NTSB | National Transportation Safety Board

Advancing Highway Safety through NTSB investigations and a Safe System Approach

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Director, Office of Highway Safety
April 17, 2024



AVIATION • RAILROAD • TRANSIT • HIGHWAY • MARINE • PIPELINE • COMMERCIAL SPACE

Overview

- NTSB Background
- NTSB Investigations
  - Mount Pleasant Crash
  - North Las Vegas Crash
  - Pittsburgh Bridge Collapse
  - Hamden Battery Electric Transit Bus Fire
- Safe Systems Approach
- Summary



NTSB At A Glance

- Independent federal agency
- Investigate civil aviation accidents and surface transportation events
- Determine probable cause and issue safety recommendations
- No regulatory authority
- Five Board Members nominated by the President and confirmed by the Senate to serve 5-year terms
- A staff of more than 420 investigators, analysts, researchers, and others support the mission.







The NTSB Board



Jennifer Homendy
Chair



Michael E. Graham
Member



Thomas B. Chapman
Member



Alvin Brown
Member



J. Todd Inman
Member

The Office of Highway Safety



- Total staff of 30 (Managers, investigators, writers, and support staff)
- 2 branches: Multi-disciplinary Investigations / Special Investigations
- MIB: 2 teams (Investigator-in-Charge, 5 Senior Investigators)
- Ready to “launch” at a moment’s notice

