NTSB School Bus Investigations: Updates and Safety Recommendations

July 2019

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IPTA School Transportation Annual Conference
Outline

• About the NTSB
• Special Investigation Report (2018)
  – *Baltimore, MD & Chattanooga, TN crashes*
• Oakland, Iowa Investigation (2019)
Our Mission

The NTSB is an independent Federal agency charged by Congress with investigating every civil aviation accident in the United States and significant accidents in the other modes of transportation – highway, marine, railroad and pipeline – and issuing safety recommendations aimed at preventing future accidents.
Independently Advancing Transportation Safety

- 31 Office of Highway Safety staff
- Response Operations Center
- Ready to “launch” 24/7
- 3 highway teams: IIC and 5 investigators
What types of highway crashes do we investigate?

- High public interest?
- New issues?
- Emerging technology?
- Make a difference?
NTSB process at a glance

- **On-scene Investigation**
  - Organizational meeting
  - Groups & parties
  - Progress meetings
  - Media briefings
  - Press releases

- **Preliminary Report**
  - Factual information

- **Public Hearing**
  - Fact finding
  - Depositions
  - Witnesses

- **Board Meeting**
  - Docket
  - Findings
  - Conclusions
  - Probable cause
  - Safety recommendations

**Government in the Sunshine Act**
Board Meeting in Washington, DC

- Public meeting
- Webcast
- Official adoption of:
  - Report
  - Findings
  - Probable cause
  - Safety recommendations
Most Wanted List 2018-2019

Require medical fitness

Strengthen occupant protection
Selective Issues in School Bus Transportation Safety

Crashes in Baltimore, Maryland, and Chattanooga, Tennessee
Baltimore, Maryland

- November 1, 2017 @ 6:30 a.m.
- 2015 IC school bus
  - 67-year-old driver, bus aide
  - AAAfordable Transportation LLC / BCPS
- 2012 Ford Mustang
  - 51-year-old driver
- 2005 New Flyer transit bus
  - 33-year-old driver, 13 passengers
  - Maryland Transit Administration
Crash Sequence
Crash Sequence

Emily Moore

School bus-car impact

Frederick Ave
Crash Scene & Injury Information

- **Fatalities** (2 bus drivers, 4 transit passengers)
- **Serious injuries** (5 transit passengers)
- **Minor injuries** (school bus attendant, 4 transit passengers, car driver)
Chattanooga, Tennessee

- November 21, 2017
- 2008 Thomas Built school bus
  - 24-year-old driver
  - 37 students
- Durham School Services
- Hamilton County Department of Education
Crash Sequence

- 3:13 pm. departed Woodmore Elementary School
- Traveled south on Talley Road
Crash Sequence
Crash Sequence

Talley Road

Sunset Avenue

Impact Location
Crash Sequence

Tire friction marks

School bus and tree
Utility pole

Mailbox

Sunset Ave

Talley Road

SPEED LIMIT 30

SPEED LIMIT 30
Video Analysis, Crash Simulation

- Bus at 52-mph
- 30-mph speed limit zone
- On cellphone
- Excessive speed resulted in loss of control

- Students: 6 fatally injured, 26 serious-to-minor injuries
- 5 students and driver uninjured
Special Investigation Report

Baltimore, MD          Chattanooga, TN

✓ Bus driver oversight ✓
✓ Carrier oversight ✓
✓ Seatbelts ✓
Baltimore School Bus Driver

- Seizures since childhood
  - Sudden, unpredictable, loss of consciousness
- Incapacitated by a seizure led to crash
- Denied seizures to get medical card
- Fraudulently obtained CDLs
- Increase referral of medically unfit drivers
Seizures While Working

• Seizure April–May 2016
• Seizure October 24, 2017 (1 week prior to crash)
• Dispatched for 5 days until crash without doctor’s release
Baltimore City Public Schools (BCPS)

- Heavily involved with daily operations
- Maintained all documentation
- 2008–2016 driver worked for 5 contractors
- 5 school bus crashes
  - October 2011 “passed out”
  - No follow-up or action taken
AAAfordable & BCPS Oversight

- AAAfordable allowed medically unfit driver to operate school bus
- BCPS failed to recognize driver high risk
  - Failed to follow its own SOPs
  - Crash reports incomplete, missing
  - Failed to follow Maryland regulations
Chattanooga, TN Driver

- **Driver experience**
  - Hired in 2016, had driven few weeks total before crash

