REGIONAL SAFETY TASK FORCE

Lane Departure Crashes and the Safe System Approach

October 1, 2021

DELAWARE VALLEY dvrpc REGIONAL PLANNING COMMISSION

CONNECT WITH US! @DVRPC #RSTF #VISIONZERO

Housekeeping

- Number of attendees
- Meeting recorded
- Use Chat feature for questions and to relay technical issues
- Mic and video features enabled for breakout groups

Opening Remarks

- **Patricia Ott, P.E., RSP,** Managing Member, MBO Engineering, LLC

REGIONAL SAFETY TASK FORCE

@dvrpc

RSTF Goal:

To reduce roadway crashes and eliminate serious injuries and fatalities from crashes in the Delaware Valley

Share the conversation!

Use **#rstf** during today's meeting, and

tag **@DVRPC**

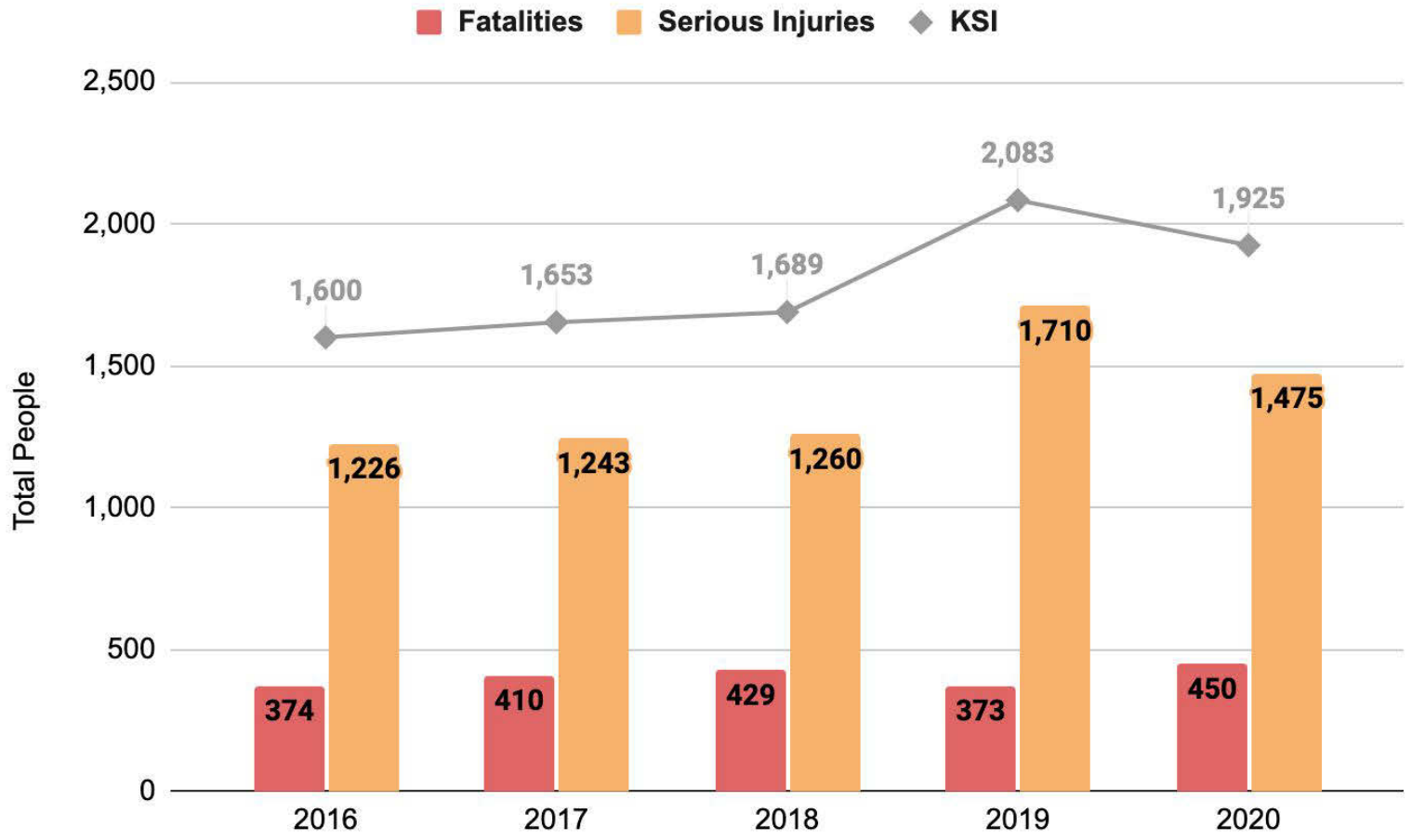
Transportation Safety Analysis & Plan Update

- Strategies from the **Special Strategies Session** (7/15) will be incorporated into the TSAP
- The priority strategy lists were sent via email
  - Please email comments to mgorini@dvrpc.org
- The full TSAP report will be published early next year as an ArcGIS Online Storymap

Introduction

- **Kevin Murphy,** Manager, Office of Safe Streets, Delaware Valley Regional Planning Commission

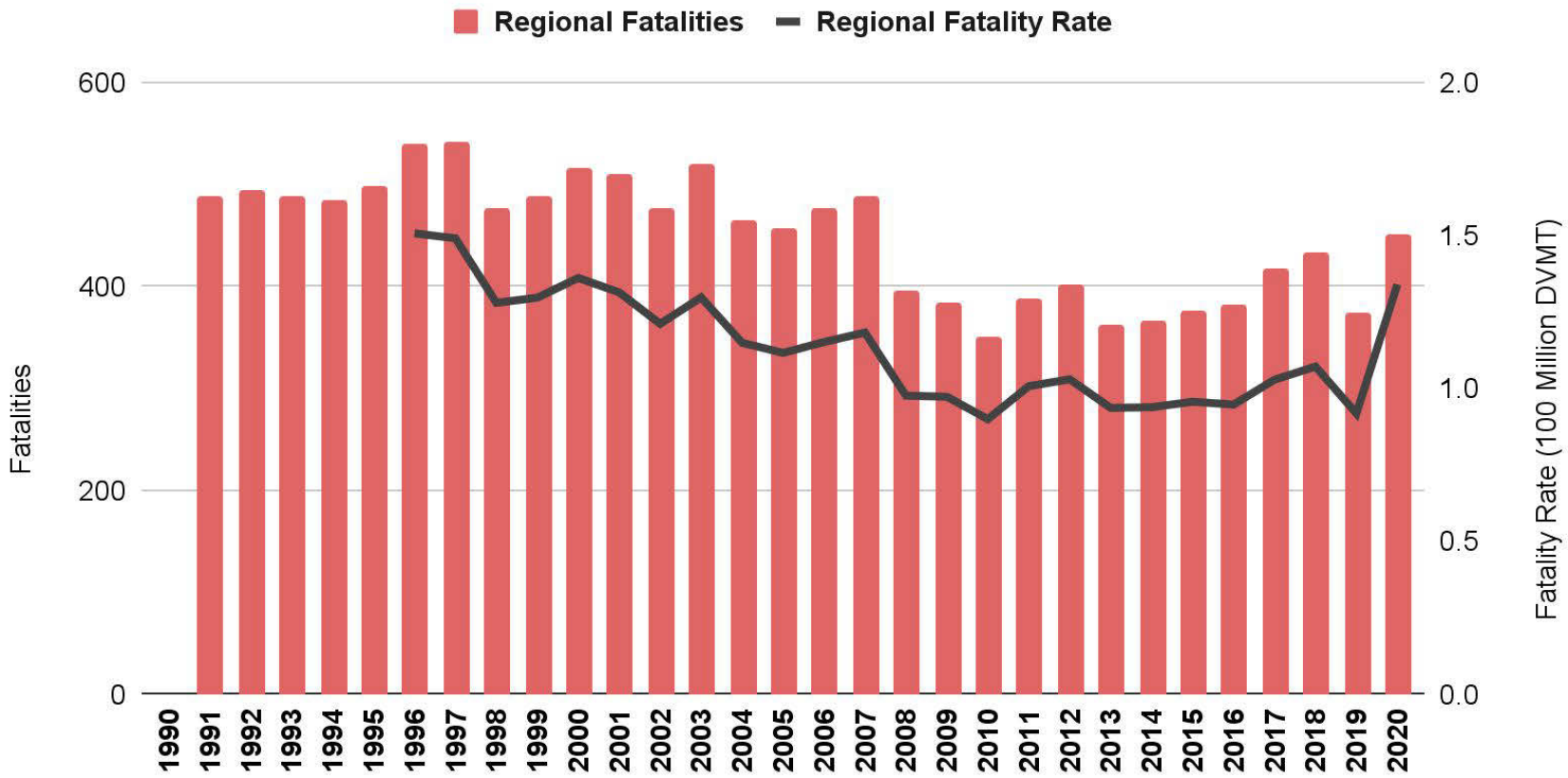
Total KSI - Regional Trend (by person), 2016-2020



- In 2020, an estimated **38,680** people killed in crashes - the largest projected number of fatalities since 2007:
  - 7.2-percent **increase** from 36,096 in 2019
  - VMT **decreased** 13.2 percent over 2019

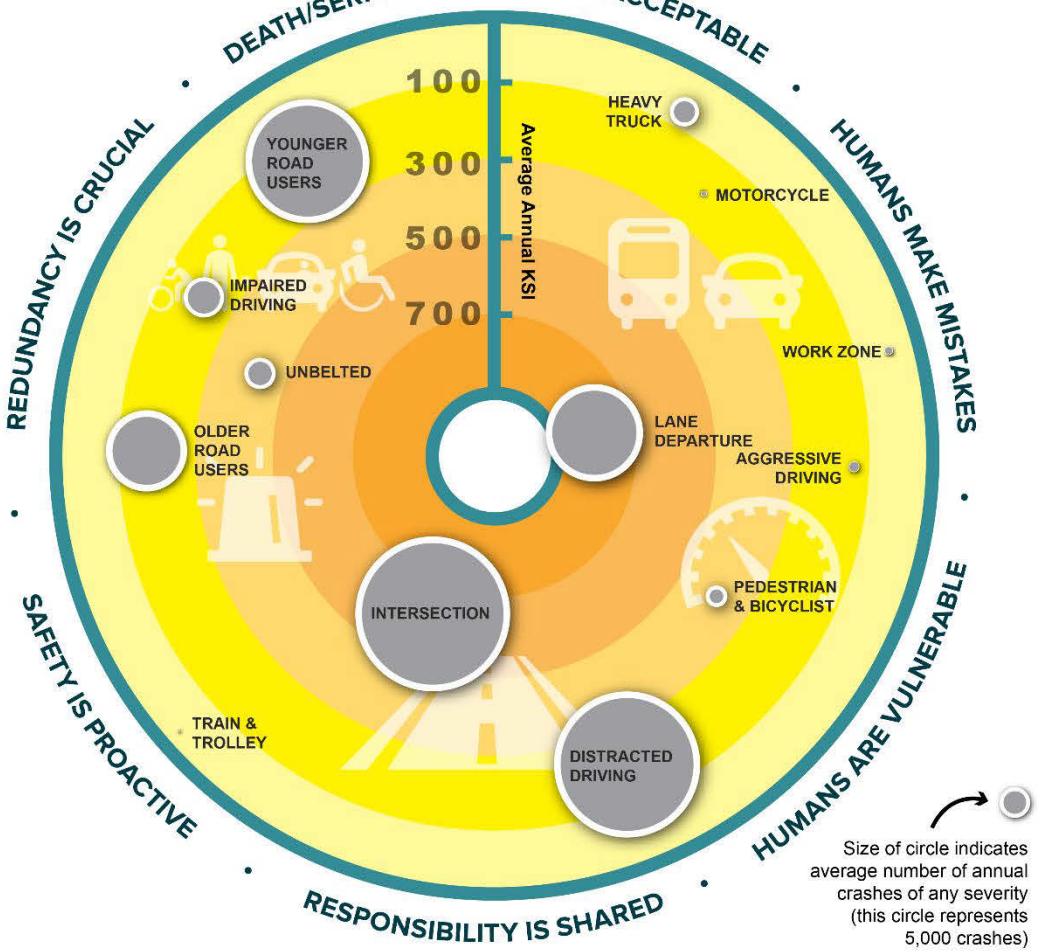
Total estimated fatalities in **roadway departure** related crashes increased by 3 percent from 2019 to 2020.

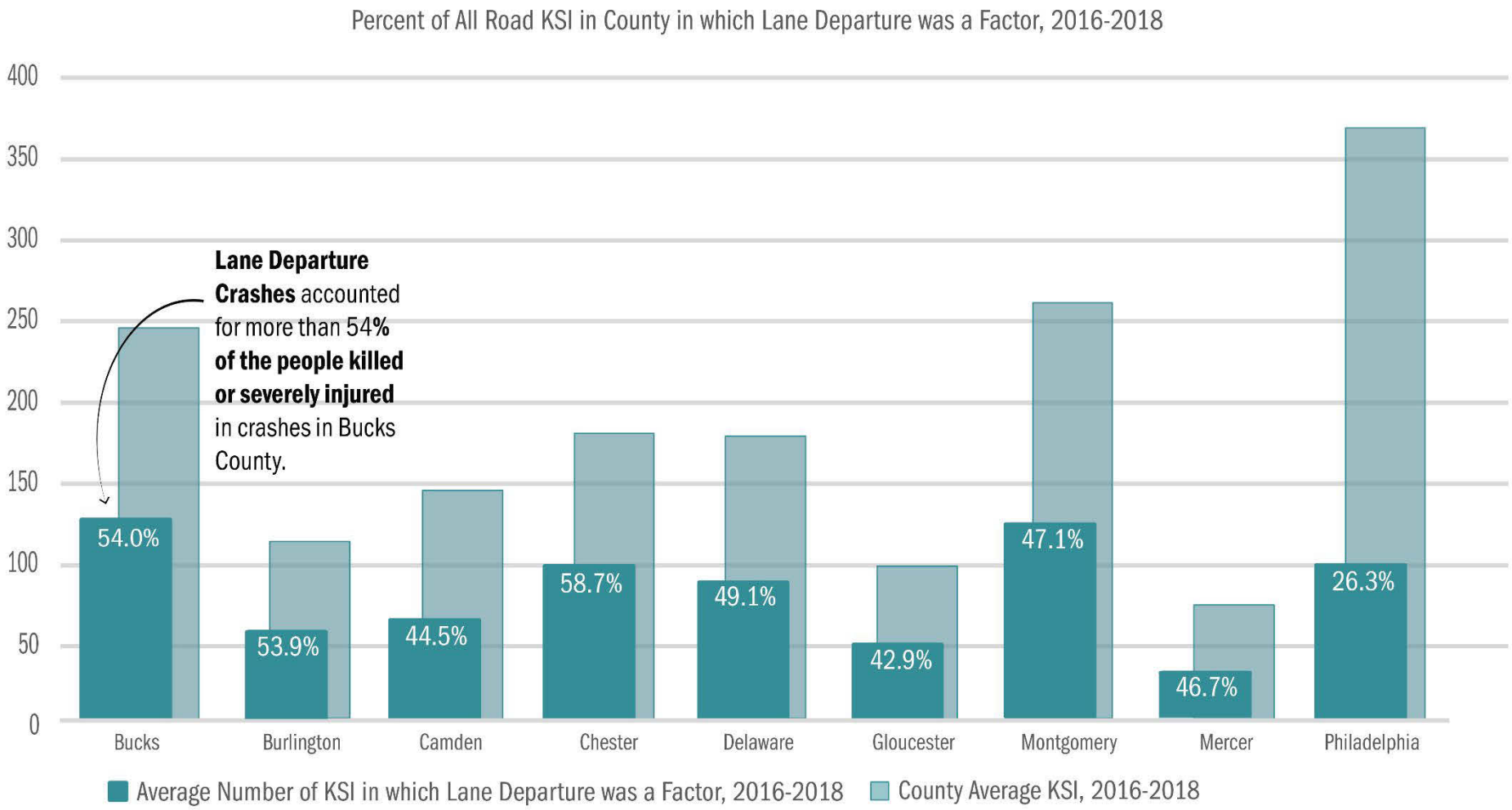
30 Year Regional Trend of Fatalities and Fatality Rate



