NTSB | National Transportation Safety Board

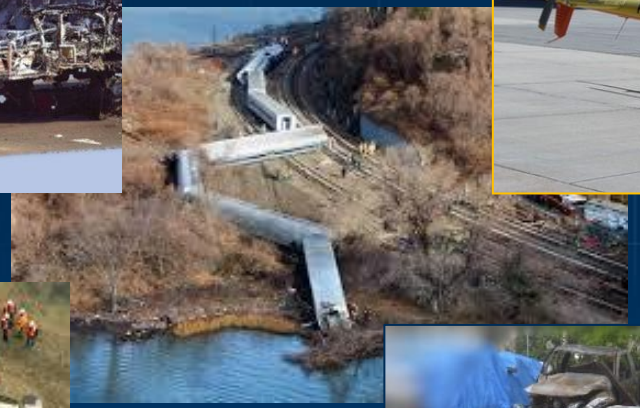
Multivehicle Crash Near Mt. Pleasant Township, Pennsylvania

Overview

- NTSB overview
- Mount Pleasant Crash Summary
- Onboard Recorders
- CDL Training and Deviation from the Law
- Advanced Vehicle Technologies
- Summary

What is the NTSB?

- Independent crash investigations
- All transportation modes



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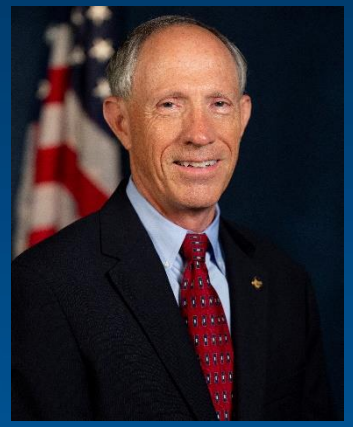
National Transportation Safety Board

- Established by Congress: 1967
  - To investigate and determine the causes of crashes in all modes of transportation
- Independent agency
  - 1974 – separate agency from US DOT
- Not a regulatory agency
- Issue recommendations only

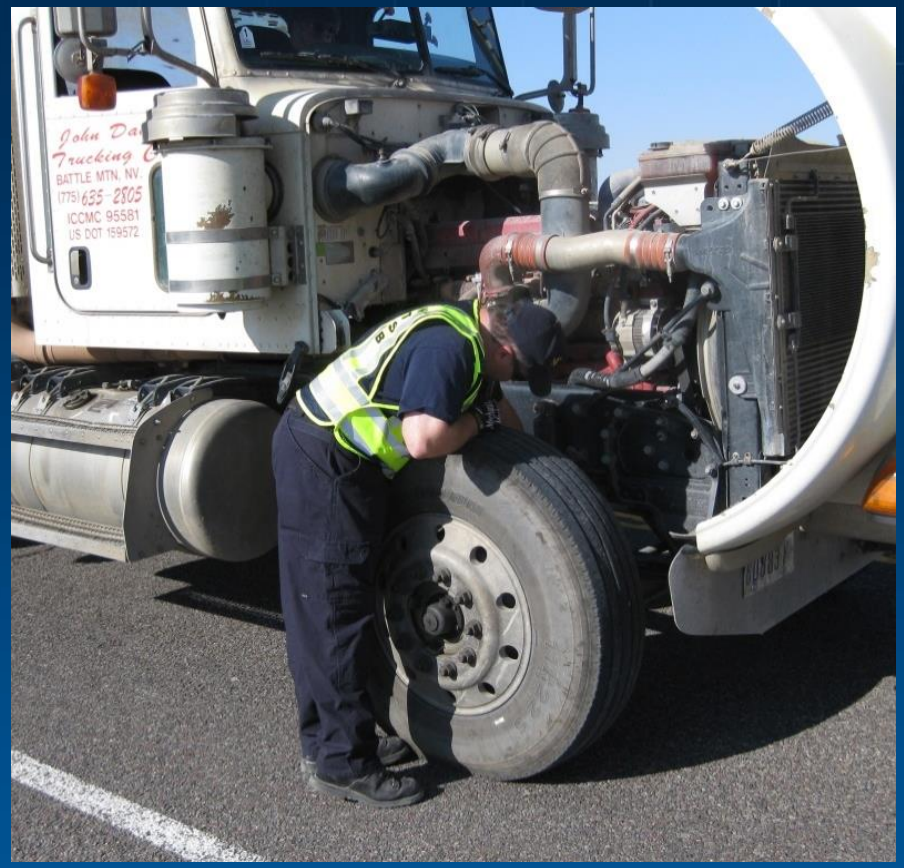
Structure of the NTSB

- 5 presidentially-appointed Members — by and with the advice and consent of the Senate

NTSB Office of Highway Safety

- Total staff of 32: managers, investigators, technical writers, and support staff
- Crashes monitored 24-7 from NTSB's Response Operations Center
- Ready to "Launch" at a moment's notice



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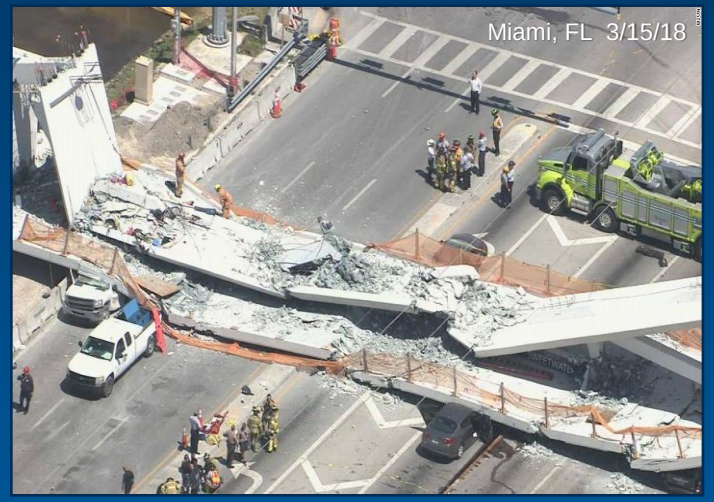
What Types Of Highway Crashes Do We Investigate?



