



National Transportation Safety Board

Truck-Tractor Semitrailer
Median Crossover Collision
With Medium-Size Bus on
Interstate 35, Davis, Oklahoma

September 26, 2014



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Median Crossover Collision Davis, Oklahoma

Jennifer Morrison
Investigator-in-Charge

Crash Location



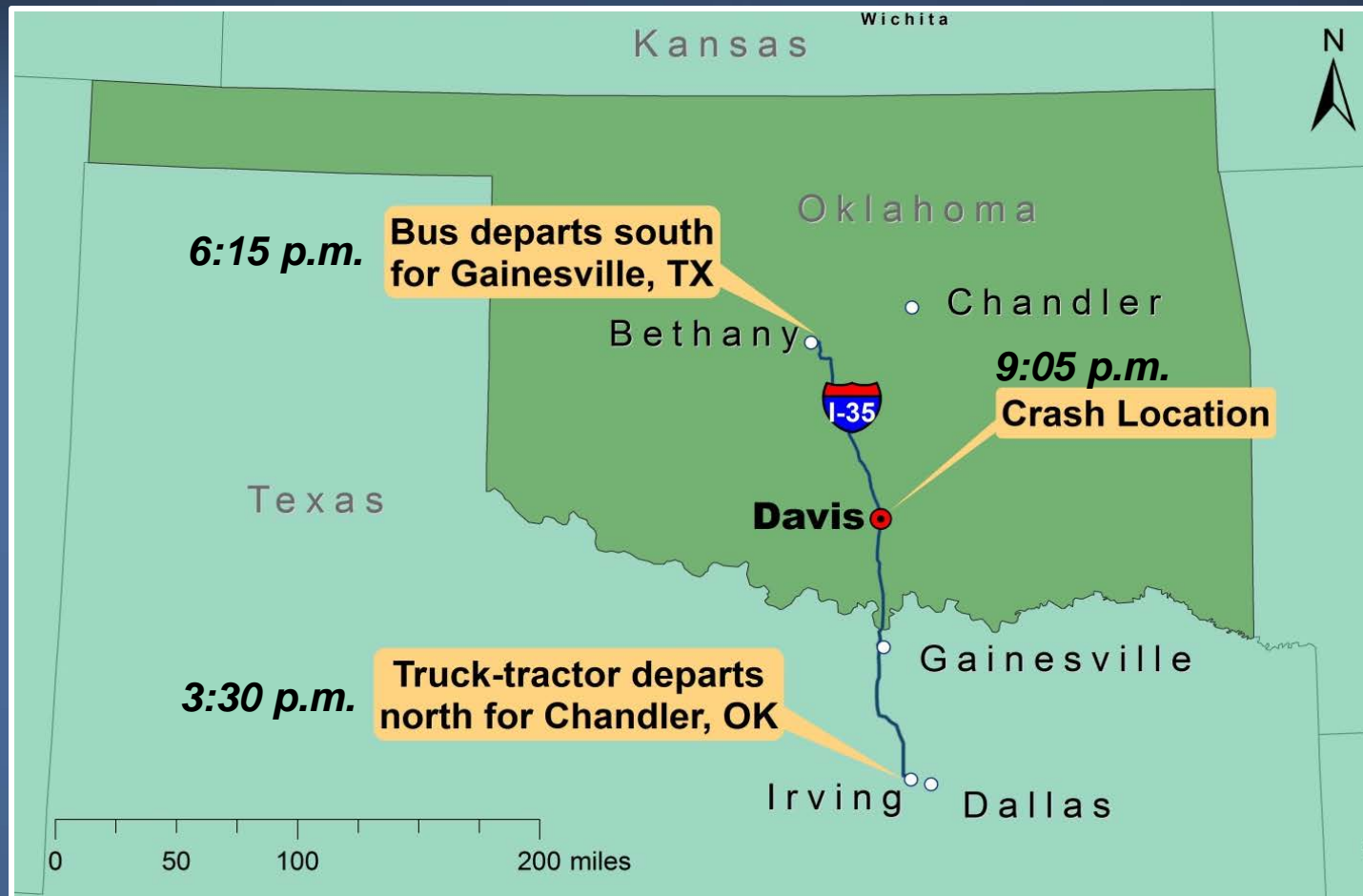
Crash Overview

- 2013 Peterbilt truck-tractor combination unit
 - 53-year-old driver

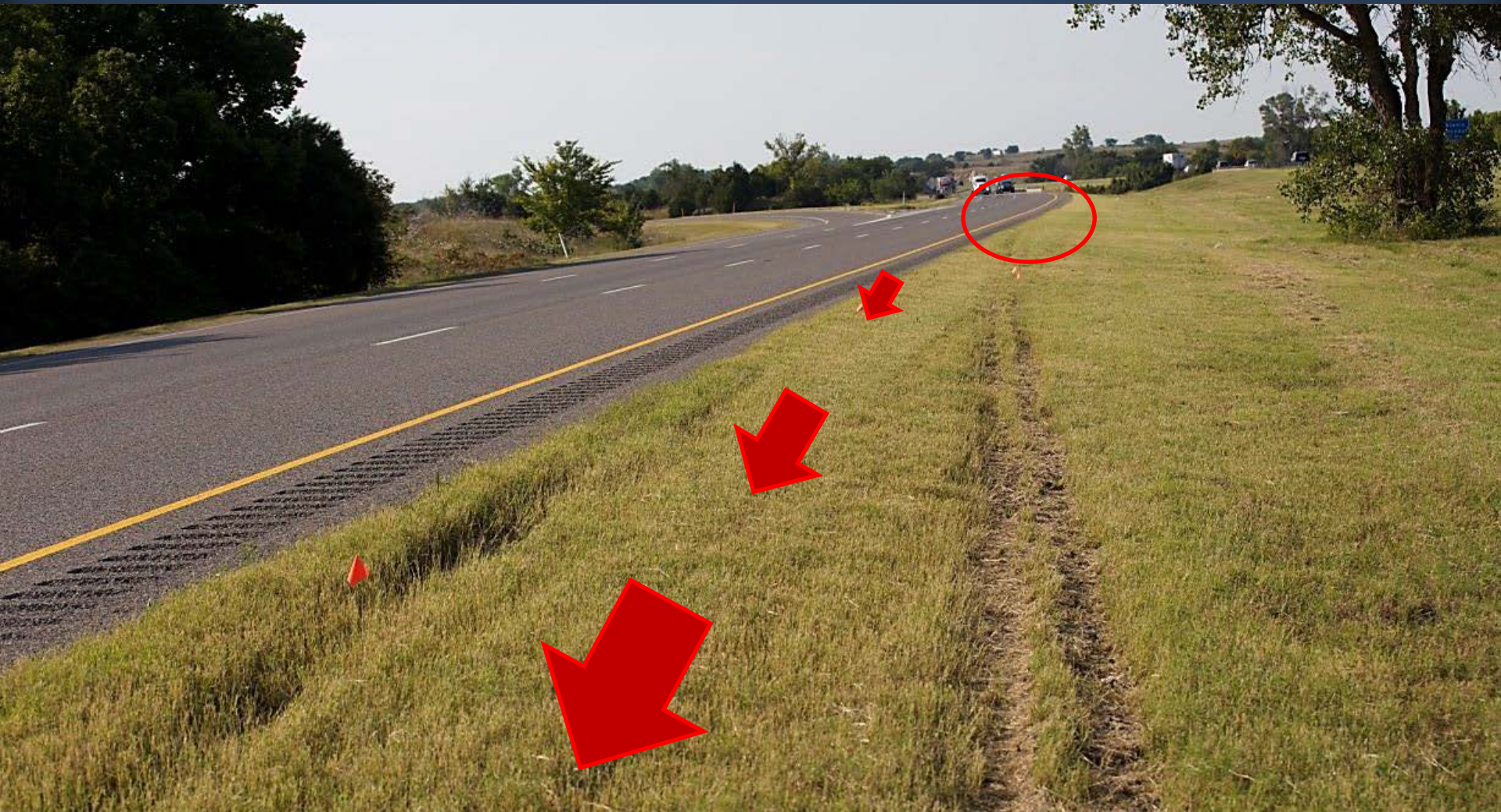
- 2008 Champion medium-size bus
 - 48-year-old driver
 - 15 passengers



