NAFMP
North American Fatigue Management Program

# Motor Carrier Lessons Learned from Six Fatigue-Crash NTSB Investigations

## Missouri Trucking Association – Safety Conference

March 6, 2026

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# Overview

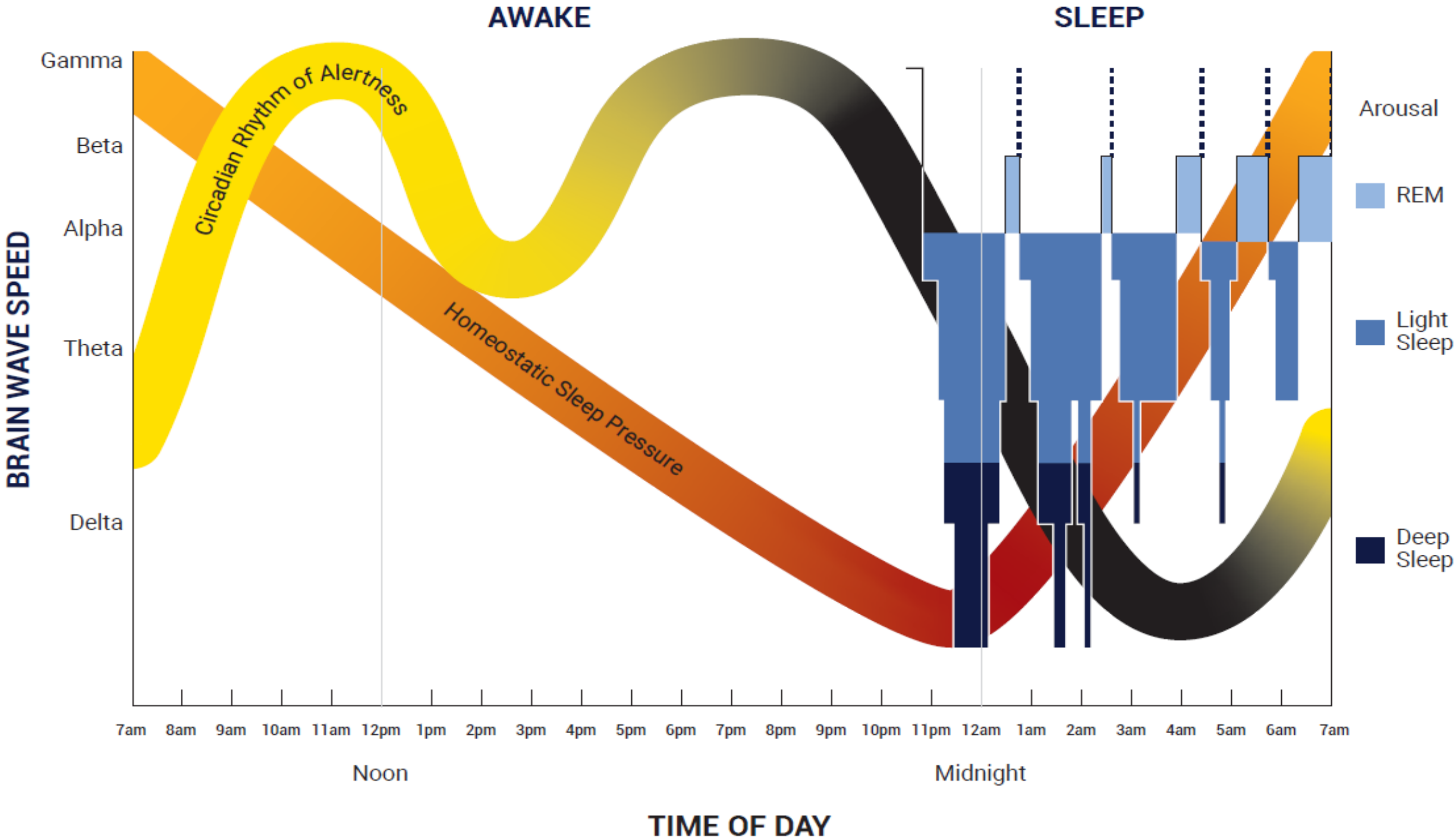
1. Sleep and Alertness Biochemistry
2. NTSB Crash Investigations
3. Fatigue Characteristics
4. Fatigue Management Program
5. Next Steps

# Sleep and Alertness Biochemistry

# Poll

**What will kill you faster?**

- No Sleep
- No breathing
- Starvation
- Dehydration


AWAKE
SLEEP
Gamma
Beta
Alpha
Theta
Delta
BRAIN WAVE SPEED
Circadian Rhythm of Alertness
Homeostatic Sleep Pressure
Arousal
REM
Light Sleep
Deep Sleep
7am 8am 9am 10am 11am 12pm 1pm 2pm 3pm 4pm 5pm 6pm 7pm 8pm 9pm 10pm 11pm 12am 1am 2am 3am 4am 5am 6am 7am
Noon
Midnight
TIME OF DAY

