

Naturalistic Driving Data Baseline for ADS- Equipped Commercial Motor Vehicles

101ST TRB ANNUAL MEETING

TRUCK AND BUS TECHNOLOGY
SUBCOMMITTEE ACS60(5)

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U.S. Department of Transportation

Federal Motor Carrier Safety Administration



VIRGINIA TECH
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PROJECT OVERVIEW

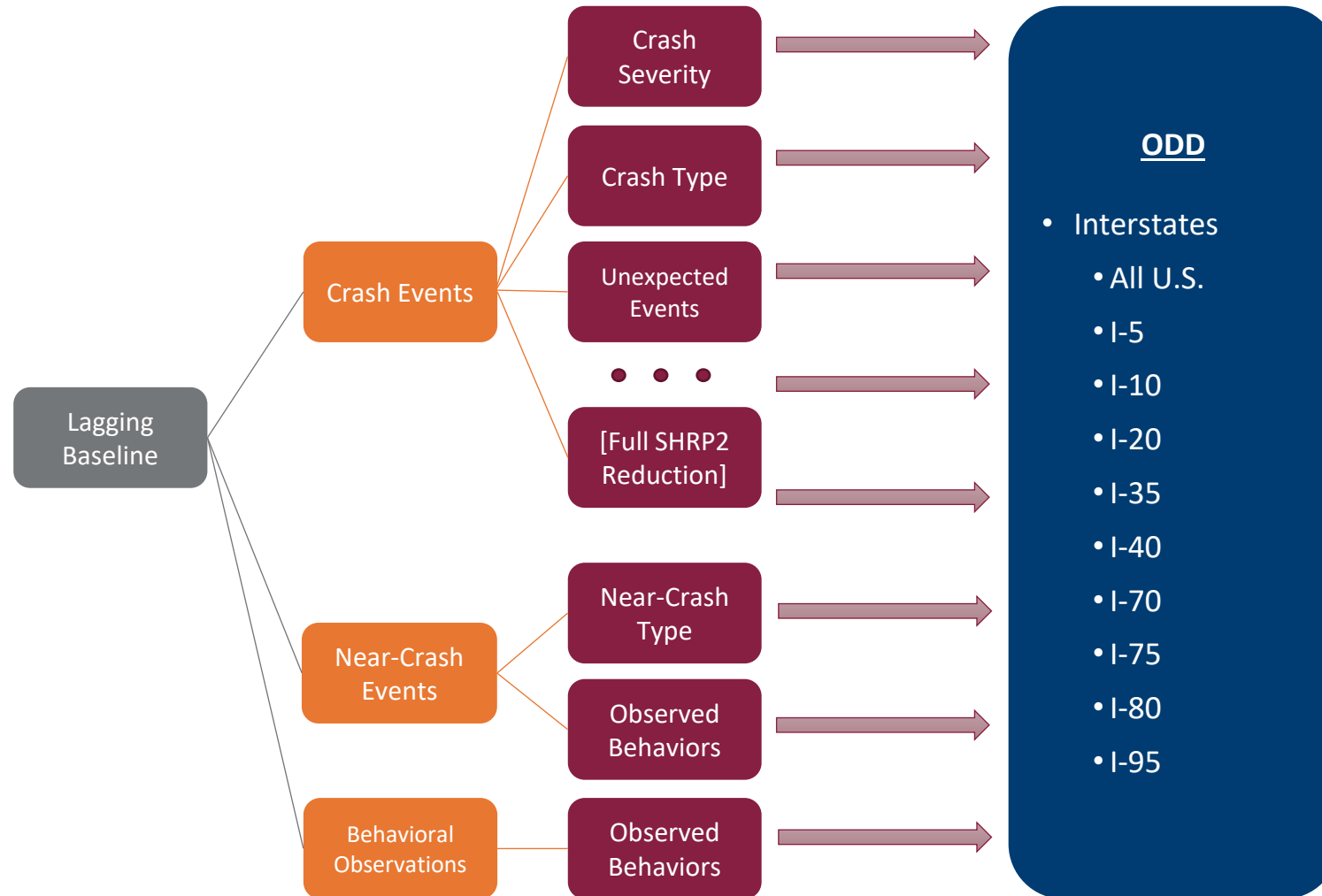
- Research funded by the U.S. Department of Transportation, Federal Motor Carrier Safety Administration
- Driving data sources:
 - FMCSA Data Repository, Class 8 Highway Continuous Naturalistic Driving Collections
 - SmartDrive Systems, Inc., Class 8 Highway Naturalistic Driving Collection; August 2016 – August 2018
- Map data sources:
 - Topologically Integrated Geographic Encoding and Referencing (TIGER) GIS
 - NAVTEQ Maps by HERE Technologies

