



IT'S ALL ABOUT SAFETY.

REDUCE RISK - MINIMIZE LIABILITY - IMPROVE THE SAFETY OF YOUR FLEET

July 18-20, 2016

Renaissance Schaumburg Convention Center Hotel, Schaumburg, IL



Award in conjunction with





Insurance Institute for Highway Safety
Highway Loss Data Institute

New Safety Technology: Does it Work?

Kay Wakeman
Research Analyst

Schaumburg, IL
July 19, 2016

iihs.org

IIHS is an independent, nonprofit scientific and educational organization dedicated to reducing the losses — deaths, injuries and property damage — from crashes on the nation's roads.

HLDI shares this mission by analyzing insurance data representing human and economic losses from crashes and other events related to vehicle ownership.

Both organizations are wholly supported by auto insurers.

Member groups

Acceptance Insurance
ACE Private Risk Services
Affirmative Insurance
Alfa Alliance Insurance Corporation
Alfa Insurance
Allstate Insurance Group
American Family Mutual Insurance
American National
Ameriprise Auto & Home
Amica Mutual Insurance Company
Auto Club Enterprises
Auto Club Group
Auto-Owners Insurance
Aviva Insurance
Bankers Insurance Group
Bituminous Insurance Companies
California Casualty Group
Capital Insurance Group
Chubb & Son
Colorado Farm Bureau Mutual Insurance Company
Concord Group Insurance Companies
COUNTRY Financial
CSAA Insurance Group
CSE Insurance Group
Direct General Corporation
Erie Insurance Group
Esurance
Farm Bureau Financial Services
Farm Bureau Insurance of Michigan
Farm Bureau Mutual Insurance Company of Idaho
Farmers Insurance Group of Companies
Farmers Mutual Hail Insurance Company of Iowa
Farmers Mutual of Nebraska
Florida Farm Bureau Insurance Companies
Frankenmuth Insurance
Gainsco Insurance
GEICO Group

The General Insurance
Georgia Farm Bureau Mutual Insurance Company
Goodville Mutual Casualty Company
Grange Insurance
Hallmark Insurance Company
Hanover Insurance Group
The Hartford
Haulers Insurance Company, Inc.
Horace Mann Insurance Companies
ICW Group
Imperial Fire & Casualty Insurance Company
Indiana Farmers Mutual Insurance Company
Infinity Property & Casualty
Kemper Preferred
Kentucky Farm Bureau Insurance
Liberty Mutual Insurance Company
Louisiana Farm Bureau Mutual Insurance Company
The Main Street America Group
Mercury Insurance Group
MetLife Auto & Home
Michigan Millers Mutual Insurance Company
MiddleOak
Mississippi Farm Bureau Casualty Insurance Company
MMG Insurance
Munich Re America
Mutual of Enumclaw Insurance Company
Nationwide
New Jersey Manufacturers Insurance Group
Nodak Mutual Insurance Company
Norfolk & Dedham Group
North Carolina Farm Bureau Mutual Insurance Company
Northern Neck Insurance Company
Ohio Mutual Insurance Group
Old American County Mutual Fire Insurance
Old American Indemnity Company
Oregon Mutual Insurance
Pekin Insurance

PEMCO Insurance
Plymouth Rock Assurance
Progressive Corporation
The Responsive Auto Insurance Company
Rockingham Group
Safe Auto Insurance
Safeco Insurance
Samsung Fire & Marine Insurance Company
SECURA Insurance
Sentry Insurance
Shelter Insurance
Sompo Japan Insurance Company of America
South Carolina Farm Bureau Mutual Insurance Company
Southern Farm Bureau Casualty Insurance Company
State Auto Insurance Companies
State Farm
Tennessee Farmers Mutual Insurance Company
Texas Farm Bureau Insurance Companies
Tower Group Companies
The Travelers Companies
United Educators
USAA
Utica National Insurance Group
Virginia Farm Bureau Mutual Insurance
West Bend Mutual Insurance Company
Western National Insurance
Westfield Insurance
XL Group plc

Funding associations

American Insurance Association
National Association of Mutual Insurance Companies
Property Casualty Insurers Association of America

Crash Testing 101

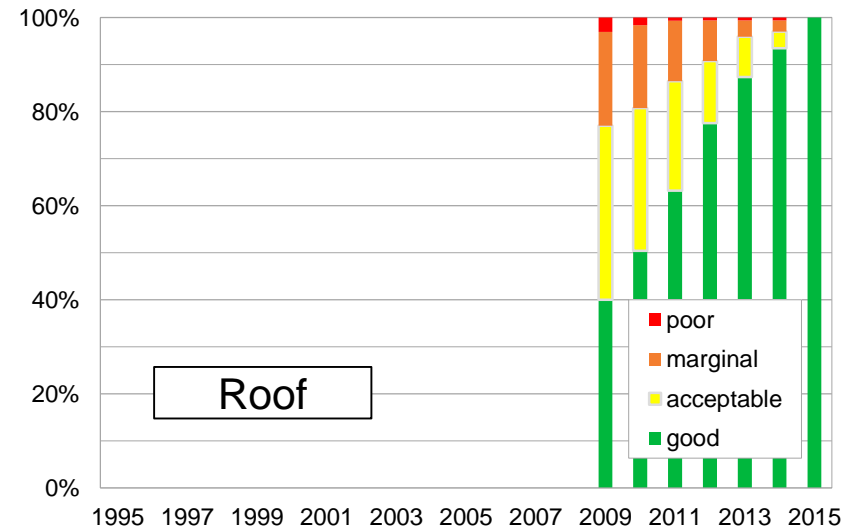
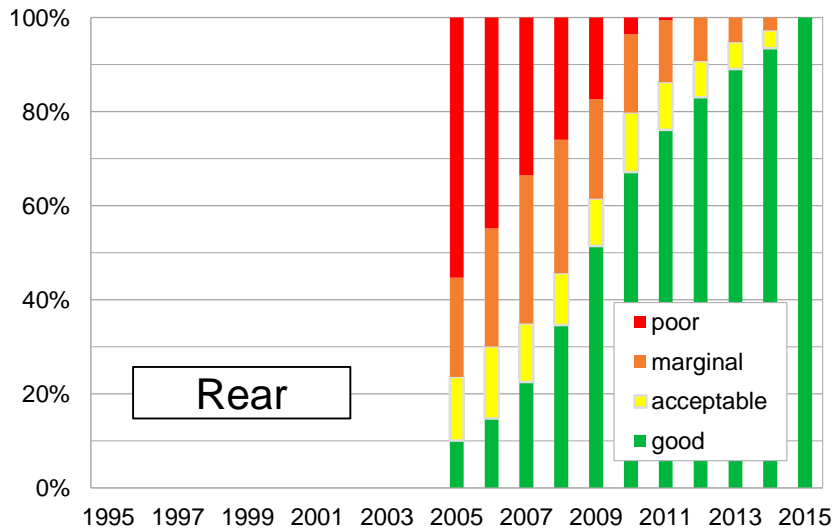
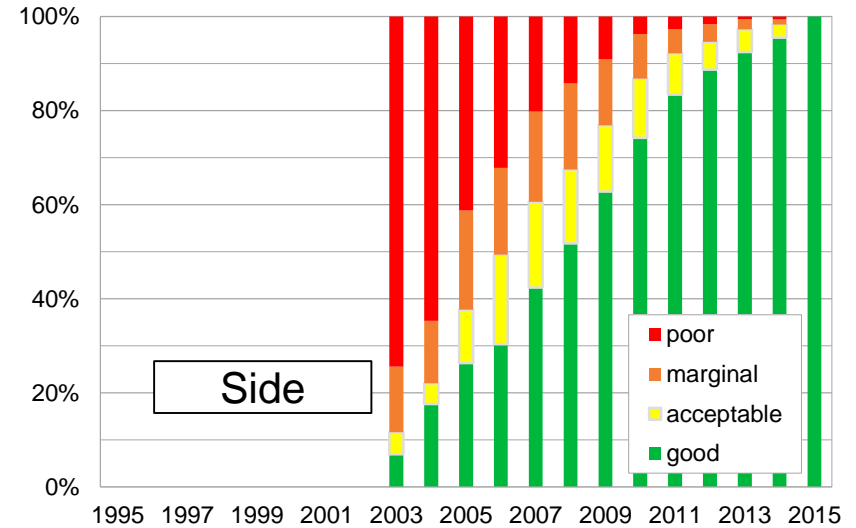
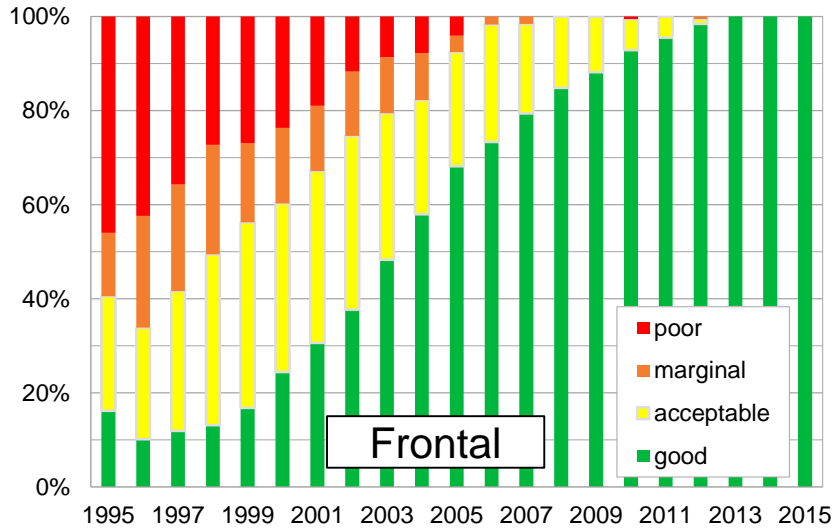
IIHS crashworthiness tests



- Front moderate overlap, beginning 1995
- Side impact, beginning 2003
- Rear crash (whiplash mitigation), beginning 2004
- Roof strength, beginning 2009

Crash protection ratings by model year

Improvements: Beginning in 1995



50th Anniversary

40 mph frontal offset crash test

1959 Chevrolet Bel Air and 2009 Chevrolet Malibu

The logo for the Insurance Institute for Highway Safety (IIHS) is centered on a black rectangular background. The text "INSURANCE INSTITUTE" is written in a white, serif, all-caps font. Below it, the text "FOR HIGHWAY SAFETY" is written in a white, serif, all-caps font, with a blue horizontal bar behind the words "FOR HIGHWAY SAFETY".

INSURANCE INSTITUTE
FOR HIGHWAY SAFETY

1959 Chevrolet Bel Air and 2009 Chevrolet Malibu



Small overlap frontal - 2012

Definition of small overlap

Majority of loading outside longitudinal structures



frame rail
largely
undamaged

Overhead video small overlap test



Small overlap frontal ratings

	Overall	Structure	Restraints & Kinematics	Injury			
				Head & neck	Chest	Femur & pelvis	Foot & tibia
Acura TL	G	A	G	G	G	G	G
Volvo S60	G	G	A	G	G	G	G
Infiniti G	A	M	G	G	G	G	G
Acura TSX	M	M	M	G	G	G	P
BMW 3 series	M	M	M	G	G	G	P
Lincoln MKZ	M	P	M	G	G	G	A
Volkswagen CC	M	M	P	G	G	A	G
Mercedes C class	P	P	M	G	G	G	P
Lexus IS 250/350	P	P	P	G	G	G	P
Audi A4	P	P	P	G	G	P	G
Lexus ES 350	P	P	P	G	G	M	P

good **G** acceptable **A** marginal **M** poor **P**



SWEDEN 1 GERMANY 0



The 2012 Volvo S60- the highest rated vehicle in the Insurance Institute for Highway Safety's new small overlap frontal crash test. The German guys? Well, let's just say that they didn't even come close.

5 YEAR WARRANTY - 5 YEAR SCHEDULED MAINTENANCE
5 YEAR WEAR & TEAR - 5 YEAR ROADSIDE ASSISTANCE

**SAFE + SECURE
COVERAGE PLAN**

Highway Loss Data Institute

HLDI data providers have 84% share of PPA

- 21st Century Insurance
- Alfa Alliance Insurance Corporation
- Allstate Insurance Group
- American Family Mutual Insurance
- American National Family of Companies
- Amica Mutual Insurance Company
- Auto Club Group
- Automobile Insurers Bureau of Massachusetts
- Chubb & Son
- COUNTRY Financial
- CSAA Insurance Group
- Erie Insurance Group
- Esurance
- Farm Bureau Financial Services
- Farmers Insurance Group of Companies
- Florida Farm Bureau Insurance Companies
- Foremost
- GEICO Corporation
- The Hartford
- Kemper Preferred
- Kentucky Farm Bureau Insurance
- Liberty Mutual Insurance Company
- MetLife Auto and Home
- National General
- Nationwide
- New Jersey Manufacturers Insurance Group
- PEMCO Insurance
- Plymouth Rock Assurance
- Progressive Corporation
- Rockingham Group
- Safeco Insurance Companies
- SECURA Insurance
- Sentry Insurance
- State Farm Insurance Companies
- Tennessee Farmers Mutual Insurance Company
- The Travelers Companies
- USAA

Other data suppliers



Size of HLDI passenger vehicle database

Number of unique VINs in files, July 2016

model year	number of vehicles
2007	15,319,965
2008	13,613,895
2009	8,940,858
2010	10,362,909
2011	11,099,593
2012	12,204,669
2013	13,212,881
2014	12,798,816
2015	12,675,143
2016	6,374,598
total	116,603,327

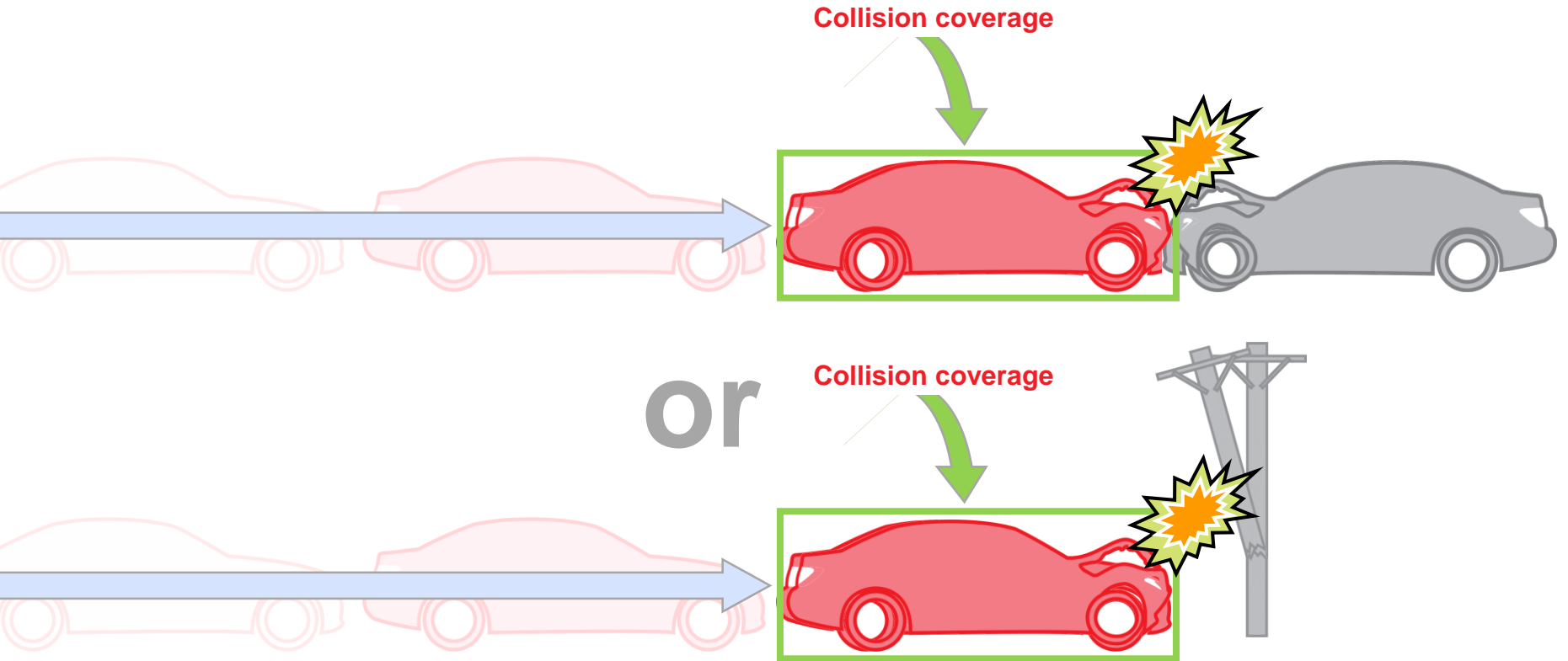
Coverages reported to HLDI

Private Passenger Auto

- Collision
- Comprehensive
- Personal injury protection (PIP)
- Medical payments (MedPay)
- Physical damage liability (PDL)
- Bodily injury liability (BI)