# Six NTSB Crash Investigations

# 1. Crash Facts

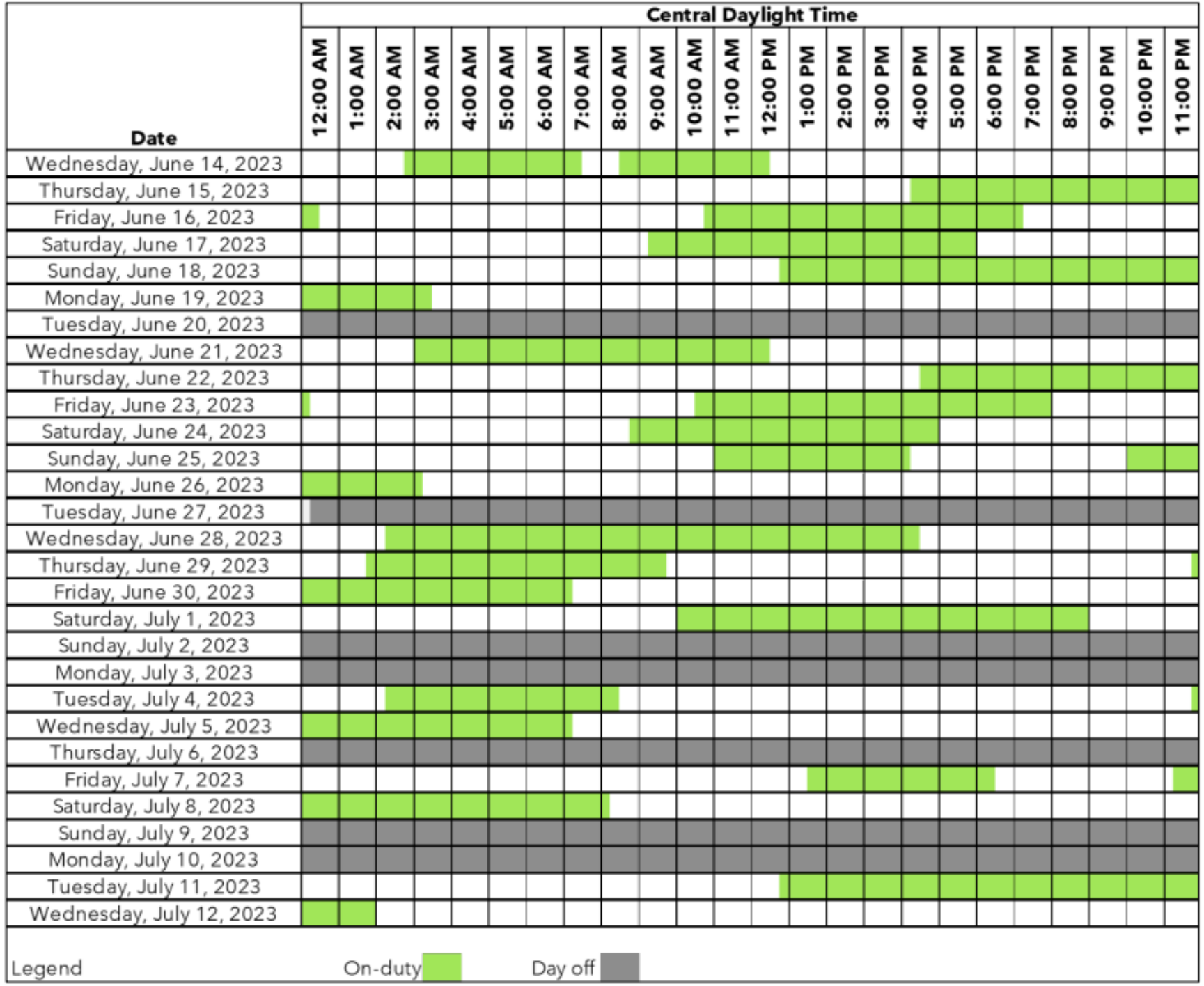
- At 1:48 a.m. July 12 2023, a motorcoach carrying 21 people veered off Interstate 70 near Highland, Illinois, colliding with three parked combination vehicles
- Three passengers died
- The driver and 11 other passengers sustained injuries of varying severity

Source: NTSB
https://www.ntsb.gov/investigations/Pages/HWY23MH015.aspx

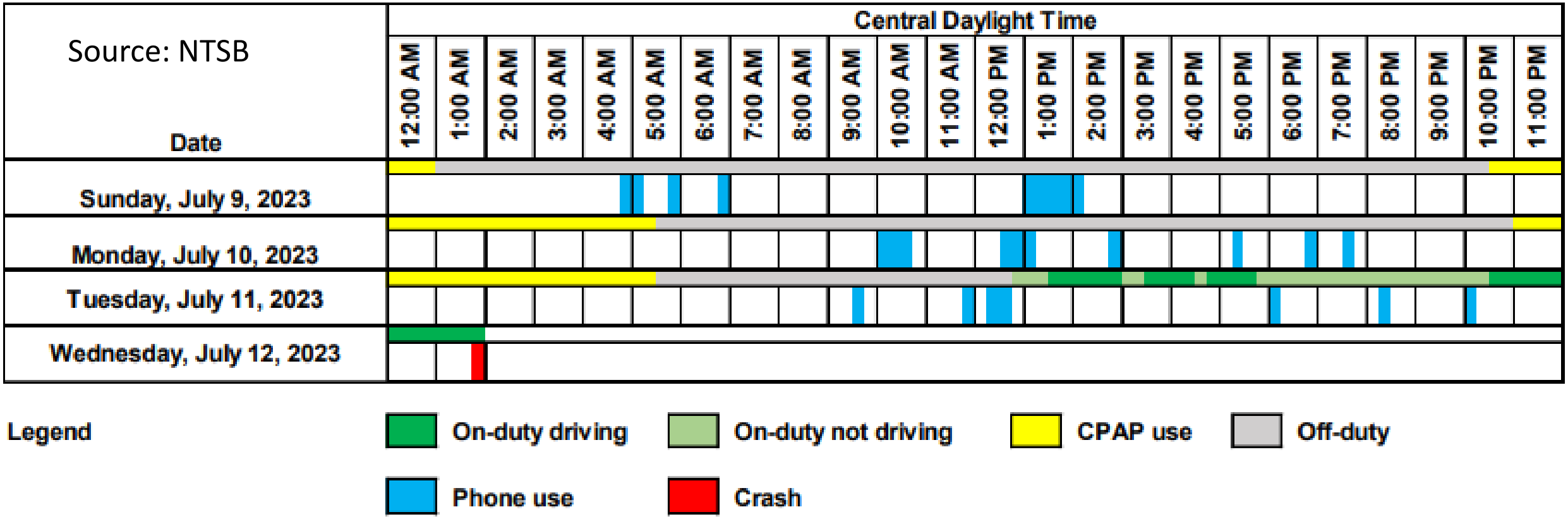
Mack
combination unit
Kenworth
combination unit
Prevost
motorcoach
Freightliner
combination unit
Direction of travel
N
Source: NTSB

# Schedule

Source: NTSB



# Schedule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Central Daylight Time
Date
12:00 AM
1:00 AM
2:00 AM
3:00 AM
4:00 AM
5:00 AM
6:00 AM
7:00 AM
8:00 AM
9:00 AM
10:00 AM
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2:00 PM
3:00 PM
4:00 PM
5:00 PM
6:00 PM
7:00 PM
8:00 PM
9:00 PM
10:00 PM
11:00 PM
Sunday, July 9, 2023
Monday, July 10, 2023
Tuesday, July 11, 2023
Wednesday, July 12, 2023
Legend
On-duty driving
On-duty not driving
CPAP use
Off-duty
Phone use
Crash

# NTSB Probable Cause

- Driver's departure of the motorcoach from the travel lanes onto the shoulder of the exit ramp due to fatigue
- Contributing to the motorcoach driver's fatigue was his irregular work-rest schedule and prolonged time awake (17 hours, 13 on duty)
- Driver medical history
  - High blood pressure treated with one prescription medication
  - Diabetes treated with one prescription
  - High cholesterol treated with one prescription medication
  - Diagnosed with obesity
  - Obstructive sleep apnea (OSA) treated with a CPAP device
  - Diagnosed with confusion due to head injury with concussion sustained in a 2018 crash, documented persistent cognitive and behavioral symptoms and was given instructions for additional testing and neurology follow-up that did not occur

