



**National
Transportation
Safety Board**

**NTSB School Bus Investigations:
Updates and Safety Recommendations**
July 2019

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Investigator-In-Charge, NTSB

IPTA School Transportation Annual Conference

Outline

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

AVIATION



HIGHWAY



MARINE



RAILROAD



PIPELINE



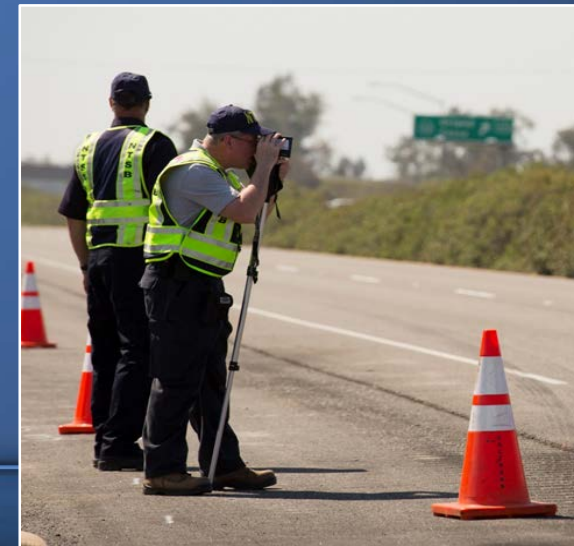
Our Mission

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.

NTSB

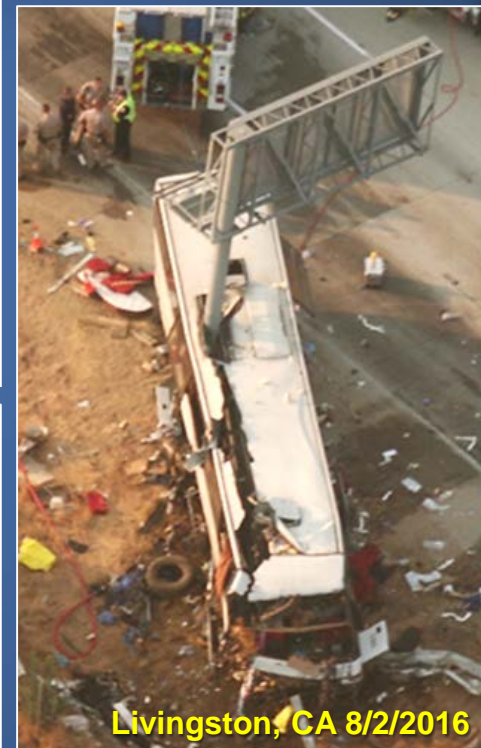
Independently Advancing Transportation Safety

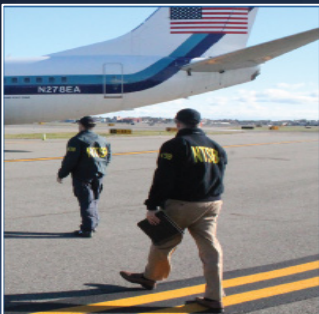
- 31 Office of Highway Safety staff
- Response Operations Center
- Ready to “launch” 24 / 7
- 3 highway teams: IIC and 5 investigators



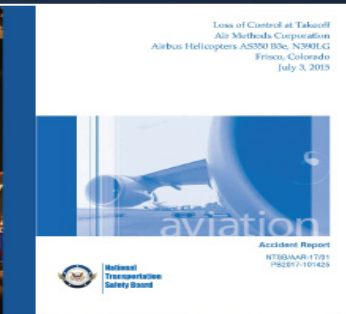
What types of highway crashes do we investigate?

- High public interest?
- New issues?
- Emerging technology?
- Make a difference?