NTSB Highway Investigations

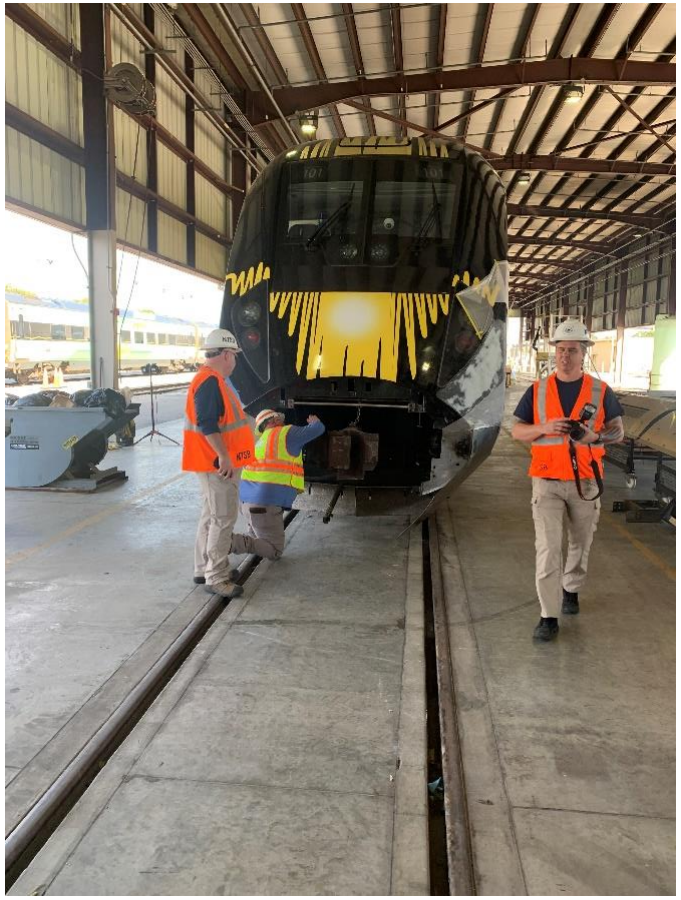


Pittsburgh, PA 1/28/22



Hamden, CT 7/23/22

Delray Beach, FL 6/28/23



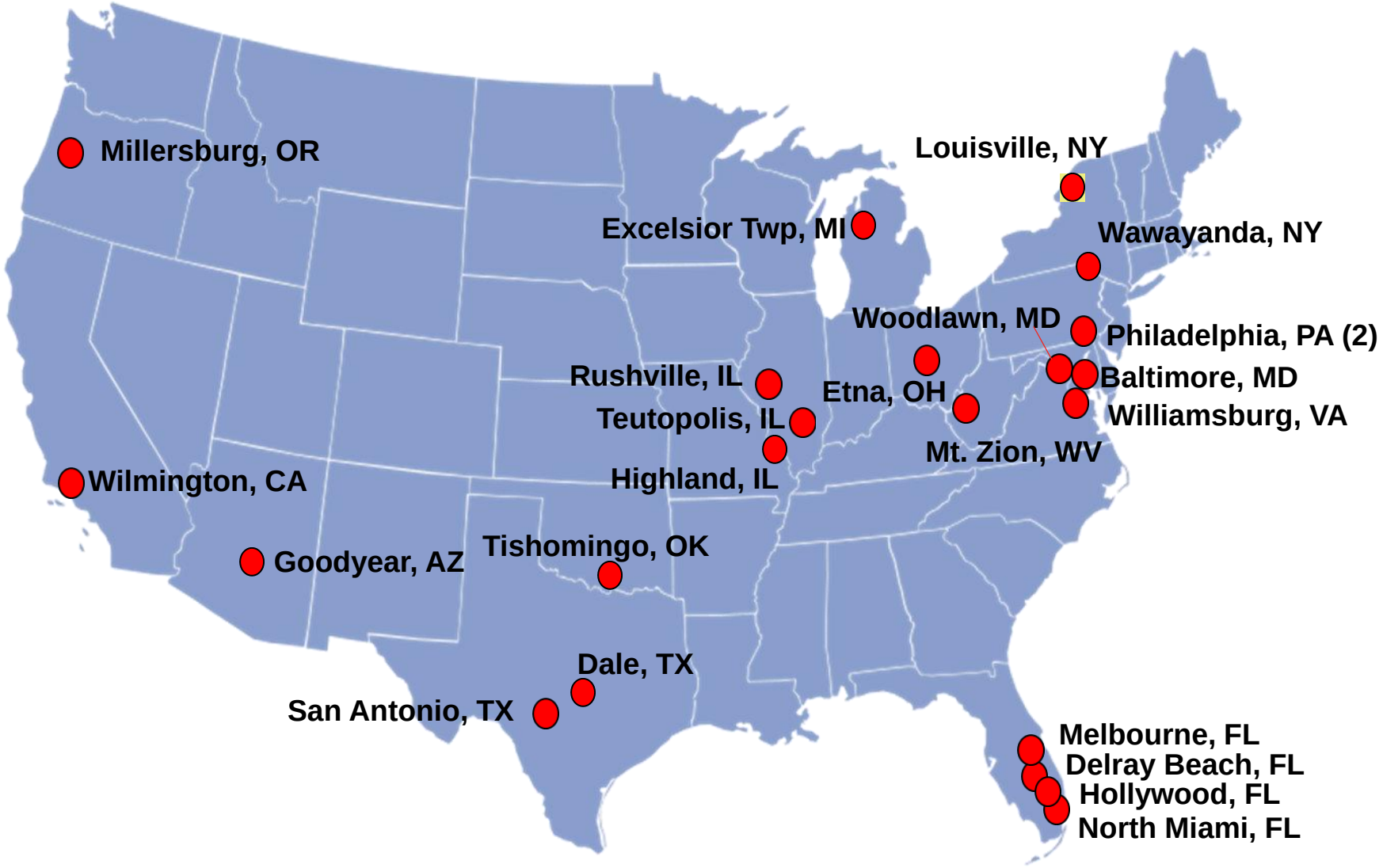
Woodlawn, MD 3/22/23



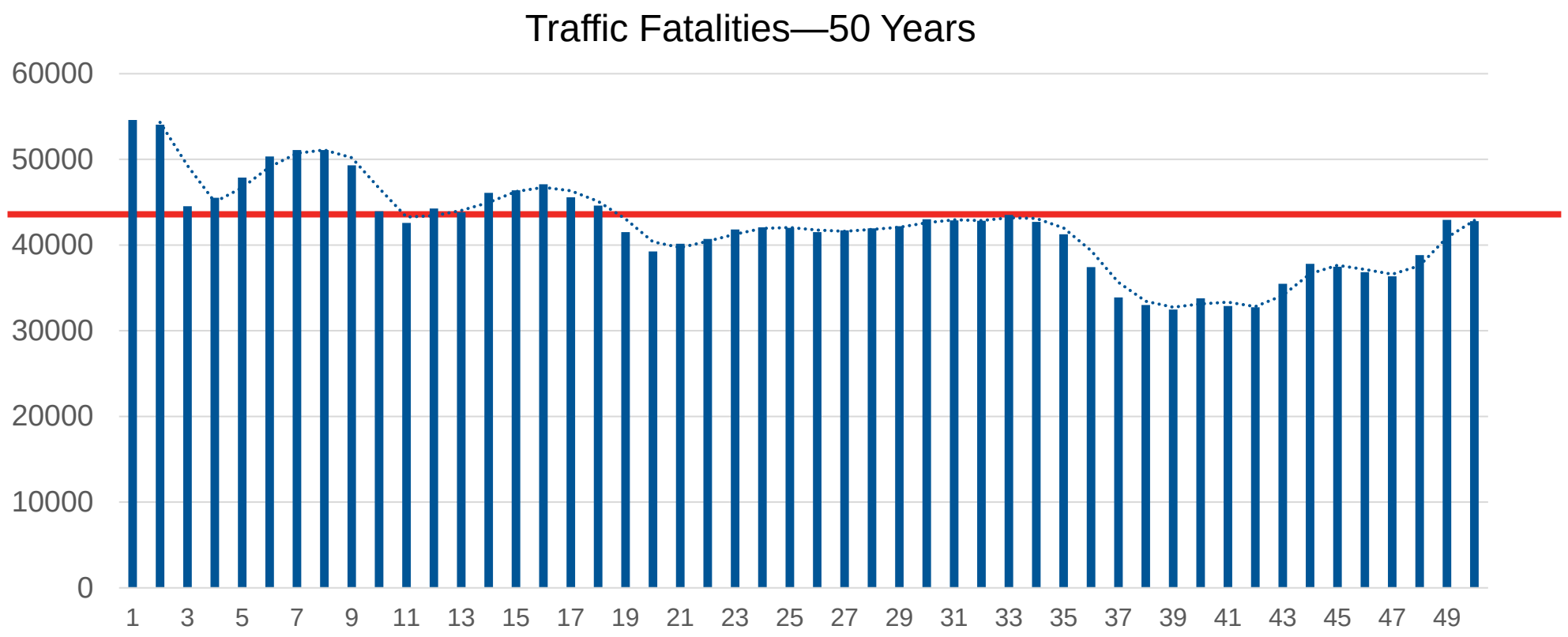
Williamsburg, VA 12/16/22



Ongoing NTSB Highway Investigations

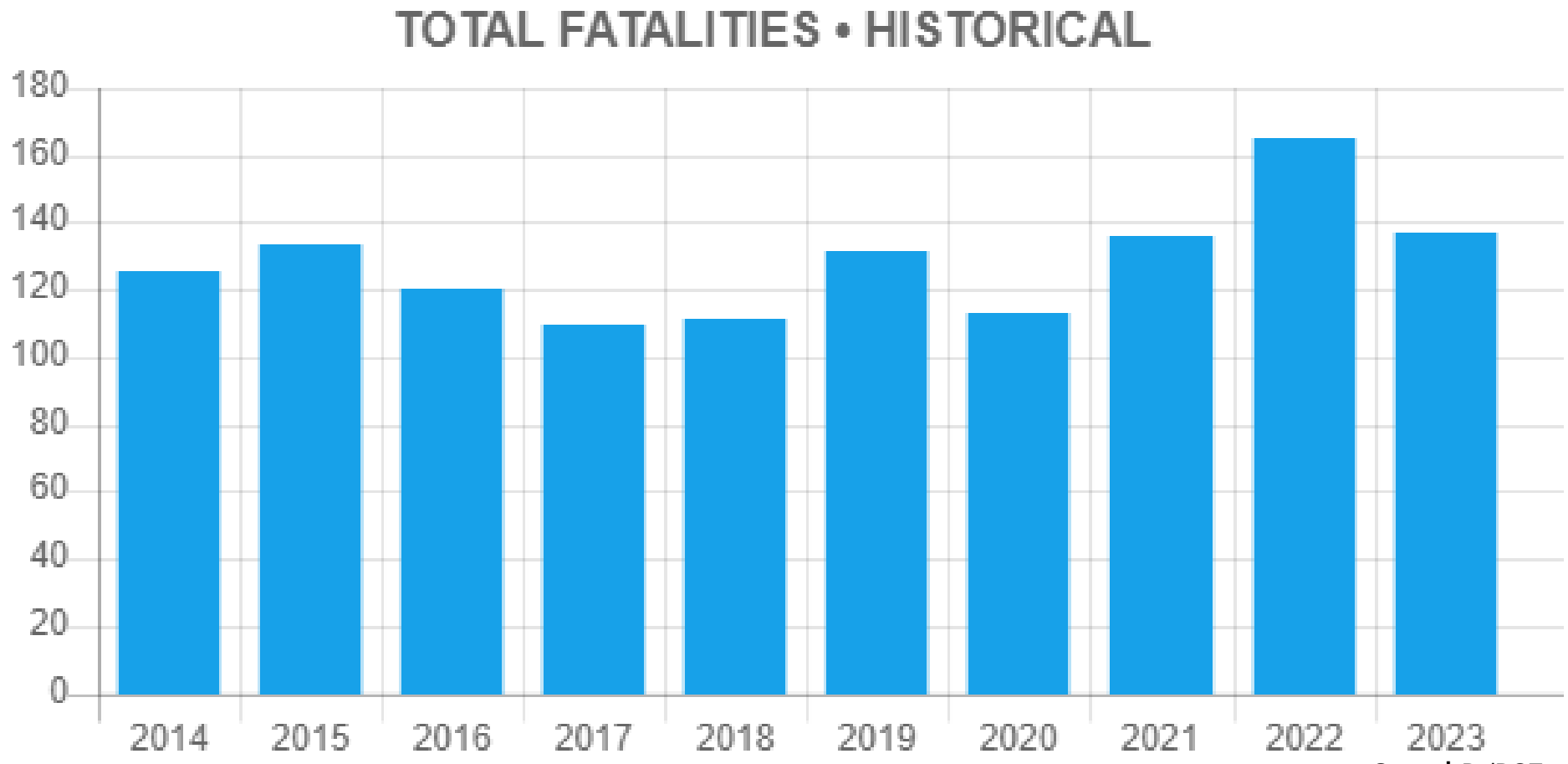


Changing Our Approach to Highway Safety



Source: NHTSA

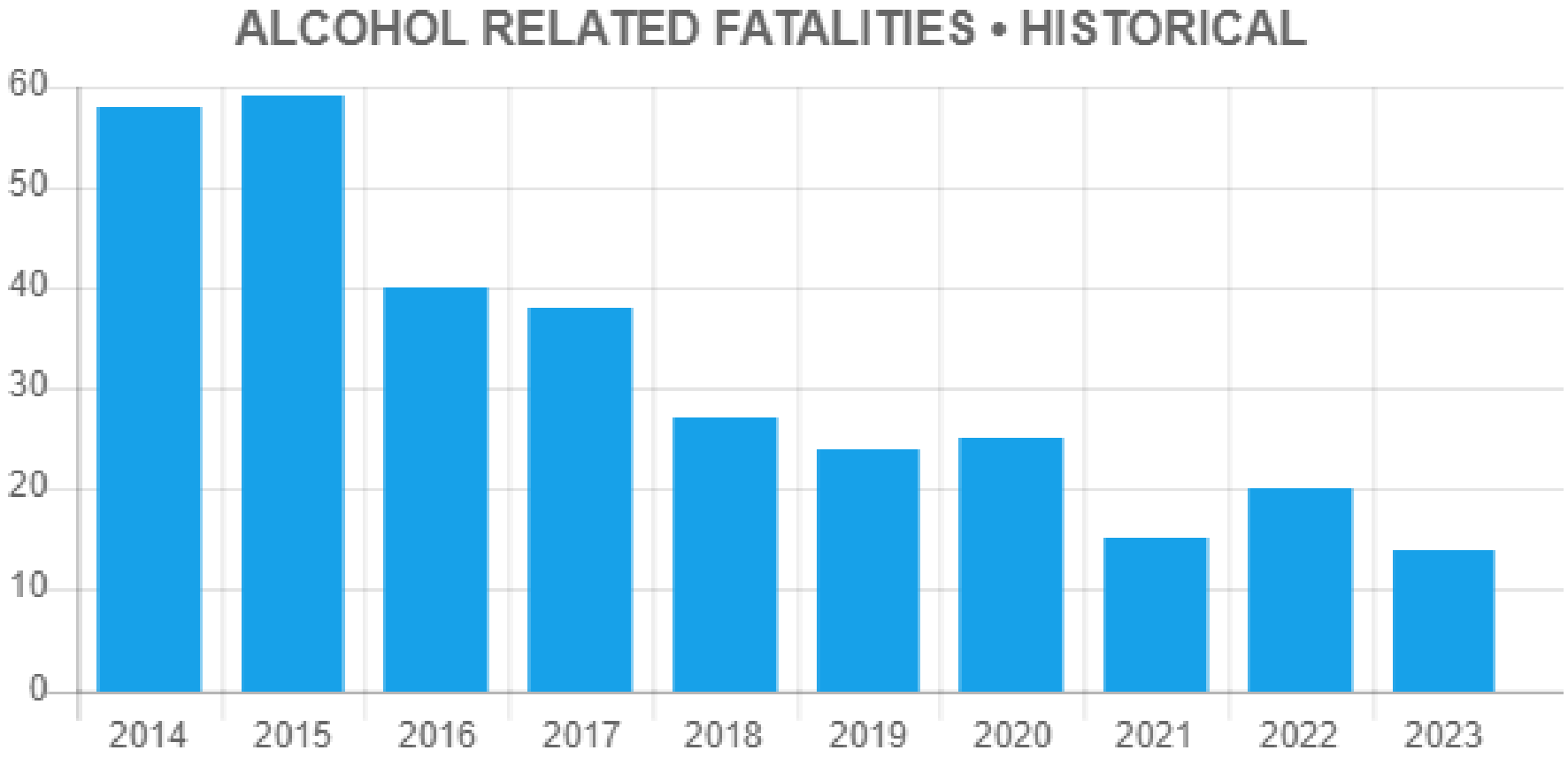
Delaware Traffic Fatalities (Decade)