Collision coverage

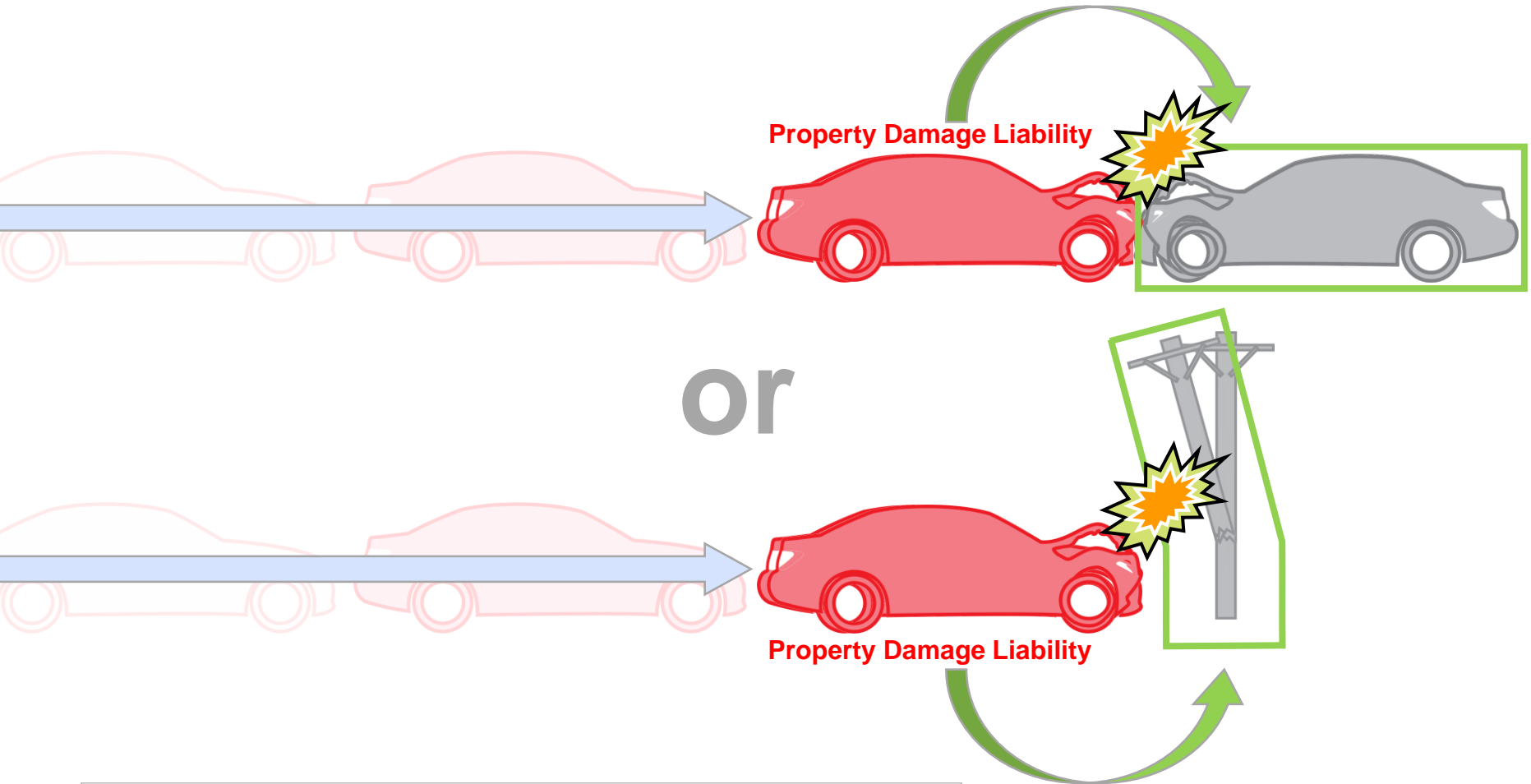
Covers damage to your vehicle if you are at fault



■ at fault ■ not at fault/other property ■ damage covered

Property damage liability coverage

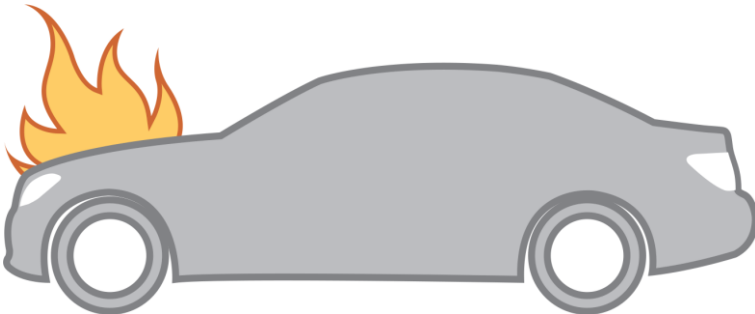
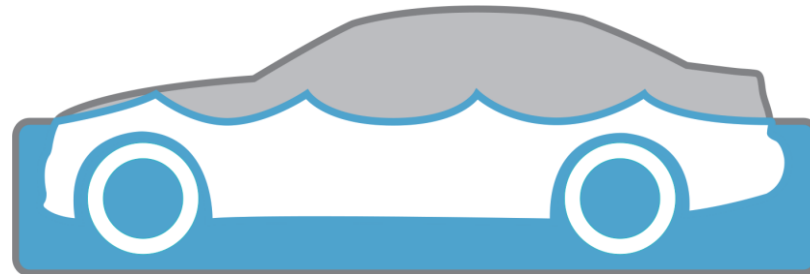
Covers damage you cause to other people's vehicles and property



■ at fault ■ not at fault/other property ■ damage covered

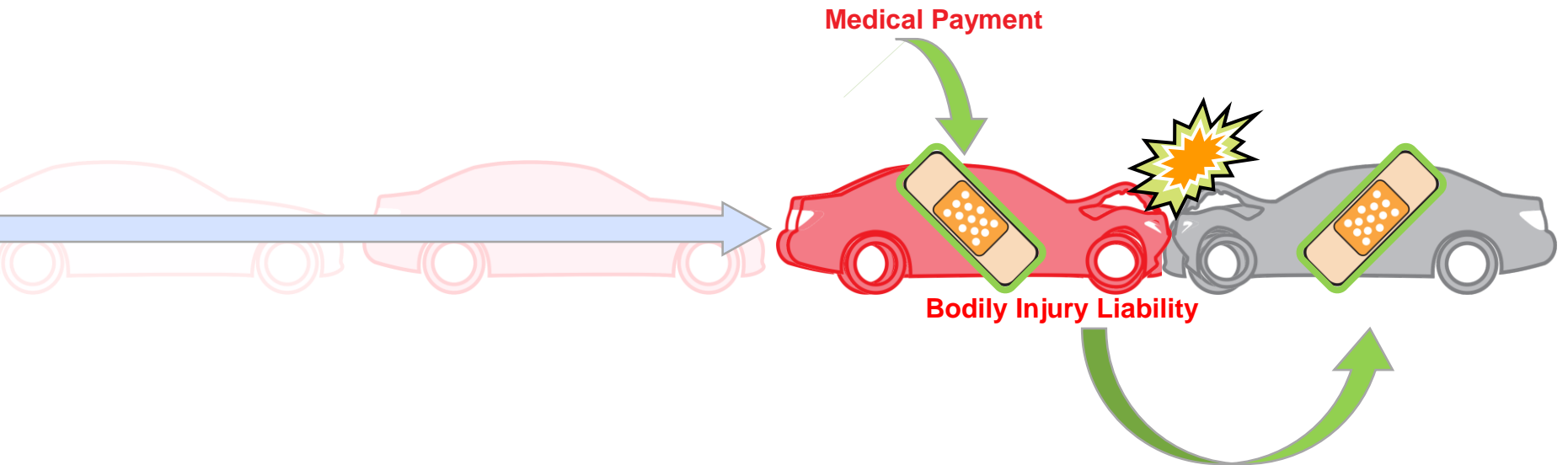
Comprehensive coverage

Covers theft and damage from reasons other than crashes



Medical payment coverage

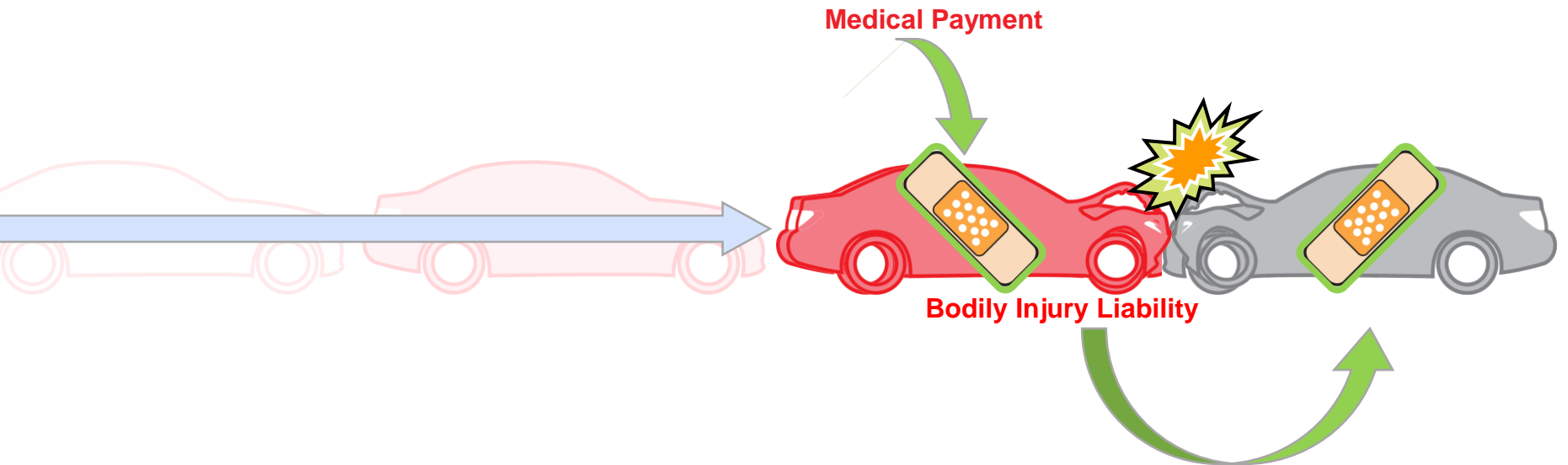
Covers injuries to you and your passengers if you are at fault in states with traditional tort systems



■ at-fault driver/passengers ■ not at-fault driver/passengers □ injuries covered

Bodily injury liability coverage

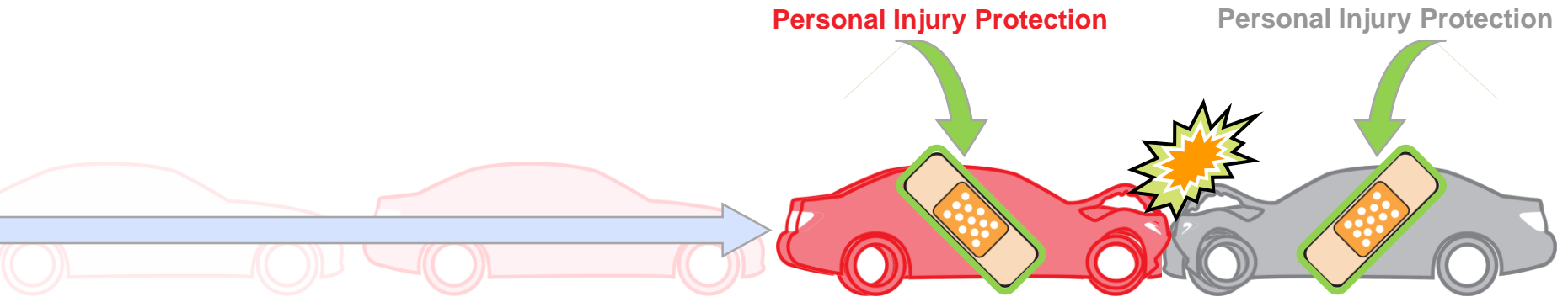
Covers injuries you cause to people in other vehicles in states with traditional tort systems



■ at-fault driver/passengers ■ not at-fault driver/passengers □ injuries covered

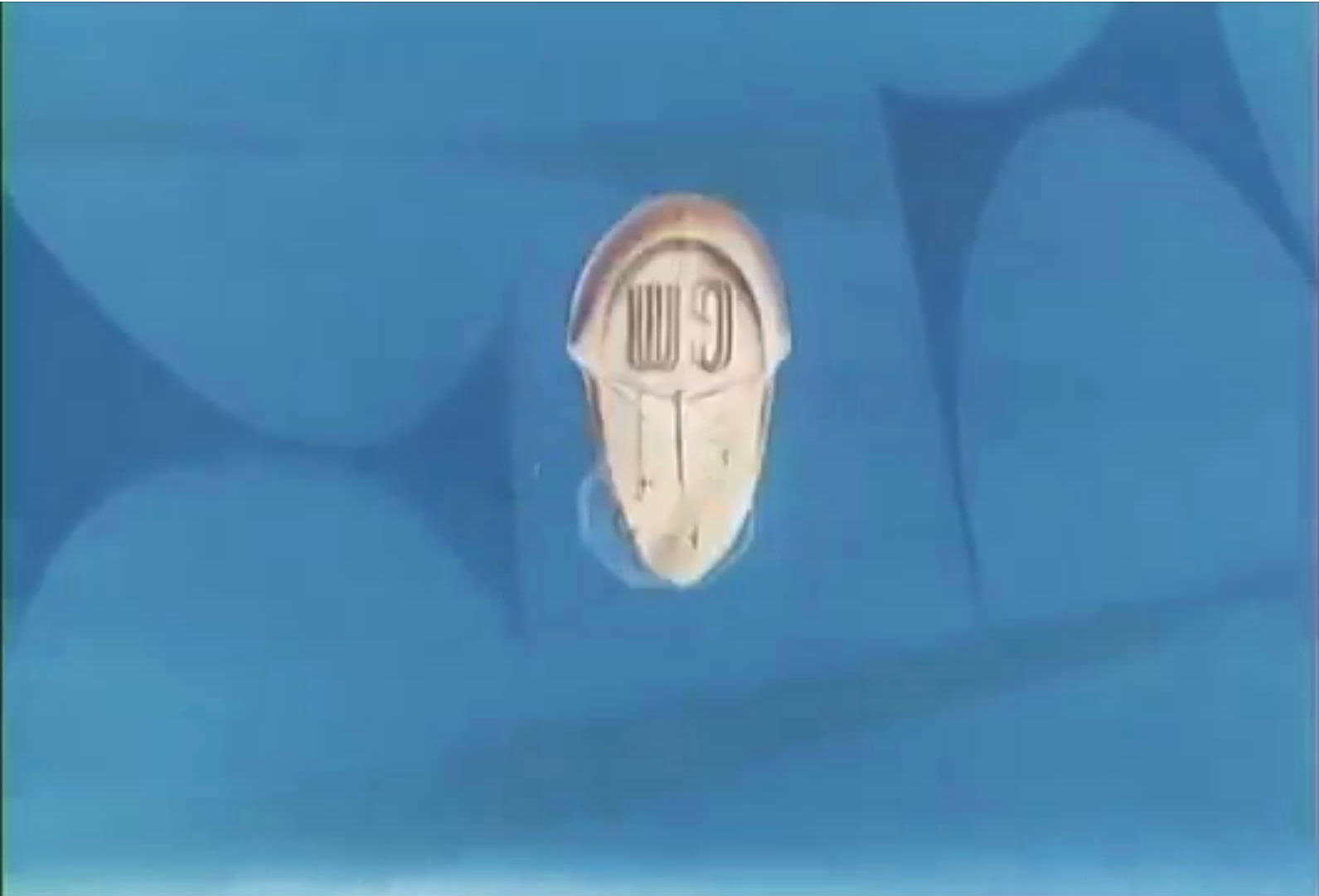
Personal injury protection coverage

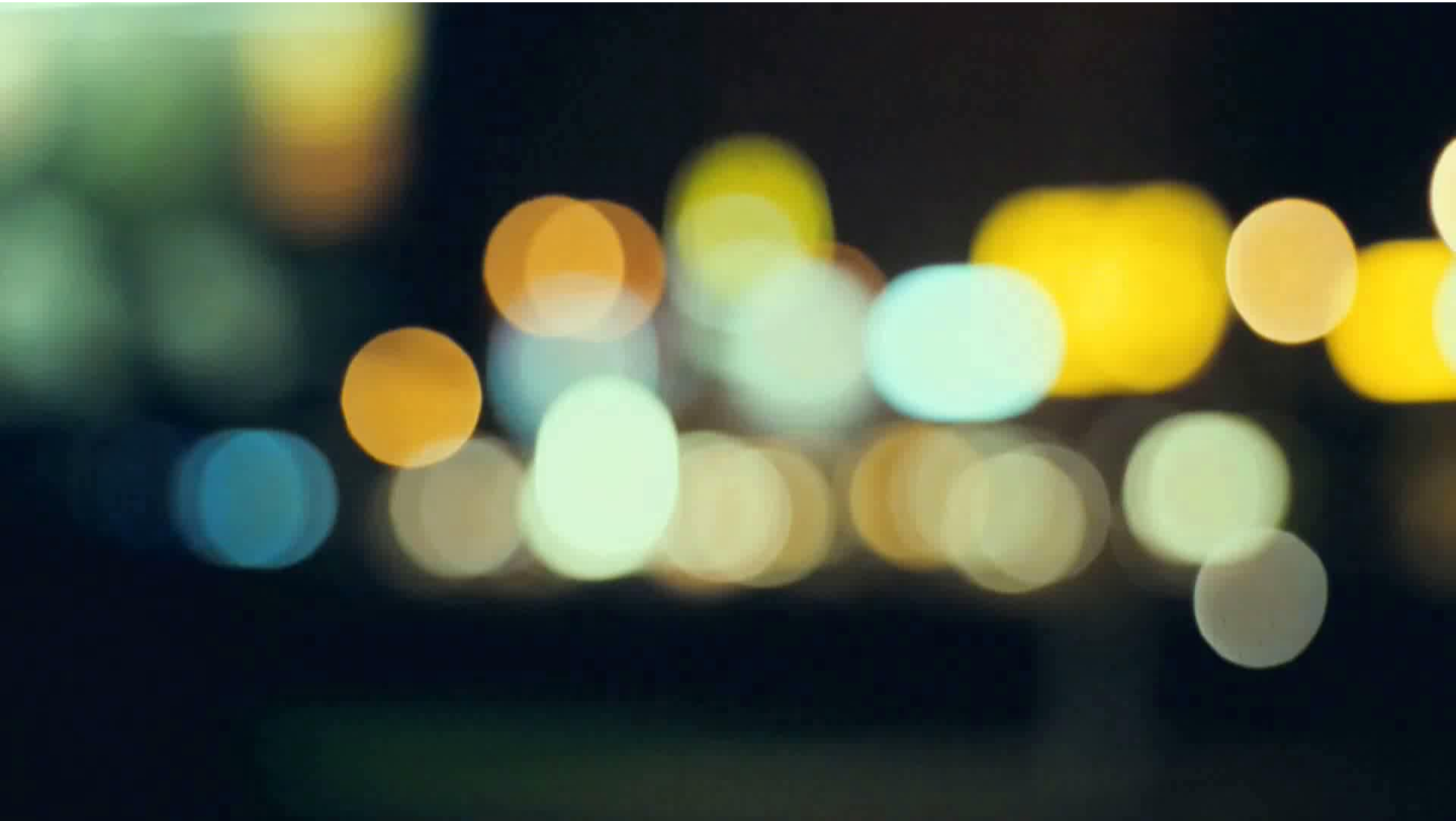
Covers injuries up to a specified amount, regardless of who is at fault, in states with no-fault systems



