



Memphis, Tennessee  
15-Passenger Day Care Van  
Run-Off-Road Accident

April 4, 2002



# NTSB 15-Passenger Van Reports

- 1999 Special Investigation (Nonconforming Buses)
  - Use of 15-passenger vans for schools, child care, and Head Start
  - Child restraints
- 2002 Safety Report (Rollover Propensity)
  - Electronic stability control
  - Rollover testing
- 2003 Accident Report (Henrietta/Randleman)
  - Occupant protection
  - Vehicle maintenance
  - Driver training







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# Parties to the Investigation

- Tennessee Department of Transportation
- Tennessee Department of Human Services
- Memphis Police Department



# Tippy Toes Day Care Center

- Privately owned
- Licensed by Tennessee Department of Human Services
- Provided child transportation
  - Between home and Tippy Toes
  - Between Tippy Toes and school
- 1999 Ford E-350 15-passenger van

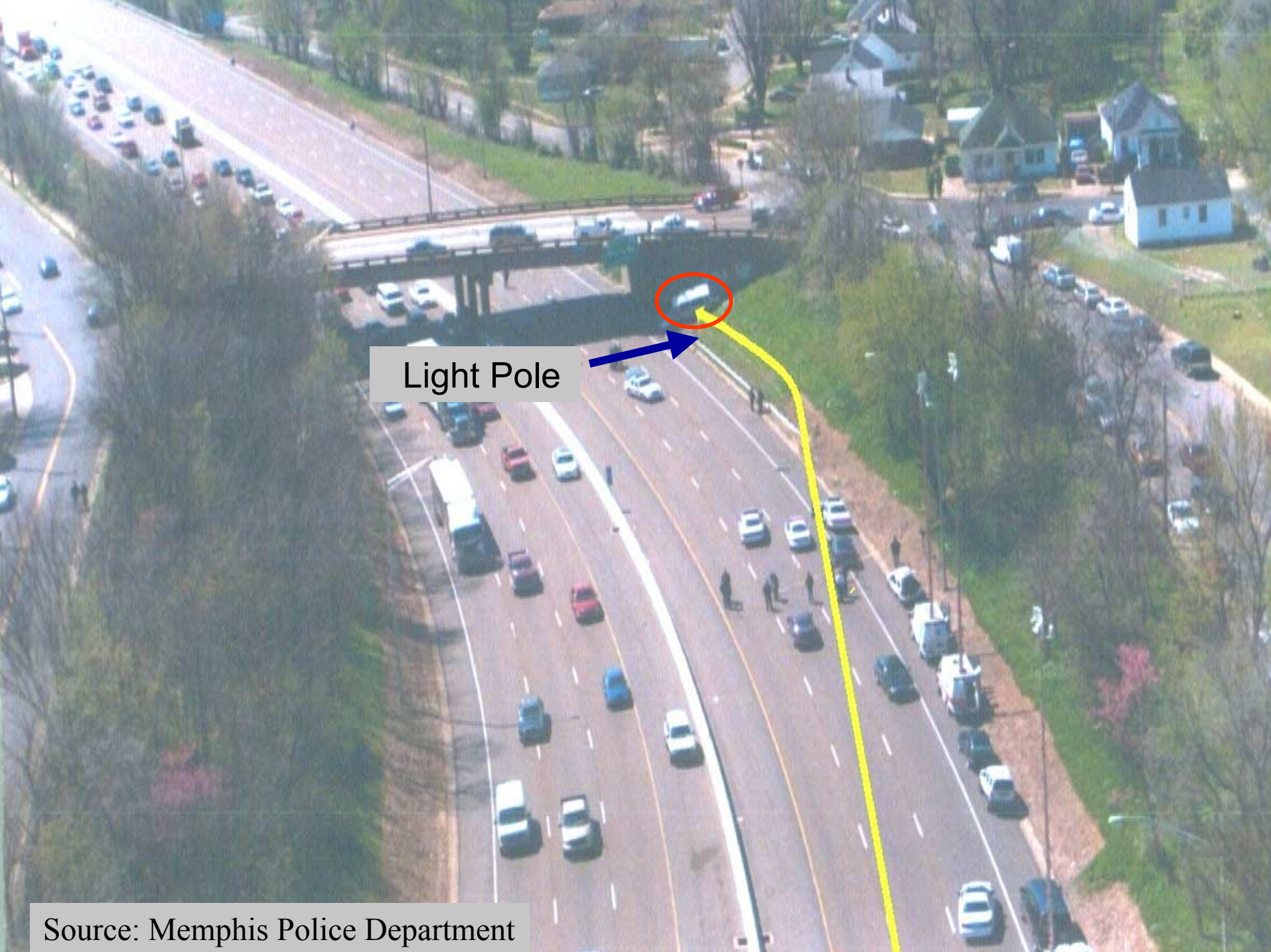


# Accident Sequence

- Southbound Interstate 240
- Van departed roadway
- Overrode guardrail
- Struck light pole
- Rotated counterclockwise
- Struck bridge abutment







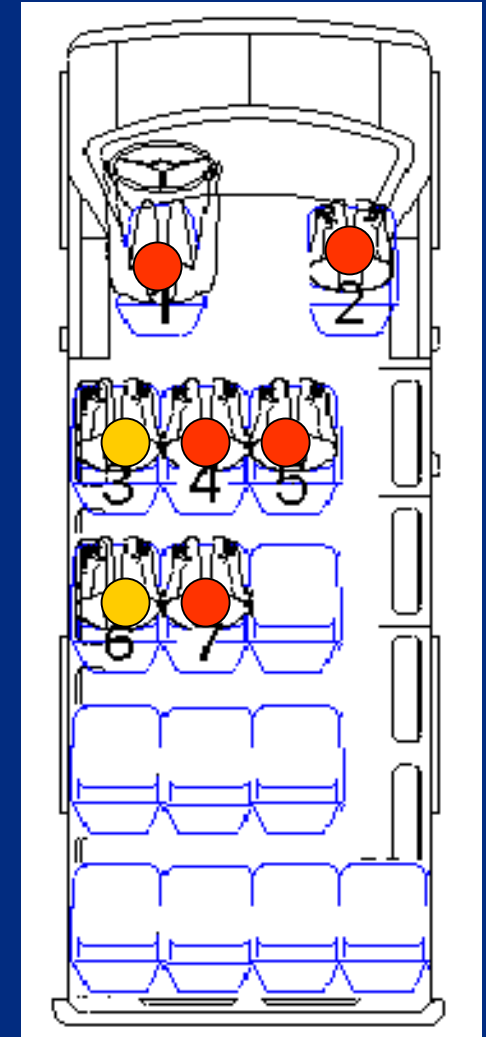
Light Pole





# Passenger Injuries

- Six passengers (ages 6 to 10 years) and 1 driver (27 years old)
- Five fatally injured
- Two seriously injured (10 year olds)





# Issues

- 15-passenger van safety
- Child care transportation oversight
  - Vehicle
  - Driver
  - Restraint use
- Highway barrier design criteria





# Proposed Recommendation Recipients

- State child care oversight agencies
- State Departments of Transportation
- American Association of State Highway and Transportation Officials
- National Association for the Education of Young Children