Aircraft Series:	35A	Aircraft Category:
Year Built:	No	Air Carrier Operator:
Factor:	Trans-Pacific Air Charter LLC	Certificate:
Factor Does Business As:	Trans-Pacific Jets	Operator Designat:
Geographical Information and Flight Plan		
Altitude at Accident Site:	Visual Conditions:	Condition of Light:
Location Facility, Elevation:	115, 8 Ft msl	Observation Time:
Distance from Accident Site:	1 Statistical Miles	Temperature/Dev:
Wind Cloud Condition:	Scattered / 4500 Ft agl	Wind Speed/Dirctn, Direction:
Alt Ceiling:	None	Visibility:
Water Setting:	29.75 inches Hg	Type of Flight Plan:
Latitude Point:	Philadelphia, PA (PHL)	Destination:
Damage and Impact Information		
# Injuries:	2 Fatal	Aircraft Damage:
# Passenger Injuries:	N/A	Aircraft Part:
# Crew Injuries:	N/A	Aircraft Engine/Prop:
# Inquiries:	2 Fatal	Latitude, Longitude:
Administrative Information		
Investigator In Charge (IC):	James P. Sullivan	
Manual Participating Persons:	Dennis Brown, Teterboro FSDO, Teterboro, NJ Markham Everett, Bonhoeffer, Jeppesen, OK David Stathopoulos, Jeppesen, OK	



On-scene Investigation

Preliminary Report

Public Hearing

Board Meeting

Final Report

NTSB process at a glance

Organizational meeting

Groups & parties

Progress meetings

Media briefings

Press releases

Factual information

Fact finding

Depositions

Witnesses

Docket

Docket

Findings

Conclusions

Probable cause

Safety recommendations

NTSB

GOVERNMENT IN THE SUNSHINE ACT

Board Meeting in Washington, DC

- Public meeting
- Webcast
- Official adoption of:
 - Report
 - Findings
 - Probable cause
 - Safety recommendations



Chairman
Robert Sumwalt



Vice Chairman
Bruce Landsberg



Member
Jennifer Homendy



Most Wanted List 2018-2019



Require medical fitness

NTSB



Strengthen occupant protection

NTSB



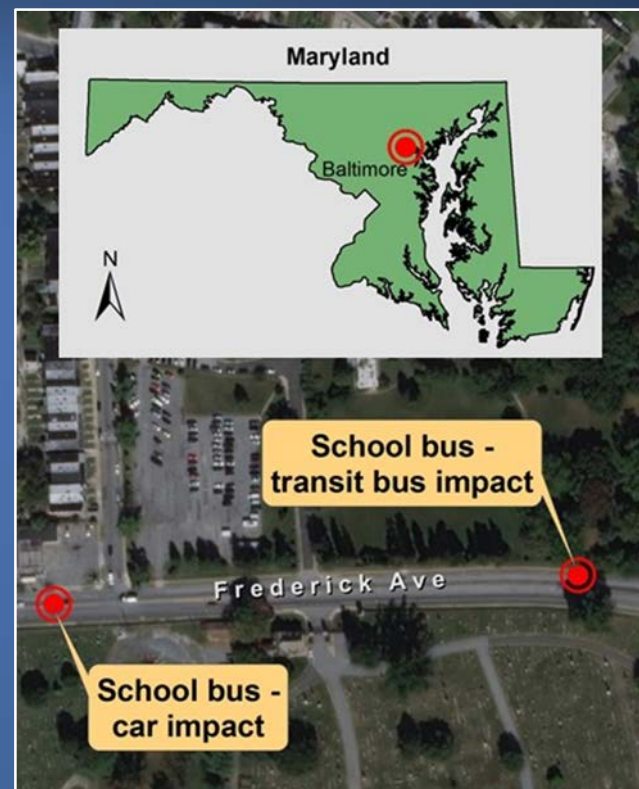
National Transportation Safety Board

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
 - AAAffordable 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



