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Phoenix, Arizona
June 9, 2021

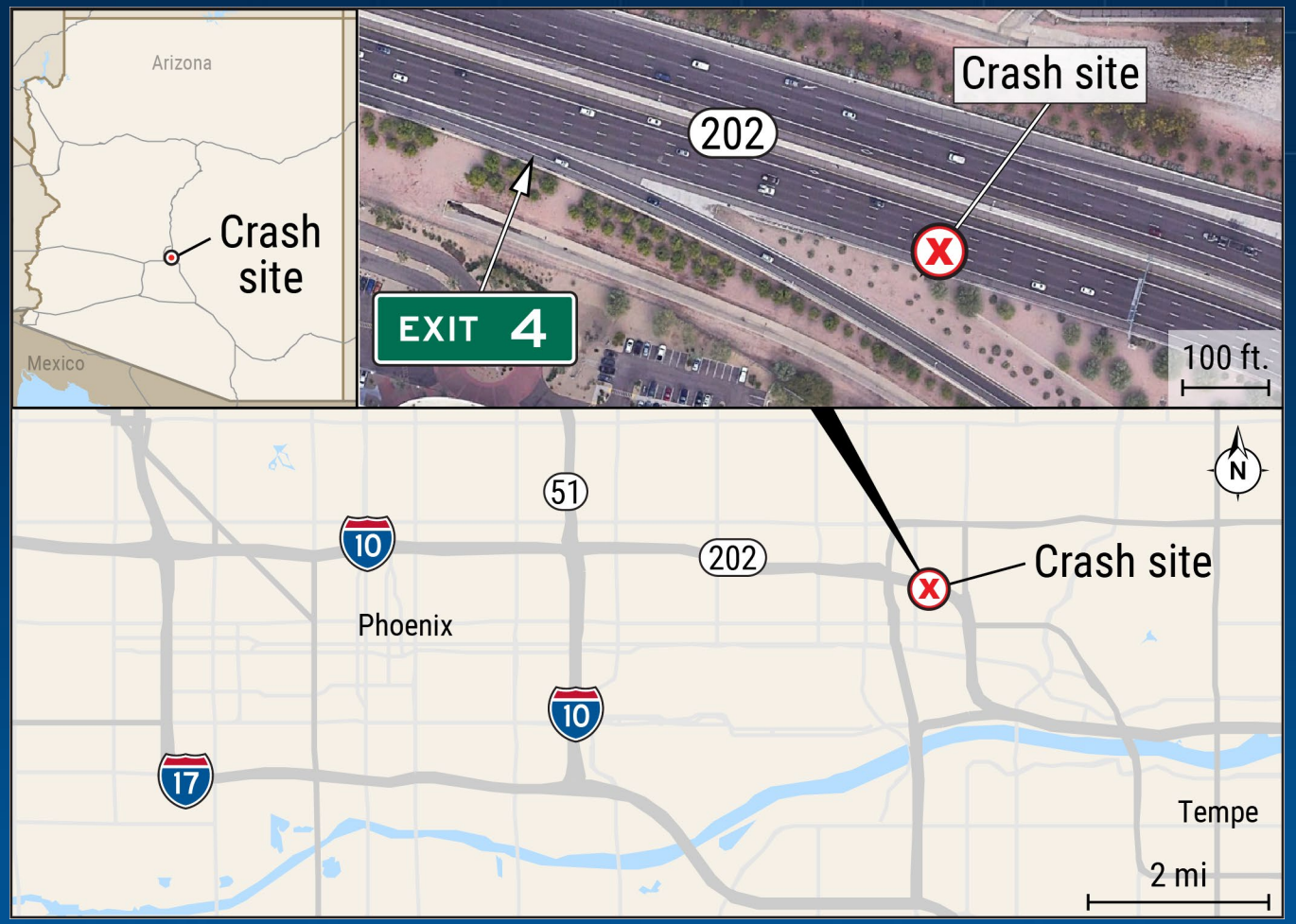
Michele Beckjord
Investigator-in-Charge

Crash Information and Location

June 9, 2021

Arizona Milk Transport, Inc.

- State Route 202
  - Eastbound 5 lanes
  - Traffic queue in right lane
  - Driver did not slow down or steer
  - Impact at 62 mph



Source: Google Earth, HERE, ESRI, NTSB overlay

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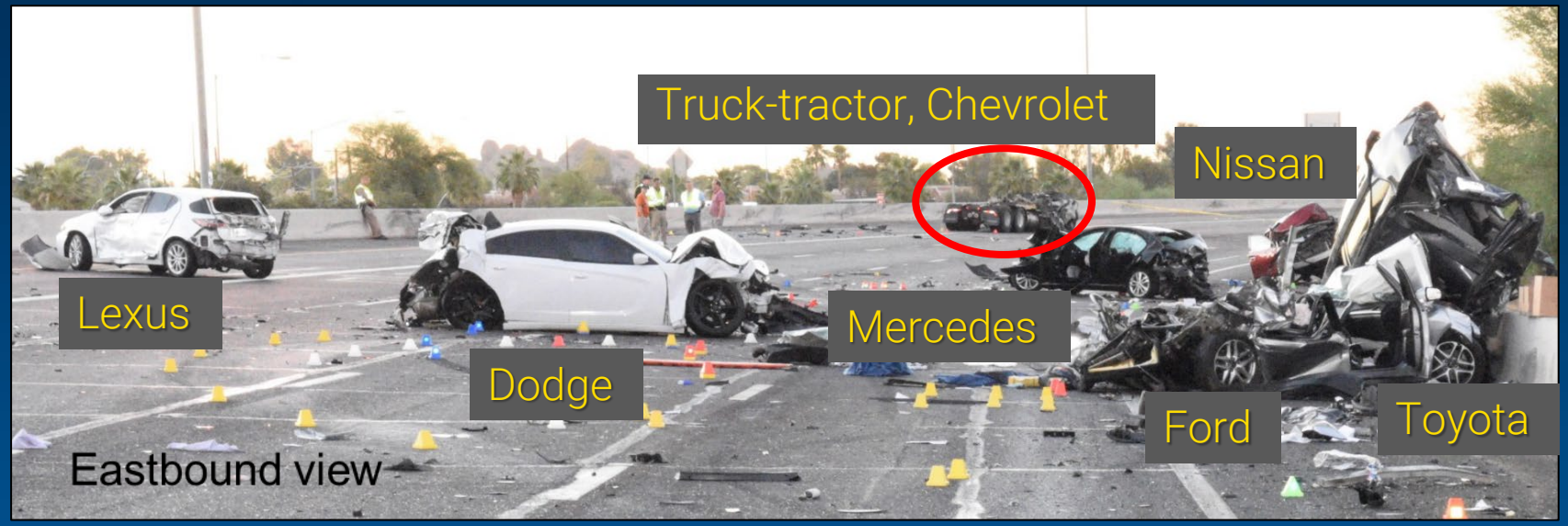
Crash Vehicles

