



**National
Transportation
Safety Board**

Seat Belts on School Buses: NTSB Crash Investigations

Kristin Poland, Ph.D.

NHTSA School Bus Occupant Protection Meeting
July 23, 2015

Overview

- NTSB investigations of seat belt equipped school buses
- Two lap belt school bus crashes:
 - Chesterfield, NJ
 - Port Saint Lucie, FL
- Occupant Simulations
- Conclusions
- Recommendations

NTSB Investigations of Seat Belt Equipped School Buses



Central Bridge, NY - 1999



Conasauga, TN - 2000



Milton, FL - 2008



Chesterfield, NJ-2012



Port Saint Lucie, FL-2012



Anaheim, CA - 2014



NTSB

Chesterfield, NJ



Port St. Lucie, FL



Lap Belts

Lateral Impact

High Impact Force in Back of Bus

Less Proper Belt Use
(Compared to
Pt. St. Lucie)

Video Evidence
Seat Integrity
Issues



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Animation of Accident Reconstruction

School Bus and Roll-Off Truck Collision at Intersection

Near Chesterfield, New Jersey

February 16, 2012

HWY12MH007

Chesterfield School Bus - Left Side



Courtesy Burlington County Prosecutors Office

Chesterfield School Bus - Right Side

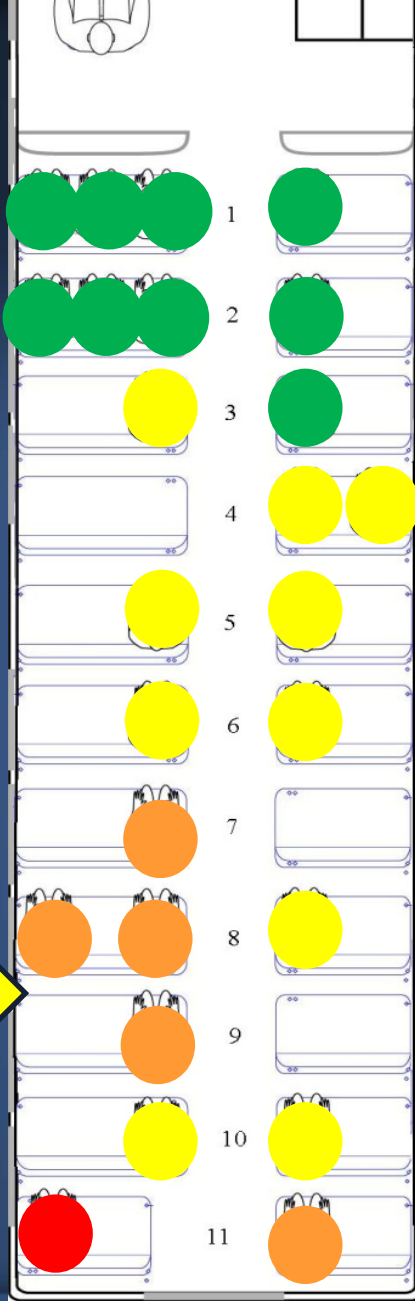


Courtesy Burlington County Prosecutors Office

Chesterfield - Injury Information

School bus occupants

- 25 passengers
- 1 fatality
- 5 serious injuries
- 10 minor injuries
- 9 uninjured
- Driver: minor injuries

