NHTSA

NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION

NHTSA Heavy Vehicle Crash Avoidance Research

2025 TRB Annual Meeting
Truck and Bus Safety Committee (ACS60)

Alrik Svenson
Research Engineer
National Highway Traffic Safety Administration

www.nhtsa.gov

NHTSA Heavy Vehicle Research Overview

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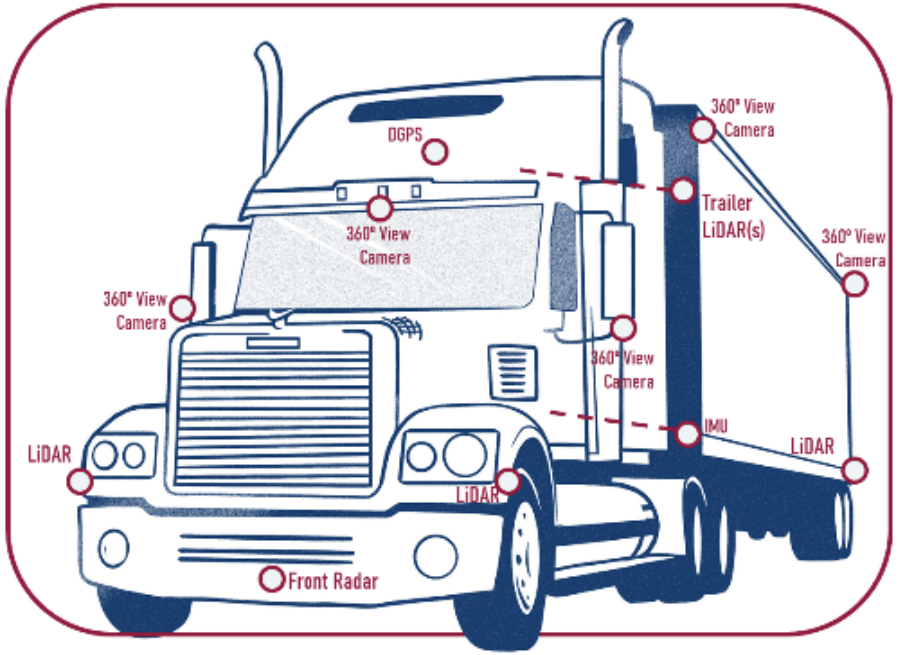
1. **Heavy Vehicle Ground Truth Trip Recorder**
2. **Heavy Vehicle Collision Avoidance Systems (CAS) Field Operational Test Study**
3. **Applied Heavy Vehicle Research Track Testing**
4. **Heavy Truck Trailer Strikable Target Development**

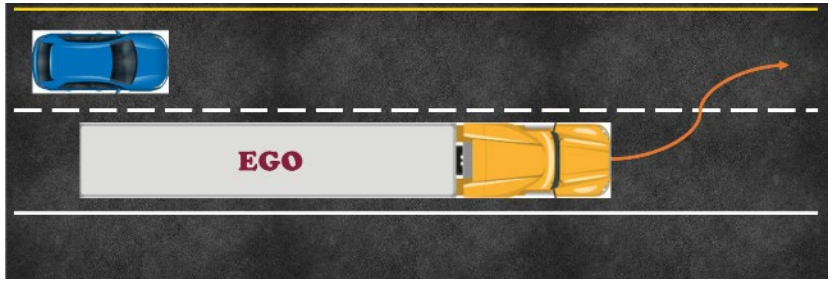
Heavy Vehicle Ground Truth Trip Recorder

- Design, prototype, and test a proof-of-concept Ground Truth Trip Recorder (GTTR) for a Class 8 tractor-trailer during on-road operations

