

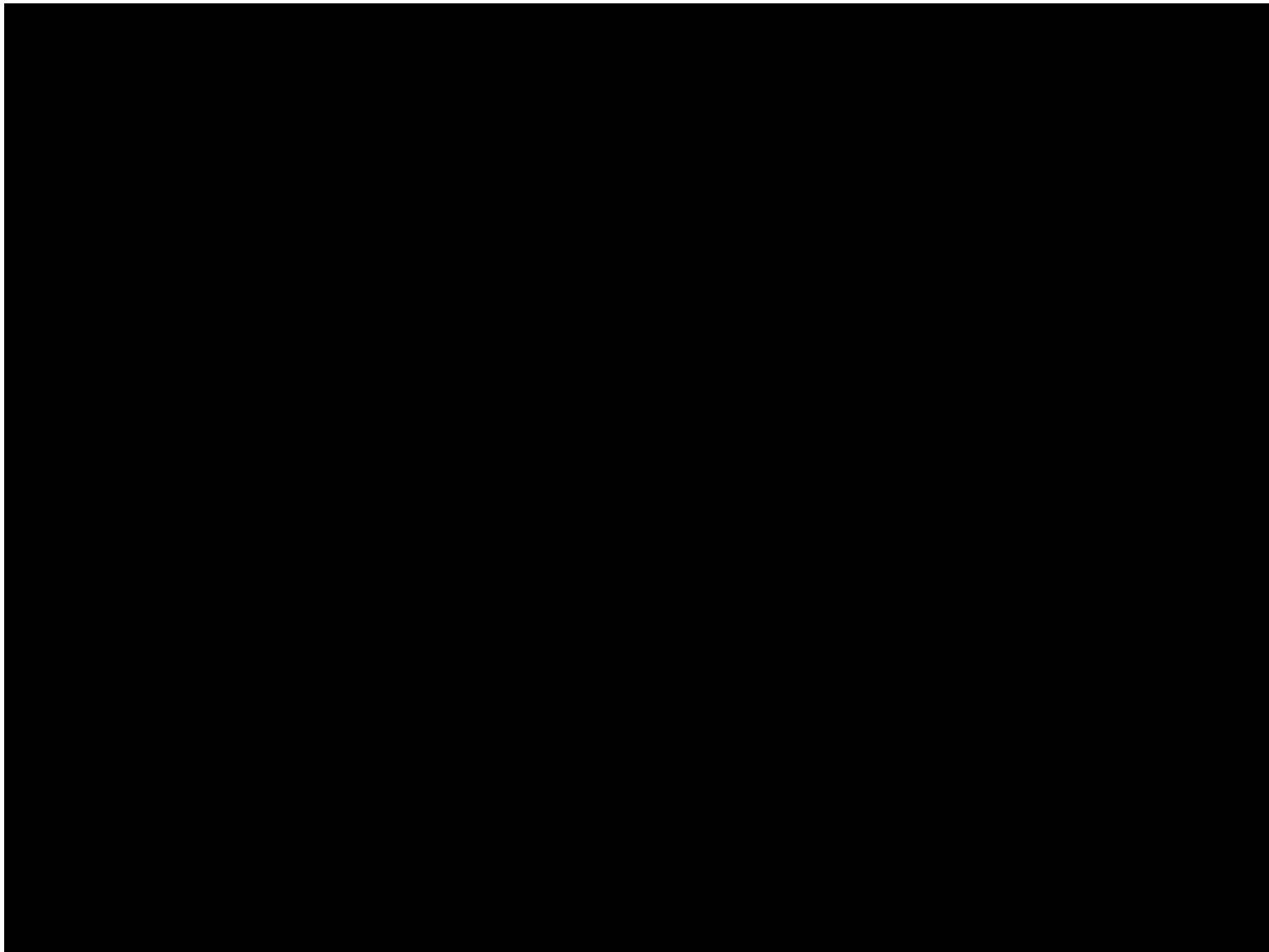
**Government / Industry Brake Research,  
Rulemaking and Technologies – CV102**