PROJECT OBJECTIVES

- Develop **human driving data performance baselines** to which automated driving system (ADS) equipped CMVs can be compared
- Utilize **real-world naturalistic CMV data** collected during (for revenue) cargo delivery
- Organize the performance baselines for key **operational design domains** (ODDs) including specific U.S. interstates (e.g., I-10)
- Develop a **publicly available tool** that can be used by ADS designers, government officials, and others to calculate CMV performance baselines for specific ODDs

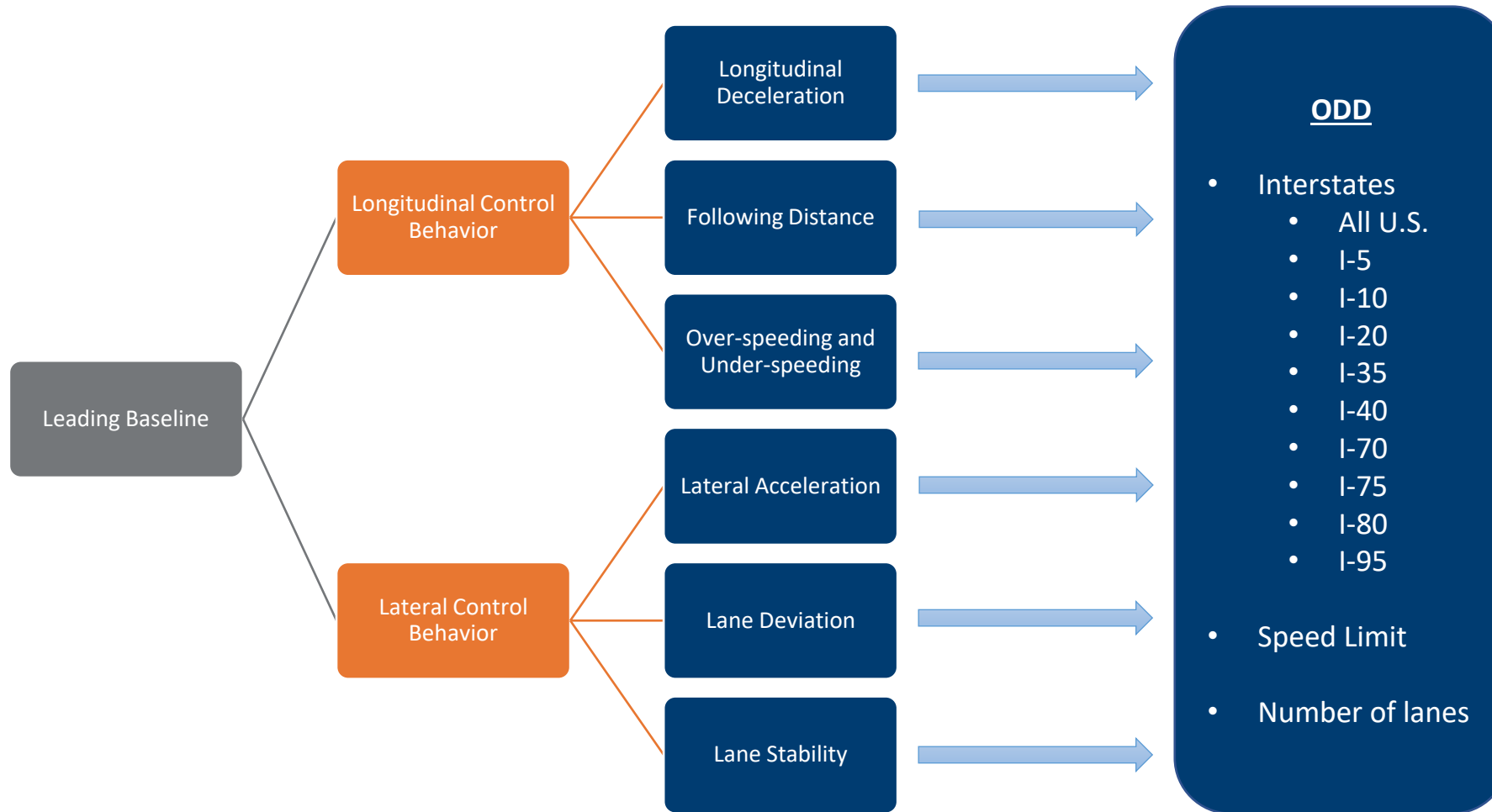