Final rest positions of vehicles

- 2016 Freightliner truck-tractor, tank-trailer
- 2016 Ford Fusion
- 2013 Toyota Prius
- 2021 Chevrolet Equinox
- 2015 Nissan Altima
- 2015 Dodge Charger
- 2018 Mercedes Benz C300W
- 2013 Lexus CT200H



Source: AZDPS– NTSB overlay

Injury Table

Occupants	Fatal	Serious	Minor	None	Total
2016 Freightliner truck	--	--	--	1	1
2016 Ford Fusion	2	2	--	--	4
2013 Toyota Prius	--	1	--	--	1
2021 Chevrolet Equinox	1	--	--	--	1
2015 Nissan Altima	1	1	2	--	4
2015 Dodge Charger	--	1	1	--	2
2018 Mercedes-Benz C300W	--	--	2	--	2
2013 Lexus CT200H	--	--	1	--	1
TOTAL	4	5	6	1	16

On-Scene and Investigative Staff

Michele Beckjord	Investigator-In-Charge
Eric Gregson	Technical Reconstruction
Rafael Marshall, PhD	Human Performance
Michael Fox	Motor Carrier Factors
Ronald Kaminski	Survival Factors
David Rayburn	Highway Factors
Jerome Cantrell	Vehicle Factors
Brian Bragonier	Vehicle Factors (on-scene)
David Pereira	Vehicle Factors
Kyle Garner	Recorders
Robert Squire	Technical Reconstruction
Aaron Sauer	UAS-RPIC

Report Development Staff

Ensar Becic, PhD	Project Manager
Monica Mitchell	Writer/Editor
Alice Park	Animation
Julie Perrot	Safety Recommendations
Christy Spangler	Graphics

Parties to the Investigation

Federal Motor Carrier Safety Administration (FMCSA)

Arizona Department of Public Safety (AZDPS)

United Dairymen of Arizona (UDA)

Daimler Trucks North America (DTNA)

Excluded Factors

- Highway design
- Mechanical condition of truck-tractor, tank-trailer, and passenger vehicles
- Emergency response was timely and effective

Safety Issues

- Inadequate safety culture of the motor carrier
- Reduce risk of fatigue for drivers operating under an agricultural hours-of-service (HOS) exemption
- Improve prioritization of messages displayed on dynamic message signs
- Increase use of occupant restraints for all seating positions
- Expedite collision avoidance technologies

Staff Presentations

Eric Gregson	Collision sequence with animation
Rafael Marshall, PhD	Driver fatigue
Michael Fox	Motor carrier factors / agricultural hours-of-service exemption
Eric Gregson	Prioritization of messages on dynamic message signs
Ronald Kaminski	Occupant protection
Jerome Cantrell	Collision avoidance technologies

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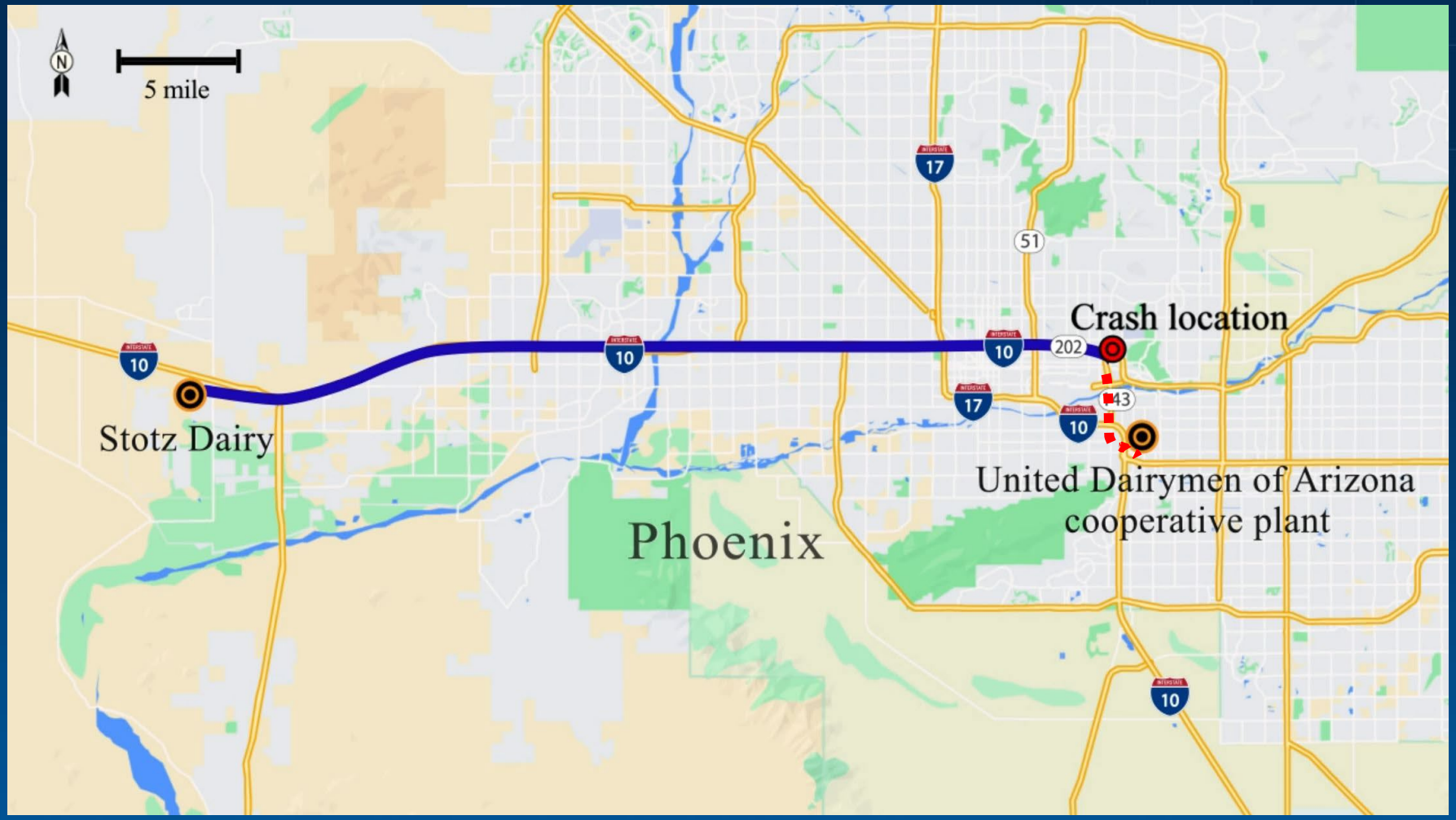
Collision Sequence with Animation