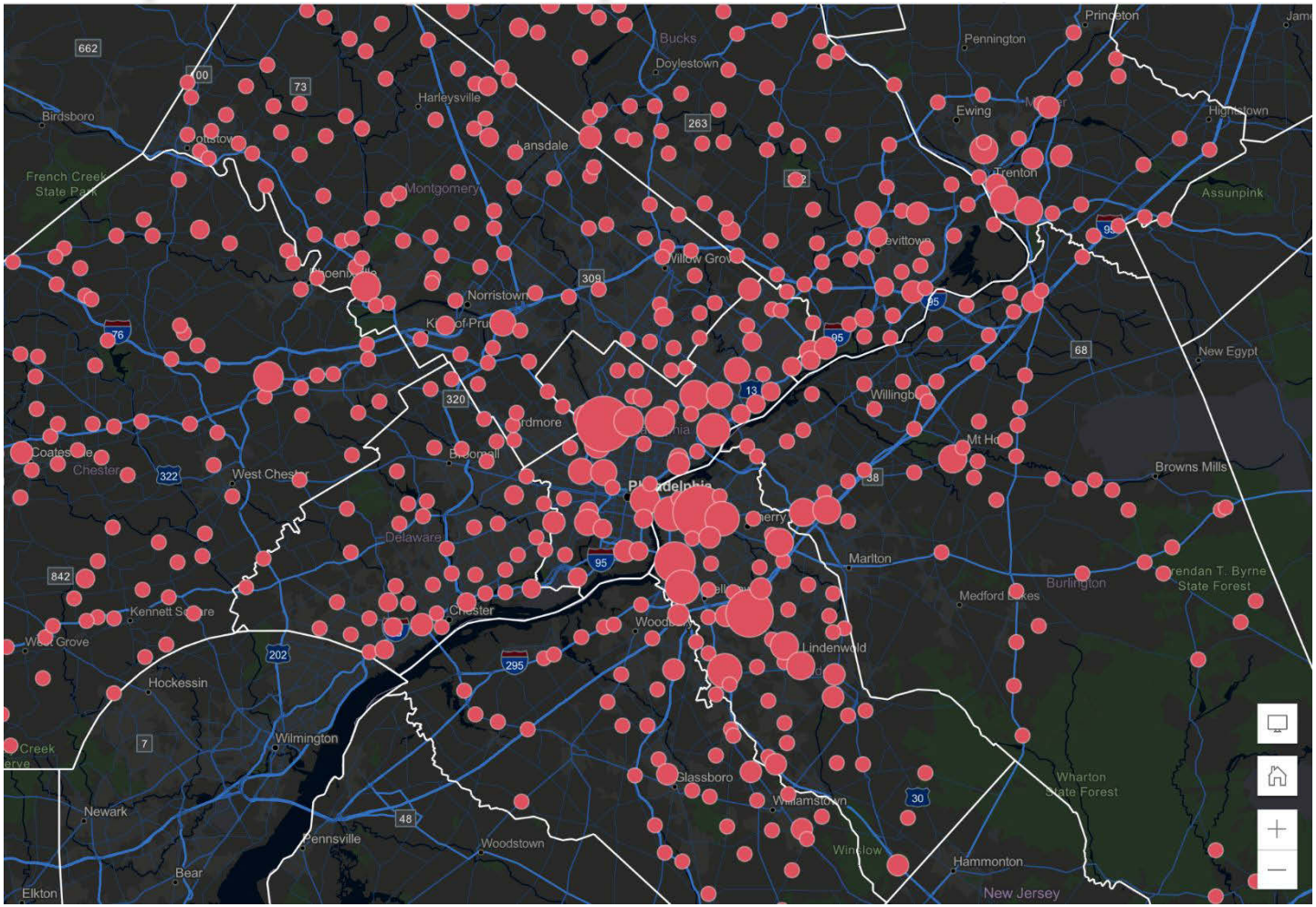
KSI & Total Crashes by Emphasis Area

2021 Transportation Safety Analysis & Plan




Percent of All Road KSI in County in which Lane Departure was a Factor, 2016-2018
400
350
300
250
200
150
100
50
0
Lane Departure Crashes accounted for more than 54% of the people killed or severely injured in crashes in Bucks County.
54.0%
53.9%
44.5%
58.7%
49.1%
42.9%
47.1%
46.7%
26.3%
Bucks
Burlington
Camden
Chester
Delaware
Gloucester
Montgomery
Mercer
Philadelphia
Average Number of KSI in which Lane Departure was a Factor, 2016-2018
County Average KSI, 2016-2018

2021 Transportation Safety Analysis & Plan: Interactive Emphasis Area Crash Maps



SSA Category	*Strategy*	*Priority*
	**Promote** the safety benefits of new **in-vehicle technologies** like lane keeping and speed monitoring.	!!!
	**Encourage** use of edgeline and centerline **rumble strips where appropriate** and look to best practices (MinnDOT) for effectiveness of sinusoidal rumble strips—a new technology that reduces ambient noise outside the car.	!!!
	Pursue use of Clear Zones (typically in rural areas) to minimize the consequences of leaving the roadway, and to also create space for people to stop if they do leave their lane (in places where the context is appropriate).	!!
	Analyze data to identify **run-off-the-road and cross-median crash trend** locations in the region, specifically on county and local roads as candidate locations for the NJ local safety program, and PA local safety efforts.	!!
	Incentivize county and local road operators to use **FHWA Proven Safety Countermeasures** to address lane departure crashes.	!!
	Develop and promote a matrix of strategies and countermeasures for lane departure crashes that differentiate between rural and urban, residential and non-residential contexts.	!!
	**Promote engineering best practices** used by NJDOT and PennDOT, or recommended by FHWA (including proven countermeasures) in keeping vehicles on the roadway.	!!

Speakers

- **Marshie Agee**

  Insurance Institute of Highway Safety

- **Maxwell Moreland**

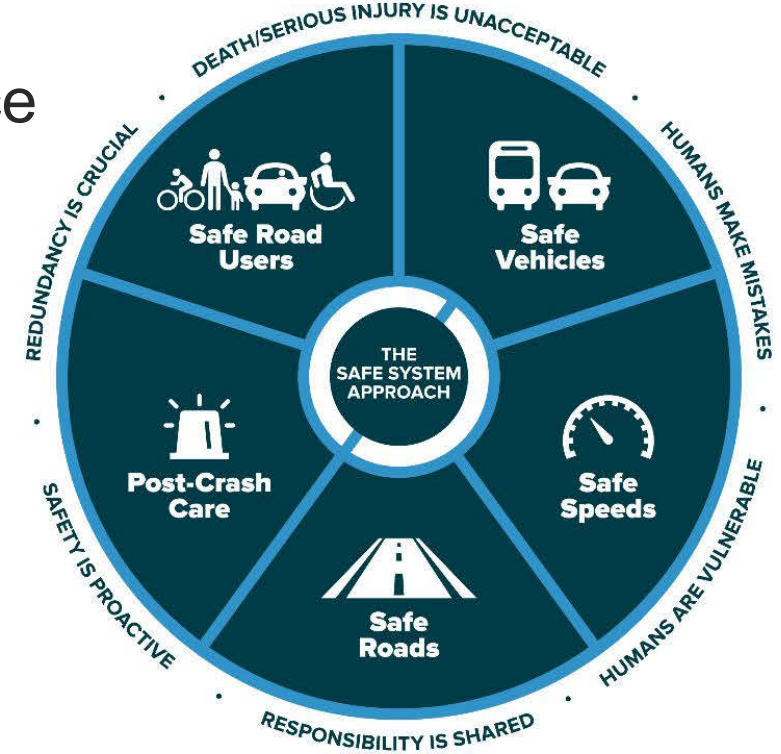
  Minnesota Department of Transportation

- **Ethan Peterson**

  Minnesota Department of Transportation

Action Item Development Groups

- Continuing the conversation in small breakout groups
- Brainstorm strategies to reduce lane departure crashes
- Consider the Safe System approach



Closing Remarks

- **Sharang Malaviya, P.E.,** Traffic Safety Supervisor, PA Department of Transportation

Breakout Group Reports

Please share one action item from your group.

Feedback and Next Meeting

- Please complete the meeting survey! The link for the survey is in the Chat
- Next meeting planned for December 2021, topic TBD
- Adjourn

Thank You!

REGIONAL SAFETY TASK FORCE

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Promoting safer vehicles

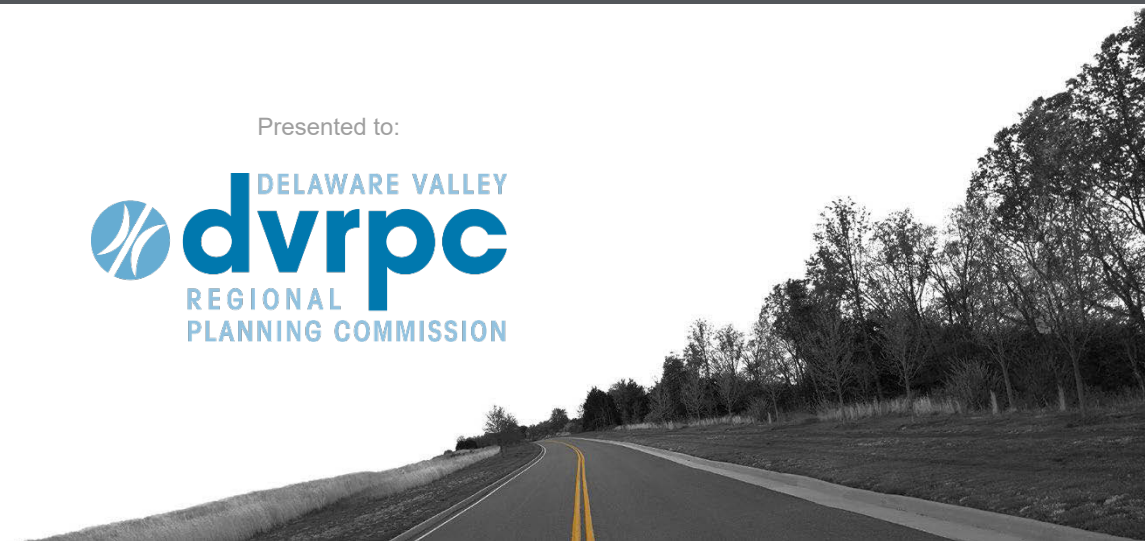
Lane Departure Crashes and the Safe System Approach
Delaware Valley Regional Safety Task Force Meeting

October 1, 2021

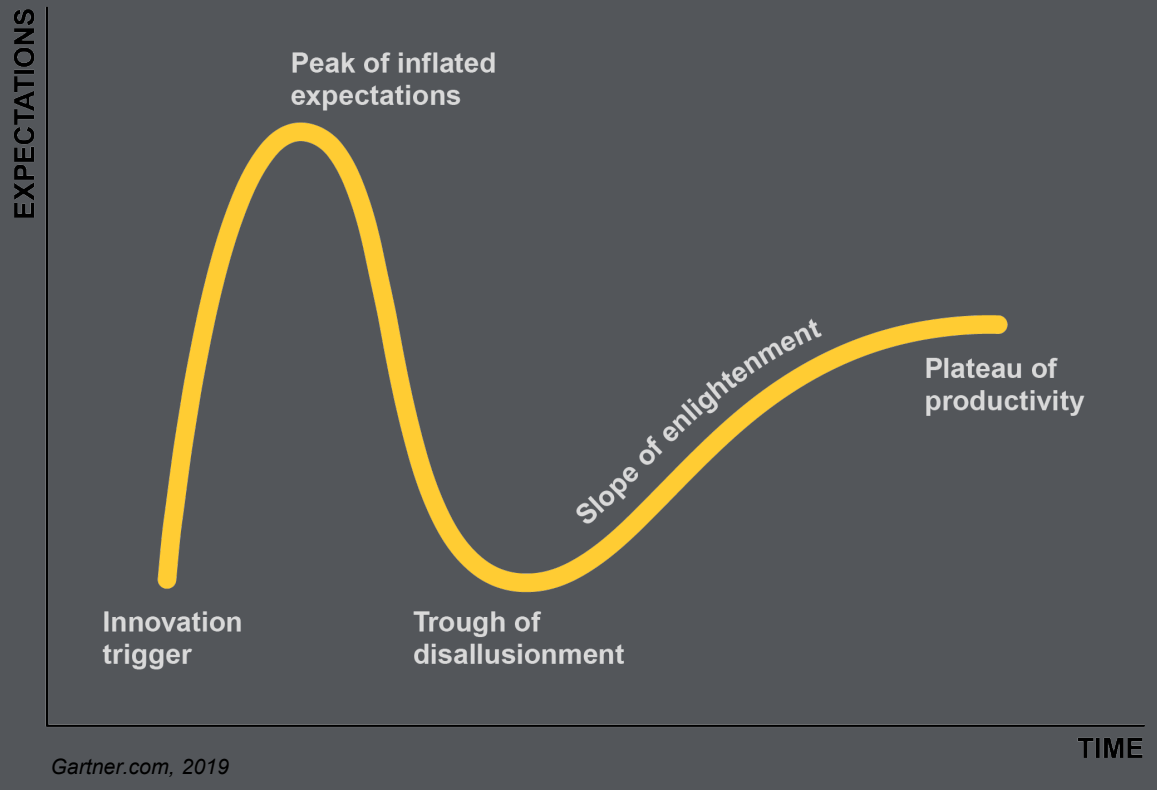
Marshie Agee
Communications Liaison

Presented to:

DELAWARE VALLEY dvrpc REGIONAL PLANNING COMMISSION



Evolution takes time…



Gartner.com, 2019

Self-Driving Cars Run into Reality — And Are Further Away Than You Think

INVESTOR'S BUSINESS DAILY *May 24, 2019*

"Autonomy will always have some constraints"

WAYMO *CEO John Krafcik, 2018*

"We overestimated the arrival of autonomous vehicles"

Ford *CEO Jim Hackett, April 2019*

IIHS HLDI

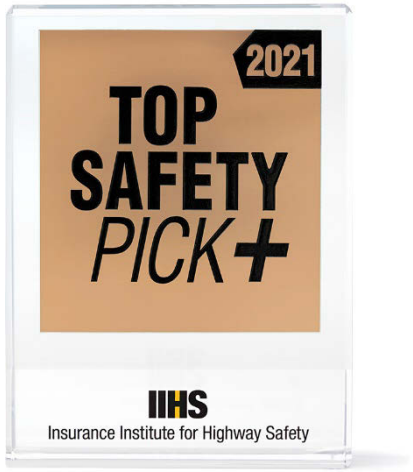
Saving lives. Preventing harm.

IIHS-HLDI mission:

To reduce deaths, injuries and property damage from motor vehicle crashes through **research and evaluation** and through **education** of consumers, policymakers and safety professionals.

