The Future of Driving

Assistive Technology; Autonomous Vehicles

A Presentation to the

Seattle Actuarial Society

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Introduction
Who I Am, What I Will Talk About

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Introduction
Who I Am, What I Will Talk About

- What is the Tech-Law Clinic and what do we do?
  - Made up of 2Ls and 3Ls and LLMs
  - Engage in long term studies where high technology and public policy converge.
  - In the past have studied issues surrounding Internet access in rural areas and use of alternative energy
  - This academic year looking at autonomous vehicles and state legislation; aim is to inform policy makers of what they might consider doing to prepare for this new technology

Introduction
Who I Am, What I Will Talk About

- **What I Will Talk About**
  - Autonomous vehicles
    - What they are
    - What will they do
    - When will they come on line
    - Legislation
  - Assistive features (touch on some but not all)
    - What they are
    - What they do
    - Who offers them for sale
    - Impact on safety
    - Adaption

Introduction
Who I Am, What I Will Talk About

- **Waiver of Liability**
  - **Much data has been provided to me by other sources**
  - **Glad to provide links to informational sources**
- **Major sources of information**
  - Insurance Institute for Highway Safety (Highway Loss Data Institute) independent, nonprofit scientific and educational organization; founded in 1959 (“IIHS” “HLDI”)
  - European Field Operational Test four year (2008-2012) comprehensive study of in-vehicle systems and assistive devices (“EU-FOT”)
  - United States Department of Transportation number of studies on assistive technology

Autonomous Vehicles
What are they?

Defined a robotic vehicle that is designed to travel between destinations without a human operator. There are various **levels of autonomy** but to qualify as **fully autonomous**, a vehicle must be able to navigate without human intervention to a predetermined destination over roads that have not been adapted for its use.

Fully autonomous vehicle

Vehicle with V2V capability

Google autonomous car

Autonomous Driving

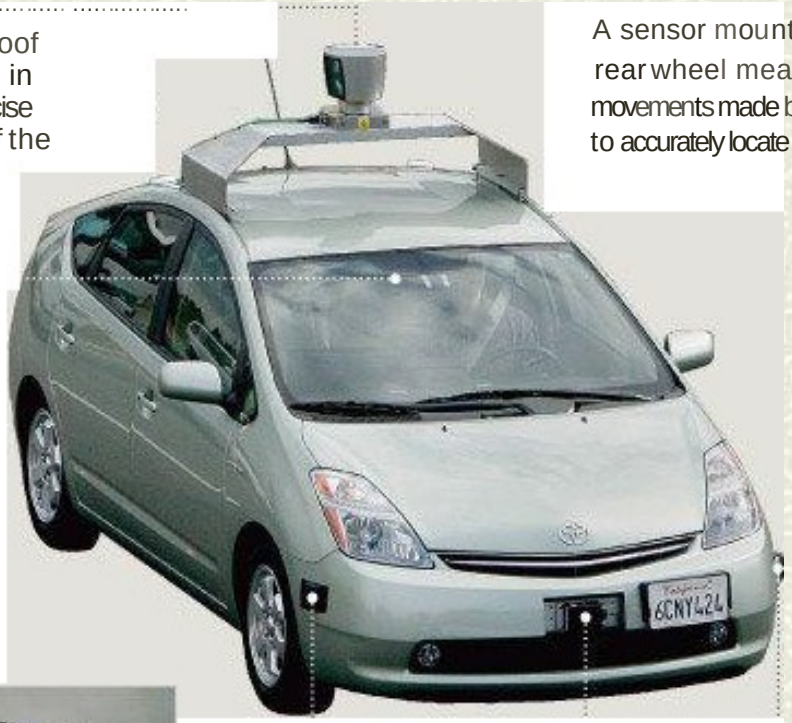
Google's modified Toyota Prius uses an array of sensors to navigate public roads without a human driver. Other components, not shown, include a GPS receiver and an inertial motion sensor.

LIDAR

A rotating sensor on the roof scans more than 200 feet in all directions to generate a precise three-dimensional map of the car's surroundings.

POSITION ESTIMATOR

A sensor mounted on the left rear wheel measures small movements made by the car and helps to accurately locate its position on the map.



VIDEO CAMERA

A camera mounted near the rear-view mirror detects traffic lights and helps the car's onboard computers recognize moving obstacles like pedestrians and cyclists.

RADAR

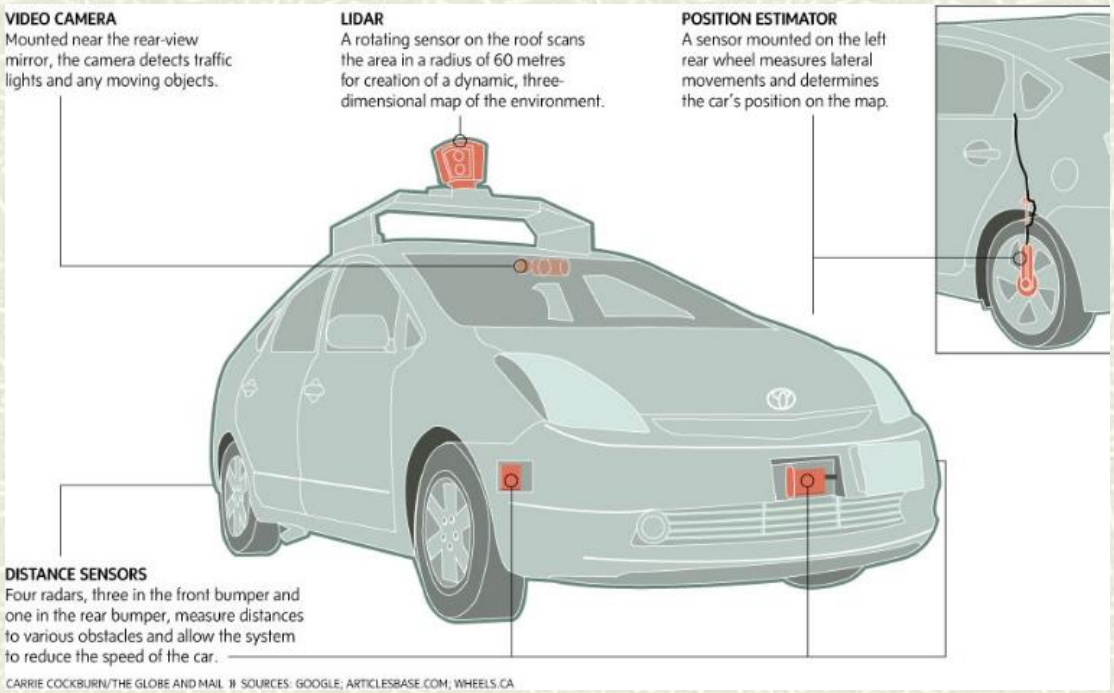
Four standard automotive radar sensors, three in front and one in the rear, help determine the positions of distant objects.

Source: Google

THE NEW YORK TIMES; PHOTOGRAPHS BY RAMIN RAHIMIAN FOR THE NEW YORK TIMES

Autonomous Vehicles
What are they?

- **Sensors on the Google Car**



Autonomous Vehicles
What are they?

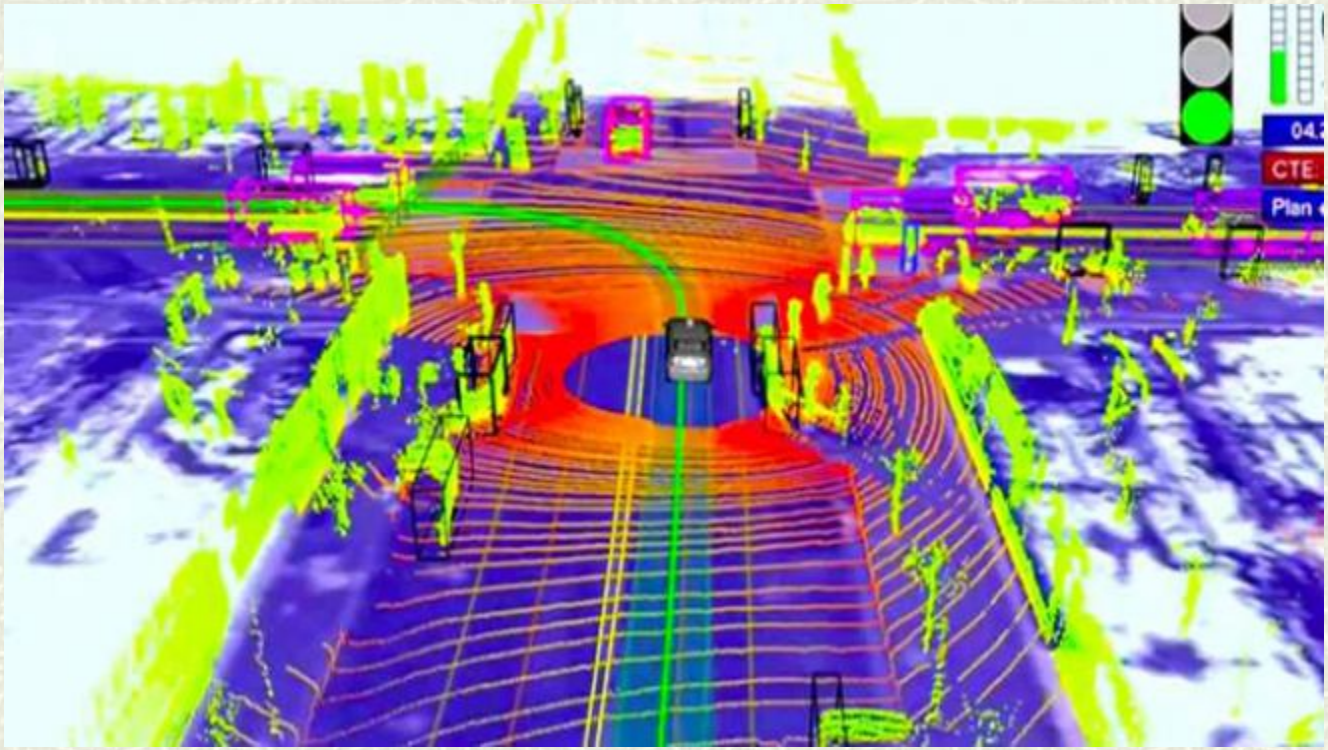
- **Example**-The Google Car
  - http://www.youtube.com/watch?v=cdgQpa1pUUE
- Autonomous vehicles sense their surroundings with such techniques as radar, lidar, GPS, and computer vision.
  - How the Google Car works
    - 1. The “driver” sets a destination. The car’s software calculates a route and starts the car on its way.
    - 2. A rotating, roof-mounted LIDAR (Light Detection and Ranging - a technology similar to radar) sensor monitors a 60-meter range around the car and creates a dynamic 3-D map of the car’s current environment.
    - 3. A sensor on the left rear wheel monitors sideways movement to detect the car’s position relative to the 3-D map.

Autonomous Vehicles
What are they?