Eric Gregson
Technical Reconstruction

Route



Source: Google Earth, NTSB overlay.

Traffic Queue

Source: AMT forward-facing video.

- Position of traffic queue in right lane
- Approached at 62–64 mph
- Vehicle data showed no braking
- Sufficient roadway existed for normal slowdown or stopping prior to impact

AMT Combination Unit

2016 Freightliner Cascadia truck-tractor

2015 Walker Stainless Equipment tank-trailer

- On-board video system provided valuable information
  - Speed
  - Driver response

Passenger Vehicle Data

- Passenger vehicle airbag control modules (ACM)
- Provided key information
  - Vehicle speed
  - Seatbelt use
  - Primary or secondary impacts

Vehicle Positions

Source: NTSB

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Animation

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Driver Fatigue

Rafael Marshall, PhD
Human Performance Group Chairman

Introduction

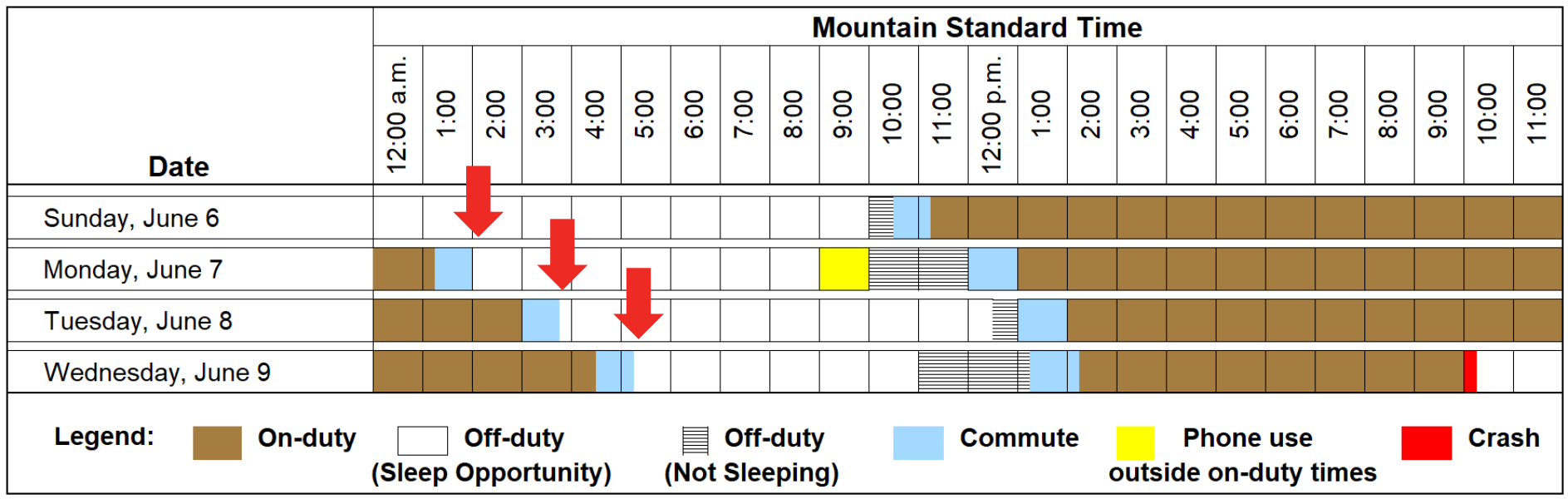
- Driver background
- Driver activities before the crash
- Video evidence prior to crash
- What we found

Driver Background

- Worked for Arizona Milk Transport since 2008
- Valid Arizona commercial driver's license (CDL) and a current medical certificate
- No history of convictions, violations, or crashes
- Drove the same truck for 3 years and was familiar with its operation
- No pre-existing medical conditions and no prescription drug use
- Postcrash toxicology negative for alcohol and drugs of abuse

Driver Activities Before the Crash

- Worked between 13-14 hours per day
- He arrived home at an increasing later time, around 2 a.m., 3:30 a.m., and 5 a.m.
- Had about 5.5-6 hours of sleep opportunity on the day of the crash



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Video from Driver Monitoring System

- Crash occurred as the driver was delivering his second load of milk to UDA
- Truck equipped with in-dash video camera that captured footage inside the truck cab and outside the windshield

(Source AMT. Overlay NTSB)

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Video from Driver Monitoring System

(Source AMT. Overlay NTSB)