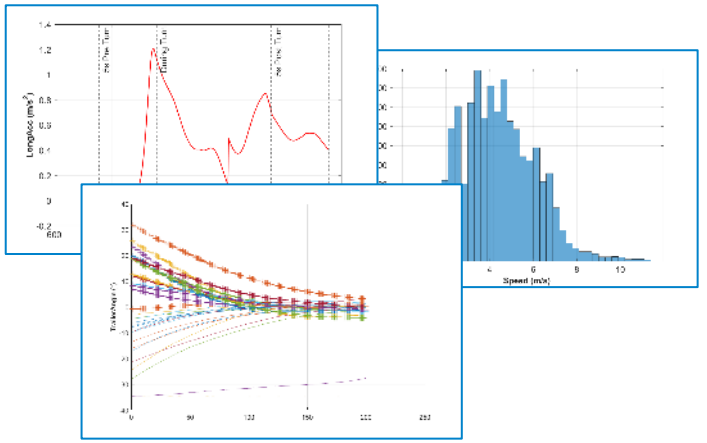
1. Develop proof-of-concept GTTR



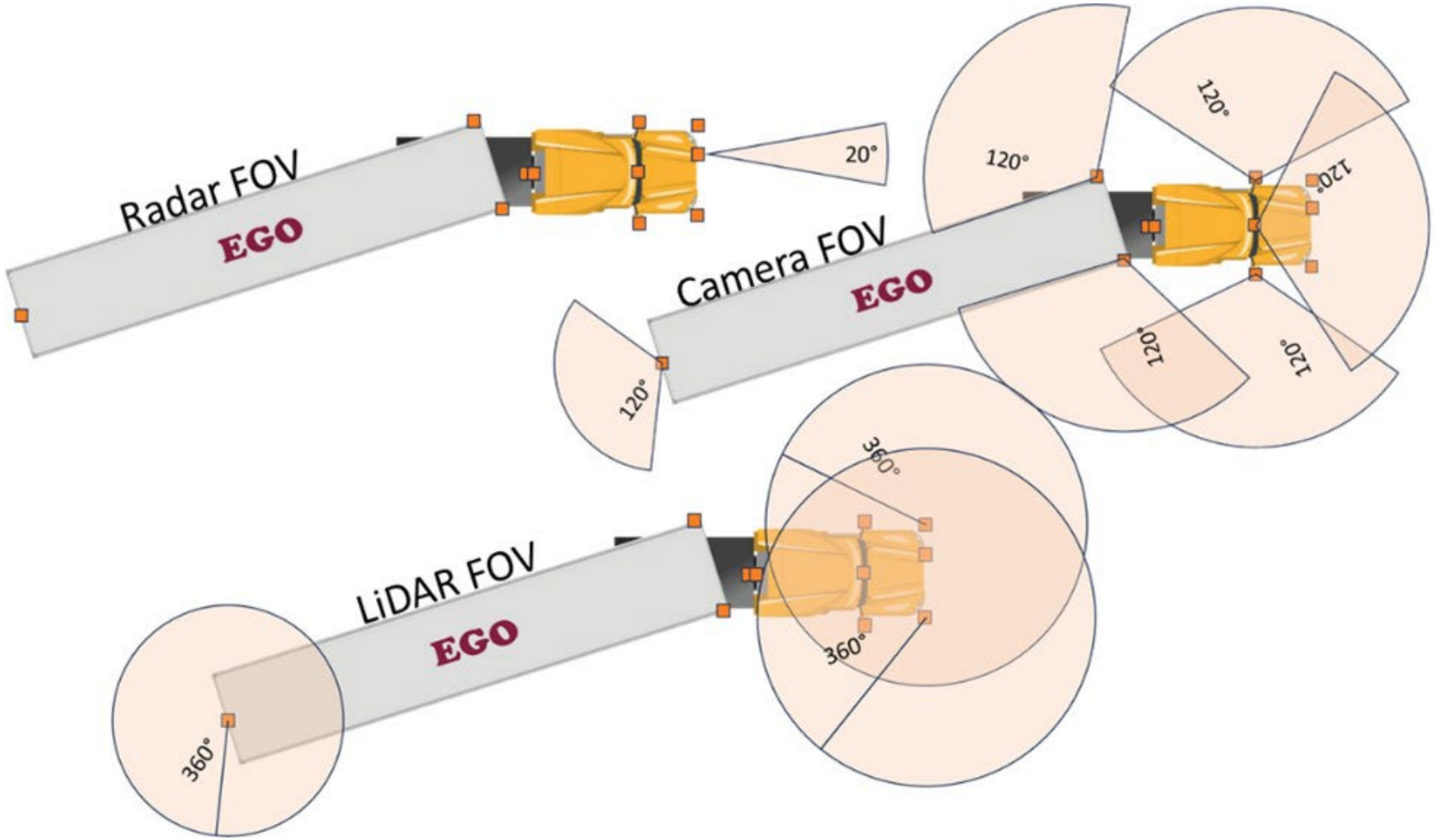
2. Identify and assess scenarios



3. Develop metrics



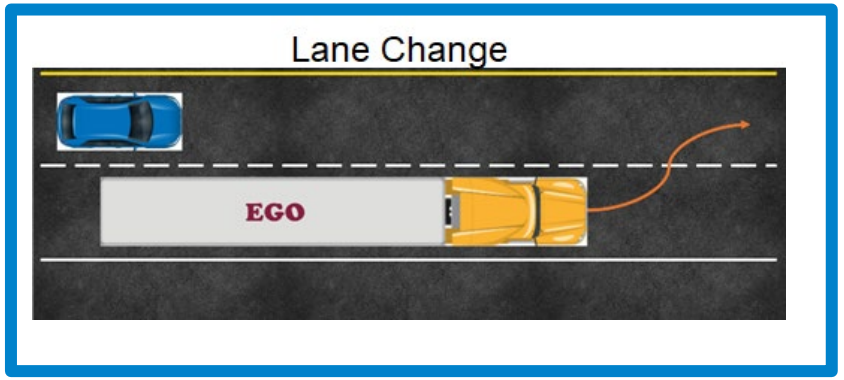
HV GTTR Field of View

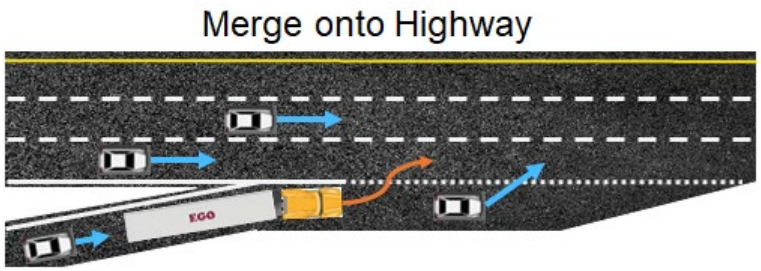


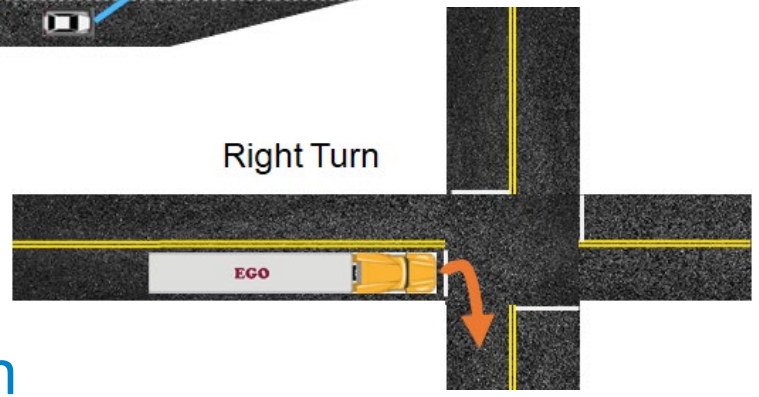
HV GTTR Scenario and Metrics Assessment

Determine the feasibility of:

- Parsing, defining, and categorizing scenarios from on-road data collected by the GTTR
- Evaluating driving performance by calculating a set of metrics







- Scenario selection criteria:
  1) Representative of HV ADS operations
  2) Capability to “stress test” GTTR
  3) Ability to execute scenario in on-road data collection

Heavy Vehicle Collision Avoidance Systems (CAS) Field Operational Test Study

- Assess validity of collision avoidance system (CAS) activations
- Collect subjective driver and safety manager ratings of CAS technology
- Investigate whether CAS activations change over time per driver
- Understand driver behaviors in response to CAS activations
- Characterize real-world scenarios and conditions involving CAS activations

