Virtual Public Roundtable on Bus Safety and Design Impacting Operator Visibility

September 10, 2024

U.S. Department of Transportation
Federal Transit Administration

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U.S. Department of Transportation
Federal Transit Administration

Public Roundtable Goals

1. Develop a common understanding of the problem related to bus safety and designs affecting operator visibility
2. Identify new insights from transit experts and the transit community around solutions and effectiveness
3. Discuss what we can do to drive improvements in operator visibility and reduce bus collisions

Agenda

- Concerns and Analysis Regarding Bus Safety Design
- Transit Experts Defining Solutions on Bus Safety
  - FTA's Office of Research, Demonstration and Innovation
  - Center for Urban Transportation Research
- Facilitated Discussion with the Transit Community
  - Labor Unions
  - Bus Manufacturers
  - Transit Agencies
  - Transit Industry Stakeholders
- Final Remarks/Closing

Paul Kincaid

Associate Administrator

Office of Communications & Congressional Affairs

U.S. Department of Transportation
Federal Transit Administration

Mary Leary

Associate Administrator

Office of Research, Demonstration and Innovation

U.S. Department of Transportation
Federal Transit Administration

Concerns and Analysis Regarding Bus Safety Design

Ivey Glendon

Acting Division Chief, Safety Assurance and Risk Management, Office of Transit Safety and Oversight (TSO)

U.S. Department of Transportation
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Bus-to-Person Collision Data

From 2008 to 2021, transit agencies reported **7,298 bus-to-person collisions** to the National Transit Database, which resulted in **537 fatalities** and **7,329 injuries**

Bus-to-Person collisions accounted for:

15%

Of All Transit Fatalities

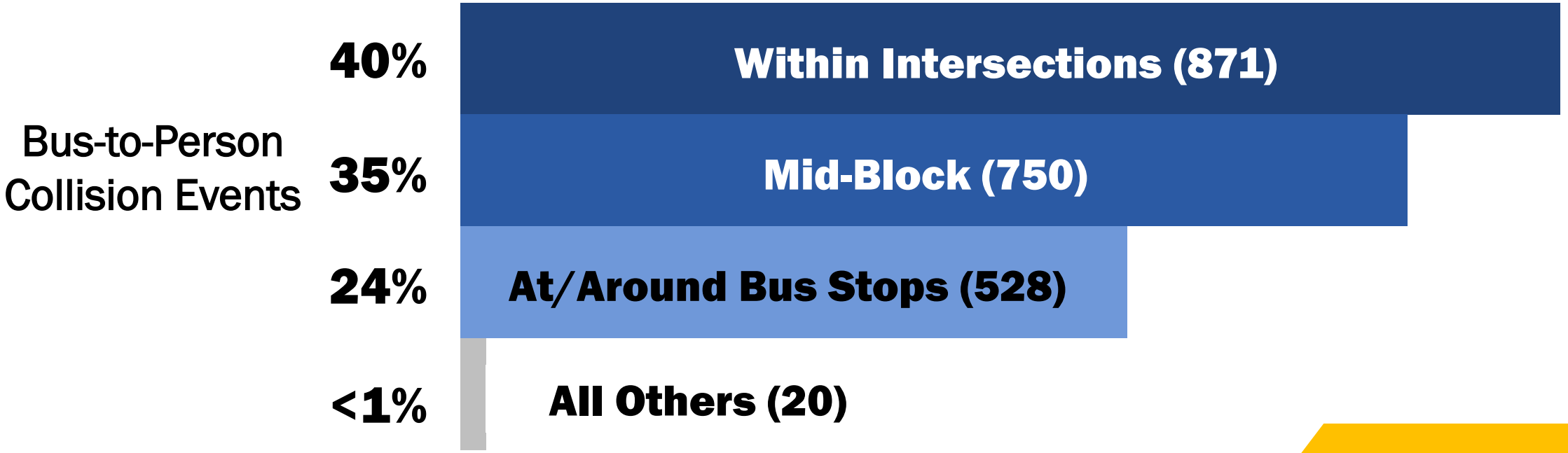
37%

Of Bus-Transit Fatalities

THE DATA

Bus-to-Person Collisions by Location

The largest percentage of bus-to-person collisions events occurred while buses were within intersections.