- 4. Radar systems in the front and rear bumpers calculate distances to obstacles.
- 5. Artificial intelligence (AI) software in the car is connected to all the sensors and has input from Google Street View and video cameras inside the car.
- 6. The AI simulates human perceptual and decision-making processes and controls actions in driver-control systems such as steering and brakes.
- 7. The car's software consults Google Maps for advance notice of things like landmarks and traffic signs and lights.
- 8. An override function is available to allow a human to take control of the vehicle.

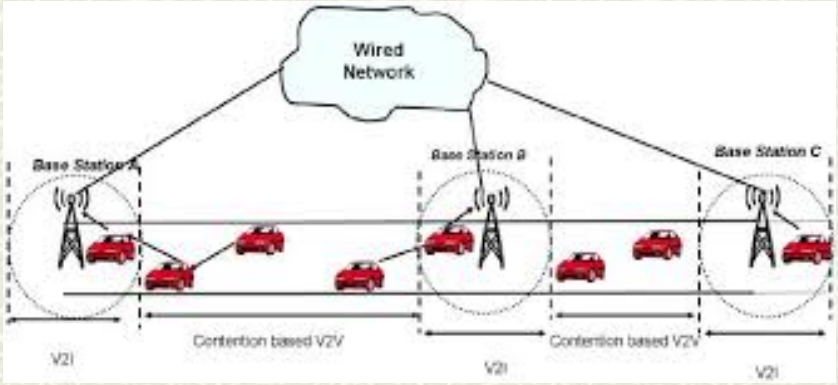
Autonomous Vehicles
What are they?

- **How the Google Car sees the world**



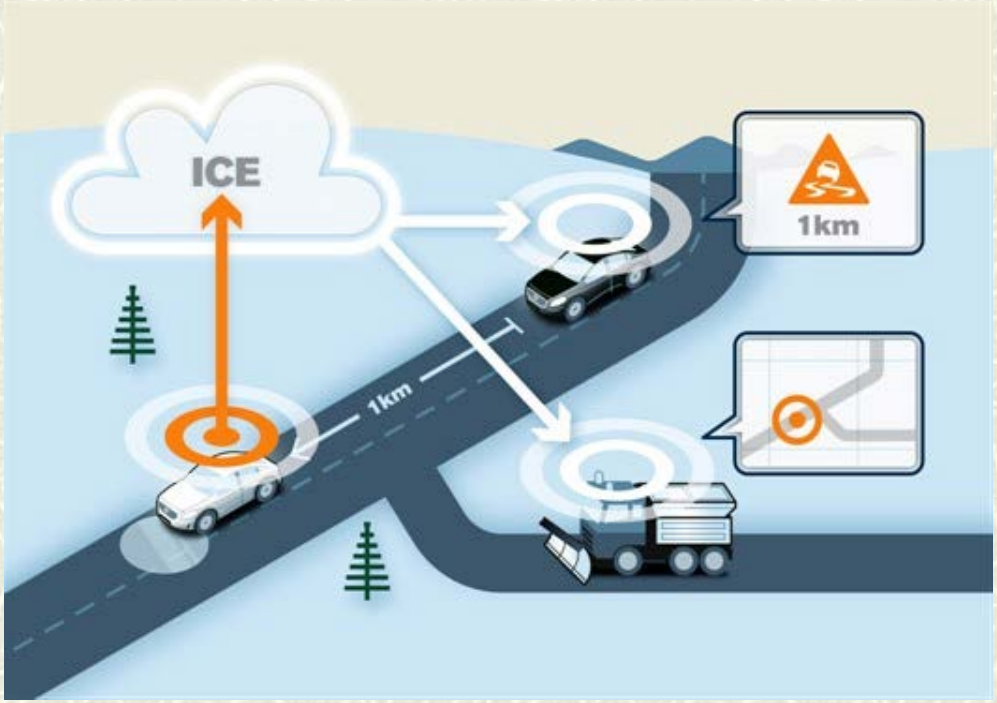
Autonomous Vehicles
What are they?

- **V2V Function** comprises a wireless network where automobiles send messages to each other with information about what they're doing. This data would include speed, location, direction of travel, braking, and loss of stability.
- **Smart Highway** one which lets information pass among vehicles and the infrastructure through wireless communications, information could include road conditions, collision warning and avoidance devices, guidance devices, electronic brakes, electronically controlled steering, and other sensors to supplement -- and ultimately, perhaps, replace -- human driving judgment.



Autonomous Vehicles
What are they?

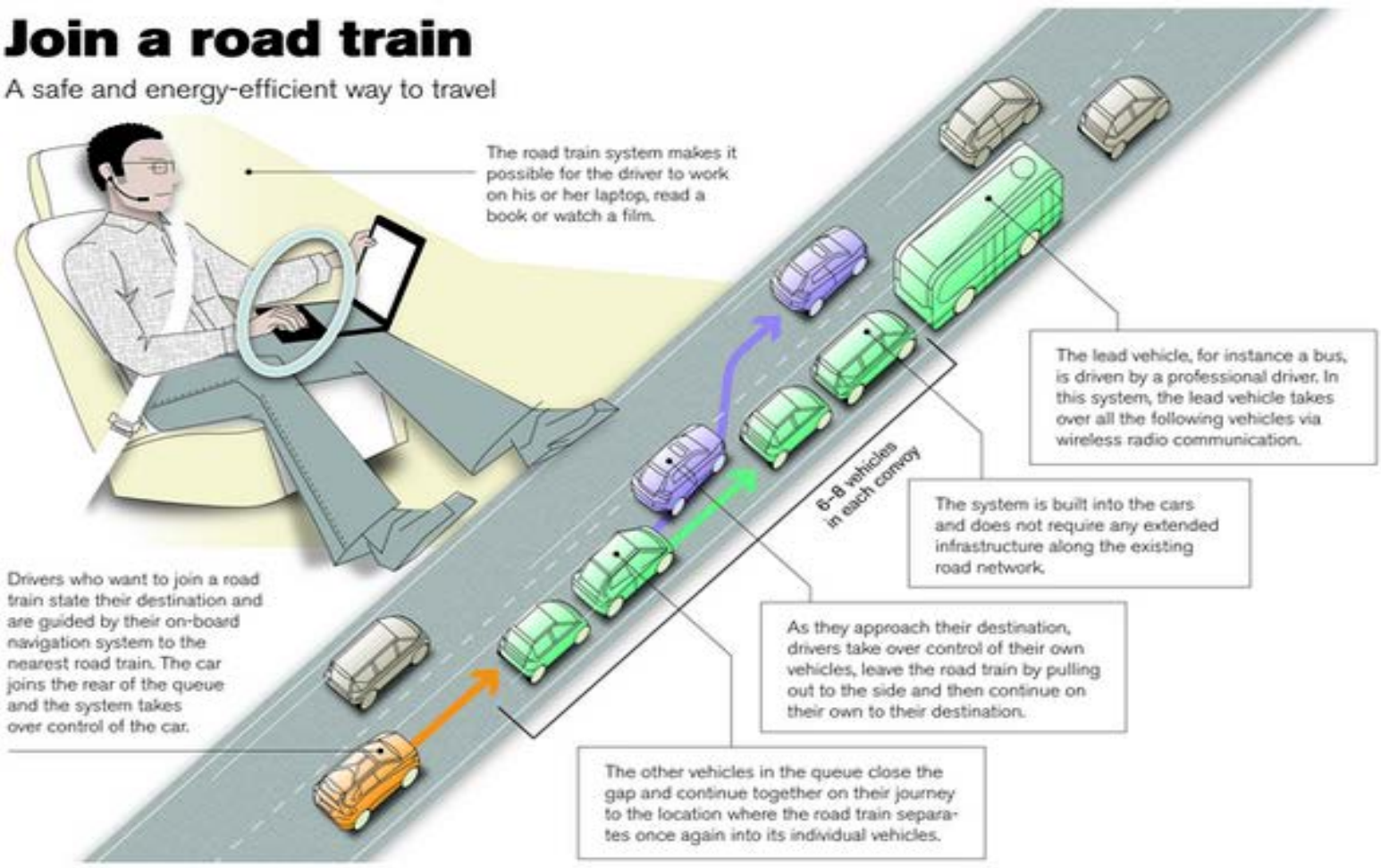
- **Cars which talk with each other and the road**



Autonomous Vehicles
What are they?

- **V2V allows "platooning"**
  - **Volvo** technology
    - All cars directed by driver in lead truck; each car is equipped with a small device (a WiFi router, essentially) and pass the directives from the box, through the car's CPU and to the throttle, brake and steering systems
    - Has potential to raise fuel efficiency by up to 20% and fit three times as many cars in a single lane.
      - **See: http://www.youtube.com/watch?v=9aB49ikYXDs**

Autonomous Vehicles
What are they?



Autonomous Vehicles
What are they?

- **Driverless commercial vehicles will be in use sooner than cars**

Autonomous Vehicles
Availability

- **Fully autonomous (Level 4) vehicles are not <u>generally</u> available at this time**
  - **Predictions**
    - **HIS Automotive** forecasts total worldwide sales of self-driving cars will grow from nearly 230,000 in 2025 to 11.8 million in 2035
      - There should be nearly 54 million self-driving cars in use globally by 2035.
      - Study anticipates that nearly all of the vehicles in use are likely to be self-driving cars or self-driving commercial vehicles sometime after 2050
      - See: http://press.ihs.com/press-release/automotive/self-driving-cars-moving-industrys-drivers-seat

Autonomous Vehicles
Availability

- **Victoria Transport Policy Institute**
  - Benefits, such as independent mobility for affluent non-drivers, may begin in the 2020s or 2030s
  - Most impacts, including reduced traffic and parking congestion, and independent mobility for low-income people increased safety, energy conservation and pollution reductions, will only be significant when autonomous vehicles become common and affordable, probably in the 2040s through 2060s, and some benefits may require prohibiting human-driven vehicles on certain roadways, which could take even longer.
  - See: http://orfe.princeton.edu/~alaink/SmartDrivingCars/Reports&Speaches_External/Litman_AutonomousVehicleImplementationPredictions.pdf

Autonomous Vehicles
Availability

- **Nissan**
  - Nissan Motor Co. pledges that we will be ready to bring multiple affordable, energy efficient, fully autonomous-driving vehicles to the market by 2020," said executive vice-president Andy Palmer
    - See: http://www.ihs.com/products/Global-Insight/industry-economic-report.aspx?ID=1065982466
- **Volvo**
  - Plans to have limited number of self driving cars available in Sweden by 2017 “Drive Me” Project
    - See: http://www.digitaltrends.com/cars/volvo-put-100-self-driving-cars-swedish-roads-pilot-project/#!ABsSH

Autonomous Vehicles
Availability

- **However** Navia shuttle which can carry up to 8 passengers launched in 2014 (See: http://mashable.com/2014/01/06/navia-driverless-shuttle/)
  - Most likely be used at airports, college campuses, theme parks or sports arenas to eliminate pollution and congestion, rather than for home use.
  - Costs about $250,000