# 2. Crash Facts

- At 6:17 a.m. June 11 2023, a truck-tractor with a tank trailer carrying 8,500 gallons of gasoline crashed while exiting northbound I-95 in Philadelphia, Pennsylvania
- The driver lost control on a curved exit ramp, causing the truck to overturn and strike a concrete barrier
- The resulting fire destroyed the truck, caused the collapse of northbound I-95 lanes and fatally injured the truck driver

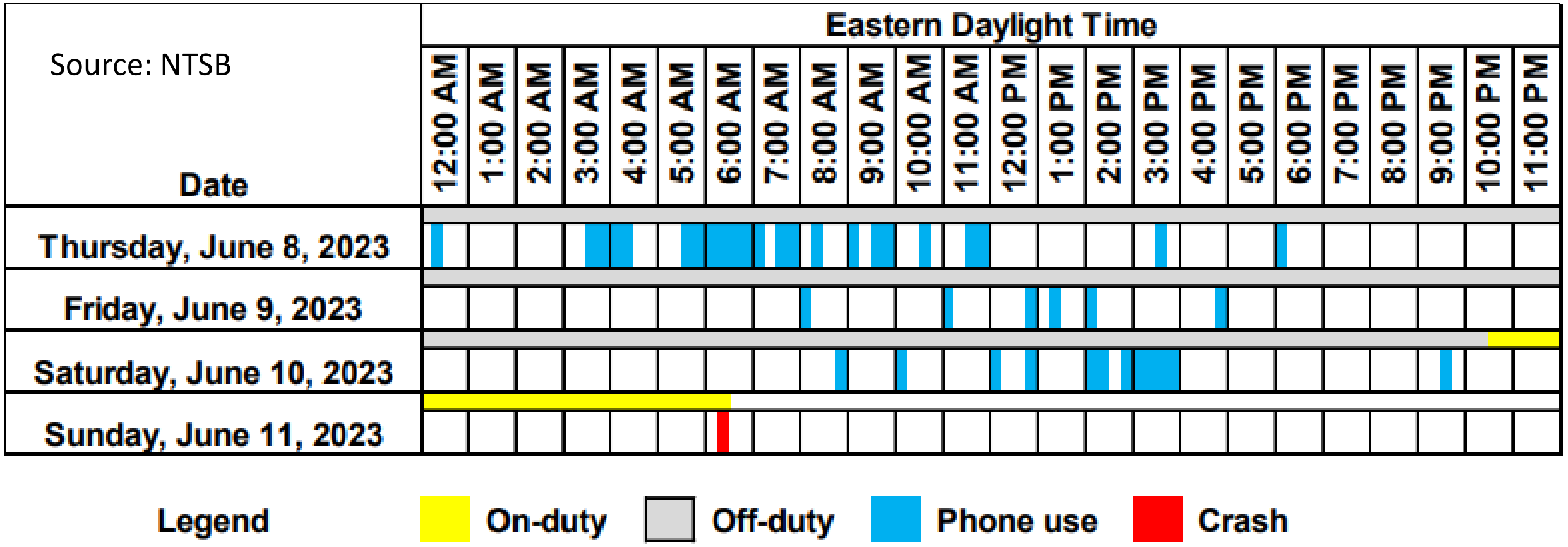
Source: NTSB

https://www.ntsb.gov/investigations/Pages/HWY23FH014.aspx

95
N
Cottman Avenue exit ramp
Southbound
95
N
Cottman Avenue exit ramp

Source: NTSB

# Schedule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4:00 PM
5:00 PM
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7:00 PM
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9:00 PM
10:00 PM
11:00 PM
Date
Thursday, June 8, 2023
Friday, June 9, 2023
Saturday, June 10, 2023
Sunday, June 11, 2023
Legend
On-duty
Off-duty
Phone use
Crash

# NTSB Probable Cause

- Driver's failure to slow the vehicle as he exited the interstate onto the exit ramp well above the posted advisory speed limit due to inattention to the roadway potentially associated with fatigue
- Among the many strategies that a robust fatigue management program can promote, this crash highlights the importance of drivers adopting sleep schedules that do not change substantially between their workdays and their days off
- History of high blood pressure, no medications
- Toxicological testing postmortem detected diphenhydramine, a sedating over-the-counter antihistamine

# 3. Crash Facts

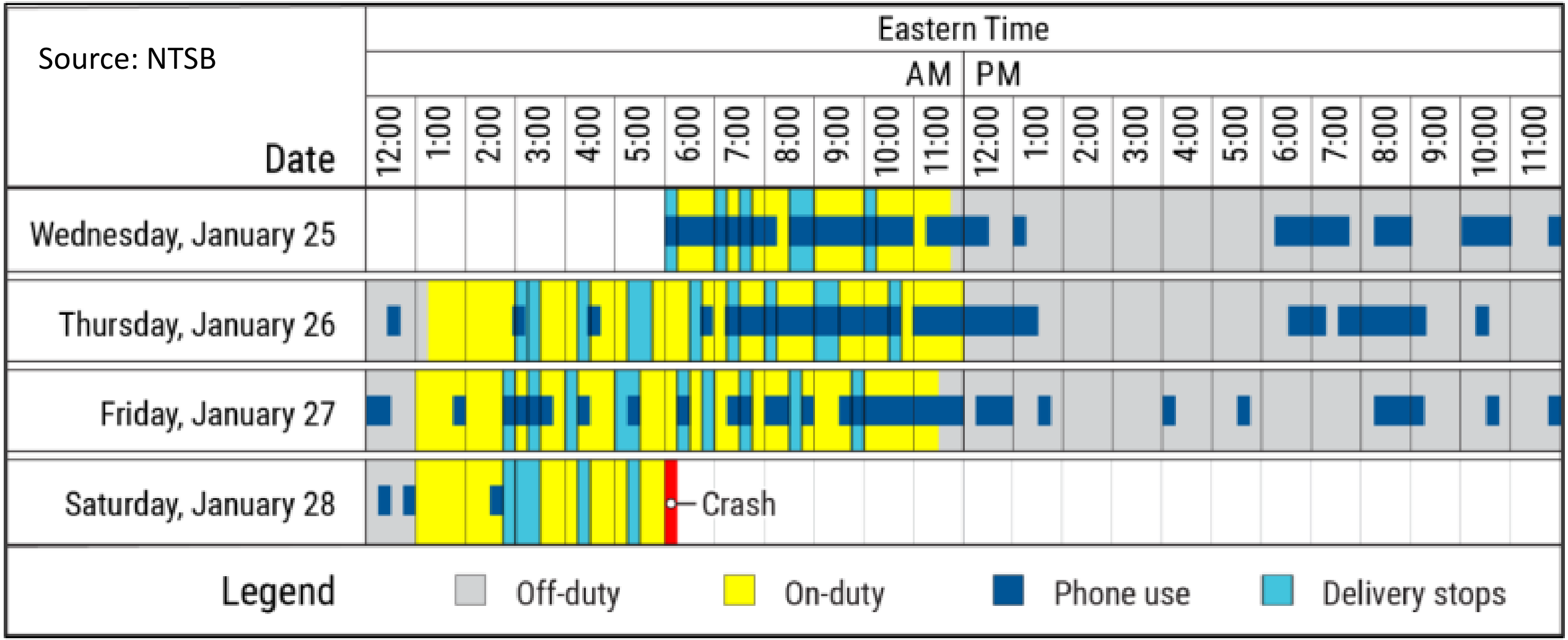
- At 6 a.m. Jan. 28 2023, a bus and a box truck collided head-on on New York State Route 37 in Louisville, New York
- The truck crossed the centerline striking the bus, which was transporting workers to a construction site
- This crash resulted in six fatalities, two serious injuries and five minor injuries among the bus passengers, along with minor injuries to the bus driver and serious injuries to the truck driver