DETROIT ASSURANCE

WINGMAN Fusion

Participating Vehicles and Fleets

Participating Vehicles

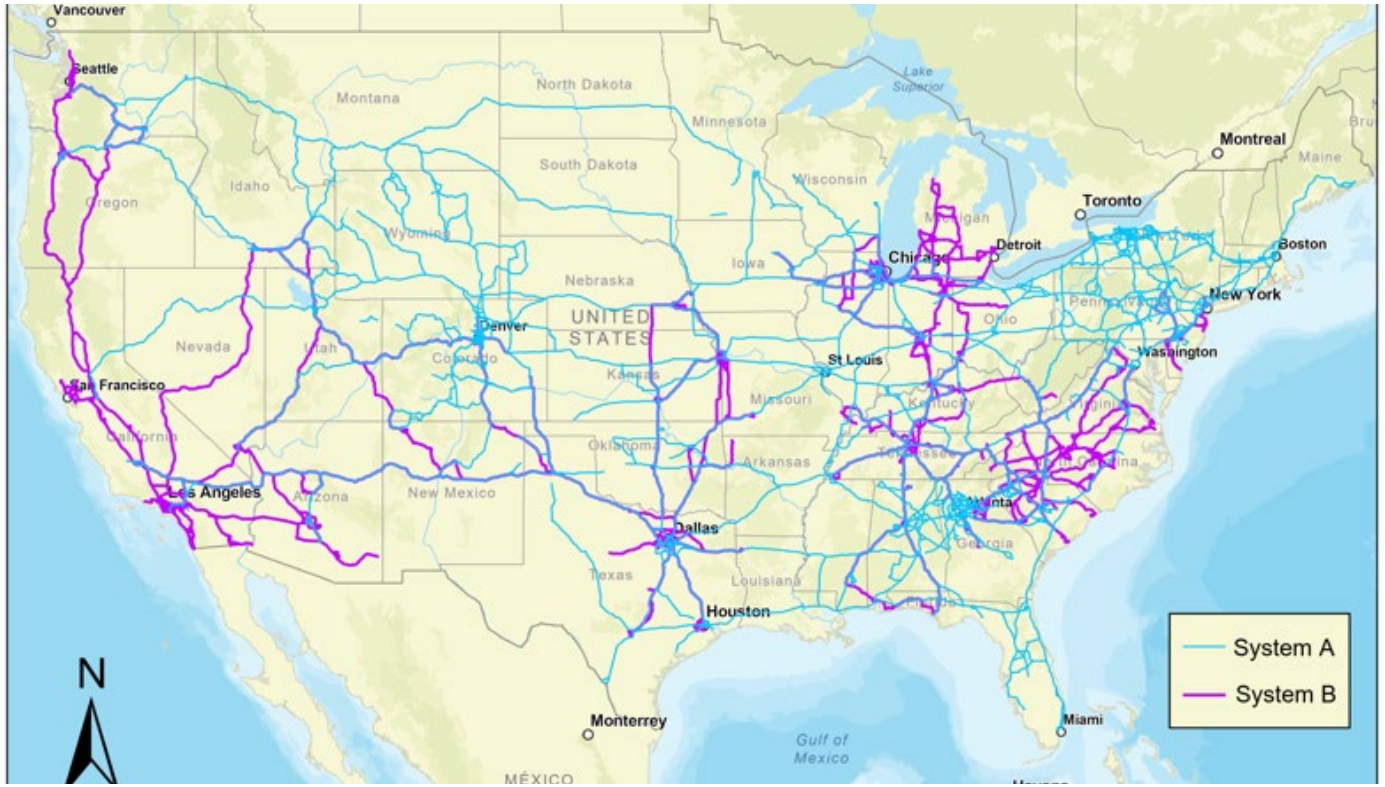
Make	Model	Model Year	Number of Vehicles
Freightliner	Cascadia	2020 - 2021	54
Kenworth	T680	2018 - 2023	34
Peterbilt	579	2020-2023	25
Volvo	VNL	2021-2022	3
Mack	Anthem	2023	1
Total	All	All	**117**

FOT focused on Class 8 tractor-trailers due to system availability and fleet participation

Participating Fleets

System	# Trucking Companies	Locations in Study
Detroit Assurance	1	• Elkton, MD • Kendallville, IN • McKinney, TX • Rock Hill, SC • Shafter, CA • Lebanon, TN
Bendix Wingman	4	• Alabaster, AL • Sylacauga, AL • Holly Springs, GA • Villa Rica, GA • Calera, GA • Farmington, NY • Sublette, KS • Denver, CO