Source: DelDOT

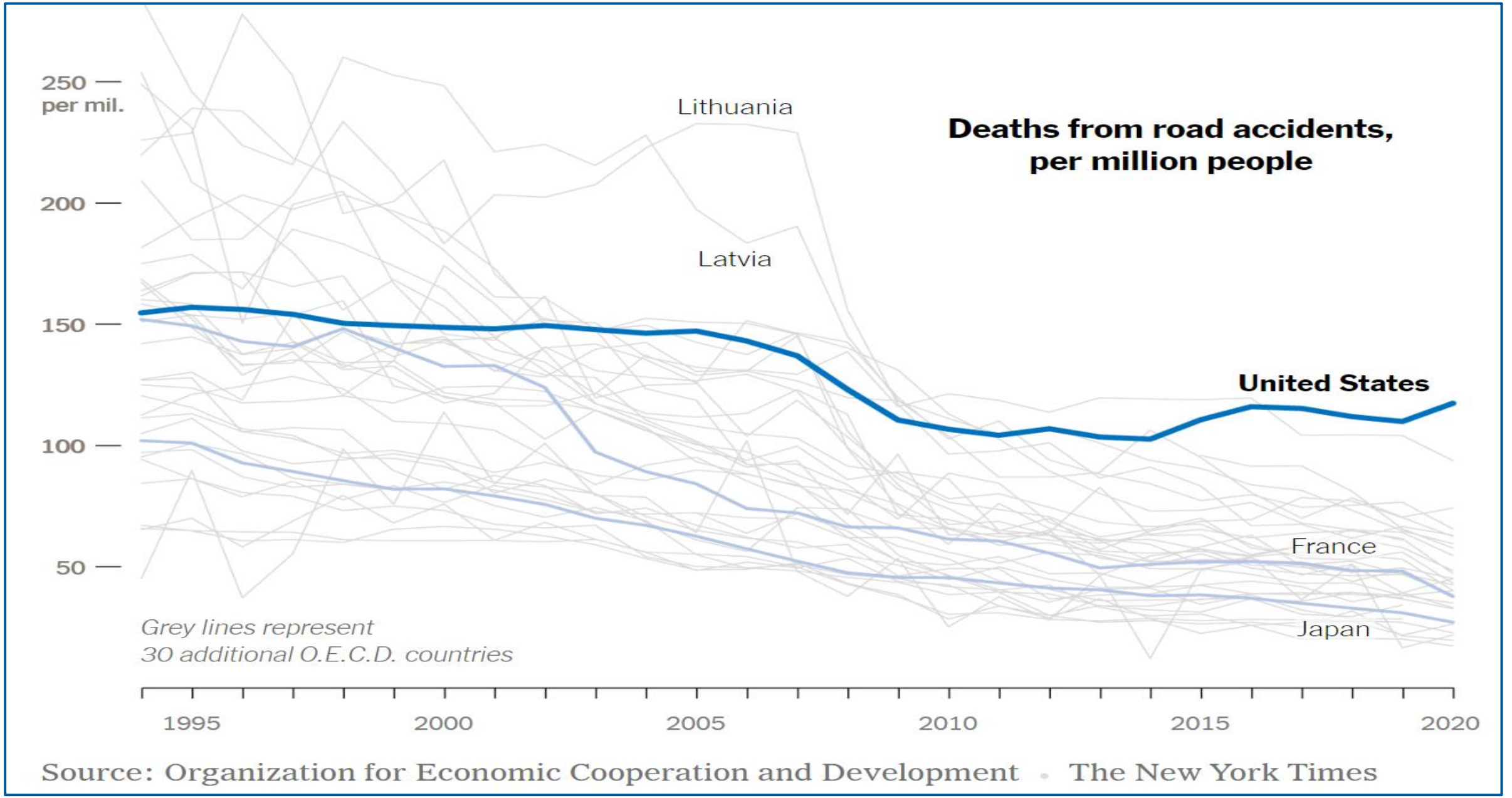
NTSB

Delaware Alcohol Traffic Fatalities (Decade)



Source: DelDOT

NTSB


Deaths from road accidents, per million people
250 per mil.
200
150
100
50
Lithuania
Latvia
United States
France
Japan
Grey lines represent 30 additional O.E.C.D. countries
1995
2000
2005
2010
2015
2020
Source: Organization for Economic Cooperation and Development • The New York Times

Change the World

Science can amuse and fascinate us all, but it is engineering that changes the world. - Issac Asimov