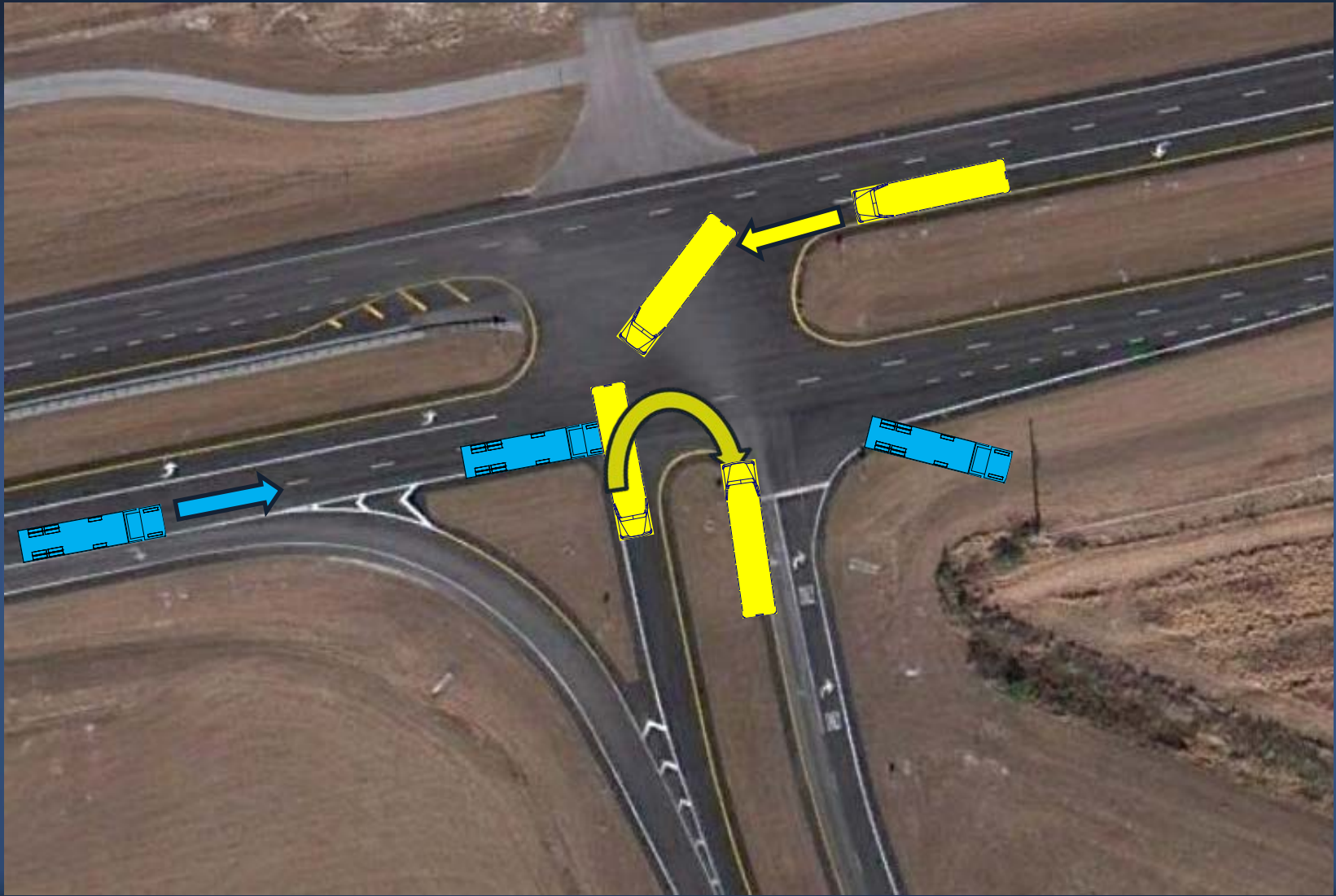


School Bus Lap Belts

- New Jersey requires passenger seat belts on school buses
- Lap belts:
 - Some worn properly
 - Many lap belts either worn improperly or not worn at all



Port Saint Lucie: Crash Description



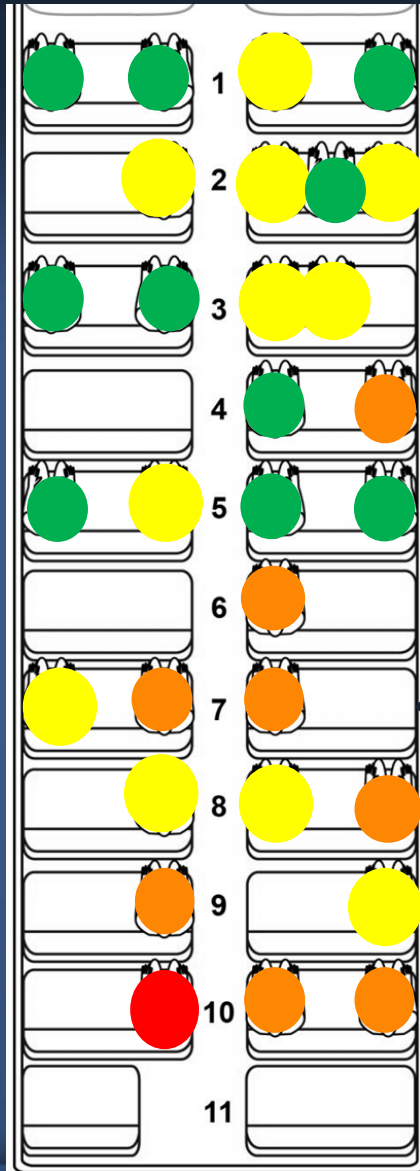
Port Saint Lucie, Florida



Port Saint Lucie School Bus Interior



Port Saint Lucie – Injury Information



School bus occupants

- 30 passengers*
- 1 fatality
 - 8 serious injuries
 - 11 minor injuries
 - 10 uninjured
- Driver – minor injuries

* Injuries were also AIS coded.