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NTSB's Multidisciplinary Team Approach

Investigator-in-Charge (IIC)

Human Performance

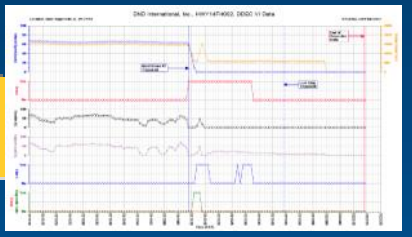
Survival Factors

Vehicle Factors

Motor Carrier Operations

Highway Factors

Data Recorders



Scene Mapping/Diagramming

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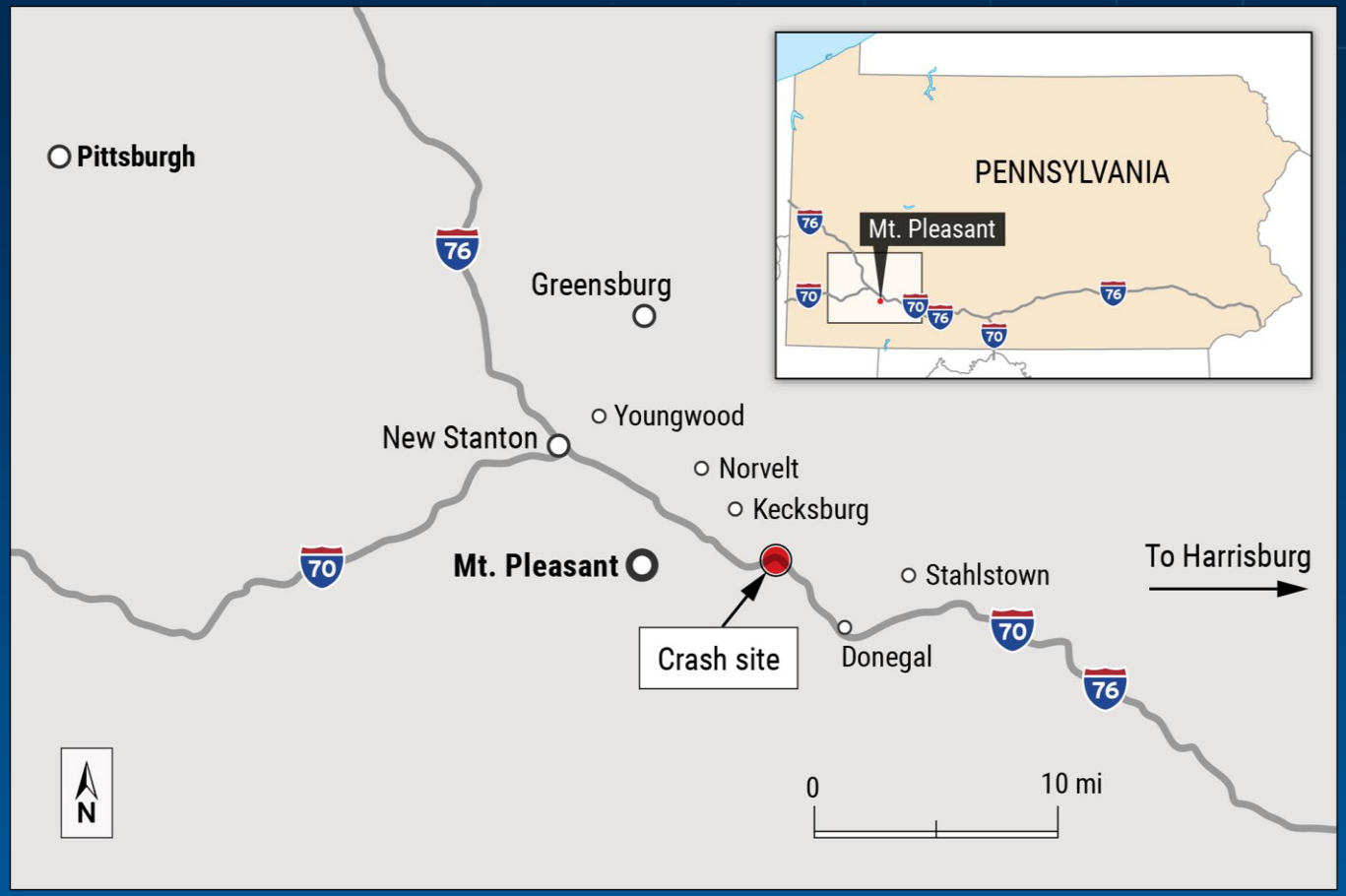
Mount Pleasant, PA Crash

Crash Summary

- Interstate 70/76
  - Pennsylvania Turnpike
  - Curving mountainous section
  - 36 miles southeast of Pittsburgh
  - Mt. Pleasant Township



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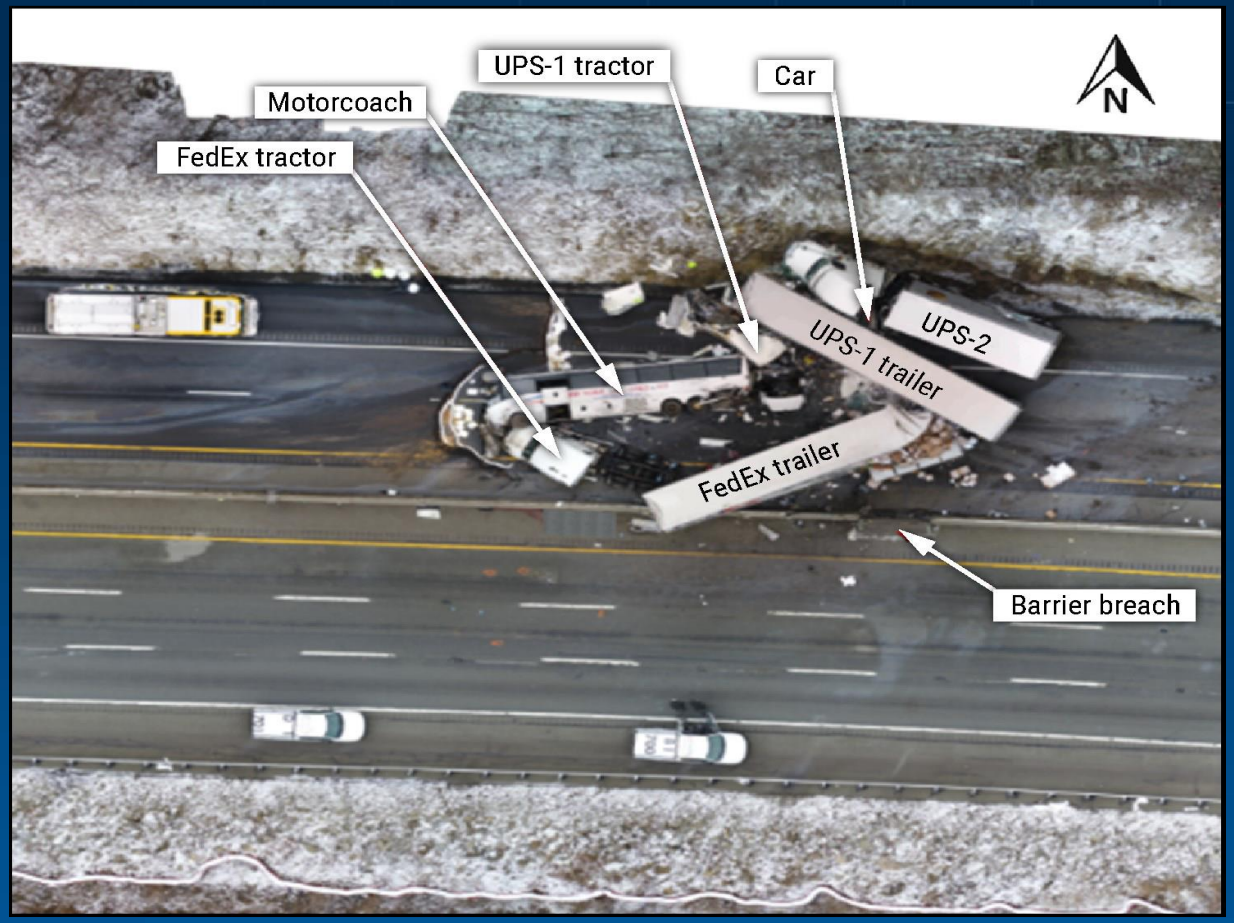
Crash Vehicles