# Vehicle Simulations





NTSB



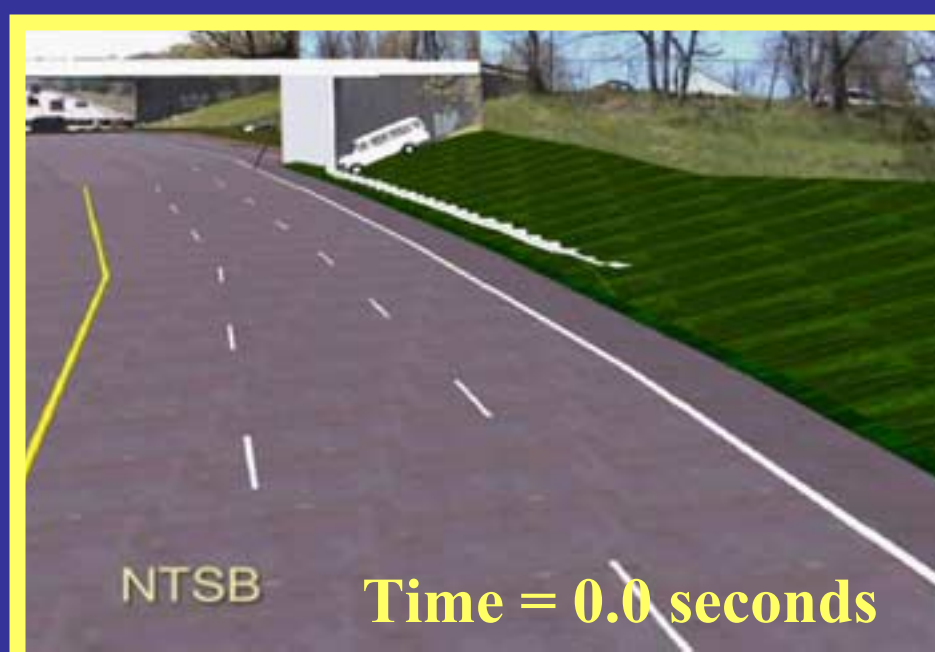
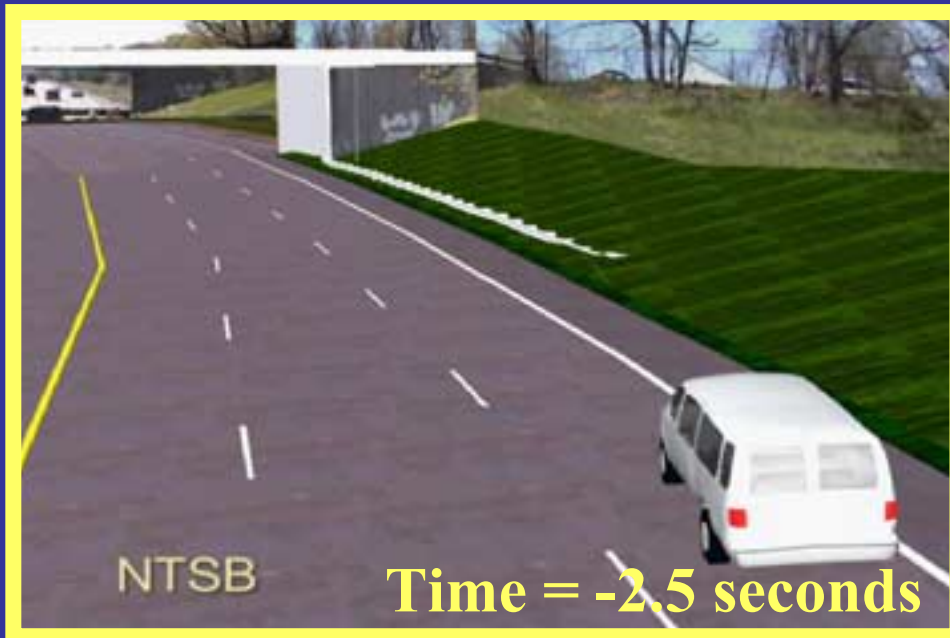
# Vehicle Simulation

- Developed based on physical evidence and vehicle deformation
  - Tire marks
  - Vehicle damage patterns
  - Damage to guardrail, light pole, bridge abutment
  - Final rest locations
- Characterizes best fit to physical evidence
- Representative of accident sequence but may not show actual accident



# Simulation Videos







# Vehicle Simulation Summary

- Van drifted from left lane
  - No applied steering
  - Duration of more than 3 seconds
- Van speed at roadway departure approximately 63 mph
- Peak van accelerations:
  - 12 g during impact with light pole and guardrail posts
  - 31 g during impact with bridge abutment
- Significant intrusion resulted

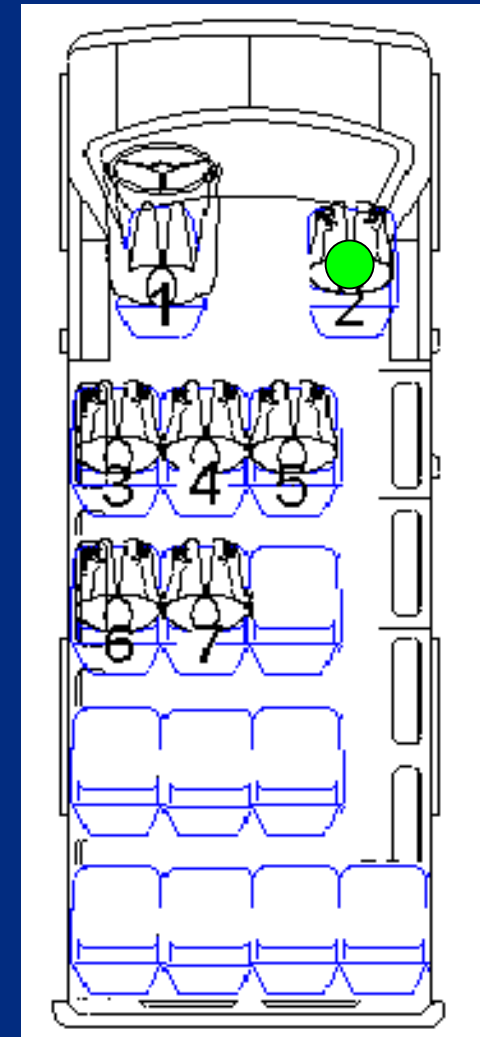






# Restraint Availability and Usage

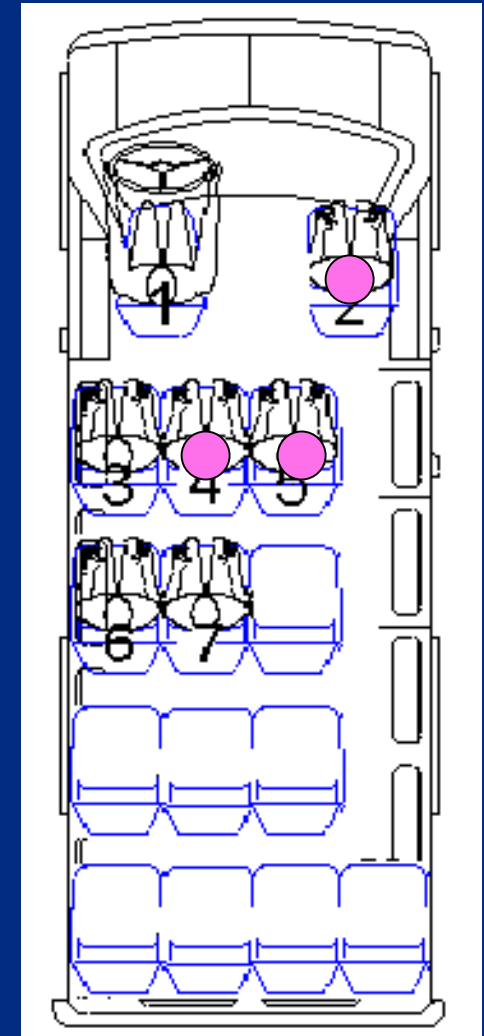
- Lap/shoulder belts and airbags available for driver and front passenger
- Lap/shoulder belts available for outboard seating positions
- Lap belts available for center positions
- Only front passenger belted





# Restraint Availability and Usage

- Age appropriate restraints critical
- Children should be in:
  - Child safety seats until 4 years old and 40 lbs
  - Booster seats from ages 4 to 8
- Pink circles highlight passengers requiring booster seats