Autonomous Vehicles
Legislation

- **Problem**-Is it legal to operate autonomous vehicles on public roadways?
  - "Computer direction of a motor vehicle's steering, braking, and accelerating without real-time human input is probably legal." Bryant Walker Smith; author "Automated Vehicles are Probably Legal in the United States"
    - See: http://cyberlaw.stanford.edu/publications/automated-vehicles-are-probably-legal-united-states
- **States with legislation governing autonomous vehicles:**
  - California, Florida, Michigan, Nevada and the District of Columbia
- **States which have or are considering such legislation:**
  - Colorado, Georgia, Louisiana, Massachusetts, Oregon, Maryland, Massachusetts, Maryland, Minnesota, New Jersey, New York, South Carolina, South Dakota, Washington and Wisconsin

Autonomous Vehicles
Legislation

- **Common features of state legislation**
  - Defines “autonomous vehicle;”
  - Department of Motor Vehicles (DMV) directed to develop full range of regulations by fixed date;
  - Manufacturer or representative allowed to operate vehicle on public roads;
  - Must always have driver in vehicle
  - Must post $5m bond;
  - Vehicle must include mechanism to disengage autonomous operation and allow immediate driver takeover

Autonomous Vehicles
Liability

- Liability issues are complex, unsettled and include:
  - Responsibility for crashes
    - Vehicle designer or manufacturer? Software designer or manufacturer? Vehicle operator? Passenger who might have been able to take over vehicle operation? Jurisdiction which granted license to operate vehicle?
  - Software and other updates
    - Will they be necessary? Should their use be required? Who should be responsible for their availability and installation?
  - Inclement weather
    - Who is responsible for system failure or inability to function during a severe storm or natural disaster?

Autonomous Vehicles
Liability

- Liability issues are complex, unsettled and include:
  - V2V or smart highway communications
    - Who should be liable for a failure to receive and/or act on essential information transmitted from another vehicle or a stationary post?
- Expect either the courts, legislative bodies or perhaps insurers to address these issues

Autonomous Vehicles
Benefits

- **What we'll get from driverless cars**
  - Fewer traffic fatalities-90% of all accidents are caused by human error (usually distraction)
  - More efficient use of roadways-can travel in much closer formation than regular vehicles
  - Save fuel-travel in close formation creates "drag" which benefits following cars
  - More mobility for the elderly and disabled
  - Less traffic tickets

Autonomous Vehicles
Benefits

- Car 2 Go, Zipcar etc. shall benefit- cars could come to customer, pick them up, drop them off and then return to their holding area
- No more teenage drivers borrowing our cars for who knows what purpose
- More free time-once technology is truly perfected travel time can be put to use working or relaxing

- **Questions**

The Future of Driving

Assistive Technology; Autonomous Vehicles

Supplement

Assistive Technologies

Assistive Functions
What are they?

- **Defined**
  - Devices in vehicles which allow the driver to forego a certain driving task or tasks for a period of time ranging from seconds to the entire trip

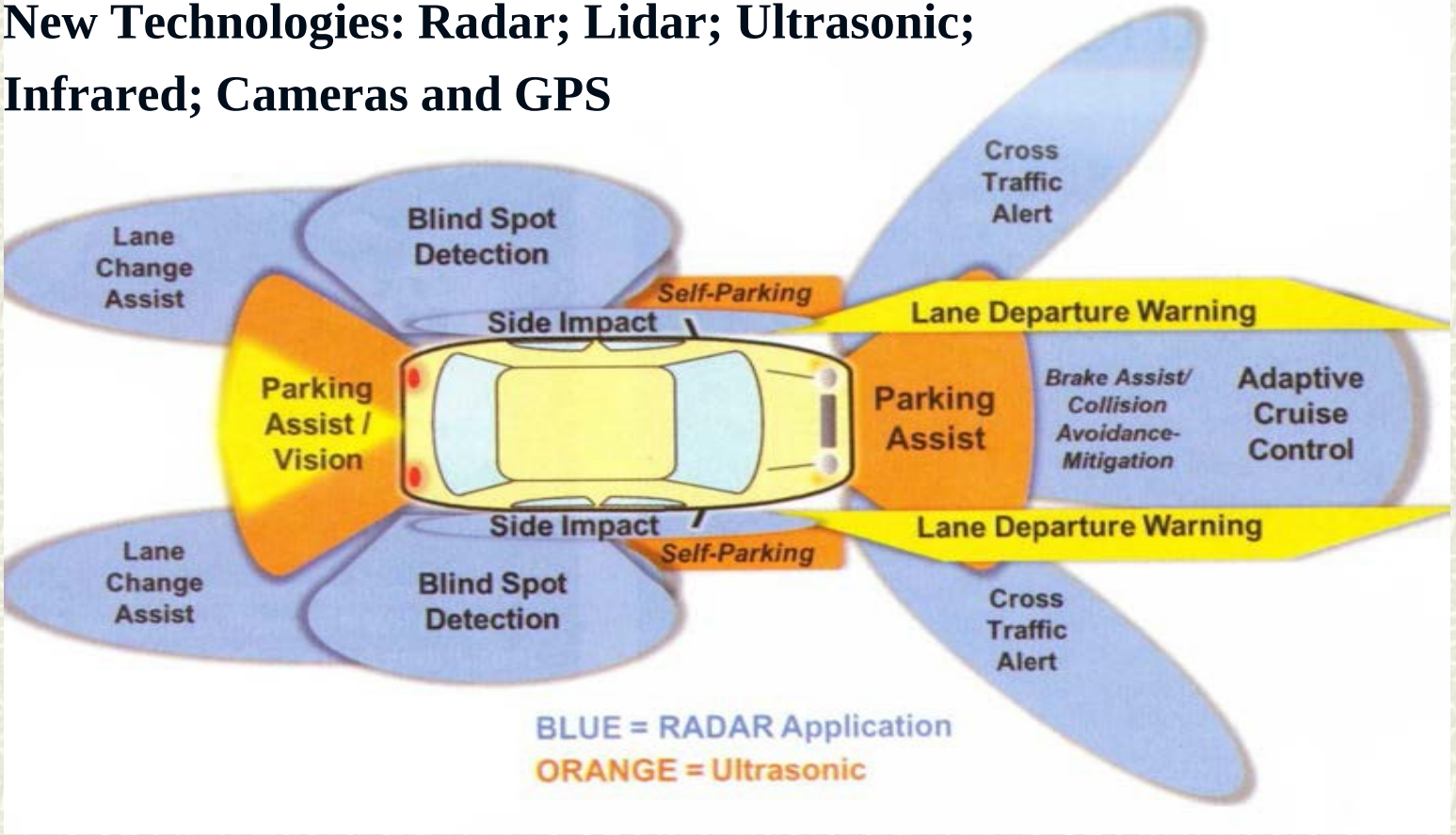
Assistive Functions
What are they?

Level of Automation	Automation	Examples of Technology	Hands/Feet/Eyes?
Level 0	None	None	H&F: Both Required E: Required
Level 1	Individual controls are automated	Adaptive cruise control Electronic stability control Dynamic brake support	H&F: Only 1 Required E: Required
Level 2	Two or more controls automated in unison	Adaptive cruise control combined with lane departure warning	H&F: Neither Required E: Required
Level 3	Driver may cede all control over vehicle for limited time	Automation for short periods of time (Volvo's City Safety)	H&F: Neither Required E: Not Required (short)
Level 4	Fully Self-Driving	Automation for entire trips With or without driver	H&F: Neither Required E: Not Required (long)

Assistive Functions

What are they?

New Technologies: Radar; Lidar; Ultrasonic; Infrared; Cameras and GPS

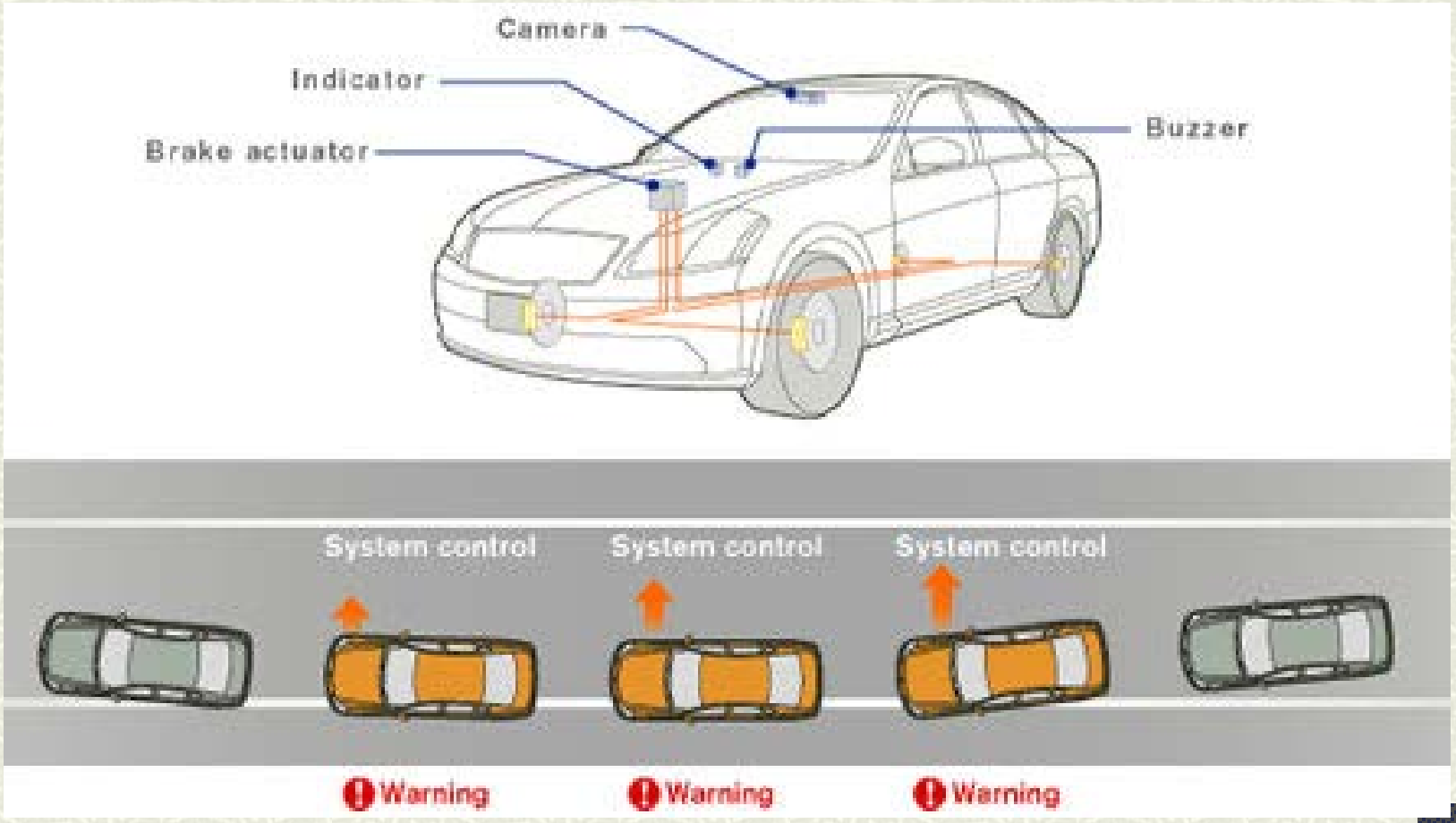


Assistive Functions
What are they?