- Final rest positions of vehicles
  - Motorcoach
  - FedEx tractor & trailer
  - UPS-1 tractor & trailer
  - Passenger car
  - UPS-2 tractor & trailer



Source: Pennsylvania State Police – NTSB overlay

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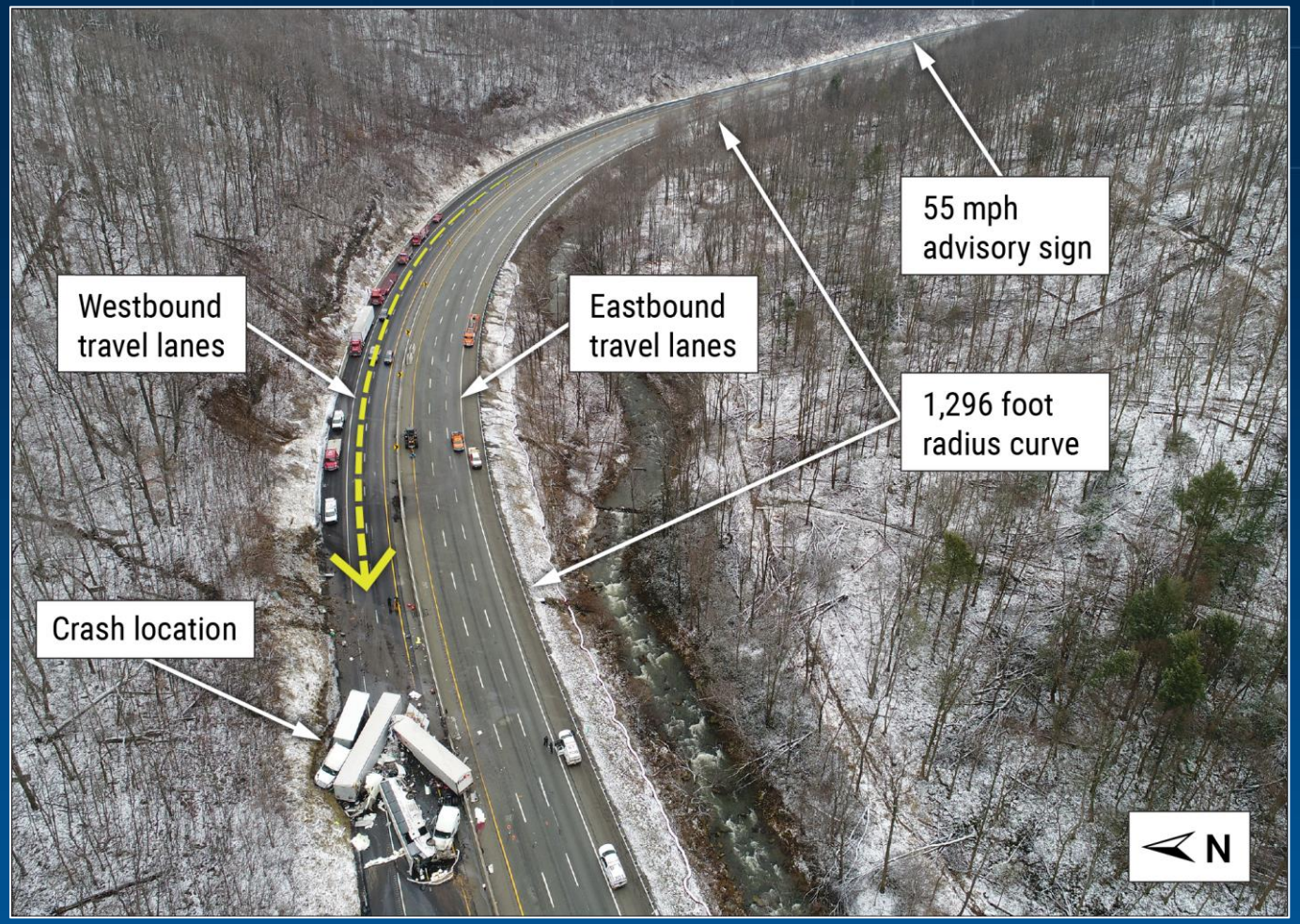
Crash Scene

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



Source: Pennsylvania State Police – NTSB overlay

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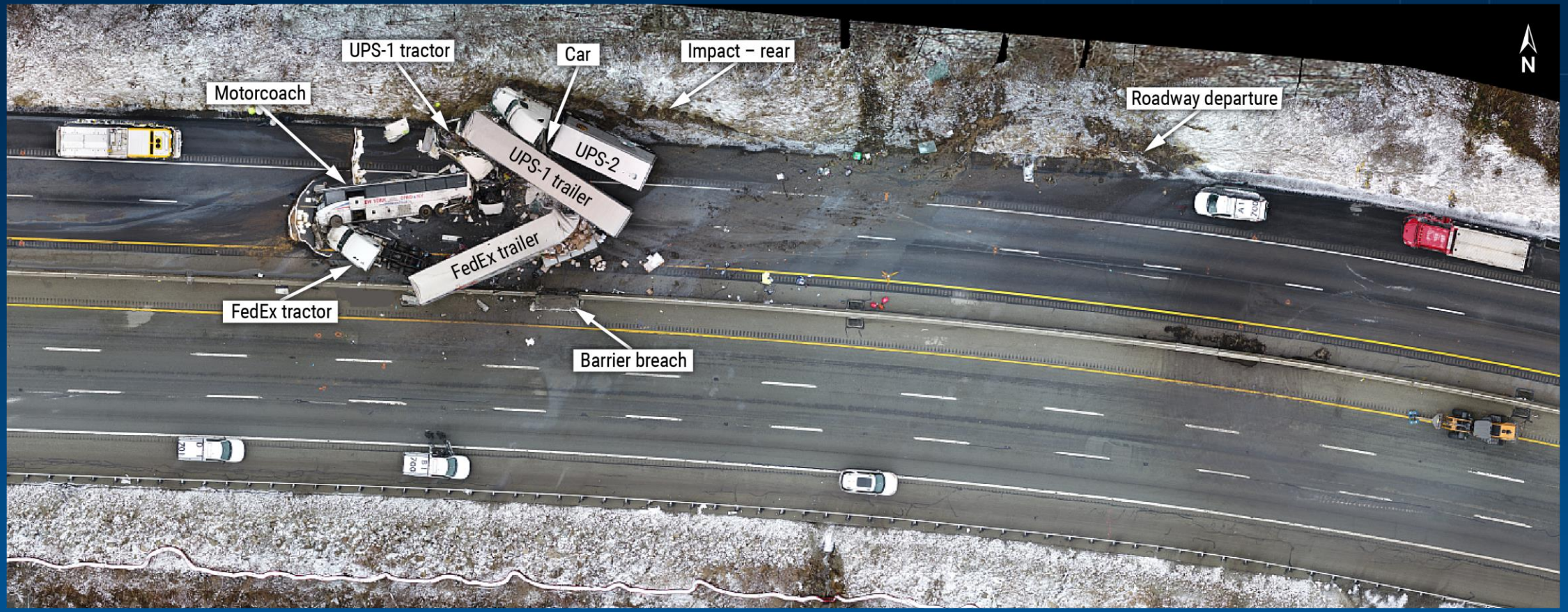
Exclusions