- **Job performance**
  - Previous crashes, numerous complaints

<table>
<thead>
<tr>
<th>Date</th>
<th>Complaint</th>
<th>Source</th>
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<tr>
<td>August 11</td>
<td>Speeding</td>
<td>Durham School Services</td>
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<td>August 12</td>
<td>Speeding</td>
<td>Durham School Services</td>
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<tr>
<td>August 18</td>
<td>Crash in bus (not reported)</td>
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<td>September 20</td>
<td>Crash in bus</td>
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<td>September 28</td>
<td>Intentionally makes students fall by erratic driving</td>
<td>Woodmore Elementary School (parents)</td>
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<td>October 27</td>
<td>Speeding</td>
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<td>Speeding</td>
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<td>November 16</td>
<td>Erratic driving</td>
<td>Woodmore Elementary School (students)</td>
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<tr>
<td>November 18</td>
<td>Speeding</td>
<td>Woodmore Elementary School (principal)</td>
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Durham, HCDE Oversight

• Hamilton County Dept. of Education
  – Contracted Durham but had limited oversight
  – Forwarded all complaints to Durham

• Durham School Services
  – Lacked systematic complaint tracking
  – Failed to provide adequate driver oversight
Summary

• Durham School Services
  – Lacked systematic complaint tracking
  – Failed to provide adequate oversight

• Durham and Hamilton County School District
  – Lack of documentation and resolution
  – Failed to remove unsafe driver
Crash Sequence Effect

- Evidence from roadway, witnesses, video system
- Loss of control over 300 feet prior to impact
- Bus beginning to roll prior to impact with utility pole
- Bus overturned onto passenger side
- Passengers thrown from seats prior to rollover/impact
Roof Crush, Intrusion, Injuries

Injury from occupant flailing / impact, ejection, intrusion
Chattanooga School Bus

37 passengers: 6 fatal, 6 serious, 20 minor, 5 uninjured

Injury severity: **fatal** (red), **serious** (orange), **minor** (green), **none** (gray)

Ejected

Roof crush Severity: mild, moderate, severe
Chattanooga Crash Outcomes

• Passengers in front of bus vulnerable to ejection
• All vulnerable to secondary impact
• More students thrown into not out of intrusion zone
• Loss of benefits of compartmentalization
Seat Belts on Large School Buses

- Federal Motor Vehicle Safety Standard 222
  - Established performance standards for voluntary installation of lap/shoulder belts on large school buses

- Compartmentalization inadequate

- Lap/shoulder belts provide best protection

- Recommend states require lap/shoulder belts

- Recommend manufacturers install lap/shoulder belts as standard (not optional) equipment
Oakland, Iowa

- December 12, 2017
- About 6:52 a.m.
- 480\textsuperscript{th} Street
- 2004 school bus
- 2 fatal
480th Street

- 2-lane gravel roadway 26.5 ft wide
  - 2.5-ft-wide earthen & gravel shoulders
  - 3-ft-deep drainage ditches
- Speed limit: 55 mph
- Average 10 vehicles daily
Crash Location
Postfire School Bus
Safety Issues

• School bus driver fitness for duty
• School bus emergency training
• School bus fire safety
Incident Timeline

- 6:50 a.m.  School bus arrives at residence, picks up child
- 6:55 a.m.  Driver of school bus radios bus barn, asks for assistance and reports fire
- 6:59 a.m.  Uncle calls child’s mother and asks her to check outside for bus location
- 7:02 a.m.  Elementary school secretary calls 911
- 7:08 a.m.  Transportation supervisor arrives at scene - bus fully engulfed in flames
Occupants and Injuries

• School bus driver
  - History of mobility issues
  - Fatal fire-related injuries

• Student passenger
  - No previous medical history
  - Fatal fire-related injuries
Oakland, IA

Driver side - rear

Loading door side
Emergency Evacuation Training

• **Bus drivers**
  - Provide training to students twice a year
  - Training not standardized
  - No training on operation of manual release for front loading door

• **Students**
  - Training only for elementary, middle school students
  - No training for high school students
School Bus Live Fire Demonstration

Lapsed time 4:00 minutes

Source: Clio Fire Dept
Excluded Driver Factors

- Current CDL with appropriate endorsements
- Operated school buses for 17 years
- Toxicology negative for alcohol/illicit drugs
- Driving regular bus and route
- Ample sleep opportunity
Backing Into the Ditch

- Driver familiar with driveway/road
- Dark, but normal, conditions
- He had backed out many times
- Cannot determine why he entered the ditch from available postcrash information
School Bus Driver Medical Conditions

• Held current medical certificate
• Chronic, ongoing conditions
  - Recurrent pain in back & both legs
  - Weakness in right leg
  - Use of cane/walker
  - Pain moving from sitting to standing
• Spinal fusion scheduled two days after crash
• Wife reported typical back pain, no other issues
School Bus Driver Fitness for Duty

• Found no evidence that conditions affected ability to operate bus
• Had difficulty standing/walking, used aids
• Crash and fire was abnormal, high-stress situation
• Driver’s back condition impaired ability to evacuate
Physical Performance Tests (PPTs)