Route Overview



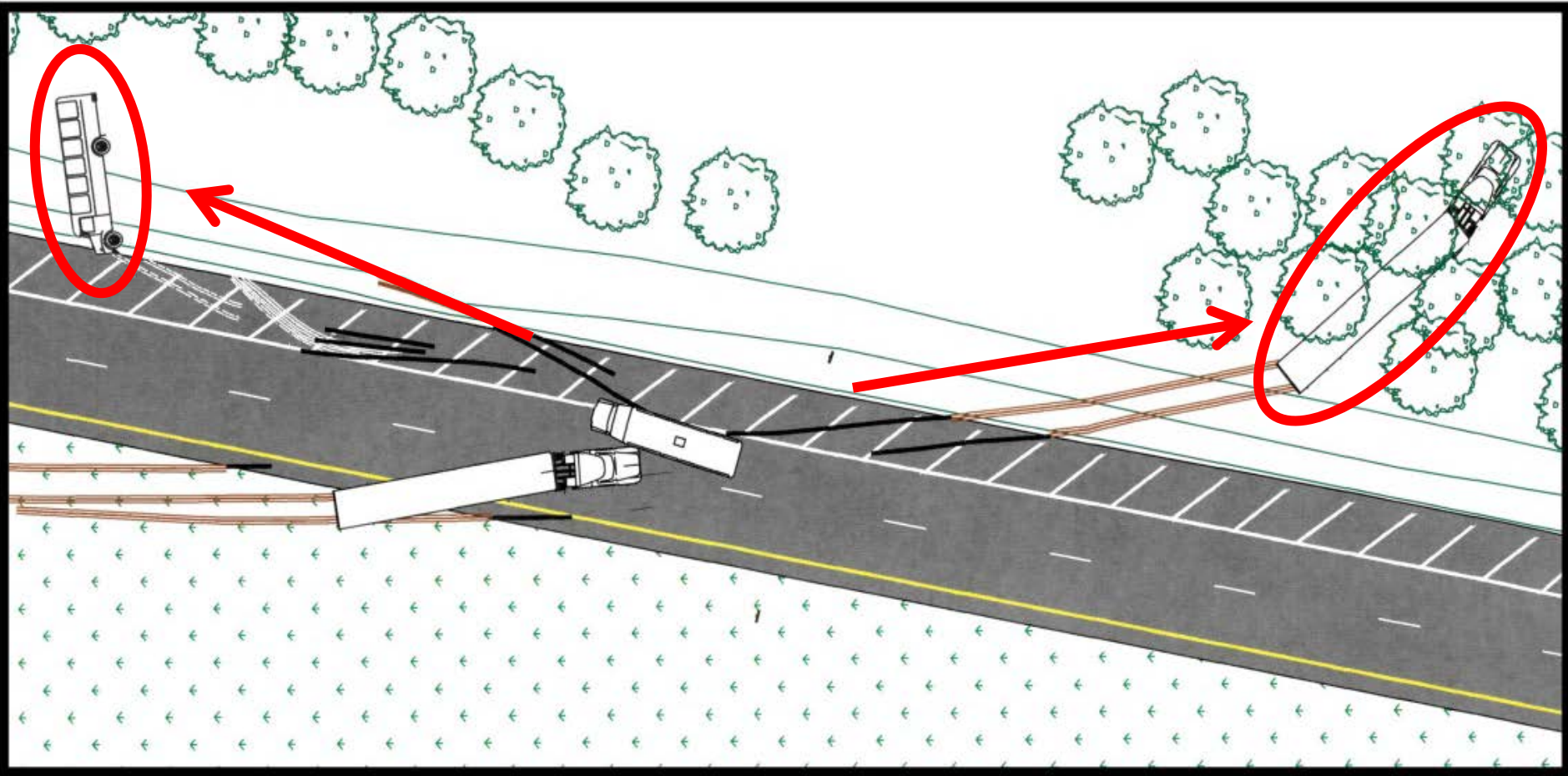
Roadway Departure



Path Through Median



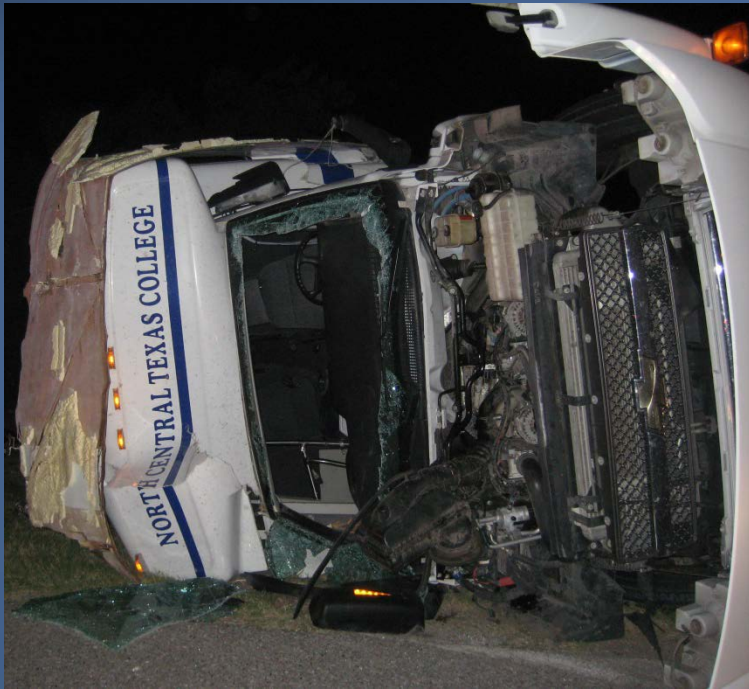
Impact Location



Animation



Vehicles at Final Rest



Scene Photographs: Oklahoma Highway Patrol

Injuries

- Bus passengers
 - 4 fatal
 - 5 serious
 - 6 minor
- Drivers
 - 2 minor

On-Scene Staff

- Member Robert Sumwalt, Member On-Scene
- Jennifer Morrison, Investigator-in-Charge
- Dennis Collins, Human Performance
- Mike Fox, Motor Carrier Factors
- Ron Kaminski, Survival Factors
- Kristin Poland, PhD, Mapping and Crashworthiness
- Dan Walsh, PE, Highway Factors
- Steve Prouty, Vehicle Factors
- George Haralampopoulos, Recorders