■ at-fault driver/passengers ■ not at-fault driver/passengers ■ injuries covered

Crash avoidance systems

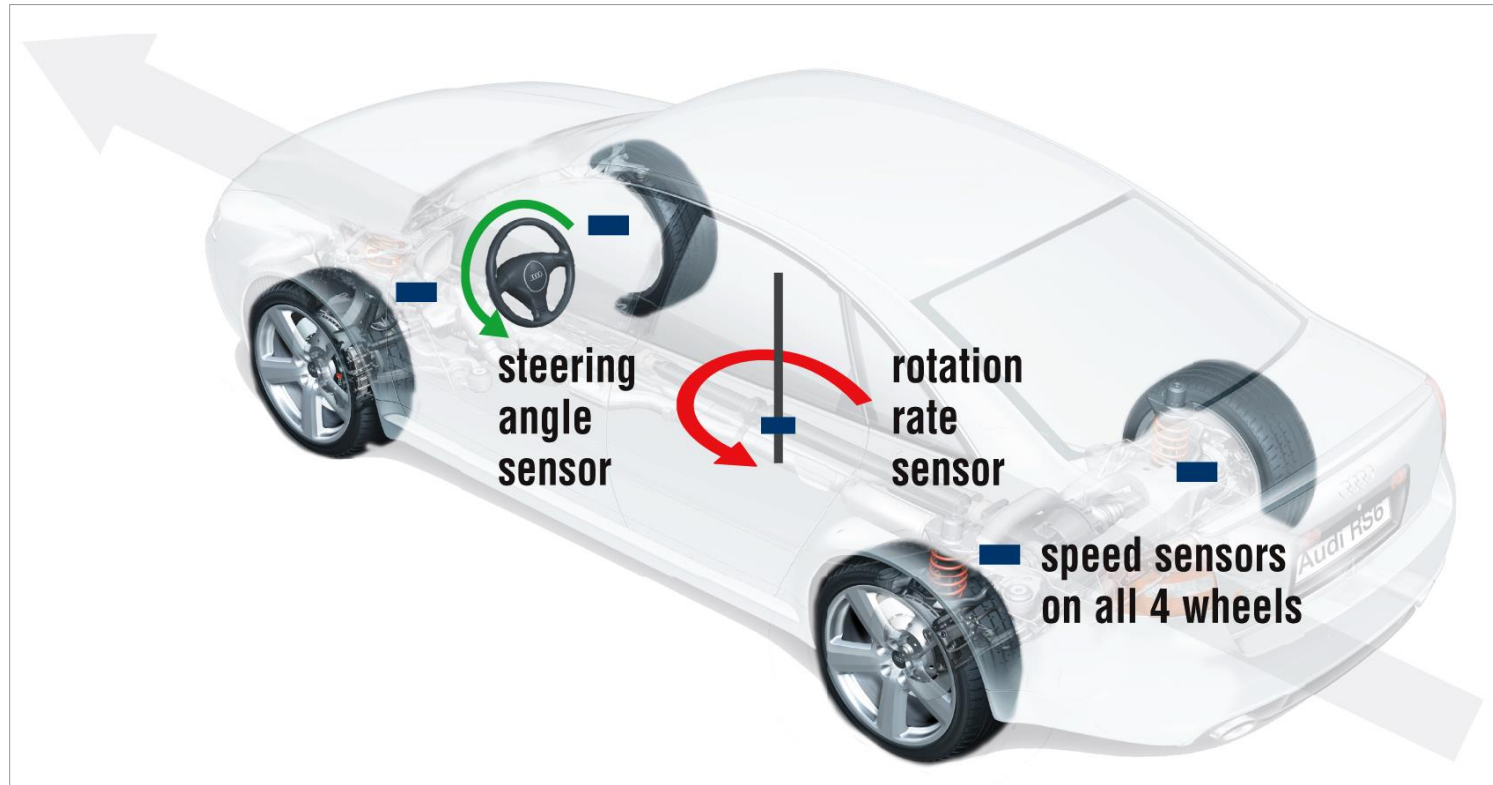






Electronic Stability Control: The first crash avoidance success

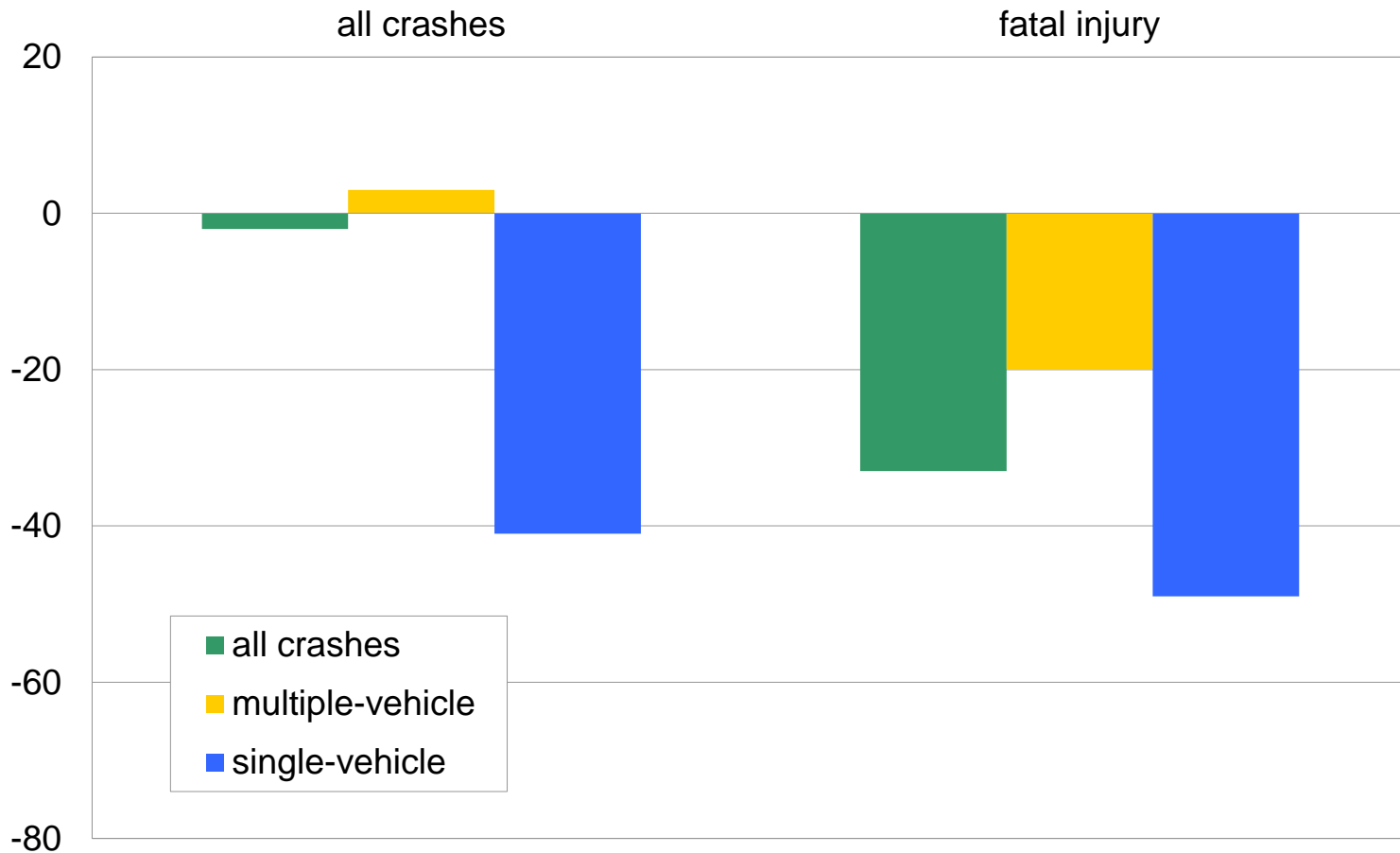
What is Electronic Stability Control (ESC)?



ESC is an extension of ABS, which has speed sensors and independent braking for each wheel. Additional sensors monitor how well a vehicle is responding to a driver's input.

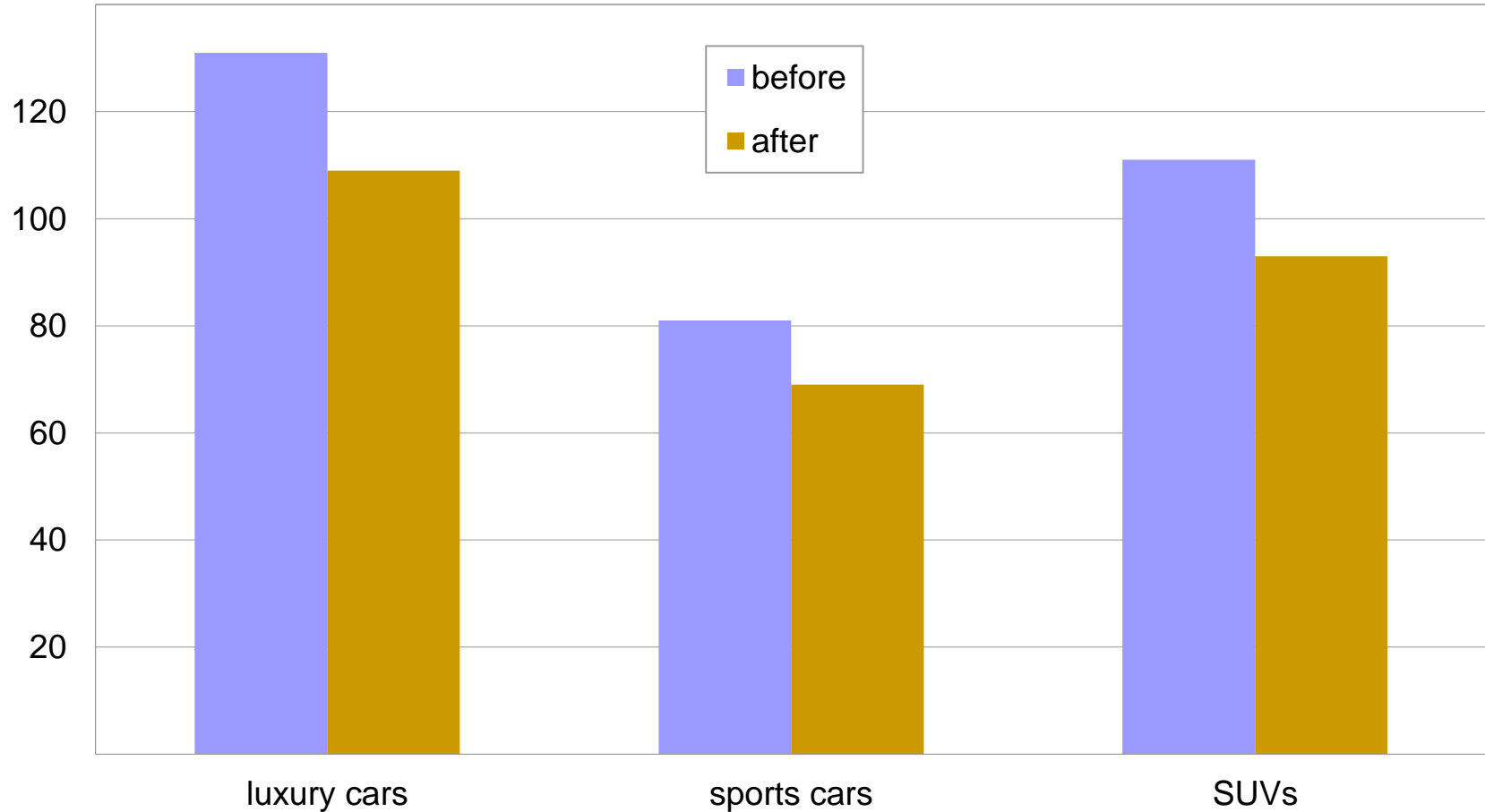
Effects on crash risk

Percent change in crash rates for vehicles with standard ESC vs. optional or no ESC, updated May 2010



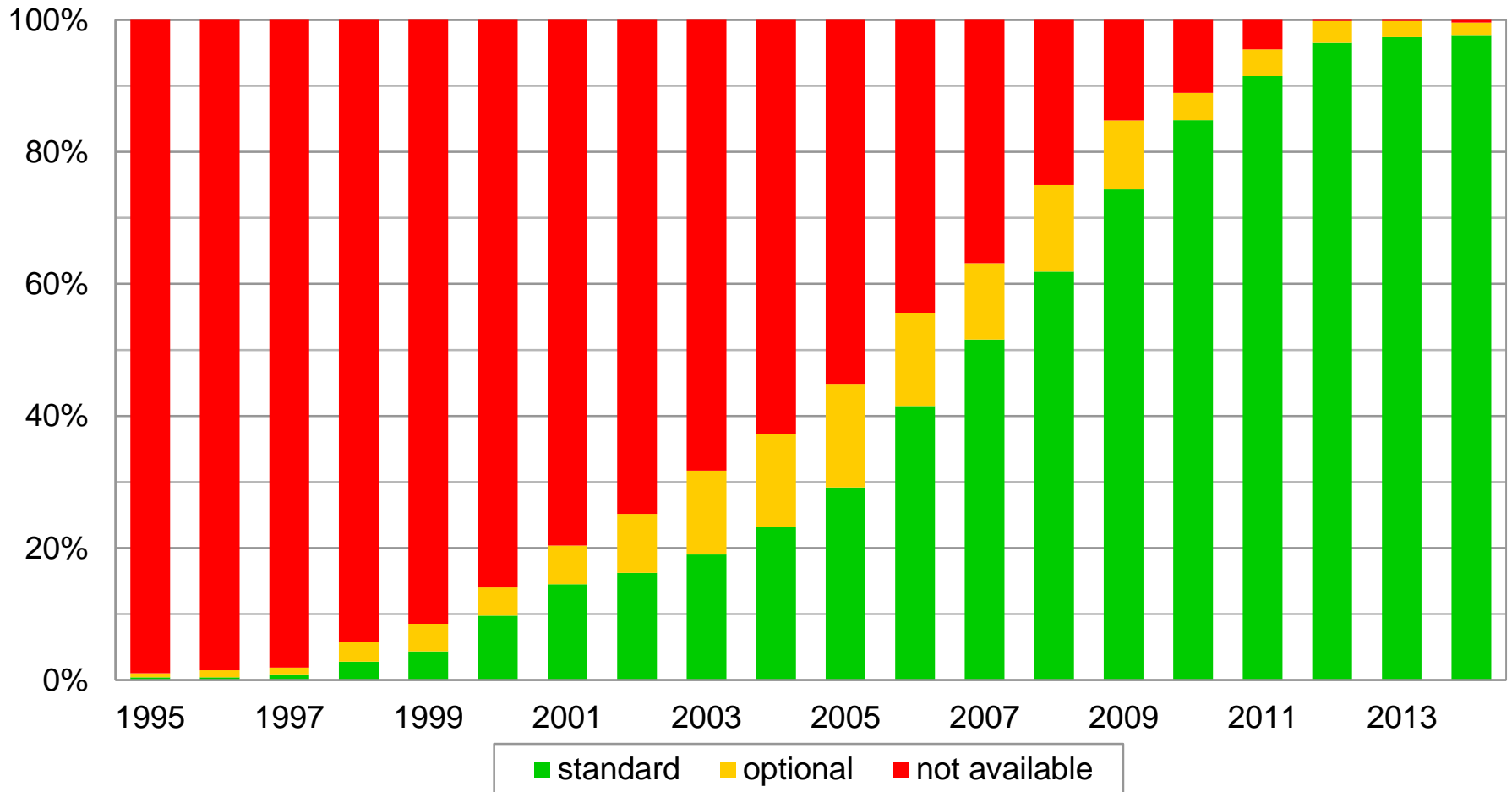
Relative overall collision losses

Before and after standard ESC, April 2006



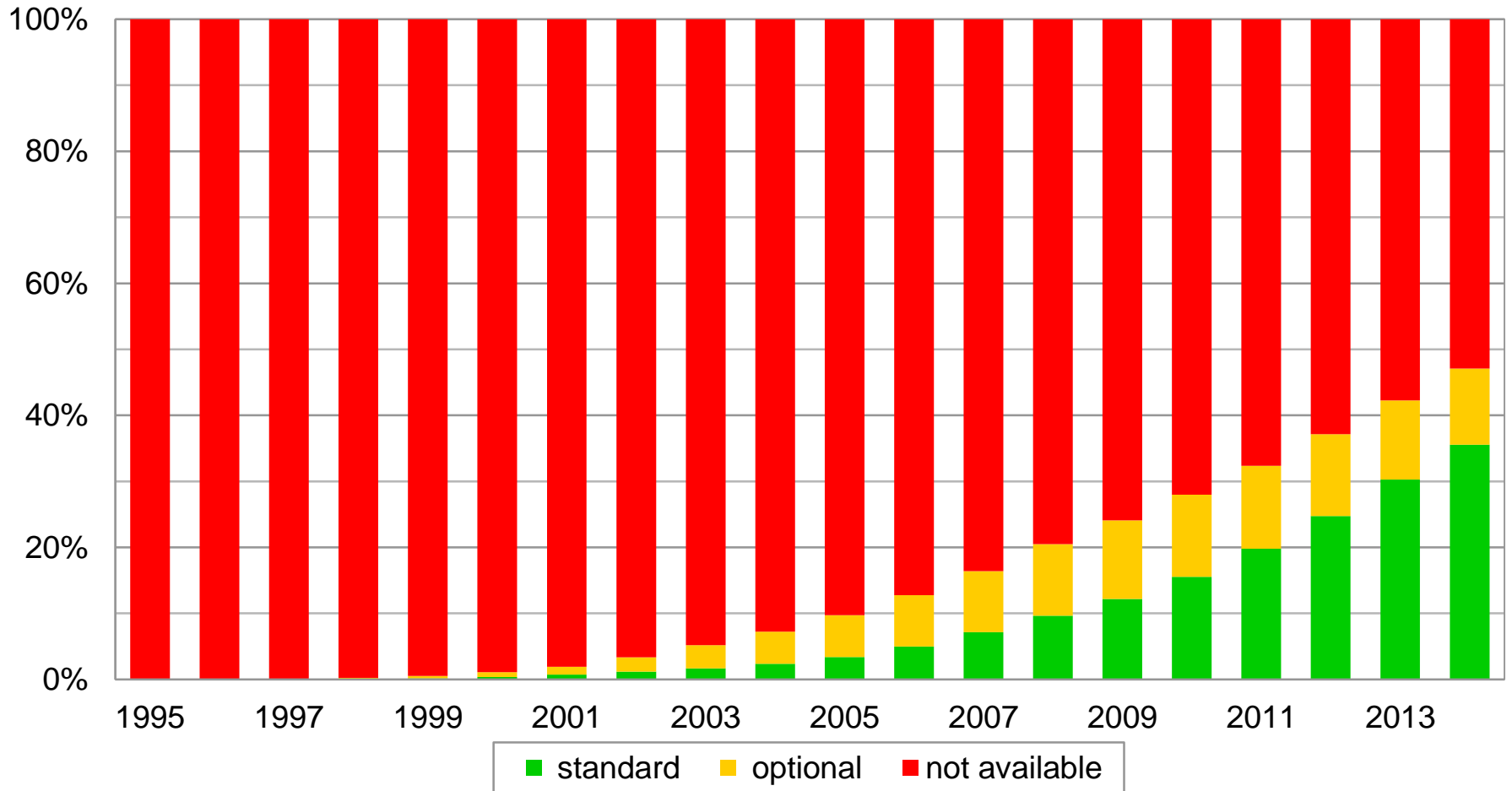
New vehicle series with electronic stability control