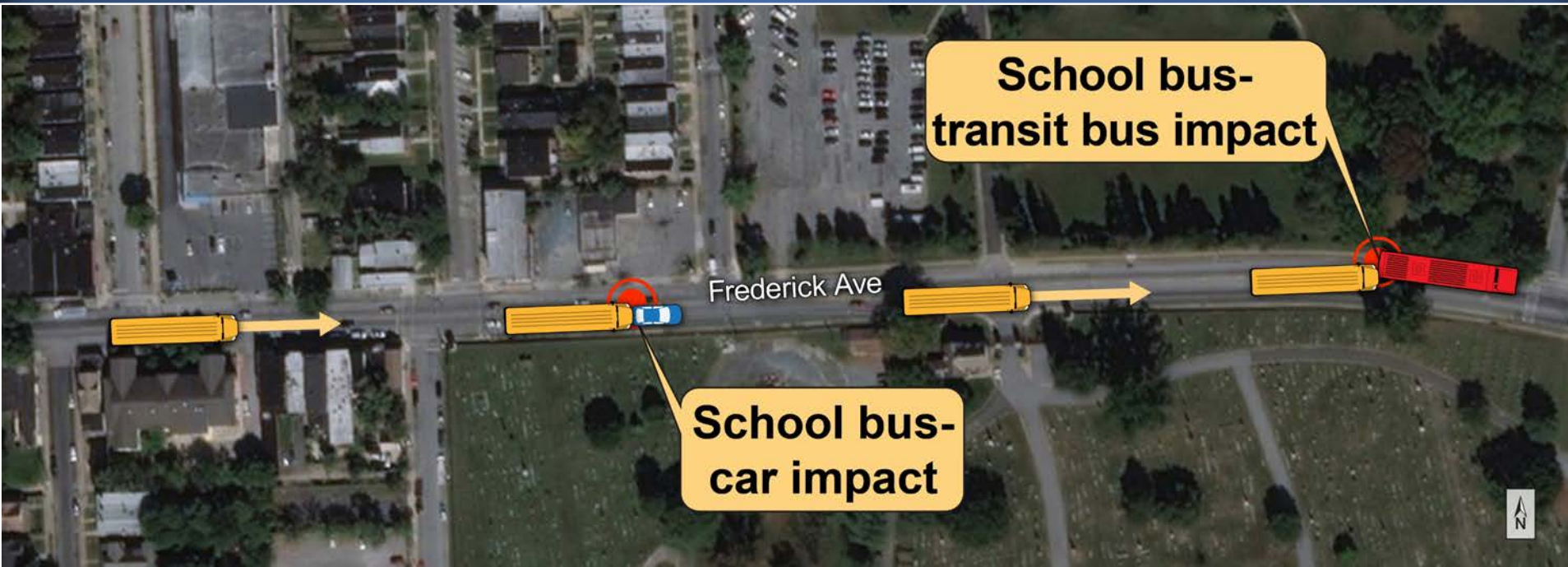
Crash Sequence



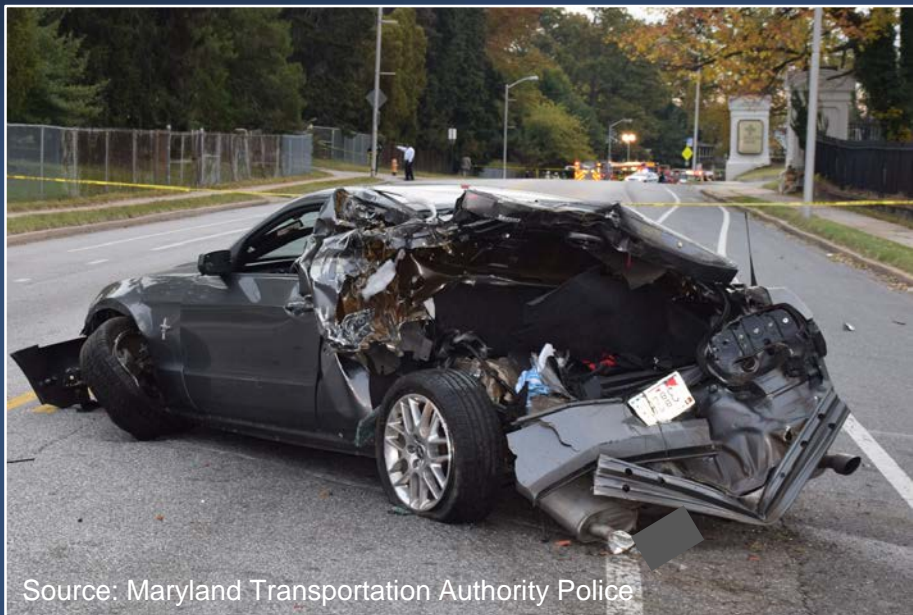
Crash Sequence



Crash Sequence



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

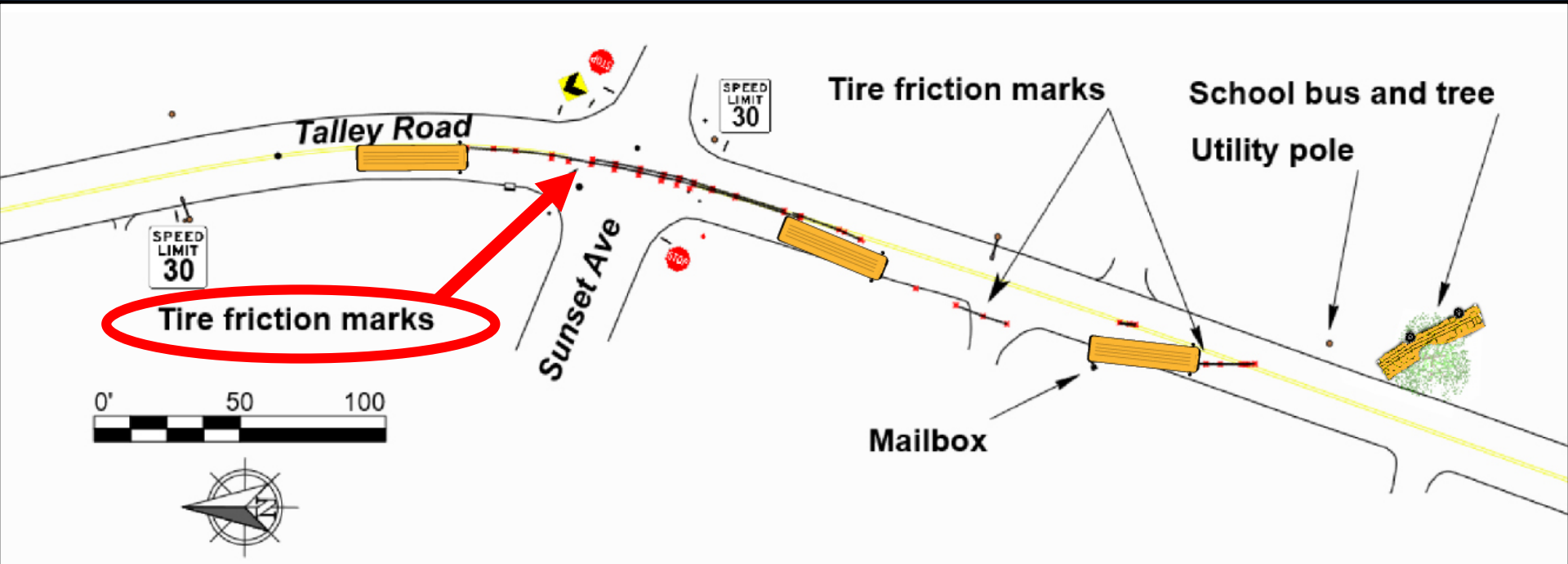
Crash Sequence



Crash Sequence



Crash Sequence



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

Date	Complaint	Source
August 11	Speeding	Durham School Services
August 12	Speeding	Durham School Services
August 18	Crash in bus (not reported)	Durham School Services
September 20	Crash in bus	Durham School Services
September 28	Intentionally makes students fall by erratic driving	Woodmore Elementary School (parents)
October 27	Speeding	Durham School Services
October 28	Speeding	Durham School Services
November 8	Speeding	Durham School Services
November 16	Erratic driving	Woodmore Elementary School (students)
November 18	Speeding	Woodmore Elementary School (principal)