Collision avoidance

2021 *TOP SAFETY PICK* requirements



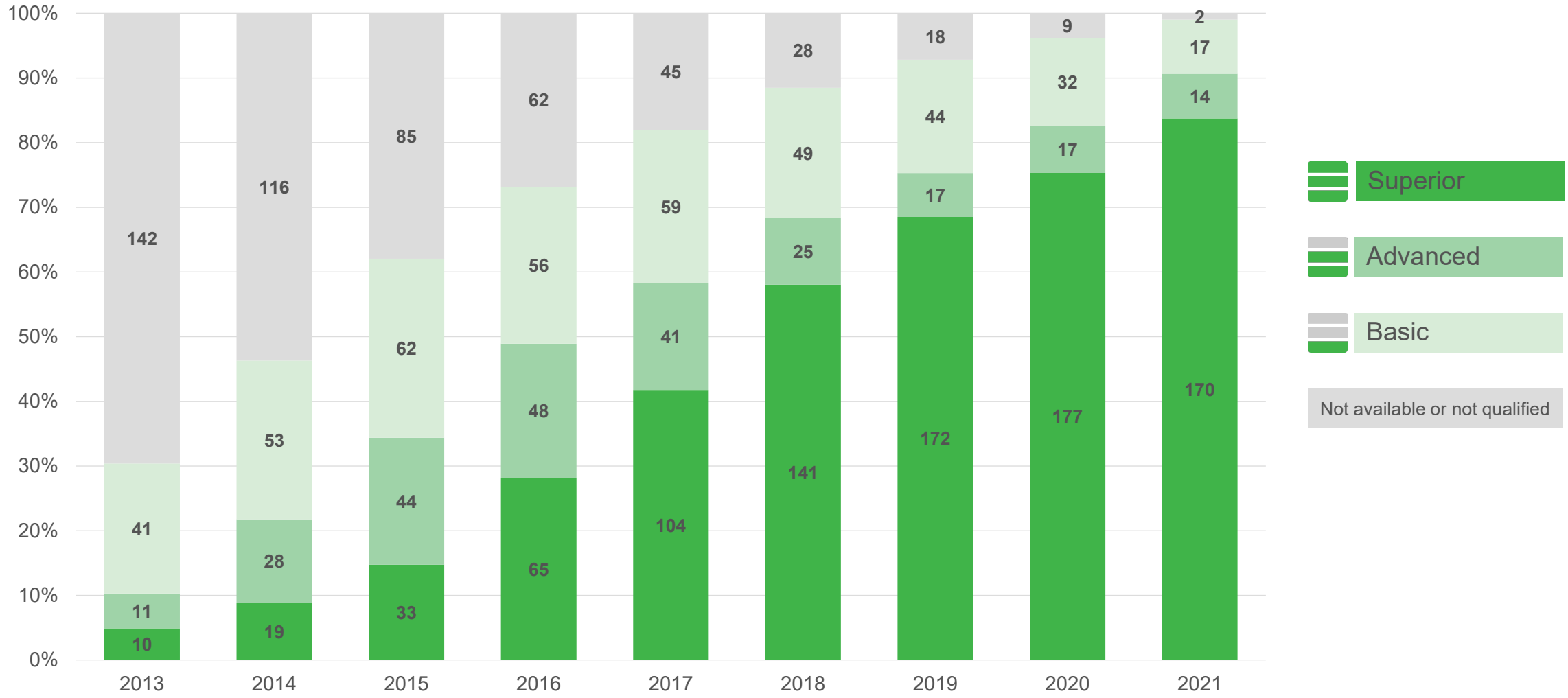
- **G** Good ratings in the driver-side small overlap front, passenger-side small overlap front, moderate overlap front, side, roof strength and head restraint tests
- Advanced or superior rating for front crash prevention (**standard or optional**) — vehicle-to-vehicle and vehicle-to-pedestrian evaluations
- **A** **G** Acceptable or good headlights with **standard equipment**

- **G** Good ratings in the driver-side small overlap front, passenger-side small overlap front, moderate overlap front, side, roof strength and head restraint tests
- Advanced or superior rating for front crash prevention with (**standard or optional**) — vehicle-to-vehicle and vehicle-to-pedestrian evaluations
- **A** **G** Acceptable or good headlights with **optional equipment**

IIHS HLDI

Front crash prevention ratings

2013-21 models



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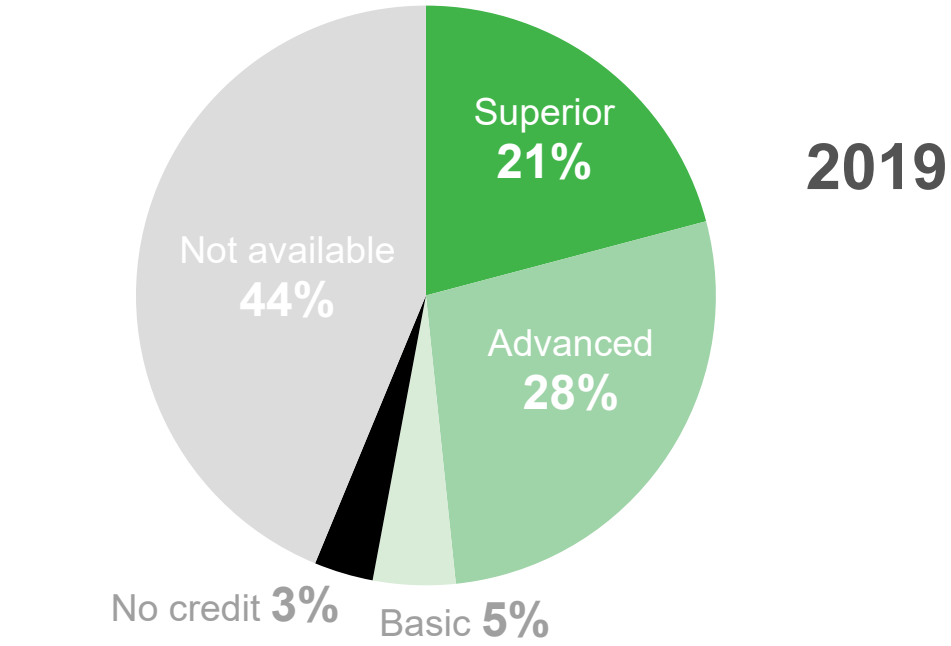
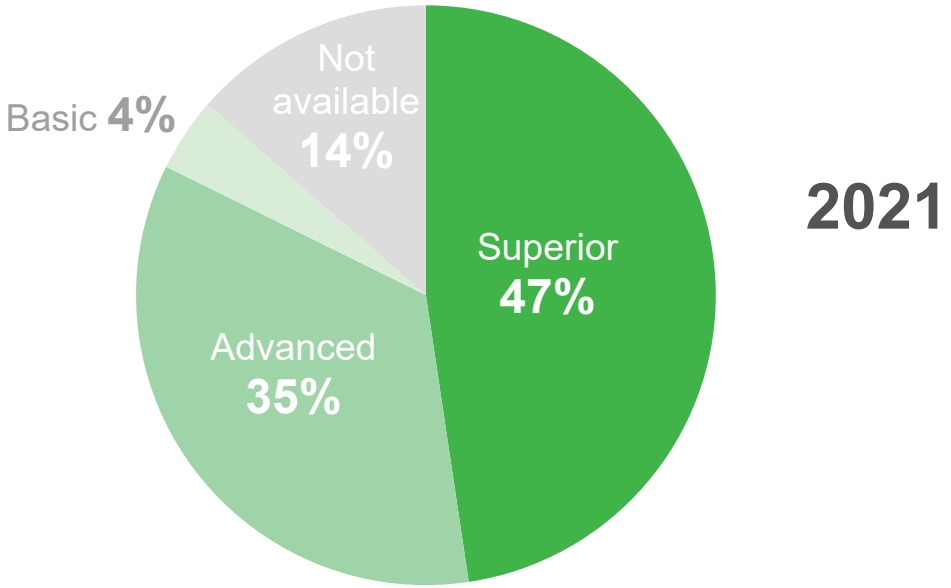
Pedestrian crash prevention ratings



2019



2021

20 automakers

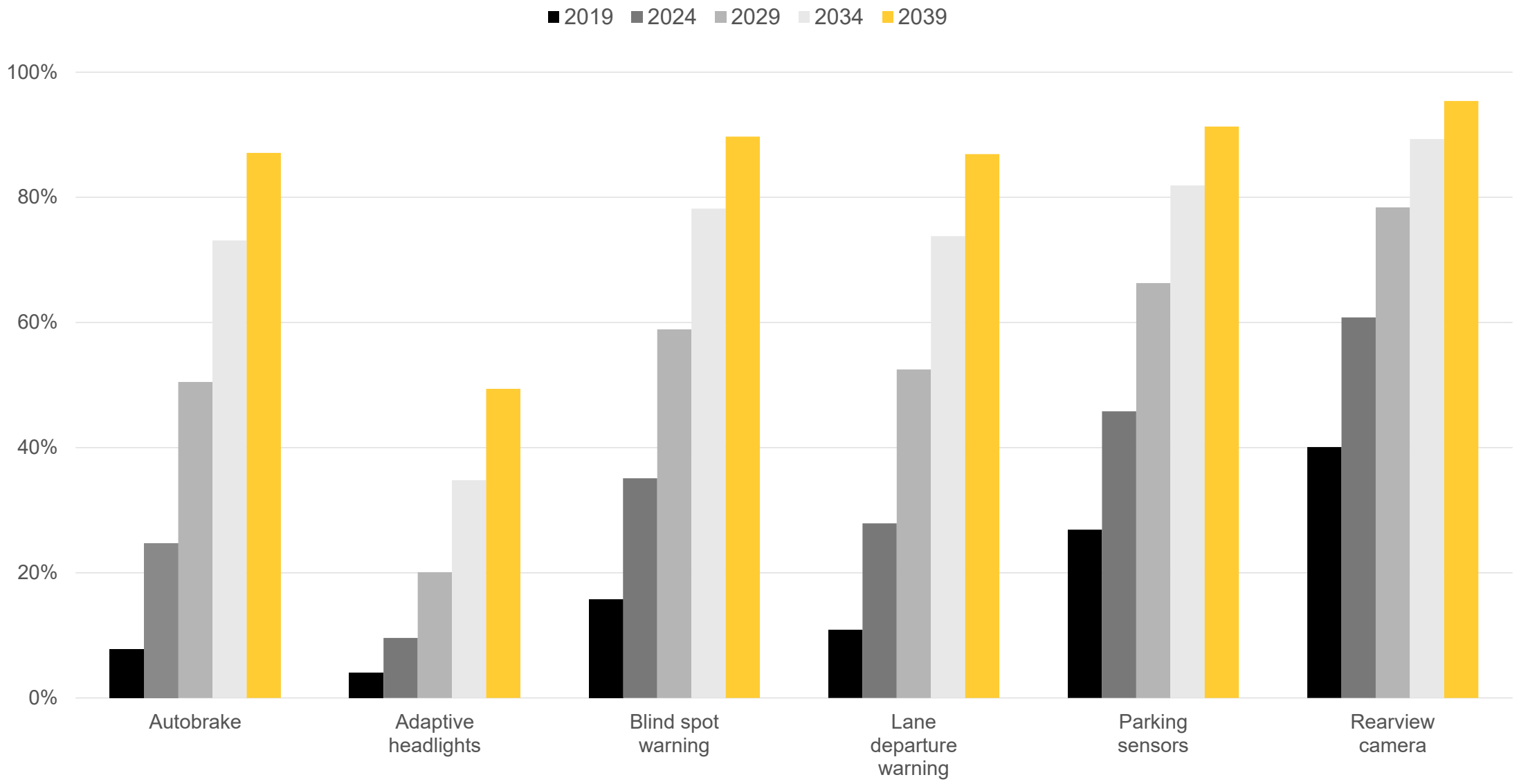
(99+% of the U.S. market)

have committed to making autobrake standard by September 2022

Audi, BMW, Ford, GM, Honda, Hyundai, Jaguar, Kia, Maserati, Mazda, Mercedes-Benz, Mitsubishi Motors, Nissan, Porsche, Subaru, Stellantis, Tesla, Toyota, Volkswagen, Volvo

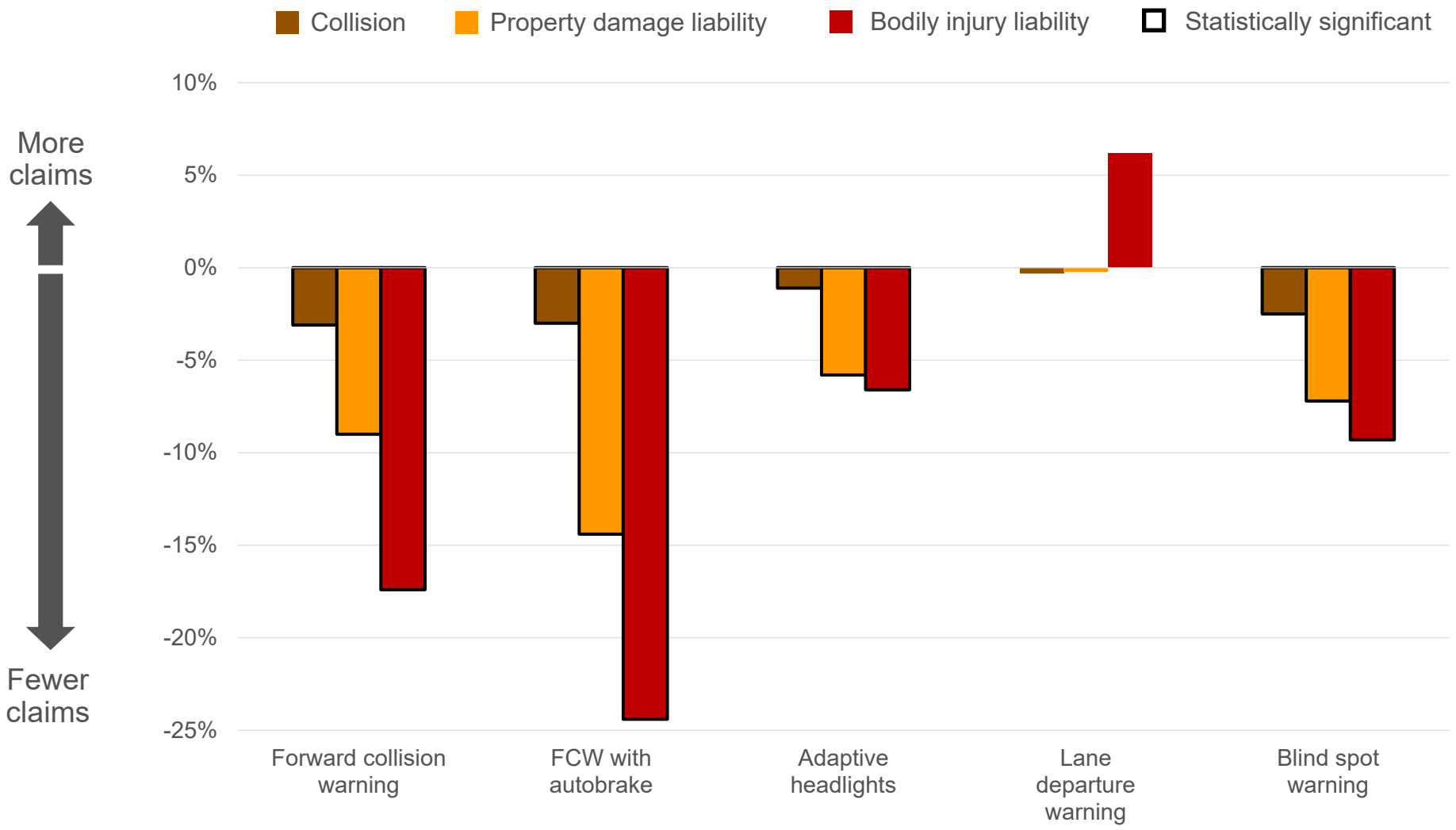
IIHS HLDI

Predicted registered vehicles by feature and calendar year



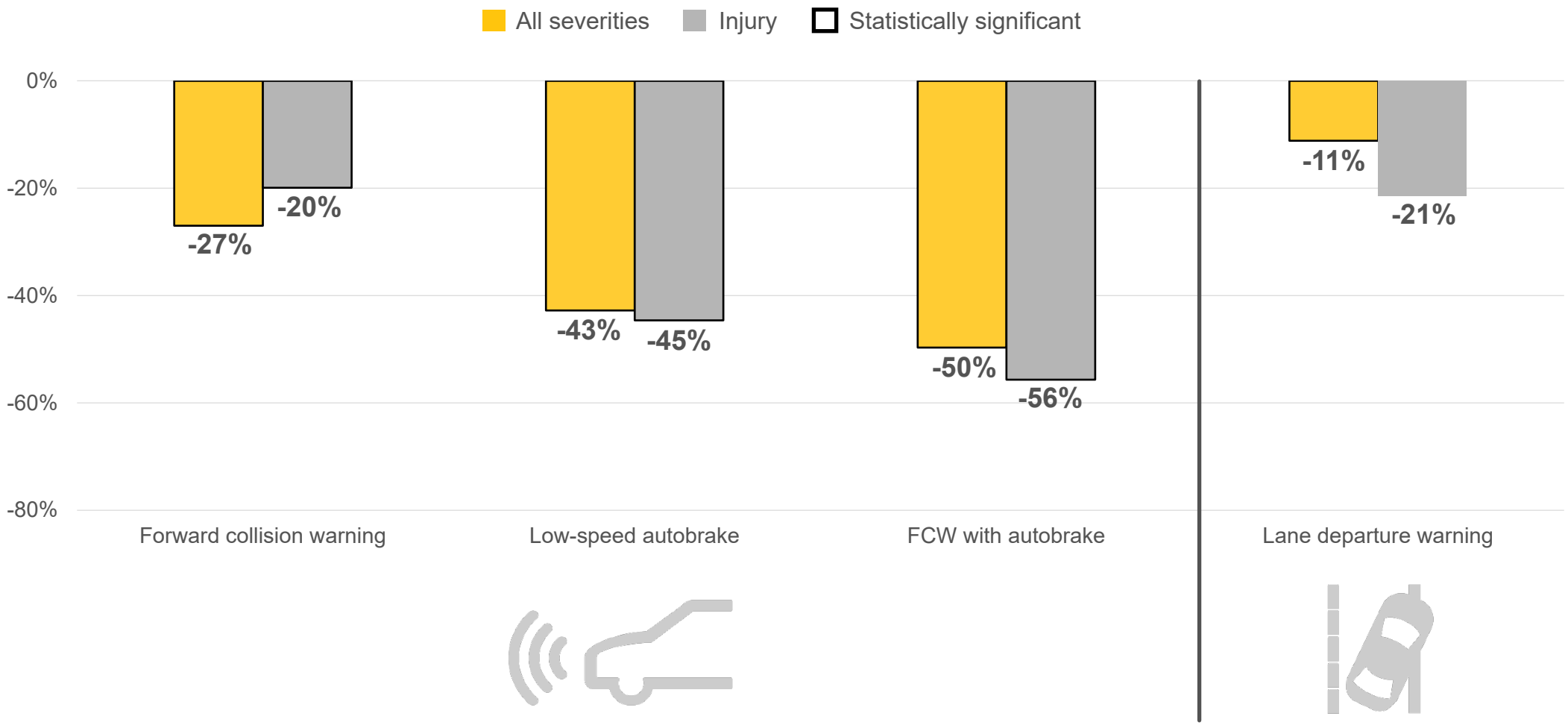
Most crash avoidance technologies are living up to expectations