- Motorcoach driver
  - Driver qualifications
  - Use of alcohol or other drugs
  - Cell phone use
  - Insufficient evidence of motorcoach driver fatigue
- Emergency response was timely and effective
- Mechanical condition of motorcoach
- Pavement condition
- Roadway salt treatment addressing freezing conditions

Issues for Discussion

- Onboard video event recorder systems
- CDL holder training and deviations from this training and the law
- Forward collision avoidance systems and
- Connected vehicle technology

Collision Sequence



Source: Pennsylvania State Police

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2005 Van Hool c2045 Motorcoach

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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

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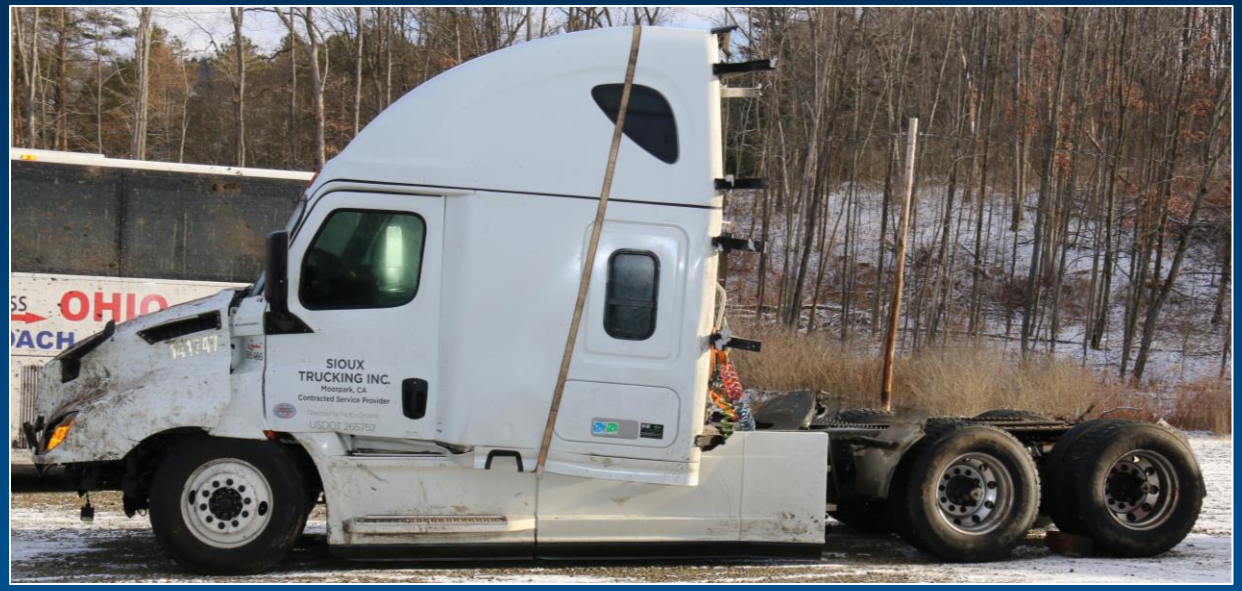
FedEx Combination Unit

2018 Freightliner Cascadia

2019 53’ Hyundai Translead semitrailer



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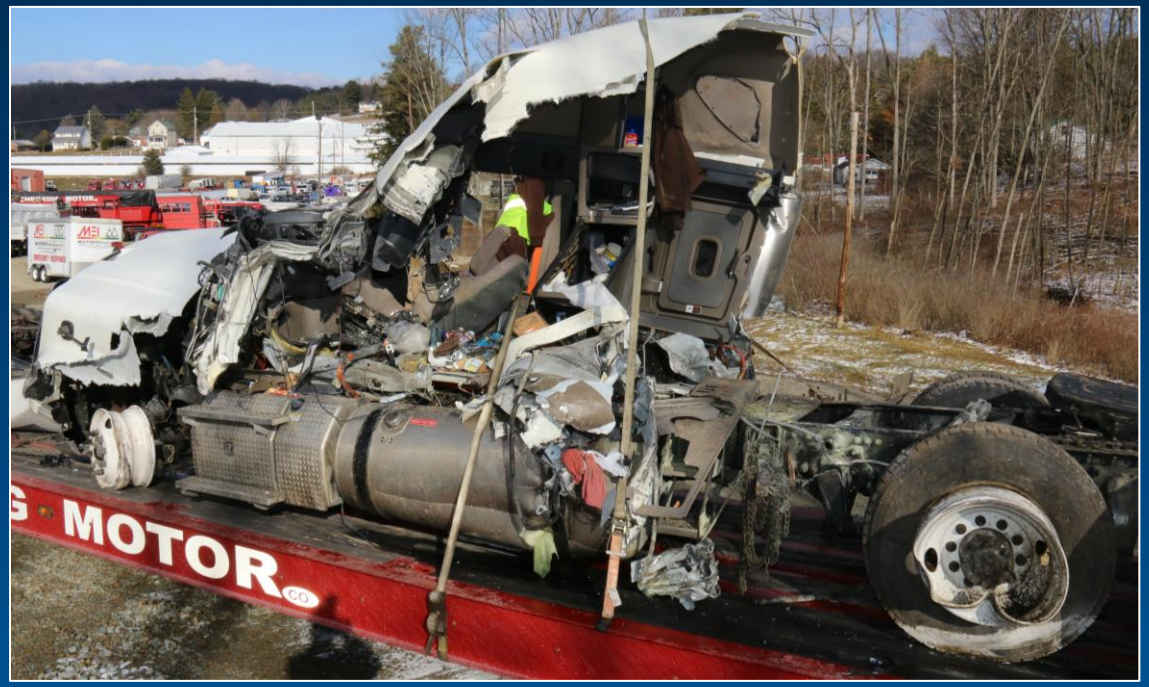
UPS-1 Combination Unit