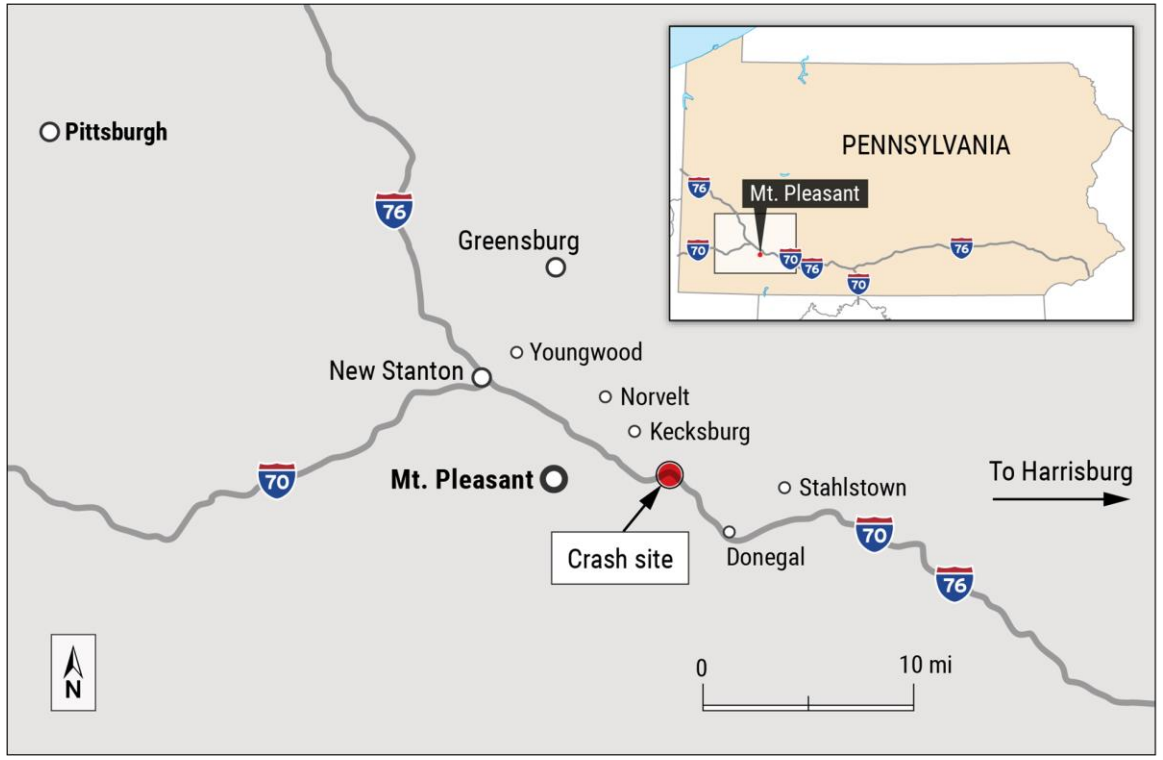






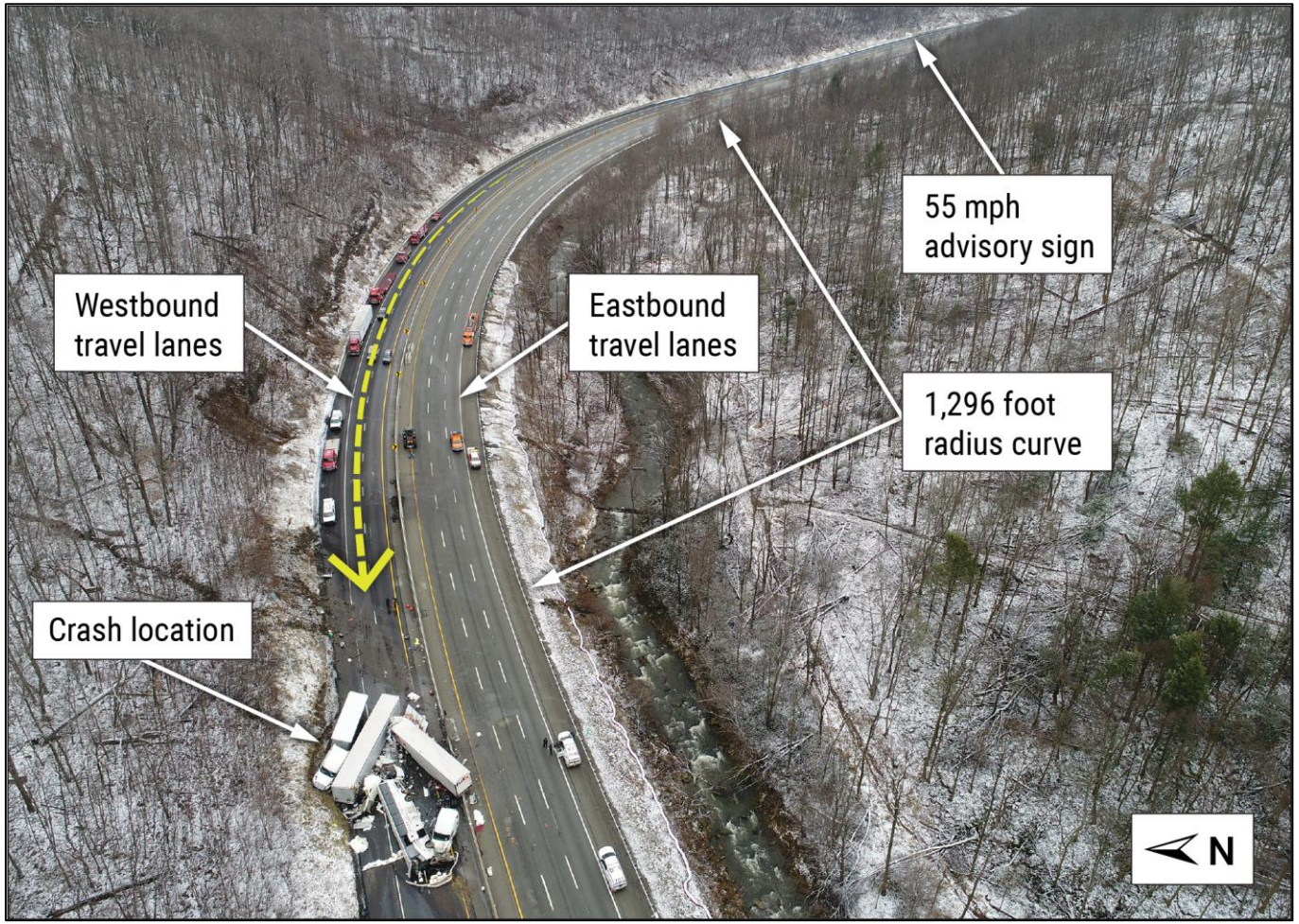
Mount Pleasant Crash Summary

- January 5, 2020 at 3:30 a.m.
- Interstate 70/76 (PA Turnpike)
- Curving mountainous section
- Snowy conditions
- 5 fatalities, 50 injuries



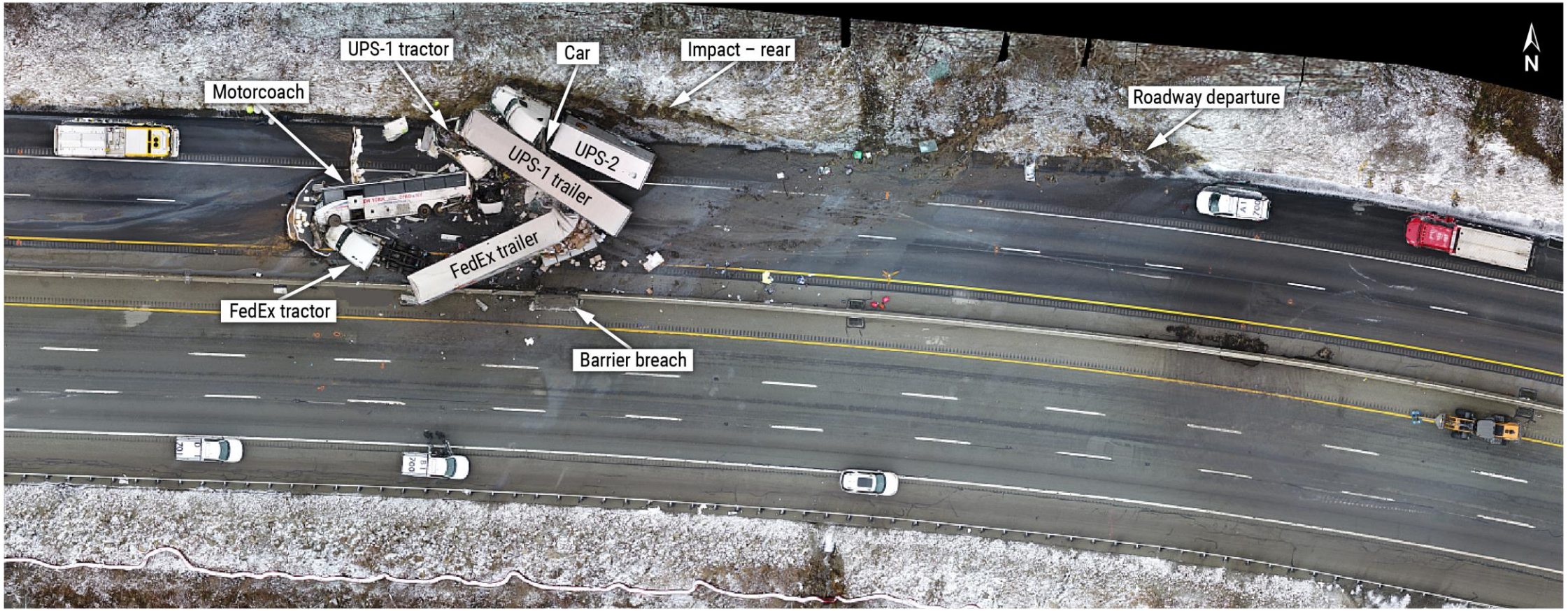
Crash Scene

- Vehicles at final rest
- Left-hand curve
- East and westbound lanes
- 55-mph warning sign