Effects on insurance claim frequency



Effects of crash avoidance systems on relevant police-reported crashes

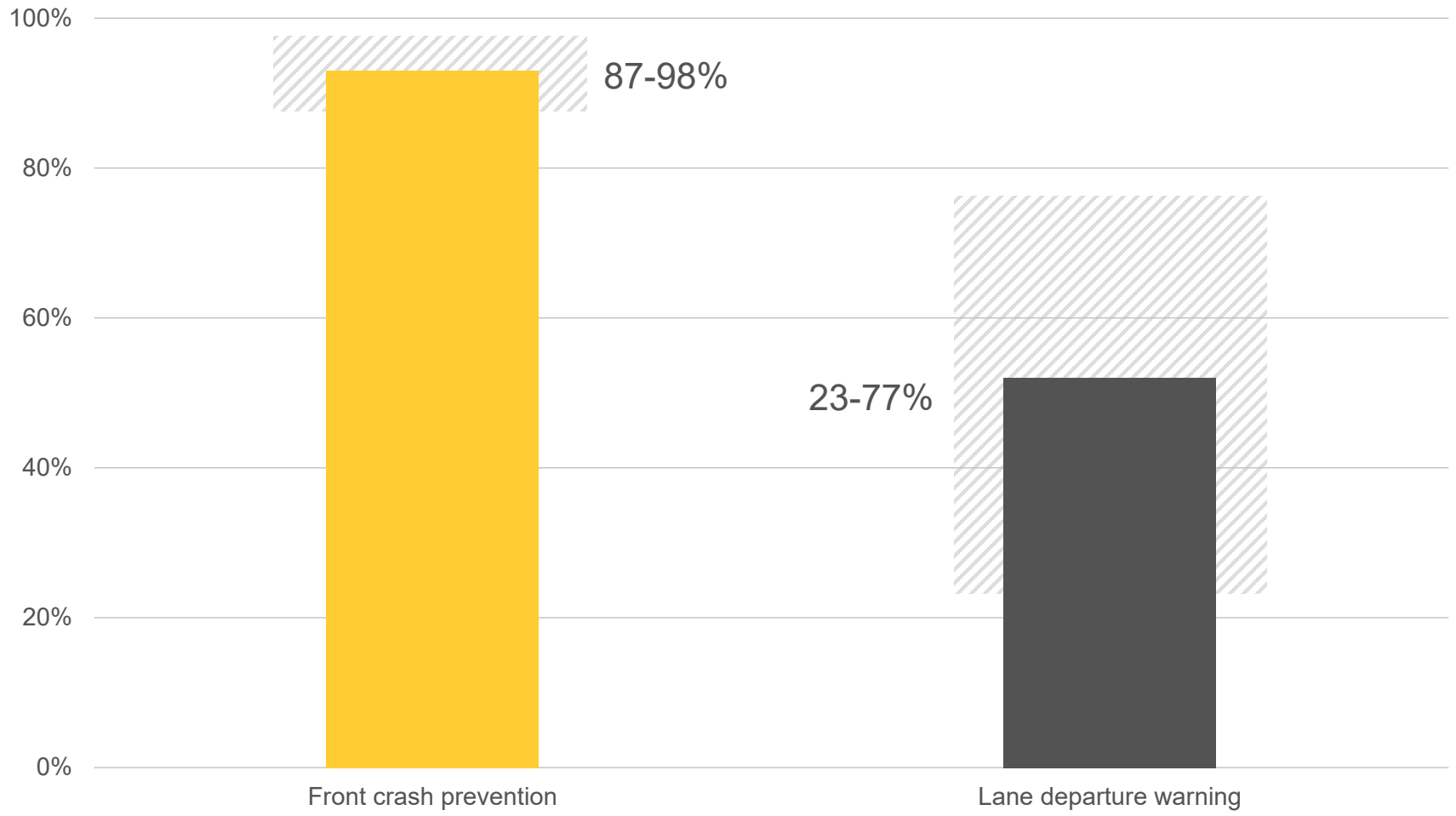
Low use of lane departure warning may limit effectiveness



IIHS HLDI

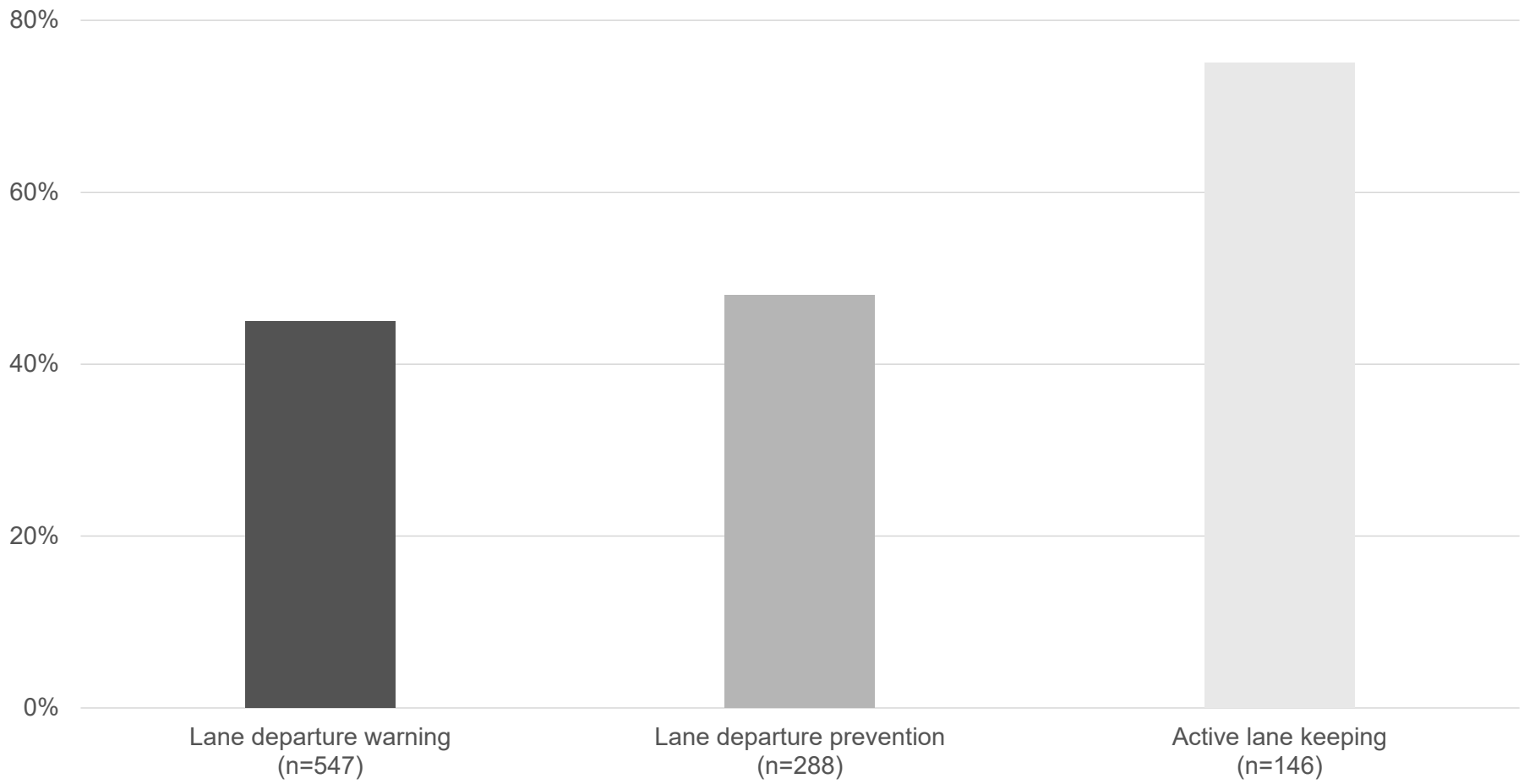
Status of crash avoidance systems

Percent with system on — mean values and value range



On-off status by maximum observable lane-maintenance intervention level

Percent with system on



What can we do to increase the use of lane maintenance systems?

- Promote the purchase of vehicles equipped with crash avoidance systems.
- Educate consumers about the benefits of using lane maintenance systems.
- Focus on designing systems to encourage greater use:

  Warning systems were more likely to be turned on if they had tactile warnings (54%) instead of auditory warnings (46%).

  Lane departure prevention systems, which guide the vehicle back into the lane when it begins to drift, also were more likely to be turned on than lane departure warning systems.

  Unlike front crash prevention, most of the lane maintenance systems studied could be deactivated with the push of a button. The Volvo XC90's active lane-keeping system had a much higher than average observed use rate of 86%. To turn the system off, drivers must navigate to a menu and go through several steps.

  Guiding drivers to stay in their lanes with slight nudges from the steering wheel and subtle braking as soon as tires start to drift versus later and more abrupt interventions may be key to boosting use of lane departure prevention systems, according to an IIHS study.

Understanding Level 2 automation

Functional performance and user experience

2016 Tesla Model S with Autopilot software ver. 7.1

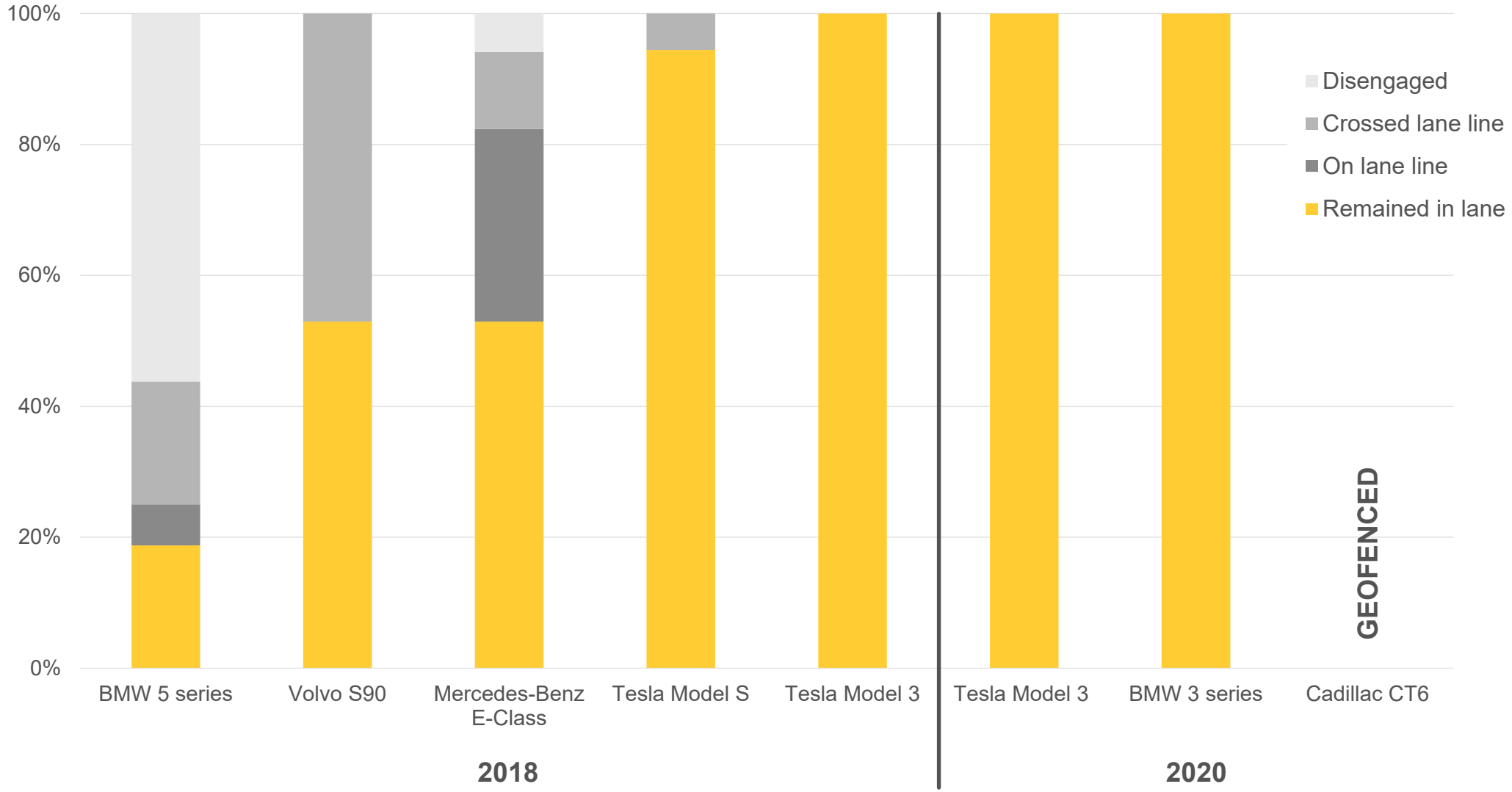
2017 BMW 5 series with Driving Assistant Plus