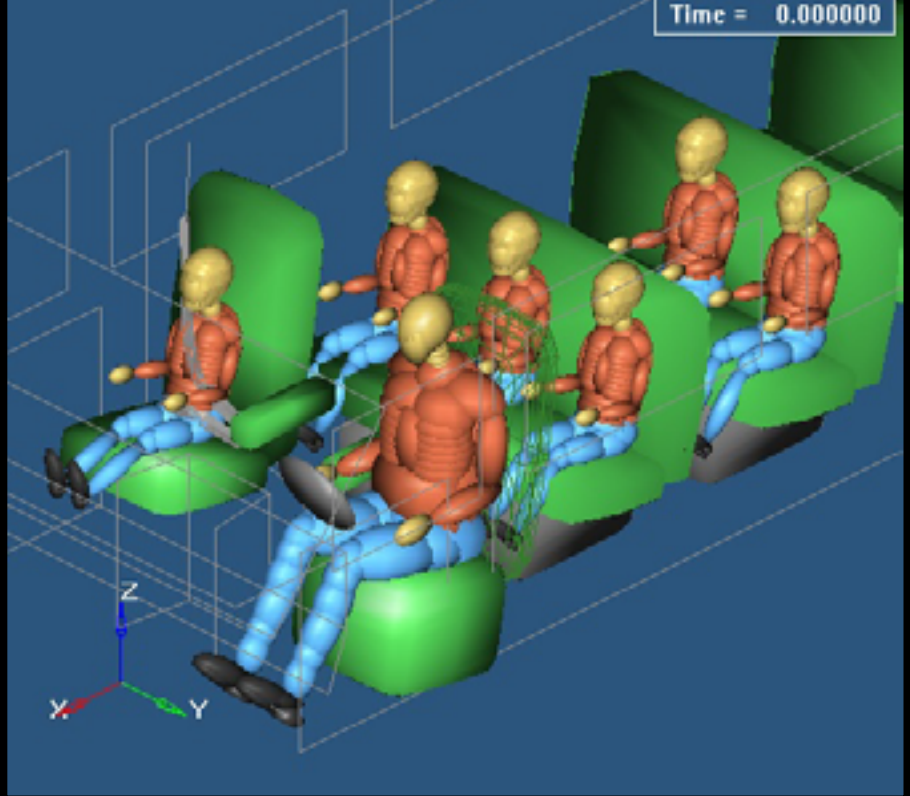


# Occupant Simulations

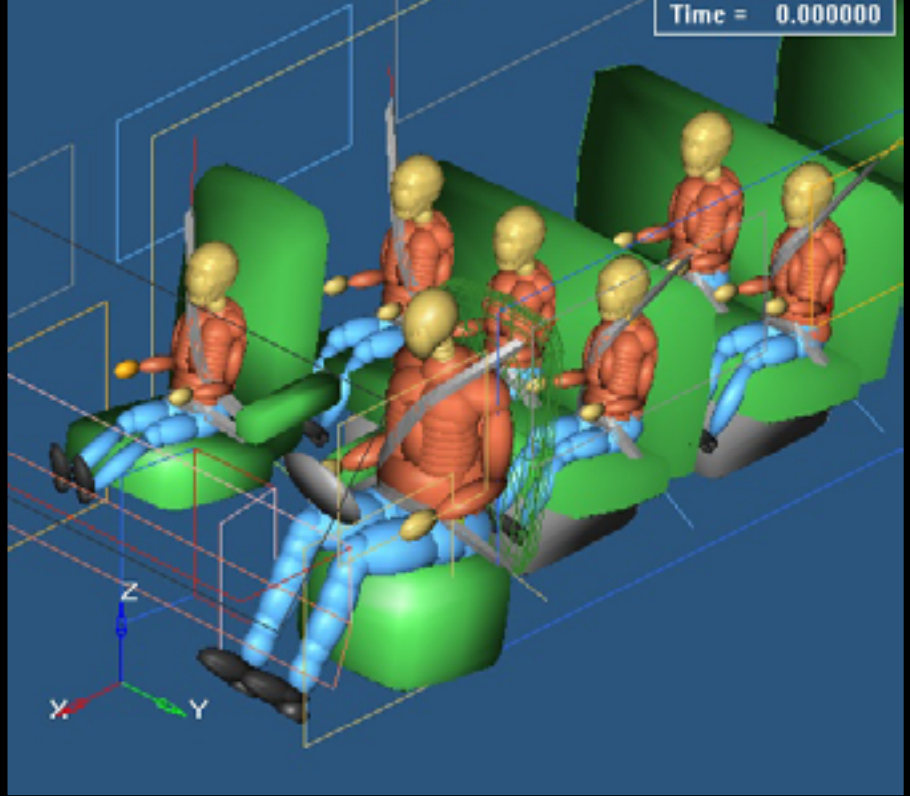
- Developed from the crash pulse from vehicle dynamics simulation
- Initial seating positions based on physical evidence and witness reports
- Representative of the occupant motion but may not show the actual motion: valid for comparisons