On-Scene Staff (continued)

- Dr. Nick Webster, Medical Factors
- Dr. Mary Pat McKay, Medical Factors
- Sean Dalton, Special Assistant
- Terry Williams, Public Affairs
- Eric Weiss, Public Affairs
- Antion Downs, Public Affairs
- Elias Kontanis, PhD, Transportation Disaster Assistance
- Liam LaRue, Government Affairs
- John Whitener, Information Technology
- Andrew Bucklin, Information Technology

Report Development Staff

- Ensar Becic, PhD, Project Manager
- Debbie Stocker, Writer Editor
- Julie Perrot, Safety Recommendations
- Ben Allen, Legal Counsel
- Tracy White, Legal Counsel
- Robert Squire, Reconstruction
- Shane Lack, Vehicle Performance
- Alice Park, Animation
- Eric Emery, PhD, Mapping Graphics
- Ivan Cheung, PhD, Mapping Graphics

Parties to the Investigation

- Oklahoma Highway Patrol
- Oklahoma Department of Transportation
- Federal Motor Carrier Safety Administration
- Quickway Transportation Inc.
- PACCAR Inc.

Safety Issues

- Truck driver's drug use
- Passenger restraint systems
- Crashworthiness of medium-size buses
- Vehicle data recording
- Median barriers



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Human Performance

Dennis Collins

Overview

- Performance of bus driver
- Performance of truck driver
- Evidence of truck driver synthetic cannabinoid use

Bus Driver

- No evidence of:
 - Licensing / experience issues
 - Distraction
 - Fatigue
 - Substance impairment
 - Medical conditions

Truck Driver

- Written statement indicates physical distraction (reaching)
- Statement inconsistent with physical evidence
- No visual/cognitive distraction
- No evidence of fatigue
- Medical conditions/medications

Synthetic Cannabinoid Evidence

- 5-fluoro-AMB in pipe
- Previous employer: declining performance, admits K2 use
- Wife: K2 use, “seizure-like” behavior
- Counselor: using synthetic drugs, including while at work



Photograph: Oklahoma Highway Patrol

Summary

- Bus driver
 - Excluded human performance factors
- Truck driver
 - Statement inconsistent with physical evidence
 - Distraction, fatigue, medications, medical conditions not factors
 - History of synthetic cannabinoid use
 - Synthetic cannabinoid found in truck



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Synthetic Cannabinoids

Dr. Nick Webster

Introduction

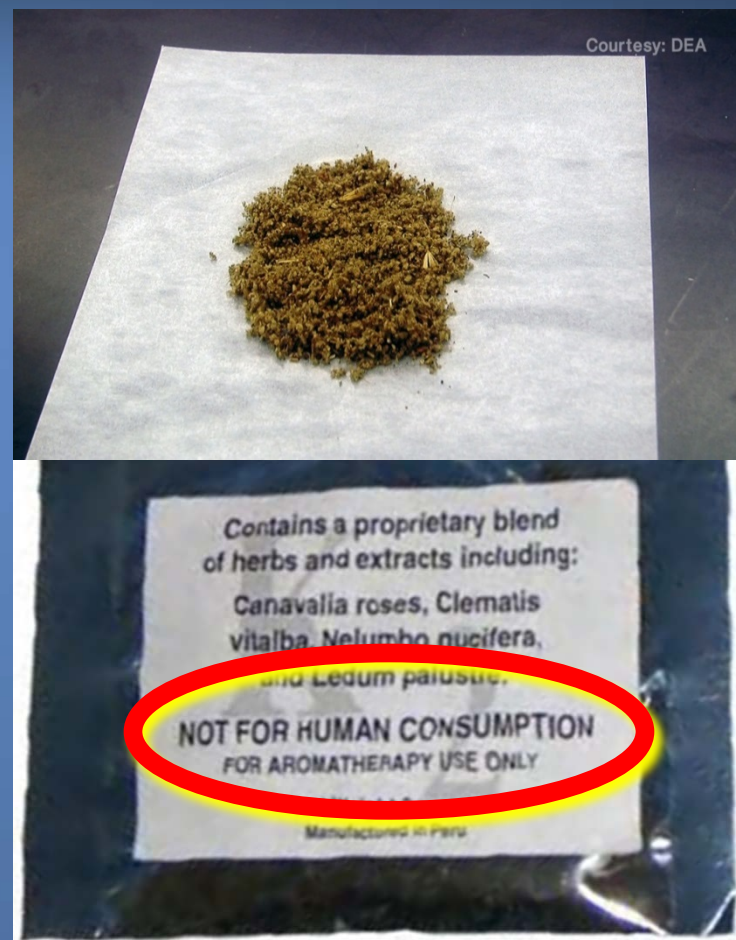
- Dangerous new class of drugs - synthetic cannabinoids
- Specific synthetic cannabinoid in this accident

Synthetic Cannabinoids

- Stimulate same brain receptors as tetrahydrocannabinol (THC) marijuana
- Synthesized in the 1980s for research into THC receptor
 - Dangerous side effects
- Not natural substitutes for marijuana

Synthetic Cannabinoid Packaging

- Applied to dried plant material
- Sold in shops and over the internet as “herbal incense” or “potpourri”
- Labeled “not for human consumption”



Synthetic Cannabinoids

- Hundreds of different names:
 - Spice
 - K2
 - Mellow Mood



Synthetic Cannabinoid Effects

- No product consistency
- Symptoms vary widely:
 - Euphoria
 - Psychosis
 - Nonresponsiveness
 - Seizures
 - Death

Synthetic Cannabinoid Adverse Events

- Adverse symptoms
 - Jan-April 2015; 330% increase (349 to 1,501) in poison control calls for symptoms related to SCs use
- Increase in deaths

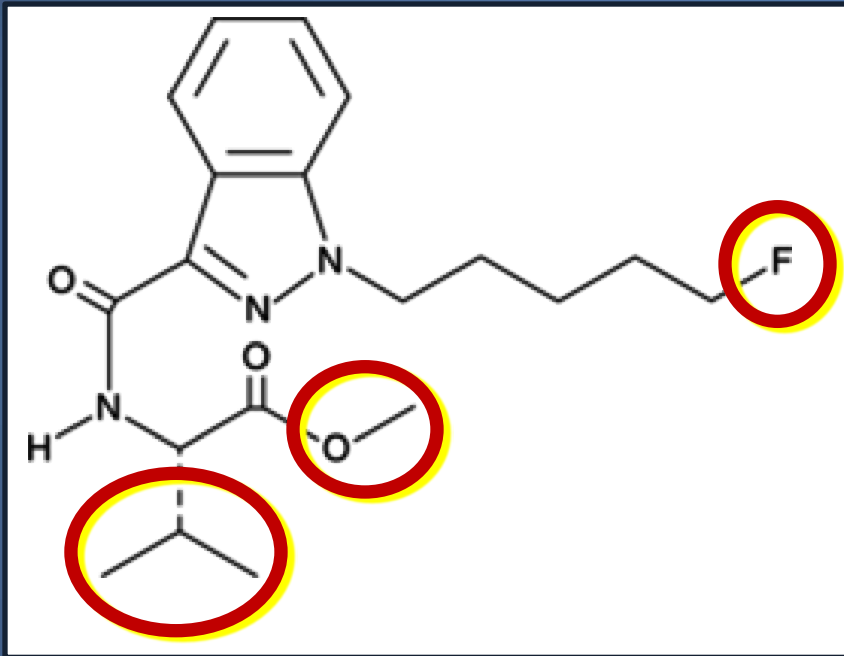
Scope of Problem

- New drug class
- Over 170 different synthetic cannabinoids have been identified
 - May be hundreds more
- Drug Enforcement Administration (DEA) Schedule I
 - 25 synthetic cannabinoids listed
 - Elusive target