2017 Mercedes E-Class with Drive Pilot

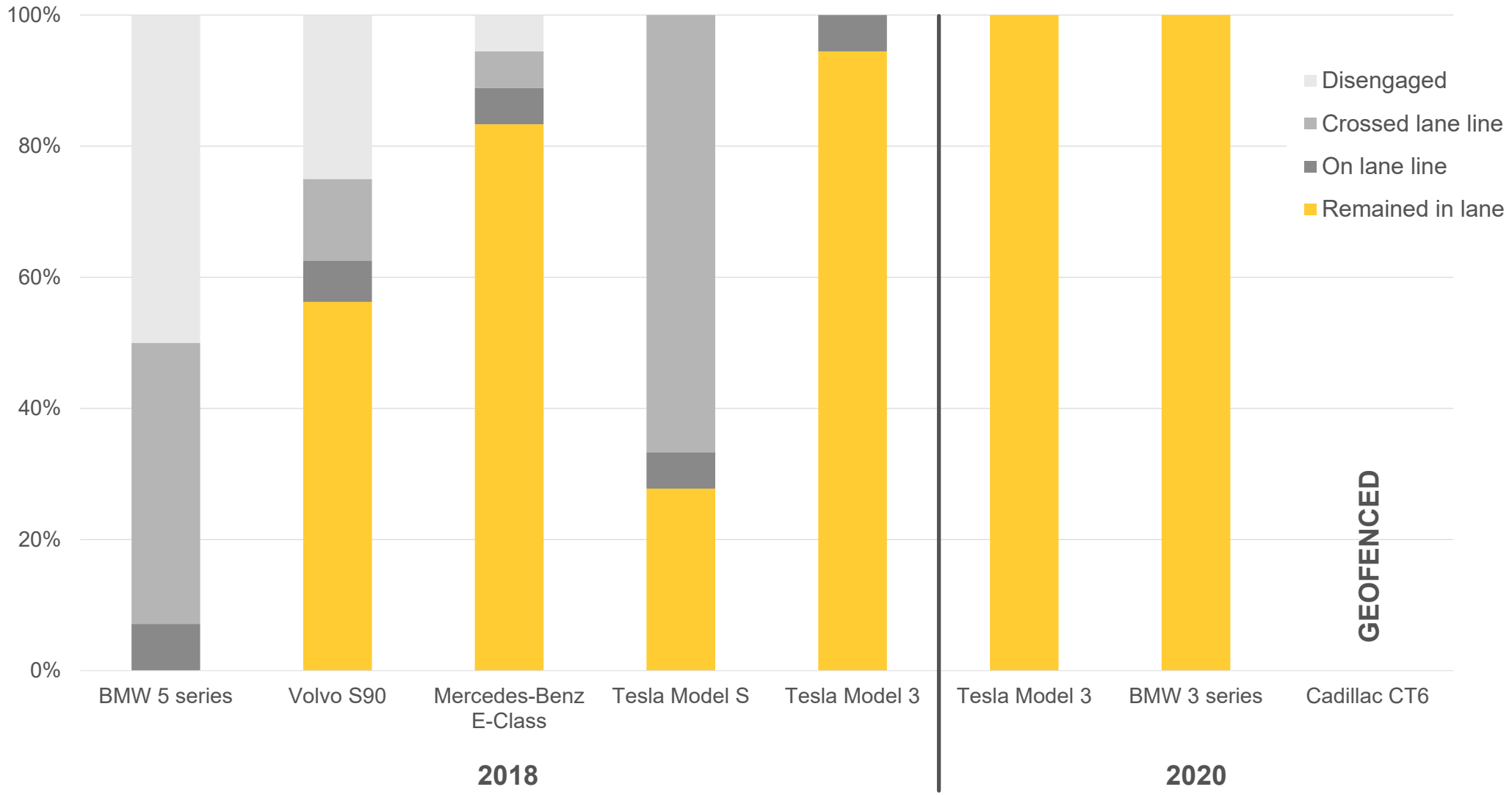
2018 Volvo S90 with Pilot Assist

2018 Tesla Model 3 with Autopilot software ver. 8.1

Lane keeping in curves

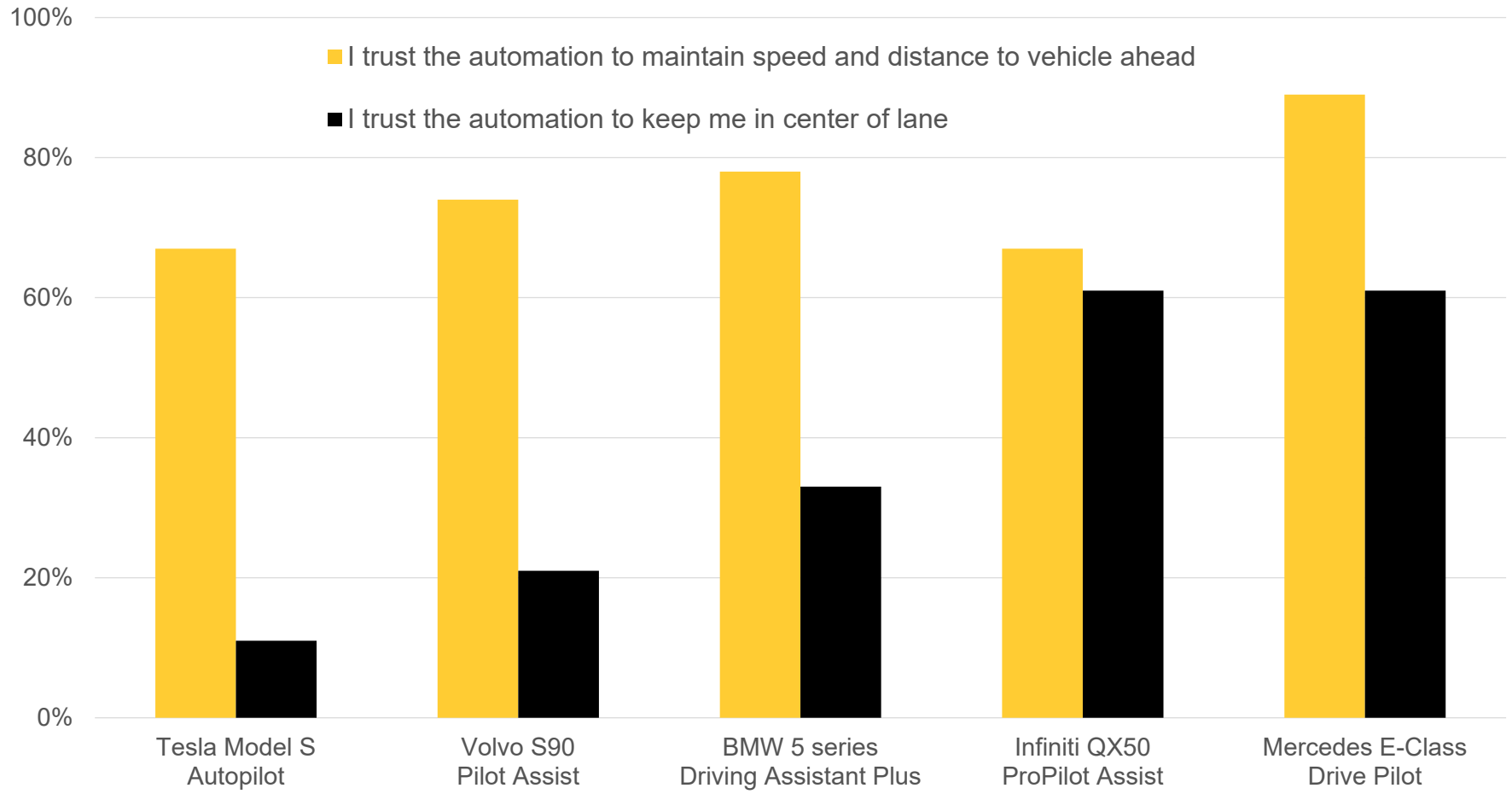


Lane keeping on hills



Adaptive cruise control trusted more than active lane keeping

Drivers who agreed or strongly agreed



Recommended escalating attention reminders

Level 2 automation

1

Visual reminder

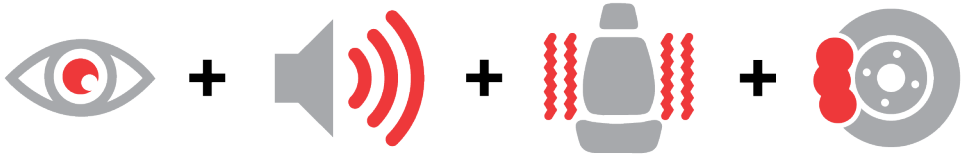
2

More urgent visual reminder + an audible or physical alert

3

Visual + audible + physical alerts

4



Visual + audible + physical alerts + pulse braking

Insurance Institute for Highway Safety
Highway Loss Data Institute

iihs.org

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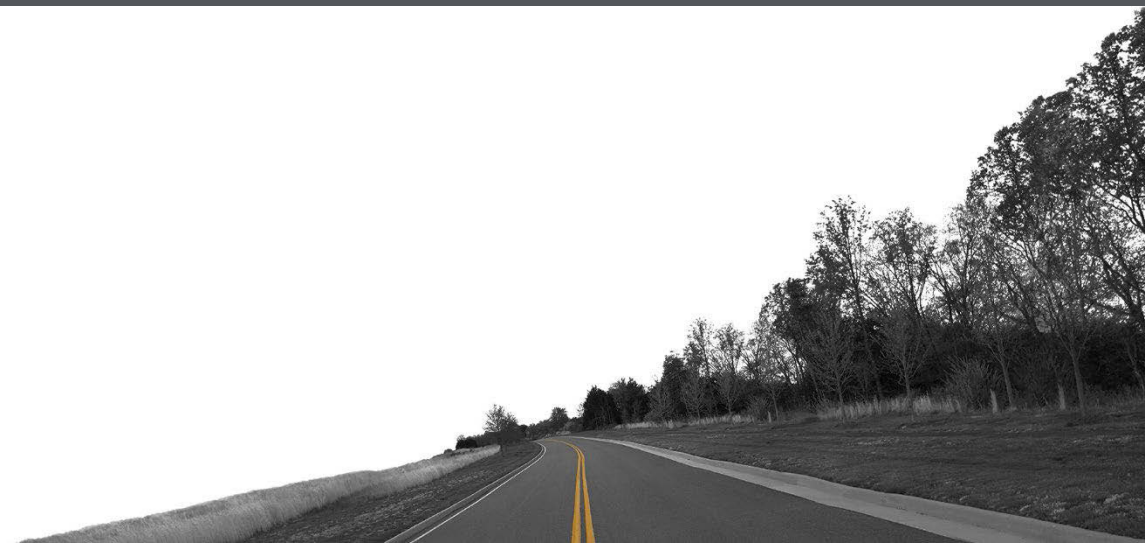
@iihs_autosafety
IIHS
/company/iihs-hldi

THANK YOU

Marshie Agee
Communications Liaison
magee@iihs.org



Safety Evaluation of Rumble Strips

DVRPC – Regional Safety Task Force

October 1, 2021

DEPARTMENT OF TRANSPORTATION

mndot.gov

Evaluations

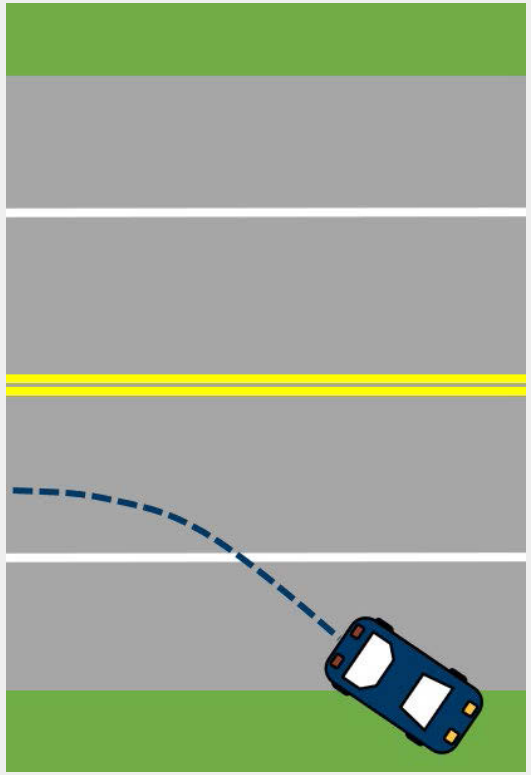
Topic reports

- Reduced Conflict Intersection Safety Evaluation 2021 (PDF)
  - Reduced Conflict Intersection Safety Evaluation 2021 – StoryMap
- Flashing Yellow Arrow Signal Head Safety Evaluation 2020 (PDF)
- Rectangular Rumble Strip Safety Evaluation 2020 (PDF)
- Speed Limit Change (55 mph to 60 mph) Safety Evaluation 2020
- Traffic Safety Impact of COVID-19 - 2020 (PDF)
- A Study of the Rural Intersection Conflict Warning System (RICWS) - 2019 (PDF)
  - An Addendum to "A Study of the Rural Intersection Conflict Warning System (RICWS)" (PDF)
  - RICWS Operations Guidance (March 2020) (PDF)
- Independent Technical Review of RICWS Evaluation (PDF)
- Enhanced Red Light Enforcement (ERLE) System Project Evaluation 2019 (PDF)
- Recommendations for the Implementation of High Tension Cable Barrier in Minnesota (Word)
- A Study of the Traffic Safety at Roundabouts in Minnesota 2017 (PDF)
  - Addendum regarding Pedestrian and Bicycle Safety at Roundabouts 2018 (PDF)
  - Roundabout site detailed reports 2017 (PDF)
  - Traffic capacity analysis of single lane roundabouts during event traffic 2017 (PDF)
- Median Acceleration Lane Usage 2017 (PDF)
- Median Acceleration Traffic Safety Study 2017 (PDF)
- Evaluation of Truck and Agricultural Vehicle Behavior at Reduced Conflict Intersections – Summary 2016 (PDF)
- Evaluation of Truck and Agricultural Vehicle Behavior at Reduced Conflict Intersections 2016 (PDF)
- Sinusoidal Rumble Strip Design Optimization Study 2015 (PDF)
- Rumble strips and rumble stripes
- Lighting Levels for Isolated Intersections 2015 (PDF)
- Fatal Head-On Crashes on Rural Two-Lane Two-Way Highways in Minnesota 2015 (PDF)
- Fatal Run Off the Road Crashes on Rural Two-Lane Two-Way Highways in Minnesota 2015 (PDF)
- A Study of the Traffic Safety at Single Lane Roundabouts in Minnesota 2015 (PDF)
- A Study of the Traffic Safety at Reduced Conflict Intersections in Minnesota 2015 (PDF)
- Measuring Minnesota's Traffic Safety Culture 2015 (PDF)
- MnDOT RICWS Safety 2015 (PDF)
- Cable Median Barrier summary 2014 (PDF)
- Rumble strip noise study 2014 (PDF)
- Evaluation of the Impact of Reduced Conflict Intersections on Truck and Large Agricultural Vehicle Crashes 2014 (PDF)
- Minnesota Evaluation of Six Inch Edgelines 2013 (PDF)
- Minnesota's Best Practices for Pedestrian/Bicycle Safety 2013 (PDF)

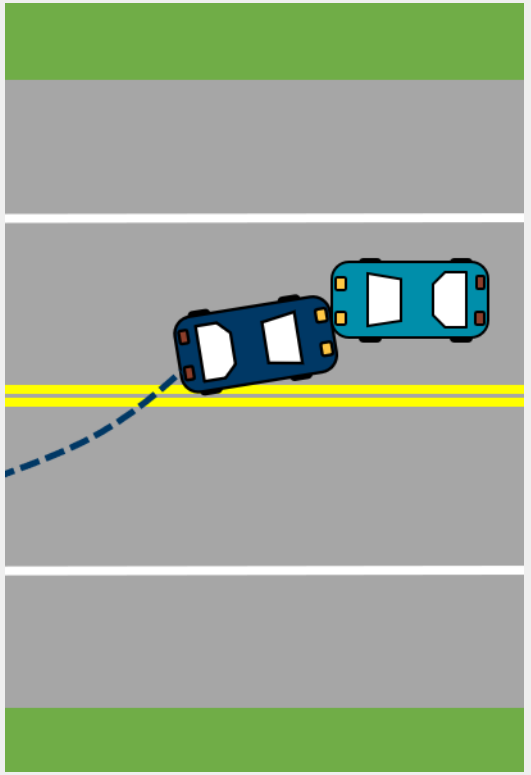
http://www.dot.state.mn.us/trafficeng/safety/reportspubl.html

Why Rumble Strips

2016-2020 in Minnesota



Single Vehicle
Run Off Road Crashes
Fatal/Serious Injury Crashes
2,589 (32% of total)



Head-On Crashes
Fatal/Serious Injury Crashes
1,004 (11% of total)

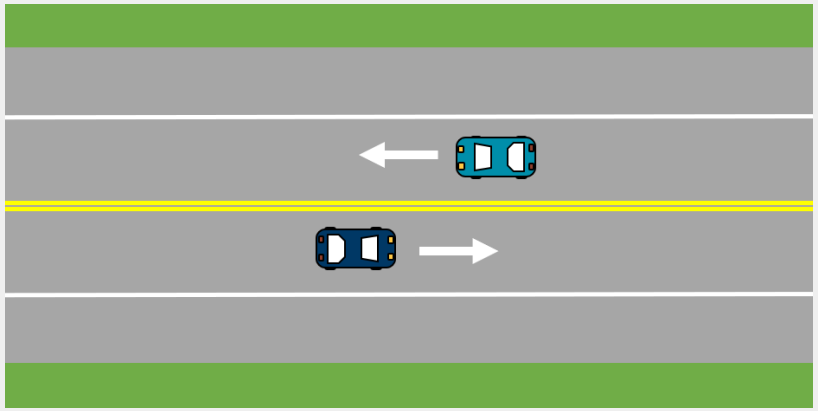
Head-On Fatal Crash Contributing Factors

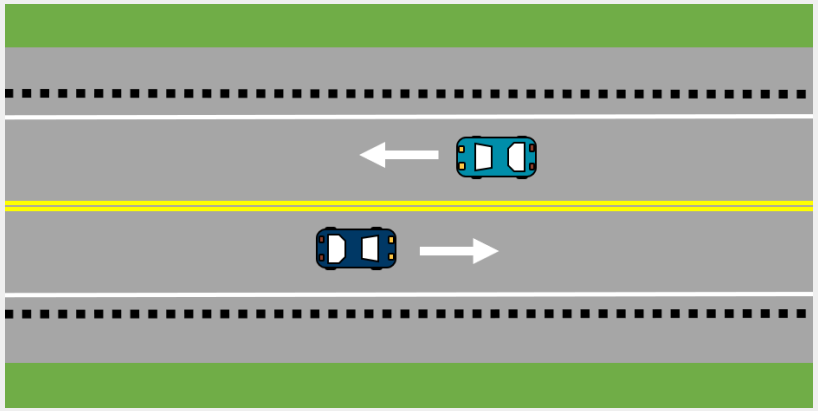
Table 1: Vehicle action prior to a fatal head-on crash (2009-2013)

