

NTSB

National
Transportation
Safety Board



Bus Roadway Departure and Rollover

Pala Mesa, California
February 22, 2020

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Kris Poland, PhD	Deputy Director, Office of Highway Safety (OHS)
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Dennis Collins	Investigator-in-Charge/Human Performance Factors (OHS)
Brian Bragonier	Vehicle Factors (OHS)
Mike LaPonte	Motor Carrier Factors (OHS)
Sheryl Harley	Survival Factors, Office of Rail, Pipeline & Hazardous Materials Safety (RPH)
Bob Squire	Technical Reconstruction (OHS)
Steve Prouty, P.E.	Highway Factors (OHS)
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Pala Mesa, California

February 22, 2020

Dennis Collins
Investigator-in-Charge

Trip Overview

- Began in El Monte, CA, 7:30 a.m.
- Executive Lines, Inc.
- Regularly scheduled route to San Ysidro, CA
- 2014 Freightliner chassis, General Coach America 30-passenger coach body
- Four scheduled stops along the way, including Temecula, CA



The Crash

- Driver and 20 passengers on bus after Temecula stop
- About 10:23 a.m.
- Driver lost control
- Bus departed roadway to the right, rolled 1.5 times, came to rest on roof
- Data shows about 74 mph, sustained braking, sharp steering to the right
- Reports of moderate rain and wet roadway at the time



Source: California Highway Patrol

Injuries

- Passengers
 - 3 fatally injured
 - 12 seriously injured
 - 5 with minor injuries
- Driver
 - Minor injuries



Source: California Highway Patrol (CHP)

Vehicle Damage



Investigative and On-Scene Staff

Dennis Collins

Investigator-in-Charge & Human Performance

Brian Bragonier

Vehicle Factors

Michael LaPonte

Motor Carrier Factors

Steve Prouty, P.E.

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Safety Recommendations

Jess Thomas

Route and Location Map

Parties to the Investigation

- Federal Motor Carrier Safety Administration (FMCSA)
- California Highway Patrol (CHP)
- California Department of Transportation (Caltrans)

Excluded Factors

- Emergency response
- Highway factors
- For the driver
 - Licensing or driving experience
 - Cell phone use
 - Use of alcohol or other drugs
- Mechanical condition (except tires)

Safety Issues

- Tire Safety and Wet Roadway Driving
 - Driving at safer speeds on wet roadways
 - Ensuring adequacy of tire tread depth standards for commercial vehicles
 - Maintaining safe tire tread depths on commercial vehicles
- Occupant Protection
 - Addressing lack of roof strength standards for certain buses
 - Increasing seat belt usage on buses

Staff Presentations

- Tire tread depth, tread depth standards, and encouraging safer speeds (Brian Bragonier)
- Tire maintenance and ensuring safe tread depth (Michael LaPonte)
- Bus roof strength standards and seat belt use (Sheryl Harley)

Tire Tread Depth Standards and Wet Roadway Driving

Brian Bragonier

Overview

- Roadway conditions
- Speed
- Driver input
- 2014 General Coach America Midsize Bus
 - Tire tread condition
 - Electronic stability control
- NHTSA, FMCSA, and State of California tire tread regulations
- Tire tread depth research

Factors in the Crash

- Wet roadway
 - No drainage issues
- Vehicle speed
 - Above speed limit
 - Consistent with other vehicles
- Driver actions
 - Braking and sharp steering
 - Tend to make loss of control worse
- Tire tread depth
 - Discussed in following slides

2014 General Coach America Midsize Bus

- 2014 Freightliner S2 106 chassis
 - Produced as an incomplete vehicle
- Configured with bus body by General Coach America
 - 30-passenger capacity
- 29,000 lbs. gross vehicle weight rating (GVWR)
 - 2 axles
 - Dual tires on rear axle
- Not equipped with electronic stability control (ESC)

Electronic Stability Control (ESC)

- Helps maintain vehicle control during steering maneuvers
 - Detects improper driver input and reduces vehicle speed
- Does not increase available friction between tires and roadway
- Had the bus been equipped with ESC, the crash may have been prevented
- Newly manufactured buses are required to have ESC

Bus Tire Tread Condition

Axle	Postcrash Bus Tread (Left)	Postcrash Bus Tread (Right)
Steer	10/32 nd inch	11/32 nd inch
Rear/Drive	1/32 nd inch (inside dual)	1/32 nd inch (inside dual)



Steer Tire



Inside Dual Tire

Bus Tire Tread Condition

- Driver performed pretrip inspection of bus and indicated tires were OK on inspection form
- Carrier maintenance records show tires on rear axle had been repeatedly replaced with used tires in months before crash

NHTSA Tire Tread Depth Regulations

- 49 *Code of Federal Regulations (CFR)* Part 570 (Vehicle In Use Inspection Standards) Subparts A and B
 - Established criteria for inspection of motor vehicles by state inspection systems
 - Do not impose requirements on any person
 - Subpart A pertains primarily to inspection of passenger vehicles
 - Subpart B states tires on commercial vehicles shall have a minimum of 4/32 inches tread depth on steer tires and all other tires must have at least 2/32 inches tread depth