Synthetic Cannabinoid Structure

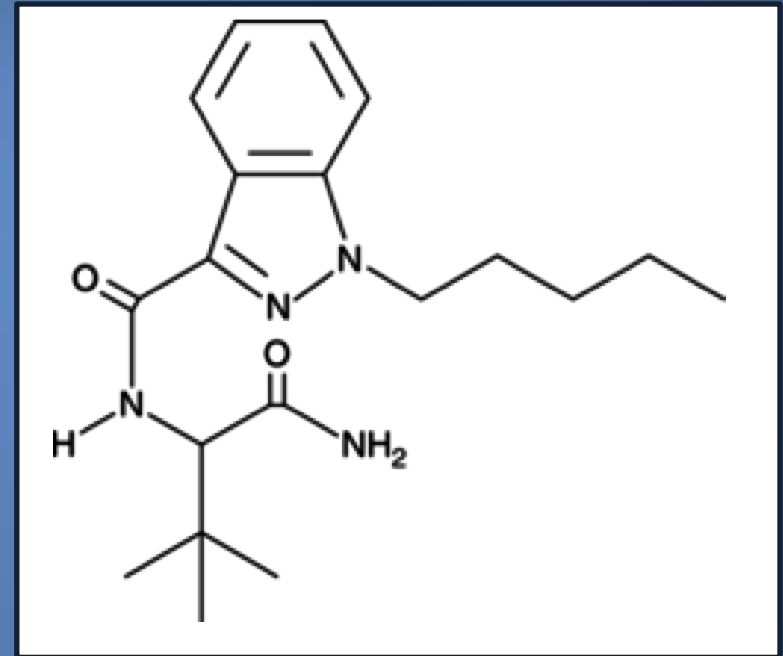
5-fluoro-AMB

In pipe - not a Schedule I Drug



ADB-Pinaca

Schedule I Drug



DEA determined 5-fluoro-AMB may be treated under Federal Law as a Schedule I

Drug Testing Challenges

- THC analysis well described
 - Abundant research
 - Easily identified for many days
- 5-fluoro-AMB testing issues
 - Drug elimination process unknown
 - Breakdown products / metabolites unknown
 - Timing unknown

Truck Driver's Postaccident Drug Testing

- Blood collected 2 hours and 45 minutes after the accident
- Positive for known medications
- Unable to confirm the presence or absence of 5-fluoro-AMB or its metabolites

Summary

- Synthetic cannabinoids are powerful, dangerous drugs
- Truck driver had history of synthetic cannabinoid use
- Pipe positive for 5-fluoro-AMB
- No corrective actions = nonresponsive
- No evidence for alternate explanations
- Truck driver incapacitation



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Synthetic Cannabinoids in Commercial Transportation

Mike Fox

Presentation Overview

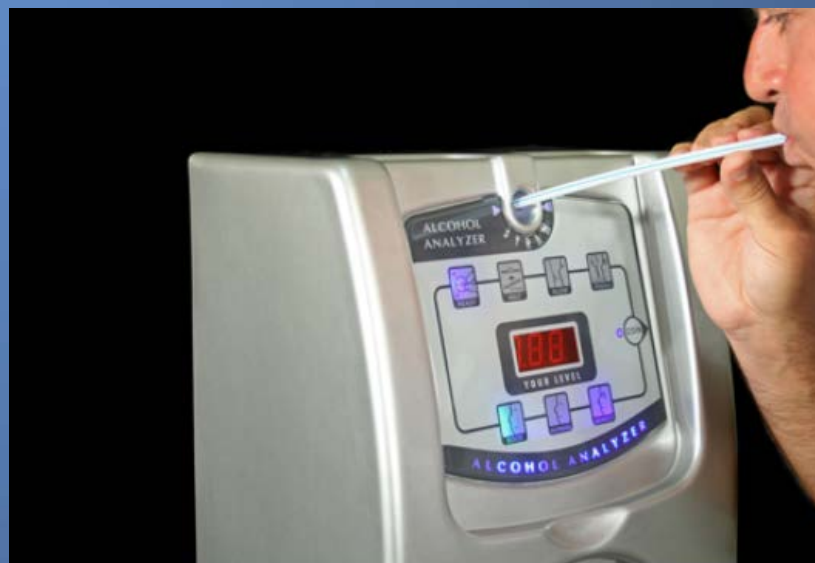
- Motor carrier compliance
- Current DOT testing Part 382/40
- Disconnect between synthetic cannabinoids & DOT testing
- Research on prevalence of synthetic drugs with CMV drivers
- FMCSA & stakeholders develop solutions to synthetic cannabinoid use

Motor Carrier Drug Testing

- Quickway Transportation
 - Properly qualified and screened
 - Random program in compliance
- Big Star Trucking also compliant
- All DOT drug tests negative

Part 382

- Pre-employment
- Random drug and alcohol testing
- Reasonable suspicion
- Post-accident
- Other (follow-up)



DOT Testing §40.85 ~ 1991

- 5 Panel Test – all modes
- Required for CDL drivers
 - Marijuana metabolites
 - Cocaine metabolites
 - Amphetamines
 - Opiate metabolites
 - Phencyclidine (PCP)

§382.213 and §392.4

- Prohibits Schedule I drugs
- Prohibits any substance that renders incapable of driving CMV
- Synthetic cannabinoids not tested under §40.85
- No data on synthetic cannabinoids
- Research needed on synthetic cannabinoids among commercial drivers

Reasonable Suspicion

- 1 hour training drug / alcohol
- Only 15.7% were positive
- Visual detection vs. results indicate need for improvement
- FMCSA & stakeholders need to collaborate on solutions

Develop Aids to Carriers

- Educate drivers
- Performance based tests
- Training similar to Drug Recognition Experts (DREs)
- Expanded authority
- Driver facing cameras



Summary

- Carriers were in compliance
- §40.85 does not include synthetic cannabinoids
- Synthetic drugs widely available
- Research on synthetic drug use is needed
- Plan to detect and deter synthetic drug use is needed