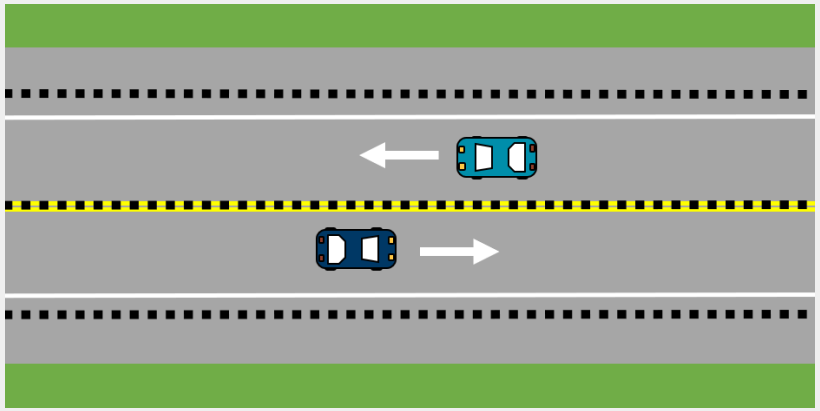
Description	Number of Crashes	Percent of Crashes
Drifting over centerline	162	64.5%
Loss of Control	77	30.7%
Passing	7	2.8%
Incorrect Lane Use	5	2.0%
Total	**251**	**100%**

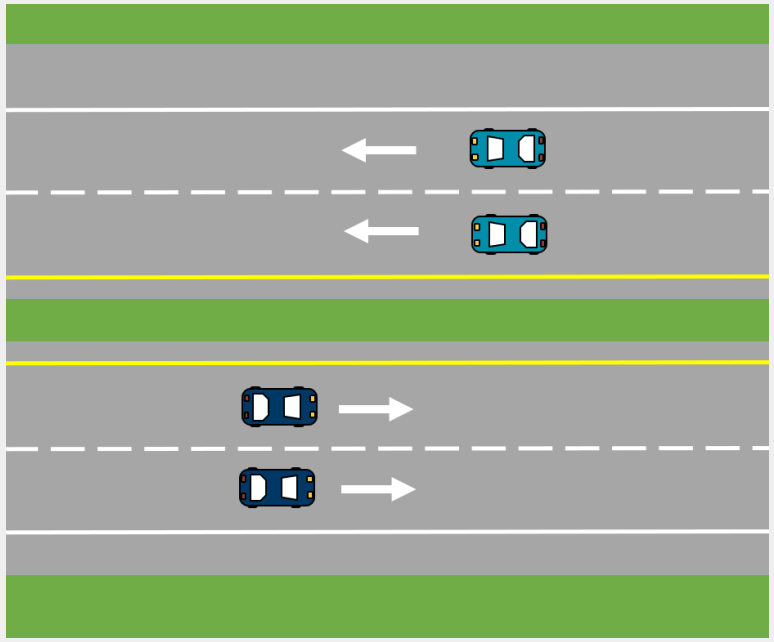
http://www.dot.state.mn.us/trafficeng/safety/reportspubl.html

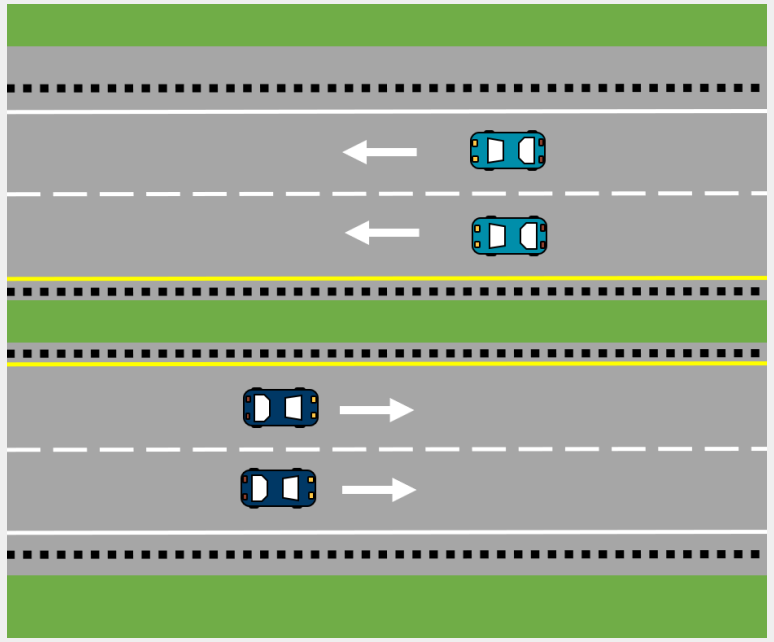
Rumble Strip Types Evaluated



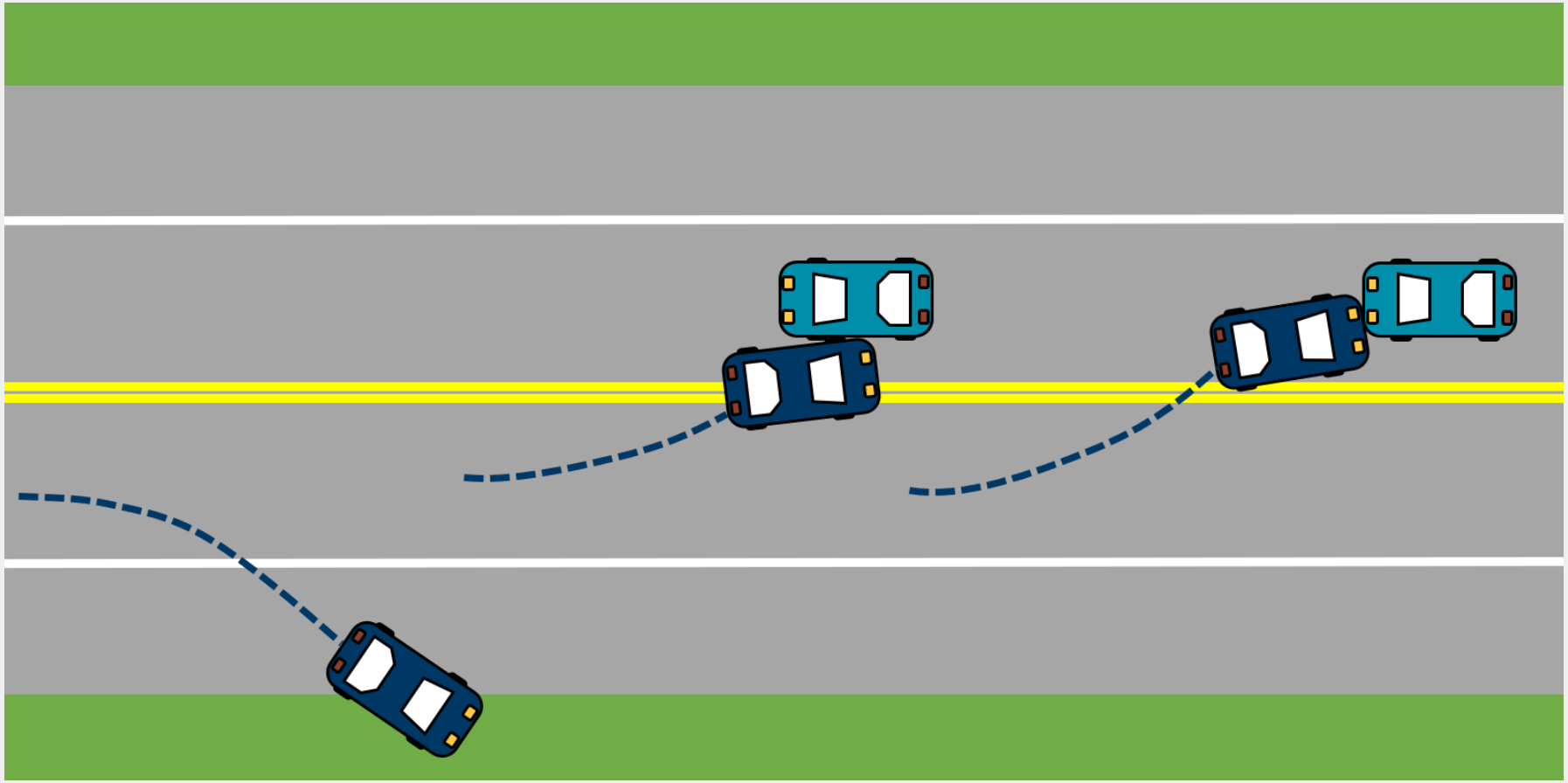








Target Crash Types

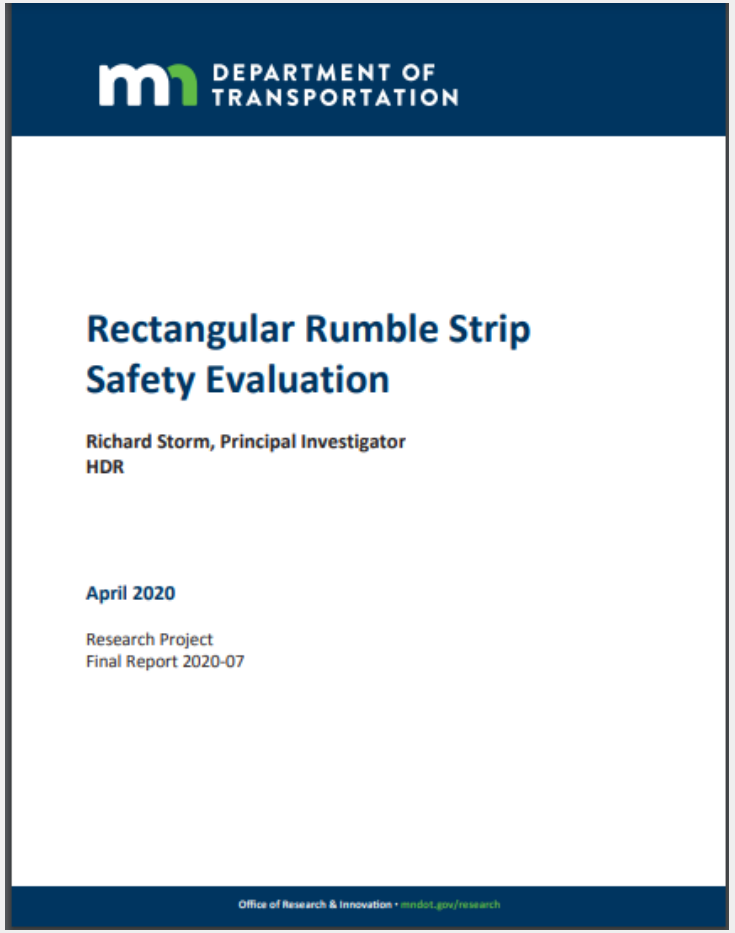


Literature Review

CMF Clearinghouse Review (December 2019)
2 Lane Undivided Rural Roads

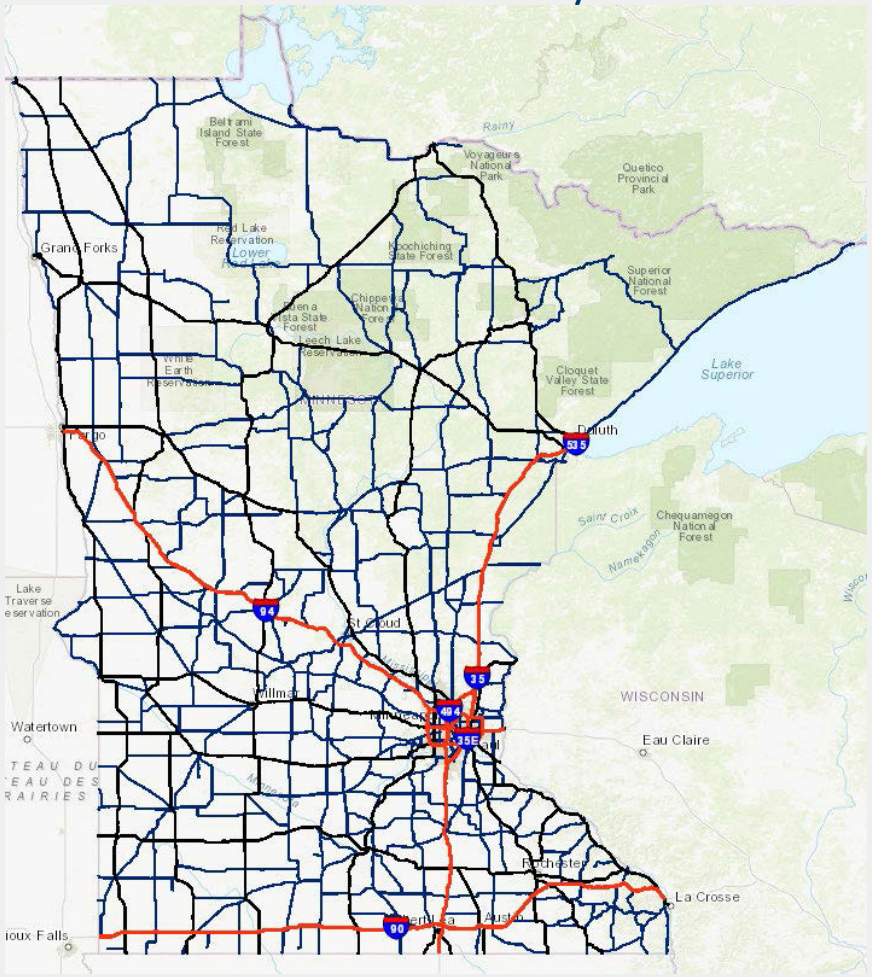
Rumble Type	Average CMF (Total Crashes)	Average CMF (Fatal and All Injury Crashes)
Shoulder	0.84	0.74
Centerline	0.75	0.76
Shoulder + Centerline	0.72	0.79