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Video from Driver Monitoring System

(Source AMT. Overlay NTSB)

Video of Driver Actions

Driver statement

- Noticed brake lights in the distance before colliding with something

Video footage 8 seconds before impact

- Truck driver was facing forward, with his left hand on the steering wheel
- Had an earphone in his ear, but was not on a call or texting
- No indication of response to the approaching traffic queue

Video footage 0.25 seconds before impact

- Driver lifted his right hand from his lap and gripped the steering wheel

What We Found: *Driver Fatigue*

Exclusions

- Driver was properly licensed and was an experienced truck driver
- He was not distracted by his phone or any other external source
- He was not impaired by alcohol or other drugs

Driver Fatigue

- Long work hours
- Reduced sleep opportunity
- Lack of response to the conspicuous brake lights

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Motor Carrier Factors and Agricultural Exemption from Hours-of-Service Limits

Michael Fox
Motor Carrier Group Chairman

Overview

Operations of Arizona Milk Transport

- Carrier overview
- Safety culture

Broader oversight of agricultural HOS exemption

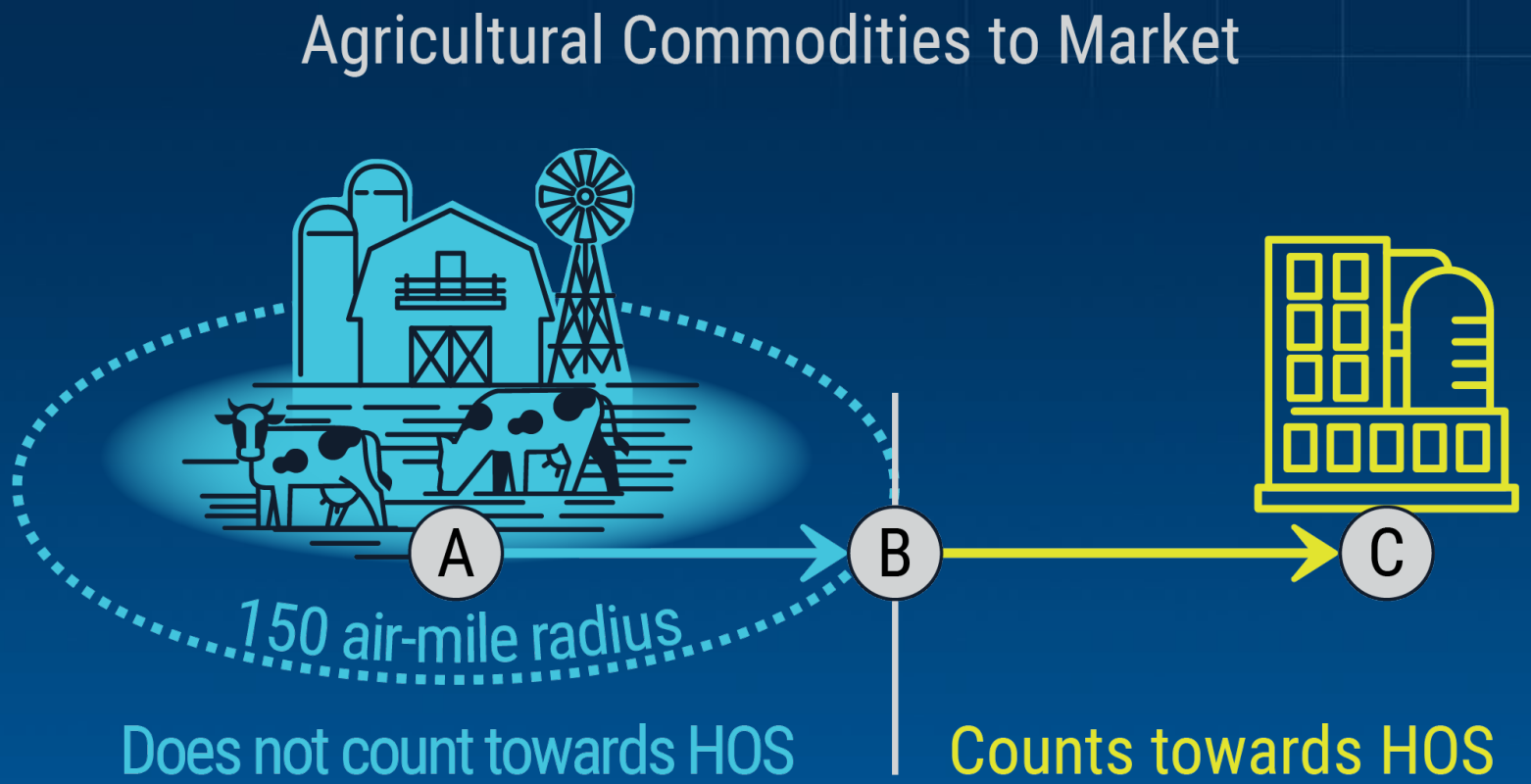
- Fatigue management programs
- Associations (milk / dairy) and CVSA
- Federal regulations

Arizona Milk Transport Inc. (AMT)