By model year



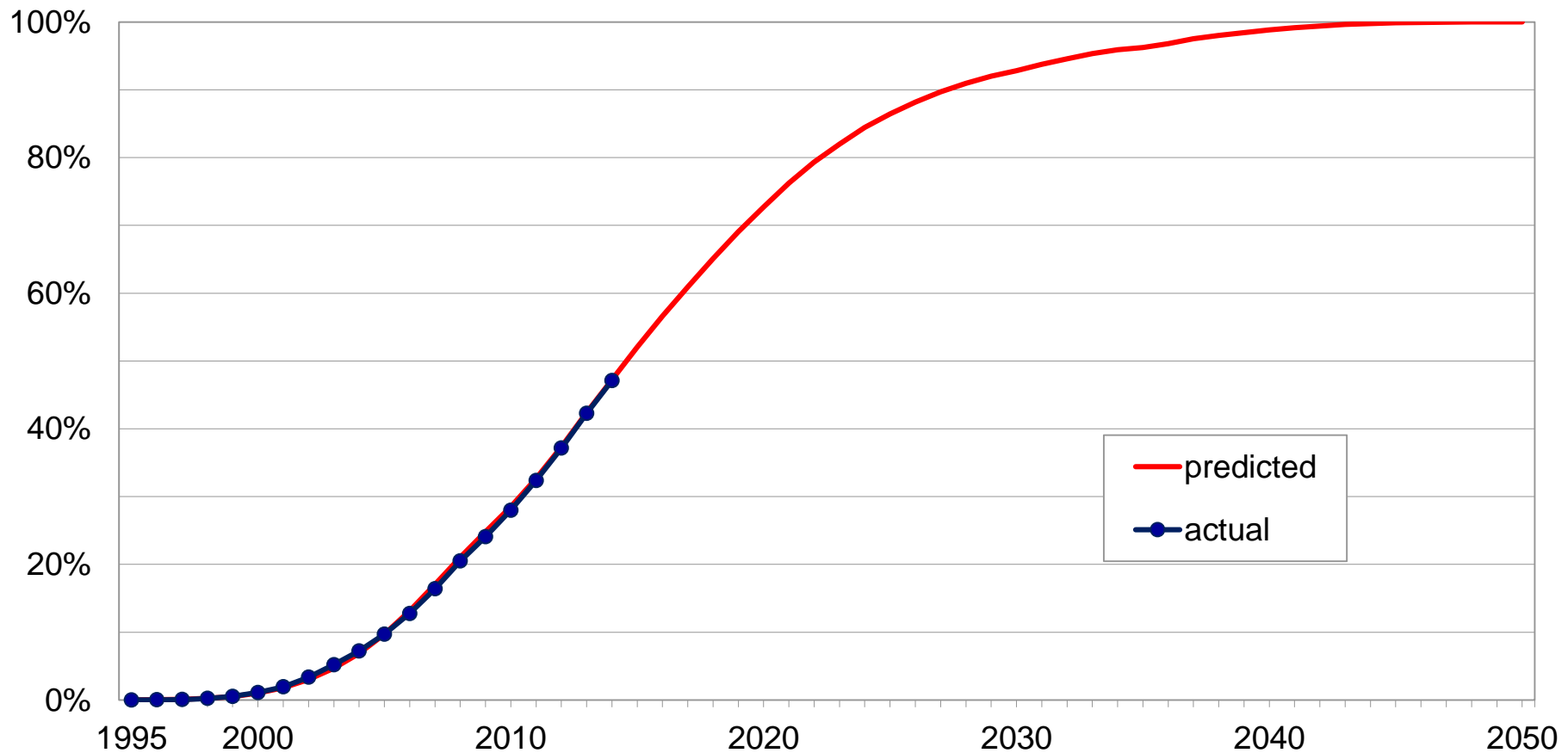
Registered vehicles with electronic stability control

By calendar year



Registered vehicles with available electronic stability control, actual and predicted

By calendar year

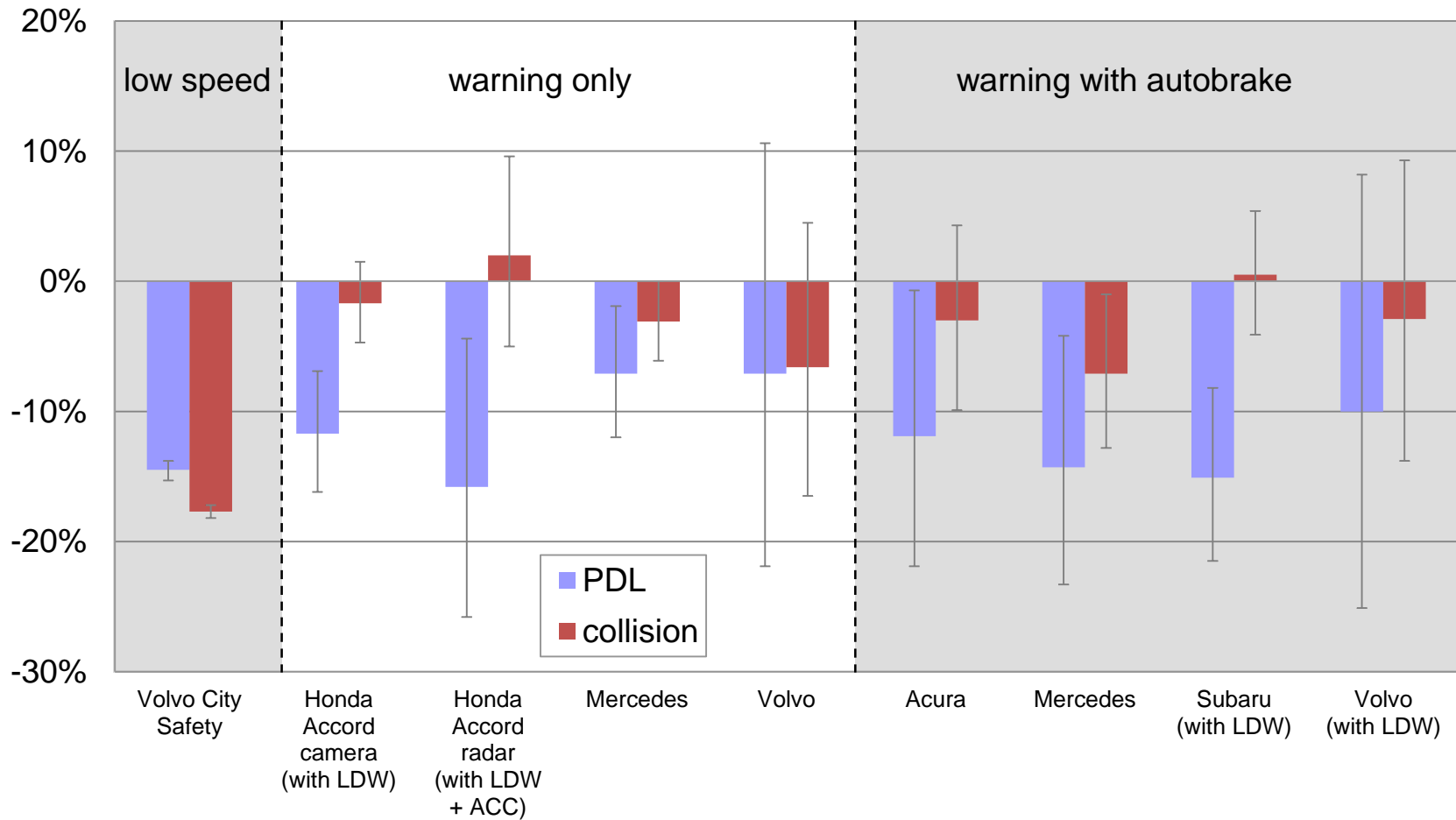


Forward collision warning

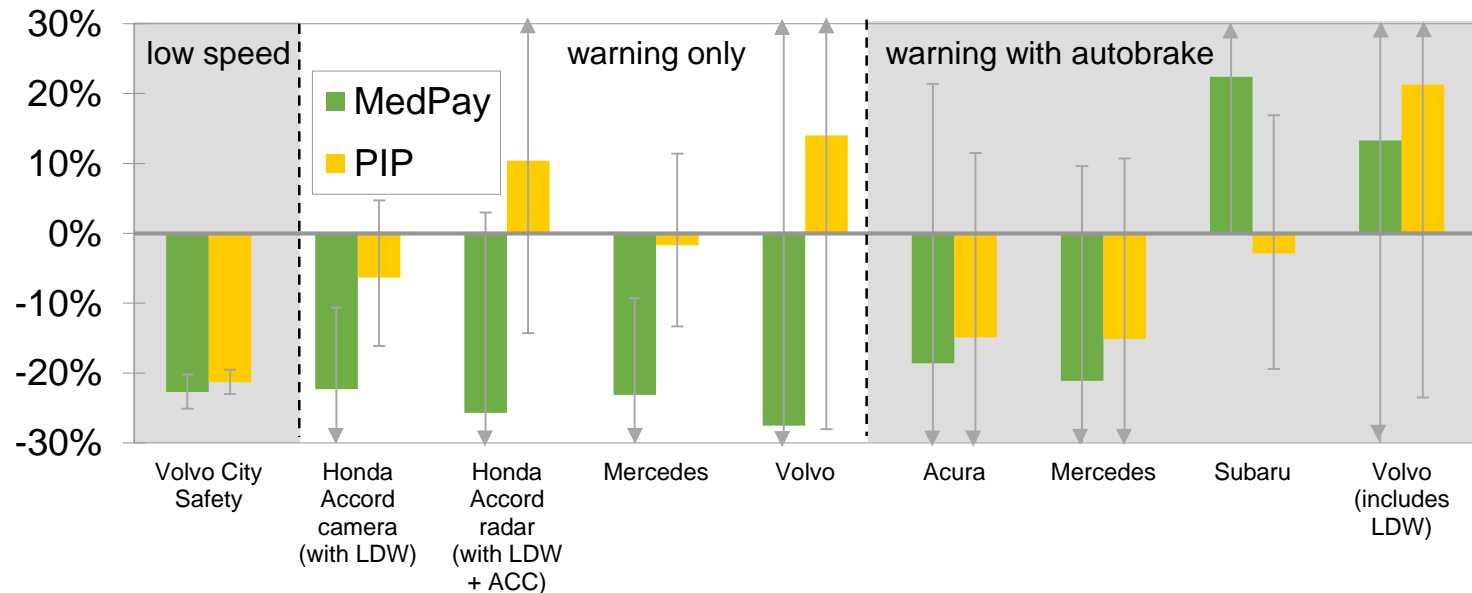
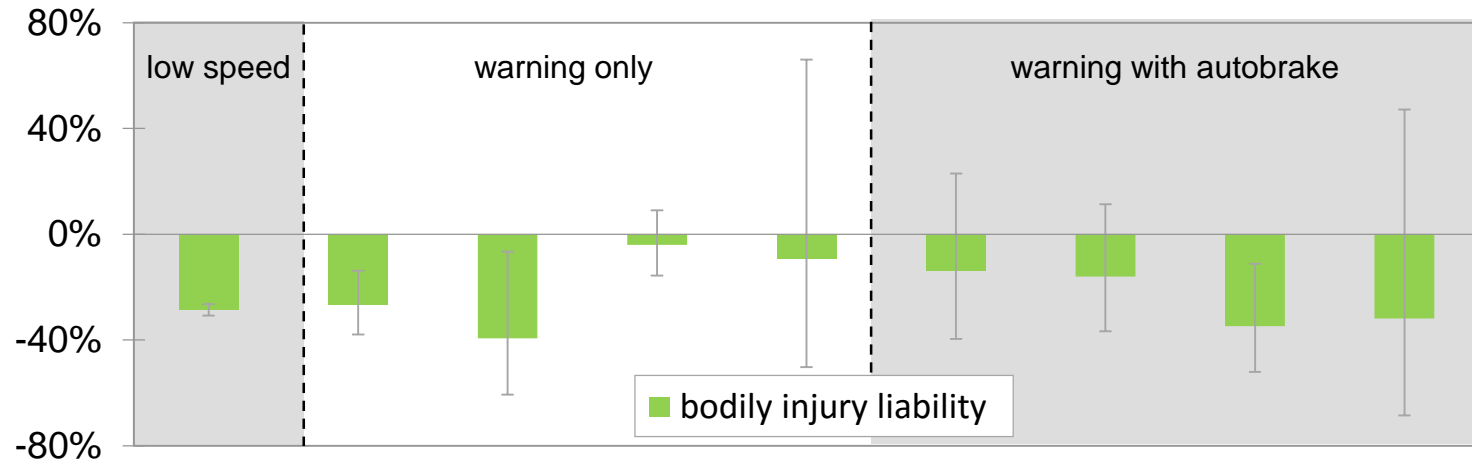