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Survival Factors

Ronald Kaminski

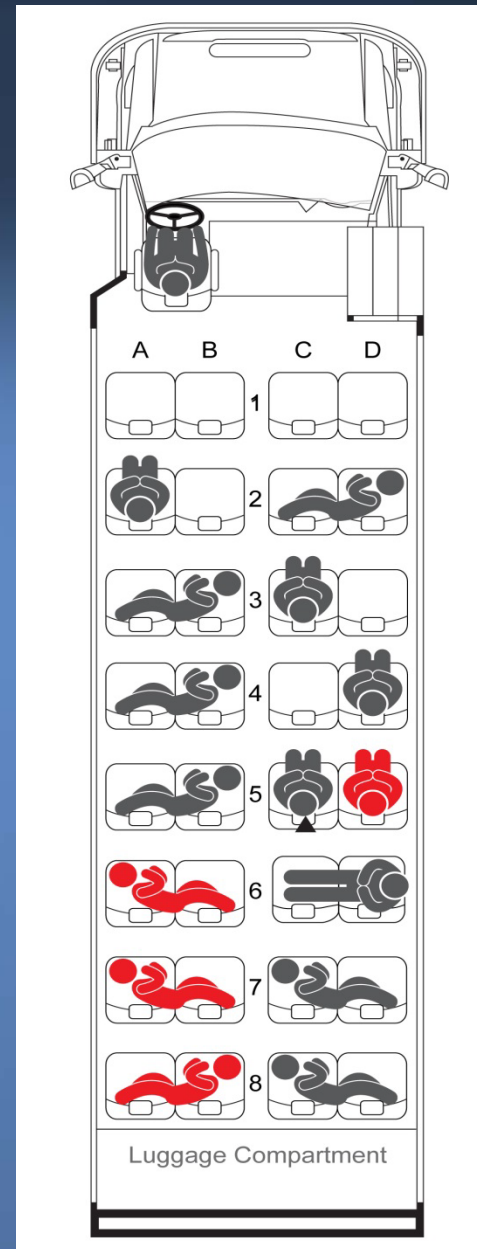
Overview

- Lack of seat belt use by bus passengers
- North Central Texas College did not enforce seat belt use policy
- Buses excluded from state seat belt laws

Bus Seat Belts and Usage

- Lap and shoulder belt for the driver
- Passenger lap belts
- Driver restrained
- All 15 student passengers unrestrained
 - No instruction on seat belt use
 - Not aware that bus was equipped

Seating Chart



Belt Maintenance and Inaccessibility



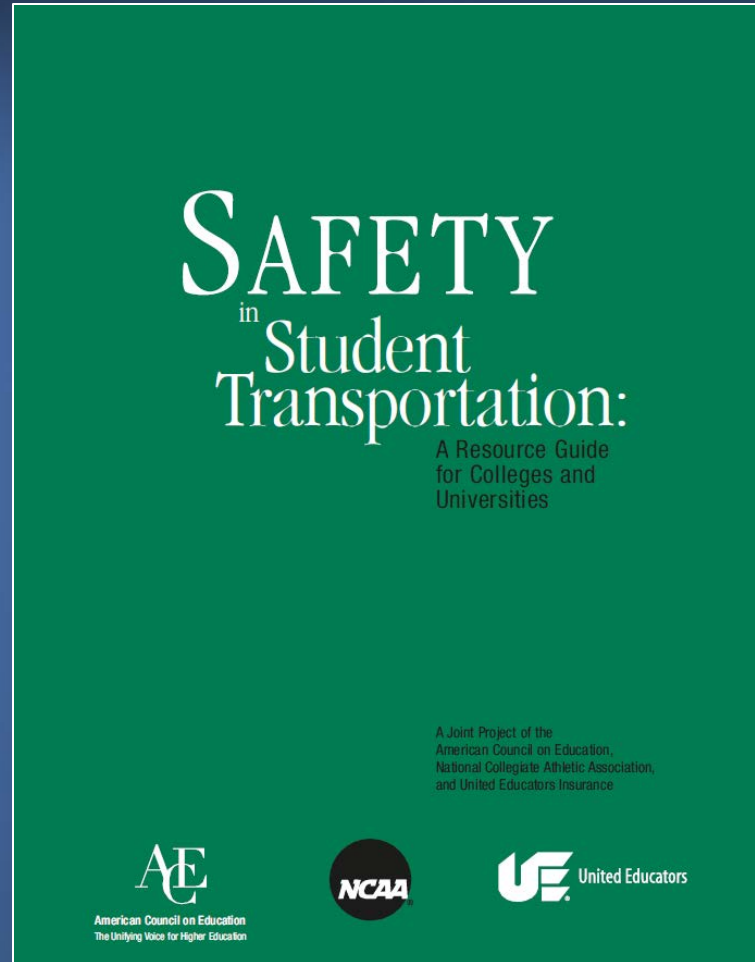
Bus Seat Belt Usage

- Seat belts prevent ejection
- Unbelted occupants are 30 times more likely to be ejected
- 75% of those ejected in fatal crashes die
- Lack of seat belt use likely worsened bus passenger injuries

NCTC Seat Belt Use Policy

- Signed policy required:
 - Driver to use seat belt
 - Passengers to use seat belts
 - No operation without belt usage
- New policy established
 - Yearly review and signature of school policy and redesigned vehicle sign-out card

NCAA Travel Guide



State Seat Belt Laws

- School policies vs State laws
- 34 States with primary enforcement
- Primary enforcement laws result in reduction of fatalities
- Do not extend to motorcoaches and other buses

State Seat Belt Laws

- NTSB - almost 50 years of seat belt advocacy
- NHTSA rulemaking for motorcoaches and large buses, into effect 2016
- Reduce risk of fatalities by 77%
- State definitions vary

Summary of Issues

- Lack of seat belt usage
- Lack of enforced seat belt policy
- Primary enforcement increases seat belt use
- Mandatory seat belt laws for all vehicles, all seating positions are needed



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Medium-Size Bus Crashworthiness

Kristin Poland, Ph.D.

Overview

- Medium-size bus crashworthiness
 - Previous NTSB recommendations
 - Lack of federal requirements
- Crash-involved vehicle design
- Crash outcome



Crashworthiness

- Definition: The ability for a vehicle to protect its occupants from injury during a crash
- Medium-size buses
 - No federal requirements for:
 - Roof strength
 - Sidewall structure
 - Window retention
 - Occupant protection

Previous NTSB Recommendations

- Include medium-size buses in NHTSA motorcoach rulemaking for:
 - Occupant protection system
 - Rollover integrity
 - Advanced window systems

Crash-Involved Vehicle Design

- Some school bus standards used:
 - School bus roof strength
 - School bus joint strength
 - Did not meet minimum requirements
- Equipped with lap belts

Crash Outcome



Left Side

Right Side



Summary

- Medium-size bus needs:
 - Crashworthiness
 - Restraint systems
 - Side impact protection



Photograph: Oklahoma Highway Patrol



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Vehicle Data Recorders

George Haralampopoulos

Overview

- Engine Control Modules (ECMs)
- Data limitations from crash vehicles
- Crash survivability of recorders
- Previous Event Data Recorder (EDR) recommendations

Engine Control Modules

- Primary functions
 - Control engine timing, fuel delivery
 - Communicate with other onboard electronic systems
- Secondary functions (if available)
 - Record diagnostic fault code data
 - Record other triggered events