Onboard Video Systems

- Continuous video and audio system
- Four interior cameras
- 15 frames per second; 59 min 39 sec
- Began prior to student loading; ended 15 minutes after impact
 - Vehicle and occupant motion
 - Passenger egress
 - Emergency response





Port Saint Lucie – Belt Use Information



Belt Use

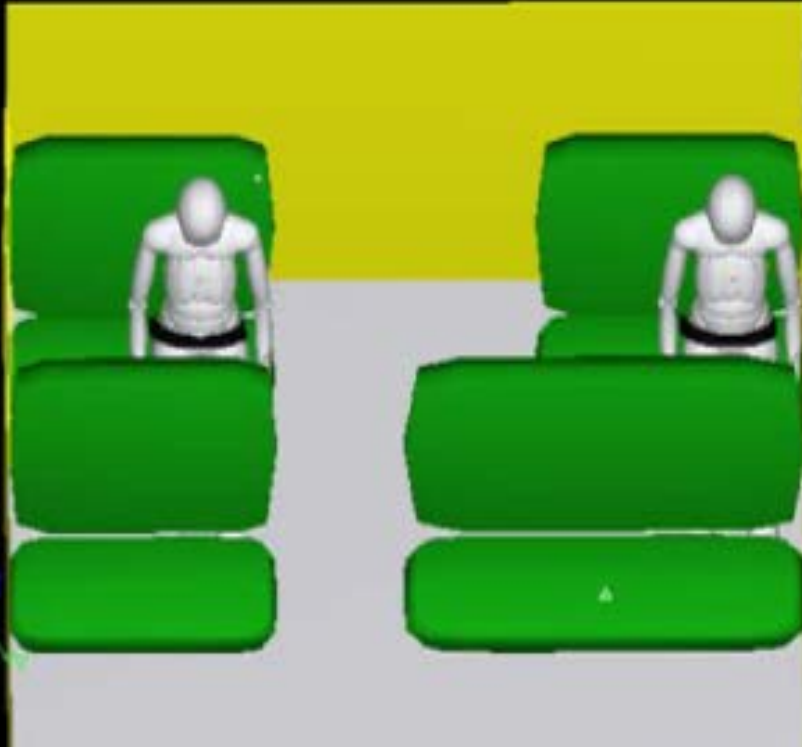
- = Belt Used Properly
- = Belt Adjusted Loosely
- = Belt Not Visible

↓ = Camera Positions



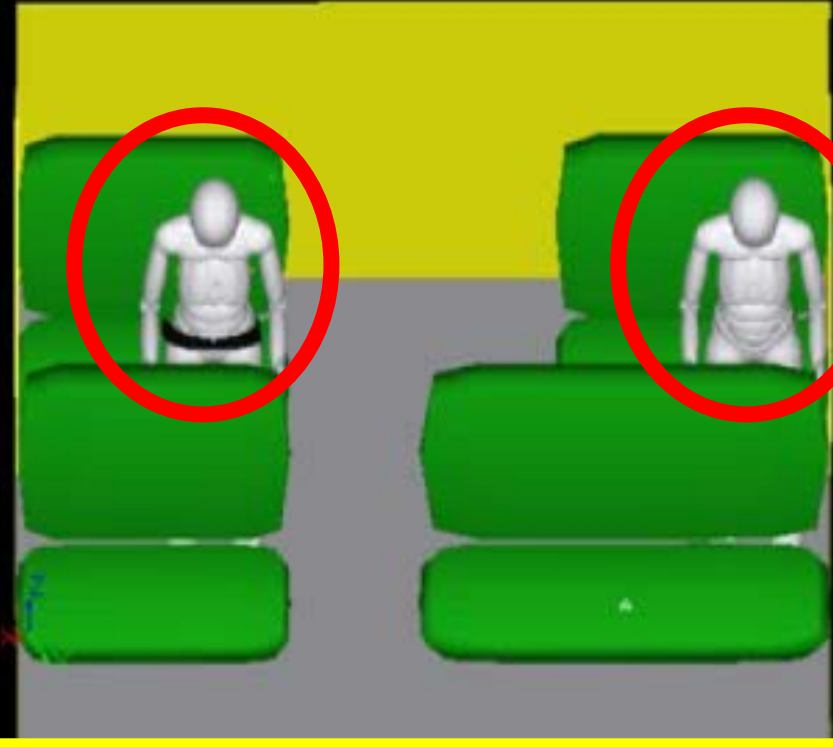
Chesterfield: Occupant Kinematic Simulations