Insurance Institute for Highway Safety
Highway Loss Data Institute

Changes in physical damage claim frequency with front crash prevention systems

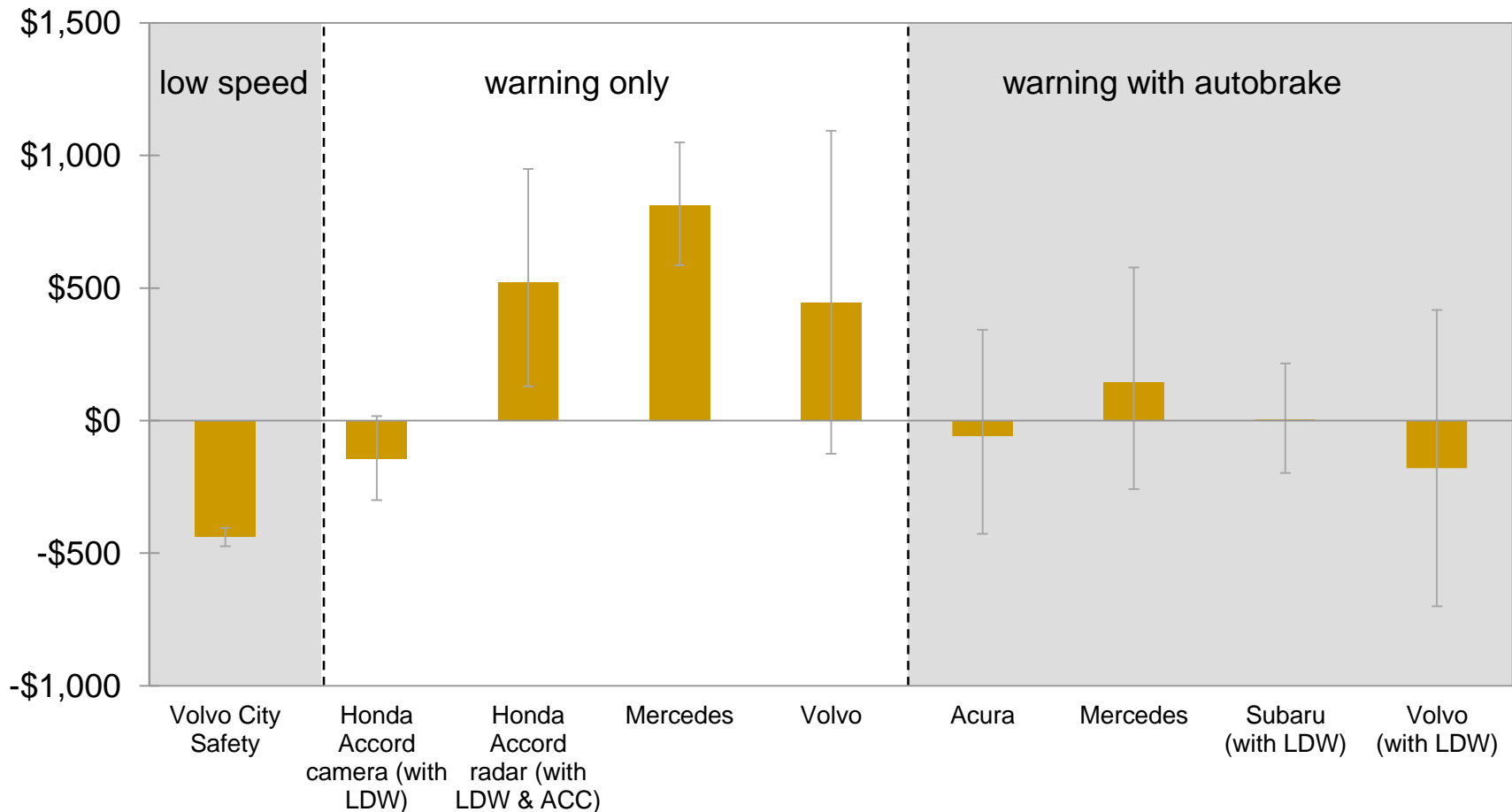


Changes in injury claim frequency with front crash prevention systems



Front crash prevention systems

Change in collision claim severity



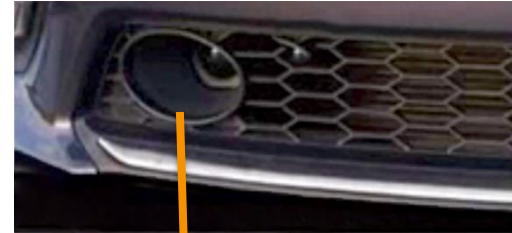
Honda Accord forward collision warning

Camera vs. radar



available on trims other than Touring

change in collision
claim severity
-\$145

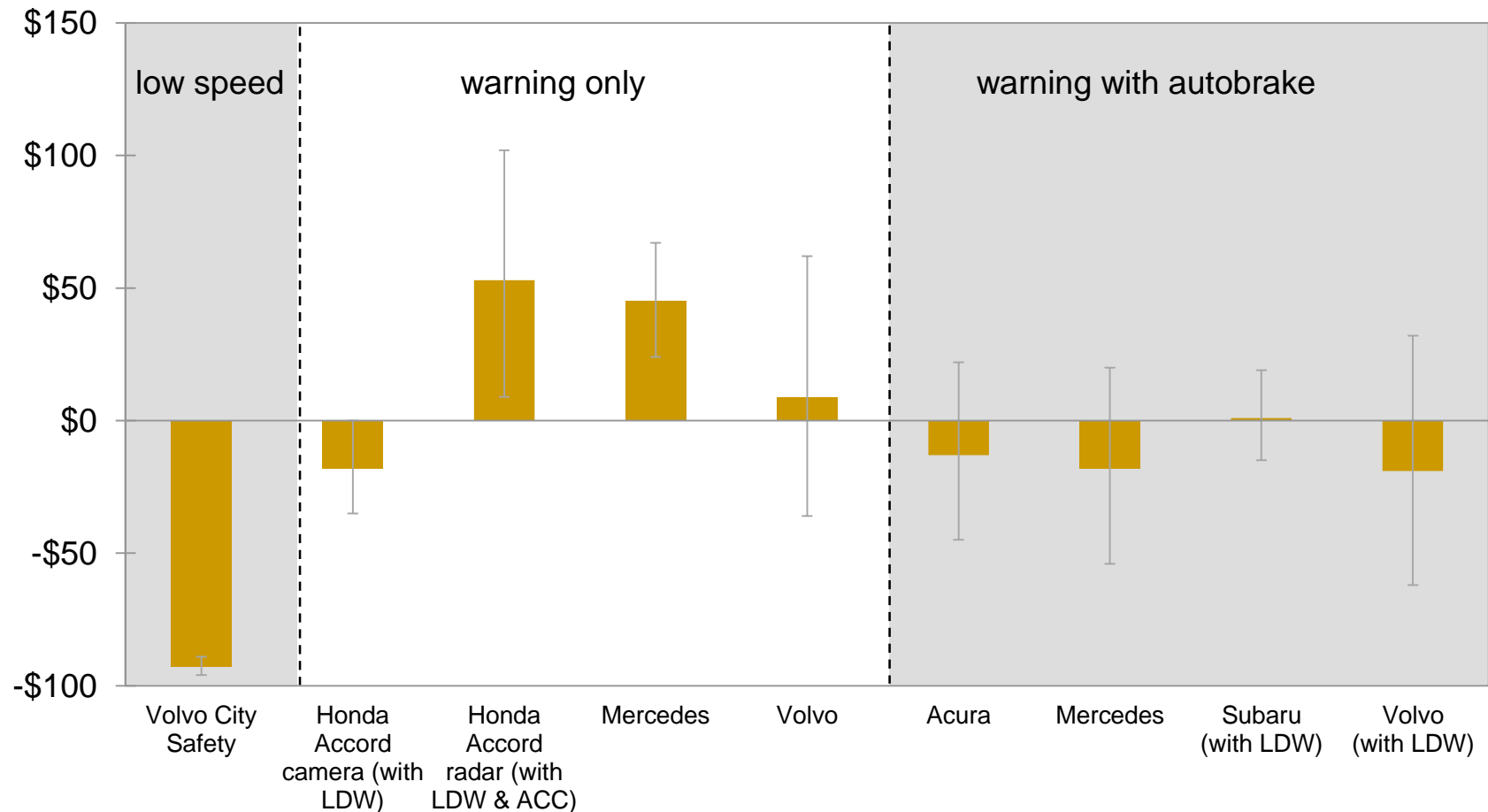


standard on Touring trim

change in collision
claim severity
\$522

Front crash prevention systems

Change in collision overall losses



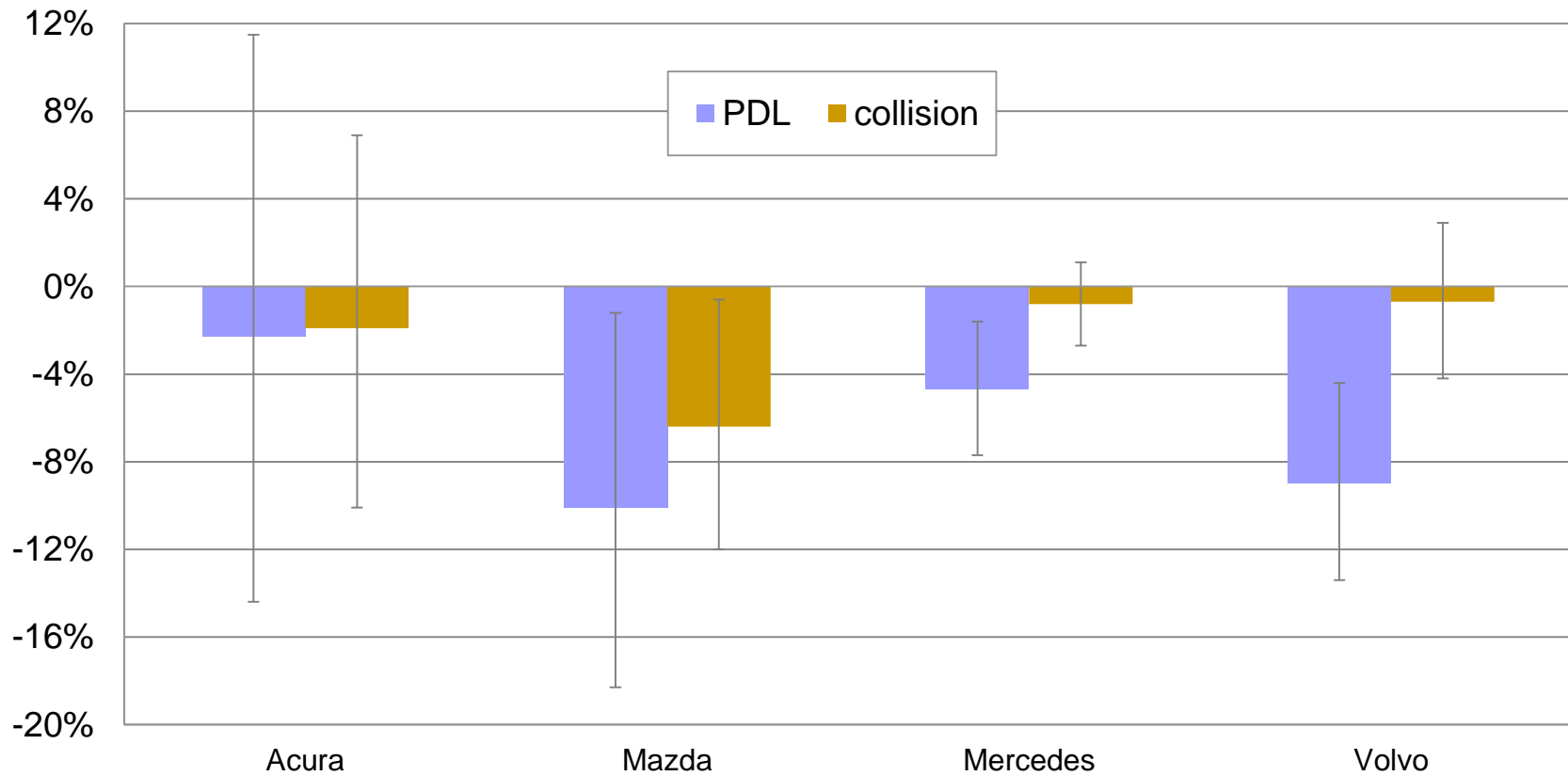
Adaptive headlights



Insurance Institute for Highway Safety
Highway Loss Data Institute

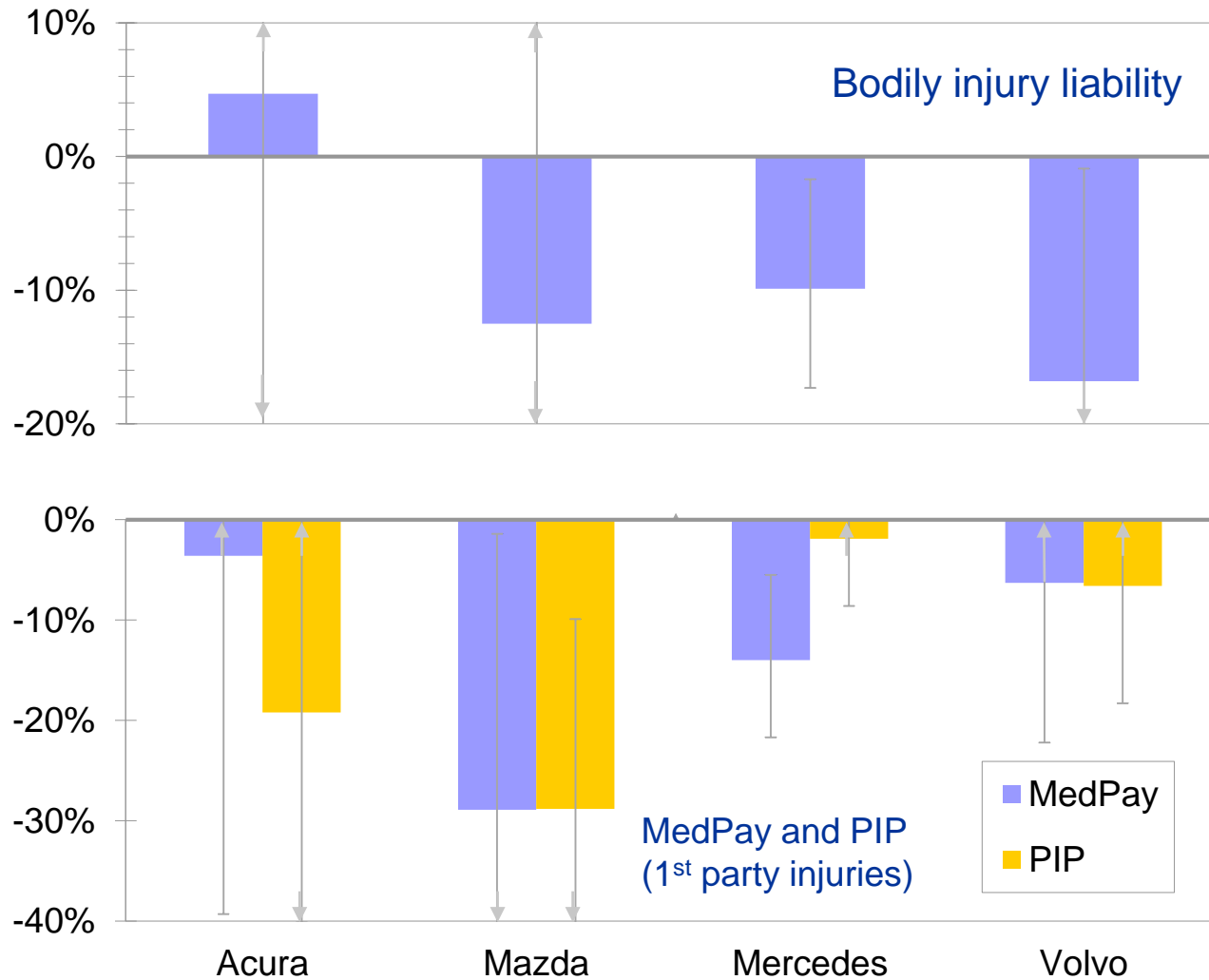
Adaptive headlights

Change in claim frequency



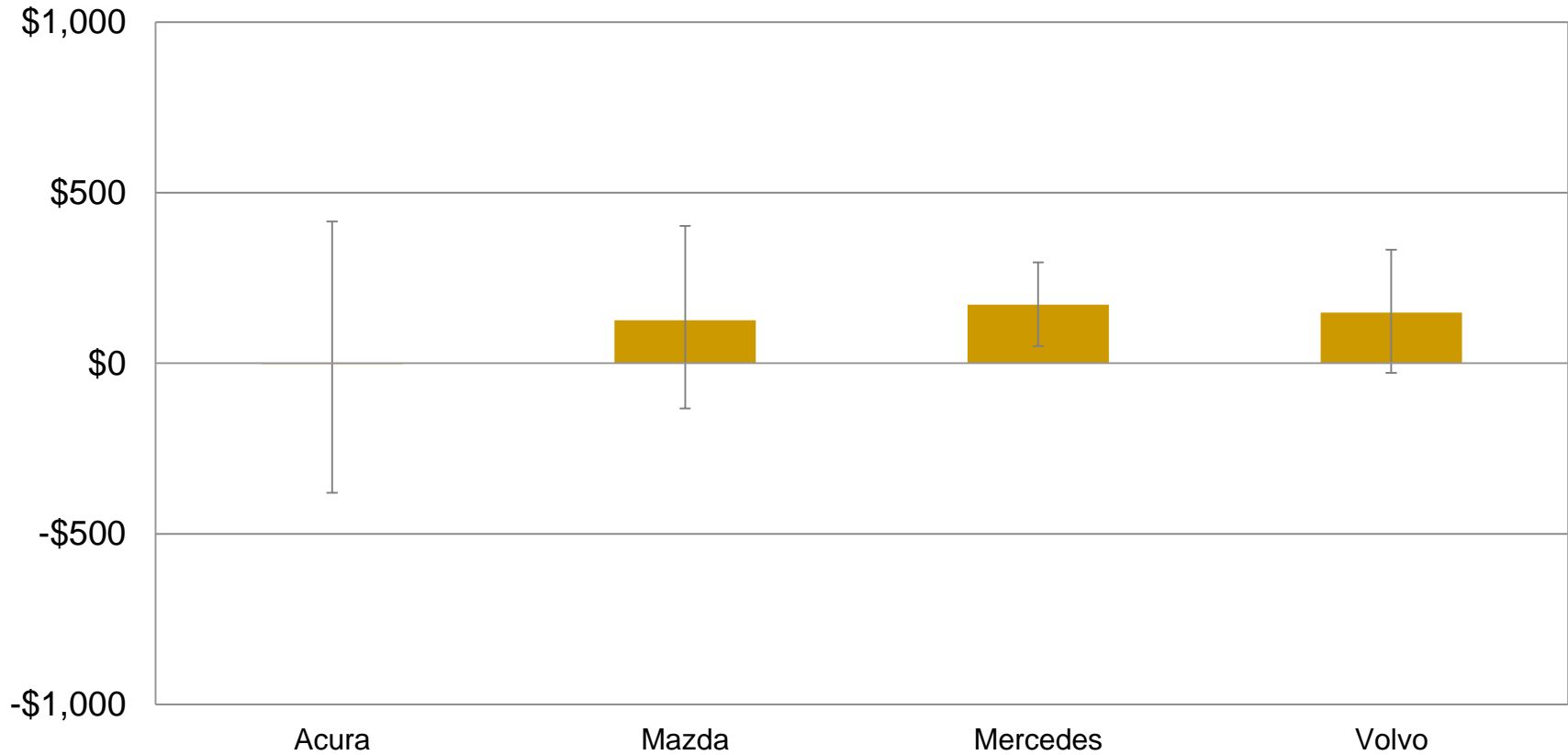
Adaptive headlights

Change in claim frequency



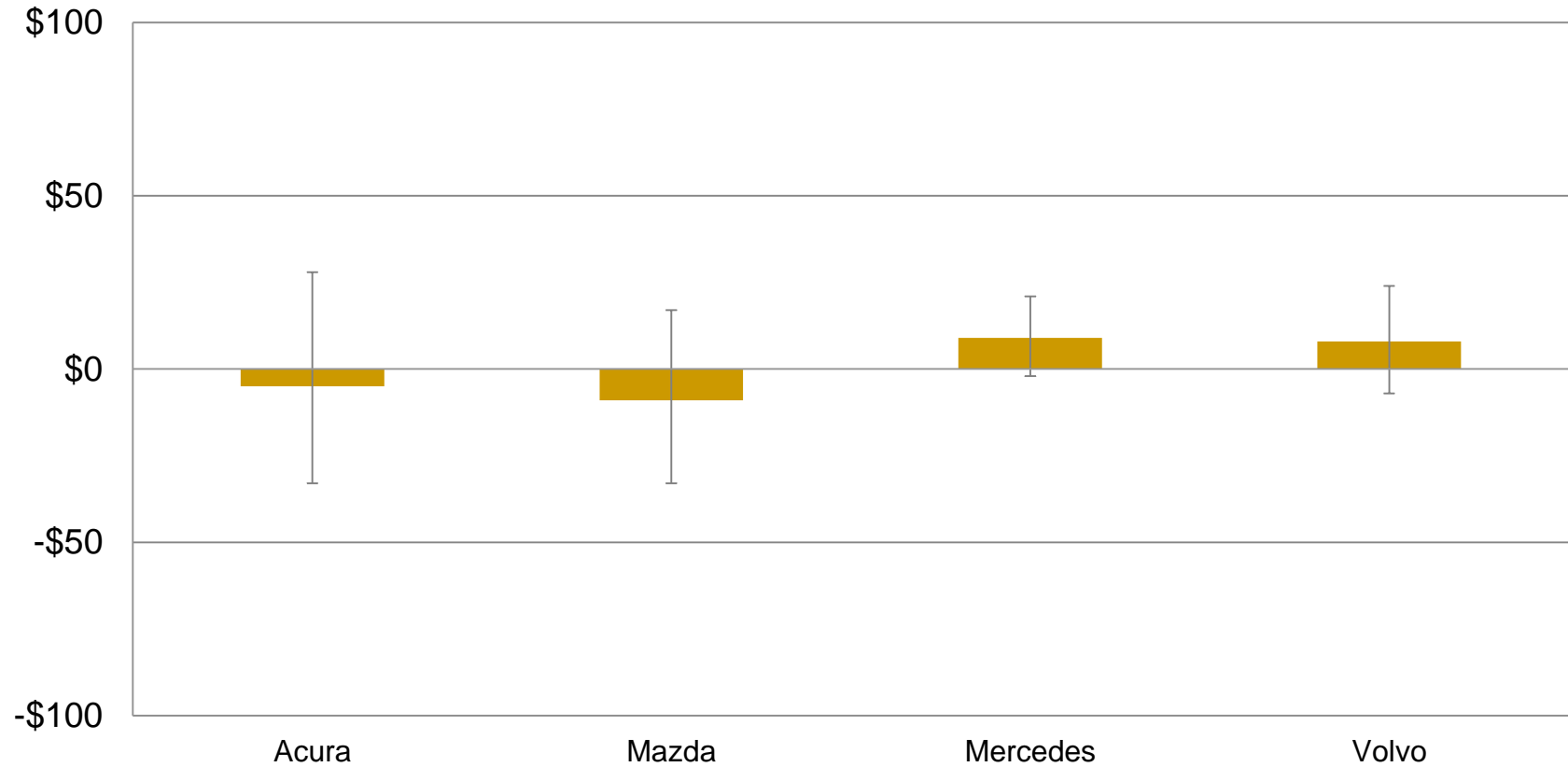
Adaptive headlights

Change in collision claim severity



Adaptive headlights

Change in collision overall losses



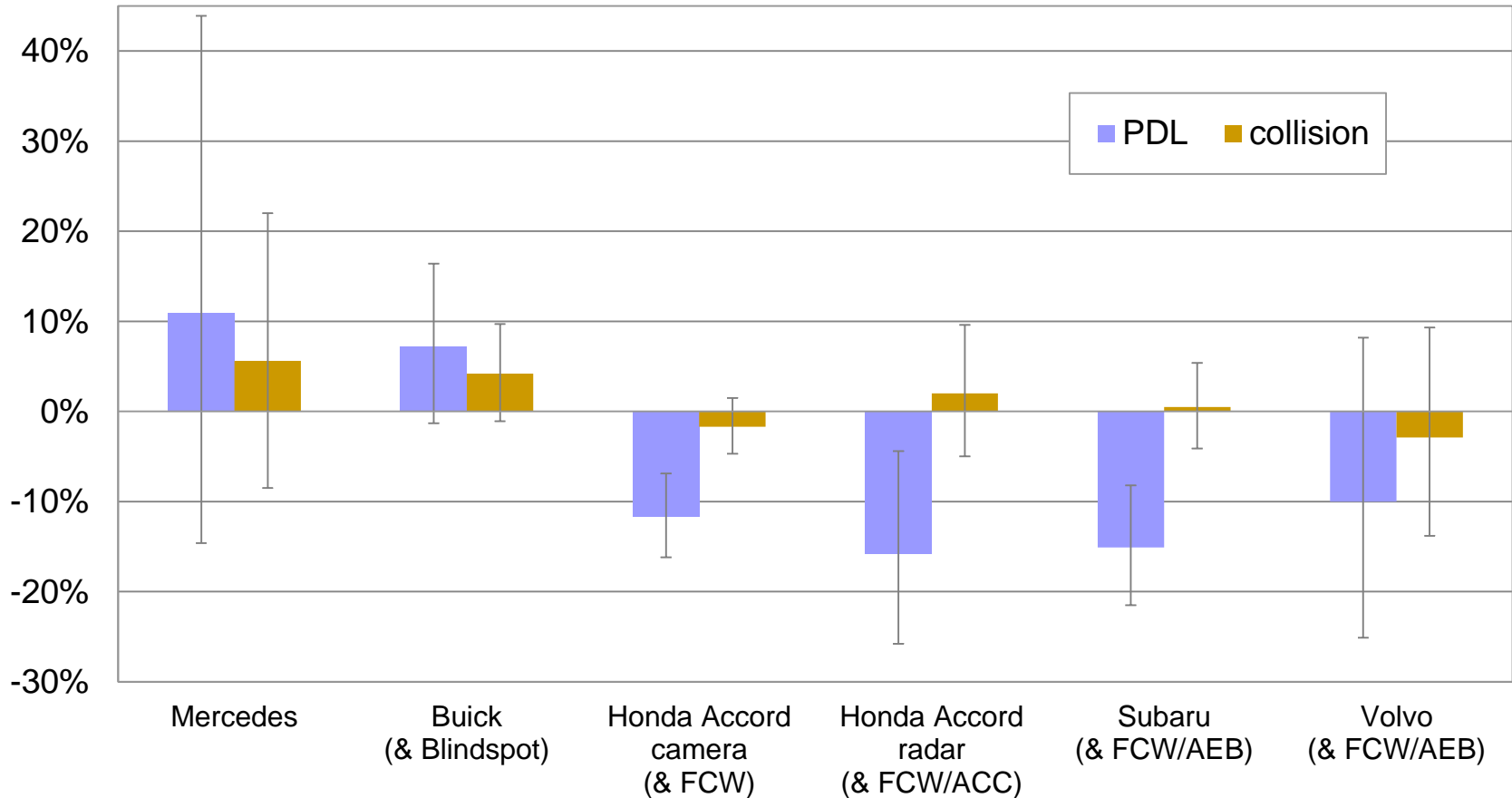
Lane departure warning



Insurance Institute for Highway Safety