Time = 0.000000



Time = 0.000000

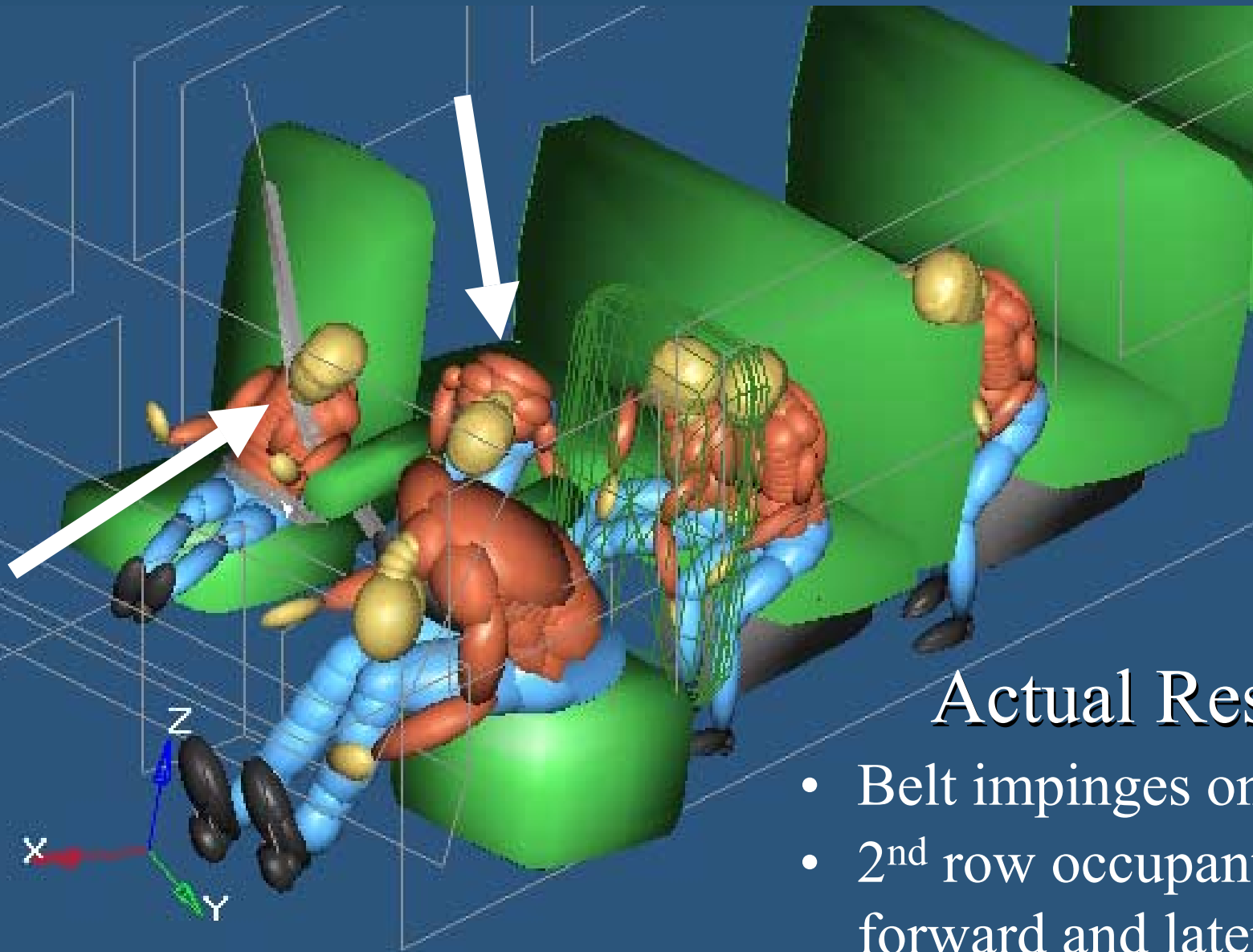


# Simulations

Time = 0.000000

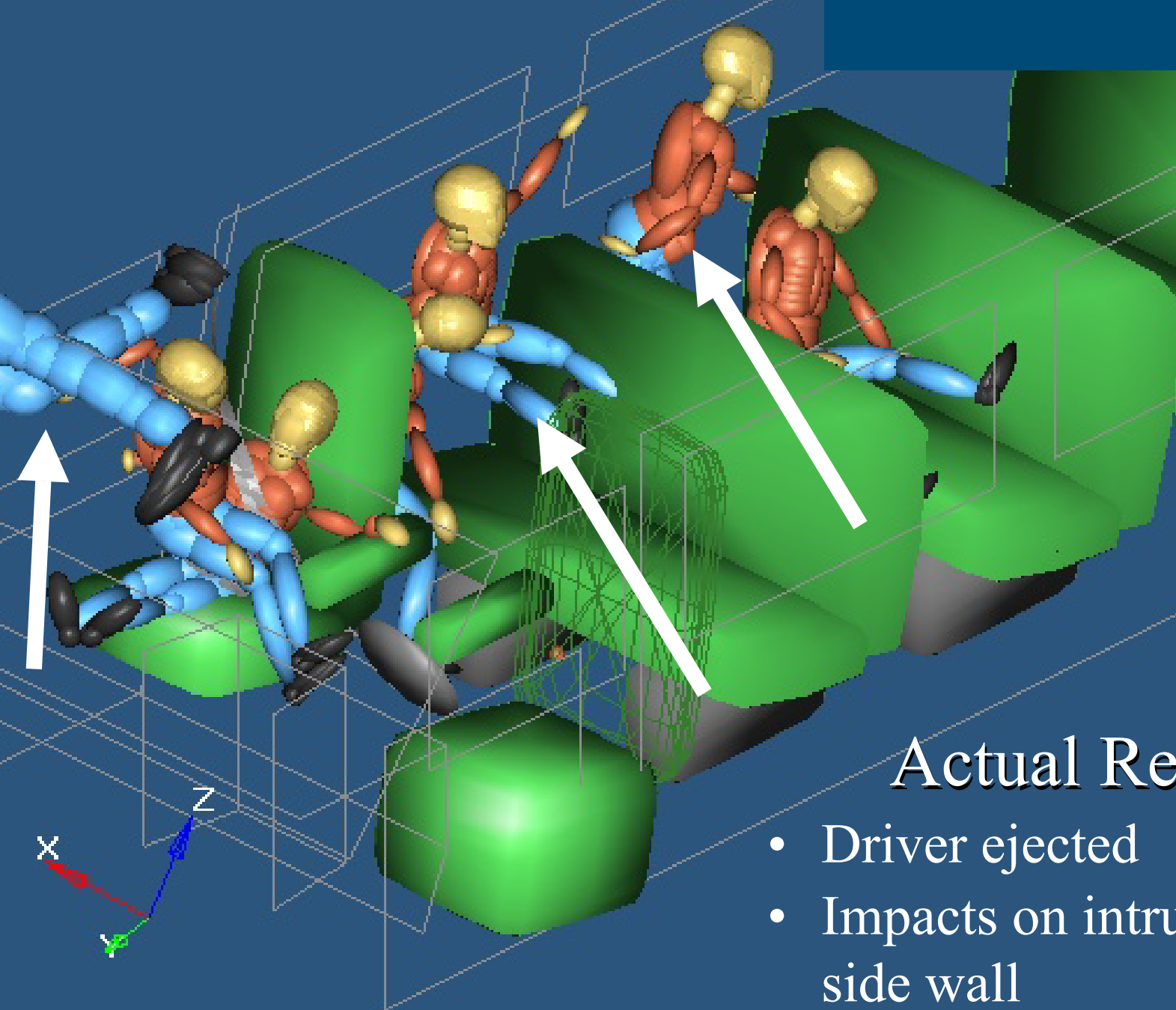






## Actual Restraint

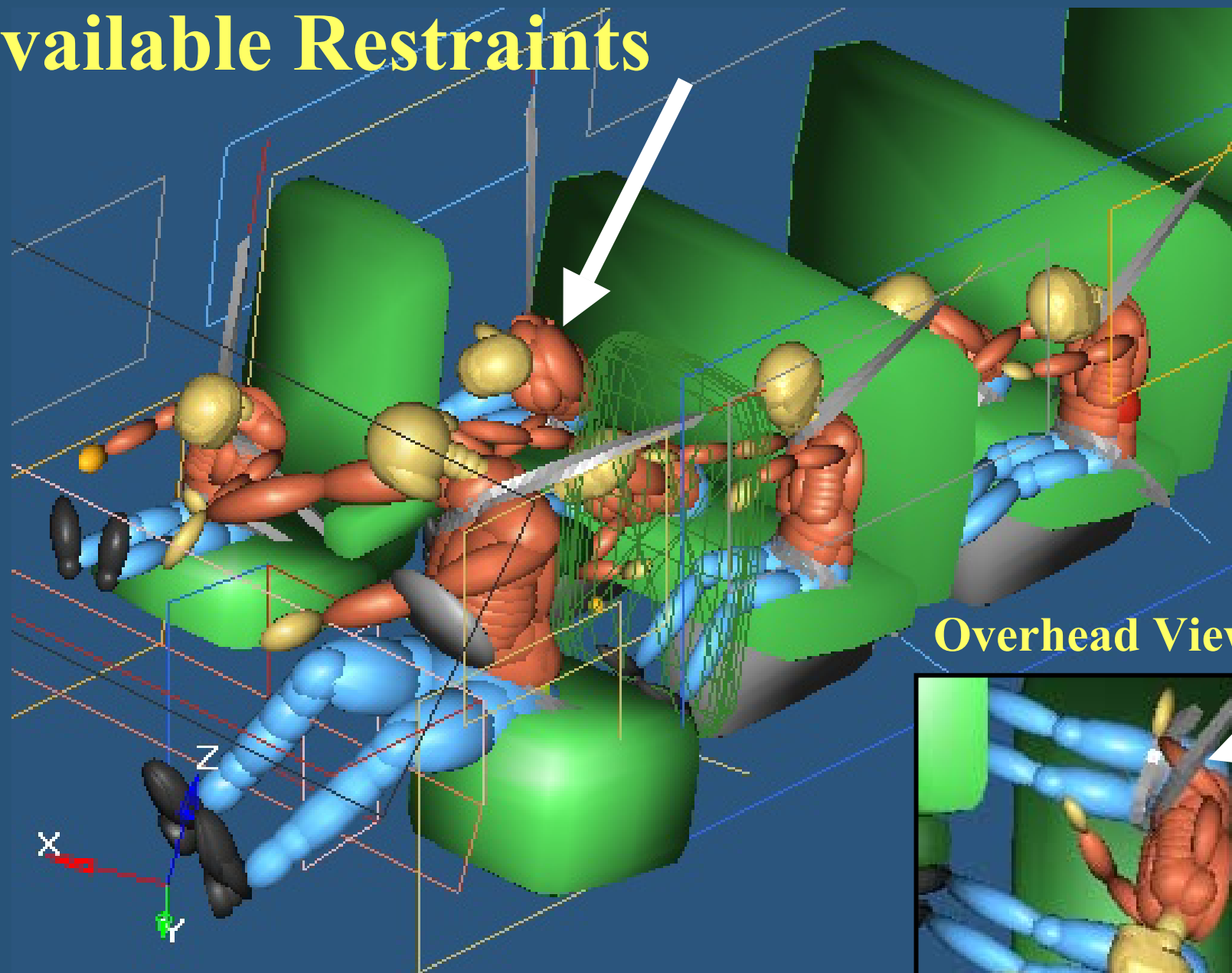
- Belt impinges on neck
- 2<sup>nd</sup> row occupant traveling forward and laterally into driver's region