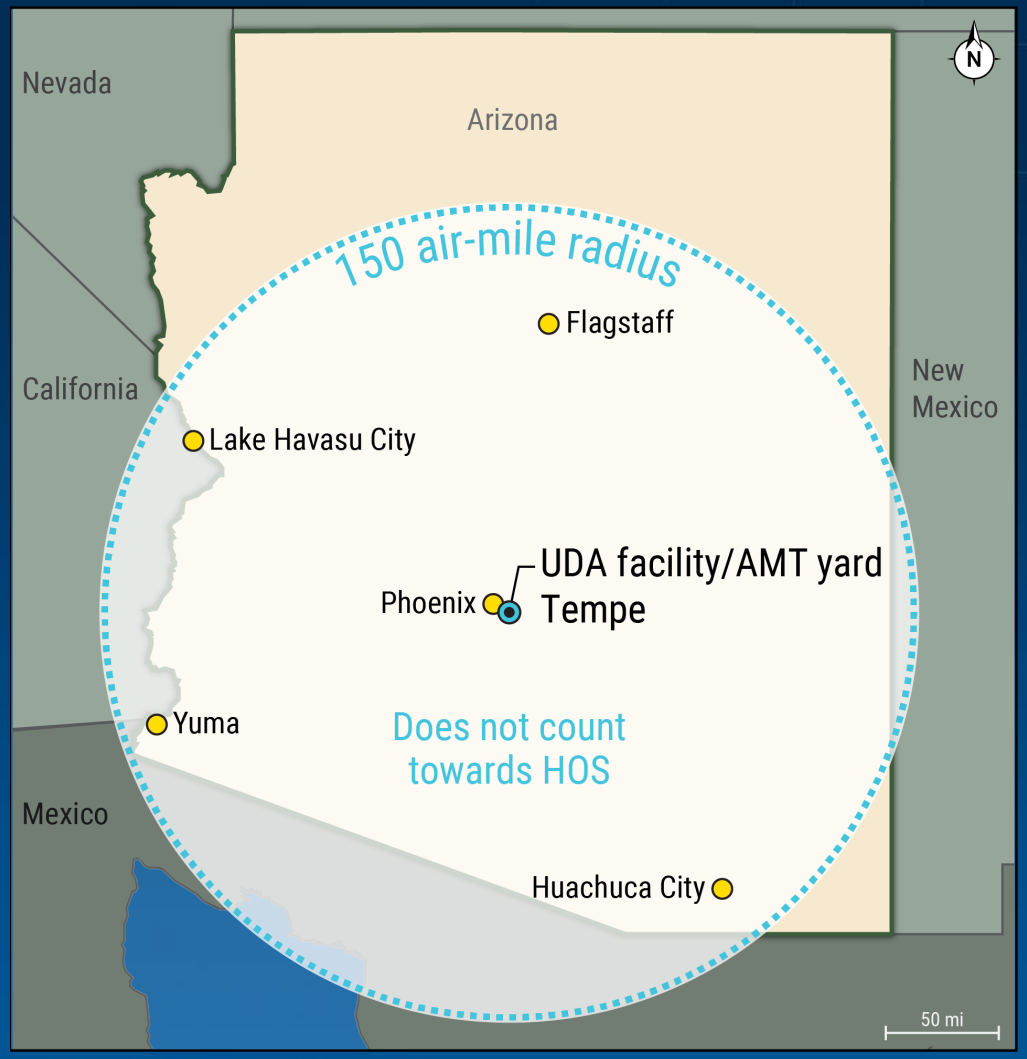
- Obtained USDOT number in 2005
- Intrastate carrier – hauls raw milk
- 26 truck-tractors, 0 trailers
- 35 CDL drivers
- Operated under agricultural (AG) hours-of-service (HOS) exemption

49 *CFR* 395.1(k) Agricultural (AG) Exemption

- Determined by the state
- Arizona harvest all year
- All time within the 150 air-mile radius exempt
- Outside of radius, HOS apply
- Drivers operating under AG exemption could be at greater risk of fatigue



150 Air-Mile Radius in Arizona



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AMT Safety Culture

- AMT's HOS guidance based on USDOT rules to control fatigue
- AMT failed to enforce its policies regarding maximum on-duty hours
- Did not explain the AG exemption
- Did not have standalone fatigue policy

Source: AMT

Driver Oversight: AMT Hours of Service

- AMT policy required drivers complete a log sheet when operating
  - On-duty for more than 12 hours
- Drivers restricted to:
  - Maximum 11 hours of driving
  - 14 on-duty hours
  - 60 hours / 7-day period
- AMT policy stated drivers audited at the end of every pay period

Driver Oversight: Drivers Did Not Follow AMT Policies

Crash-Involved Driver's Reported Hours vs. Reconstructed			HOS Regulations for Non-Exempt
Dates	**Driver-Reported Hours**	**NTSB-Reconstructed On-Duty Hours**	
May 16–22	70	83.25 (7 days)	60 hours in 7- day period
May 23–29	70	77.25 (7 days)	
May 30–June 5	60	63.5 (7 days)	
June 6–8	36	42.5 (3 days)	

- On-duty hours by other AMT drivers
  - 4 worked more than 60 hours in 7-day period; one reported 80 hours and another reported 89 hours

AMT Fleet Management System

- Triggered by such as hard braking, stability control event
- Crash-involved driver
  - Reprimanded in September 2020 for cell phone use
  - A month before crash, the Drivecam event showing cell phone use; AMT did not discipline the driver
- Other drivers
  - Many drivers with dozens of events, 1 with 128 events
  - AMT did not assign 77% of reported events
  - Drivers kept repeating the same risky behaviors showing ineffective fleet management

What We Found: *AMT Oversight Issues*

- AMTs lack of oversight to ensure adherence to company policies
  - Allowed the crash-involved driver to operate well beyond the carrier allowable hours of operation
  - AMT's implementation of the fleet management and driver monitoring system was ineffective
- What we propose:
  - Two recommendations to Arizona Milk Transport

What We Found: *AMT Lacked Fatigue Mitigation*

- AMT did not have a fatigue management program or incorporate fatigue in its policies
- NTSB history of recommending fatigue management program
- North American Fatigue Management Program (NAFMP)
  - Education for drivers, their families, managers, dispatchers, shippers
  - Screening for sleep disorders and treatment practices
- What we propose:
  - One recommendation to Arizona Milk Transport

What We Found: *CVSA's Role in Promoting NAFMP*

- Implementing a fatigue management program reduces crash risk
- In 2021 FMCSA awarded the contract to CVSA to operate the NAFMP
  - Grow the program and develop future reiteration through education and outreach
  - Conduct webinars, in-person meetings, and educational events at conferences
- CVSA can influence all motor carriers in reducing the risk of operating while fatigued, including those operating under the AG exemption
- What we propose:
  - One recommendation to the Commercial Vehicle Safety Alliance