Naturalistic Data: Exposure



- Exposure targeted regions across the United States
- Driver data collection period of generally 3 months
- CAS systems were de-identified as part of the study

System	Hours of Naturalistic Driving Data Collected
A	19,618.9
B	12,094.5
Total	31,713.4

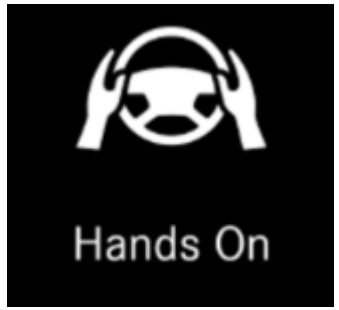
Naturalistic Driving Data Collection Summary	
# Drivers	150
# Miles	1,889,797
CAS Longitudinal Activations	236,665
CAS Lateral Activations	40,869

Applied Heavy Vehicle Research Track Testing

- Rollover and loss of control maneuvers
  - Obstacle avoidance maneuver – sine with dwell
  - Speed to fast for a curve maneuver – 150-foot J-turn
- Rear-end crashes
  - Lead vehicle stopped, slower moving, and decelerating scenarios
  - False activation scenarios
- Pedestrian crashes
  - Crossing subject vehicle path scenario
  - Along subject vehicle path scenario
- Lane departure crashes
  - Straight 12-foot wide lane with solid and dashed lane lines
  - Turn signals and system deactivation suppression test scenarios
  - Sources: SAE J3240 (modified to test trucks)

Sample Test Results Medium Duty Truck Lane Departure Test

- Unintended lane departure scenario
- Subject vehicle speeds
  - 72 km/h (~45mph)
  - 100 km/h (~62 mph)
- Lane lines – solid and dashed
  - left and right departures
- Lateral velocity targets
  - 0.2 to 0.6 m/s, relative to the lane line
- 2 test trials per condition



Lane Departure Rates

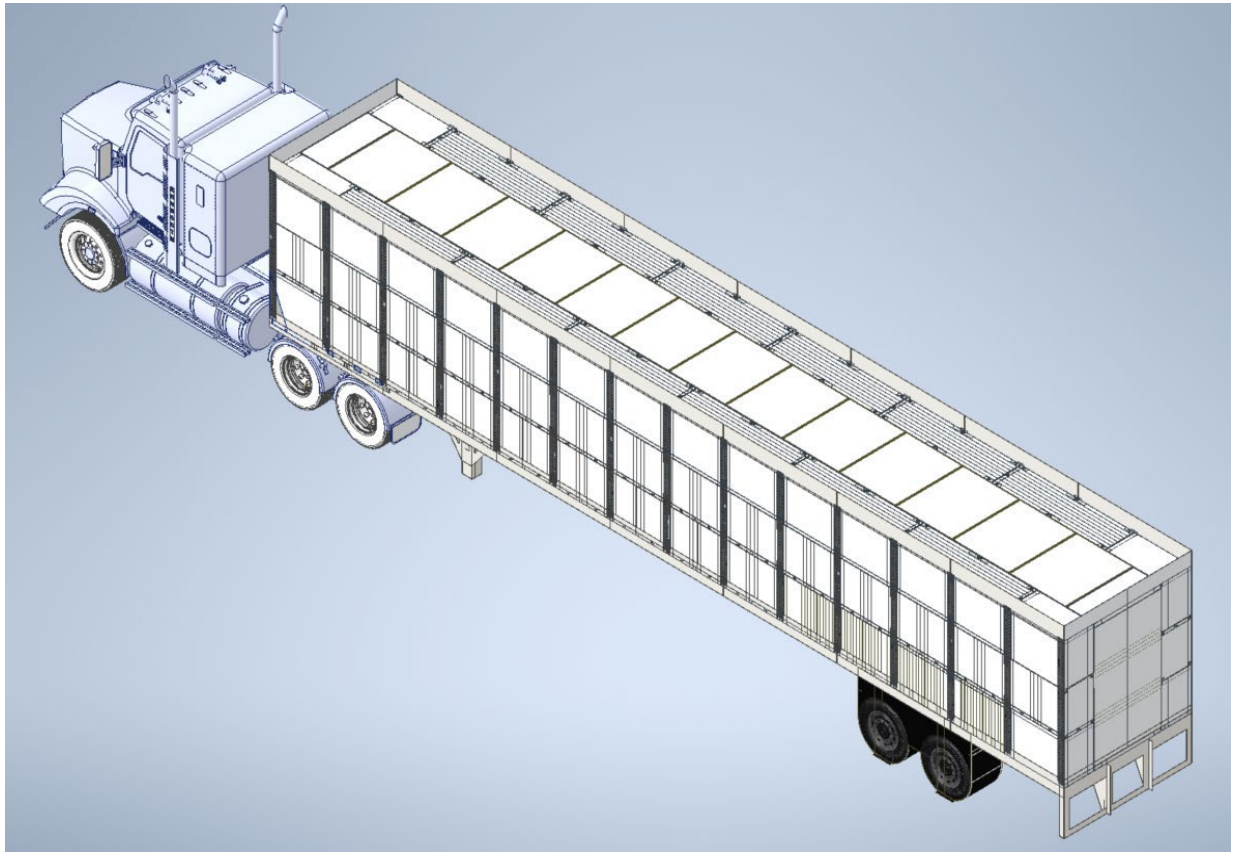
Lateral Velocity to Lane Line (m/s)	Vehicle Speed is 72 km/h (45 mph)				
	Steer Direction	Left		Right	
	Test Trial	1	2	1	2
0.2	Out of Lane (m)	0.03	-	0.44	0.01
	LKA Intervention	✓	✓	✓	✓
0.3	Out of Lane (m)	0.20	-	0.52	0.50
	LKA Intervention	✓	✓	✓	✓
0.4	Out of Lane (m)	0.33	0.03	0.31	0.29
	LKA Intervention	✓	✓	✓	✓
0.5	Out of Lane (m)	0.69	0.18	0.62	0.90
	LKA Intervention	✓	✓	✓	✓
0.6	Out of Lane (m)	0.73	0.38	1.64	1.28
	LKA Intervention	✓	✓	No Correction	✓