Source: NTSB

https://www.ntsb.gov/investigations/Pages/HWY23FH005.aspx

Source: NTSB

# Schedule


Source: NTSB
Eastern Time
AM
PM
Date
12:00
1:00
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3:00
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6:00
7:00
8:00
9:00
10:00
11:00
12:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
Wednesday, January 25
Thursday, January 26
Friday, January 27
Saturday, January 28
Crash
Legend
Off-duty
On-duty
Phone use
Delivery stops

# NTSB Probable Cause

- Driver's fatigue due to insufficient sleep and circadian disruption, which lowered his level of alertness to the driving task and resulted in the truck crossing the centerline of the roadway into the opposing lane of travel and colliding with the oncoming bus
- Fatigue caused by limited and fragmented sleep as well as circadian disruption associated with his shift-work schedule
- No medical conditions

# 4. Crash Facts

- At 1:36 a.m. Dec. 16 2022, a truck-tractor with a semitrailer crashed into the rear of a slower-moving bus on Interstate 64 near Williamsburg, Virginia
- The truck, traveling between 65 and 70 mph with cruise control, did not brake before impact, while the bus was moving at 20 to 25 mph
- The collision resulted in the deaths of three bus occupants, serious injuries to nine bus occupants and the truck driver, and minor injuries to 11 bus occupants

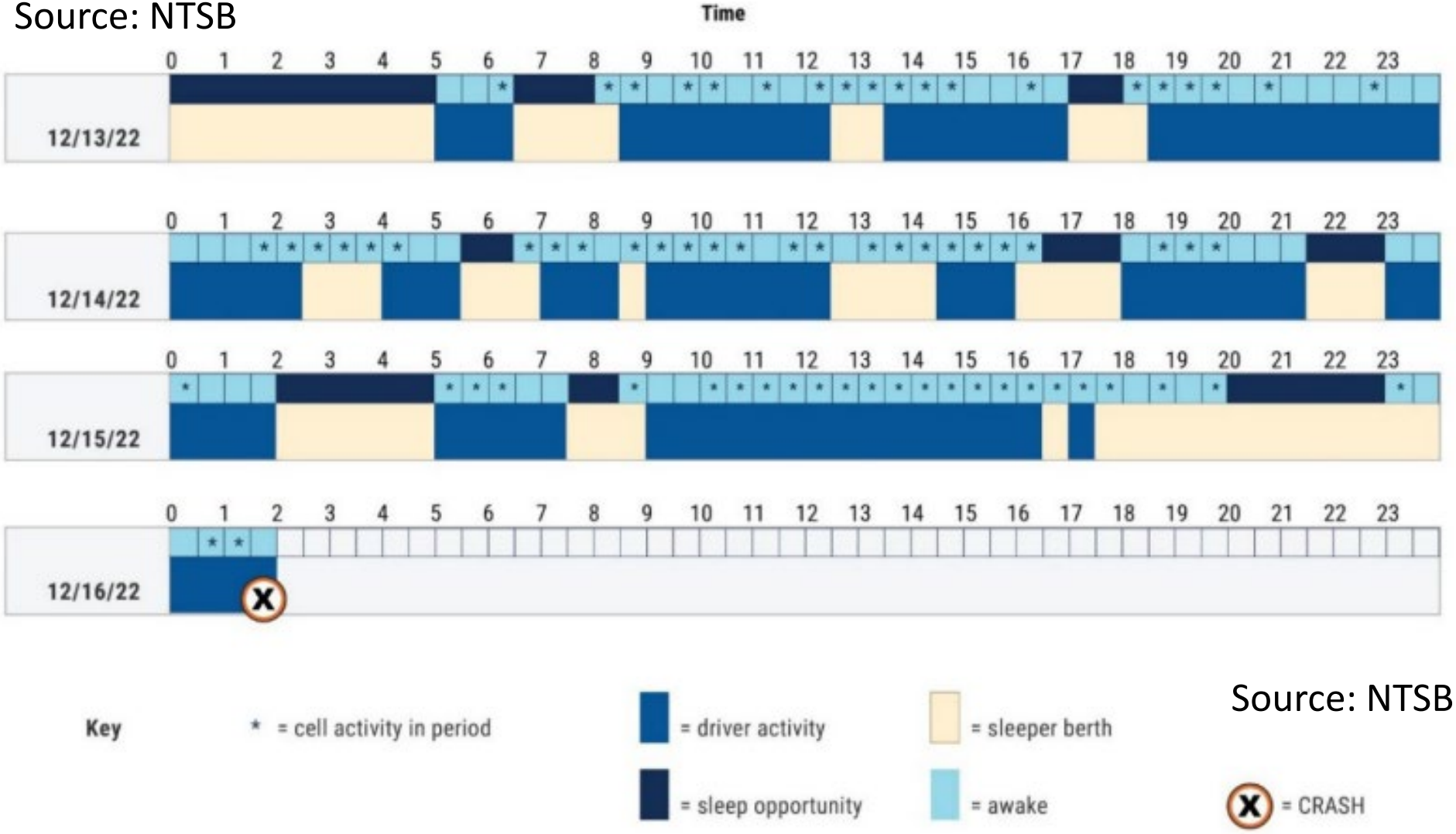
Source: NTSB

https://www.ntsb.gov/investigations/Pages/HWY23MH004.aspx

Source: NTSB

# Schedule

Source: NTSB




Source: NTSB

# NTSB Probable Cause

- Driver's fatigue, due to excessive driving time and limited sleep opportunity, which resulted in his lack of response to the slow-moving bus ahead
- Contributing to the truck driver's fatigue was the motor carrier creation of fictitious driver accounts in the electronic logging device system that enabled drivers to operate their vehicles for hours in excess of federal regulations
- No medical conditions