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



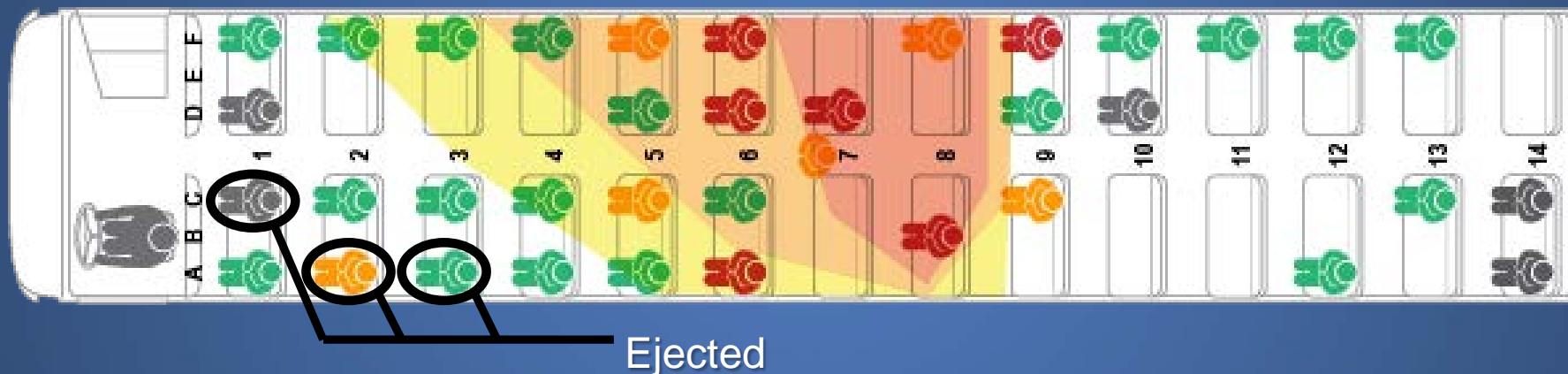
Roof Crush, Intrusion, Injuries



Injury from occupant flailing / impact, ejection, intrusion

Chattanooga School Bus

Roof crush Severity: mild, moderate, severe



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

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

Chattanooga Crash Outcomes

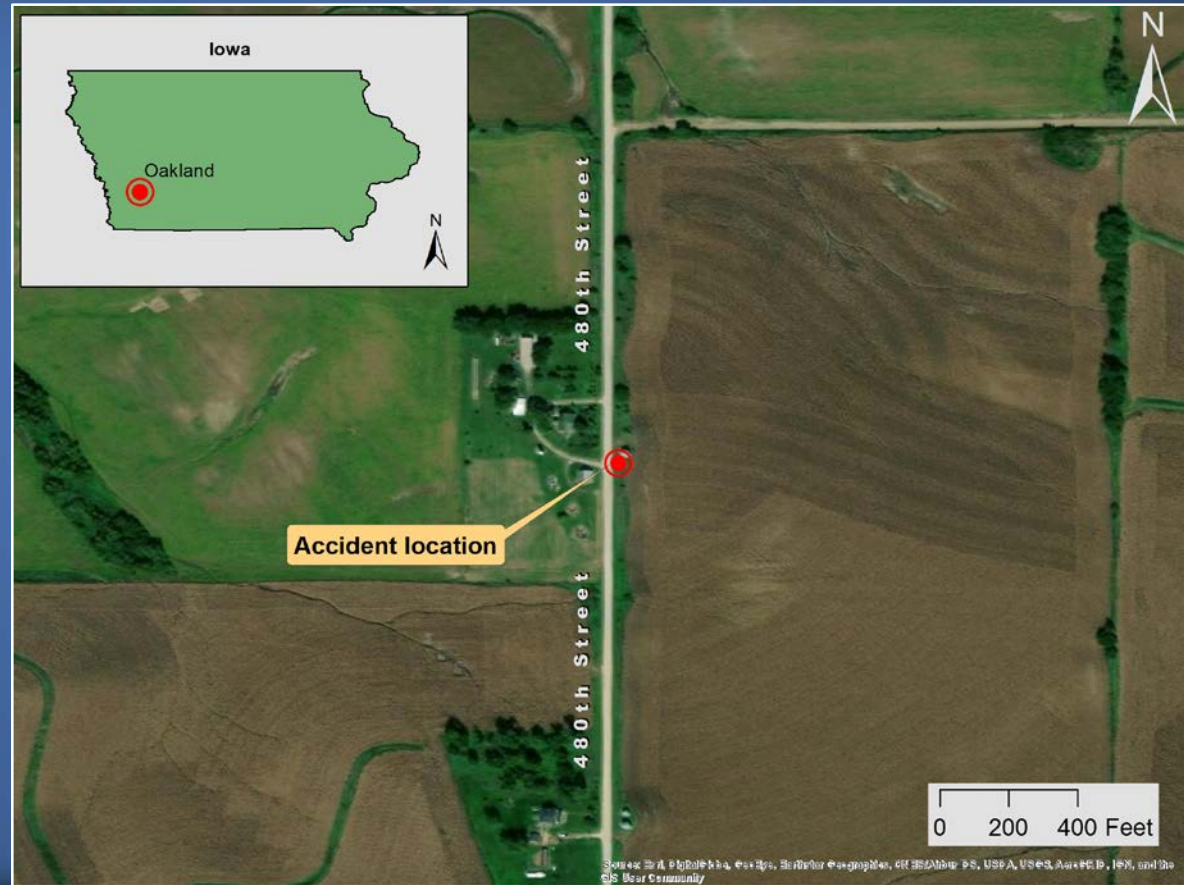
- Passengers in front of bus vulnerable to ejection
- All vulnerable to secondary impact
- More students thrown *into* not out of intrusion zone
- Loss of benefits of compartmentalization