THE DATA

Bus Collisions in Intersections

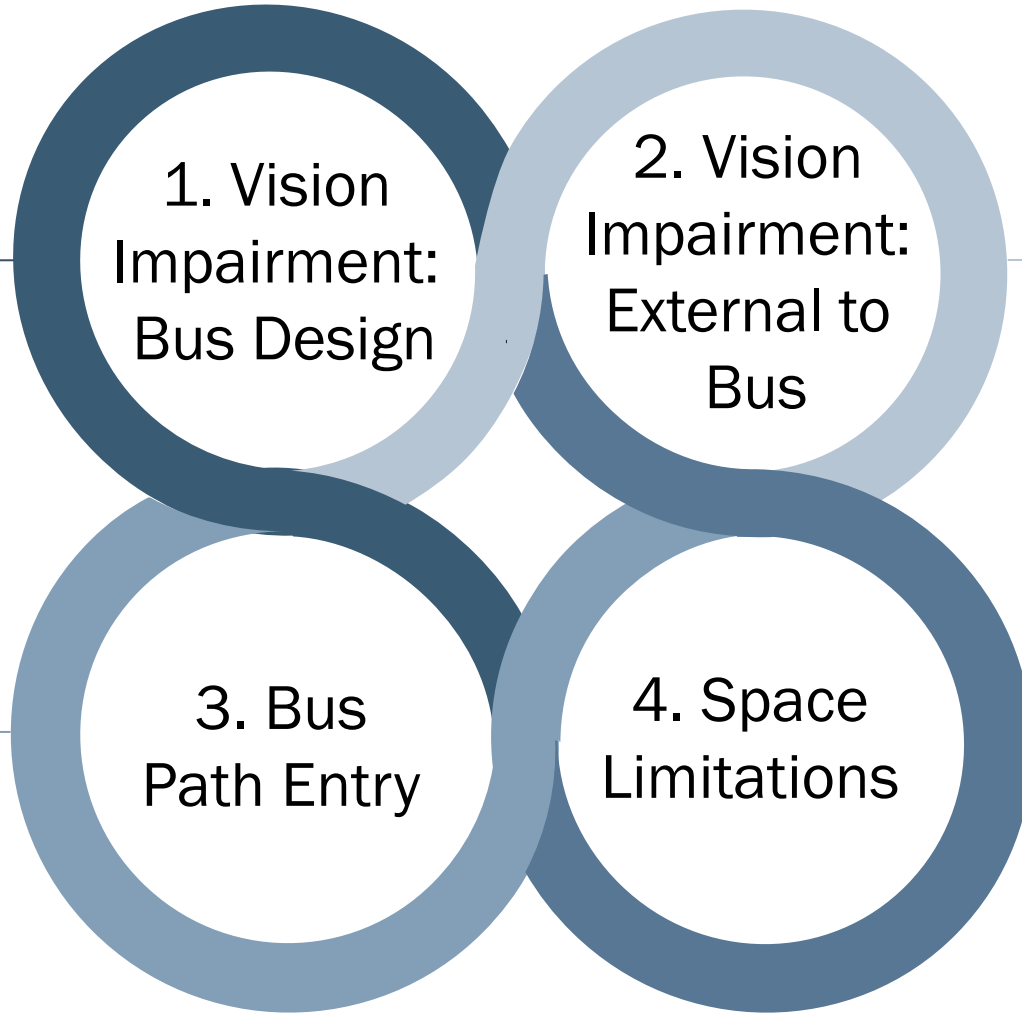
39% of fatalities from bus collisions with vehicles intersections occurred when the bus turned left.

27% of fatalities and injuries from bus collisions with people in intersections were crosswalk pedestrians hit as the bus made a left turn.

THE DATA

Bus-to-Person Collisions Hazards

- A-Pillar
- Fare box
- Side mirrors



- Posts
- Street Vendors
- Signage

- Pedestrians
- Bicyclists
- Micromobility users

- Bus Stops
- Adjacent Sidewalks

Recommended Actions in FTA Safety Advisory 23-1

- Identify specific hazards that may cause or contribute to bus-to-person collisions and consider mitigation strategies to reduce bus-to-person collisions
- Focus on bus operator vision impairment through vehicle design and operator driving policies and procedures