Highway Loss Data Institute

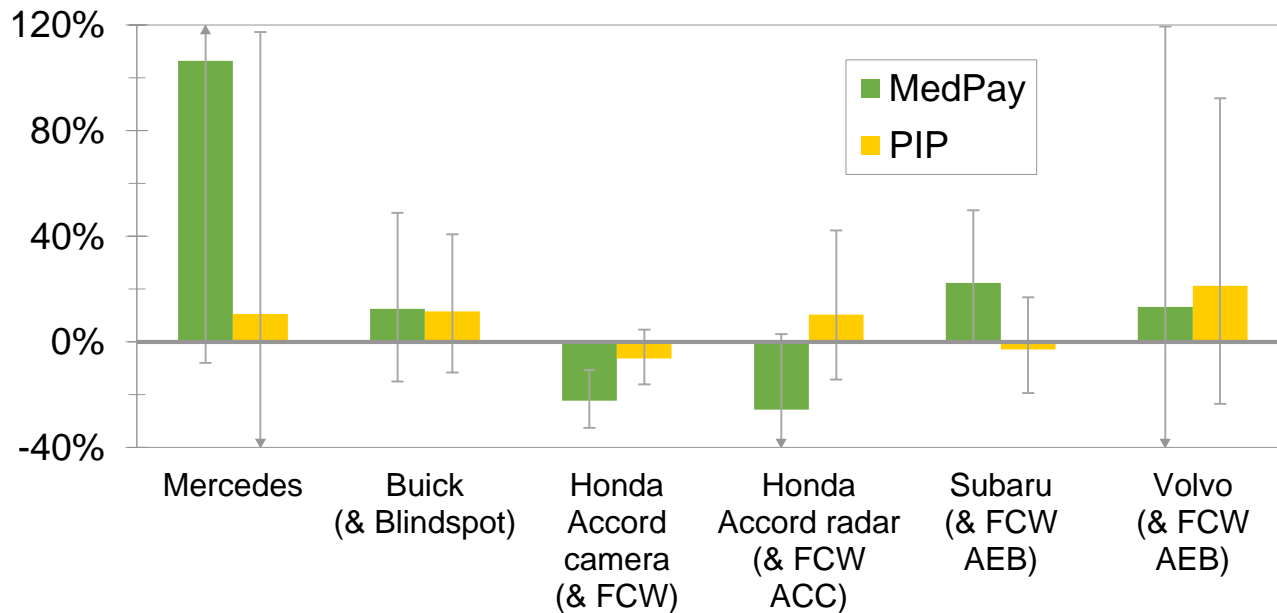
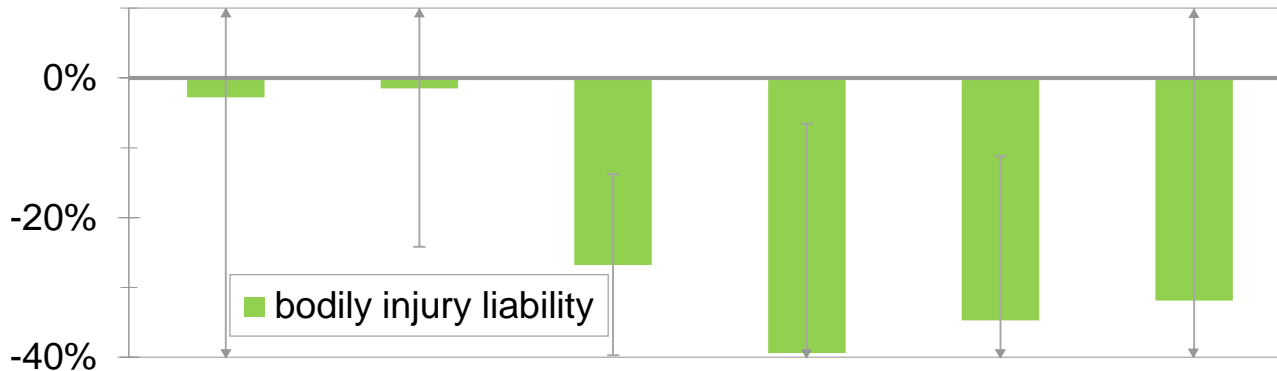
Lane departure warning systems

Change in claim frequency



Lane departure warning systems

Change in claim frequency



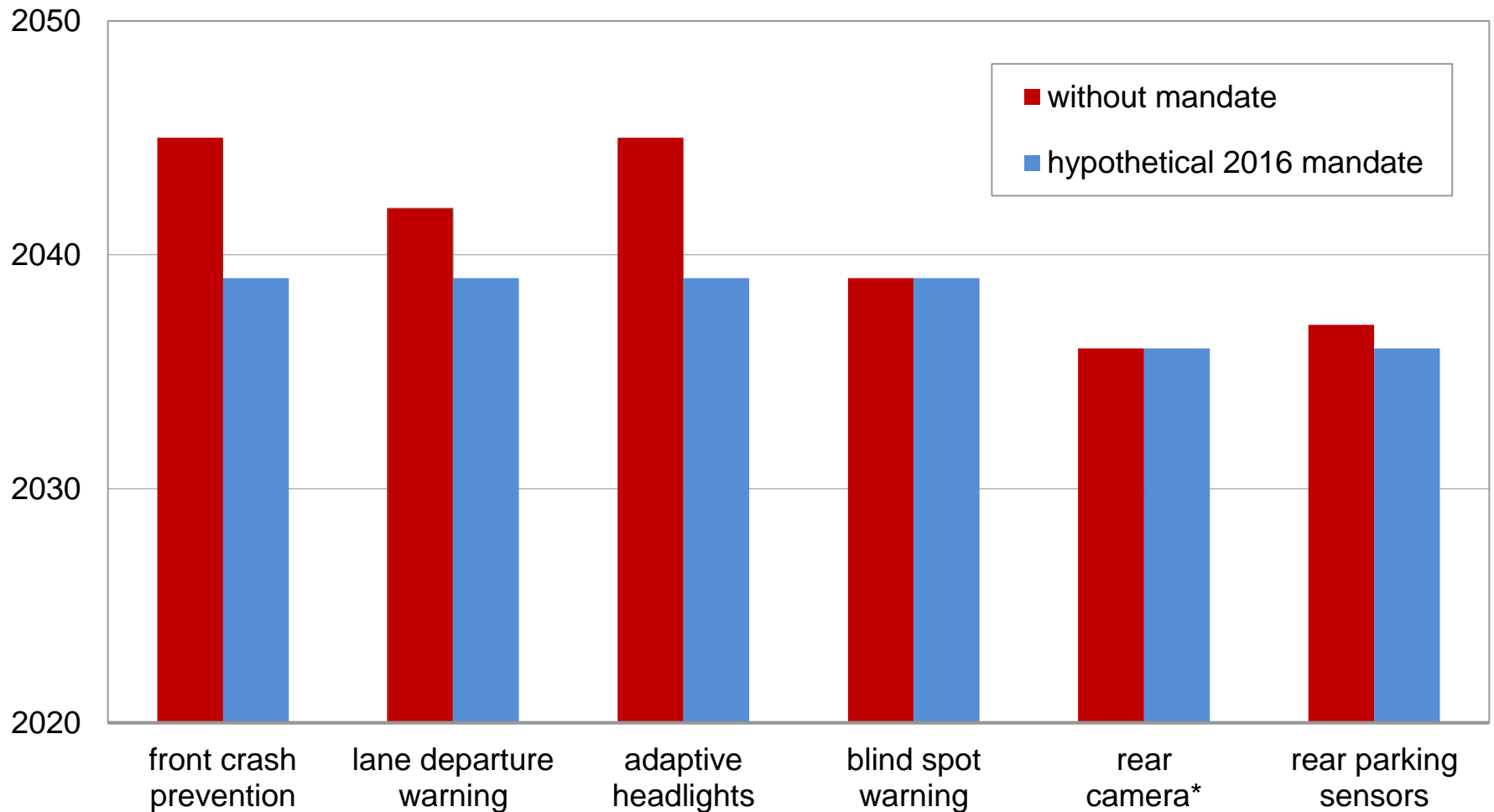
What's next for vehicle safety?

Insurance claim frequency changes for various crash avoidance systems

Pooled estimates across vehicle models

	percentage change		
	Collision	PDL	BIL
forward collision warning	-2	-9	-15
FCW with autobrake	-1	-14	-19
adaptive headlights	-1	-5	-8
lane departure warning	+2	-5	+6
rear camera	+1	-3	0
side view assist (blind spot)	-2	-10	-15

Calendar year features reach 95% of registered vehicles with and without hypothetical mandate



* rear camera mandate May 1, 2018

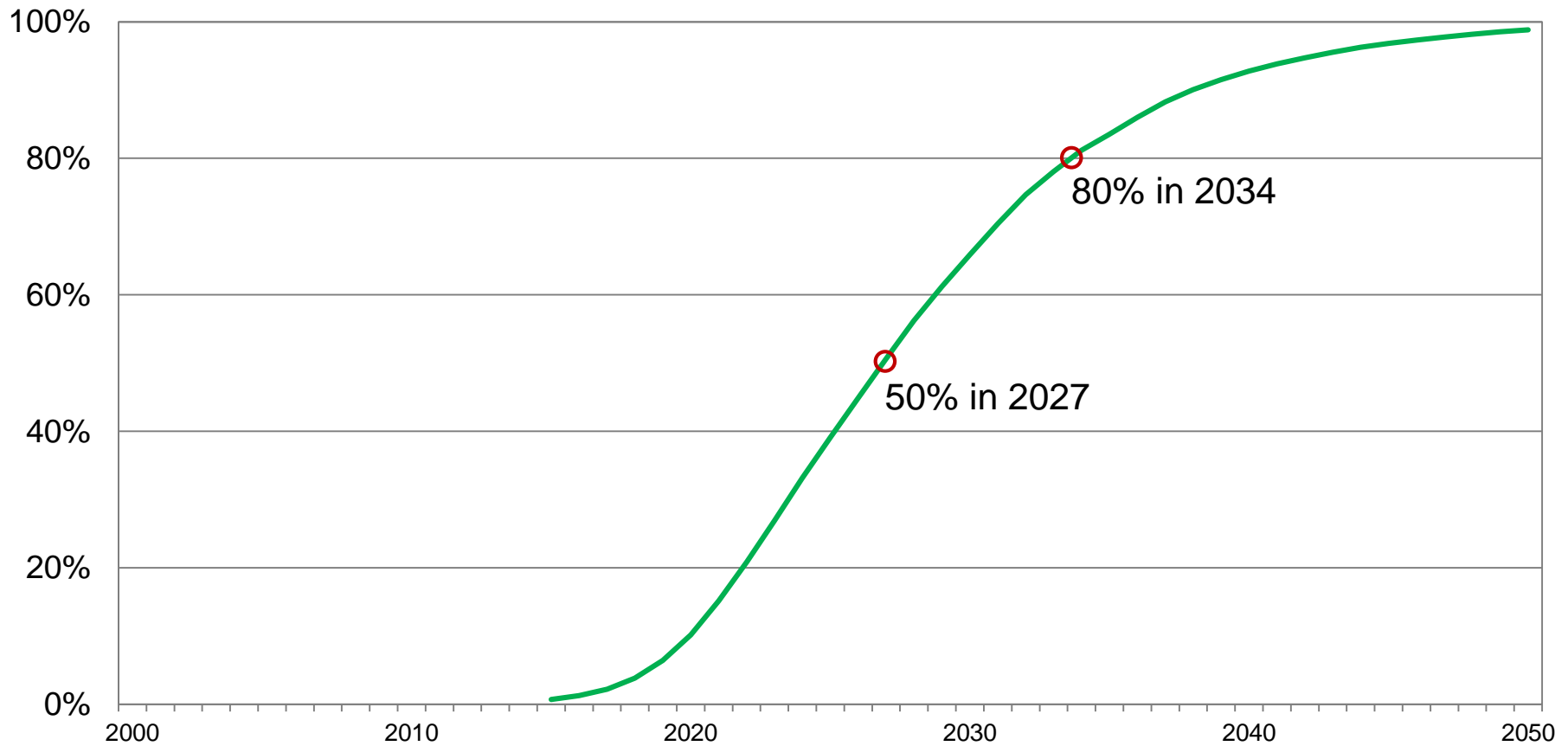
Twenty automakers have committed to make AEB a standard feature by September 2022

Represent > 99 percent of U.S. market

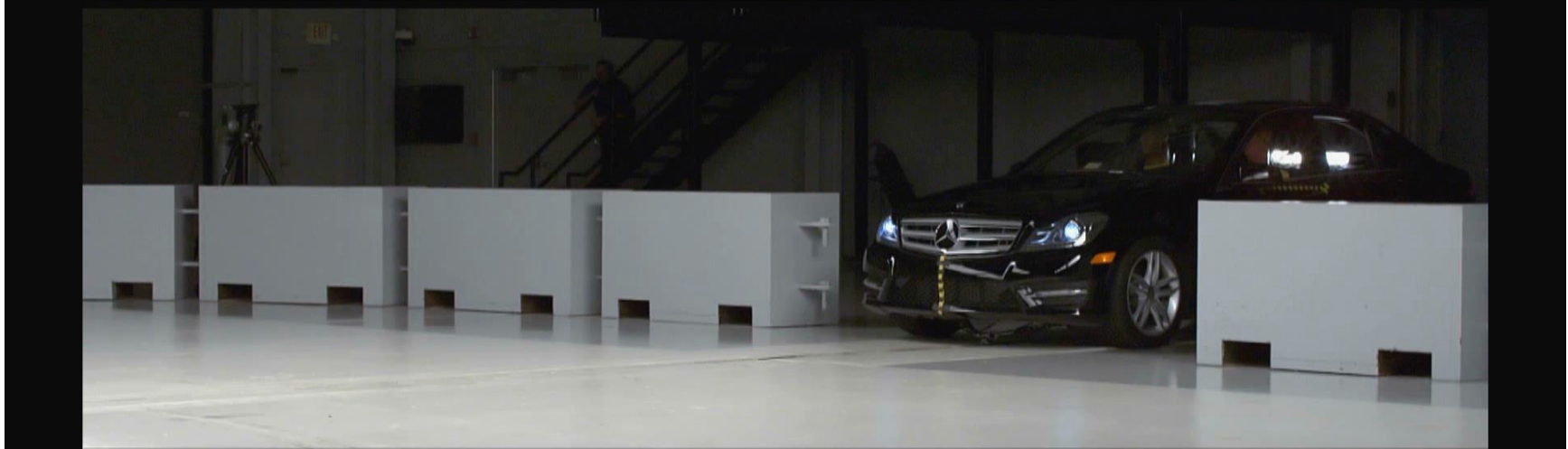


Predicted counts of registered vehicles equipped with front crash prevention

With 2022 voluntary commitment



Front crash prevention testing and rating



IIHS front crash prevention system ratings

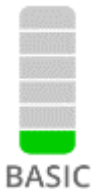
Points awarded based on autobraking speed reduction