LAGGING BASELINE

EVENT DATA



LEADING BASELINE

CONTINUOUS DATA



DATA DESCRIPTION

LAGGING EVENTS

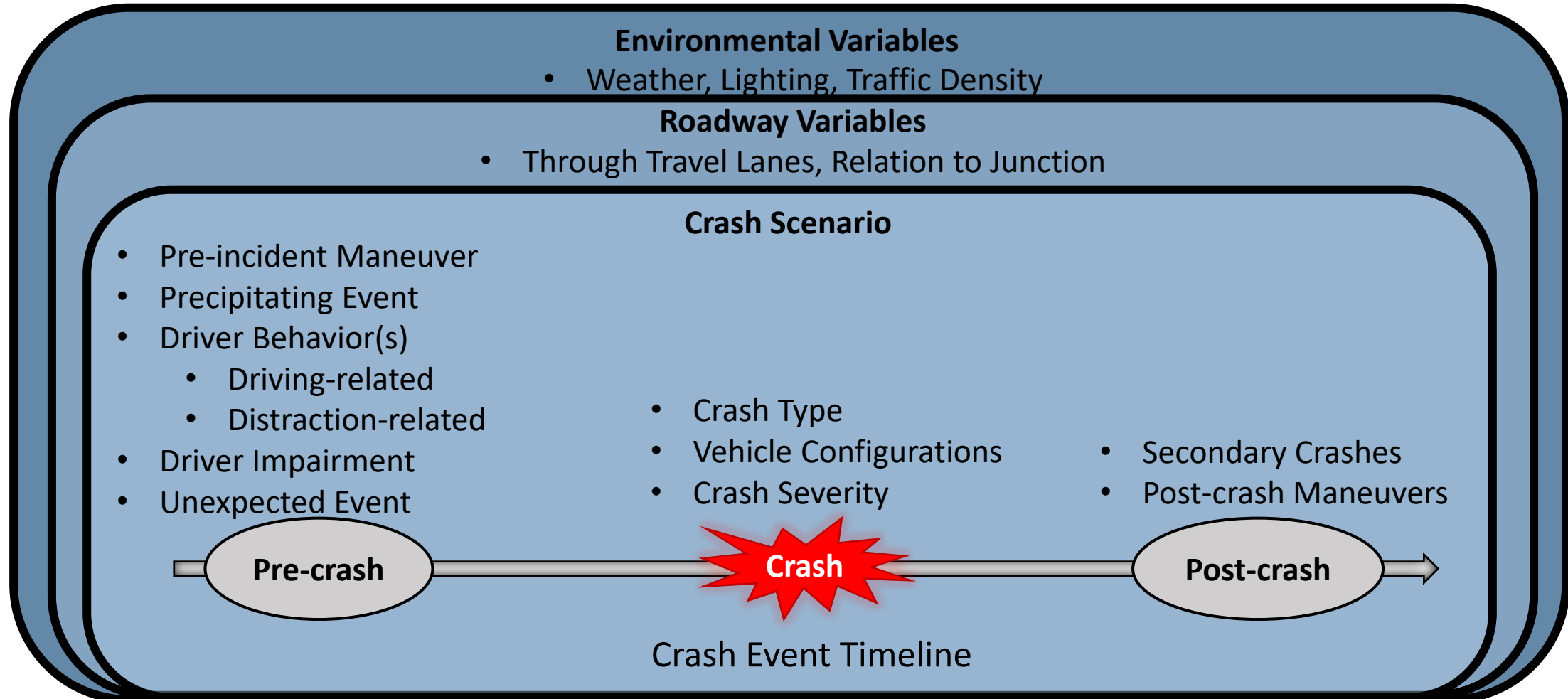
Unique CMVs in Events

ODD	Vehicles Involved in Crashes	Vehicles Involved in Near-Crashes
All U.S.	3,497	11,098
I-5	97	467
I-10	223	890
I-20	209	751
I-35	133	327
I-40	258	849
I-70	186	606
I-75	188	873
I-80	197	670
I-95	205	995

- Collected using onboard monitoring systems over 2 years (2016-2018)
- 3.44 billion U.S. interstate miles
 - 3,781 crash events
 - 16,767 near-crash events
 - 78,745 sampled behavioral events