- Driver duties include assisting passengers
- PPTs assess ability to physically carry out normal and emergency duties
- RCSD instituted a PPT after the crash
- PPTs can identify drivers who may not be able to assist in an emergency

School Bus Driver Physical Performance Test

- **Standard #2 – Entrance Door**
  - Measurement: With hand on rail, climb and descend bus steps 3 times in 30 seconds
  - Pass _____ Fail _____

- **Standard #3 – Clutch and or Brake Pedals**
  - Measurement: Repeatedly open and close service door 3 times
  - Pass _____ Fail _____

- **Standard #4 – Accelerator to Brake**
  - Measurement: Depress and hold brake pedal a minimum of 3 seconds, 5 consecutive times. (For clutch, hold clutch pedal for the duration of the test)
  - Time: _______ Pass _____ Fail _____

- **Standard #5 – Emergency Exit**
  - Measurement: Starting in a seat belted position, with hands on steering wheel and looking at seatbelt. Release seat belt, walk (Do not run) to rear most exit with a door, open door, SIT and slide out within 20 seconds
  - Time: _______ Pass _____ Fail _____

(Note: Examiner must be present at front of bus and say “GO”, then walk to the rear of bus. Test is completed when the driver’s feet touch the ground.)
Driver Medical Referrals

• Co-workers expressed concerns about driver’s medical condition
• Iowa Department of Transportation allows written request for medical evaluation of drivers
• Unclear if supervisor, co-workers knew they could have had driver evaluated
Driver Oversight Summary

- Driver licensing, experience, drugs/alcohol, route, bus, & fatigue excluded as factors in this crash
- Could not determine why bus entered ditch
- Driver medical condition likely hindered evacuation
- PPTs increase safety by assessing driver ability
- Increased awareness of ways to report drivers needed
School Bus Live Fire Demonstration

Lapsed time 4:00 minutes

Source: Clio Fire Dept.
Mesquite, Texas

- October 3, 2018 about 3:56 p.m.
- 2019 IC Bus (lap/shoulder belts)
- Mesquite ISD (driver, 42 passengers)
- Run-off-road, rollover with postcrash fire

Source: Star Telegram
School Bus Fires Safety

- Federal interior flammability standards
- State interior flammability specifications
- School bus fire areas of origin
- Fire suppression systems
Current Federal Flammability Standards

• All school buses are required to meet Federal Motor Vehicle Safety Standard (FMVSS) 302
  - Specifies maximum burn rate requirements for interior materials
  - Has not changed since adopted in 1971
Current State Flammability Specifications

• NHTSA allows states to adopt requirements imposing higher performance specifications than federal standards

• In 1990, National Congress on School Transportation adopted a procedure to measure flammability resistance
  - Mandates performance levels exceeding those in FMVSS 302
School Bus Fire Areas of Origin

- Average of nearly one school bus fire daily
- 68% of school bus fires initiate in the engine compartment or wheel area
- Lack of a complete firewall between engine and passenger compartment
Engine Firewall Openings

• Same firewall used in many types of buses
• Openings allow wiring to run between engine and instrument panel
• Unused openings not sealed with fire resistant materials
Engine Intrusion

- Some engine blocks protrude into the passenger compartment
- Large portion of firewall is cut out for engine
- Fiberglass cowling placed over this engine area
Oakland Bus Engine Cowling
Automatic Fire Suppression Systems (AFSS)

- Most systems deliver a fire suppressant inside the engine compartment when a sensor is activated.
- Use either thermal or optical sensors to detect heat or flame.
Automatic Fire Suppression Systems

• Can be installed during the manufacturing process or placed in older buses
• No national standards exist for installation or performance of suppression systems
• Voluntary system performance testing and certification
Current AFSS guidelines

• Several states allow for installing AFSS in school buses
• Some states require an AFSS on alternative-fuel or special needs vehicles
• Most states have adopted National School Transportation Specifications and Procedures
National School Transportation Specifications

• Fire suppression system nozzles shall be located:
  - Engine compartment
  - Under bus exterior
  - Under driver dashboard
  - Electrical panel

• Not located in passenger compartment

• Alert the driver that system has activated

• Alternate-fueled buses may be equipped with fire detection and suppression systems with interior or exterior detection
Fire Safety Summary

• Federal flammability standards have not changed since 1971
• Fire resistant materials slow spread of fire
• Automatic fire suppression systems can prevent or mitigate school bus fires
Lessons Learned

- School buses are still *the safest* means of transportation to and from school
- There is always room for improvement
- Safety recommendations can benefit everyone

"From tragedy we draw knowledge to improve the safety of us all."
Thank you!

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