What We Found: *Importance of Associations*

- US Food and Drug Administration (FDA) liaison meeting
  - National Conference for Interstate Milk Shipments (NCIMS)
  - International Dairy Food Association (IDFA)
  - International Milk Haulers Association (IMHA)

- Dairy industry can reduce the risk of fatigue by incorporating a transportation safety component in the oversight of motor carriers

- What we propose:
  - One recommendation to the IDFA and NCIMS and one recommendation to the IMHA

Broader Oversight: Federal Role

- HOS limits have stayed consistent, 10–12 max driving hours and 12–15 on-duty hours
- Research showed drivers operating 10–11 hours have 3.59 times greater crash rate over the first hour
- AG-exempt drivers can operate unlimited hours within the 150 air-mile radius
- FMCSA lacks data regarding number of AG-exempt carriers, crash rate, or severity of crashes

What We Found: *Lack of Monitoring & Oversight*

- Drivers operating under the AG exemption would be at greater risk of fatigue
- Agricultural exemption not intended to be unmonitored
- National Highway System Designation Act, Section 345(d)
- Extent of operation by AG-exempt motor carriers beyond traditional HOS is unclear
- What we propose:
  - Two recommendations to the US Department of Transportation (USDOT)

Summary

- AMT safety culture was inadequate
  - Did not follow their own policies
  - Driver monitoring system not used to correct driver behaviors
- Fatigue management programs are an effective tool for managing fatigue
- Associations can play a vital role by encouraging their members who use contracted carriers to implement a fatigue management program
- Agricultural exemption needs evaluation by the USDOT

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Prioritization of Messages on Dynamic Message Signs

Eric Gregson
Technical Reconstructionist

Overview

- What is a dynamic message sign
- Arizona Department of Transportation (ADOT) priority levels for dynamic message signs
- Priority level ADOT used for the dynamic message signs
- Appropriate priority level for the dynamic message signs messaging relative to safety risk of the incident

What is a Dynamic Message Sign (DMS)

- Large signs over or near roadways
- Display messages to the public
  - Safety messages
  - Other travel information
  - Travel times posted during rush hours

Source: Arizona Department of Transportation (ADOT)

ADOT Priority Levels for Dynamic Message Signs

10 priority levels of messages

- High-priority messages (levels 1–3)
  - Level 1 – Automated wrong-way messages
  - Level 2 – Active unplanned closures
  - Level 3 – Active planned closures
- Low-priority messages (levels 4–10)
  - Level 4 – Active unplanned lane restrictions or ramp closures
  - Level 5 – Active planned lane restrictions or ramp closures
  - Levels 6–10 – Information related event messages, such as Amber alerts

Pre-Crash Road Closure Incident

- At 9:16 p.m. AZDPS notified the Transportation Operations Center, advising all five eastbound lanes were closed
- Eastbound lanes were reopened at 10:00 p.m.
- Multivehicle collision occurred at 10:07 p.m.

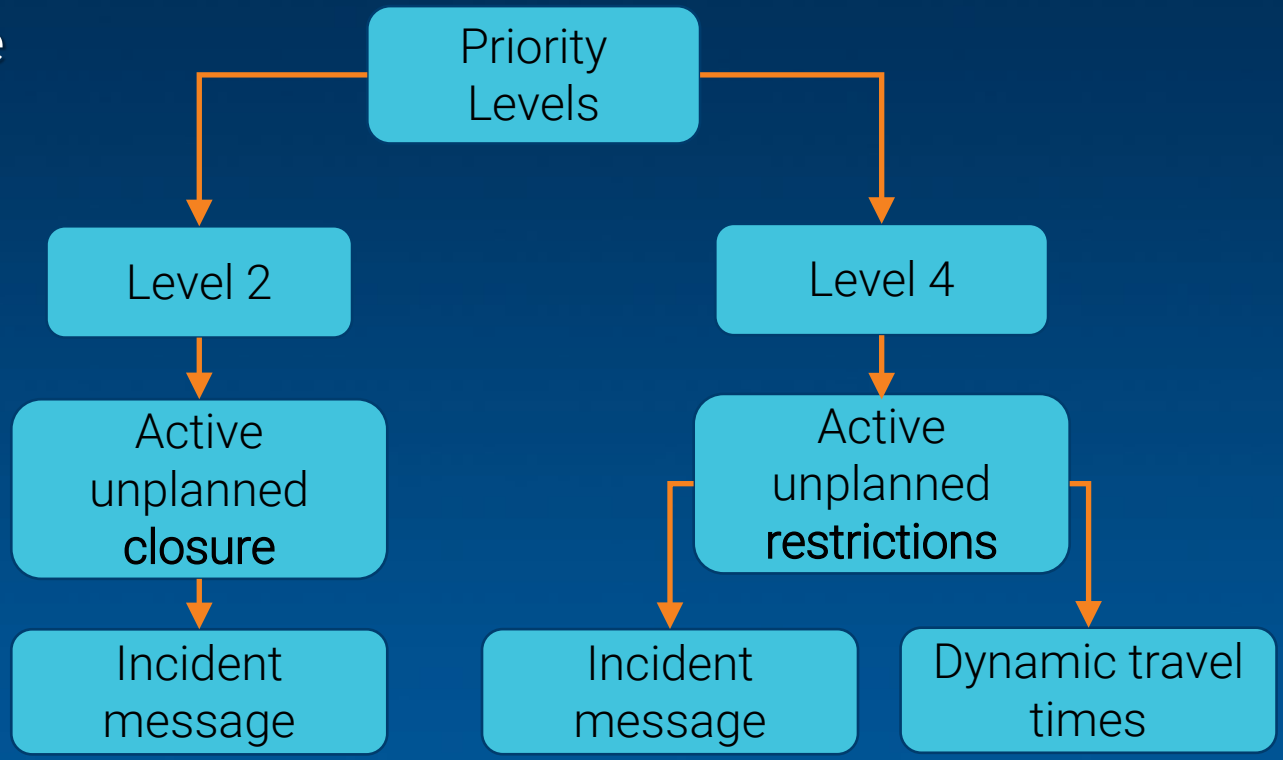
Level ADOT Used for Dynamic Message Signs