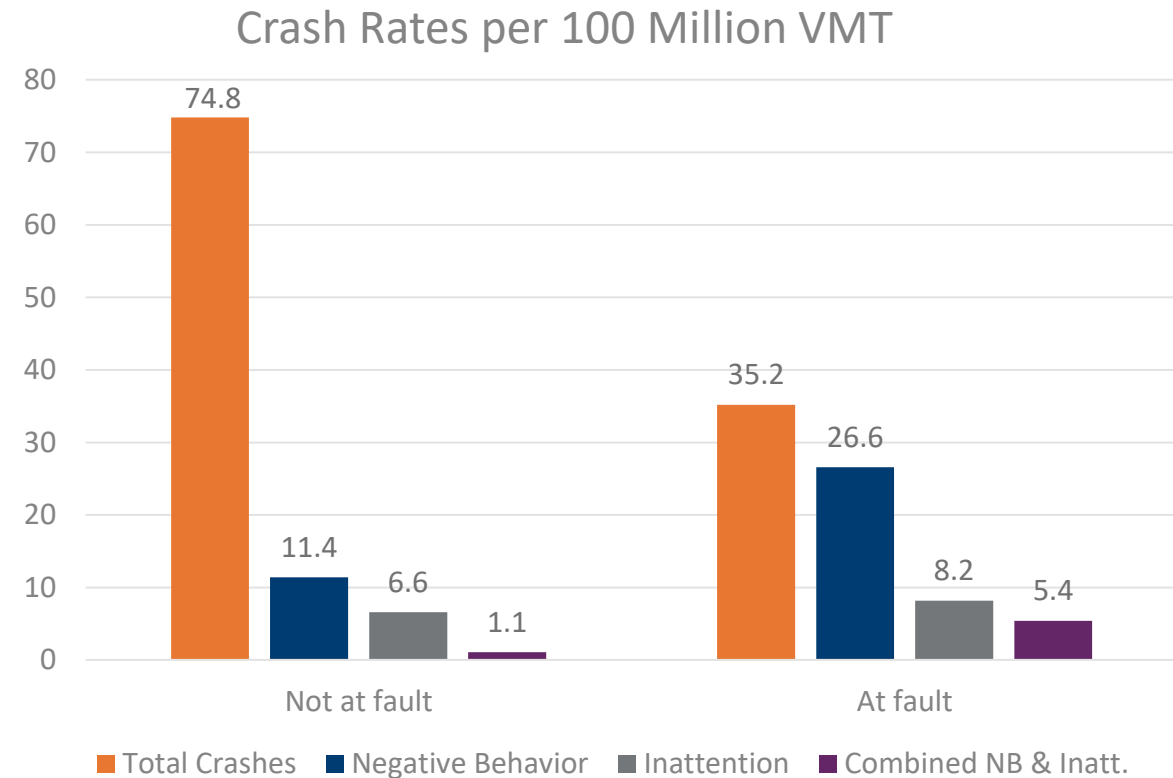
CRASH REDUCTION VARIABLE OVERVIEW

LAGGING EVENTS



ADS IMPACT ON CMV CRASHES

- 32% of all crashes were at the fault of the subject driver
- Among at-fault, 84% have a negative behavior or inattention component present
- ADS is expected to impact 84% of at-fault CMV crashes
 - 29.4 crashes per 100 million VMT out of 110 total crashes per 100 million VMT
 - Implies ADS is only on subject CMV



DATA DESCRIPTION

LEADING CASES

Interstate Exposure (1,000 VMT)