Source: Pennsylvania State Police – NTSB overlay

Collision Sequence



Source: Pennsylvania State Police

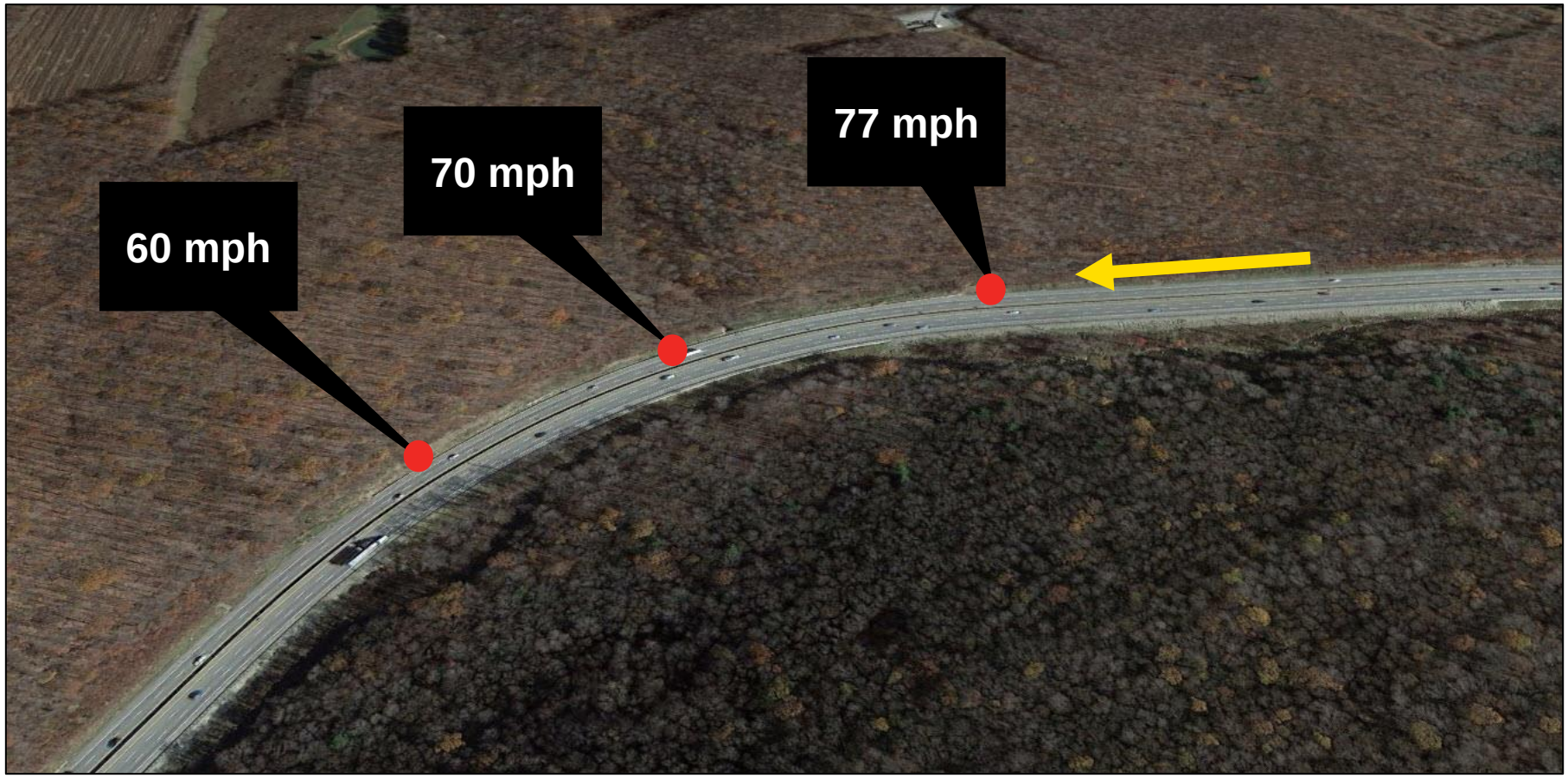
Overturned Motorcoach



Source: FedEx forward-facing video, annotated by NTSB

- Initial position of rest was blocking both travel lanes and shoulders
- Entered curve at 77 mph
- Light braking upon entering curve decreased speed to 70 mph
- After brakes released vehicle speed changes not associated with braking or throttle occurred
- Speed changes consistent with vehicle yawing from excessive steering inputs
- Sufficient roadway traction existed for normal travel

Motorcoach Driver



Source: Google Maps, annotated by NTSB

FedEx Driver Response

- FedEx truck entered curve at 53 mph
- Driver steered to left, applied brake
- Driver reacted within 0.3 seconds
- FedEx truck slowed to 21 mph



Source: FedEx truck forward-facing video, annotated by NTSB

UPS-1 Driver Response

- UPS-1 entered curve at 71 mph
- FedEx truck had begun slowing
- Driver applied brakes, steered right
- UPS-1 collision occurred at 56 mph

What We Found: *FedEx and UPS Drivers' Responses*

- FedEx driver reduced speed on wet roadway, reduced crash severity
- UPS-1 driver's initial speed too fast for wet roadway conditions
  - Driver's braking attempt failed to reduce speed before impact
  - Contributed to severity of crash from impact speed

Probable Cause

The motorcoach driver's loss of control due to the motorcoach's unsafe speed on the wet curve and the driver's likely excessive steering inputs

Contributing to the severity of the crash was the high initial and impact speed of the second truck.

What percentage of light vehicle crashes involve human error as the cause of the crash?

12%

24%

50%

94%



Safe Systems Approach

THE SAFE SYSTEM APPROACH VS. TRADITIONAL ROAD SAFETY PRACTICES

Traditional		Safe System
Prevent crashes	→	Prevent deaths and serious injuries
Improve human behavior	→	Design for human mistakes/limitations
Control speeding	→	Reduce system kinetic energy
Individuals are responsible	→	Share responsibility
React based on crash history	→	Proactively identify and address risks

Whereas traditional road safety strives to modify human behavior and prevent all crashes, the Safe System approach also refocuses transportation system design and operation on anticipating human mistakes and lessening impact forces to reduce crash severity and save lives.