2018 Freightliner Cascadia

2018 53’ Stoughton semitrailer



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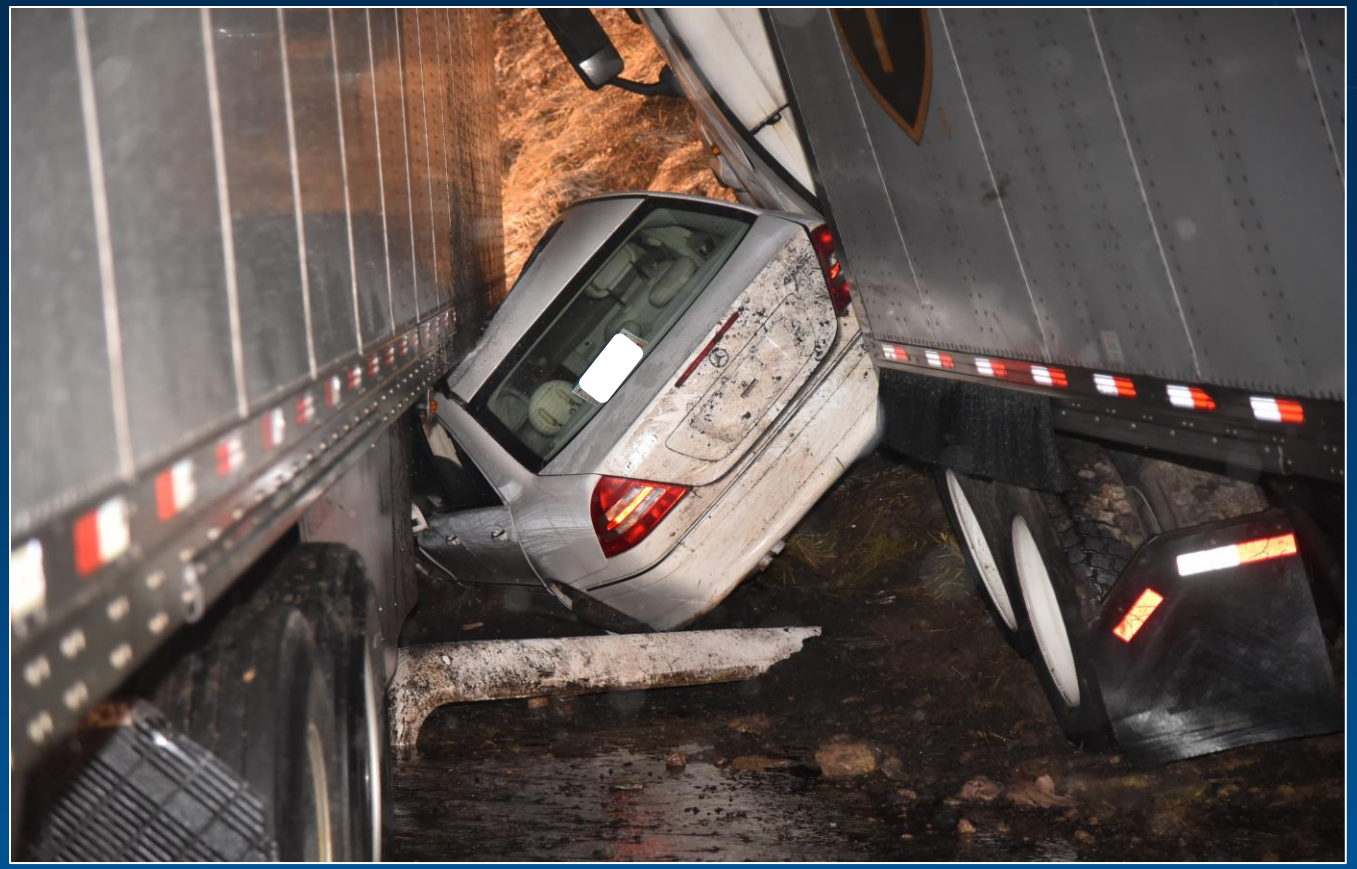
2007 Mercedes Benz C280



Source: Pennsylvania State Police

UPS-2 Combination Unit

2018 Freightliner Cascadia

2020 28.5’ Stoughton semitrailer

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Onboard Video Event Recorders

- FedEx truck video system provided key information:
  - Motorcoach speed and lane position when passing
  - Position and visibility of overturned motorcoach on roadway
  - FedEx driver reacted quickly to hazard
  - FedEx truck speed and crash severity

Source: FedEx forward-facing video

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Lack of Data on Motorcoach

- Cause of motorcoach initial loss of control
- Driver performance including steering inputs and fatigue
- Engagement of engine brake

NTSB History of Video Recording Systems

- Crashes with vehicle equipped with onboard video recorders
  - 2008 crash in Mexican Hat, Utah
  - 2012 crash in Kearney, Nebraska
  - 2013 crash in Port Saint Lucie, Florida
- 2015 report *Commercial Vehicle Onboard Video Systems*
- 2009 crash in Miami, Oklahoma

What We Found: *Onboard Video Event Recorders*

- Forward- and inward-facing video event recorder system on the FedEx truck provided valuable information
- Video event recorder systems can provide key safety information about crash circumstances
- Video event recorder systems can be proactively used to improve driver performance
- What we recommended:
  - One recommendation to the National Highway Traffic Safety Administration
  - One recommendation to the Federal Motor Carrier Safety Administration
  - One reiteration to the American Bus Association, United Motorcoach Association

The Drivers

- Crash trip (motorcoach)
- Driving in adverse weather conditions
- Motorcoach driver background
- Truck drivers' performance in crash sequence

Signage

- 38 signs installed along westbound lanes
- 5 dynamic message signs
- “Curves ahead” advisory speed sign with flashing beacons
  - Warn motorists to reduce speed to 55 mph, particularly at night
- Connected vehicle technology
  - Harrisburg Connected Project

Source: PTC

Source: PTC

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Speed Limits

- Regulatory 70 mph speed limit
  - Maximum speed on highway section, established by law, and is enforceable
  - 1,054 miles of straight sections
- Advisory 55 mph speed sign
  - Recommended safe speed for all vehicles, not enforceable
  - 150 horizontal curves (51 miles) for advisory speeds of 55, 60, 65 mph

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Motorcoach Crash Trip

- Departed NYC at 10:00 p.m.
- Scheduled arrival 4:15 a.m.
- 10 miles from destination
- Driving for 7 hours
- Unable to determine fatigue