Safety Advisory Recommended Actions

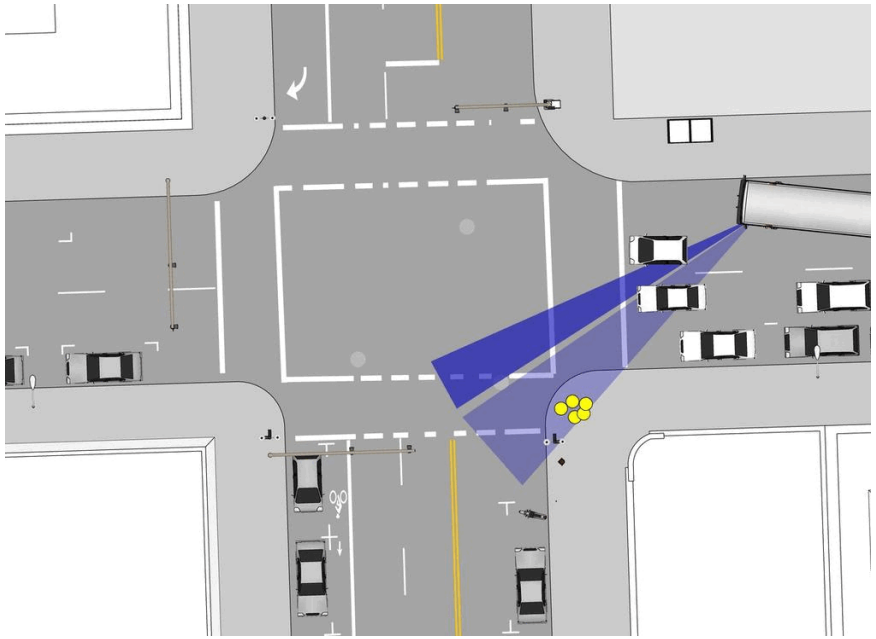
*Transit agencies that focus on **bus operator vision impairment** as a safety hazard may consider the below categories of safety risk mitigations, among others:*

Vehicle Design

1. Vehicles
2. Vehicle Systems

Operator Driving Policies and Procedures

1. Scanning
2. Square Left Turns



FTA Safety Research Overview

Roy Chen

General Engineer

Office Of Infrastructure & Asset Innovation, Office of Research, Demonstration and Innovation (TRI)

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Federal Transit Administration

Safety Research Overview

Pilot Demonstration Programs

- 34 Pilot Demonstrations
- 20 Projects Are Completed
- 15 Technical Reports Published
- FTA Reports And Publications | FTA (Dot.Gov)

Bus Collision Avoidance & Mitigation
(5 Projects)

Highway-rail Grade Crossings Safety
(4 Projects)

Suicide Prevention & Trespasser Detection
(4 Projects)

Transit Worker Safety
(8 Projects)

Condition Assessment & Monitoring
(7 Projects)

Operational Resiliency/ Emergency Response And Recovery
(6 Projects)

Vehicle Safety Research

- Operator barrier configuration
- Improve operator ergonomics and visibility (mirror, A-pillar, seat, steering wheel, and dashboard)
- Reduce operator distractions (dashboard controls, state-aware display, head-up display)
- Seating configuration & materials

Transit Vehicle Crashworthiness

Bus Compartment Design

Secondary Impact

Standards Research

- 26 Technical Research Reports published
- The research reports provided background information on existing standards, international standards, potential gaps on existing standards.
- Research conducted in collaboration with industry stakeholders
- [Standards Development Program | FTA (dot.gov)]

Battery Electric Buses & Charging Systems	**Emergency Lightning, Signage And Evacuation**
Rail Tunnel Inspection, Maintenance	**Transit Accident Investigations/ Data Recorders**
Transit Rail Transmission-Based Train Control	**Transit Vehicle Crash Energy Management**
Roadway Worker Protection	**Medical Fitness For Duty And Fatigue Risk Management**

Bus Collision Prevention Pilots

NYMTA – Prototype mirror design that minimizes obstruction

- Transit Bus Mirror Configuration Pilot Project Final Report (dot.gov)

Pierce Transit - Low-cost LiDAR technology to prevent collisions

- Pierce Transit Automated Collision Avoidance and Mitigation Safety (dot.gov)

LA Metro – Vision based system to prevent collisions

Thank you!