Lap Belted



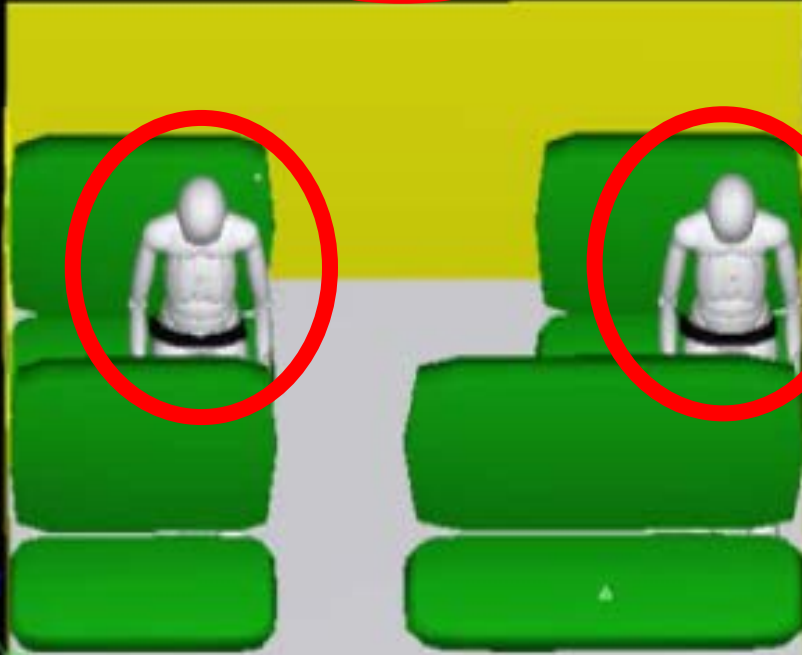
Unbelted

0.00 s



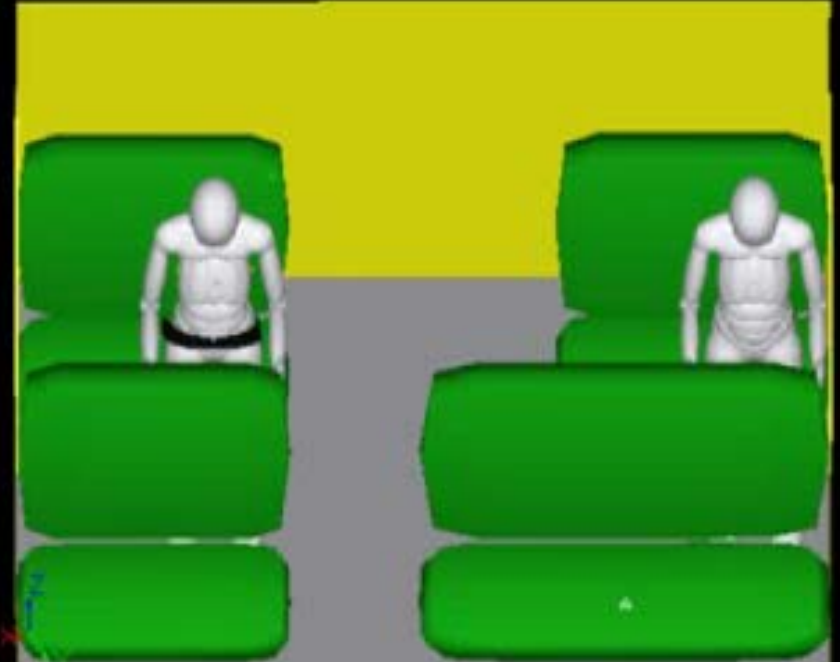
Chesterfield: Occupant Kinematic Simulations