12 mph test		25 mph test	
speed reduction (mph)	points	speed reduction (mph)	points
less than 5	0	less than 5	0
5 to 9	1	5 to 9	1
10 or more	2	10 to 22	2
		23 or more	3

Front crash prevention ratings



vehicles without forward collision warning or autobrake; or vehicles equipped with a system that doesn't meet NHTSA or IIHS criteria



vehicles earning 1 point for forward collision warning or 1 point in either 12 or 25 mph test



vehicles with autobrake that achieve 2-4 points for forward collision warning and/or performance in autobraking tests



vehicles with autobrake that achieve 5-6 points for forward collision warning and/or performance in autobraking tests

Speed reduction in 12 and 24 mph tests

Volvo S60
2 point advanced

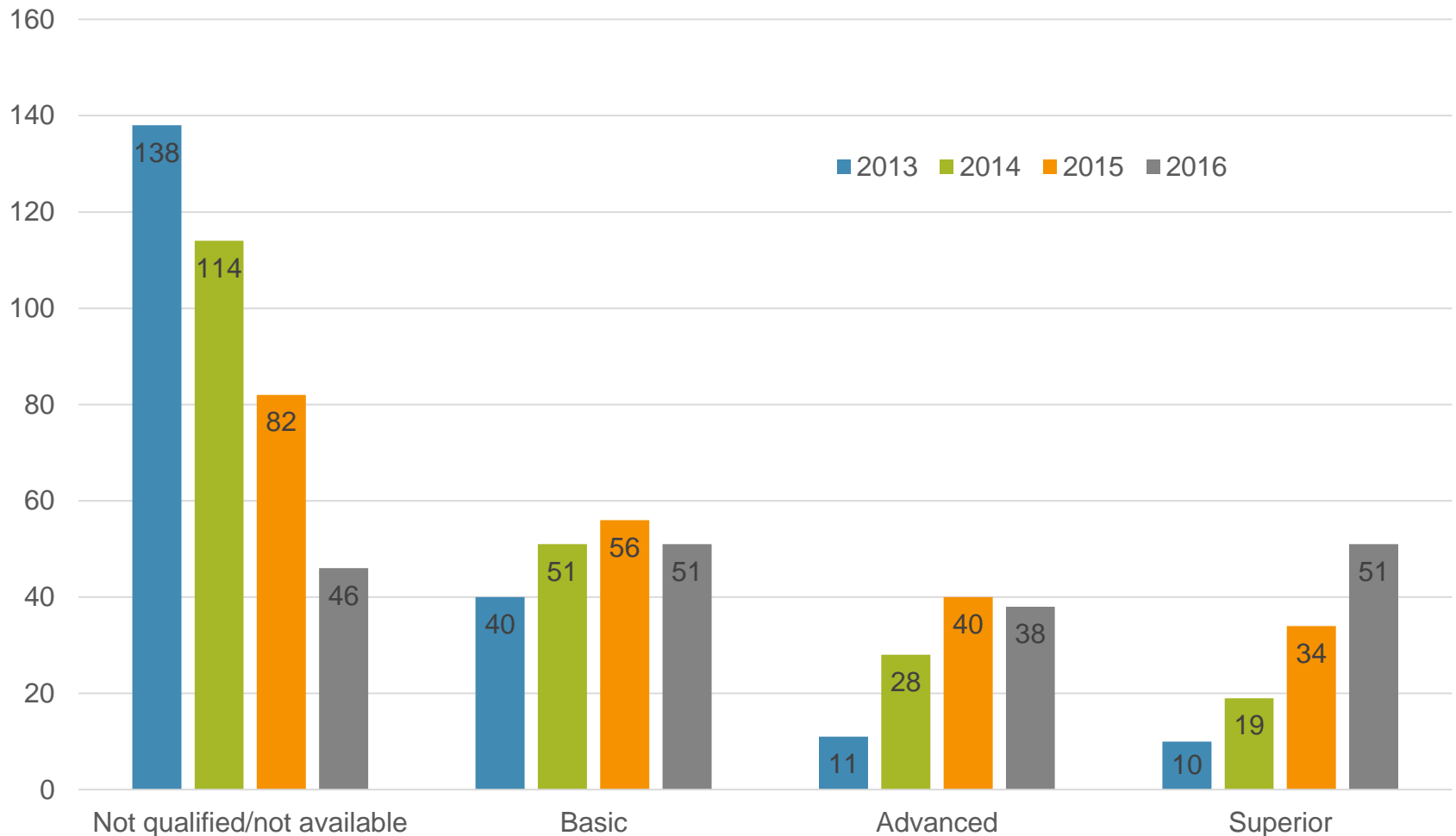
Dodge Durango
3 point advanced

Subaru Outback
6 point superior



Front crash prevention ratings

2013 – 2016 models (as of March 2016)











Effect of weather on AEB performance



February 17, 2015



Vehicles

		2014 Infiniti Q50	2015 Subaru Legacy	2014 Volvo S80
				
sensors		radar	stereo camera	radar, mono camera, LIDAR
speed reduction	12 mph	12 mph	12 mph	12 mph
	25 mph	24 mph	25 mph	13 mph
rating		 SUPERIOR	 SUPERIOR	 SUPERIOR

All vehicles tested at 12 mph

**2014
Infiniti Q50**



Speed reduction

7 mph

**2015
Subaru Legacy**



6 mph

**2014
Volvo S80**



4 mph

2014 Infiniti Q50 tested at 25 mph

2014 Infiniti Q50



Speed reduction

24 mph



11 mph

2015 Subaru Legacy tested at 25 mph

2015 Subaru Legacy



Speed reduction

25 mph



7 mph

2014 Volvo S80 tested at 25 mph

2014 Volvo S80



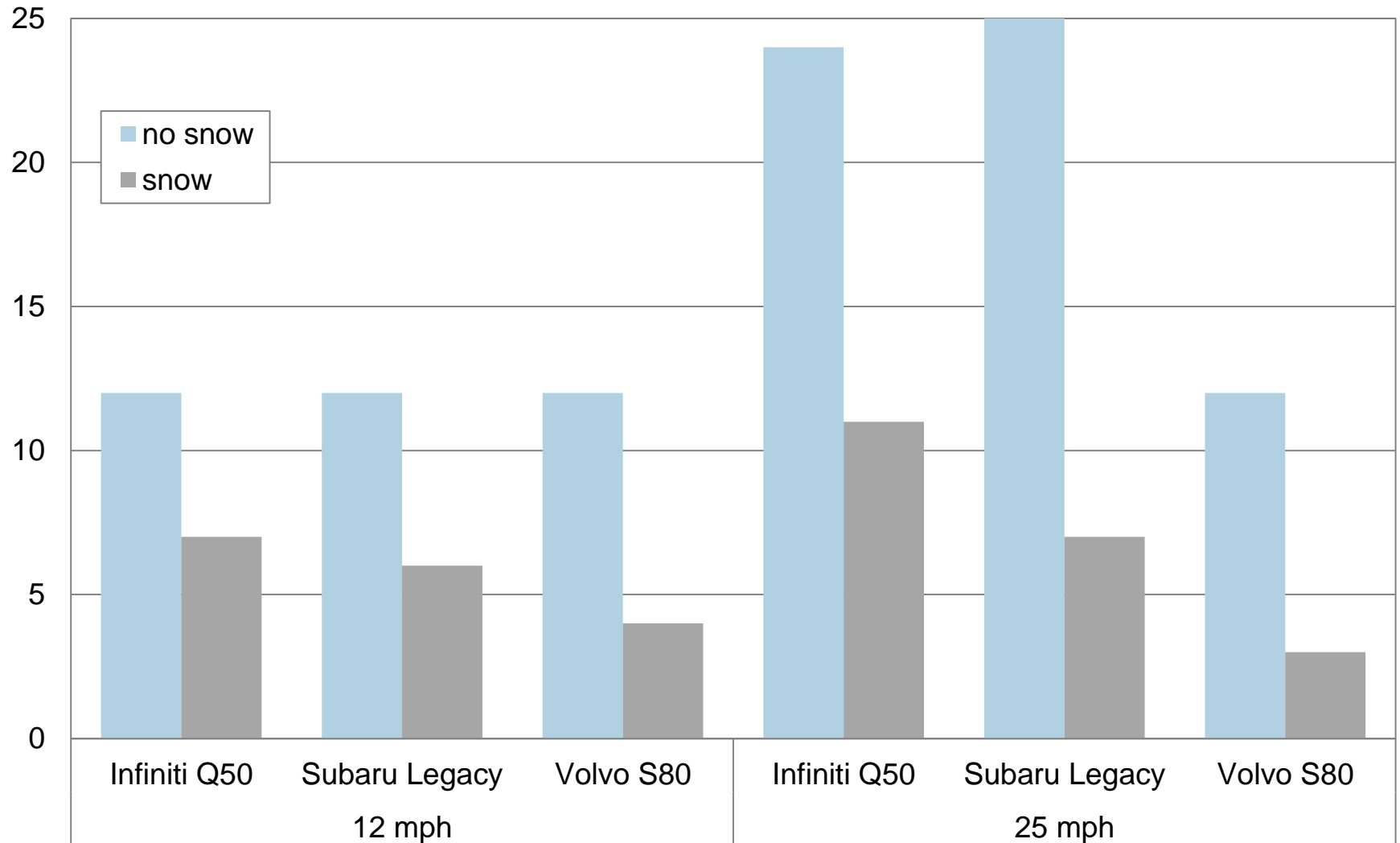
Speed reduction

12 mph



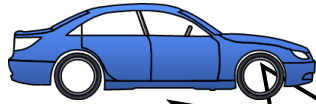
3 mph

Speed reductions (mph)



Warning times when traveling at 12 mph

2014 Infiniti Q50



Warning
33 ft. or 1.8 secs.

2015 Subaru Legacy



Warning
35 ft. or 1.9 secs.

2014 Volvo S80



Warning
34 ft. or 1.9 secs.

Braking times when traveling at 12 mph

2014 Infiniti Q50



Brake
24 ft. or 1.3 secs.



2015 Subaru Legacy



Brake
18 ft. or 0.9 secs.



2014 Volvo S80

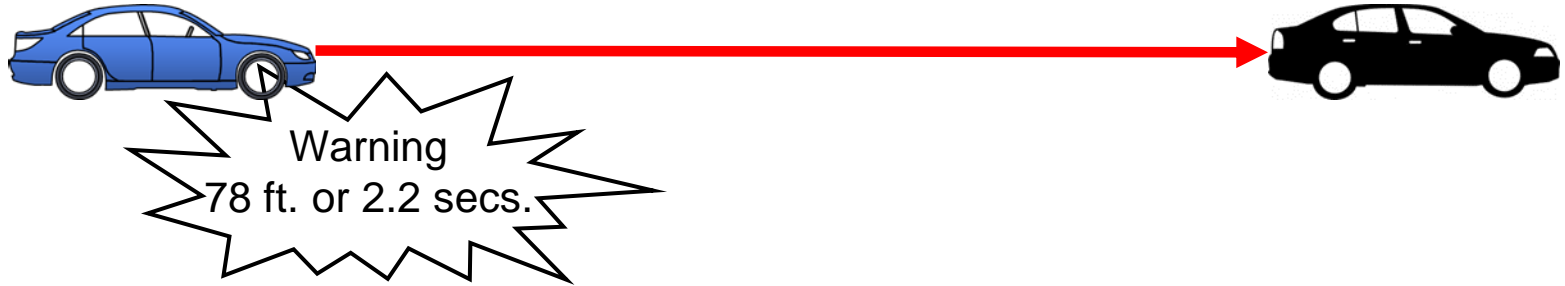


Brake
13 ft. or 0.7 secs.



Warning times when traveling at 25 mph

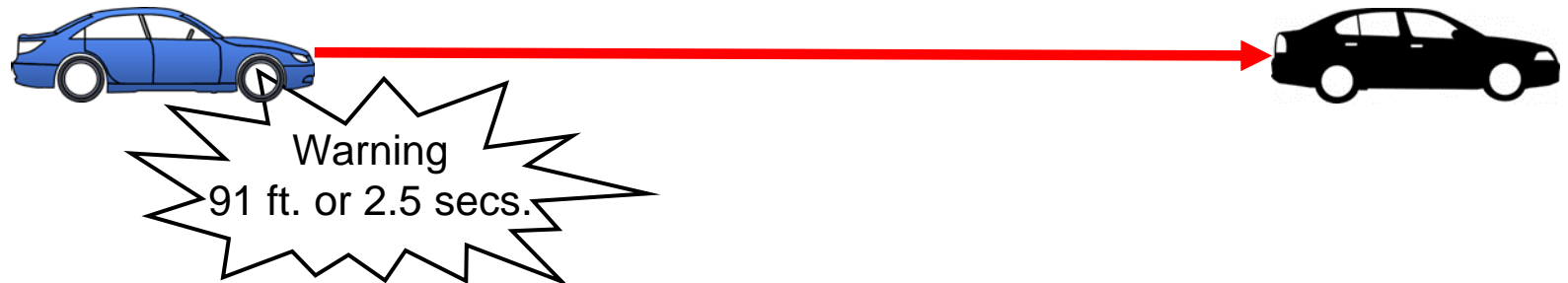
2014 Infiniti Q50



2015 Subaru Legacy



2014 Volvo S80



Braking times when traveling at 25 mph

2014 Infiniti Q50



Brake

59 ft. or 1.7 secs.



2015 Subaru Legacy



Brake

45 ft. or 1.3 secs.



2014 Volvo S80



Brake

26 ft. or 0.7 secs.



Conclusions

- ▶ Systems offered by manufacturers use different technology
 - Radar, camera, LIDAR, etc.
- ▶ Some systems have similarities
 - These 3 vehicles had similar warning times
- ▶ Systems also have differences
 - Brake activation times and brake levels vary
 - Differences can lead to different performance in adverse weather

TOP SAFETY PICK

Requirements for 2016 *TOP SAFETY PICK* awards



Good rating in moderate overlap front, small overlap front, side, roof strength and head restraint tests

&

Basic rating for front crash prevention



meet *TOP SAFETY PICK* criteria

&

Advanced or Superior rating for front crash prevention

2016 IIHS TOP SAFETY PICK+

Minicar	Scion iA		Large luxury cars	Acura RLX	Lexus RC
Small cars	Acura ILX	Subaru Impreza	Audi A6 built after January 2015	Hyundai Genesis	Mercedes-Benz E-Class
	Lexus CT 200h	Subaru WRX			
	Mazda 3	Volkswagen Golf 4-door and SportWagen models			
	Subaru Crosstrek	Volkswagen GTI 4-door			
Midsize moderately priced cars	Chrysler 200	Subaru Outback	Small SUVs	Fiat 500X built after July 2015	Mitsubishi Outlander
	Honda Accord 2-door coupe	Toyota Camry		Honda CR-V	Subaru Forester
	Honda Accord 4-door sedan	Toyota Prius v		Hyundai Tucson	Toyota RAV4
	Mazda 6	Volkswagen Jetta		Mazda CX-5	
	Nissan Maxima	Volkswagen Passat	Midsize SUVs	Honda Pilot	Nissan Murano
	Subaru Legacy				
Midsize luxury/near luxury cars	Audi A3	Volvo S60	Midsize luxury SUVs	Acura MDX	Lexus NX
	BMW 2 series	Volvo V60		Acura RDX	Volvo XC60
	Lexus ES			Audi Q5	Volvo XC90
Large family car	Toyota Avalon				

2016 IIHS TOP SAFETY PICK

Small cars
Chevrolet Sonic
Kia Soul

Nissan Sentra
autobrake not tested

Midsize moderately priced car
Chevrolet Malibu Limited fleet model

Small SUVs
Buick Encore

Nissan Rogue
autobrake not tested

Midsize SUVs
Chevrolet Equinox
GMC Terrain

Kia Sorento

Midsize luxury SUV
Mercedes-Benz GLE-Class
autobrake not tested

Minivans
Honda Odyssey

Kia Sedona

Large pickup
Ford F-150 SuperCrew

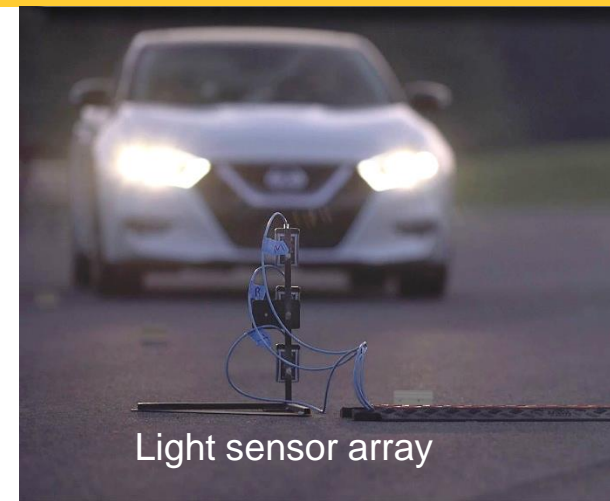
Advanced lighting testing and rating

Motivation for headlight evaluation program

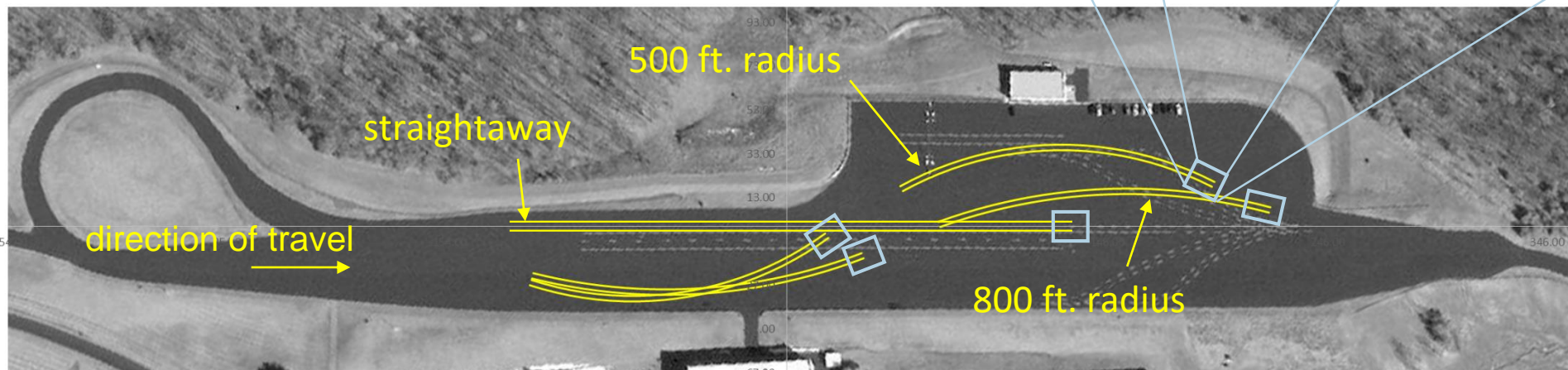
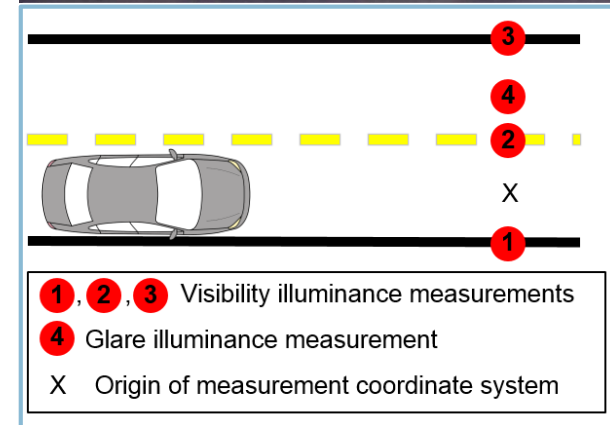
- ▶ 16,768 annual crash deaths in dark/dawn/dusk light conditions (2013 FARS)
- ▶ HLDI analyses point to benefits for curve-adaptive headlights (2012 HLDI analyses of Mazda, Acura, Mercedes, Volvo claims)
- ▶ Human factors experiments have established link between detection performance and improved lighting
- ▶ FMVSS 108 produces wide range of on-road visibility
 - Large variation in allowable intensity
 - Performance is not measured when installed, so factors like lamp height and spread are not captured
 - Aim is not regulated

Dynamic headlight test setup

- ▶ Vehicle approaches:
 - 500 ft. radius left and right curves at 40 mph
 - 800 ft. radius left and right curves at 50 mph
 - Straightaway at 40 mph
- ▶ Record illuminance readings for:
 - Visibility – edges of road at 10 in. above ground
 - Glare – center of oncoming lane (3 ft. 7 in.)