Roy Chen

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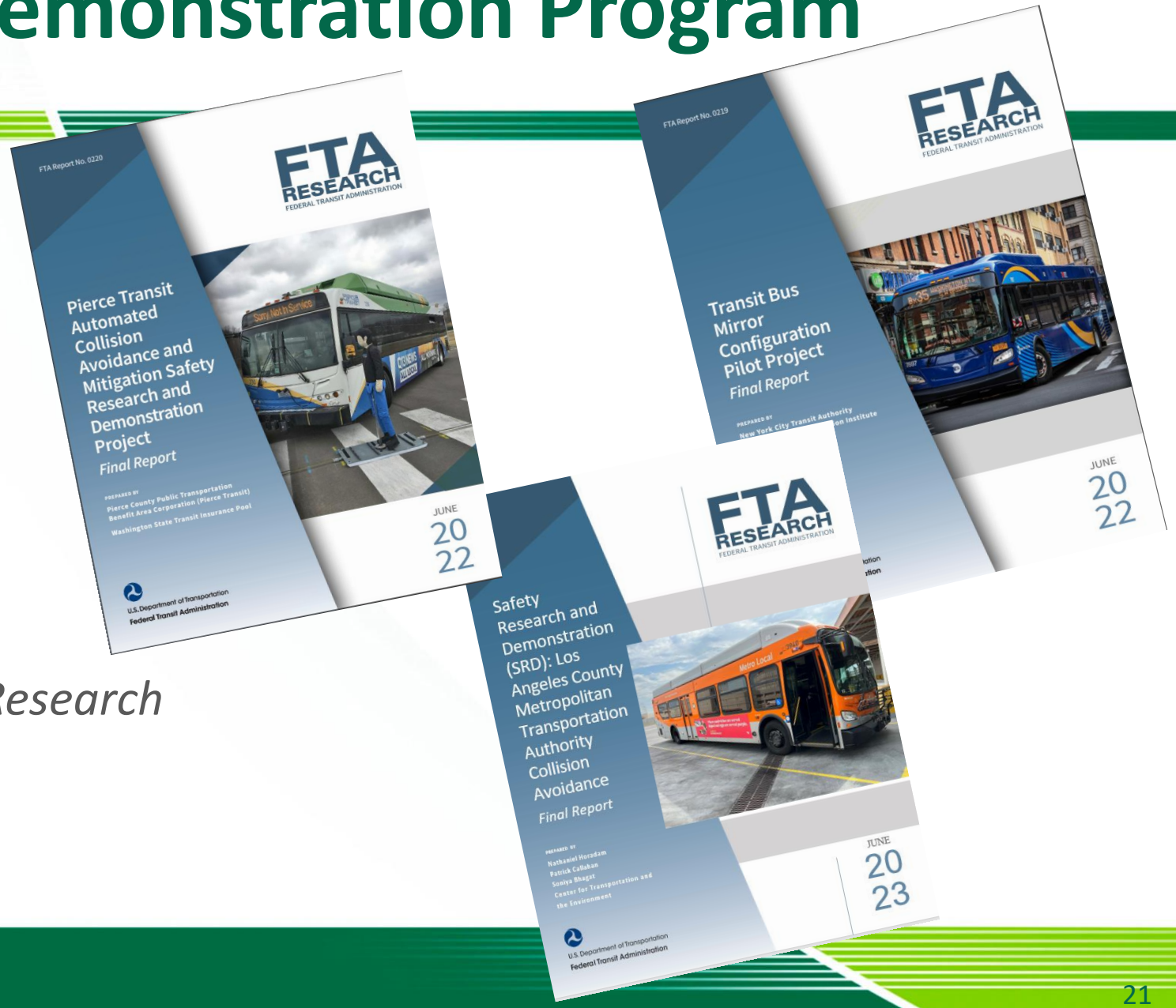
Safety Research Demonstration Program