# 5. Crash Facts

- At 10:07 p.m. June 9 2021, a truck-tractor with a tank trailer crashed into a queue of stopped passenger vehicles on SR-202 in Phoenix, Arizona
- Traveling at 62-64 mph without slowing or steering, the truck initiated a chain-reaction collision involving seven other vehicles
- The crash resulted in four fatalities and 11 injuries among passenger vehicle occupants, with the truck-tractor and one car consumed by fire

Source: NTSB

https://www.ntsb.gov/investigations/Pages/HWY21MH008.aspx

1 mile
LAW ENFORCEMENT
AT PRIEST
EXPECT TO STOP
Dynamic Message Sign
10
202
Crash location
143
Priest Drive
Dynamic Message Sign
10
202

Source: NTSB

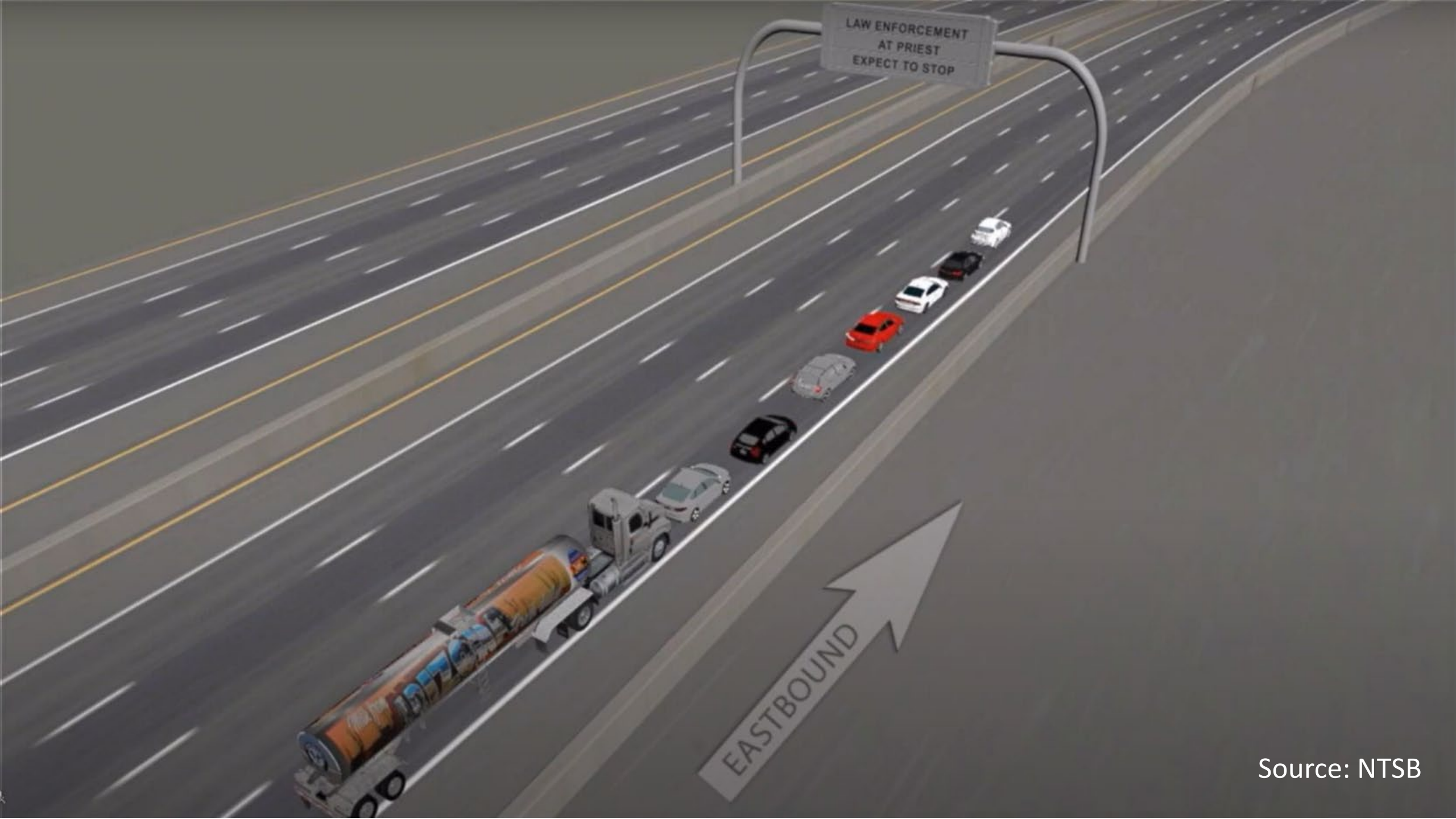
Source: NTSB

Source: NTSB

Source: NTSB

Source: NTSB

Source: NTSB




Source: NTSB

Tank trailer
Chevrolet
Truck tractor
Nissan
Lexus
Mercedes
Dodge
EASTBOUND
Toyota
Ford
Fatally injured: 4 persons
Hospitalized: 11 persons

Source: NTSB

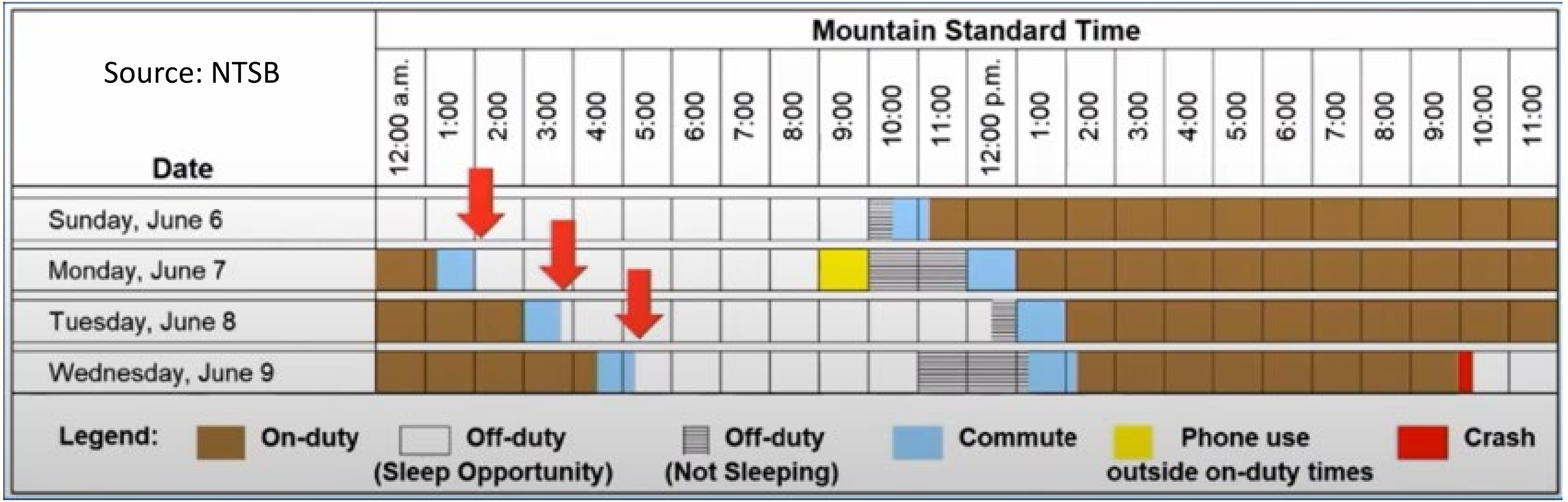
Toyota
Mercedes
Ford
Right shoulder barrier