Crash Protection and Data Limitations

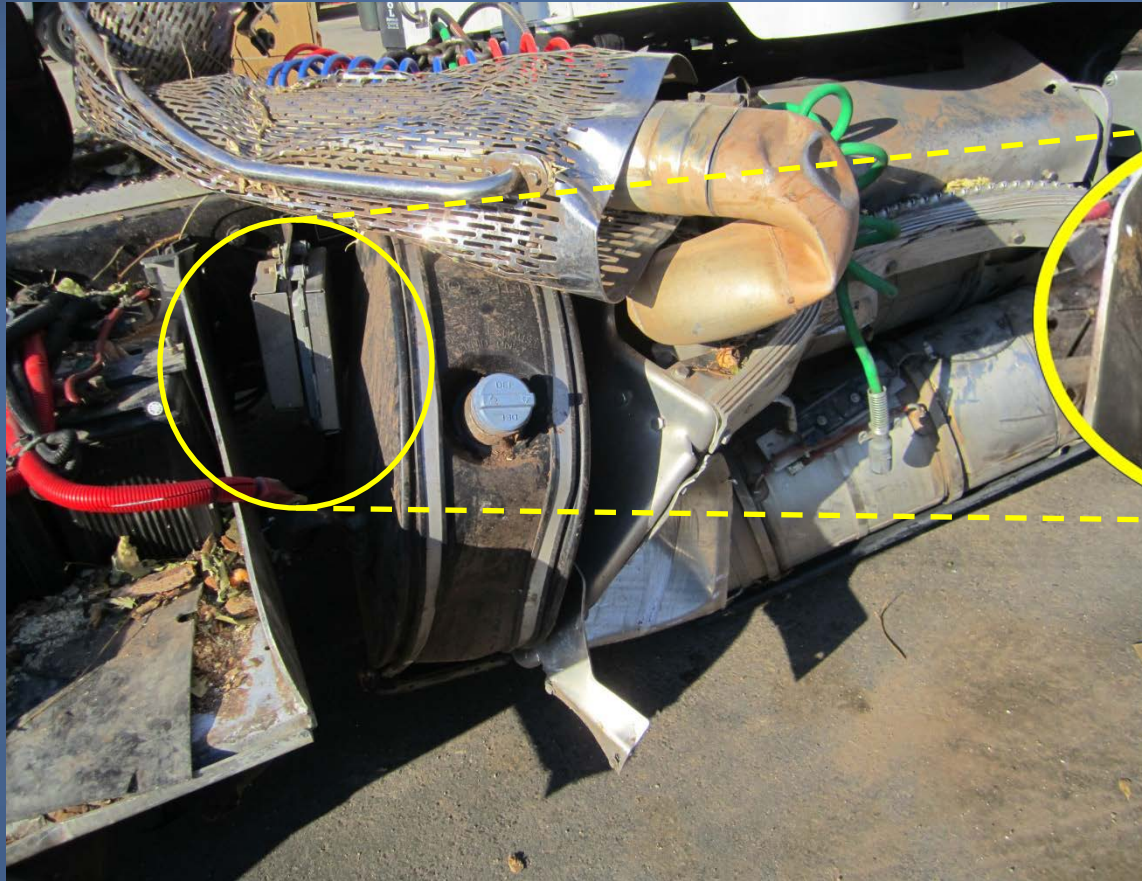
- Truck ECM required 4 additional modules to download
- Risk of data loss exists if any of the modules are damaged or missing