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Environmental Conditions

Source: Pennsylvania State Police

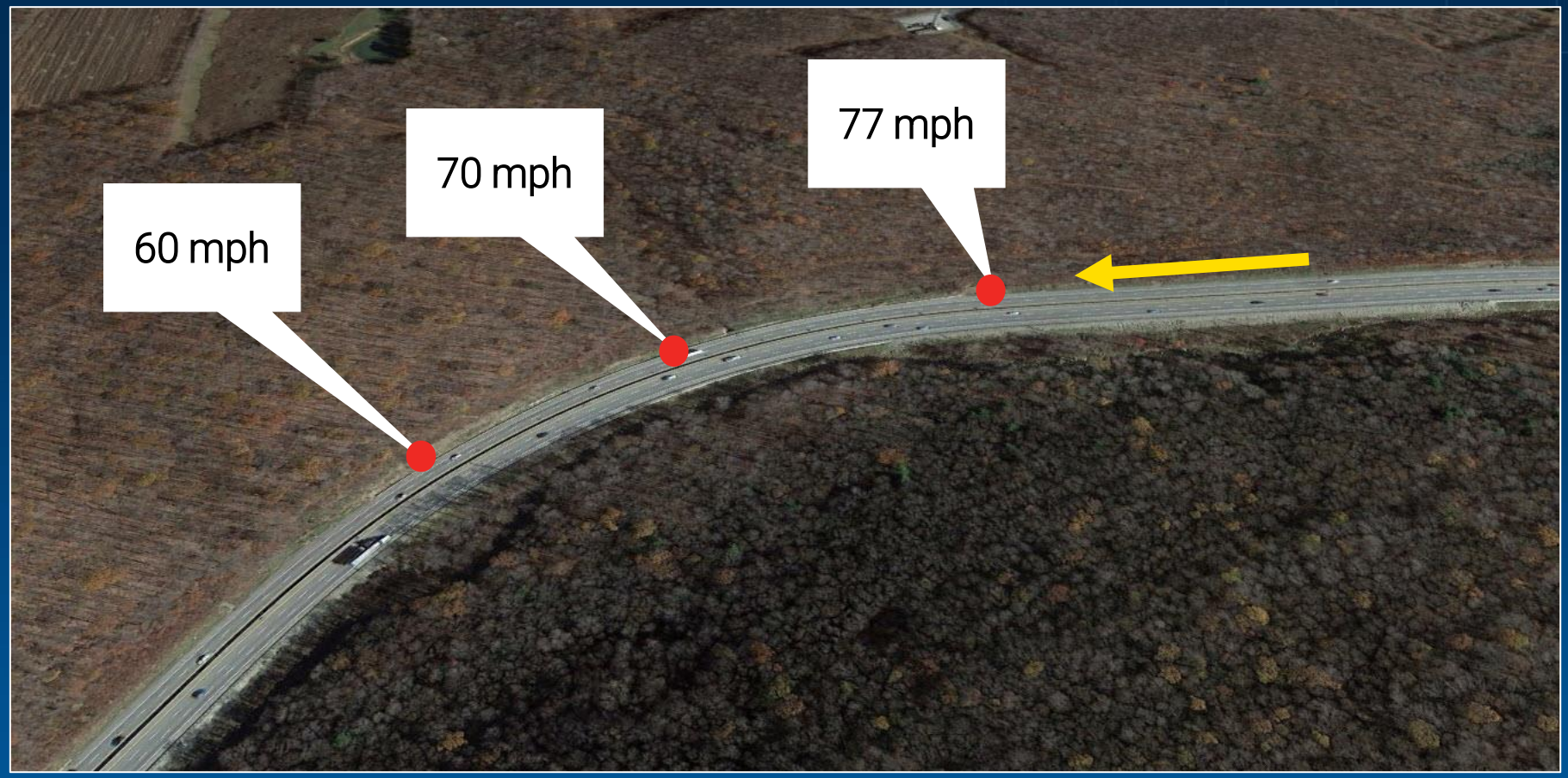
Driving in Adverse Weather Conditions

- 25% of speeding-related large-truck fatalities occurred in adverse weather (FARS)
- Adjust speed to safely match weather conditions
- Increase following distance
- Take curves at slower speeds and do not brake while in curves
- Avoid using engine brakes

Motorcoach Driver Background

- Experienced and properly licensed
  - 11 years of commercial driving experience
  - Class “A” commercial license, passenger endorsement, no restrictions
  - 2-year medical certification
- Previous excessive speed citation (September 2019)
- 2 previous minor crashes

Motorcoach Driver



Source: Google Maps, annotated by NTSB

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What We Found: *Motorcoach Driver*

- Traveling at excessive speed on wet roadway in descending curve
- Excessive speed, roadway conditions contributed to loss of control
- Driver likely made excessive steering inputs
- Likely engine brake contributed to loss of traction

Comm. Drivers Manual: Speed I

2.6 – Controlling Speed

Driving too fast is a major cause of fatal crashes. You must adjust your speed depending on driving conditions. These include traction, curves, visibility, traffic and hills.

Slippery Surfaces. It will take longer to stop, and it will be harder to turn without skidding, when the road is slippery. Wet roads can double stopping distance. You must drive slower to be able to stop in the same distance as on a dry road. Reduce speed by about one-third (e.g., slow from 55 to about 35 mph) on a wet road. On packed snow, reduce speed by a half, or more. If the surface is icy, reduce speed to a crawl and stop driving as soon as you can safely do so.

Comm. Drivers Manual: Speed II

2.6.3 – Speed and Curves

Drivers must adjust their speed for curves in the road. If you take a curve too fast, two things can happen. The tires can lose their traction and continue straight ahead, so you skid off the road. Or, the tires may keep their traction and the vehicle rolls over. Tests have shown that trucks with a high center of gravity can roll over at the posted speed limit for a curve.

Slow to a safe speed before you enter a curve. Braking in a curve is dangerous because it is easier to lock the wheels and cause a skid. Slow down as needed. Don't ever exceed the posted speed limit for the curve. Be in a gear that will let you accelerate slightly in the curve. This will help you keep control.

Comm. Drivers Manual: Speed Retarder

2.13.2 – Driving

Slippery Surfaces. Drive slowly and smoothly on slippery roads. If it is very slippery, you shouldn't drive at all. Stop at the first safe place.

Start Gently and Slowly. When first starting, get the feel of the road. Don't hurry.

Check for Ice. Check for ice on the road, especially bridges and overpasses. A lack of spray from other vehicles indicates ice has formed on the road. Also, check your mirrors and wiper blades for ice. If they have ice, the road most likely will be icy as well.

Adjust Turning and Braking to Conditions. Make turns as gently as possible. Don't brake any harder than necessary, and don't use the engine brake or speed retarder. (They can cause the driving wheels to skid on slippery surfaces.)

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

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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

UPS-2 Driver Response

- UPS-2 entered curve at 69 mph
- UPS-2 3–5 seconds behind UPS-1
- Driver observed UPS-1 collision
- Driver applied brakes, steered right
- UPS-2 came to rest next to sedan

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
- UPS-2 driver had visual cues to warn of collisions ahead

Commercial Vehicle Safety Systems

- Heavy Vehicle Speed Limiters
- Forward Collision Avoidance Systems (CAS)
- Connected Vehicle Technology (V2X)

Heavy Vehicle Speed Limiters

- Motorcoach did not have a speed limiter
- Passive speed limiters
  - Maximum vehicle speed is pre-set, mechanically or electronically
- Advanced speed limiters (intelligent speed assistance)
  - Relies on cameras and GPS to read and verify roadway speed limit
  - Adjusts vehicle maximum speed in real time

Previous NTSB Recommendations

- Safety recommendations issued in 2012 to NHTSA:
  - Develop performance standards for advanced speed-limiting technologies for heavy vehicles (H-12-20)
  - Mandate advanced speed limiters in heavy vehicles (H-12-21)
- Lack of progress on recommendation by NHTSA
  - Classification is “Open—Unacceptable Response”