# **NHTSA VRTC HV Forward Collision Avoidance and Mitigation Research**

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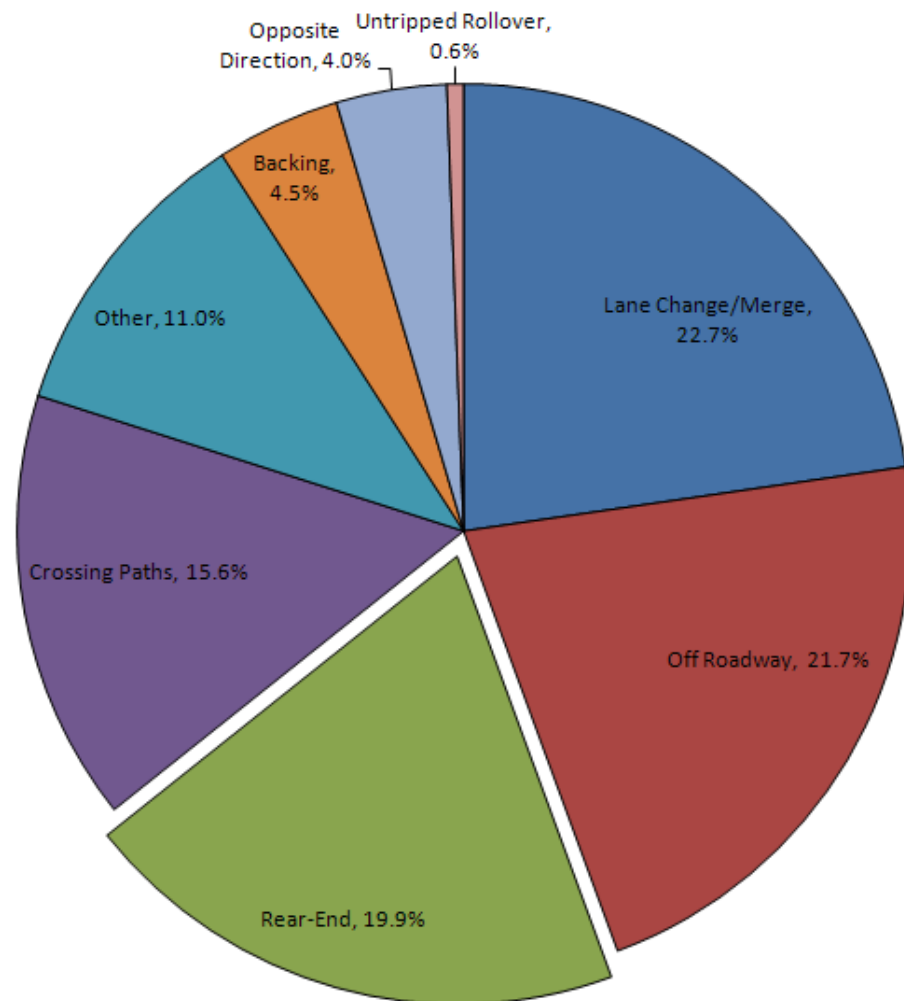


# Overview

- Heavy Vehicle Rear-End Crash Problem
- Definitions of Rear-End Crash Avoidance Technologies
- LV NCAP Forward Collision Warning Test
- Heavy Vehicle Rear End Collision Avoidance Research at VRTC
- Conclusions

# Heavy Truck Crashes

- Rear-end Crashes accounted for 19.9% of all police reported heavy truck crashes based on GES 2004.
- Heavy truck was the striking vehicle in 60% of these rear end crashes.



# Rear-End Pre Crash Scenarios

Most frequent rear-end pre-crash scenarios:

- ≡ 26%: Lead vehicle stopped
- ≡ 14.5%: Lead vehicle decelerating
- ≡ 13.3%: Lead vehicle moving at constant speed

Development of Crash Imminent Test Scenarios for Integrated Vehicle-Based Safety Systems DOT HS 810 757



# Technologies Preventing Rear-End Crashes

ACC – Autonomous Cruise Control  
ICC – Intelligent Cruise Control  
ACB – Active Cruise with Braking

Comfort and  
Convenience with  
some safety benefits

FCW – Forward Collision Warning

Passive – Driver must  
take action.