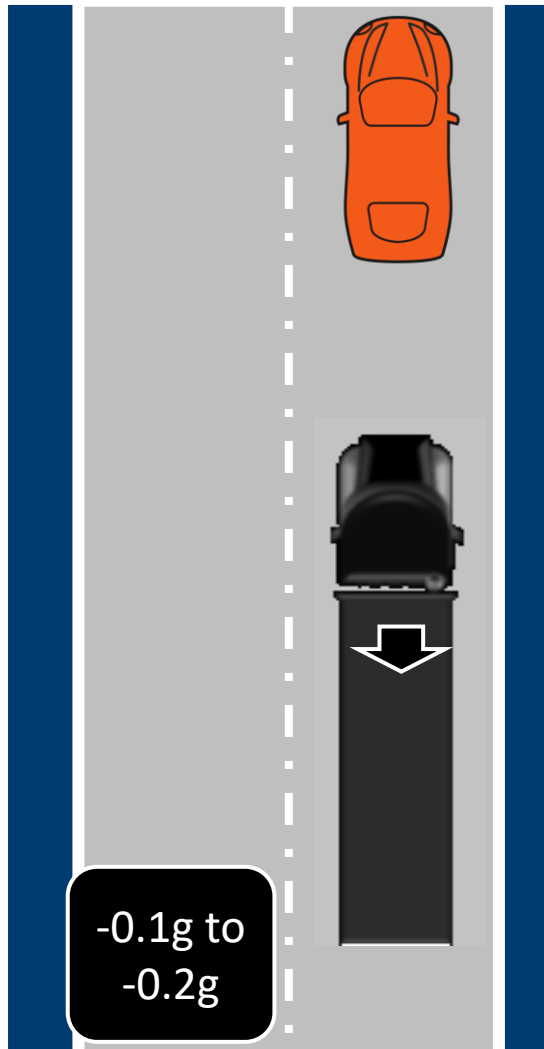
ODD (Interstate System)	Exposure by Speed (1,000 VMT)	Exposure by Lane Tracking (1,000 VMT)	Exposure by Radar Data (1,000 VMT)
All U.S.	3,121.8	1,662.1	1,314.5
I-5	7.5	3.7	3.0
I-10	146.7	84.7	83.5
I-20	43.8	21.6	16.2
I-35	10.2	4.9	4.0
I-40	141.7	69.7	55.9
I-70	40.3	17.9	21.6
I-75	26.9	12.2	7.6
I-80	49.4	22.0	29.9
I-95	123.1	63.9	37.6

- Collected using research-based continuous data while in revenue service (VTTI)
- 244 drivers across 6 study collections
- ODD: Total interstate system exposure