What We Found: *Heavy Vehicle Speed Limiters*

- Speed contributed to both the cause and severity of this crash
- Speed limiters help drivers avoid exceeding regulatory, advisory, and variable speed limits
- What we recommended:
  - Reiterate Safety Recommendations H-12-20 and -21 to NHTSA

Forward Collision Avoidance Systems (CAS)

- Three Freightliner truck-tractors were equipped with forward CAS
  - Not functioning on UPS-1
  - FedEx and UPS-2 did not activate precrash
- CAS: audible warning, automatic emergency braking (AEB)
- Designed to mitigate or prevent rear-end crashes
- Performance affected by
  - Generational capabilities
  - Roadway and crash parameters

Forward CAS: Standards and Testing

- No federal performance standards for CAS in heavy vehicles
- NHTSA proposed testing protocols in 2019
  - No pass/fail criteria
  - Maximum tested speed of 45 mph
  - Straight roadway, clear weather
  - Rear of a passenger vehicle as the only target
- Parameters of this crash were likely beyond NHTSA's proposed testing protocols

Previous NTSB Recommendations

- More than 25 recommendations, starting in 1995 through 2015
- In 2015, issued Safety Recommendation H-15-5 to NHTSA:
  - Complete development and application of performance standards and protocols for the assessment of forward CAS in commercial vehicles
  - Classification remains “Open—Acceptable Response”

What We Found: *Collision Avoidance Systems*

- Parameters in the Mt. Pleasant Township crash beyond proposed system capabilities and proposed federal test procedures
- Voluntary installation and use of forward CAS and AEB in heavy vehicles by manufacturers and operators
- What we recommended:
  - Reiterate Safety Recommendation H-15-5 to NHTSA

Maintenance Issues

- UPS Truck 1 – misaligned radar sensor
- Error code and warning since June 2019
  - Detected by Penske in July 2019
  - Noted several times on maintenance records
  - No Driver Vehicle Inspection Report (DVIR) entry by driver

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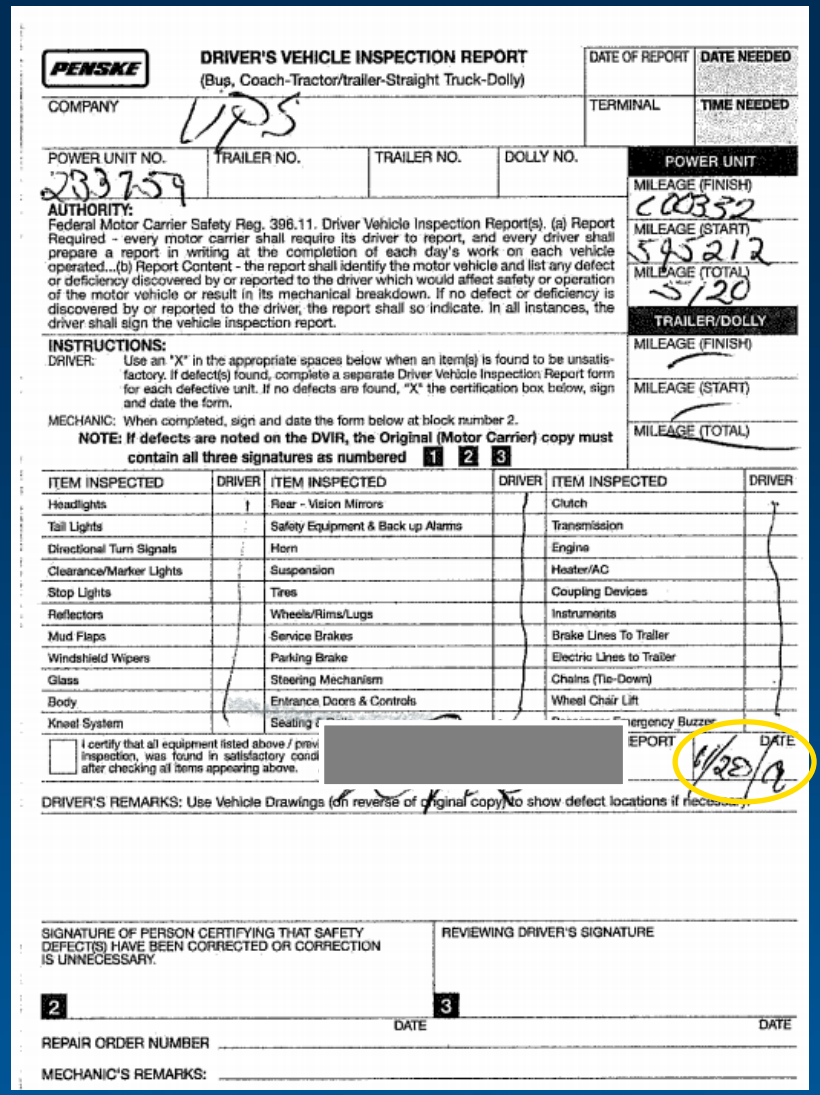
Driver Vehicle Inspection Reports from UPS Truck 1



PENSKE

DRIVER'S VEHICLE INSPECTION REPORT
(Bus, Coach-Tractor/trailer-Straight Truck-Dolly)

DATE OF REPORT | DATE NEEDED

COMPANY: UPS | TERMINAL | TIME NEEDED

POWER UNIT NO.	TRAILER NO.	TRAILER NO.	DOLLY NO.
233759			

POWER UNIT
MILEAGE (FINISH): 600352
MILEAGE (START): 595212
MILEAGE (TOTAL): 5120

TRAILER/DOLLY
MILEAGE (FINISH)
MILEAGE (START)
MILEAGE (TOTAL)

AUTHORITY:
Federal Motor Carrier Safety Reg. 396.11. Driver Vehicle Inspection Report(s). (a) Report Required - every motor carrier shall require its driver to report, and every driver shall prepare a report in writing at the completion of each day's work on each vehicle operated...(b) Report Content - the report shall identify the motor vehicle and list any defect or deficiency discovered by or reported to the driver which would affect safety or operation of the motor vehicle or result in its mechanical breakdown. If no defect or deficiency is discovered by or reported to the driver, the report shall so indicate. In all instances, the driver shall sign the vehicle inspection report.