Truck-tractor
Chevrolet

Source: NTSB

# Schedule

Source: NTSB



# NTSB Probable Cause

- Driver's failure to respond to the fully conspicuous traffic queue, likely as the result of fatigue
- Contributing to the crash was the motor carrier's
  - Poor oversight of its drivers
  - Lack of fatigue management program
  - Failure to enforce its own policies, such as those regarding on-duty hours
  - All a consequence of its inadequate safety culture
- No medical conditions

# 6. Crash Facts

- At 6:45 a.m. June 12 2020, a truck-tractor with a semitrailer struck the end of a slowed and stopped traffic queue on Interstate 39 near Arlington, Wisconsin, which had formed due to prior collisions
- This initiated an eight-vehicle crash that resulted in four fatalities and three serious injuries

Source: NTSB

https://www.ntsb.gov/investigations/Pages/HWY20FH006.aspx

Peterbilt truck-tractor
Mack truck
Freightliner truck-tractor
VW sedan
Kia SUV
Source: NTSB

# NTSB Probable Cause (1 of 2)

- Driver's failure to respond to slow-moving traffic due to fatigue
- Insufficient evidence on medical conditions
  - Cardiac disease
  - Diabetes
  - Gabapentin medication
- According to his wife, the driver had been experiencing ongoing fatigue for which he was scheduled to be evaluated by his doctor the day after the crash

# NTSB Probable Cause (2 of 2)

- Contributing to fatigue was his undiagnosed obstructive sleep apnea
  - High BMI (48 kg/m2). The truck driver's BMI corresponds to severe obesity, which alone placed him at high risk of significant OSA
  - Large neck circumference. This factor is even more strongly associated with OSA risk than BMI
  - Men are two to three times more likely to have OSA than nonpostmenopausal women
  - The truck driver was 55 years old. OSA risk in adults increases with age until about the sixth or seventh decade of life
  - The truck driver had high blood pressure and diabetes. OSA is more prevalent among people with those conditions
  - The truck driver smoked which increases OSA risk

# Fatigue Characteristics

# Poll

**Alertness and fatigue are like an on/off switch, you are either awake or asleep**

- True
- False

# Alertness Spectrum

- **Delta brain waves:** Deep sleep. 1 to 4 Hertz
- **Theta brain waves:** Sleeping or daydreaming when awake. 4 to 8 Hertz
- **Alpha brain waves:** Awake and calm. 8 to 12 Hertz
- **Beta brain waves:** Awake, alert, busy, and focused. 12 to 38 Hertz
  - **Low beta waves:** Thinking. 12 to 15 Hertz
  - **Beta waves:** Performing or focusing. 15 to 22 Hertz
  - **High beta waves:** Excited or anxious. 22 to 38 Hertz
- **Gamma brain waves:** Highly alert and consciousness. 30 to 80 Hertz

# Poll

**The only cause of fatigue is insufficient sleep**

- True
- False

# Alertness Has Supply & Demand

- Supply Factors
  - Internal individual susceptibility: circadian rhythm, amount of sleep, time of day, time awake, stimulants, other drugs, health, genes, mood
- Demand Factors
  - Task related: Time on task, task complexity, task monotony
  - Environmental: Road conditions, weather, stress (heat, noise, vibration), vehicle design, social interaction, other stimulation

# Poll

**In truck/bus crash statistics, driver fatigue is…**

- The number 1 cause
- Not a significant cause
- Underrepresented

# NTSB Study

- Factors That Affect Fatigue In CMV Crashes
  - The Safety Board believes that the incidence of driver fatigue is underrepresented in FARS in general and in FARS specifically with regard to CMV drivers.
  - Research has suggested that CMV driver fatigue is a contributing factor in 30 to 40 percent of all CMV crashes.

# CMV Driving Worsens Fatigue

- Tight schedule to get enough sleep
- Extended work hours + commuting
- Changing work schedules
- Work/sleep periods conflict with circadian rhythm
- Limited time for rest & naps
- Unfamiliar & uncomfortable sleep locations
- Sleep disruptions
- Difficulty finding nutritious food on the road
- Limited opportunities for exercise
- Personal, work and environmental stressors

# Poll

Why manage fatigue?

# Fiduciary Duty for Lifetime Earnings and Profits

- Lower Fatigue Related Crashes
- Lower Legal Liability Exposure
- Cost Reduction
  - Driver retention
  - Medical costs
  - Maintenance
- Labor force
  - Safer
  - More productive
  - Healthier & happier