Lisa Staes

Associate Director

Center for Urban Transportation Research
University of South Florida

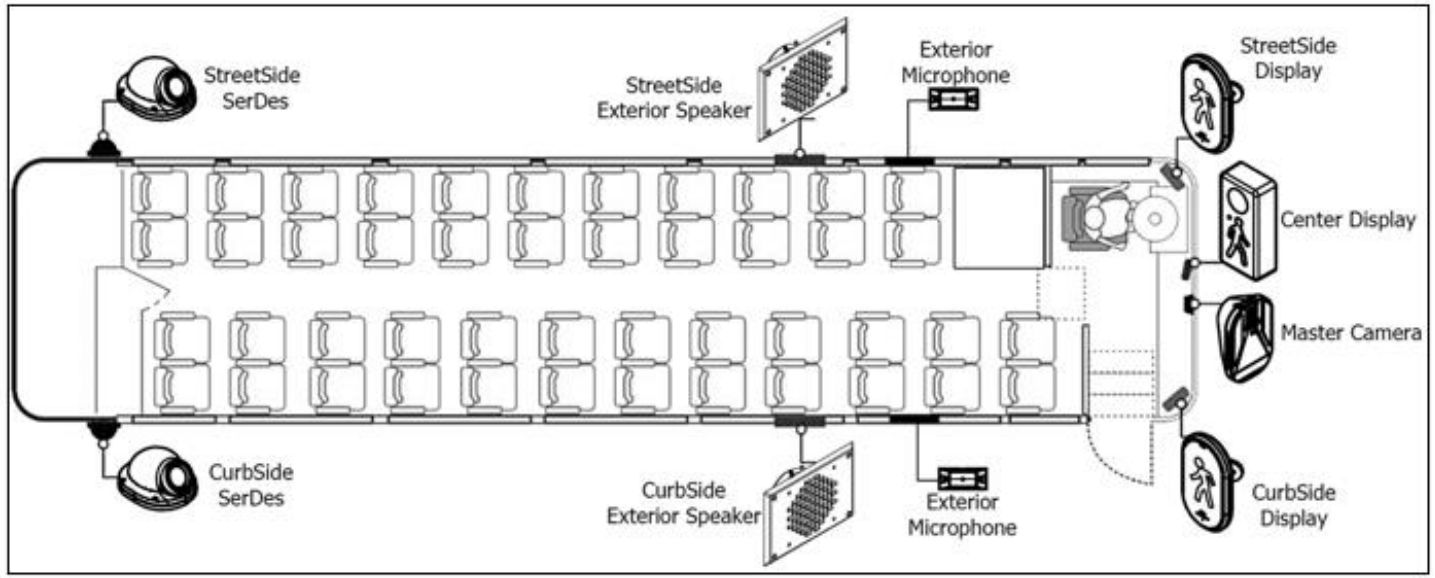
Safety Research Demonstration Program

Collision Avoidance and Mitigation Pilots

- LA Metro
- NYMTA
- Pierce Transit

LA Metro – Collision Avoidance

- 50 buses in active service, deployed for 18 months – both stealth and revenue service testing. Evaluated system accuracy and effectiveness.
- The technology recorded warning events triggered by imminent
  - Pedestrian collision
  - Forward collision with a vehicle
- A reduction of generated warnings or earlier braking was examined to determine efficacy



LA Metro

- Lessons Learned
  - Technology increase in cost as they increase in maturity
  - Quality control challenges in the prototype testing phase led to delays and challenges with the installation and integration of the technology
  - Operator familiarization training is imperative for collision avoidance technology installation projects

NY MTA

- Prototype street-side mirror design for transit buses
- 3D scan of front end of buses
- Virtual simulation with different body types
- Static testing
- Dynamic testing in the field with 10 buses per depot at 3 depots

Figure 4-1 *Prototype mirrors—low mount with convex (l), semi-curved low mount (c), and semi-curved high mount (r)*