INSTRUCTIONS:
DRIVER: Use an 'X' in the appropriate spaces below when an item(s) is found to be unsatisfactory. If defect(s) found, complete a separate Driver Vehicle Inspection Report form for each defective unit. If no defects are found, "X" the certification box below, sign and date the form.
MECHANIC: When completed, sign and date the form below at block number 2.
NOTE: If defects are noted on the DVIR, the Original (Motor Carrier) copy must contain all three signatures as numbered 1 2 3

ITEM INSPECTED	DRIVER	ITEM INSPECTED	DRIVER	ITEM INSPECTED	DRIVER
Headlights		Rear - Vision Mirrors		Clutch	
Tail Lights		Safety Equipment & Back up Alarms		Transmission	
Directional Turn Signals		Horn		Engine	
Clearance/Marker Lights		Suspension		Heater/AC	
Stop Lights		Tires		Coupling Devices	
Reflectors		Wheels/Rims/Lugs		Instruments	
Mud Flaps		Service Brakes		Brake Lines To Trailer	
Windshield Wipers		Parking Brake		Electric Lines to Trailer	
Glass		Steering Mechanism		Chains (Tie-Down)	
Body		Entrance Doors & Controls		Wheel Chair Lift	
Kneel System		Seating		Emergency Buzzer	

☐ I certify that all equipment listed above / prev... inspection, was found in satisfactory cond... after checking all items appearing above. [redacted] EPORT DATE 4/28/15

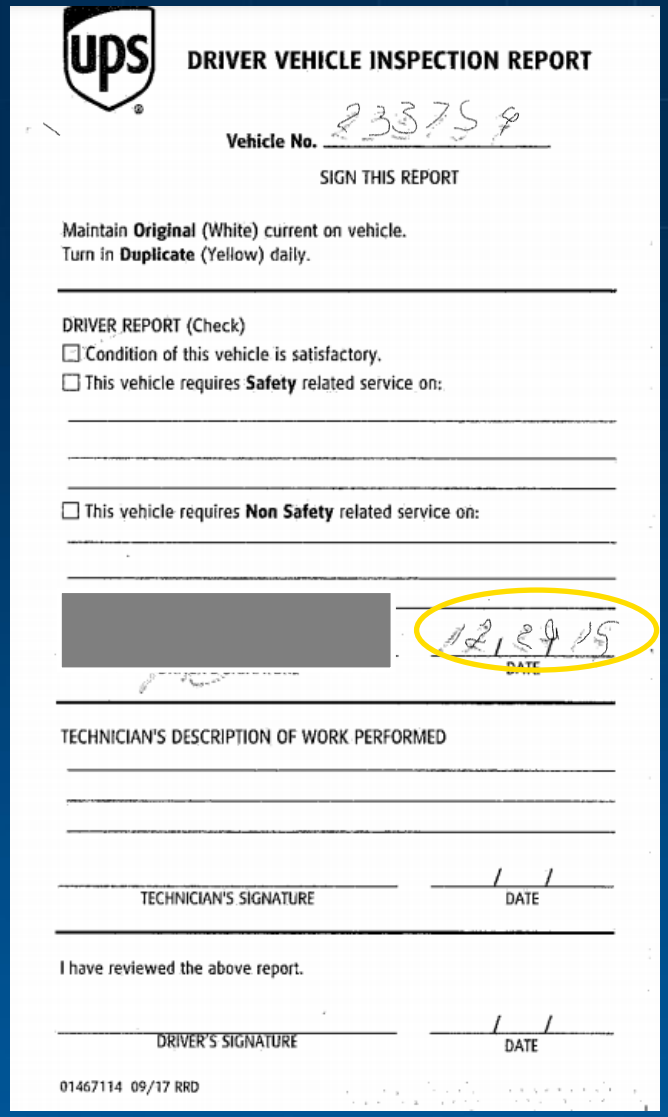
DRIVER'S REMARKS: Use Vehicle Drawings (on reverse of original copy) to show defect locations if nec...

SIGNATURE OF PERSON CERTIFYING THAT SAFETY DEFECT(S) HAVE BEEN CORRECTED OR CORRECTION IS UNNECESSARY. | REVIEWING DRIVER'S SIGNATURE

2 DATE | 3 DATE

REPAIR ORDER NUMBER

MECHANIC'S REMARKS:



ups

DRIVER VEHICLE INSPECTION REPORT

Vehicle No. 233759

SIGN THIS REPORT

Maintain **Original** (White) current on vehicle.
Turn in **Duplicate** (Yellow) daily.

DRIVER REPORT (Check)
☐ Condition of this vehicle is satisfactory.
☐ This vehicle requires **Safety** related service on:

☐ This vehicle requires **Non Safety** related service on:

[redacted] 4/28/15 DATE

TECHNICIAN'S DESCRIPTION OF WORK PERFORMED

TECHNICIAN'S SIGNATURE | DATE

I have reviewed the above report.

DRIVER'S SIGNATURE | DATE

01467114 09/17 RRD

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Postcrash Actions

- Penske
  - Places vehicle with Forward Collision Avoidance System defects out of service
  - Lessor receives notification email
  - Between May 2020 and December 2021, over 6,300 vehicles affected

- UPS
  - Changed driver training
  - Changed check ride form to account for advanced safety systems

What We Found: *Reporting Nonfunctional Safety Systems*

- Maintaining the full functionality of installed collision avoidance systems is critical to vehicle safety
- If drivers report defects or faults in collision avoidance system, repairs can be made more readily, improving safety
- What we recommended:
  - One recommendation to the Federal Motor Carrier Safety Administration
  - One recommendation to the American Trucking Associations, Owner-Operator Independent Drivers Association, Commercial Vehicle Safety Alliance, American Bus Association, United Motorcoach Association, Transport Workers Union, Amalgamated Transit Union and the International Brotherhood of Teamsters
  - One recommendation to FedEx and UPS

Connected Vehicle Technology

- V2X enables vehicles to communicate with:
  - Other vehicles or roadway users
  - Infrastructure
- Communication identifies vehicle's speed, location, direction of travel
- Not impacted by:
  - roadway geometry or weather
  - does not require line of sight
  - vehicle speeds or positioning in roadway

Previous NTSB Recommendations

- Connected vehicle technology complement to forward CAS
- In 2013, issued safety recommendations to NHTSA:
  - Develop performance standards (H-13-30)
  - Mandate connected vehicle technology in all highway vehicles (H-13-31)
- V2X technology has matured since 2013
- NHTSA has taken no regulatory action

What We Found: *Connected Vehicle Technology*

- V2X technology provides alerts earlier than camera or radar systems
- In the Mt. Pleasant Township crash, connected vehicle technology:
  - Might have prevented or mitigated vehicle collisions
  - Might have reduced injury severity
- What we recommended:
  - Reiterating H-13-30 and -31 to NHTSA

FCC Ruling to Reduce the Safety Spectrum

- In 2021, FCC final rule:
  - Reduced safety spectrum to 30 MHz
  - Allocated remaining bandwidth to unlicensed devices
- Interference from unlicensed devices, such as those using wi-fi, negatively impacts performance of connected vehicle devices
- FCC actions have an adverse impact on deployment of:
  - Near-term and long-term connected vehicle technologies
  - State DOT vehicle-to-infrastructure technology

What We Found: *Connected Vehicle Technology*

- Challenges to V2X deployment resulting from FCC final rule potentially detrimental to future advancement of V2X
- V2X critical to mitigation and prevention of crashes
- FCC provision of sufficient spectrum without interference needed
- US DOT to ensure nationwide deployment needed
- What we recommended:
  - One recommendation to the Federal Communications Commission
  - One recommendation to the US Department of Transportation

Summary

- Importance of recorders
- The crash was preventable
- Three of the four drivers were not following their training
- Safety technology has limits
- Safety technology needs to checked and repaired
- Multiple levels of safety improves outcomes

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