CIB – Crash Imminent Braking  
CMB – Collision Mitigation Braking  
DBA – Dynamic Brake Assist  
ABA – Automatic Brake Application

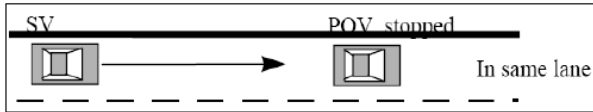
Active – Various  
levels of autonomous  
braking

# LV New Car Assessment Program

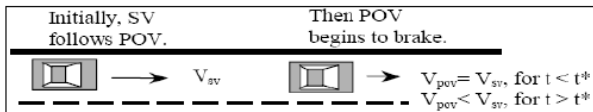
- MY 2011 New Vehicles
  - NCAP Crash Avoidance Technologies
    - 1. Electronic Stability Control
    - 2. Forward Collision Avoidance
    - 3. Lane Departure Warning
  - [www.regulations.gov](http://www.regulations.gov)
    - Docket No. NHTSA-2006-26555
- Confirmation tests for each of these technologies

# LV FCW Test Maneuvers

- SV speed, all tests: 72.4 km/h (45 mph)
- Stopped POV



- Decelerating POV
  - Initial POV speed: 72.4 km/h
  - Initial SV-to-POV Headway = 30m
  - POV deceleration: 0.3g



- Slower Moving POV
  - POV speed: 32.2 km/h (20 mph)



Programmable brake controller used to maximize accuracy, repeatability, and reproducibility of the Decelerating POV tests





# Key FCW NCAP Evaluation Criteria

- Successful Test Requirements
  - 7 trials per condition are performed
  - TTC requirements must be satisfied for 5 of the 7 trials
  - TTC requirements must not be violated 2 consecutive trials
- Time To Collision (TTC)
  - Stopped POV: 2.1 sec
  - Decelerating POV: 2.4 sec
  - Slower Moving POV: 2.0 sec

# HV Rear-End CA Research Objectives

- Quantify the state-of-the-industry for HV FCW and CIB from performance testing with a POV
  - Time To Collision (TTC)
  - Delta V @ impact
- Determine if the LV FCW confirmation test can be adapted for HV evaluation
- Identify issues and challenges unique to HV

# Test Vehicles

- 2006 Freightliner Century Class 6X4
  - Retrofitted MW OnGuard System
- 2006 Volvo VNL64T630 6x4
  - Retrofitted Bendix Wingman ACB System
- 28 ft Great Dane Flatbed
  - 121 style control trailer

# Test Matrix

Scenario	Speed (MPH)	Freightliner		Volvo	
		Bobtail	121 Style Loading	Bobtail	121 Style Loading
SV encounters a stopped POV	35	X	X	X	X
	45	X	X	X	X
	55	X	X	X	X
SV encounters a decelerating POV	35	X	X	X	X
	45	X	X	X	X
	55	X	X	X	X
SV encounters a slower moving POV	35	X	X	X	X
	45	X	X	X	X
	55	X	X	X	X

Draft – Subject to change

# Balloon Car – POV for CIB



# Stopped POV: LV CIB Example



# HV Example



# HV Example#2





# HV Example #3



# Known Issues

- Current protocol designed for FCW not CIB
- Stopped Lead Vehicles
  - State-of-Industry not detecting stopped lead vehicles that were not previously tracked
- Confirm track tests and protocol not generating artificial data
  - Mass estimation
  - Accurate target response
  - RCS of target

# Conclusions

- Rear-end collision avoidance technology is expected to improve automotive safety in both LV and HV
- FCW - Potential to reduce 21% of heavy vehicle rear end crashes
  - VTTI: 2/2008 DOT HS 810 910
  - Battelle: 2006 Evaluation of the Volvo IVI FOT
- CIB – Current research in support of understanding performance and determining safety benefits

# Questions?

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