FMCSA Tire Regulations

- 49 *CFR* 393.75
 - Requires minimum of 4/32 inches tread depth on steering axle
 - All other tires must have minimum tread depth of at least 2/32 inches
- *California Vehicle Code*
 - Same requirements as FMCSA

Tire Tread Depth Research

- *CFR* on tire tread depth does not convey any engineering reference for the determination of these standards
- Based on the NHTSA standards, an inference can be drawn that steer axle tire tread depth is more critical than that on the rear axles
 - No consideration for potential ramifications to dynamic stability and vehicle control
- Research shows poor tread on the rear axle and substantially better tread on the steer axle can adversely affect vehicle wet surface handling

Tire Tread Depth Research

- Potential for significant tread depth variance between tires on separate axles or even separate axle ends
 - New tires can have as much as 18/32 inches tread depth
 - Minimum required tread depths of 2/32 inches

What We Found: *NHTSA/FMCSA Tread Regulations*

- Current minimum tread depth requirements may be insufficient to ensure adequate traction
 - Particularly for passenger-carrying vehicles such as buses
 - Do not address tread depth disparity between tires
- What we propose:
 - Two recommendations to NHTSA
 - One recommendation to FMCSA

Bus Tire Tread Condition

Axle	Regulatory Minimum Tread	Postcrash Bus Tread (Left)	Postcrash Bus Tread (Right)
Steer	4/32 nd inch	10/32 nd inch	11/32 nd inch
Rear/Drive	2/32 nd inch	1/32 nd inch (inside dual)	1/32 nd inch (inside dual)



CVSA Out-of-Service Criteria

- Tire tread depth out-of-service criteria
 - Both dual tires must have less than 1/32 inches tread
 - Measured at two adjacent major tread grooves
 - Three separate locations
- Bus would have been in violation of both federal and state regulations
 - Would not have been placed out of service if inspected roadside
 - Tires would need to be replaced before being allowed to make another trip

What We Found: *Vehicle Loss of Control*

- Loss of vehicle control was due to combined effects
 - Substandard tread depth of rear axle tires
 - Excessive speed for wet roadway
 - Inappropriate driver inputs
- ESC would have assisted the driver in maintaining control
- What we propose:
 - One recommendation to the American Bus Association and the United Motorcoach Association

Tire Maintenance

Michael LaPonte
Motor Carrier Factors Group Chairman

Overview

- Executive Lines, Inc.
- Federal and state oversight of Executive Lines
- California bus maintenance and safety inspection form
- Tire rotation practice

Executive Lines, Inc.

- Issued USDOT Number in 2004
 - For-hire interstate passenger carrier
- Domiciled in El Monte, California
- At time of crash, operated 8 vehicles and employed 12 drivers
- Operated between Los Angeles area and Mexican border
- No longer operating as a motor carrier

Executive's Safety Policies

- Only hired drivers with bus driving experience
- General compliance with federal regulations, such as:
 - Maintaining driver qualification files
 - Having a drug testing program
- Industry best practices
 - No safety plan or driver training program
 - Did hold annual driver safety meetings

Federal Oversight of Executive Lines

- Passed new entrant safety assurance audit in February 2005
- Five Satisfactory compliance reviews
- One Conditional review in 2009
 - Later upgraded to Satisfactory
- Postcrash review was Satisfactory
- At time of crash, had alert in BASICs for Hours-of-Service compliance
- Vehicle Maintenance BASIC was never in alert

California Oversight of Executive Lines

- Several state agencies provided oversight with disparate focus
- California Highway Patrol (CHP) ensures compliance with regulations related to safe operation of commercial motor vehicles
- CHP terminal inspection program
 - Focus on vehicle maintenance
 - Inspection conducted every 13 months for passenger carriers
 - Executive had five inspections, last one on January 3, 2019; all were Satisfactory

California Bus Inspection Form

- Bus Maintenance & Safety Inspection Form 108A
- Inspections required every 45 days
 - Conducted by carrier
- Covers 40 inspection items, including condition of tires
- Records repairs to vehicle, noting mileage at time of repairs
- CHP has not updated form since 2005

CHP Form 108A (February 10, 2020)

CHASSIS / CHASSIS	OK	DEF
28. Wheels, tires, lug nuts - cracks, secured - tread - inflation <i>Rines, llantas, tuercas - rajadas, seguridad, banda rodante, presion de aire</i>	*	✓
29. Wheel seals, leaks - hyd. brake system leaks <i>Retenes de las ruedas y fugas - fugas de la sistema hidraulico</i>		✓
30. Check steering gear mounting - free lash, oil level <i>Revisar sinfin del volante y monturas - juego libre, nivele de aceite</i>	*	✓
31. Steering arms, drag links, tie rods <i>Brazos de direccion y barras de acoplamiento, terminales</i>	*	✓

What We Found: *Tire Maintenance Oversight*

- CHP form 108A is good tool to help carriers perform required inspections
- Recording tire tread depth measurements will highlight to carrier need for proper tread depth when tires are inspected
- What we propose:
 - *One recommendation to CHP*