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.
- 480th 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 Scene



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

Manual Door Release



School Bus Live Fire Demonstration



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

Measurement: With hand on rail, climb and descend bus steps 3 times in 30 seconds

Standard #2 – Entrance Door Pass ____ Fail ____

Measurement: Repeatedly open and close service door 3 times

Standard #3 – Clutch and or Brake Pedals Pass ____ Fail ____

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)

Standard #4 – Accelerator to Brake Time: ____ Pass ____ Fail ____

Measurement: Alternately activate accelerator and brake controls 10 times in ten seconds. (Note to examiner: Stress to do this as quickly as possible; a very short practice is allowed)

Standard #5 – Emergency Exit Time: ____ Pass ____ Fail ____

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
(Note Examiner will stand at front of bus and say "GO", then walk to the rear of the bus. Test is completed when the driver's feet touch the ground)

required
allowed
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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



NTSB

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

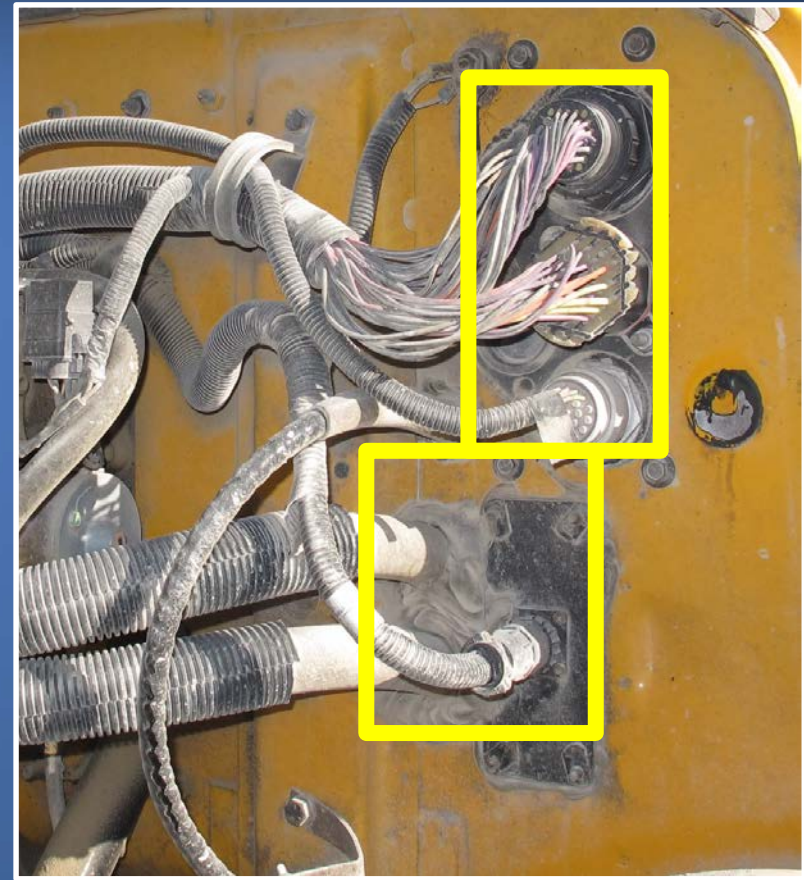
- NHTSA allows states to adopt requirements imposing higher performance specifications than federal standards
- In 1990, National Congress on School Transportation adopted a procedure to measure flammability resistance
 - Mandates performance levels exceeding those in FMVSS 302

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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