- **Lane Departure Warning** is a mechanism designed to warn a driver when the vehicle begins to move out of its lane (unless a turn signal is on in that direction) on freeways and arterial roads**.**
  - **Two types**
    - Lane Departure Warning-systems which warn driver if vehicle is leaving its lane (visual, audible or vibration warnings)
    - Lane Keeping Systems-warn driver and if no action taken automatically takes steps to keep vehicle in its lane
  - Employs video sensors, laser sensors and infrared sensors

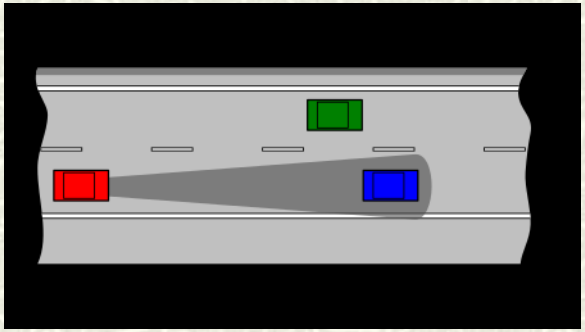
Assistive Functions

What are they?



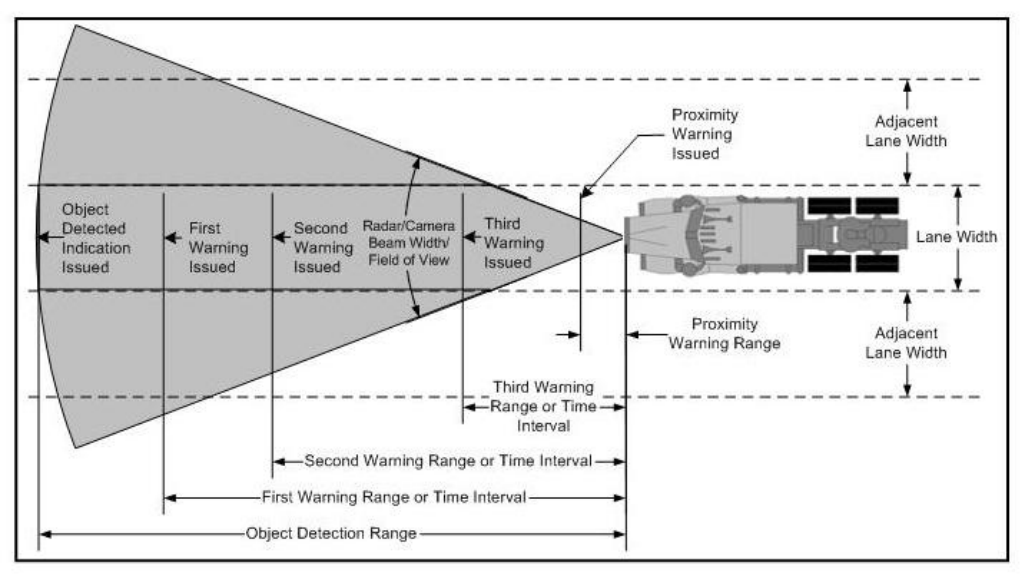
Assistive Functions
What are they?

- **Autonomous Cruise Control (**also called adaptive or radar cruise control)
  - Automatically adjusts vehicle speed to maintain safe distance from vehicles ahead
  - Uses on board sensors being lasers, radar or a combination thereof (may not function as effectively in inclement conditions)
  - **Stop and Go function** car can come to full halt (if preceding car stops) and then start again without driver involvement



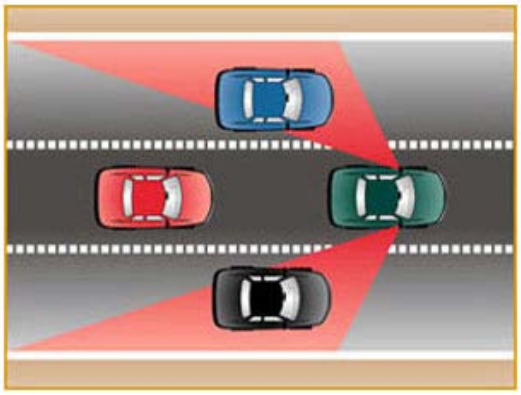
Assistive Functions
What are they?

- **Forward collision warning** uses radar and sometimes laser and camera sensors to detect an imminent crash. Once the detection is done, these systems either provide a **warning** to the driver when there is an imminent collision or **take action autonomously** without any driver input (by braking or steering or both)



Assistive Functions
What are they?

- **Blind spot detection** vehicle-based sensor device that detects other vehicles located to the driver's side and rear. Warnings can be visual, audible, vibrating or tactile
  - Normally uses some kind of electronic detection device(s) mounted on the sides of the car (often in the vicinity of the external rear view mirrors or near the rear bumpers) that sends out either electromagnetic (radar) waves or takes computer-processed images with a digital camera and analvzes them

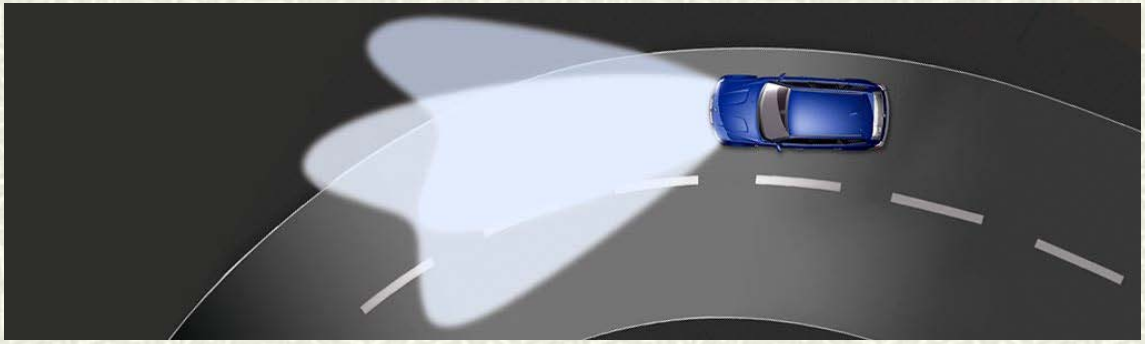


Assistive Functions
What are they?

- **City Safety (Volvo)** is an auto brake technology that assists in reducing or avoiding traffic accidents at speeds up to 19 mph
  - It uses laser sensors that monitor an area approximately 20 feet directly in front of the vehicle. The feature is programmed to respond if the car in front is either at a standstill or is moving more slowly in the same direction as the car itself.
  - If City Safety determines a collision is unavoidable and the driver does not respond, it activates the vehicle's brakes and switches off the throttle.

Assistive Functions
What are they?

- **Adaptive headlights** react to the steering, speed and elevation of the car and automatically adjust to illuminate the road ahead. When the car turns right, the headlights angle to the right.
  - A car with adaptive headlights uses **electronic sensors** to detect the speed of the car, how far the driver has turned the steering wheel, and the yaw of the car.



Assistive Functions
Availability

- **Source-IIHS**

Function	2008	2013
Lane departure warning	6	20
Forward collision warning	8	27
Blind spot notification	6	29
Adaptive headlights	16	23

Assistive Functions
Availability

- **Lane departure warning can be found in cars made by:**
  - Audi Lane assist warns driver through vibration of steering wheel if leaving marked lane.
  - BMW same as above
  - Cadillac (XTS and ATS models)
    - Sends vibrating alert to driver' seat
  - Ford (includes Fusion)
    - Warns driver if drifting out of lane through a tone and flashing light
  - Honda (includes Accord)
    - Warns driver if drifting out of lane through audible and visible alerts
  - Lexus gives audible warning if drifting out of lane and if cruise control activated will take corrective action
  - Toyota offers lane departure warning and when cruise control activated can keep car on course through automatic counter steering

Assistive Functions
Availability

- **Autonomous Cruise Control can be found in cars made by:**
  - Audi (A3, A6-8, Q5 and Q7) stop and go feature is available
  - BMW (3 series and 5 series) stop and go feature is available
  - Cadillac (ATS, XTS and SRX)
  - Chevrolet (Impala)
  - Ford (Explorer and Taurus-does not function under 20 mph)
  - Honda (Accord)
  - Lexus (GS hybrid)
  - Volvo (V40, S60 and S80)

Assistive Functions
Availability

- **Forward Collision Warning can be found in cars made by:**
  - Audi warning, followed by light braking, de-acceleration and if necessary full braking
  - Ford (Lincoln and Taurus) visual warning followed by pre-charging brakes
  - Honda
  - Mercedes (S-Class) warning, tighten seat belts, raise headrests, closes open windows, partial braking
  - Nissan
  - Toyota warning, tightens seat belts, pre-charging of brakes
  - Volkswagen warning, tightens seat belts, closes windows
  - Volvo visual warning, pre-charging of brakes, actual use of brakes

Assistive Functions
Availability

- **Blind Spot Detection can be found in cars made by:**
  - Audi blinking light provides evidence of potential threat
  - BMW (5 Series) light illuminates on wing mirror.
  - Cadillac (ATS and XTS) warning flashes if driver activates turn signals
  - Ford red light illuminates on mirror; beeping noise
  - Honda warning light activated
  - Mercedes warning light activated; alert sounds if lane change attempted
  - Toyota warning light activated on wing mirror
  - Volvo warning light activated
- **City Safety System is only found in Volvos**
- **Adaptive Headlights can be found in cars made by:**
  - Acura, Audi,, BMW, Cadillac, Infiniti, Jaguar, Jeep, Land Rover, Lexus, Lincoln, Mercedes-Benz, Porsche, Volkswagen and Volvo.

Assistive Functions
Considerations

- **Success of assistive functions depends on answer to five questions**
  - 1. What is the size and nature of the crash problem being addressed?
  - 2. Is the present technology capable of addressing the problem?
  - 3. Will drivers use and accept the technology?
  - 4. What kind of information will elicit right responses from drivers?
  - 5. How will driver behavior change in response to technology?