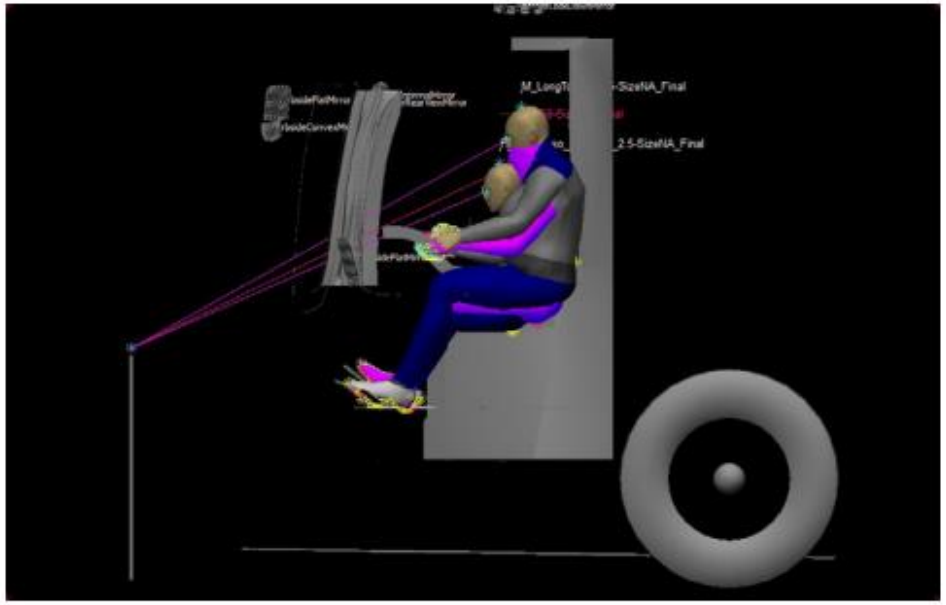


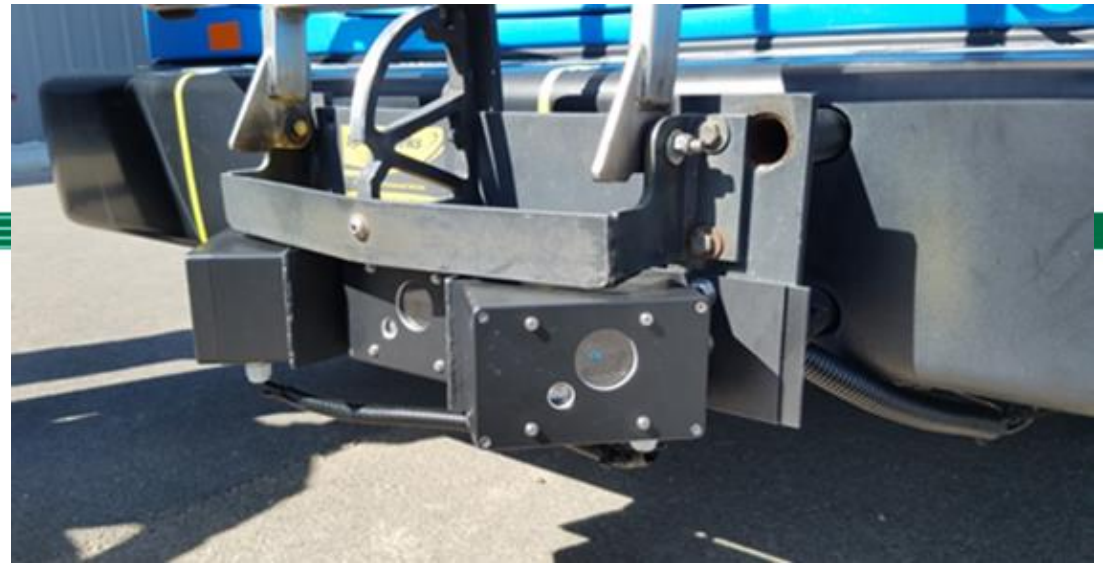
Figure 3-7 *Side view of three manikins positioned in New Flyer bus*

NY MTA

- Lessons Learned
  - Traditional mirror assemblies (both flat and convex mirrors) create significant obstructions to direct forward visibility
  - Low mounted flat glass only mirrors resulted in the smallest obstructions due to mirror heads
  - A traditional high-mount flat/convex combination with a lower assembly created similar or worse obstructions for a range of tall bus operators
  - 40-foot bus – semi-curved mirror design provided the best combination of rear and forward visibility performance with the largest range of visibility for bus operators
  - The semi-curved style mirror did not work as well on the 60-foot articulated bus

Pierce Transit

- Collision avoidance warning system on transit buses
  - 30 buses – Lidar front mount for pedestrian detection
  - 3 of 30 buses – video processor to validate accuracy
  - Closed course testing – validation and calibration
  - Revenue service testing in shadow mode



Pierce Transit

- Lessons Learned
  - Retrofitting hardware and software systems on legacy buses presented challenges associated with sensor placement
  - Sensor placement impacts interference and false positive alerts
  - Data collection challenges related to transmission consistency and concurrency, resulted in an inability to prove accuracy of the technology
  - Executive level support is crucial to ensure financial and manpower sustenance throughout the project lifecycle

Facilitated Discussion with the Transit Community

Rhoderick Ramsey, Ed.D.

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Office of Transit Safety and Oversight (TSO)

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Federal Transit Administration

Discussion Questions

- What challenges have you seen related to operator visibility?
- What determines design and placement of the components impacting visibility?
- What additional research or standardization would you like to see to address these challenges?
- What are some effective solutions to improve operator visibility?
- What steps can we (FTA, the industry and bus manufacturers) take to drive improvements in operator visibility and reduce bus collisions?

Participant Guidelines

- Effective Listening
- Timely Conversations
- Be Mindful of Virtual Surroundings and Limit Background Distractions
- Stay Muted When Not Speaking
- Stay on Topic
- Engage in Dialogue
- Mutual Respect

Labor Unions

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Bus Manufacturers

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Transit Agencies

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Transit Industry Stakeholders

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Closing Remarks

Thank you!

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