Lap Belted

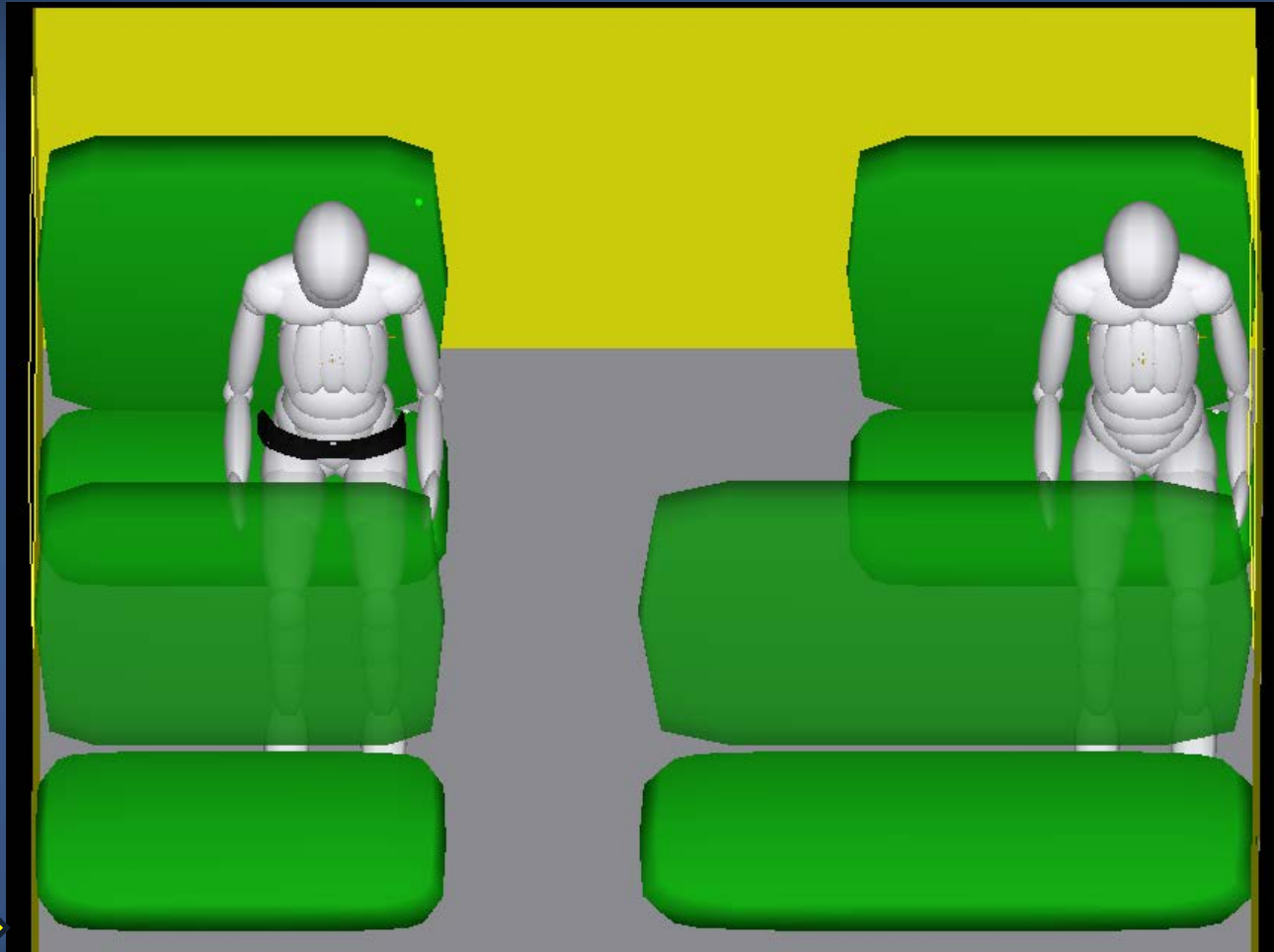


Unbelted

0.00 s



Chesterfield: Occupant Kinematic Simulations





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Occupant Kinematics Simulation Lap Belt Simulation