Assistive Functions
Considerations

- **IIHS May 2010-**Current crash avoidance features could prevent or mitigate about 1 of every 3 fatal crashes and 1 of every 5 serious or moderate injury crashes involving passenger vehicles.
  - As many as 1.9 million crashes could be prevented or mitigated each year. This is the Institute's latest estimate of the safety potential of equipping all passenger vehicles with 4 crash avoidance features already on the market.
  - Features-Lane Departure Warning; *2)* Forward Collision Warning: *3)* Blind spot detection and *4)* Adaptive headlights
  - See http://www.iihs.org/externaldata/srdata/docs/sr4505.pdf#page=4

Assistive Functions
Effectiveness-General

- **Annual Crashes Potentially Prevented or Mitigated Based on 2004-08** Source-IIHS

	All	Injury	Fatal
Forward collision warning	**1,165,000**	**66,000**	**879**
Lane departure warning	**179,000**	**37,000**	**7,529**
Blind spot notification	**395,000**	**20,000**	**393**
Adaptive headlights	**142,000**	**29,000**	**2,484**
TOTAL UNIQUE CRASHES	**1,866,000**	**149,000**	**10,238**
PERCENT OF CRASHES	**32%**	**21%**	**31%**

Assistive Functions
Effectiveness-Lane Departure Warning

- **Bad news from IIHS**
  - Lane departure warning systems seem ineffective; vehicles with the systems showed increased, not decreased, crashes in a study being released by the IIHS
  - The unexpected finding that lane-departure setups increased crashes as much as 10% is inexplicable, IIHS says.
    - David Zuby, chief research officer at IIHS, speculates that users might find the warning sounds or vibration alerts used by lane departure systems annoying and shut them off. Or the alarms are too frequent as drivers stray slightly side to side in normal diving, and so are ignored.

Assistive Functions
Effectiveness-Lane Departure Warning

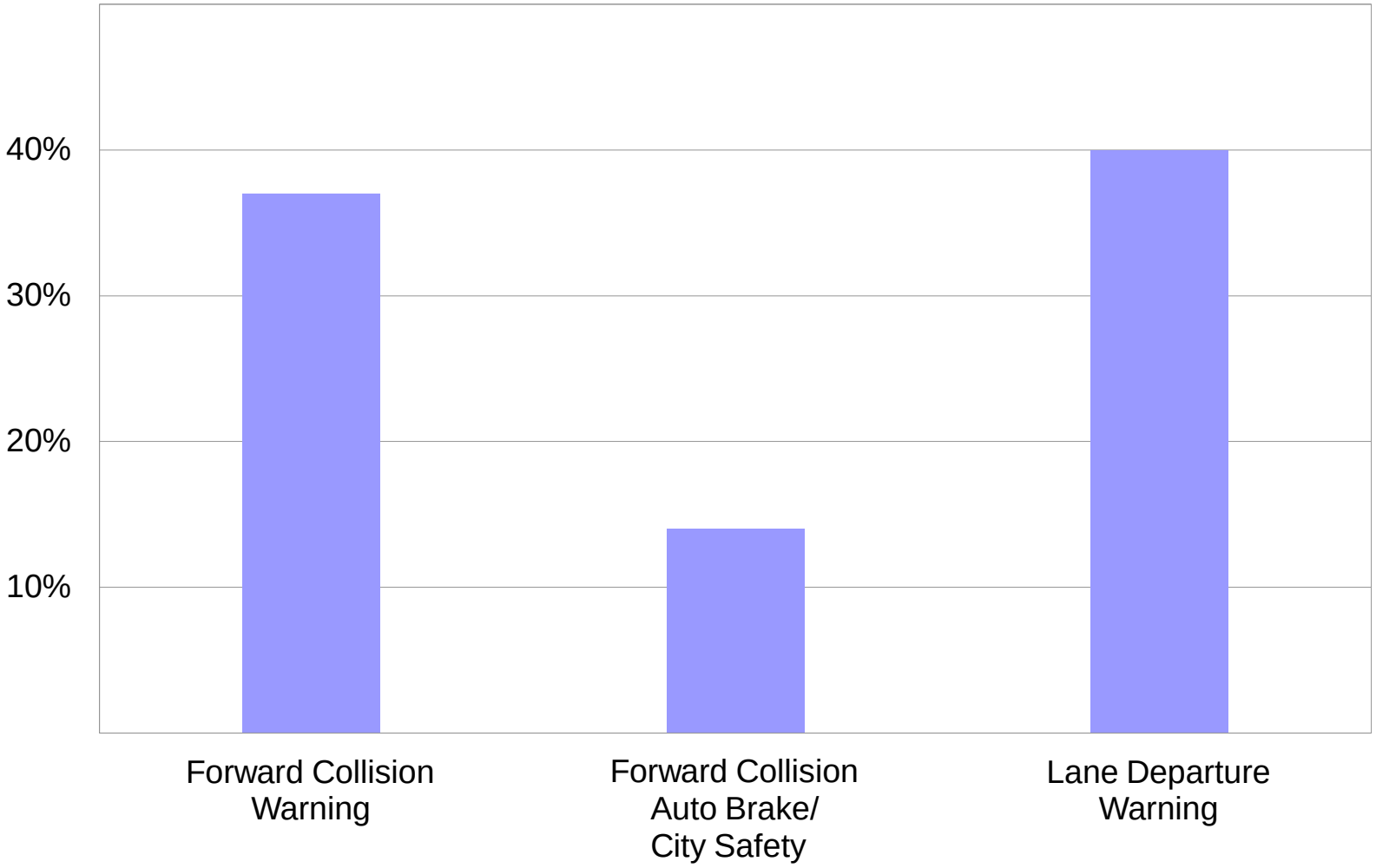
- **Bad news from IIHS**
  - The result also could be a statistical quirk, because few cars in the study had the safety feature
  - See: http://content.usatoday.com/communities/driveon/post/2012/07/more-crashes-safety-systems-high-tech-high-price-buick-mercedes-/1#.UyhtMYV8B8E

Assistive Functions
Effectiveness-Lane Departure Warning

- **However**
  - **United States Department of Transportation "Onboard Safety Systems Effectiveness Evaluation Final Report-10/2013"**
    - "The LDW system effectiveness analysis resulted in a statistically significant finding whereby trucks without LDW systems had a LDW-related crash rate (per Million Vehicle Miles Traveled) 1.917 times higher than trucks with such a system;

Percent of owners who drive with crash avoidance systems on (LDW)

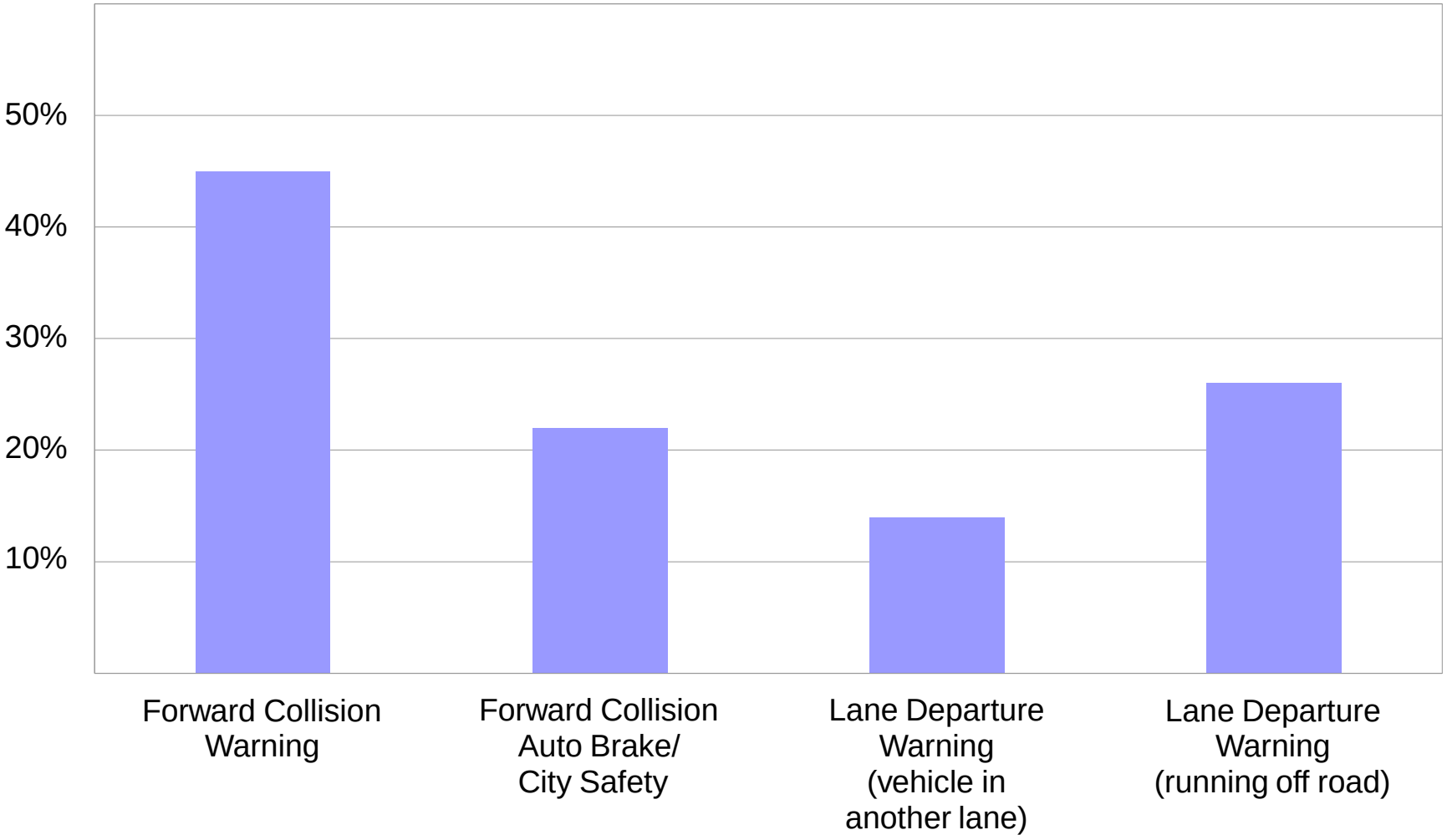
Percent of owners who report activations perceived as false or unnecessary (LDW)



Experiences with warnings (LDW)