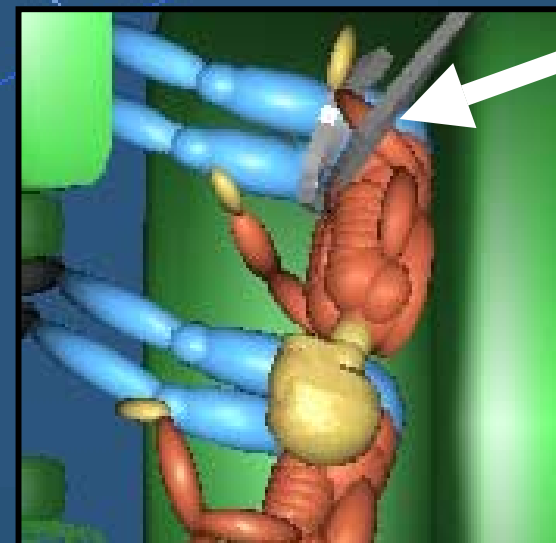
## Actual Restraint

- Driver ejected
- Impacts on intruding right side wall

# Available Restraints

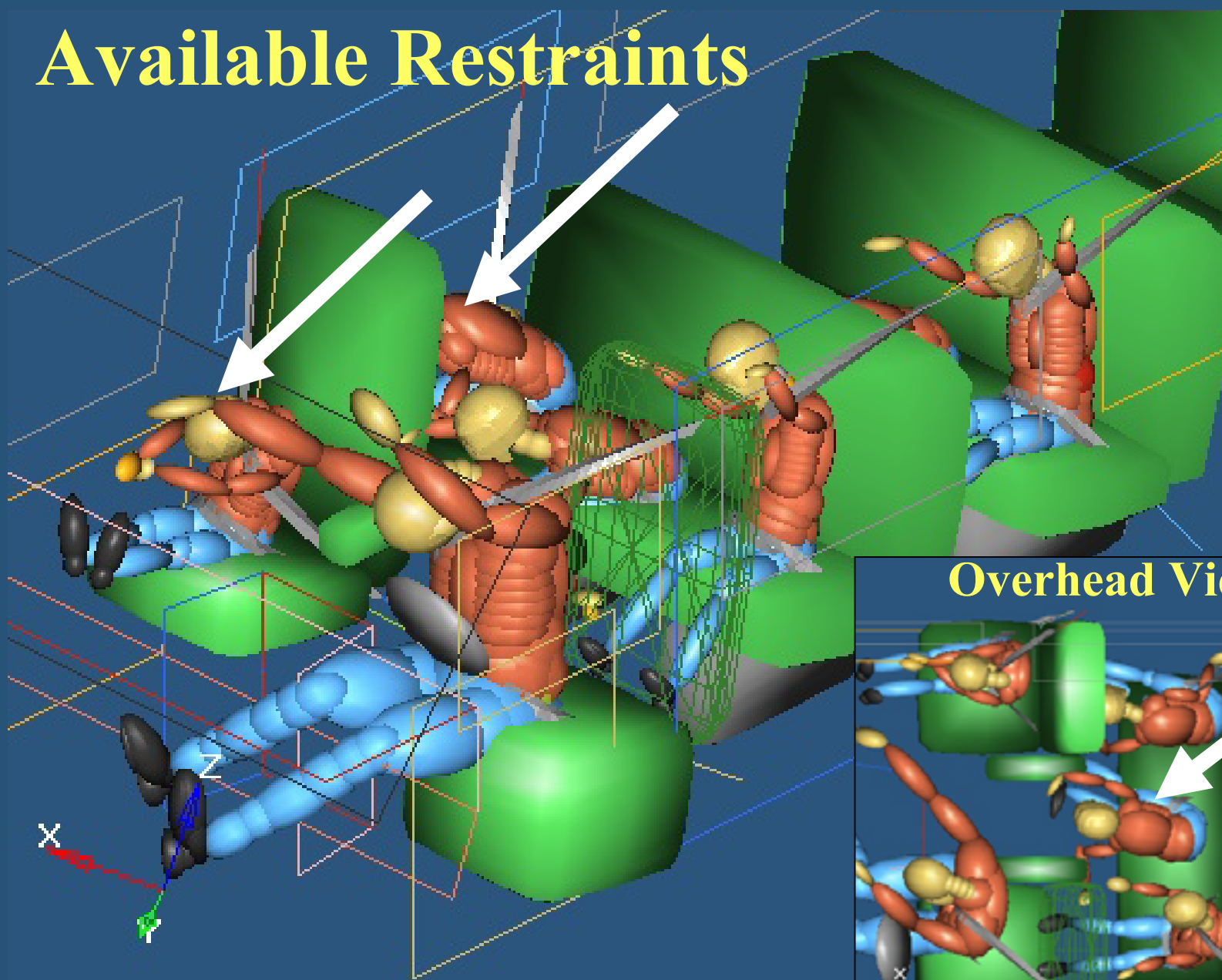


Overhead View



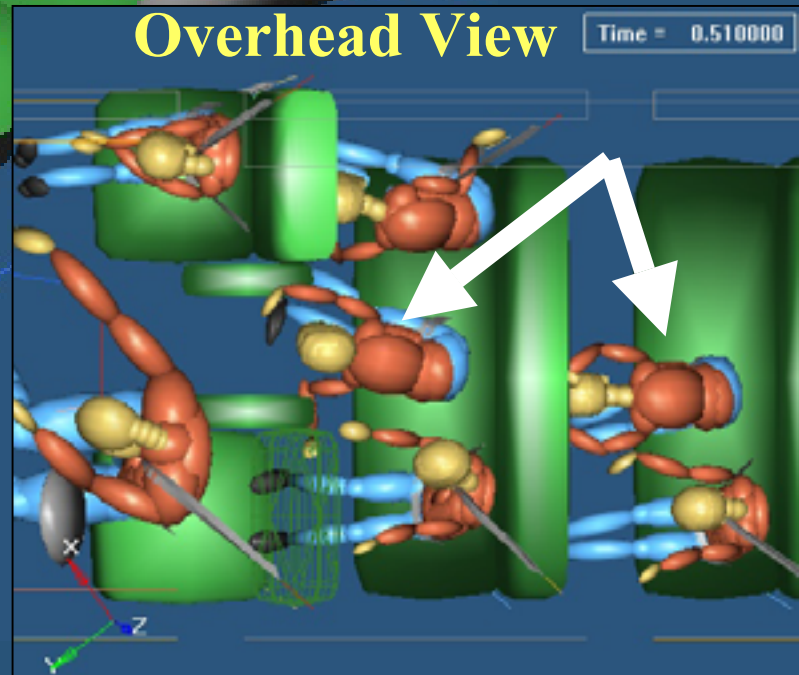


# Available Restraints

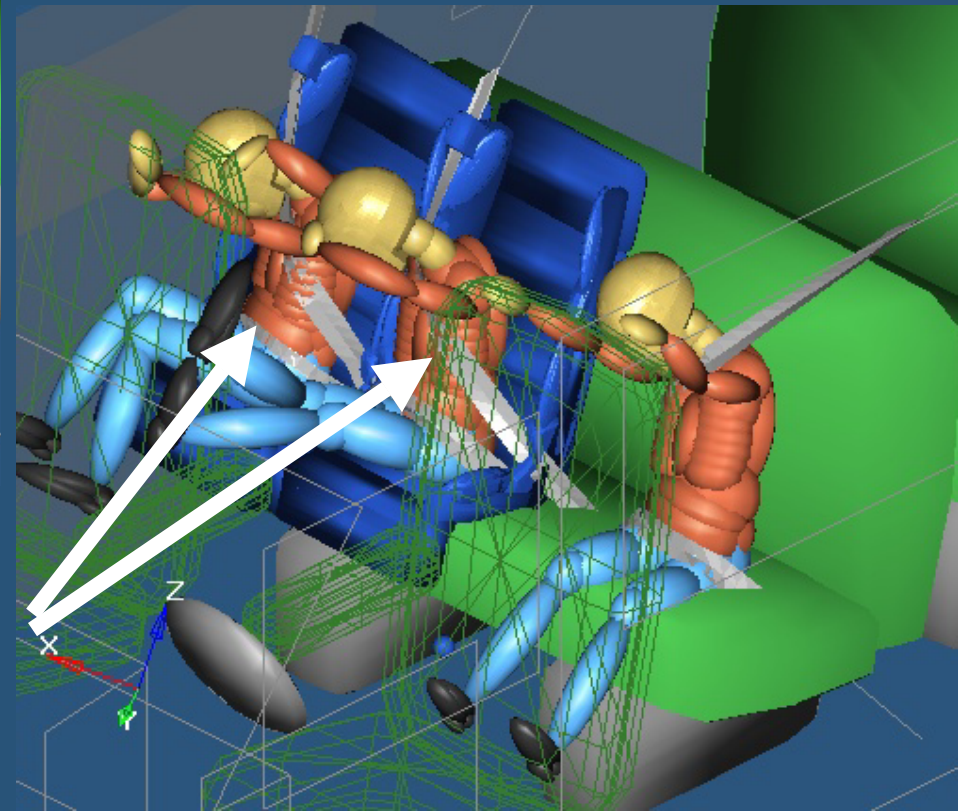
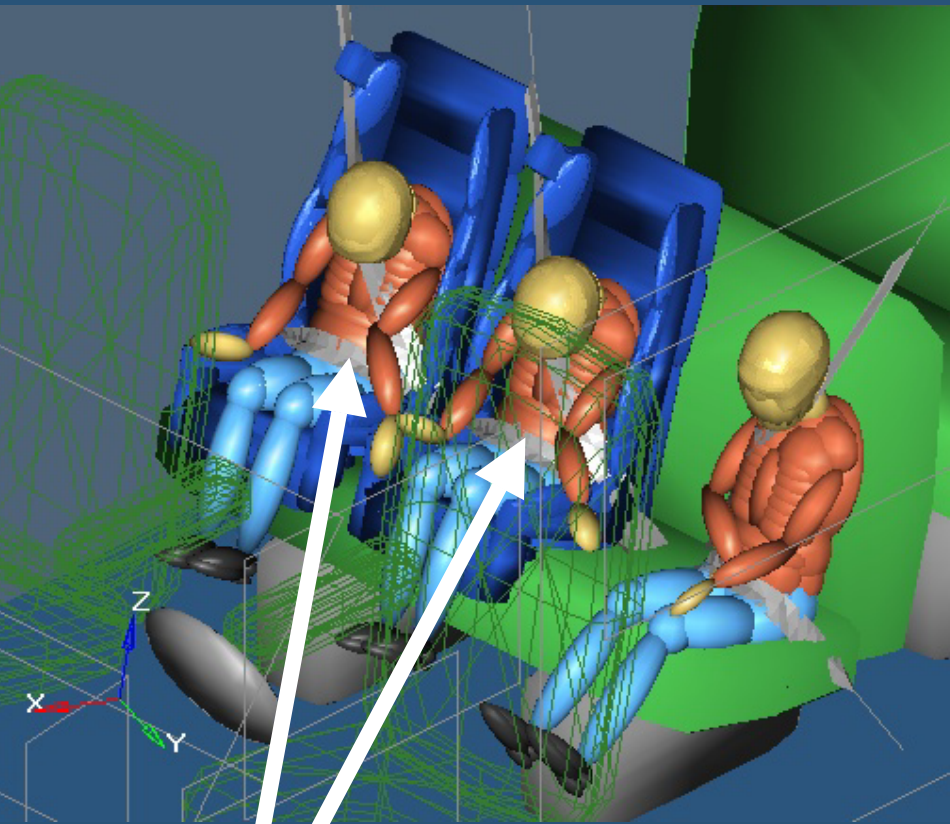


## Overhead View

Time = 0.510000



# Booster Seated Condition



# Occupant Simulation Summary

- Actual restraint condition – high injuries
  - Injuries resulted from impacts with intruding sidewall, other occupants, and interior surfaces
  - Simulated driver ejected through windshield
- Available restraint condition – high injuries
  - Less occupant motion but injuries still severe





# Occupant Simulation Summary

## Booster seat condition – low injuries

- Proper positioning of restraints
- Increased lateral restraint from high-backed booster
- Injuries less severe for two occupants in high-backed booster seats



# Human Performance Issues



# Medical Fitness

- No pre-employment physical
- Morbid obesity
- Possible diabetes
- Potential health problems





# Toxicological Impairment

- Marijuana recently used
- Possession of marijuana
- Frequent user
- No remedial action by day care operator



# Excessive Daytime Sleepiness

- 8 hours sleep
- Routine napping
- Difficulty maintaining wakefulness
- Snoring
- “Keeping driver awake” responsibility of attendant
- Children had to wake driver on occasion



# Possible Sleep Disorder

- Excessive daytime sleepiness
- Associated with obesity
- Sleep apnea
  - Snoring
  - Diabetes
  - Obesity
  - Napping
  - Untreated patients report falling asleep while driving or stopped at traffic signals







Source: Memphis Police Department

# Child Care Transportation



# Tennessee Department of Human Services Requirements, 2002

- Maintain all vehicles in safe working condition
- Emergency equipment
- Passenger log
- Child restraint and seat belt usage
- Emergency exit drills