Crash Protection and Data Limitations



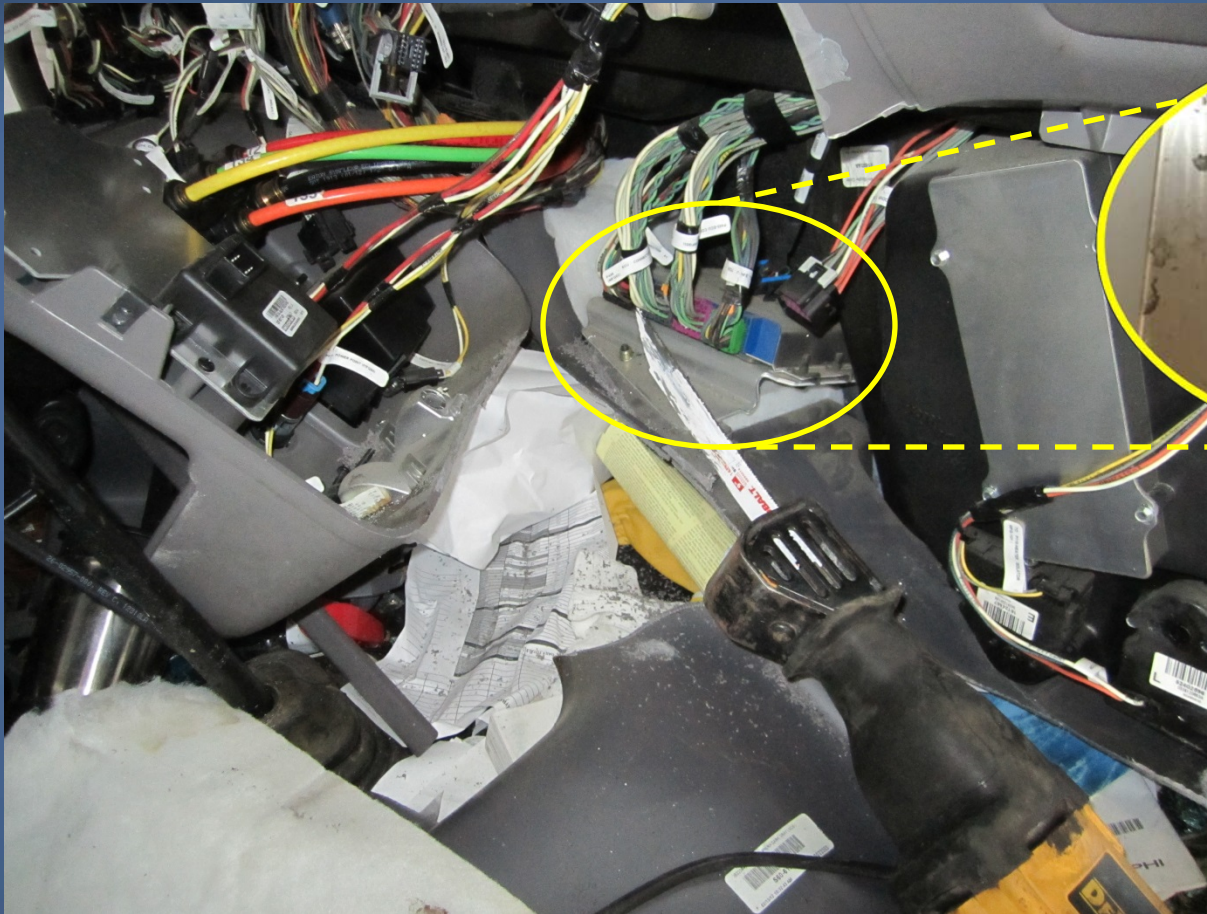
ECM

Crash Protection and Data Limitations



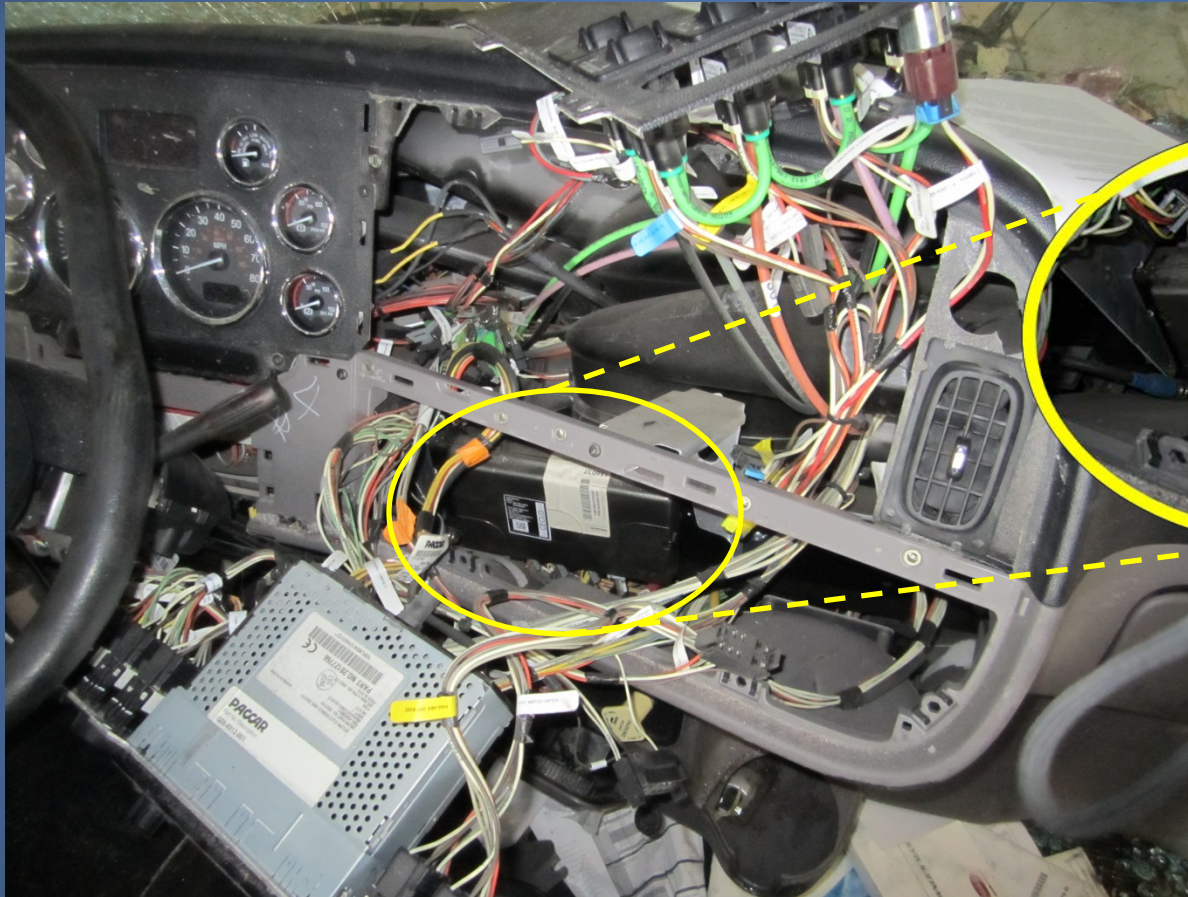
After treatment
and fuel control
modules

Crash Protection and Data Limitations



Bendix
module

Crash Protection and Data Limitations



Cab electronic control module

EDR Recommendation History

- Crash event recording is required in other modes of transportation
- 1999 - Bus recommendations
- 2010 - Truck recommendations
- Status remains “Open—Unacceptable Response”

Summary

- Without EDRs, critical data remains unavailable
- EDR use would improve analysis of vehicle collisions
- EDR data would advance research in commercial vehicle safety



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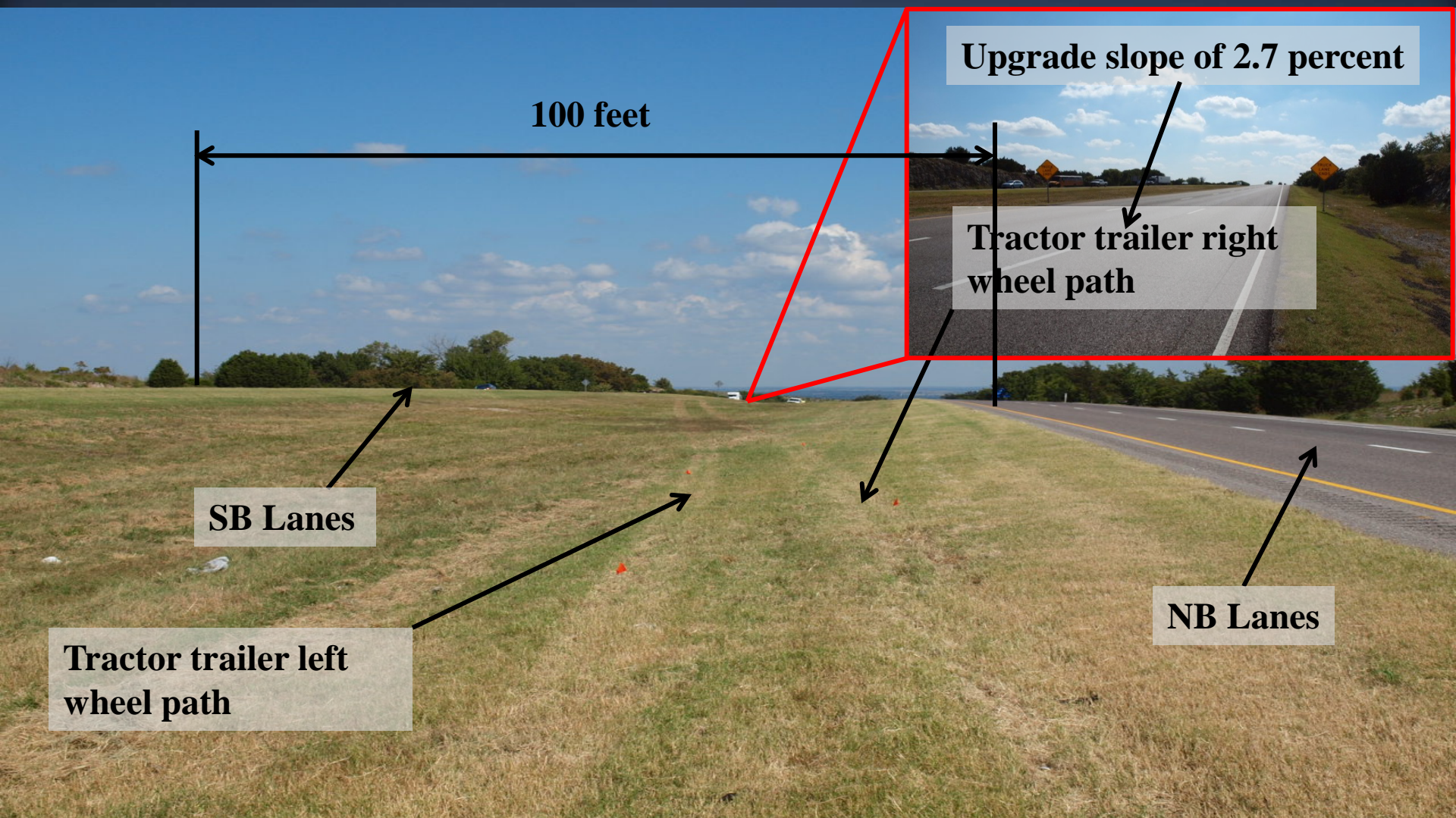
Median Barriers