Source: FHWA

Principles of the Safe System Approach



Source: FHWA

Elements of the Safe System Approach



Safe road users



Safe vehicles



Safe speeds



Safe roads

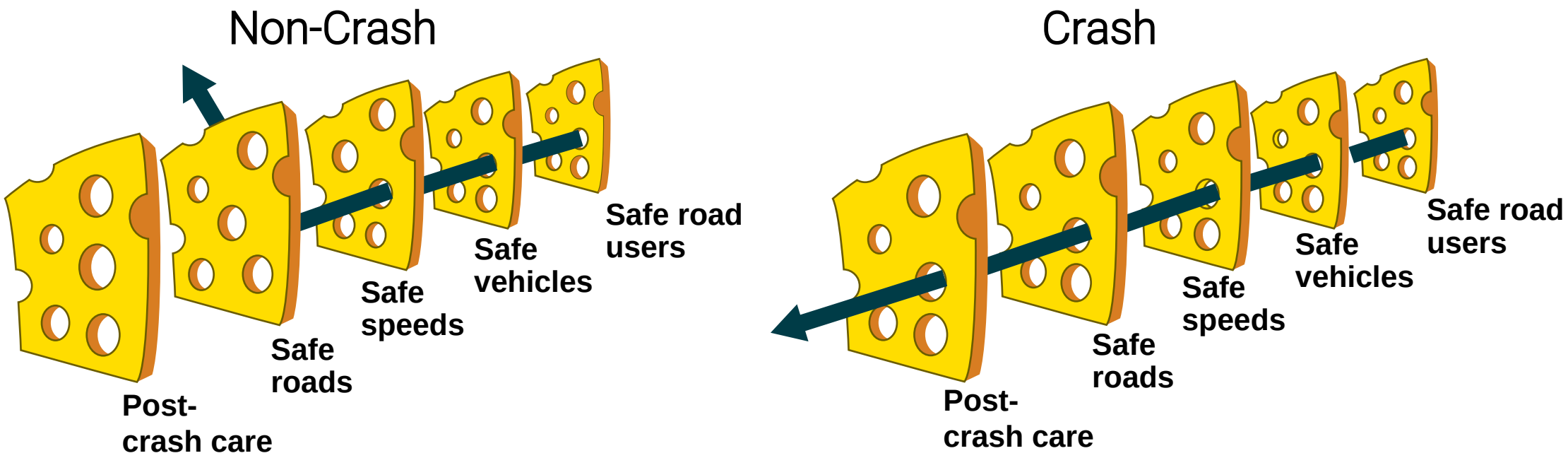


Post-crash care

Source: FHWA

The 5 Safe System Elements Create Redundancy

James Reason's Swiss Cheese Model



Source: FHWA

Safe System Based Safety Recommendations

Safer Users

- CDL training & Jake Brake training

Safer Vehicles

- Intelligent speed assist

Safer Speeds

- Variable speed limits & speed safety cameras

Safer Roads

- Move away from 85 percentile

Post Crash Care

- Video Recorders

NTSB Speeding Investigations



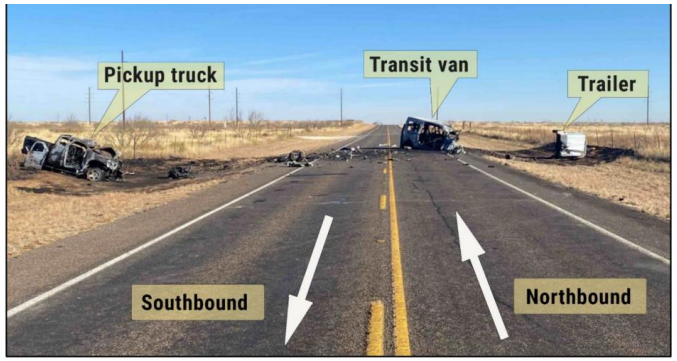
Avenal, CA 1/1/22
98 on 55 MPH road



Woodlawn, MD 3/22/23
120 on 55 MPH road



Coral Gables, FL 9/13/2021
90 on 30 MPH road



Andrews, TX 3/15/22
110 on 75 MPH road

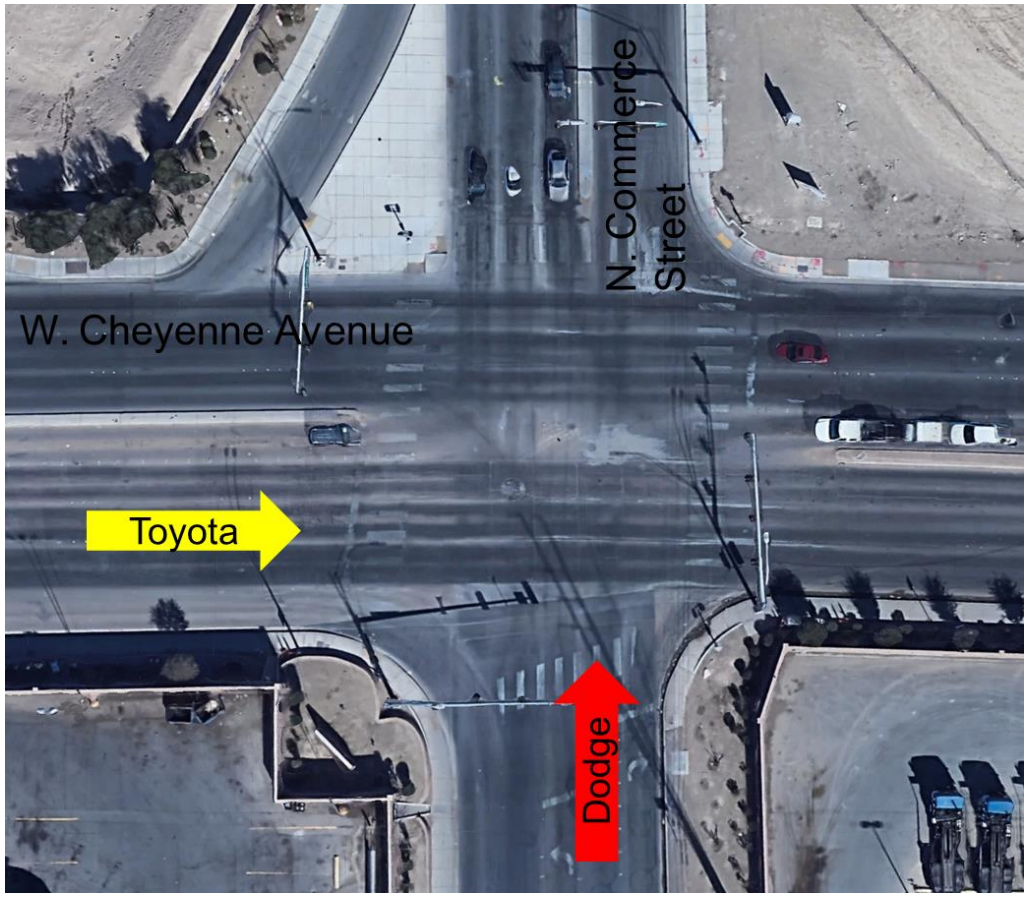


Fort Lauderdale, FL 5/8/18
116 on 30 MPH road

North Las Vegas, NV Crash

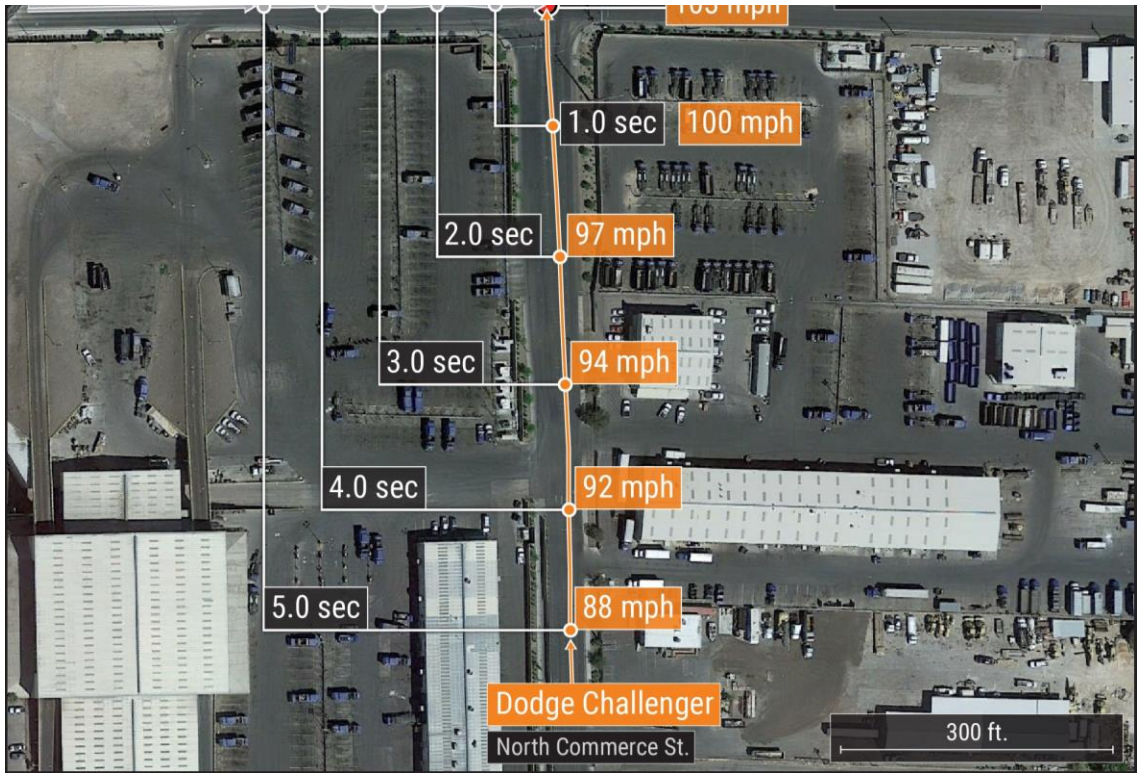
- January 29, 2022, 3:12 p.m.
- Six vehicles containing 15 occupants involved
- Nine fatalities





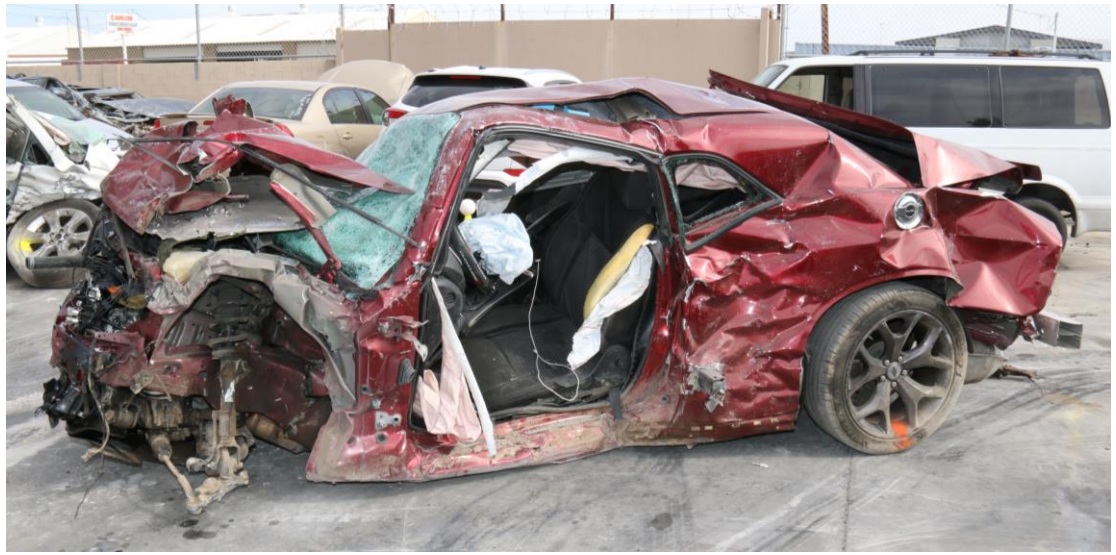
Dodge Driver's Actions

- Dodge Challenger ran stop sign and passed slow truck
- Increased speed until impact
- Red traffic signal for 29 seconds prior to entering intersection
- Did not apply brakes
- Impact at 103 mph