# Tennessee Department of Human Services Driver Requirements, 2002

- Valid driver's license
- "F" endorsement
- Medical examination
- Background check



# Tippy Toes's Lack of Oversight

- Used 15-passenger vans
- Did not require restraint use
- No driver background check
- No driver medical examination
- Aware of driver's marijuana use
- Aware of driver's sleepiness



# Tennessee Department of Human Services Oversight

- Transportation operation examined January 3, 2002
- Transportation logs reviewed with Tippy Toes's director
- Discrepancies not noted





# Governor's Committee to Review Transportation Safety of Child Care Agencies

- Assessed Tennessee's child care transportation policies
- Recommended Tennessee adopt laws to improve child care transportation safety



# Tennessee Child Care Transportation Laws

- All vehicles carrying more than 10 passengers must meet Federal school bus standards
- Regular inspections
- Annual safety inspections
- Use of age-appropriate restraints



# Tennessee Child Care Transportation Laws

- Vehicles identified by name, emergency number, and DHS complaint number
- Driver written and skills test required
- Annual health statement
- Drug testing



# Child Care Transportation

- Over 117,000 child care centers serving millions of children
- Transportation laws vary by State
  - 11 do not specify restraint usage
  - 23 do not require vehicle inspection
  - 26 do not specifically prohibit drug use
  - 40 do not require buses built to school bus standards
  - 48 do not require driver physicals
  - 49 do not require additional training
  - 49 do not require marking the vehicle





# Vehicle

- School buses or equivalent should be used
- Multifunction school activity bus (MFSAB)





Source: Girardin

# Vehicle

- School buses or equivalent should be used
- Multifunction school activity bus (MFSAB)
- 15-passenger vans do not provide equivalent protection
- Regular safety inspections
- Vehicle identification