ADOT classified traffic stoppage as low-priority message level 4

- Reserved for unplanned lane restrictions
- Alternates with dynamic travel time message

High-priority message level 2

- Active unplanned road closure
- No alternating messages



Impact of Message Prioritization on Crash

- A level 2 high-priority message matched the safety risk of the traffic incident
- Had the message regarding law enforcement activity and traffic stoppage been classified a high-priority message level 2
  - Message would not have alternated with the dynamic travel times
  - Continuously visible to motorists

What We Found: *Dynamic Message Signs*

- Dynamic message signs should display messages that match the safety risk of the traffic incident
- Unlikely that the level 4 message affected truck driver's failure to see traffic queue
- Low-priority message deemphasized the safety risk
- What we propose:
  - One recommendation to the Arizona Department of Transportation

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Occupant Protection

Ronald Kaminski
Survival Factors Group Chairman

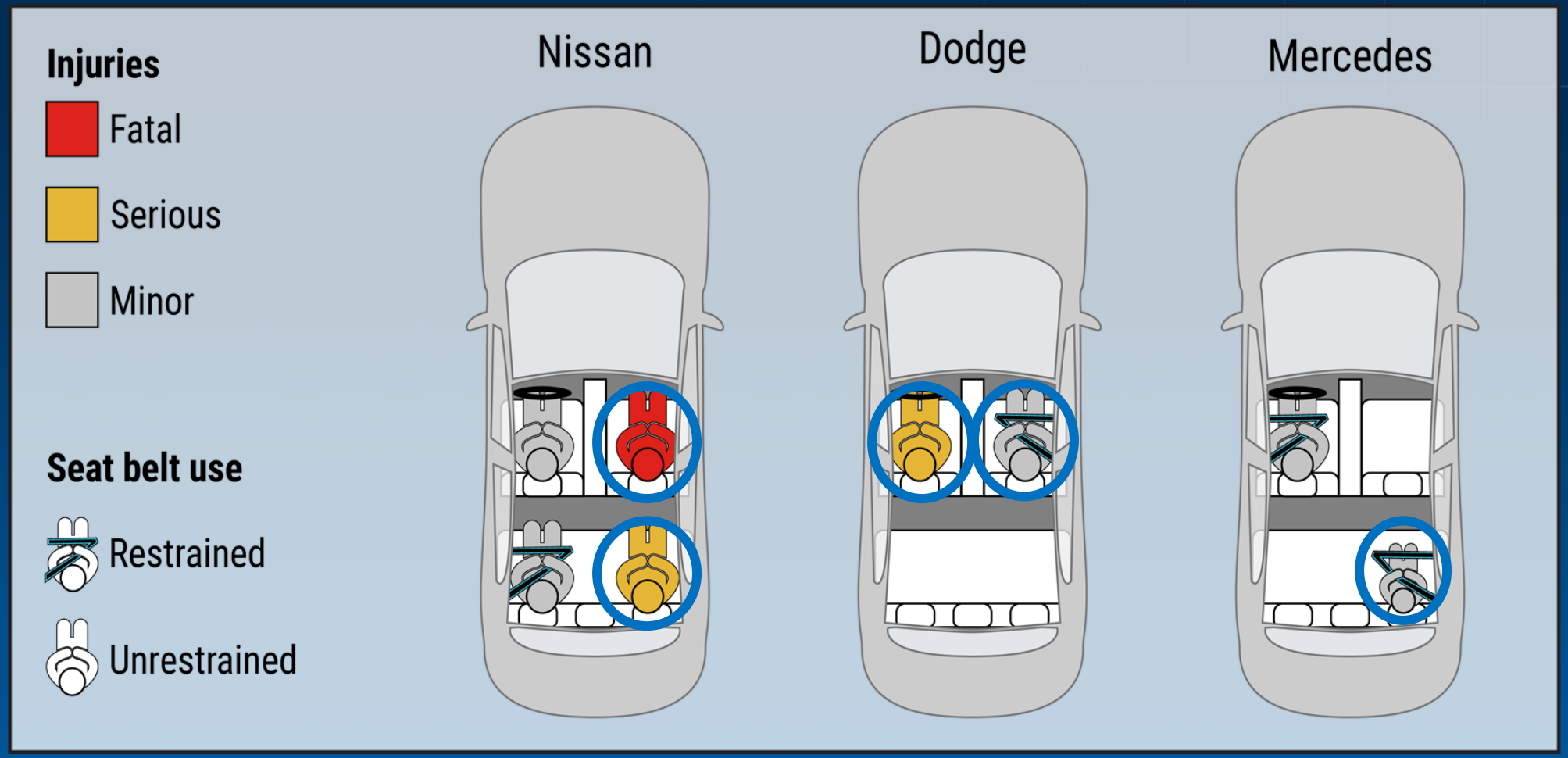
Overview

- Importance of wearing occupant restraints
- Restraint usage in Phoenix crash
- Arizona’s seat belt laws

Occupant Protection

- Lap/shoulder belts are designed to control an occupant's motion during a crash
- Vehicle occupants wearing a lap/shoulder belt less likely to be ejected and sustain fatal injuries
- Use of booster seats for rear-seated child occupant places child in correct position to benefit from lap/shoulder belt
- Injuries resulted from lack of using the available restraints

Occupant Restraint Use



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Arizona Seat Belt Statute

- In Arizona, secondary enforcement means a police officer may ticket a driver/passenger not wearing a seat belt only after stopping the vehicle for another offense
- Arizona's secondary enforcement seat belt use law applies only to front seat occupants
- 2014 crash in Davis, Oklahoma, involving a seatbelt-equipped medium-size bus

  Enact legislation that provides for primary enforcement of a mandatory seat belt use law for all vehicle seating positions equipped with a passenger restraint system (H-15-42)