Driver Impairment

- Known signs of impairment from cocaine and PCP include aggression, poor impulse control, and risk-taking behavior
- The Dodge driver was impaired by effects of cocaine and PCP at the time of the crash



Substance	NMS Labs (Blood)	FAA Forensic Sciences Laboratory (Blood)
Cocaine	390 ng/mL	394 ng/mL
Phencyclidine (PCP)	27 ng/mL	19 ng/mL

Driving History

- Multiple convictions between 1984 and 2017
- Seven speeding violations in past 5 years
  - Only one appeared on his official 10-year driving record (April 2017)
  - Four pled down to illegal parking
- Driver's history and specific actions showed repeated disregard for safety

Date	Citation
04/26/2017	Speeding
05/17/2017	Speeding
12/25/2017– 01/08/2020	License suspended
08/29/2020	Speeding
11/18/2020	Speeding
02/03/2021	Speeding
08/25/2021	Speeding
12/09/2021	Speeding
01/29/2022	*Crash*

Five Year History

North Las Vegas Probable Cause

1. the Dodge driver's excessive speed and failure to obey traffic control devices.
2. Contributing to the driver's behavior was his impairment from the effects of cocaine and phencyclidine and his disregard for safety and traffic laws.
3. Also contributing to the driver's repeated disregard for safety and traffic laws despite numerous citations was the state of Nevada's failure to deter the driver's speeding recidivism due to systemic deficiencies, including routine plea agreements that alter or drop violations, inaccurate driver records, failure to accurately track citations, and delays in reporting convictions.

NLV Safe System Recommendations

Safe Users

1. Include identification and tracking of repeat speeding offenders in the Guidelines for State Highway Safety Programs
2. Develop countermeasures to reduce speeding recidivism
3. Evaluate the safety outcomes of marketing by automobile manufacturers that emphasize speeding.

Safe Vehicle

1. Intelligent speed assistance systems in all new vehicles
2. Communication about the capabilities and benefits of intelligent speed assistance to mitigate speeding.
3. Conduct research and develop guidelines to assist states in implementing pilot intelligent speed assistance interlock programs, limiting the vehicle speed, for repeat speeding offenders.

Fern Hollow Bridge Collapse

- January 28, 2022, about 6:37 a.m.
- Structural failure and collapse
- Fell into Frick Park
- Dark with light snow
- Transit bus & 4 passenger vehicles
- Fifth passenger vehicle drove off abutment
- All injured transported by 8:26 a.m.
- Precautionary evacuation but no fire or explosion
- Emergency response excluded



Westbound Video Evidence







Eastbound Video Evidence







Fern Hollow Bridge Design

- Opened in 1973
- 447-foot-long, 64-foot-wide
- Uncoated weathering steel (UWS) bridge
- Three-span bridge with a rigid K-frame superstructure design type
- 26 tons posted weight limit
- Speed limit was 35 mph