School Bus and Roll-Off Truck Collision at Intersection

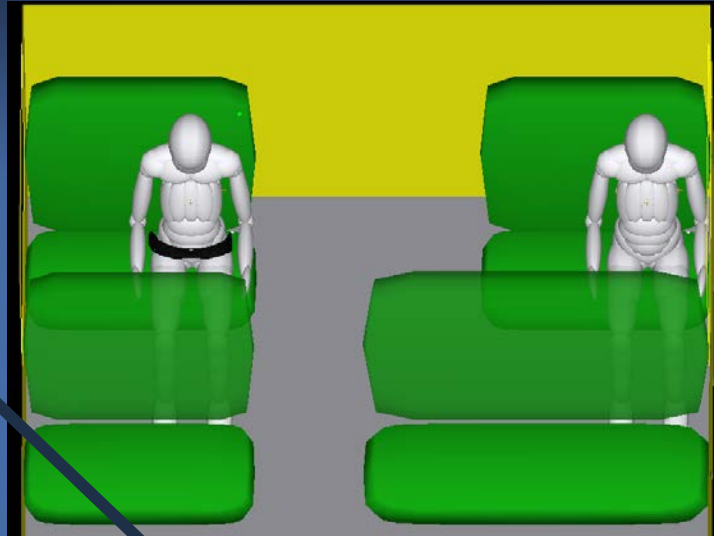
Near Chesterfield, New Jersey

February 16, 2012

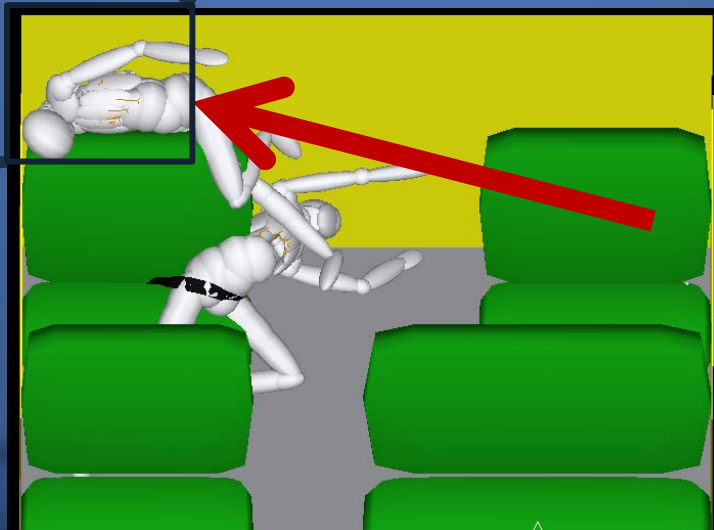
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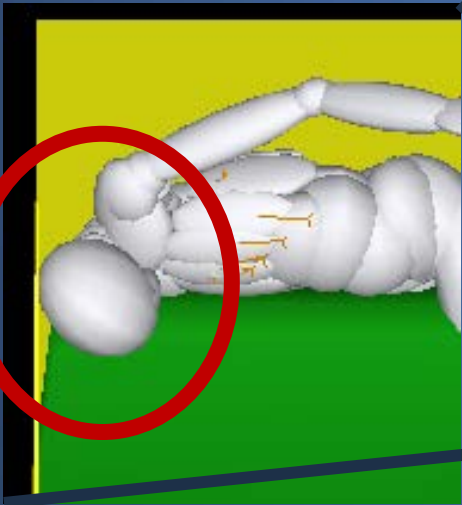
Chesterfield: Unbelted Occupant Motion