What We Found: *Lack of Restraint Usage*

- Use of lap/shoulder belts by vehicle occupants would have reduced injuries, ejection
- Seat belt use for adults in states with primary enforcement seat belt use laws is 4% higher than in other states
- In 2019, the Arizona State Legislature considered, but did not pass bill
- What we propose:
  - Reiterate Safety Recommendation H-15-42

What We Found: *Improper Restraint Usage*

- Lap/shoulder belt use without appropriate booster seat contributed to child occupant injuries
- Children are usually between 8 and 12 years old before a seat belt fits properly
- Booster seats are 65–68% effective in reducing moderate-to-critical injuries of 5- to 8-year-old vehicle occupants in all types of crashes
- What we propose:
  - Safety Alert - Child Passenger Safety (ntsb.gov)

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Collision Avoidance Technologies

Jerome Cantrell
Vehicle Factors Group Chairman

Overview

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

Forward Collision Avoidance System (CAS)

- Designed to mitigate or prevent rear-end crashes
- Includes visual/audible warning (FCW), automatic emergency braking (AEB)
- Performance affected by
  - Generational capabilities
  - Roadway and crash parameters (environment, speed, forward hazard)

Forward CAS: Standards and Testing

- No federal performance standards for CAS in heavy vehicles
- National Highway Traffic Safety Administration (NHTSA) published testing protocols in 2019
  - No pass/fail criteria
  - Test speed of 25 mph for a stopped vehicle ahead
  - Straight roadway, clear weather
  - Rear of a passenger vehicle as the only hazard

Previous NTSB Recommendations

- More than 20 recommendations, starting in 1995
- 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

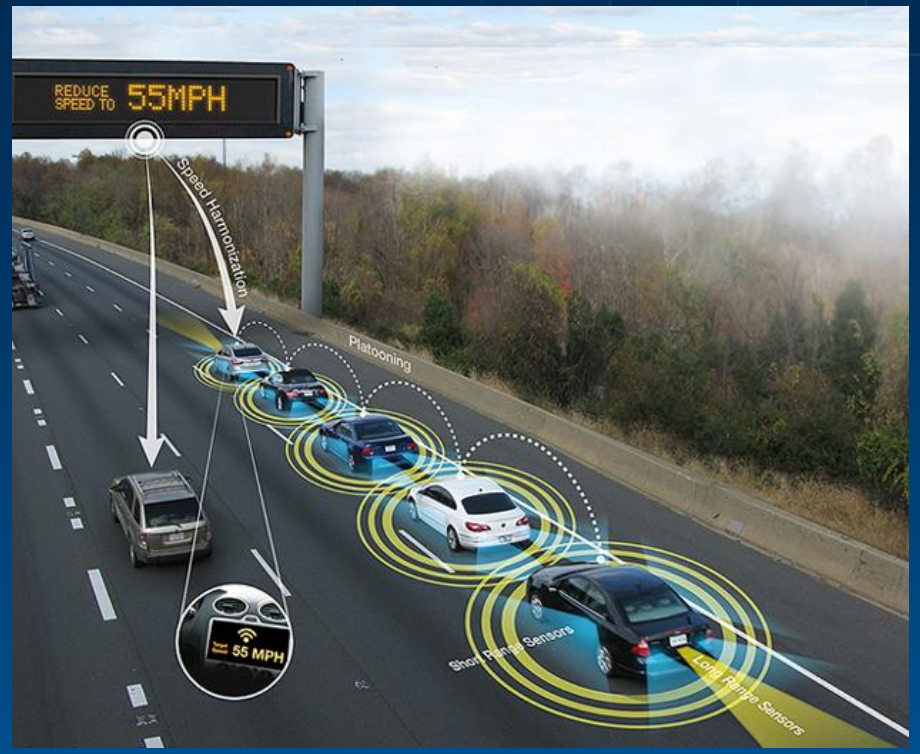
- Remains classified Open—Unacceptable Response

What We Found: *Forward Collision Avoidance Systems*

- Crash speed parameter (62–64 mph) exceeded NHTSA's test protocols (25 mph)
- What we propose:
  - Reiterating H-15-5: Complete development and application of performance standards and protocols for the assessment of forward CAS in commercial vehicles

Connected Vehicle Technology

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



Source: USDOT

Previous NTSB Recommendations: Connected Vehicle

In 2013, issued safety recommendations to NHTSA:

- H-13-30 – Develop minimum performance standards for connected vehicle technology for all highway vehicles
- H-13-31 – Once minimum performance standards for connected vehicle technology are developed, require this technology to be installed on all newly manufactured highway vehicles

Recommendation status

- Reiterated 5 times since 2013
- Notice of Proposed Rulemaking issued in 2017
- Currently classified Open–Unacceptable Response

What We Found: *Connected Vehicle Technology*

- V2X technology provides alerts earlier than camera or radar sensors
- In the Phoenix crash, connected vehicle technology:
  - Might have prevented or mitigated vehicle collisions
  - Might have reduced injury severity
- What we propose:
  - Reiterating H-13-30 and H-13-31 to NHTSA

Impact of Recent FCC Rulemaking

2021 Federal Communications Commission (FCC) final rule:

- Terminated the use of the lower 45 MHz
- Forced state DOTs and local governments to end Dedicated Short-Range Communication (DSRC)-based V2I projects
- Harmful interference from unlicensed devices in neighboring spectrum bands

Previous NTSB Recommendations: V2X Deployment

- In 2022, issued safety recommendations
  - H-22-1 – To the USDOT to implement a plan for nationwide deployment of connected vehicle technology that 1) resolves the issue of interference, 2) ensures the sufficient spectrum for connected vehicle technology and 3) defines communication protocols for future deployment of connected vehicle technology
  - H-22-6 – To the FCC to implement appropriate safeguards to protect vehicle-to-everything communications from harmful interference from unlicensed devices, such as those that use wi-fi

What We Found: *V2X Deployment*

- 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
- USDOT to ensure nationwide deployment needed
- What we propose:
  - Reiterate and classify recommendation H-22-6 to the Federal Communications Commission
  - Reiterate and classify recommendation H-22-1 to the US Department of Transportation

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