# Occupant Protection

- Seat belts do not properly fit children
- Children 8 and under should be in age-appropriate restraints
- Children over 8 should use lap/shoulder belts
- No children in front seat





# Driver

- Background check
- Pre-employment physical
- Pre-employment and random drug tests
- Review by the State



# Child Care Transportation Oversight

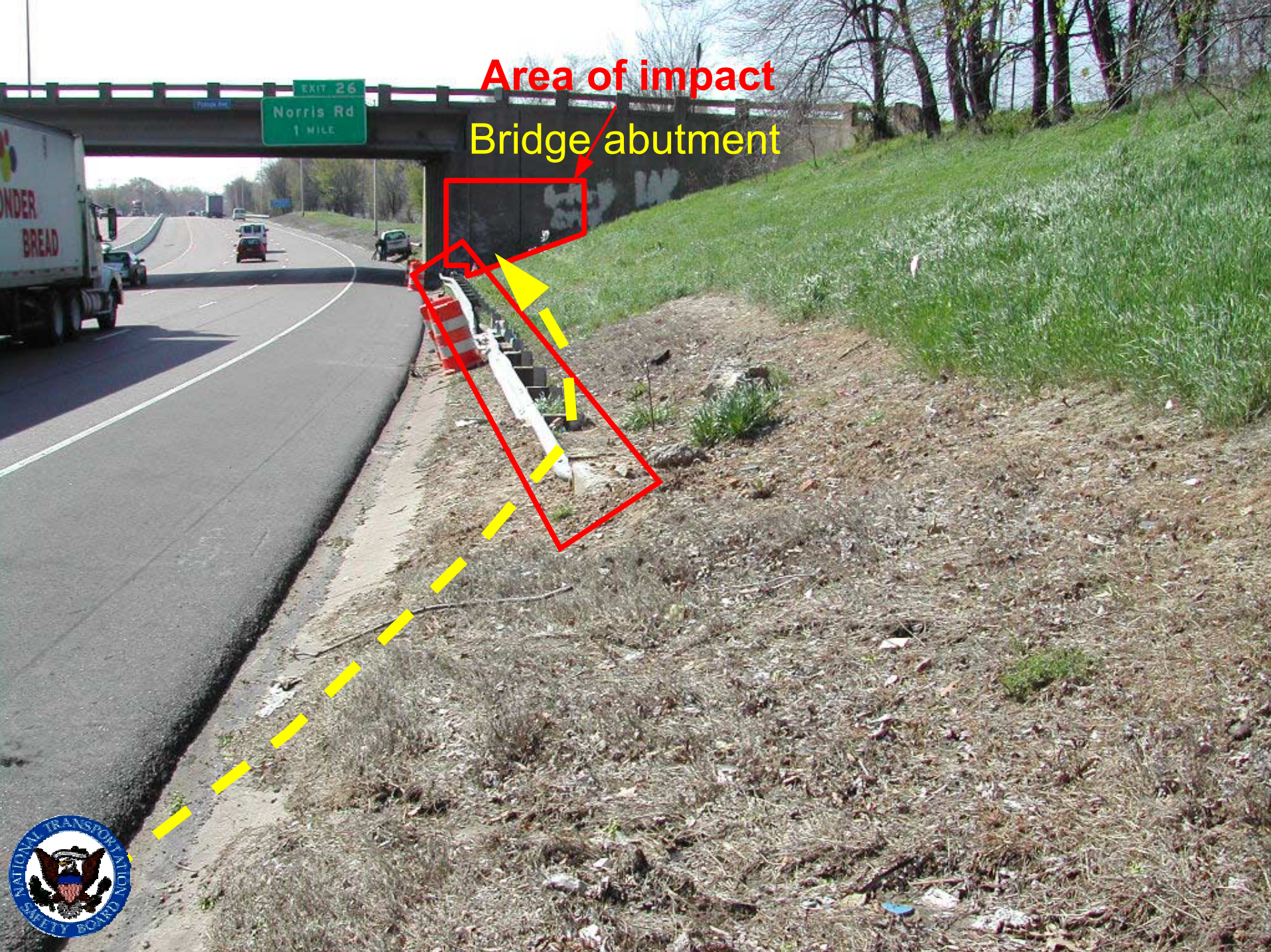
- Tennessee is only State with comprehensive program
- Comprehensive oversight needed in all States
  - Vehicle
  - Driver
  - Operations
- Accreditation
- U.S. Department of Health and Human Services: \$4.8 billion



# Highway Issues







Area of impact

Bridge abutment





# Person Avenue Barrier

- Original construction did not incorporate barrier
- Barrier system first installed in 1977
- Barrier system replaced in 1993, 2001, and 2002
- Same type of terminal used in each installation





EXIT 26  
Norris Rd  
1 MILE

37 percent

26 inches

5 inches

Flares away from road







**Tire furrow leading to barrier impact**





# Accident Scene Design Elements

- Steep 37-percent backslope
- Barrier located along horizontal curve
- Design of bridge abutment was same as a vertical wall





# AASHTO Barrier Design Parameters

- Highway design speed
- Clear zone distance
- Theoretical stopping distance, also referred to as “runout length”
- Runout length allows vehicle to stop prior to shielded hazard



# AASHTO Guidance

- Provides tables and formulas to establish length of need for roadside barriers
- Focuses on barrier installations located along straight segments of roadway