Lane Keeping Assist Test

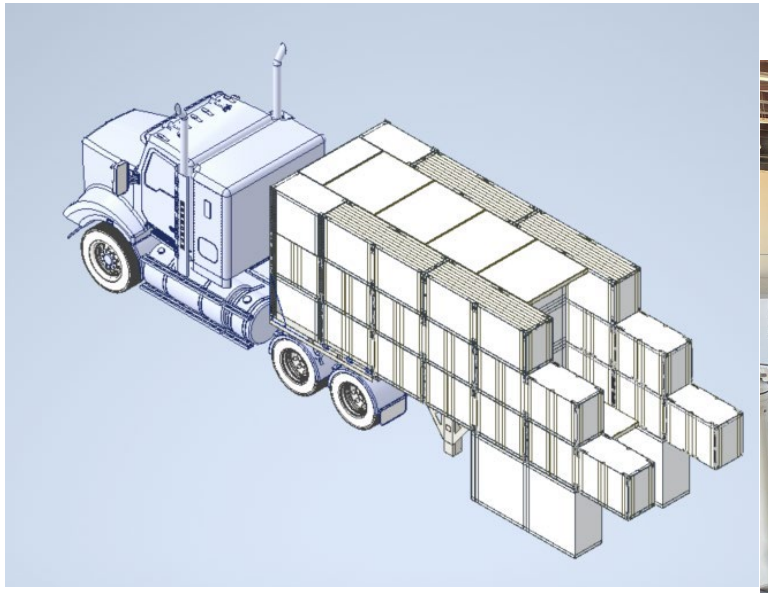
Heavy Truck Trailer Strikable Target Development

- Supports NHTSA's Crash Avoidance testing with a realistic, durable, and reusable target vehicle.
- Similar concept to other test targets currently being used by NHTSA.
- Project is being conducted by Dynamic Research, Inc. (DRI).

Trailer Target Design



Trailer Target Build and Testing



Response Test Video

Durability Testing Video – Vehicle Impact

NHTSA Heavy Vehicle Crash Avoidance Research

Thank you for your attention!

For more information on these and other NHTSA Safety Research:

https://www.nhtsa.gov/events/nhtsa-safety-research-portfolio-public-meeting-fall-2024

Alrik Svenson

Alrik.Svenson@dot.gov