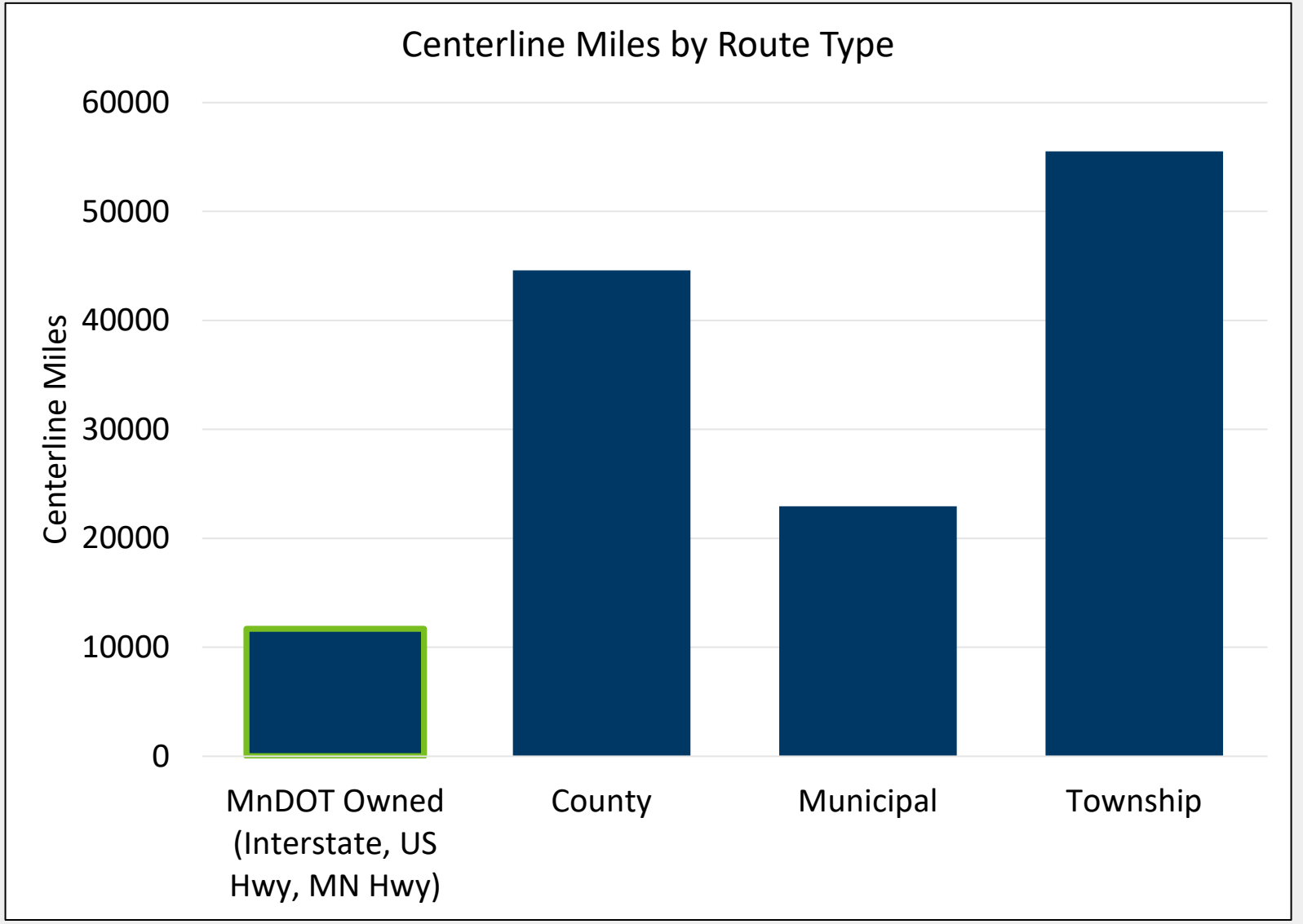
Rectangular vs Sinusoidal



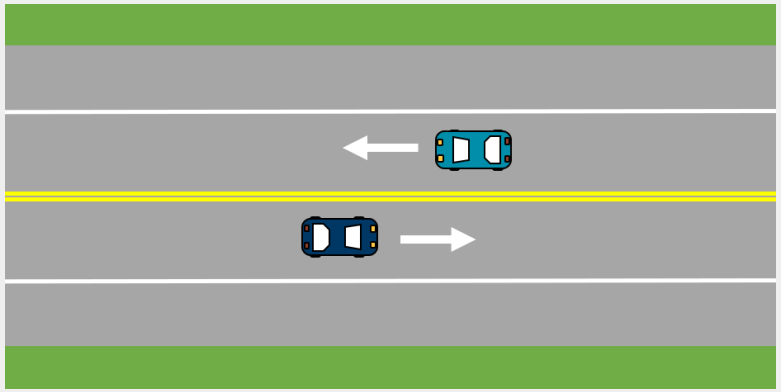
MnDOT Roadways

MnDOT Roadways





Cross-Sectional Analysis



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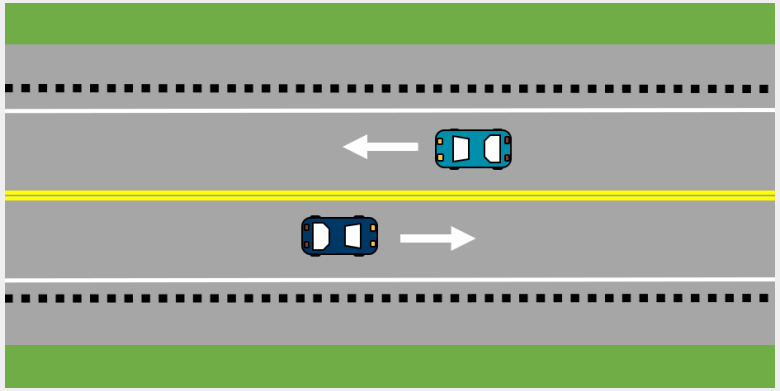
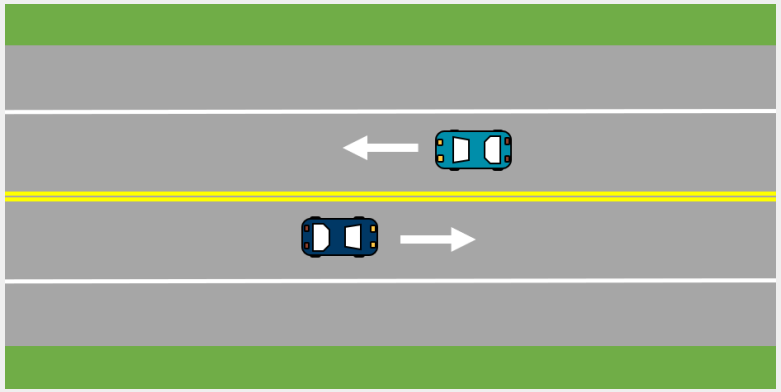
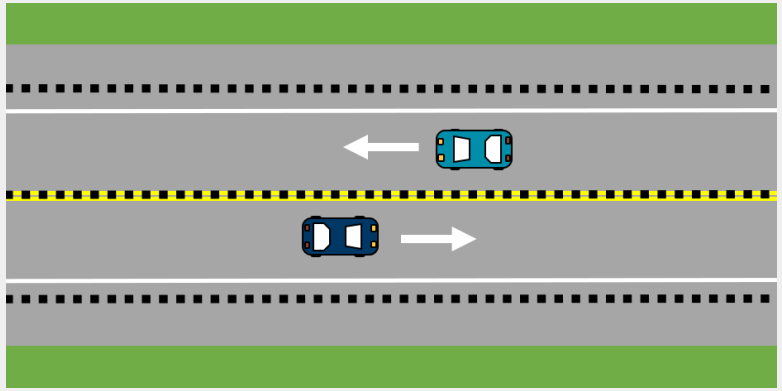
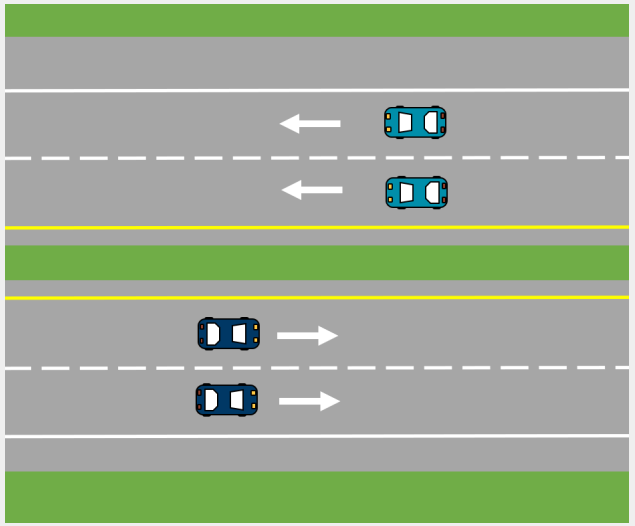




vs





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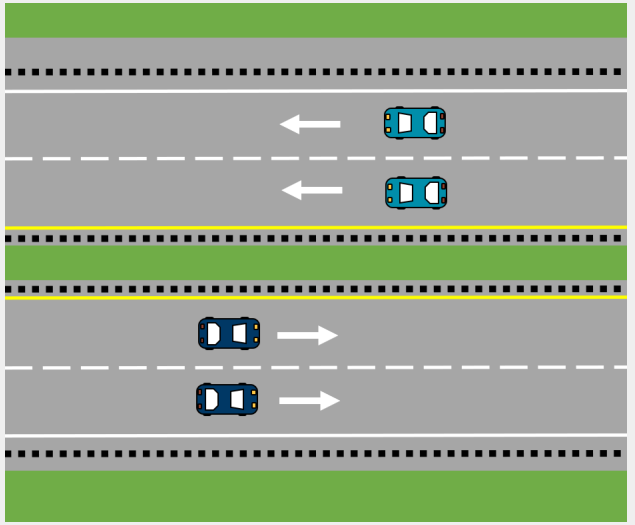
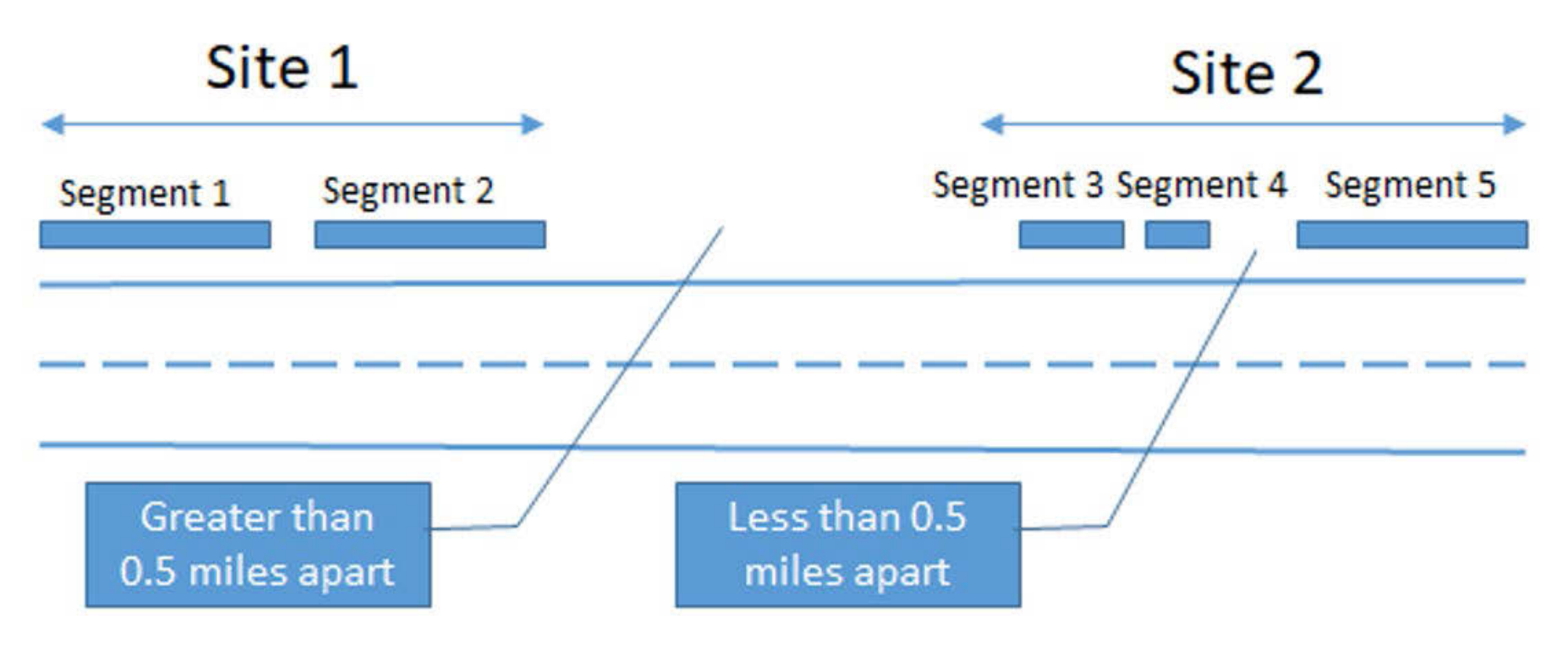


Analysis Details



Rectangular Rumbles Results – Average CMFs

	Total Crashes	Single Vehicle Run Off Road Crashes	Head-On/Sideswipe Opposing Direction Crashes
2 Lane Rural Undivided Centerline + Shoulder Rumbles	0.73	0.68	0.64
2 Lane Rural Undivided Shoulder Rumbles	0.68	0.76	--
4 Lane Rural Divided Shoulder Rumbles	0.66	0.40	--

Sinusoidal Rumbles Results

	Average CMF Total Crashes
2 Lane Rural Undivided Sinusoidal Shoulder Only	--
2 Lane Rural Undivided Sinusoidal Centerline Only	--
2 Lane Rural Undivided Sinusoidal Centerline + Rectangular Shoulder	0.48

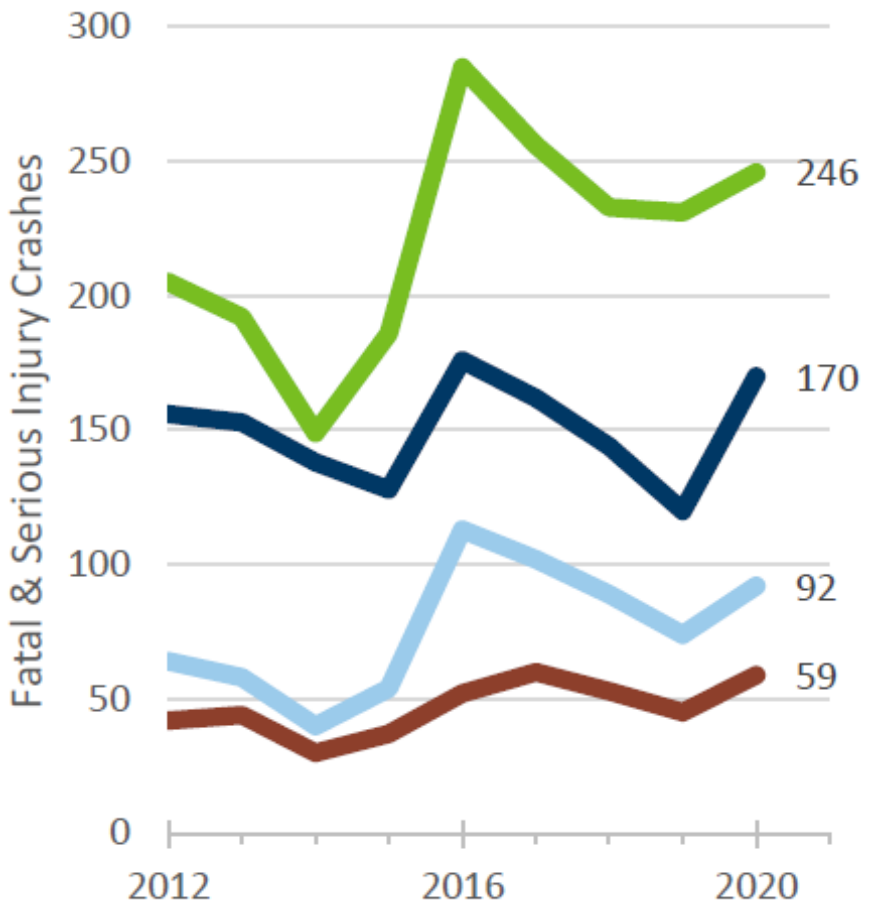
Results Comparison

CMFs for Total Crashes

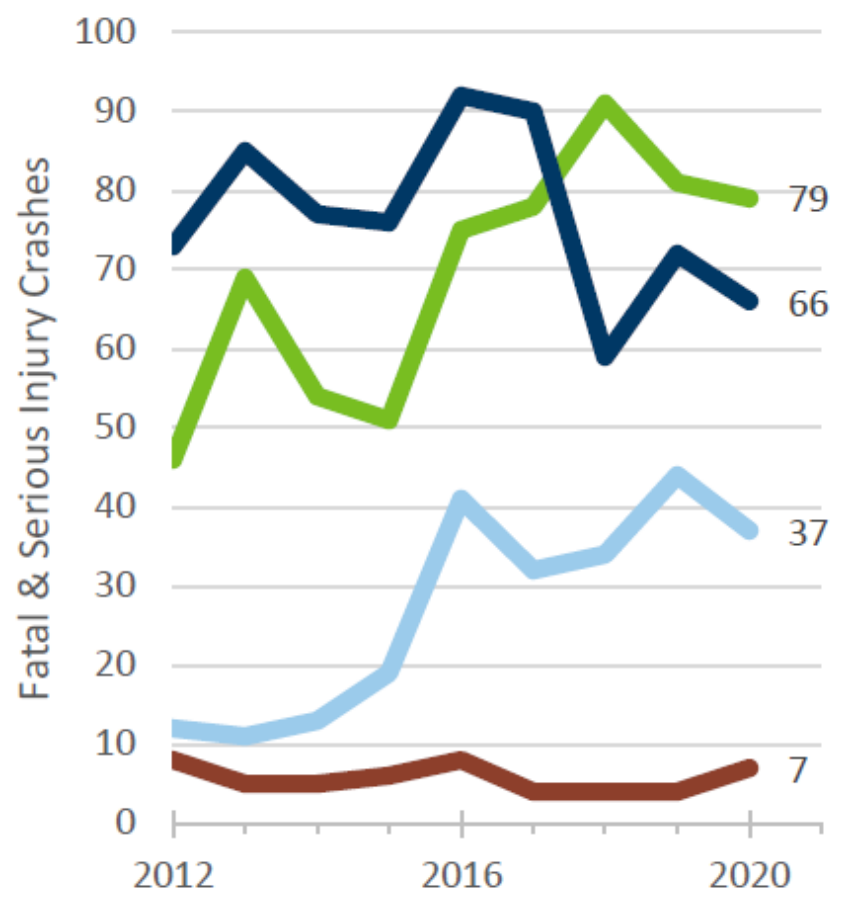
Rumble Type	Nationwide	Minnesota Rectangular	Minnesota Sinusoidal
2 Lane Undivided Shoulder	Average: 0.84 Range: 0.53-1.40	Average: 0.68 Range: 0.58-0.80	n/a
2 Lane Undivided Shoulder + Centerline	Average: 0.72 Range: 0.44-1.02	Average: 0.73 Range: 0.62-0.86	Average: 0.48 Range: 0.30-0.79