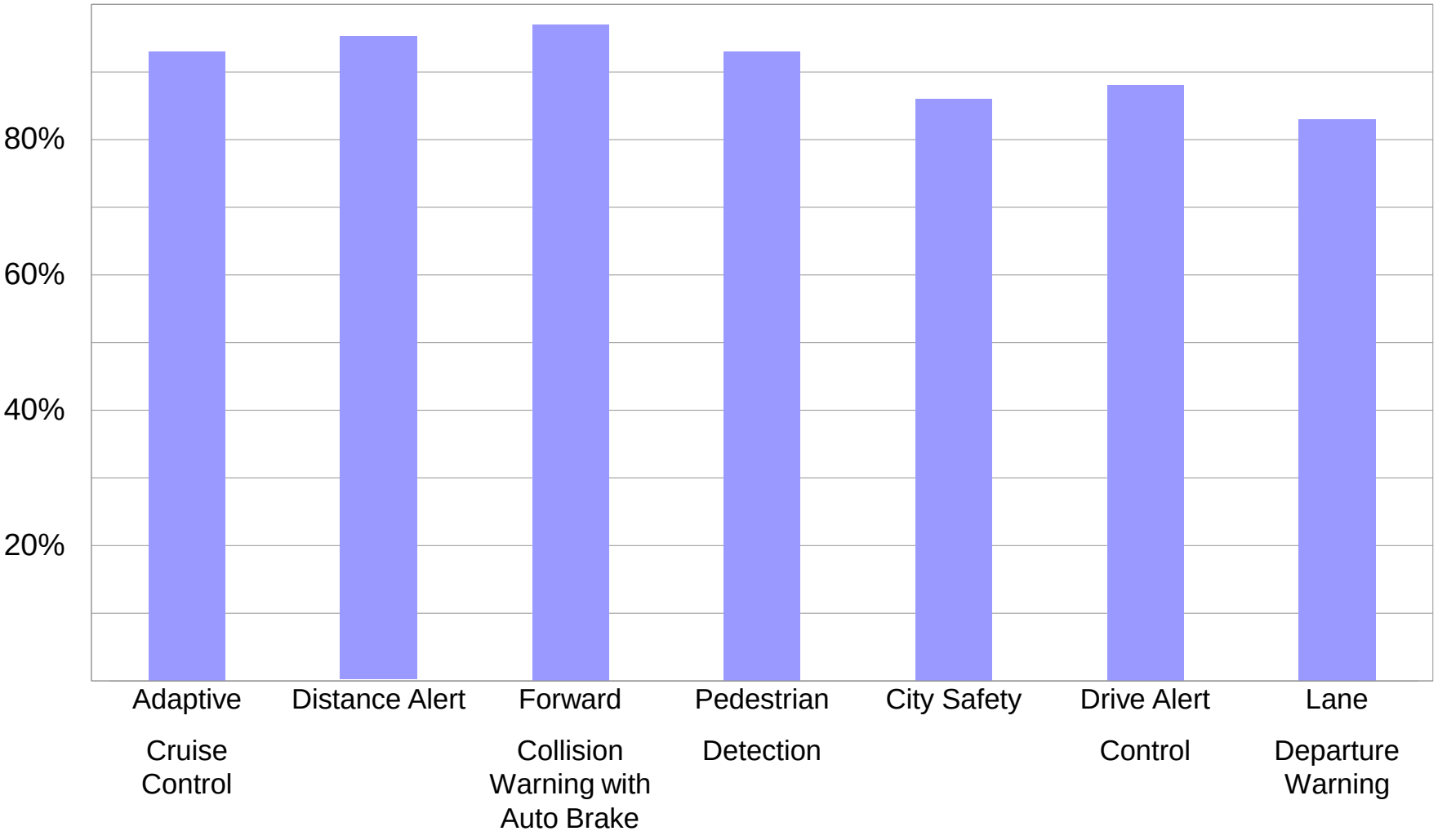
Percent of owners who find warning….	Forward Collision Warning buzzer	Forward Collision Warning flashing light	Lane Departure Warning chime
useful	97	98	96
annoying	24	10	33

Percent of owners who believe systems helped prevent a crash (LDW)



Percent of owners who want system on next vehicle

Among all owners with the system (LDW)



Assistive Functions
Effectiveness-Autonomous Cruise Control

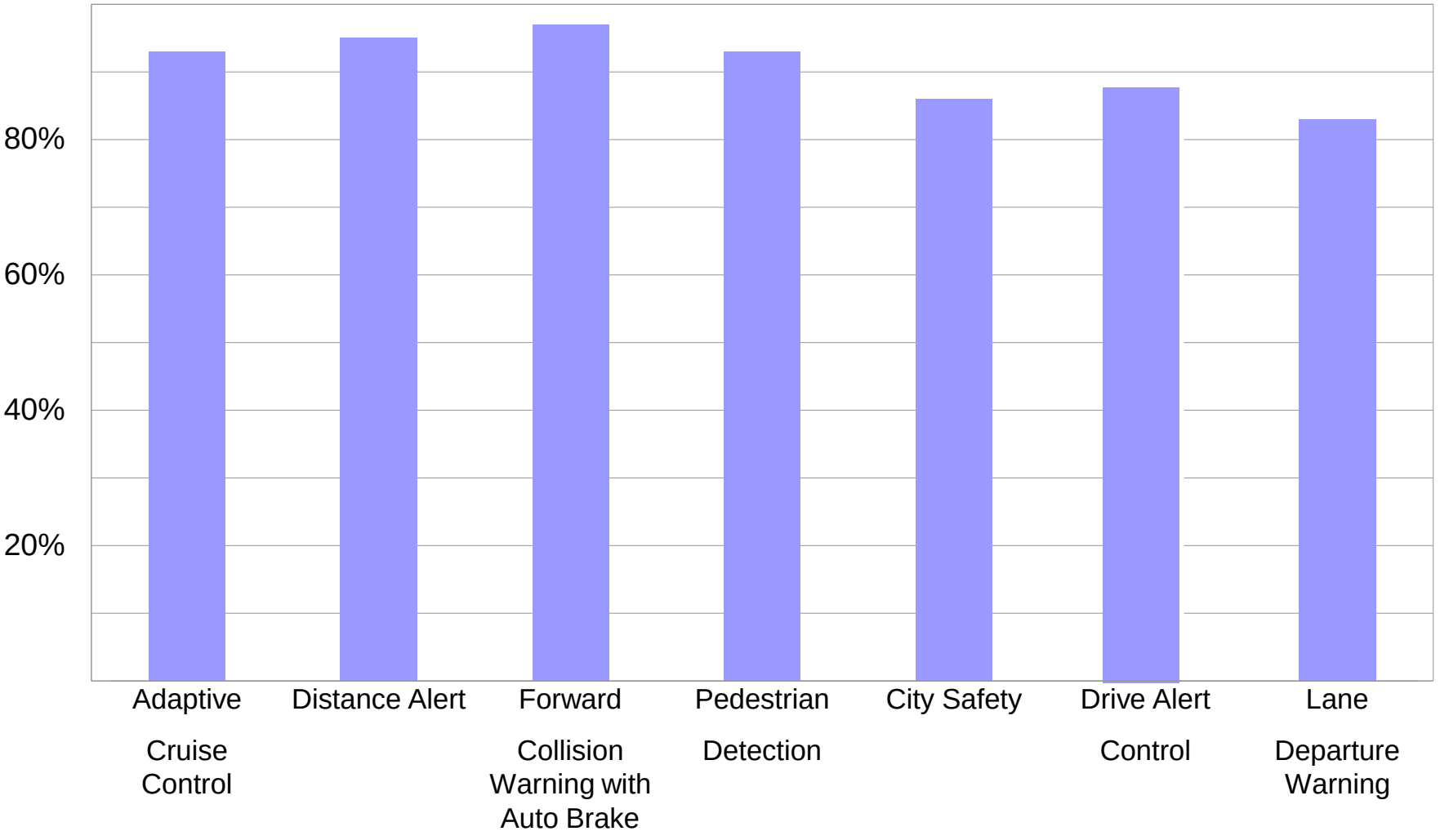
- **Source-European Field Operational Test** See: http://www.eurofot-ip.eu/
  - An ACC system can help reduce the likelihood of a collision with the vehicle in front, since the system can apply the brakes more quickly than a driver can react.
  - A car with ACC control and collision warning, cuts the risk of colliding with the vehicle in front on an expressway by up to 42%.
  - ACC was used on expressways for more than 51% of the total distance covered –80% of drivers feel progress on the road is more comfortable and convenient.
  - 94% feel safer with the ACC system activated.

Assistive Functions
Effectiveness-Autonomous Cruise Control

- …accident prevention systems are appreciated as long as they are adjusted in a way which corresponds to the practical situation. It is particularly important to avoid “excessive signals” with a correct adjustment.
- People learned to use it quickly, and its great appeal caused it to be heavily utilized. ACC usage definitely serves to lengthen typical headway clearances and even cultivates a less aggressive driving style in many persons.

Percent of owners who want system on next vehicle

Among all owners with the system (ACC)

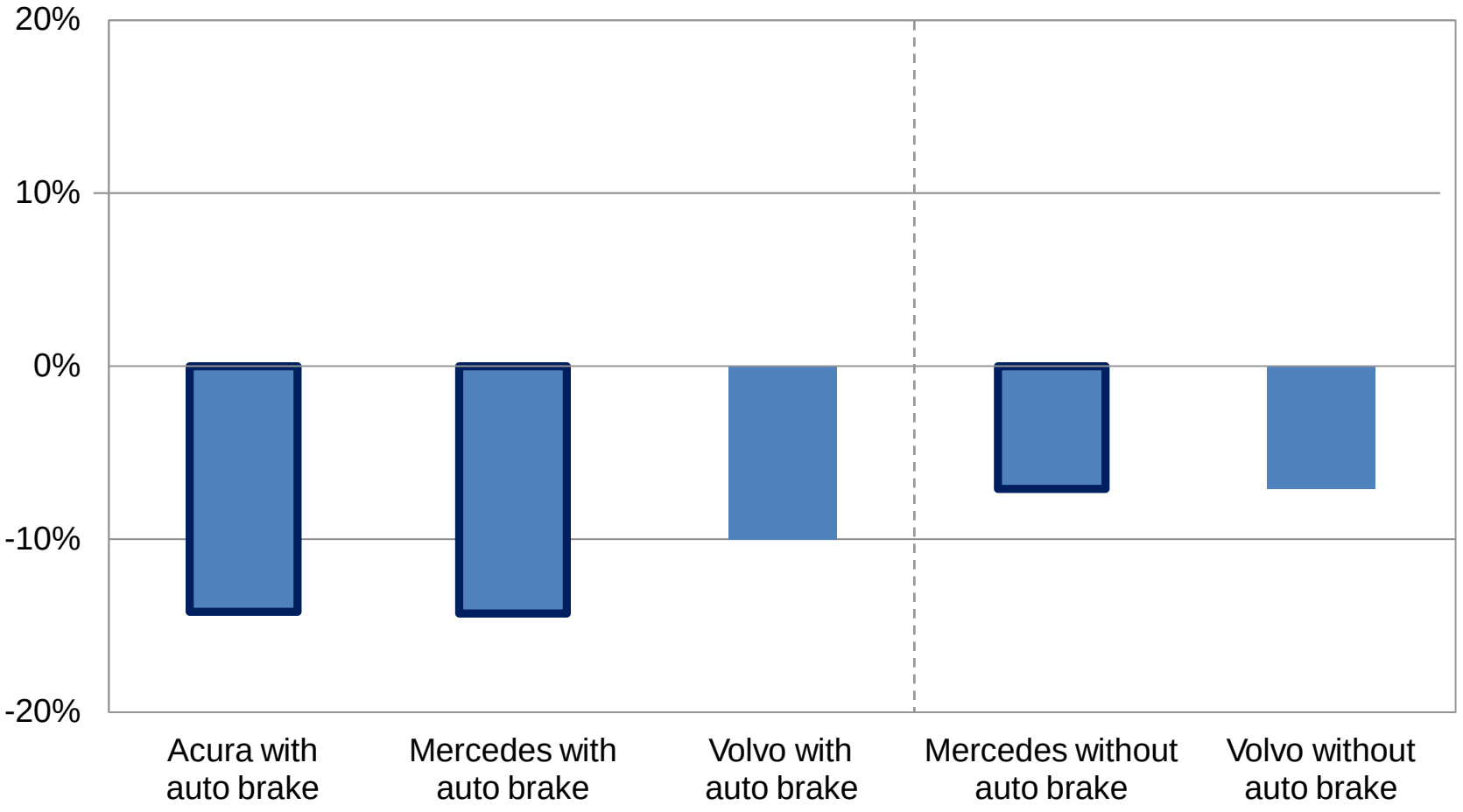


Assistive Functions
Effectiveness-Forward Collision Warning

- **US Department of Transportation Report**
  - Drivers expressed a number of benefits with FCW systems, such as improved following distance . Drivers also stated the FCW helped alert them to their fatigue.
  - The FCW systems aided drivers in conditions where visibility was poor, such as heavy rain, fog, or poor lighting
  - This included detecting inconspicuous vehicles without lights and vehicles parked on the shoulder of the road
- **IIHS Study**
  - Forward collision prevention systems appear to work; cues are effective
  - Autonomous braking improves effectiveness