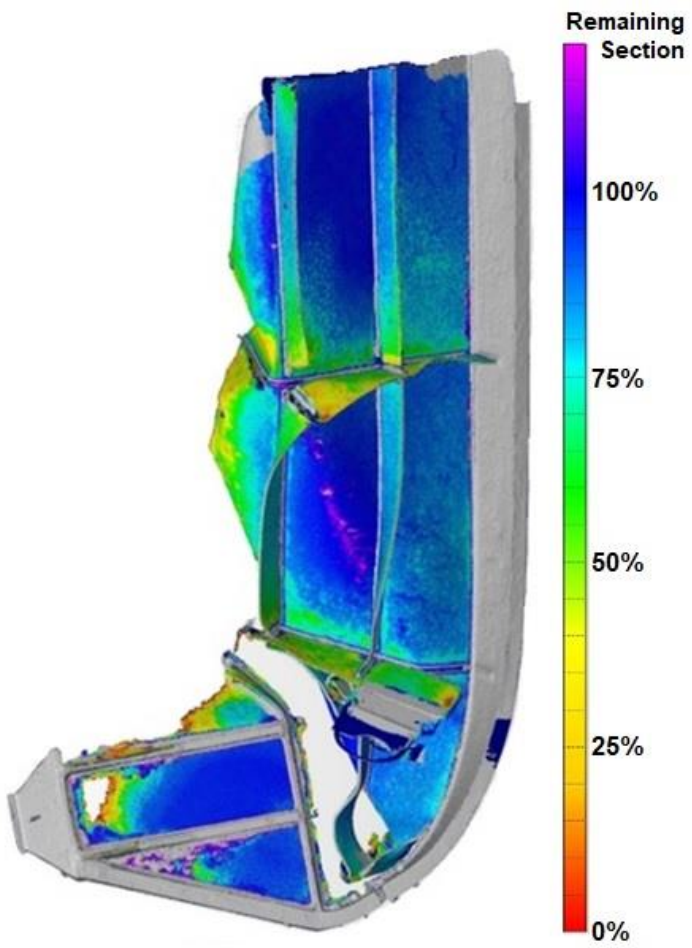


Source: National Steel Bridge Alliance

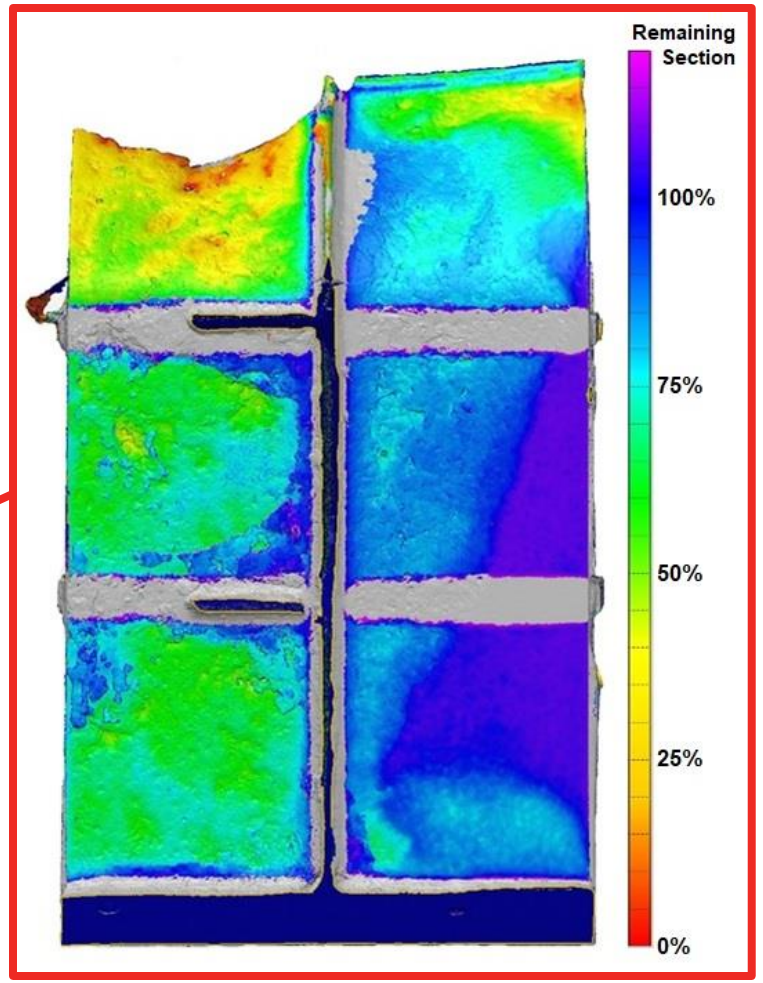
Damage to Bridges Legs

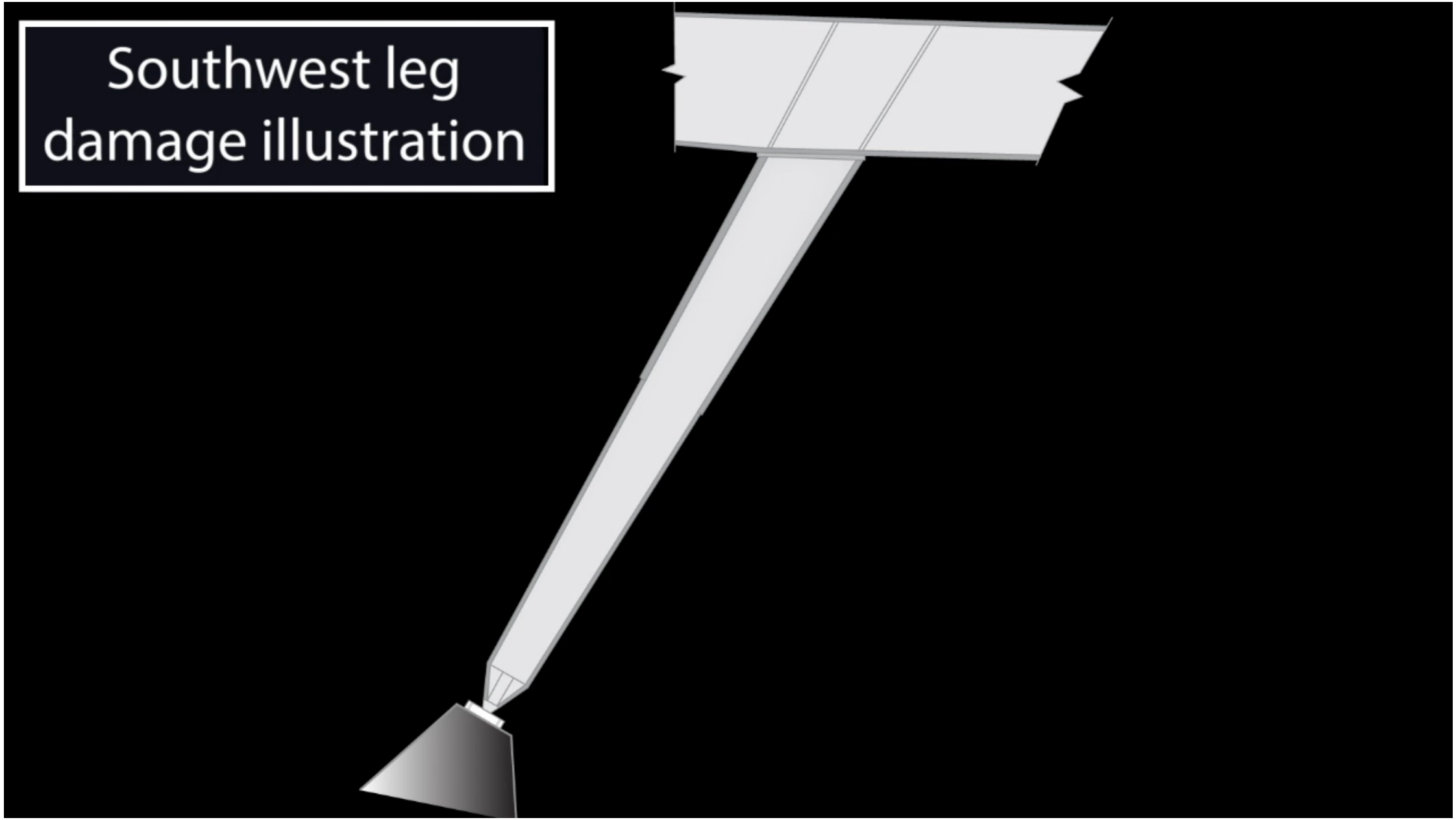


3D Laser Scanning – Southwest Leg








Southwest leg
damage illustration

Bridge Inspections



Maintenance Priority Codes

Maintenance Priority Code	Short Definition	Action Timeframe
0 CRITICAL	Immediate Response Required	Within 7 Days
1 HIGH PRIORITY	As Soon as Work can be Scheduled	Within 6 Months
2 PRIORITY	Review Work Plan and Re-Prioritize Schedule	Routine Inspection Interval
3 SCHEDULE	Add to Scheduled Work	Add to Schedule
4 PROGRAM	Add to Programmed Work	When Funds are Available
5 ROUTINE	As Per Existing Maintenance Schedule	Within the Next Work Cycle

Stiffeners on Southwest Leg

2013



Source: NBIS Inspection Report for Forbes Avenue Over Fern Hollow and Nine Mile Run, CDM Smith, September 2013

2021



Source: NBIS Inspection Report for Forbes Avenue Over Fern Hollow and Nine Mile Run, Gannet Flemming, Inc., September 2021

Clogged Drainage Inlets

2005



Source: NBIS Inspection Report for Forbes Avenue Over Fern Hollow and Nine Mile Run, Wilbur Smith Associates, September 2005

2011



Source: NBIS Inspection Report for Forbes Avenue Over Fern Hollow and Nine Mile Run, Wilbur Smith Associates, September 2011

2017



Source: NBIS Inspection Report for Forbes Avenue Over Fern Hollow and Nine Mile Run, CDM Smith, September 2017

2021



Source: NBIS Inspection Report for Forbes Avenue Over Fern Hollow and Nine Mile Run, Gannet Flemming Inc., September 2021

Fern Hollow Probable Cause

1. The failure of the transverse tie plate on the southwest leg of the bridge, a fracture-critical member (nonredundant steel tension member), due to corrosion and section loss
2. Resulting from the City of Pittsburgh's failure to act on repeated maintenance and repair recommendations from inspection reports.
3. Contributing to the collapse were:
    1. the poor quality of inspections,
    2. the incomplete identification of the bridge's fracture-critical members (nonredundant steel tension members), and
    3. The incorrect load rating calculations for the bridge.
    4. Insufficient oversight by the Pennsylvania Department of Transportation of the City of Pittsburgh's bridge inspection program.

Hamden Bus Fire

- 3:39 a.m. July 23, 2022
- CT Transit Facility
- 2021 New Flyer Xcelsior
  - 40 foot Battery Electric Transit Bus (BETB)
- Two injuries (smoke inhalation) when moving bus





Additional Electric Transit Bus Fire Investigations

Indianapolis

- June 15, 2022, 11:58 p.m
- 2015 Complete Coach Works Zero Emission Propulsion System
- IndyGo operator



Source: IndyGo

Philadelphia

- November 9, 2022, 8:43 a.m
- 2018 Proterra E2 Catalyst BEB40
- Battery internal moisture fault code
- Proterra issued recall 11/30/22



Comparison of Electric Transit Bus Fire Responses

Event	Hamden	Indianapolis	Philadelphia
First fire department action	Moved other buses, then removed the involved bus	Cut power to the chargers and then removed the involved bus	Water on bus
FD BETB training	Yes, not used	Yes, used	No
Isolation of bus	30 minutes; bus moved to parking lot	55 minutes; bus moved to grass area away from building	3 hours 25 minutes; isolation area constructed
Extinguishing method	Upon reignition, monitored the fire and let it burn without extinguishment	Applied 750 gallons of water to cool battery	Application of a large amount of water from hoses and sprinkler system, monitored for heat
Monitored bus?	Yes. HFD fire watch for ~5 hours after the main event was extinguished	IFD monitored for ~1 hour after the bus was isolated outdoors and batteries cooled.	Yes. Placed in an isolated sandbox for 24 hours
Reignition	Yes, about 4 hours later and again 2 days later	No	No

Lessons Learned

- Importance of emergency response guides
- FTA handbook of deploying battery electric transit buses
- TRB research on monitoring risks associated with BETBs

Delaware Open Recommendations

Motorcycle helmets

Use of PEDs

Increase BAC collection

Place of least drink

BAC: 80% fatal/ 60% non-fatal

Older driver highway safety program

Per se BAC .05

Passive alcohol detection

Target repeat DWI offenders

Pilot drivers: no cell phone use

Automated speed enforcement

School bus seatbelts

Fitness for school bus drivers

Bicycle helmets

Stop arm cameras

State sharing suspension/infractions

Oral fluid collection

Drug test facility ANSI/ASB Standard 120

Drug impaired driving criminal justice tool

Repeat speeding driver program

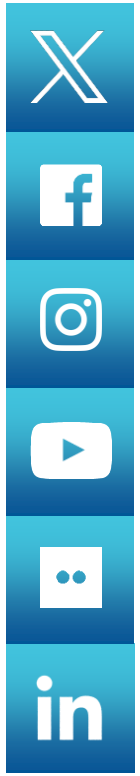
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