Tire Rotation Practice

- Executive Lines used new tires only on front axle
 - Would move both front tires to rear axle at 5/32-inch tread depth
 - Would remove rear tires from service at 2/32-inch tread depth
 - Rear tires on crash bus replaced twice since November 3, 2019
- Some motor carriers follow same tire rotation practice
- United Motorcoach Association and U.S. Tire Manufacturers Association (USTMA) do not recommend this tire rotation practice

What We Found: *Tire Rotation*

- Executive Lines' deficiencies in tire replacement and rotation practice allowed bus to operate with tires with less than required tread depth
- Practice of replacing rear axle tires with used tires from steer axle can result in non-uniform tread depths, leading to loss of traction
- What we propose:
 - One recommendation to the United Motorcoach Association and the American Bus Association

Bus Roof Strength Standards and Seat Belt Use

Sheryl Harley
Survival Factors Investigator

Overview

- Crashworthiness
- Roof Structural Integrity
- Passenger Ejection
- Occupant Injury and Seat Belt Use
- California Bus Passenger Safety Laws

2014 30-Passenger Freightliner Bus



Source: California Highway Patrol

Roof Structural Integrity



Interior Structural Deformation



Occupant Injury and Seat Belt Use

- Driver
 - Minor injury
 - Properly secured seat belt
- Passengers - 20
 - 3 fatal injuries
 - 12 serious injuries
 - 5 minor injuries
 - **5 Passengers Ejected**
- Passenger seat belt use
 - 1 properly secured
 - 2 improperly secured

Bus Roof Strength Standards at Time of Crash

- Federal Motor Vehicle Safety Standard (FMVSS) 216 and 216a
 - Establishes minimum level of safety or crashworthiness for buses
 - Standard applies to buses up to GVWR 10,000 lbs.
 - Does not apply to some multi-stage vehicles
- Crash bus was not required to meet any roof strength standard

Current Bus Roof Strength Standards

- FMVSS 227
 - Issued: 12-29-2021 Effective: 12-30-2024
 - Enhances rollover structural integrity
 - Improves roof support and resistance to deformation
 - Prohibits intrusion into occupant space
- Applicability:
 - Buses with GVWRs greater than 26,000 lbs.
 - Over-the-road (OTR) buses regardless of GVWR
- Exclusions:
 - Non-OTR buses between 10,001 and 26,000 lbs. GVWR

NTSB History of Bus Collisions with Rollover Event

- Prior investigations
 - 1999 Highway Special Investigation Report - Bus Crashworthiness Issues
- Most recent investigation - 2019 Bryce Canyon City, Utah
 - Issued recommendation H-21-2

What We Found: *Bus Roof Strength Standards*

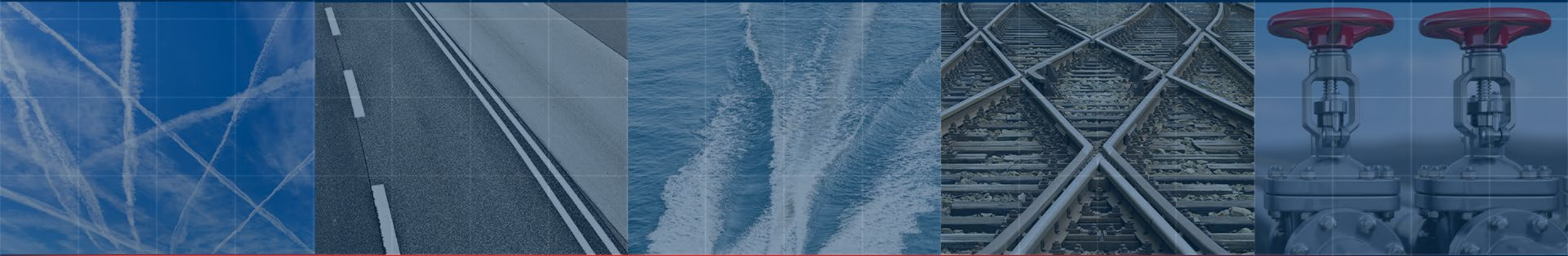
- FMVSS standards regarding roof strength not applicable to all passenger-carrying buses
- 2014 Freightliner bus did not meet FMVSS definition and was not required to conform to the standard
- Lack of crashworthiness and failure of roof structural integrity resulted in passenger ejection
- What we propose:
 - One reiterated recommendation (H-21-2) to the National Highway Traffic Safety Administration

California Bus Passenger Safety Laws

- Passenger obligation
 - Seat belt use required
 - Penalty for violation
- Motor carrier obligation
 - Driver notification to passengers regarding mandatory use
 - Posted placards and/or signs

What We Found: *Seat Belt Use Law*

- Passengers unaware or not restrained
- Driver did not provide required passenger notification on mandatory seat belt use law
- No placards/signs affixed to bus
- Owner of motor carrier stated he was unaware of California vehicle law regarding mandatory seat belt use
- What we propose:
 - Two recommendations to the California Highway Patrol
 - One recommendation to the American Bus Association and the United Motorcoach Association



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