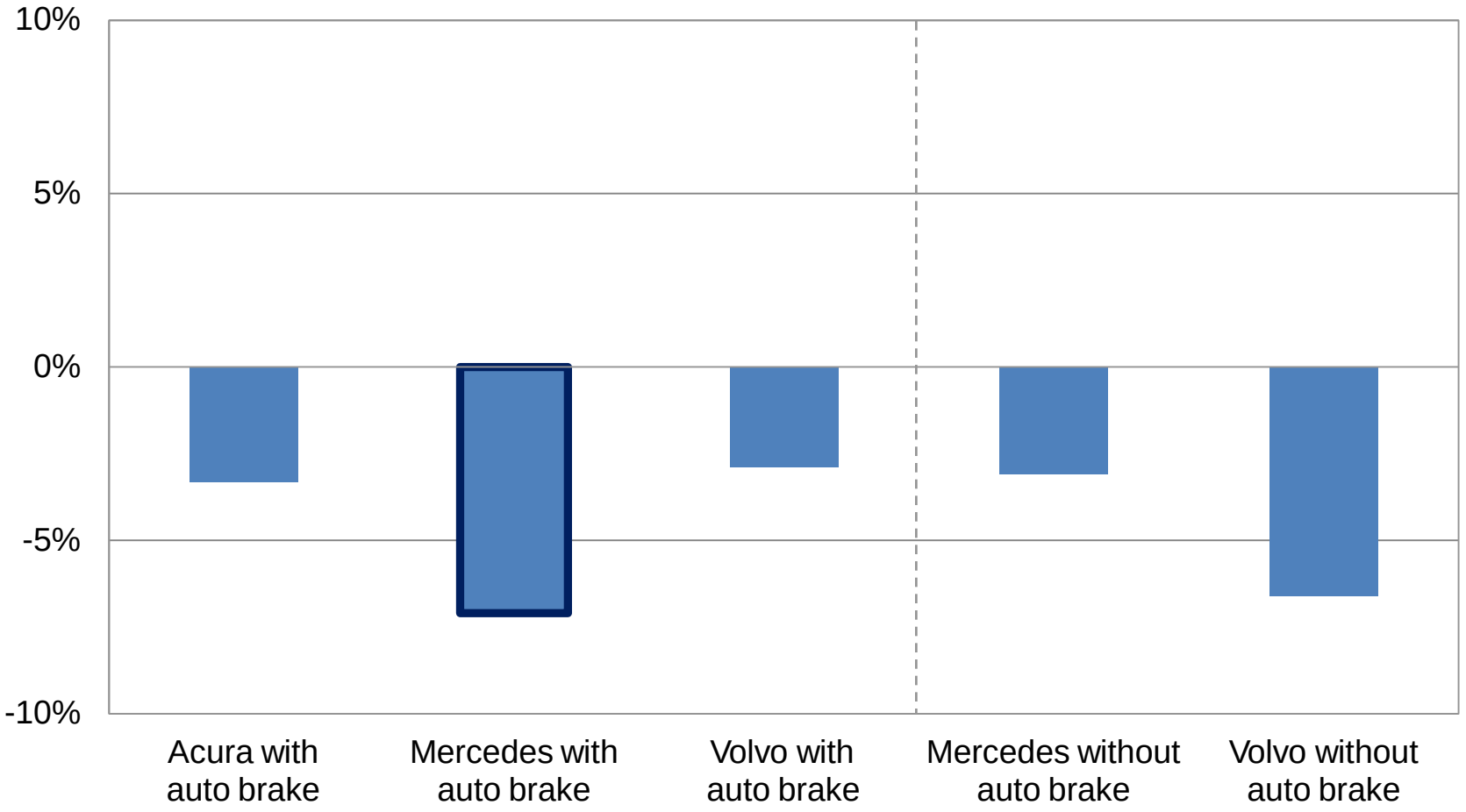
Forward collision warning with and without autonomous braking