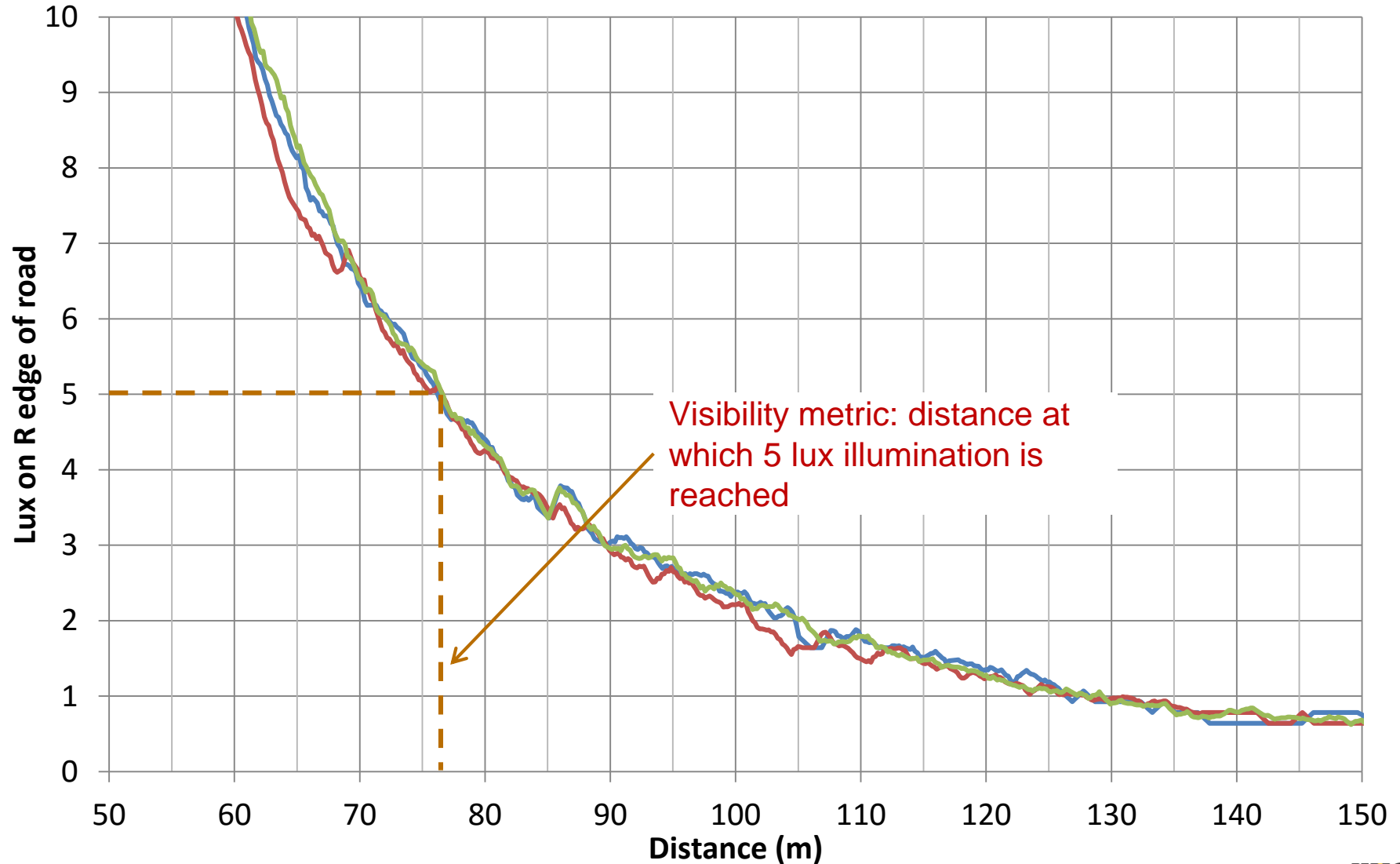


Light sensor array

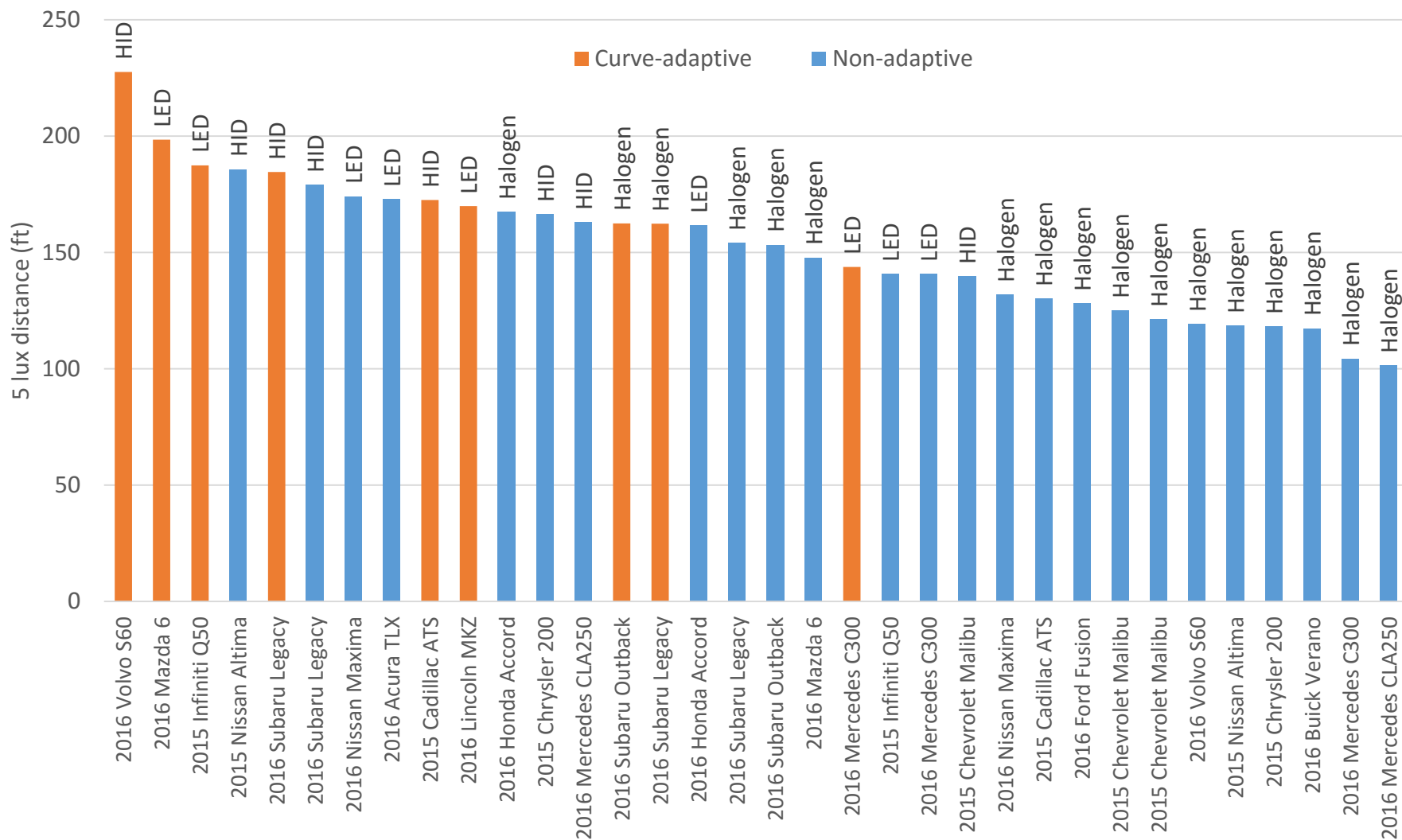


Sample data: straightaway

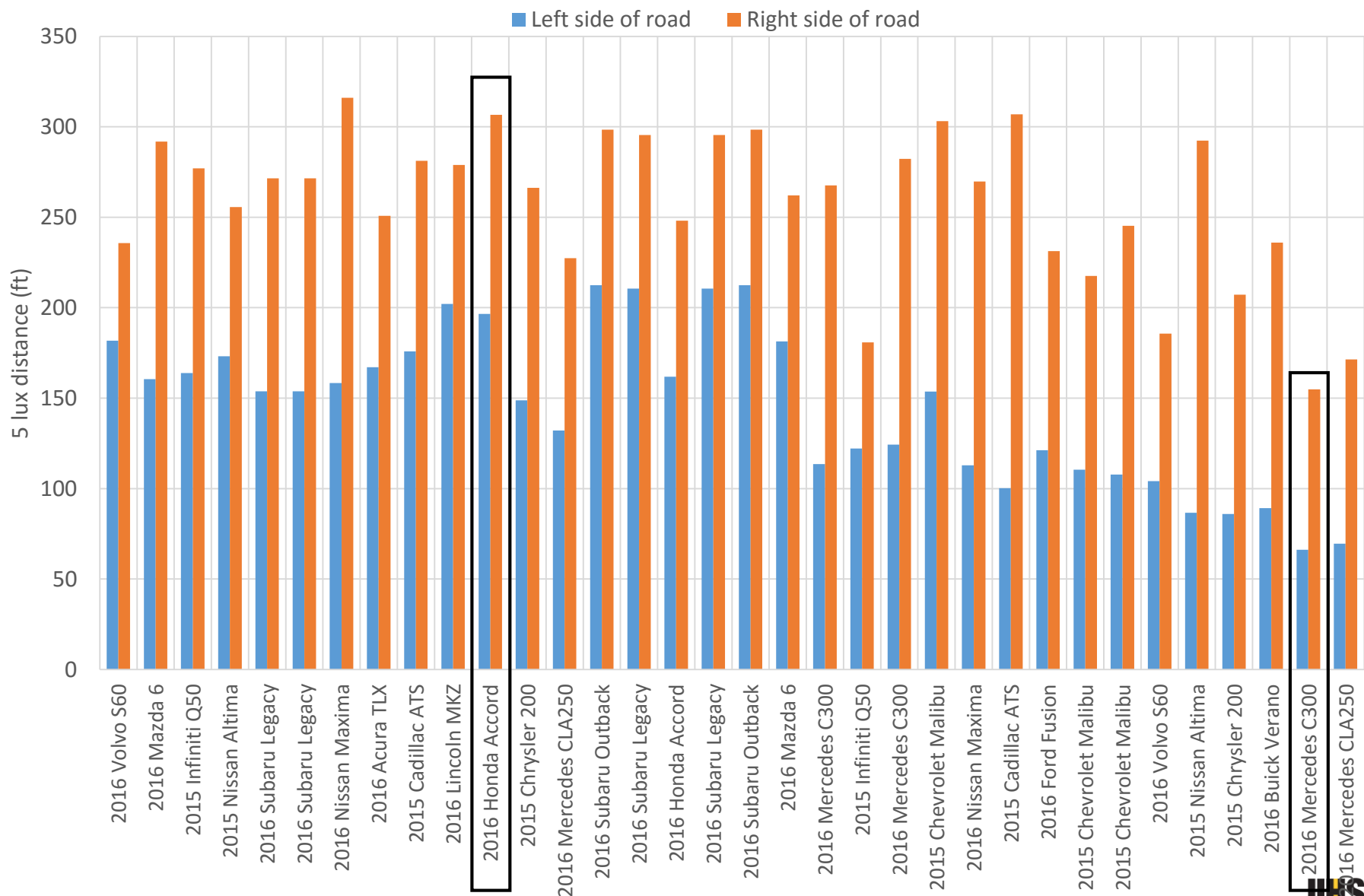
3 different approaches for same vehicle



Initial midsize car results: low beam 4 curve average



Initial midsize car results: low beam straightaway



Differences in headlight illumination

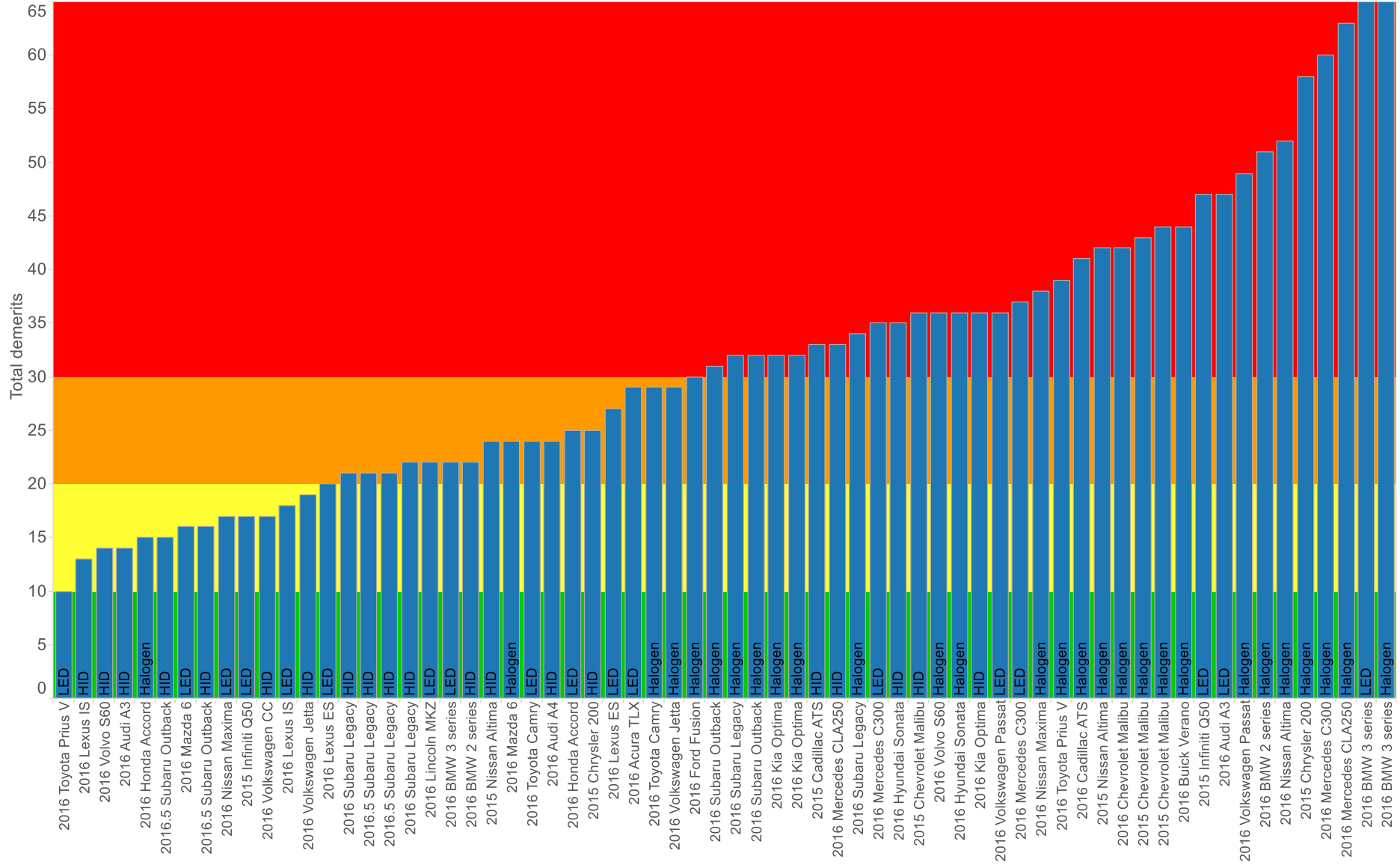
Deer is 270 feet from front of car; approximate reach of Accord's 5 lux



Translating test results to ratings

- ▶ Rating based on:
 - Straightaway and curve visibility (weighting roughly 60/40)
 - Low and high beams (weighting roughly 75/25)
 - Acceptable glare
- ▶ Bonus given for automatic high beams (“high beam assist”)
- ▶ Results of all tests are combined into an overall demerit score with rating boundaries applied

Midsized car results





Insurance Institute for Highway Safety
Highway Loss Data Institute

More information and links
to our YouTube channel
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