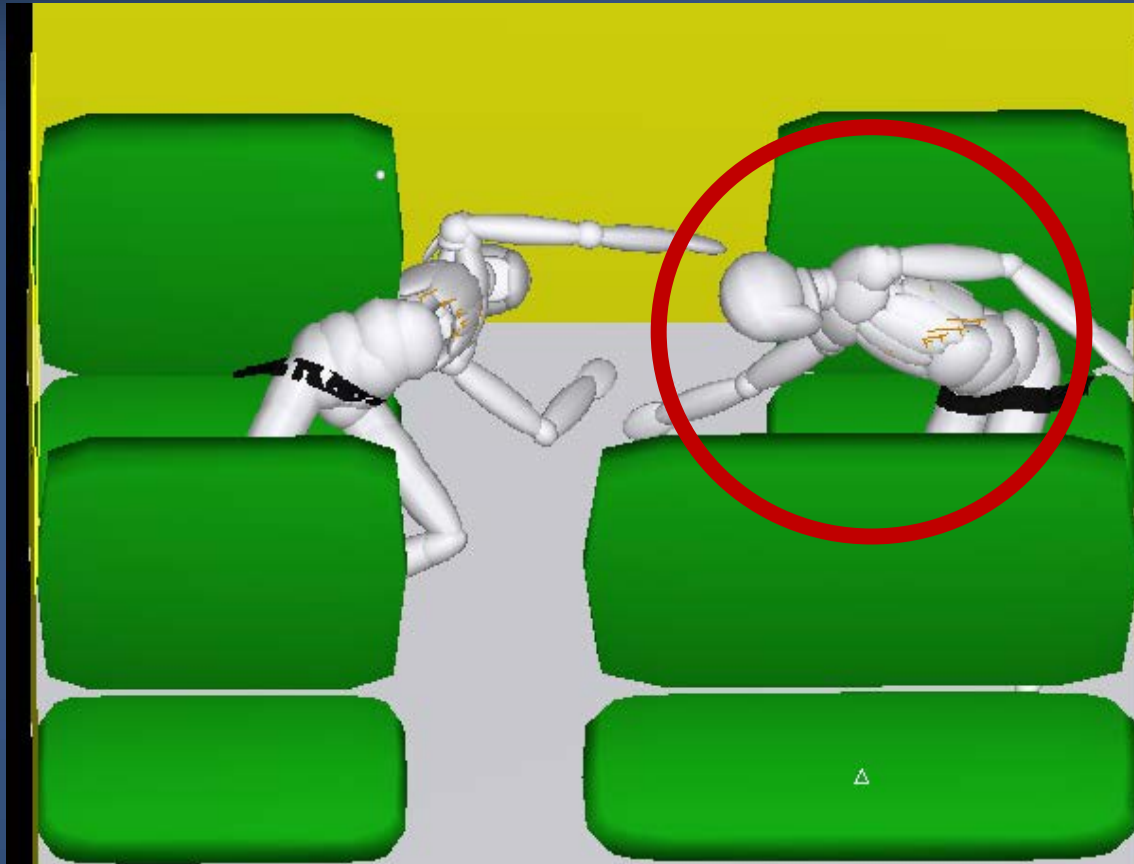
Time = 0.0 second



Time = 1.4 seconds



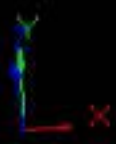
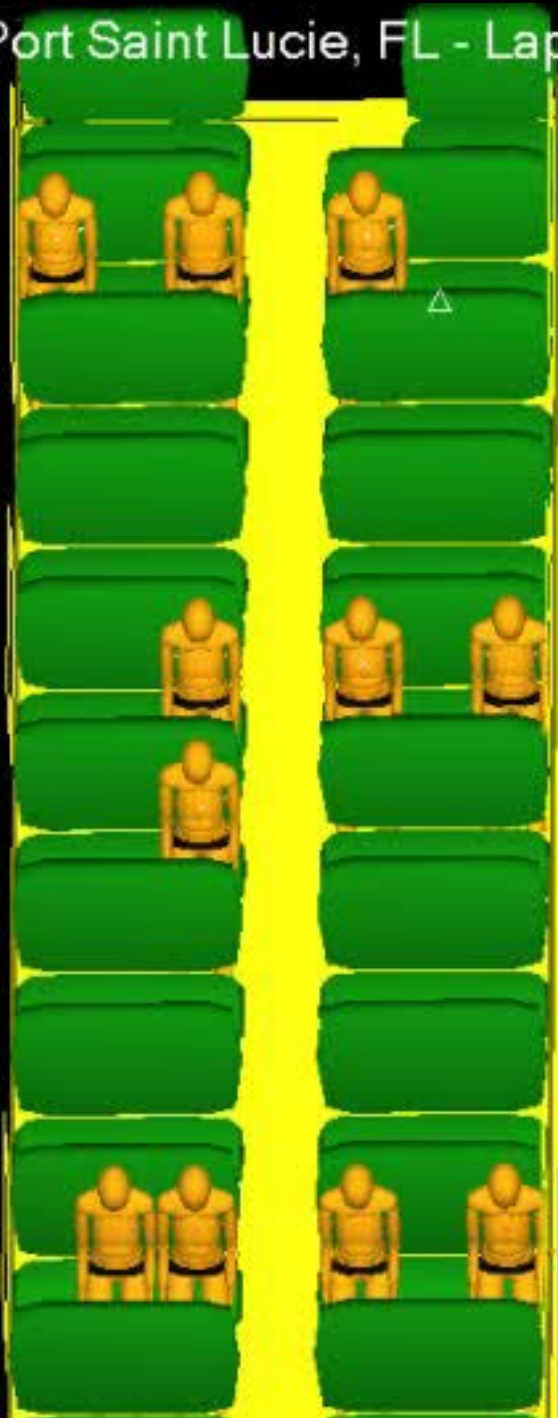
Chesterfield: Lap Belted Occupant Motion