Dan Walsh

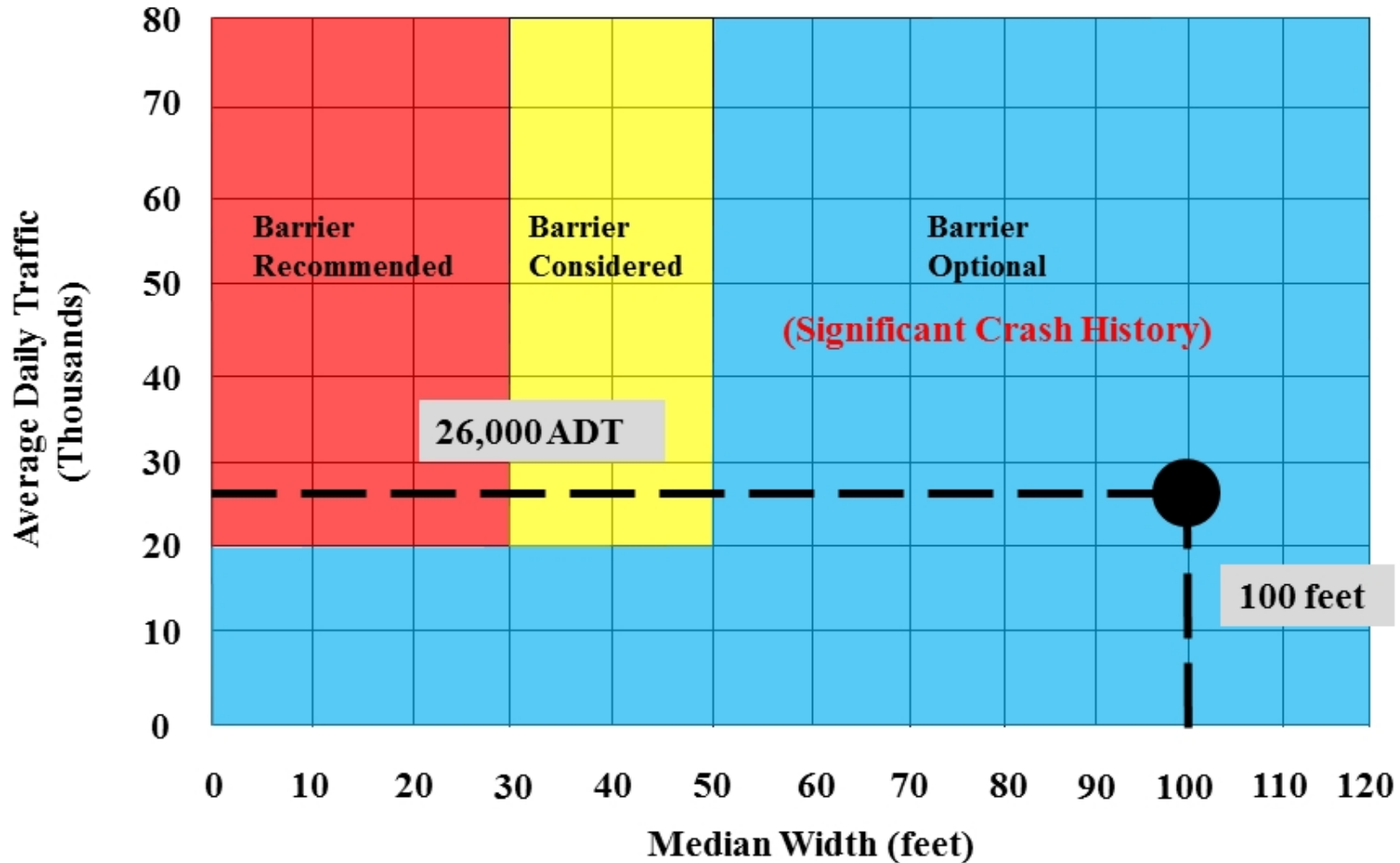
Overview

- I-35 median
- AASHTO median barrier guidelines
- ODOT median cable barrier guidelines
 - New median cable barrier planned on I-35
- NCHRP Project 22-31
 - Heavy vehicle crossover median crashes

I-35 Median and Upgrade Slope

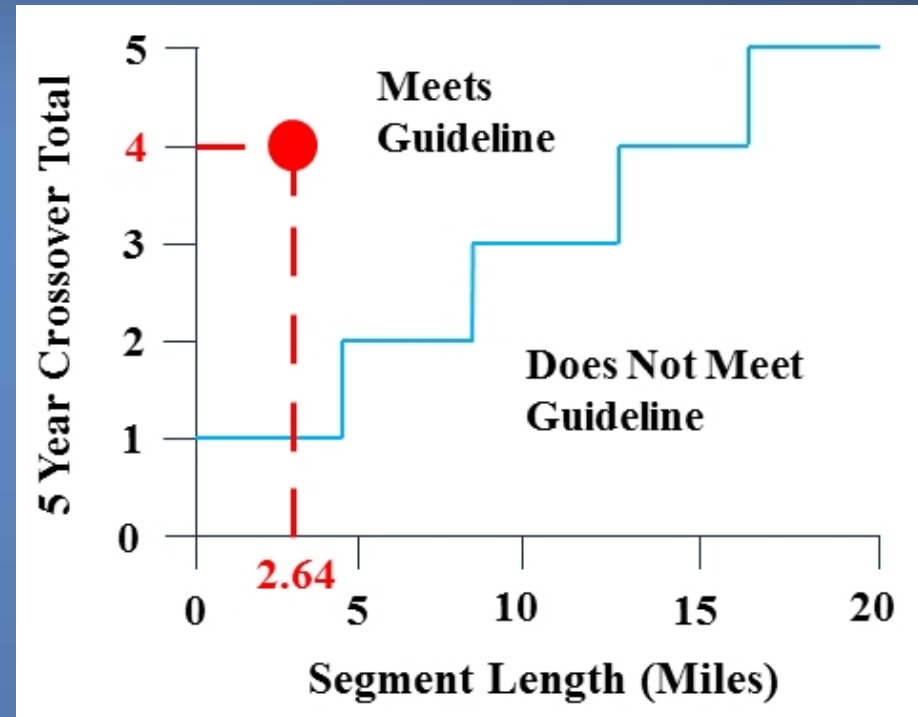


AASHTO Median Barrier Guidelines



ODOT Median Cable Barrier

- October 28, 2014
 - Finalized guidance
 - Crash history
- ODOT examination
 - 4 median crossover crashes
 - Met guideline
 - Construction started



Previous Recommendations

- Munfordville, KY median crossover crash
 - March 26, 2010
 - 11 fatalities
 - NTSB issued 4 recommendations
 - FHWA and AASHTO
 - Selection of median barriers capable of redirecting heavy vehicles
 - Classified “Open—Acceptable Response”

NCHRP Project 22-31

- Develop median barrier guidelines
 - Estimated completion in June 2018
 - Address previous recommendations
- Meeting with TRB and AASHTO
 - Revised work plan for the project
 - Historical crash data, heavy vehicle crossover frequency, and traffic volumes

Summary

- NCHRP Project 22-31
 - Valuable data to address heavy vehicle crossover median crashes
 - 3 year wait time is long period
- Davis, OK median crossover crash
 - ODOT median cable barrier guidelines
 - Provide State DOT's critical information



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