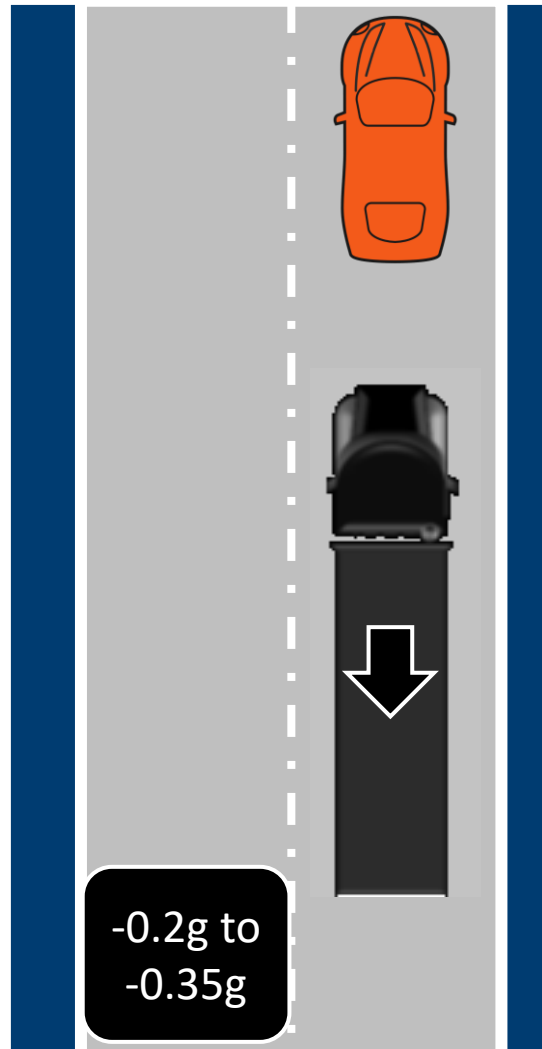
LONGITUDINAL DECELERATION CASES

LEADING CASES

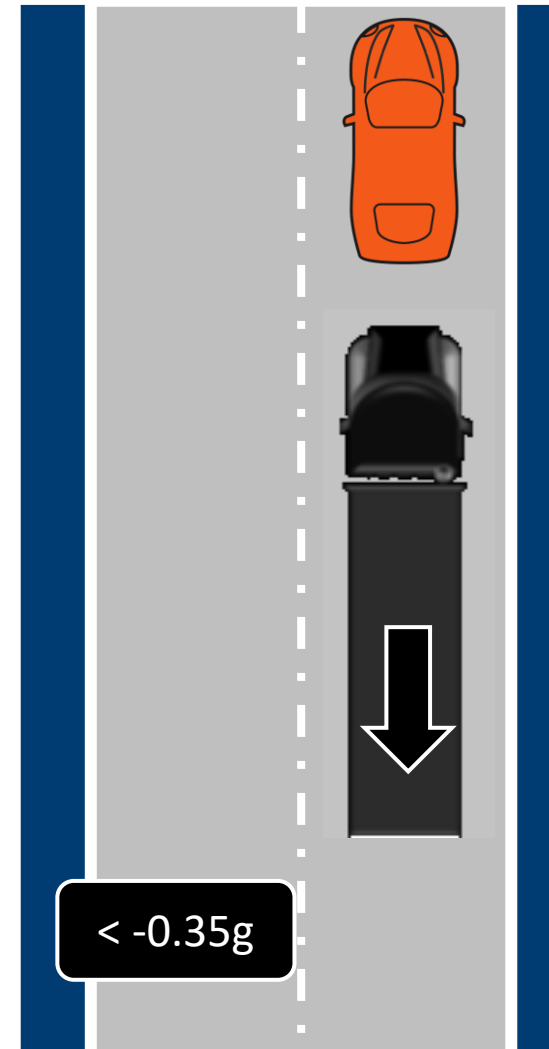
Type 1



Type 2



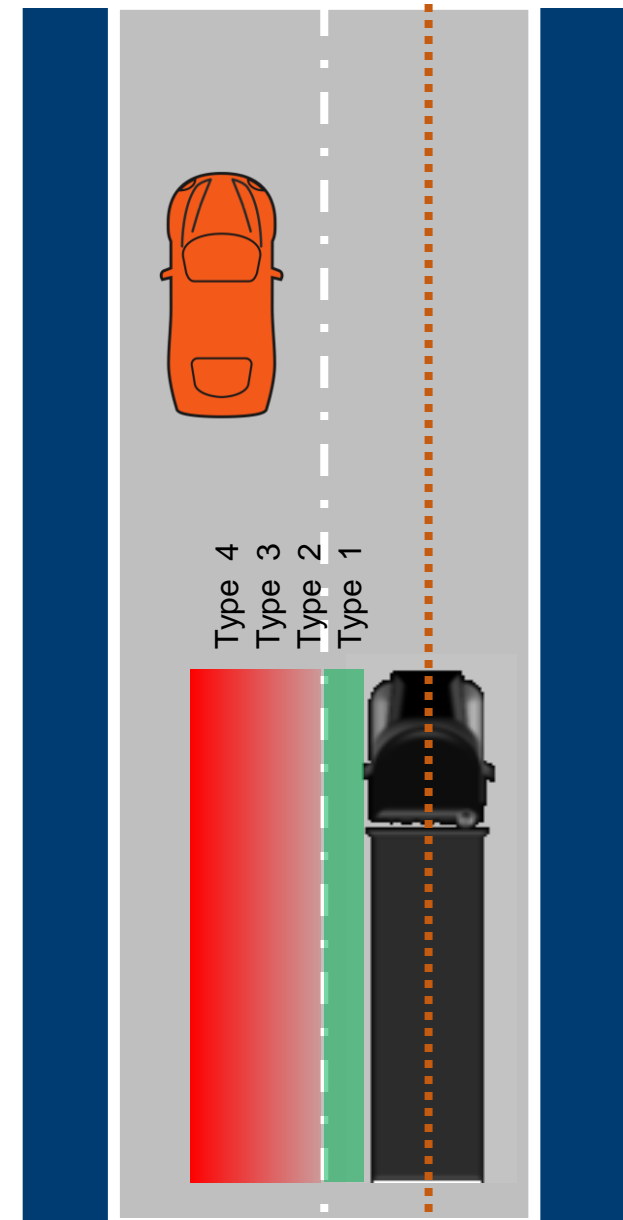
Type 3



LANE DEVIATION CASES

LEADING CASES

- Both tires inside the lane (0"–21")
 - Type 1: Acceptable lane keeping
- Lane deviation 21"–33"
 - Type 2: One tire is outside the lane (0"–12")
- Lane deviation 33"–45"
 - Type 3: One tire is outside the lane (12"–24")
- Lane deviation more than 45"
 - Type 4: One tire is outside the lane (> 24")



Thank You

Full Report:

<https://rosap.ntl.bts.gov/view/dot/57506>

Brief:

[https://ntlrepository.blob.core.windows.net/lib/82000/82100/82193/Naturalistic Driving Baseline CMV Report Final Report Research Brief 08-19-21.pdf](https://ntlrepository.blob.core.windows.net/lib/82000/82100/82193/Naturalistic_Driving_Baseline_CMV_Report_Final_Report_Research_Brief_08-19-21.pdf)

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