Time = 1.4 seconds

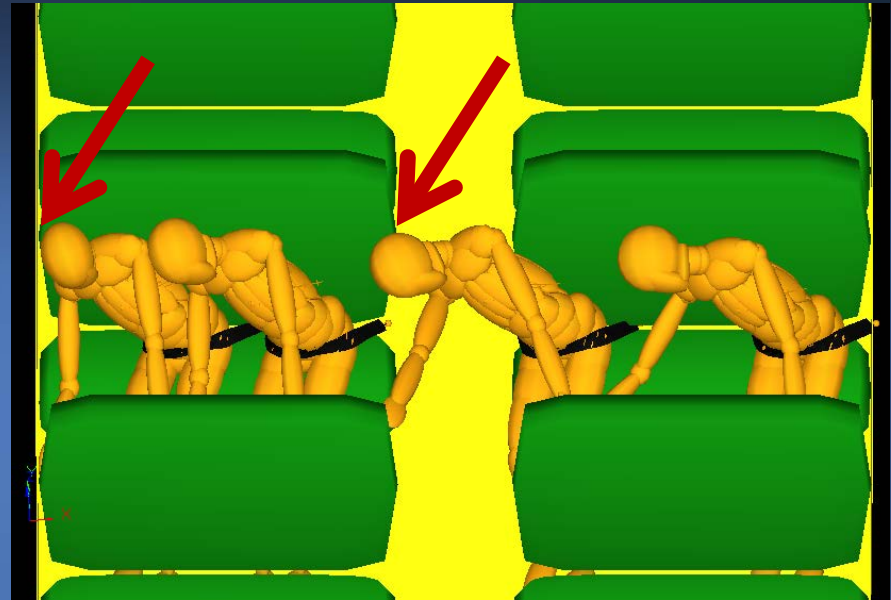
Port Saint Lucie, FL - Lap Belted

0.00 s

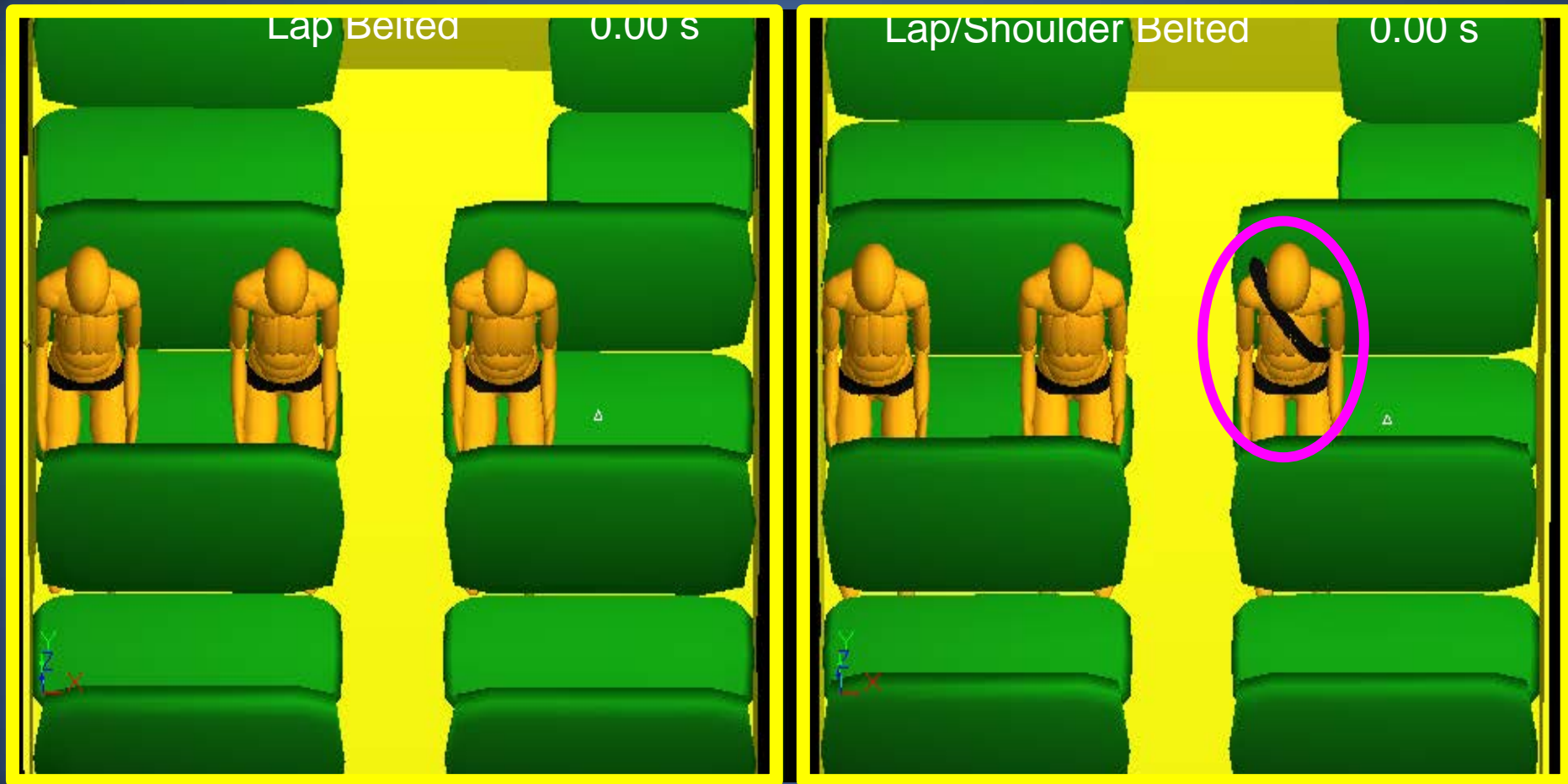


Injury from Contact on Non-Protected Interior Surfaces

- Lap belts do not prevent injury from upper body flailing
- Hard surfaces a risk even with compartmentalization and/or lap belts
- Previous recommendation to protect interior surfaces



Reducing Flailing Injuries





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Occupant Kinematics Simulation

Lap/Shoulder Belt Comparison Simulation

School Bus and Truck Tractor Semi-Trailer
Collision at Intersection

Near Port Saint Lucie, Florida
March 26, 2012

HWY12FH008



Conclusions



- Some lap belts worn improperly or not at all
- Lap belts can provide a benefit to passengers who wear them properly
- Properly worn seat belts enhance school bus safety

Conclusions (cont.)



- Properly worn lap/shoulder belts reduce injuries related to upper body flailing
- Educate students, parents and school districts about proper belt use on school buses

Recommendations

- 1999 Bus Crashworthiness Report:
 - Develop performance standards for school bus occupant protection (H-99-45)
- Guidelines to assist in training about importance of proper belt use (H-13-32, -33, -35)
- Lap/shoulder belts should be considered when purchasing belt-equipped buses (H-13-36)

Thank You

Kristin Poland, Ph.D.

Office of Research and Engineering

Kristin.Poland@ntsb.gov