Lane Departure Severe Crashes Over Time

Single Vehicle Run Off Road



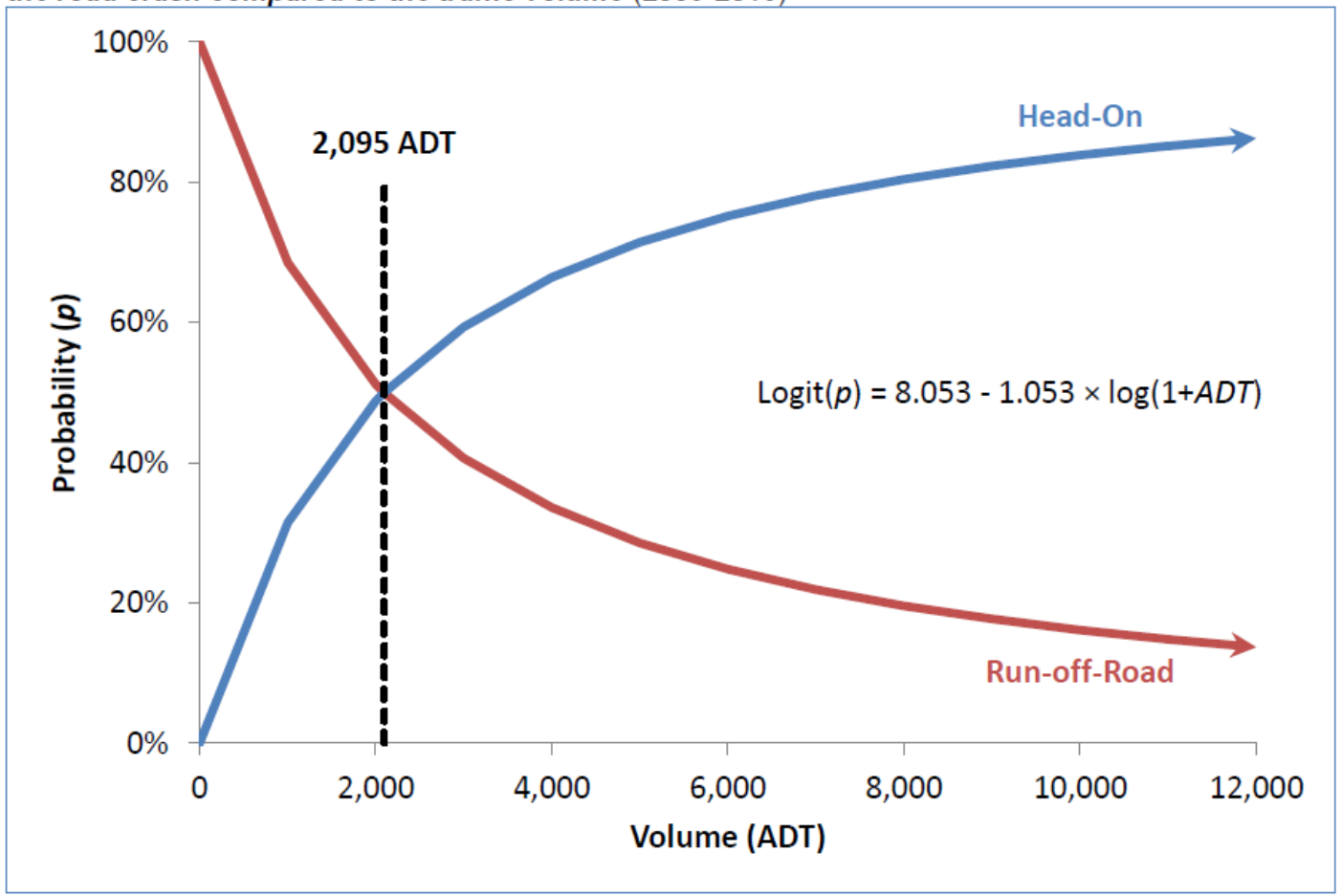
Head On



Trunk Highway | County | City | Township

Centerline Rumble Location Recommendations

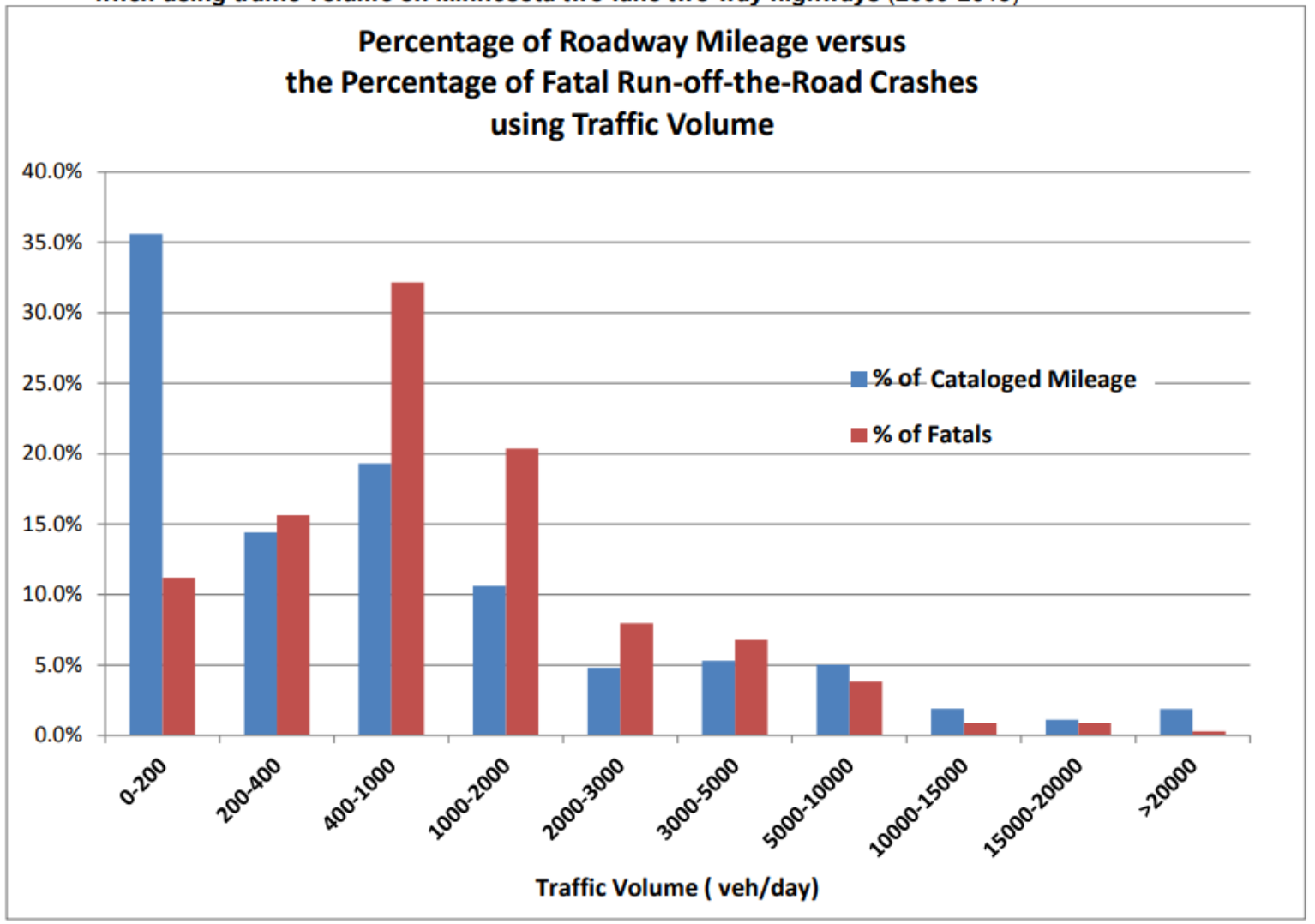
Figure 2: Logistical Regression estimating the probability of a fatal head-on crash or fatal run off the road crash compared to the traffic volume (2009-2013)



http://www.dot.state.mn.us/trafficeng/safety/reportspubl.html

Shoulder Rumble Location Recommendations

Figure 2: Percentage of roadway mileage versus the percentage of fatal run-off-the-road crashes when using traffic volume on Minnesota two-lane two-way highways (2009-2013)



Thank You!

Max Moreland

maxwell.moreland@state.mn.us

REGIONAL SAFETY TASK FORCE

DELAWARE VALLEY dvrpc REGIONAL PLANNING COMMISSION

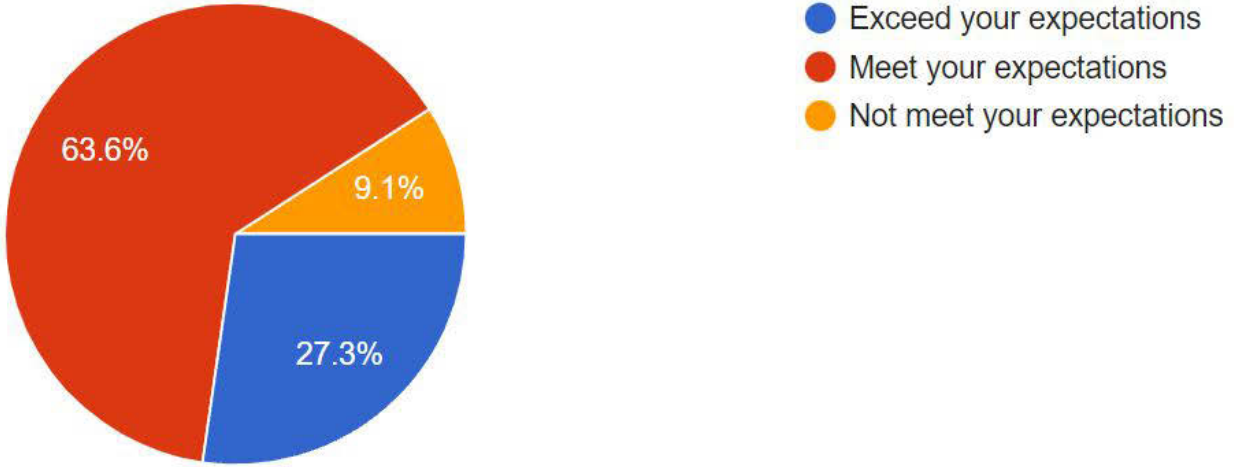
SURVEY HIGHLIGHTS:

RSTF Lane Departure Crashes and the Safe System Approach

October 1, 2021

Did this meeting:

11 responses



What at today's meeting met, exceeded, or didn't meet your expectations?

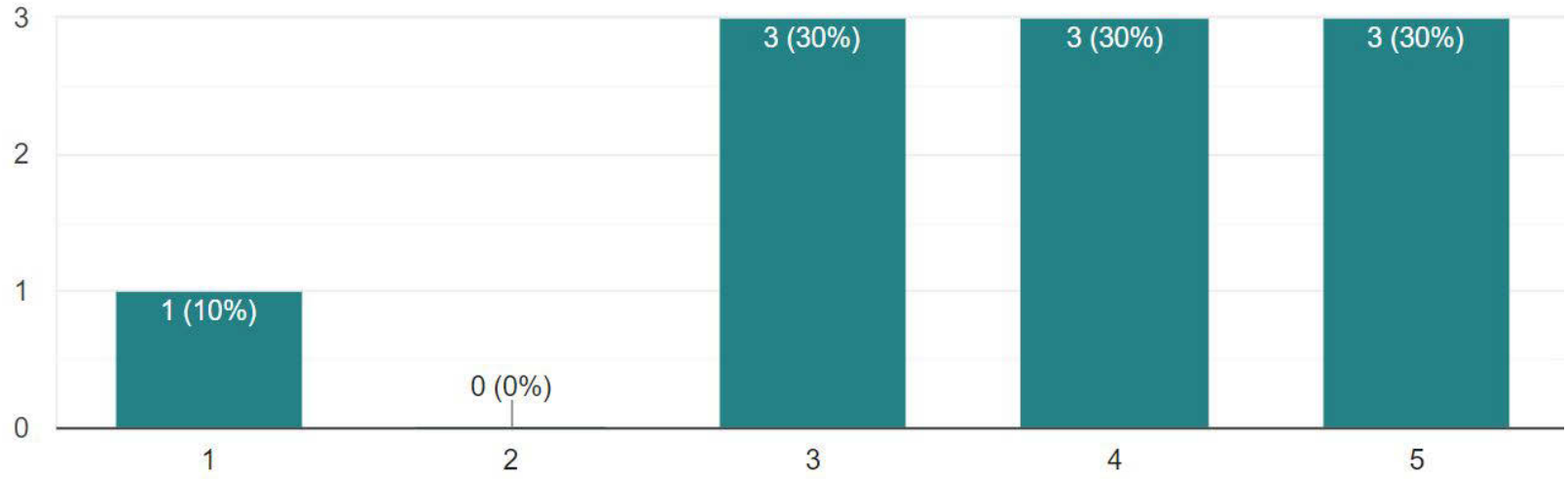
- “Incredible information and amazing work being done.”
- “I learned a great deal about auto and roadway safety measures.”
- “Good information for someone who does not know a lot about the automation specifics.”
- “Enjoyed the discussion most - helped to synthesize the presentations.”
- “I loved the depth and detail from the mndot presenters. Would love to see more of that in the future for other safety treatments.”

- “I liked learning about reducing crashes and fatalities by adding to cars and roads, but what about removing unnecessary traffic from residential roads that were once industrial years ago. I believe DOT has some road updating in a lot of urban areas to help reduce crashes and fatalities.”

- none!

How relevant and helpful do you think it was for your job?

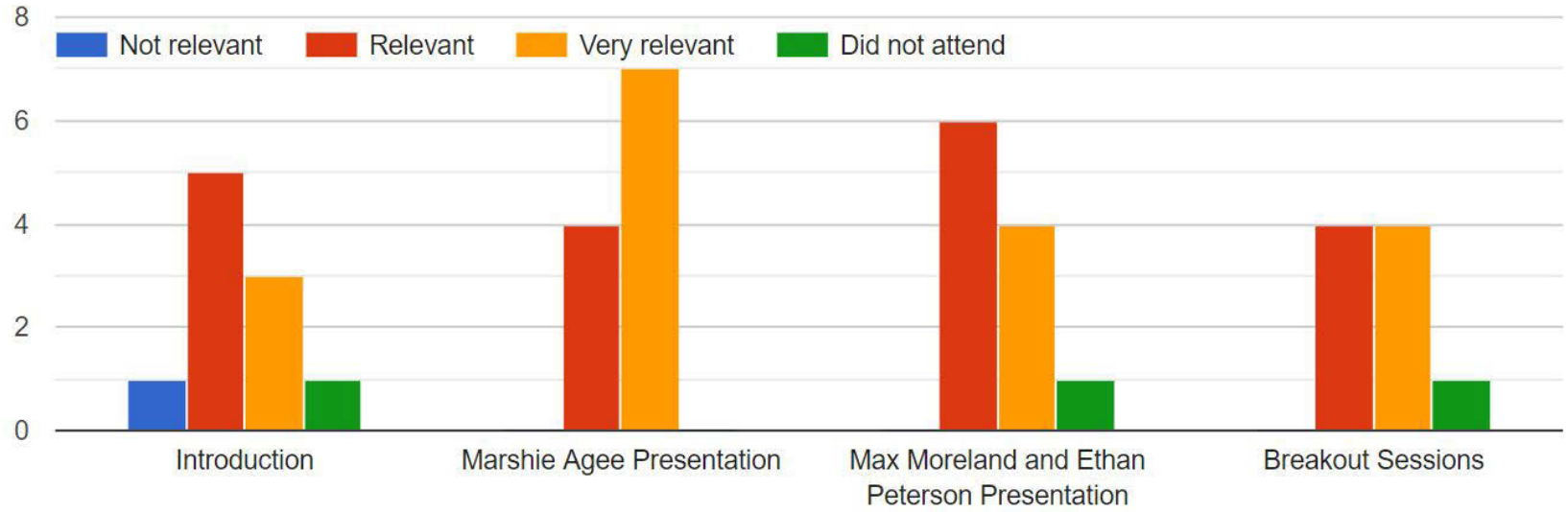
10 responses



Not very

Very much

Which sessions did you find most relevant?



Please provide any additional comments or suggestions that will make RSTF meetings more useful in the future.

RSTF-Specific Comments:

"Contact List?"

"Please continue to send the meeting agenda, including presenters in advance."

"Looking at truck traffic that should not be on small urban roads in order to decrease crashes."

The RSTF is adopting a Safe System approach to action item development. How did this influence your group's discussion? Is there more that DVRPC can do to help?

"Discussion was more about the presentations than the Safe System approach."

"We shared something that we each bring to the solution. I have already collaborated with Marshie on a safety education project. She was great!"

"It would have been great to have someone from PennDOT of NJDOT talk about how their applying this work locally."