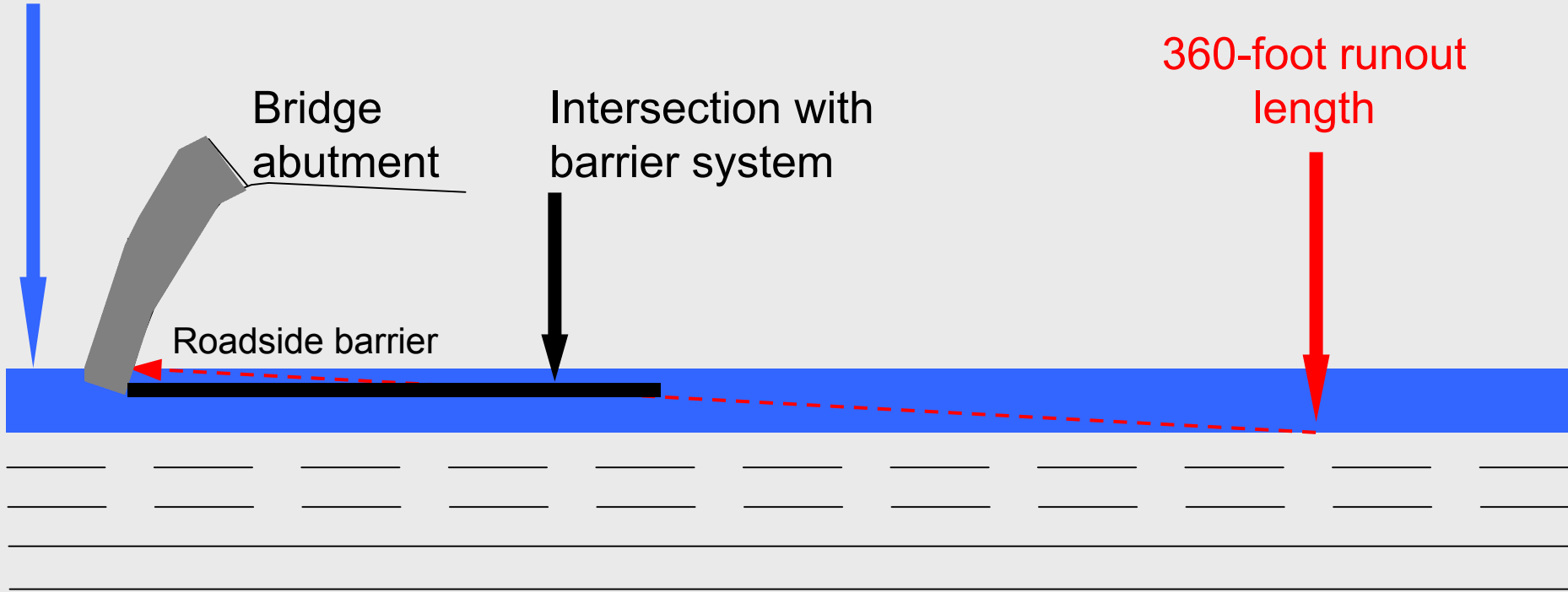
21-foot  
clear zone

Bridge  
abutment

Intersection with  
barrier system

360-foot runout  
length

Roadside barrier



Example of barrier length based on  
straight roadway alignment



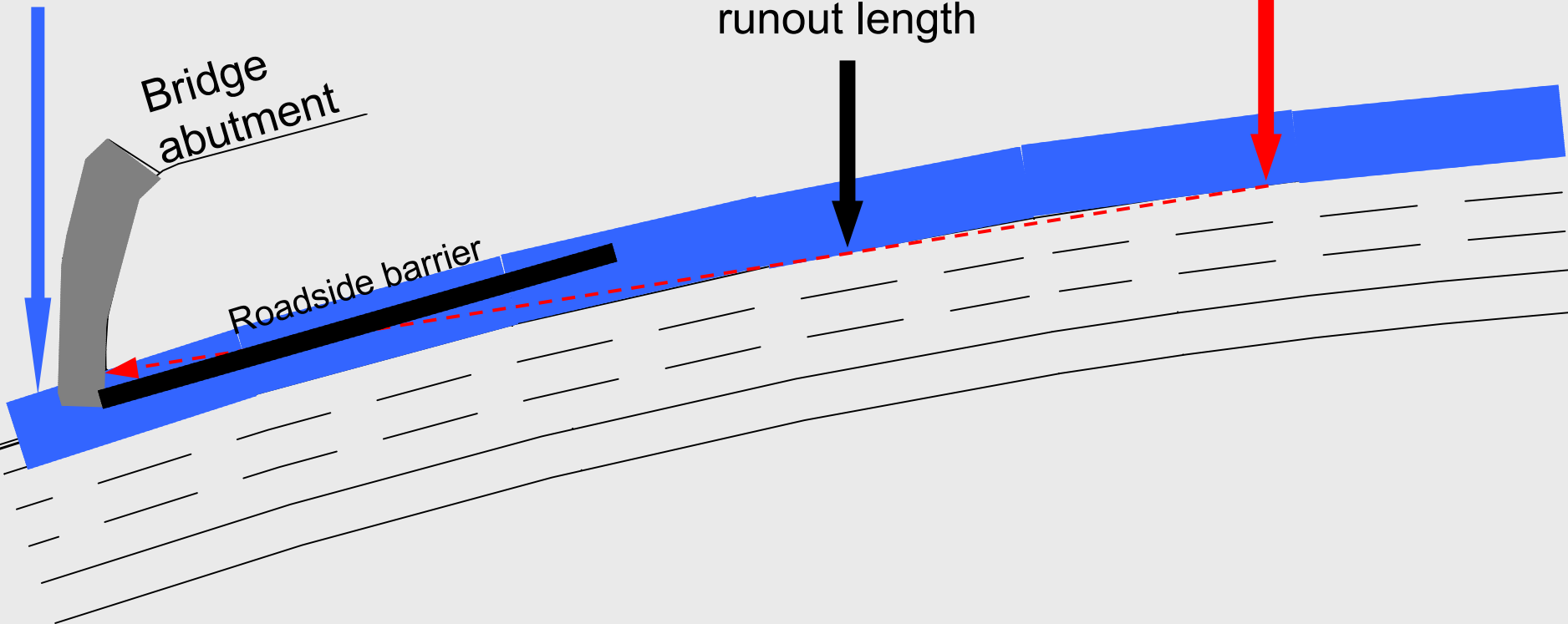
21-foot  
clear zone

Bridge  
abutment

Roadside barrier

Effective  
runout length

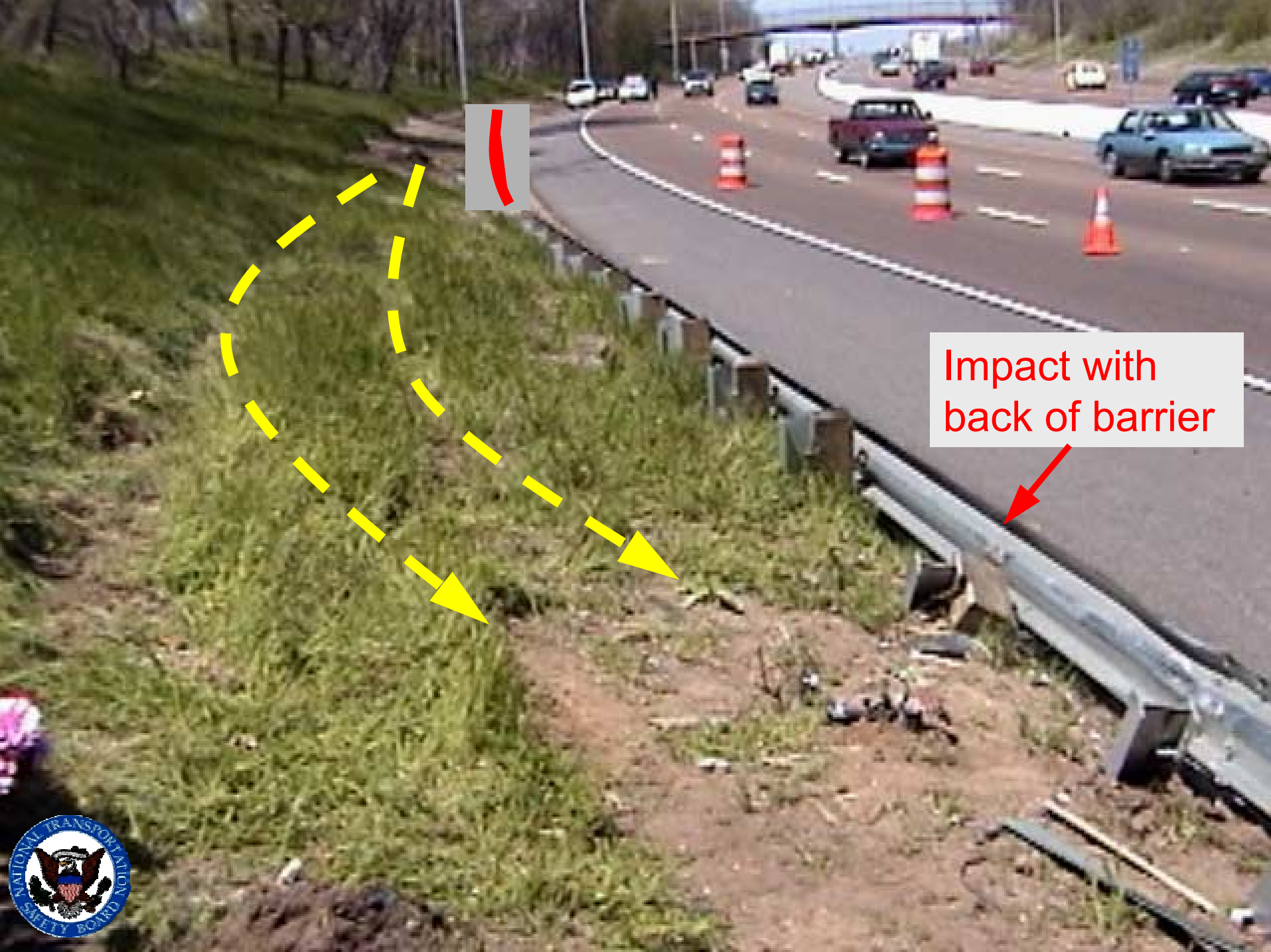
360-foot runout  
length



Southbound lanes of Interstate 240  
at the accident location







Impact with  
back of barrier





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