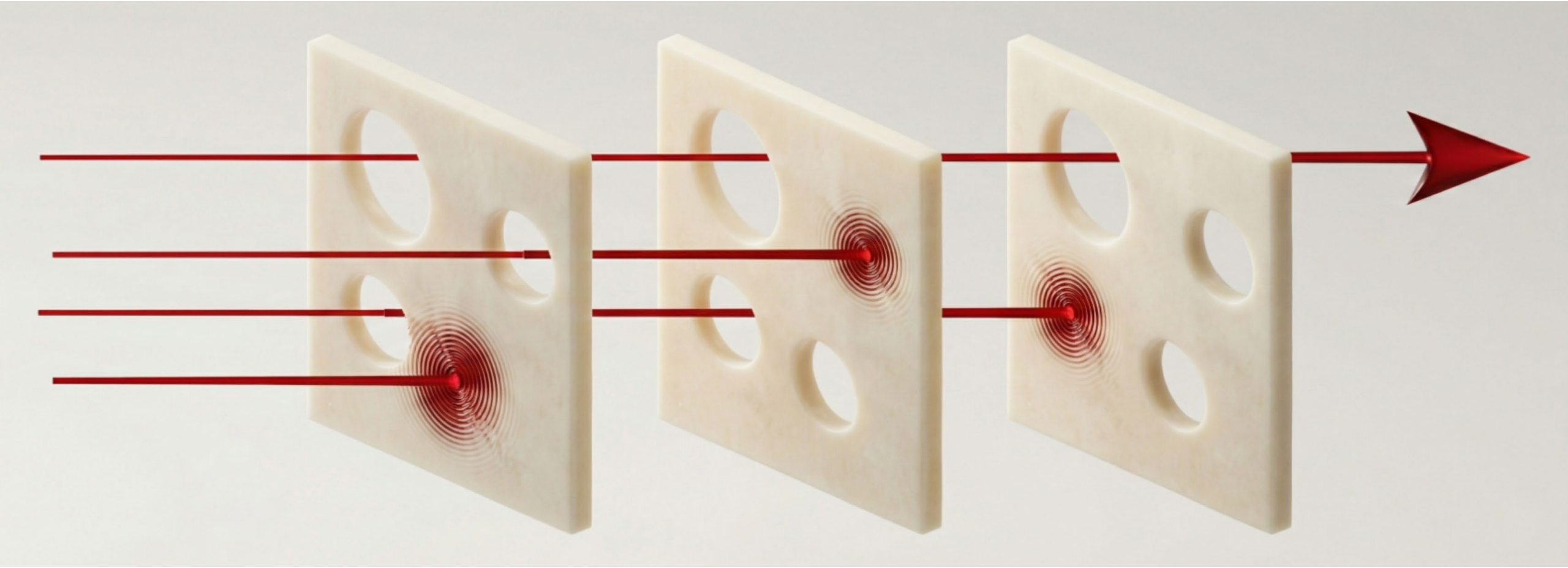
# Fatigue Management Program

# Fatigue Management Program (FMP)

- Safety Culture
  1) Education
  2) Training
  3) Continuous communications – Including partnerships
- Fatigue Risk Management System
  1) Operations
  2) Identify risks with processes and controls
     - Predictive, proactive, reactive
     - Sound scheduling, sleep disorders management program, fatigue detection technologies
  3) Risk assessment
  4) Measures and countermeasures
  5) Evaluation

FMP Template
Module 2: Safety Culture and Management Practices
Implementation Manual

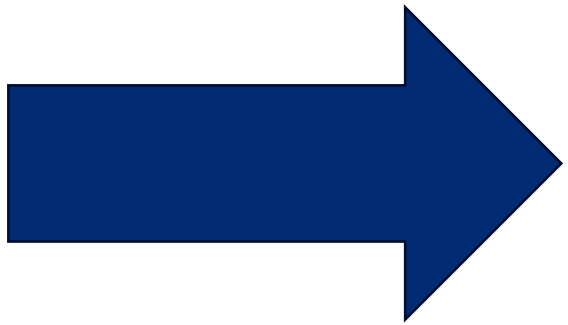
# The Swiss Cheese Model



# Swiss Cheese Layer: Safety Culture

# Safety Culture

- Knowledge
- Skills
- Attitudes



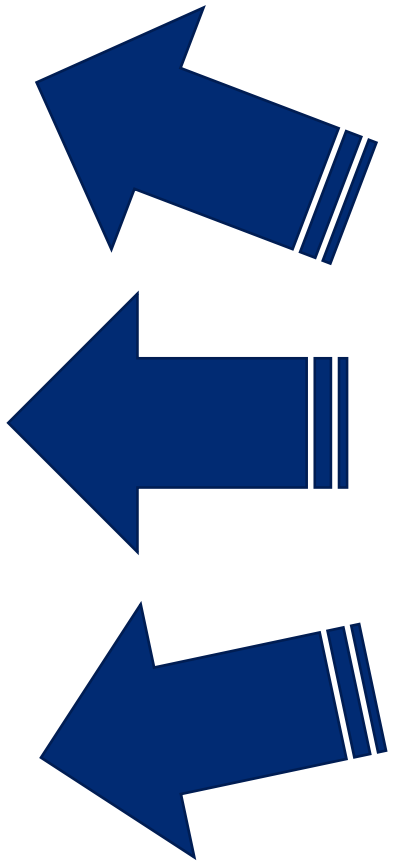
- ✓Behavior Change
- ✓Elimination of Stigmas

# Education & Training Courses

- eLearning Platform & PowerPoint Downloads
  - Motor carrier executives and managers
    - Module 1 (Intro), 2 (Safety Culture), 7 (Sleep Disorders), 10 (Technologies)
  - Motor carrier trainers
    - Module 5 (Train-the-Trainer)
  - Motor carrier dispatchers and driver managers
    - Module 9 (Scheduling)
  - Freight Shippers, Receivers, Brokers
    - Module 6 (Role of shippers & receivers on driver safety)
  - Drivers
    - Module 3 (Driver Ed), 8 (Sleep Disorders) & 9 (Scheduling)
  - Driver Families
    - Module 4 (Family Ed)

# Wellness Affects All Body Systems

- Messaging
  - Nervous
  - Endocrine
  - Immune
  - Reproductive
- Plumbing
  - Respiratory
  - Cardiovascular
  - Digestive
  - Urinary
- Support
  - Skeletal
  - Muscular
  - Integumentary



- Sleep Hygiene (Webinar)
- Positive Relationships (Webinar)
- Mindfulness (Webinar)
- Nutrition (Webinar)
- Exercise (Webinar)

# Poll

**Drivers can tell when they are fatigued…**

1. Always, based on their perception
2. When trained to recognize it
3. Rarely; that's why it's a problem

# Objective Signs of Fatigue

- Eyelid drop or loss of focus
- Yawning
- Wandering, scattered or disjointed thoughts, dreamlike visions
- Head movements, gentle swaying, jerking
- Reduced field-of-view (AKA: tunnel vision, highway hypnosis, white line fever)
- Fidgeting, shifting positions, adjusting windows & HVAC
- Progressive weaving, crossing rumble strip, drift and jerk steering
- Delayed or incorrect responses
- Microsleeps

# Fatigue Management Strategies

- General
- At home
- On the road
- Night driving
- Changing time zones
- Team driving

Module 3: Driver Education

# Shared Responsibility

- Reducing fatigue in driver schedules is a shared responsibility between management and drivers
  - Management, including planning and dispatch, establishes a driver's work demands and ultimately determines available sleep opportunities through the driving schedule
  - Drivers are responsible for utilizing their available rest time effectively and communicating any fatigue concerns
- An effective fatigue management program requires continuous collaboration to ensure safe and sustainable work practices

# Promoting a Safety Culture

- Cultivate a workplace that encourages drivers to value sufficient sleep and actively manage their fatigue for safety
- Drivers must be trained to recognize objective signs of fatigue as a significant physiological risk
- A true safety culture exists when drivers feel comfortable and empowered to communicate when they are tired without fear of repercussions
- If drivers are unwilling to report fatigue, the safety culture is compromised

