</th>
<th>Total direct fatalities</th>
<th>No. of Incidents</th>
<th>Total Direct Injuries</th>
<th>No. of Incidents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unknown</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Engine</td>
<td>0</td>
<td>0</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>Wheel Well</td>
<td>23</td>
<td>1</td>
<td>24</td>
<td>5</td>
</tr>
<tr>
<td>Bus Interior</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<tr>
<td>Fuel System</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>23</strong></td>
<td><strong>1</strong></td>
<td><strong>32</strong></td>
<td><strong>11</strong></td>
</tr>
</tbody>
</table>
Fire Detection & Suppression

🔥 Automatic Fire Detection & Suppression
  🔥 Currently available only for engine fires
  🔥 Heat or flame sensor triggers warning
  🔥 May also trigger suppressant delivery
🔥 Insufficient Data in Database
  🔥 Systems available only since 2004 model year
  🔥 Full VIN is needed to verify equipment
  🔥 Only 2 records qualify
Findings

🔥 Most complete year in Volpe MCF database has 109 fires (2004)
🔥 Data quality varies from state to state
  🔥 Fire origin location and ignition point reporting
  🔥 Full Vehicle Identification Number (VIN) reporting
  🔥 NFIRS comment fields
🔥 Engine compartment and wheel-well dominate fire origin locations
🔥 Brakes, tires, turbocharger, electrical system, and wheel/hub bearings dominate ignition points
Findings

🔥 Wheel well fires more costly, injurious than engine
🔥 Peak vehicle age for fires is 3-5 years
🔥 Vehicle OOS violation rates for motorcoaches in Volpe MCF database are about the same as rate for all buses (9-12 %)
🔥 Compliance Review ratings for carriers in Volpe MCF database are mostly satisfactory (72-74 %)
🔥 CR violations for carriers in Volpe MCF database are mostly for bad recordkeeping (70 %)
Safety Compliance

- Federal agencies, States, manufacturers and carriers work together to ensure carrier safety.

- NHTSA sets component performance requirements for: tires, rims, lights, vehicles controls, displays, etc. as well as overall performance such as braking, number and size of emergency exits, etc.

- FMCSA determines the safety fitness of interstate motor carriers, and assigns DOT and grants operating authority to interstate carriers. Set standards for interstate motorcoach safety equipment and inspections.

- States sets requirements, either by adopting the Federal rules or by establishing their own rules, for intrastate passenger carriers operating in that State. Important State roles are conducting vehicle inspections and participating in setting standards for inspection criteria.

- Carriers and manufacturers often cooperate voluntarily in identifying solutions for safety-related problems and training carriers’ staff.
Recommendations

Data collection
- FMCSA published Regulatory Guidance for Recording of Commercial Motor Vehicle Accidents Involving Fires (July 24, 2007)
- FMCSA intends to discuss possible NFIRS enhancements with US Fire Administration to improve data quality and access to comment field

Fire prevention
- Proper inspection criteria for pre-trip and post-trip
- Inspector and technician training
- Enhance vehicle and component design
- Automatic failure detection systems (tire pressure monitoring systems, turbocharger failure warning systems)
- Motorcoach Design Changes (design vs packaging)
Recommendations

🔥 Fire mitigation:

- **Safety equipment**: increase size and effectiveness of motorcoach fire extinguishers to adequately address the large proportion of wheel well and engine compartment fires.

- **Vehicle Design**: keep fire from wheel well and engine from entering passenger compartment; improve emergency exit windows to address the needs of mobility-impaired passengers.

- **Automatic Fire Detection and Suppression Systems**: provide detection and suppression for engine and wheel well areas.

- Reduce material flammability