# More on Safety Culture

- Webinar: Safety Culture: Transforming Fatigue Management from a Liability into a Competitive Advantage

- Module 2: Safety Culture and Management Practices

# Swiss Cheese Layer: Sound Scheduling and Routing Practices

# Scheduling Practices

- Sound scheduling and routing
- Time of day, recent sleep, continuous hours awake, cumulative sleep debt
- Shared responsibility mitigating driver fatigue in work schedules
- Regular schedules
- Forward vs backward scheduling
- Consider travel time to employment location
- Consider rests and naps during work shift
- Maximum of 16 hrs. per day or less
- Maximize benefits of scheduling tools
- Develop customized strategies for managing fatigue

# Scheduling

Webinar: The Scheduling Puzzle: Sleep Science and Driver Fatigue

Module 9: Driver Scheduling and Tools

# Swiss Cheese Layer: Fatigue Detection Technologies

# Fatigue Management Technologies Types

1. Scheduling & Trip Planning
2. Fitness for Duty Testing
3. Performance Monitoring
4. Driver Monitoring

# More on Fatigue Detection Technology

- Webinar: The Alertness Toolkit – A Motor Carrier's Guide to Fatigue Management Technologies
- Solution Series Webinars
- Module 10: Fatigue Monitoring and Management Technologies

# Technology Catalog Sources

- 2024 Good-Practice Guidance - To support industry uptake of rapidly emerging Fatigue and Distraction Detection Technologies (FDDT)
  - By Australia's National Heavy Vehicle Regulator (NHVR)

- 2020 Review of Commercially Available Devices to Detect Fatigue and Distraction in Drivers
  - By Institute for Road Safety Research in the Hague, Netherlands

- 2019 Commercial Motor Vehicle Operator Fatigue Detection Technology Catalog and Review
  - By National Surface Transportation Safety Center for Excellence

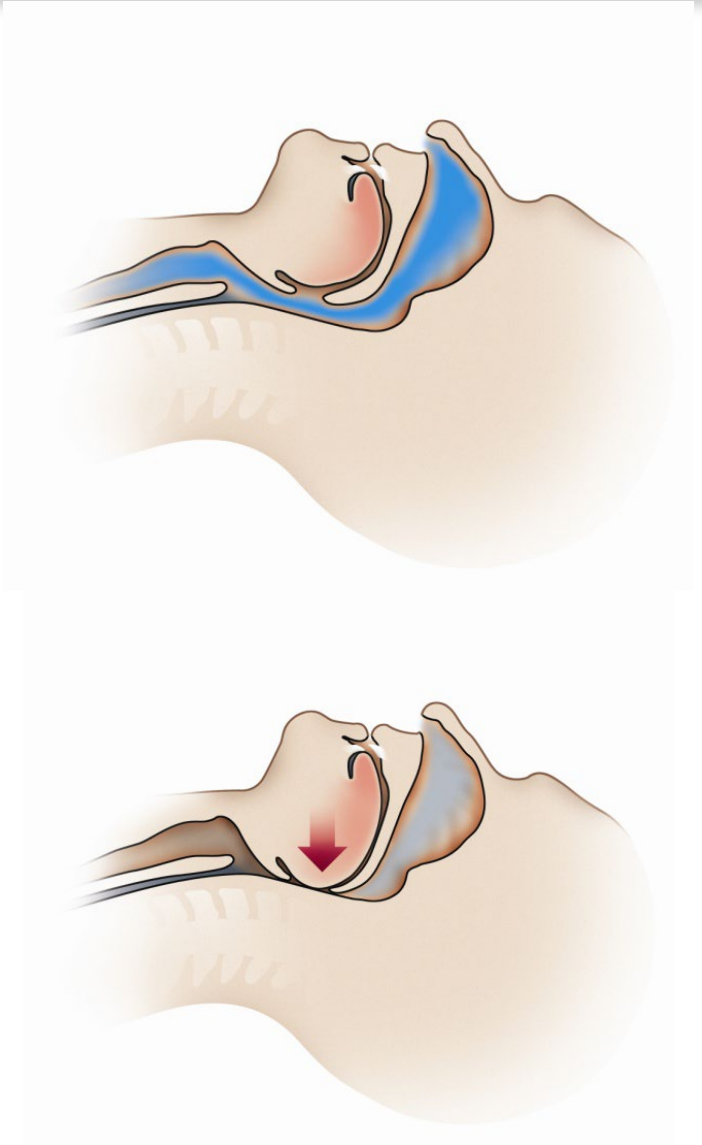
# Swiss Cheese Layer: Sleep Disorder Management

# Fatigue Susceptibility

- Sleep Deprivation
  - Sleep-related behaviors
  - Sleep hygiene
- Individual Differences
  - Genetic variations
  - Health & fitness
- Medical conditions
  - Medications
  - Sleep disorders
    - Insomnia, narcolepsy, restless leg syndrome, sleepwalking, abnormal circadian rhythms, obstructive sleep apnea (OSA)

# Obstructive Sleep Apnea

- **Apnea** = stoppage of breathing lasting 10+ seconds
- OSA = breathing stops repeatedly during sleep due to closures of the upper airway
- Apnea rate per hour:
  - <5 = normal
  - ≥5 = OSA
- OSA severity (mild, moderate, severe) based on rate
- Some people with severe OSA can have 100 per hour



# OSA Risk and Warning Signs

- OSA higher risk
  - Obese individuals, male, 40+ years old, large neck size, recessed chin, small jaw, large overbite, family history
- OSA warning signs
  - Excessive daytime sleepiness, reduced performance, loud and irregular snoring especially with gasping, high blood pressure, diabetes

# Sleep Disorders Management Program

1. Education
2. Screening
3. Testing
4. Treatment
5. Monitoring

# More on Sleep Disorders Management

- Webinar: Guide to Establishing a Sleep Disorders Management Program
- Module 7: Motor Carrier Sleep Disorders Management
- Module 8: Driver Sleep Disorders Management

# Next Steps

# NAFMP

North American Fatigue Management Program

nafmp.org

# NAFMP Website Free Resources

- Tools
  - FMP Template
  - Implementation Manual
  - ROI Calculator
- Courses
  - eLearning Platform
  - PowerPoints with and without audio
  - For carrier's executives, safety managers, dispatchers, instructors, drivers, driver's families, shippers & receivers
- Webinars, Info Sessions & Articles
  - Gallery
  - List
  - Categories
  - Sing up for article notifications
- Podcast
  - The NAFMP Pod
  - Available from eight platforms
- Events
  - Download individual event
  - Subscribe to Calendar of future events

# Connect with me to coordinate a free fatigue management session for your organization

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**Commercial Vehicle Safety Alliance**

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**Scan vCard and add me to your contacts**

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