Property damage liability claim frequency by manufacturer

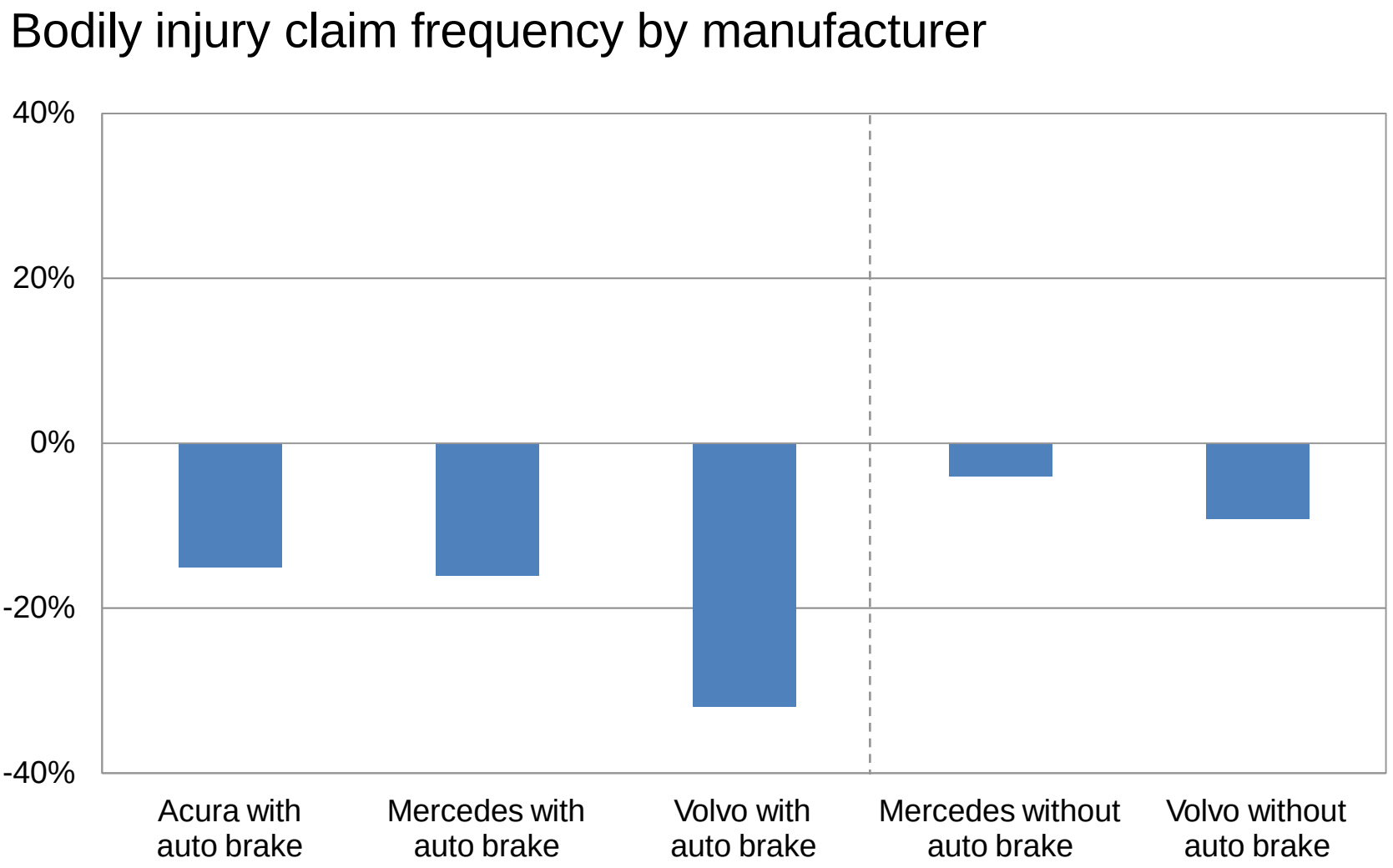


Forward collision warning with and without autonomous braking

Collision claim frequency by manufacturer



Forward collision warning with and without autonomous braking



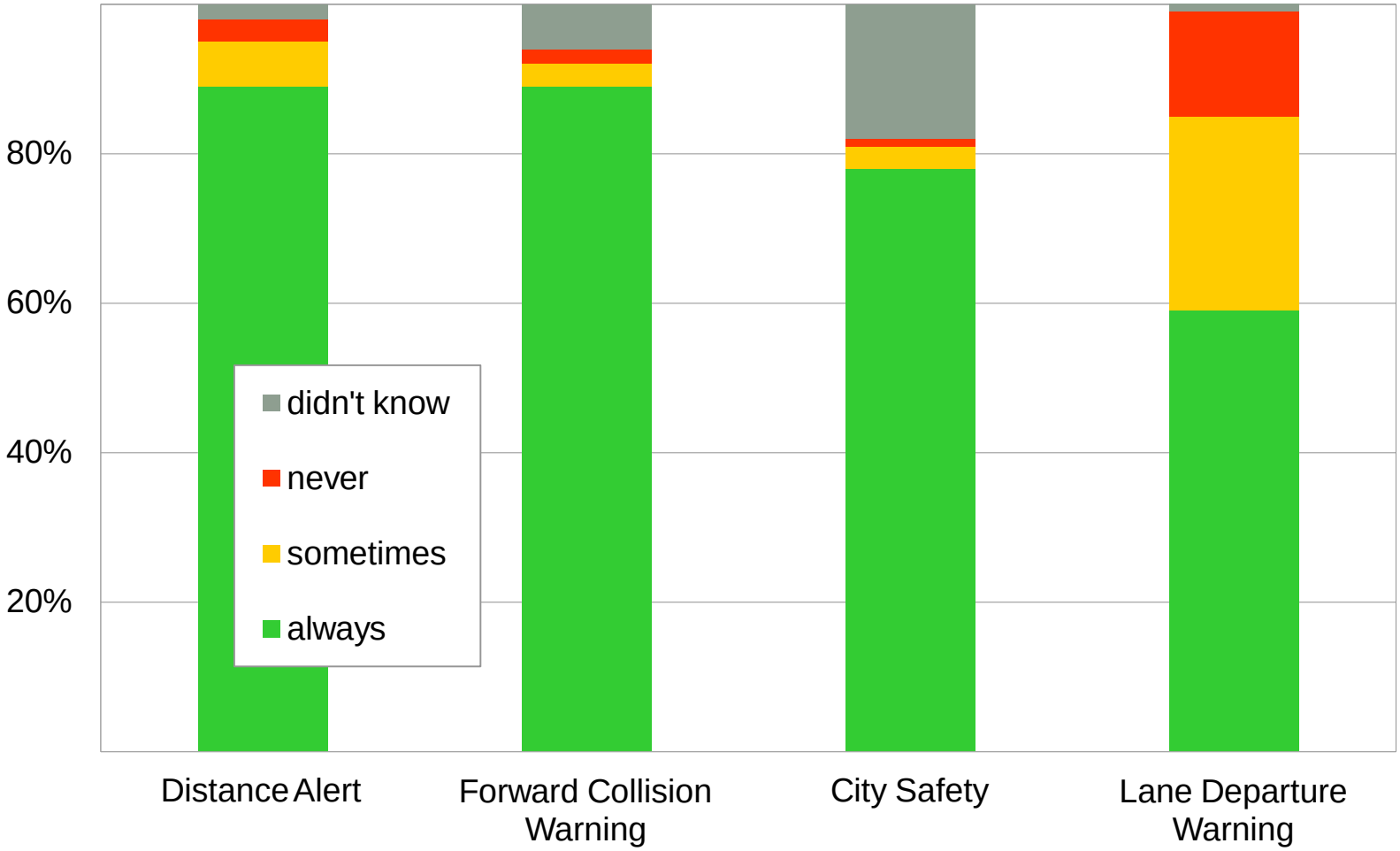
Assistive Functions
Effectiveness-Blind Spot Detection

- **Blind Spot Detection** may not be working as well as hoped
  - **HLDI**
    - General "systems, such as blind spot detection and park assist, aren't showing clear effects on crash patterns yet".
    - HLDI Bulletins
      - (Volvo) For vehicle damage losses, frequency of claims are down for property damage liability and up for collision coverage.
      - (Acura) vehicle damage loss frequencies are lower with the blind spot information feature, with larger reductions for property damage liability than collision; however, neither reduction is statistically significant and, in the case of collision, the small reduction in frequency is more than offset by an increase in average cost of the remaining claims.
      - (Buick) Did not find an insurance loss benefit from this technology

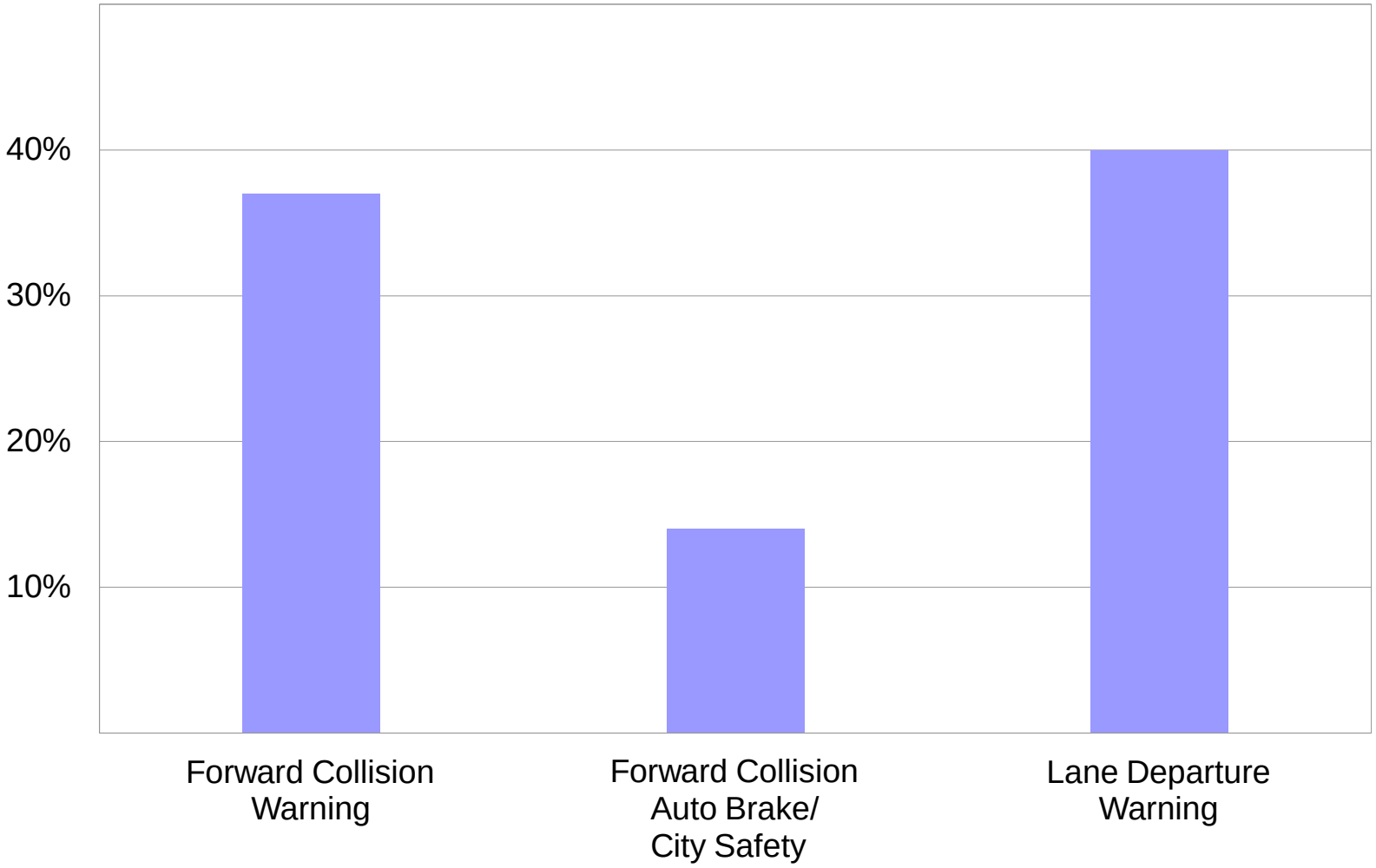
Assistive Functions
Effectiveness-City Safety

- **General-**Volvos equipped with the automaker's City Safety collision avoidance system are in 27% fewer accidents than comparable vehicles (HLDI)
  - **IIHS-**Vehicles with City Safety show significant reductions in collision claims compared with similar non-equipped vehicles

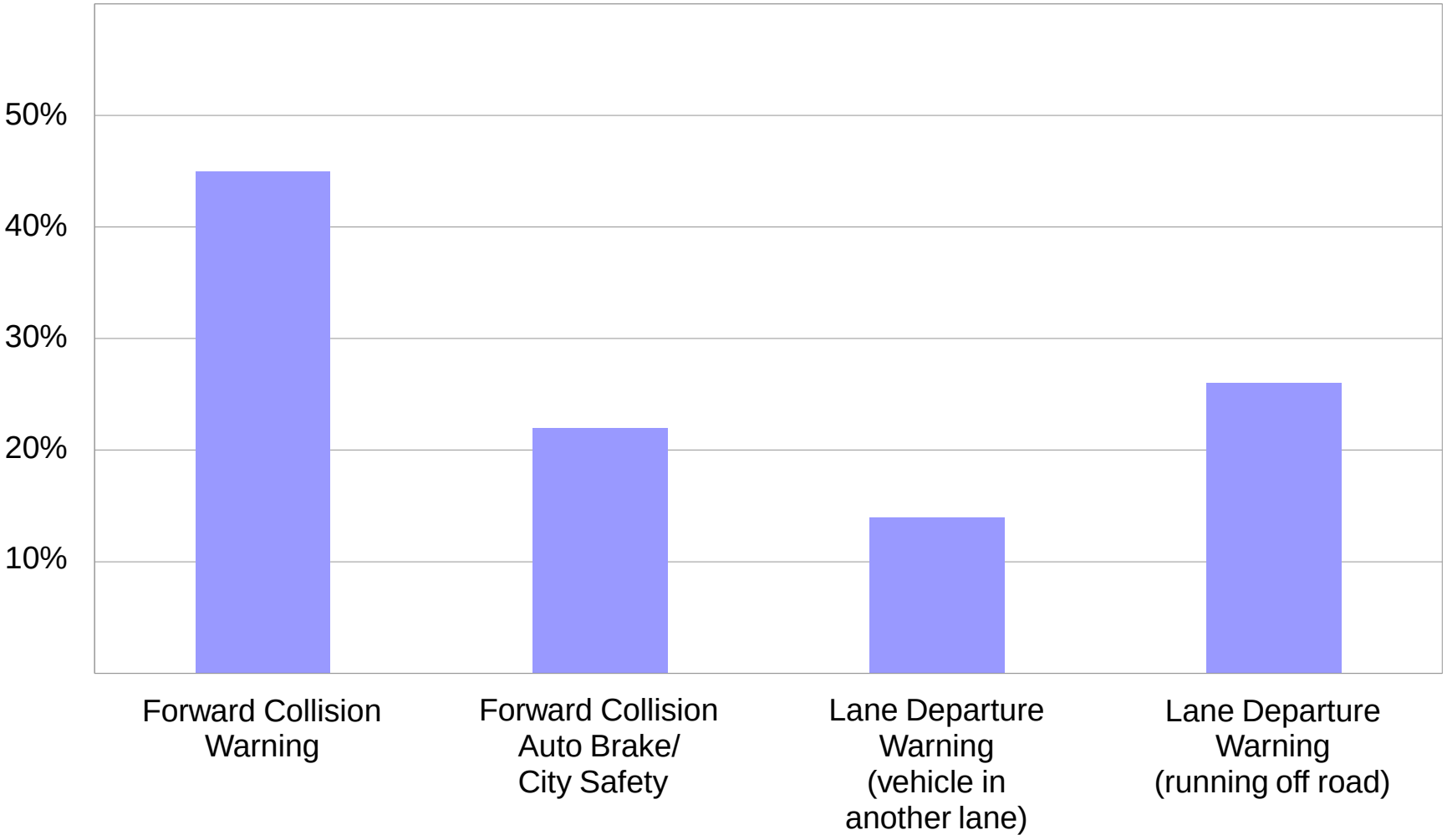
Percent of owners who drive with crash avoidance systems on (City Safety)



Percent of owners who report activations perceived as false or unnecessary (City Safety)

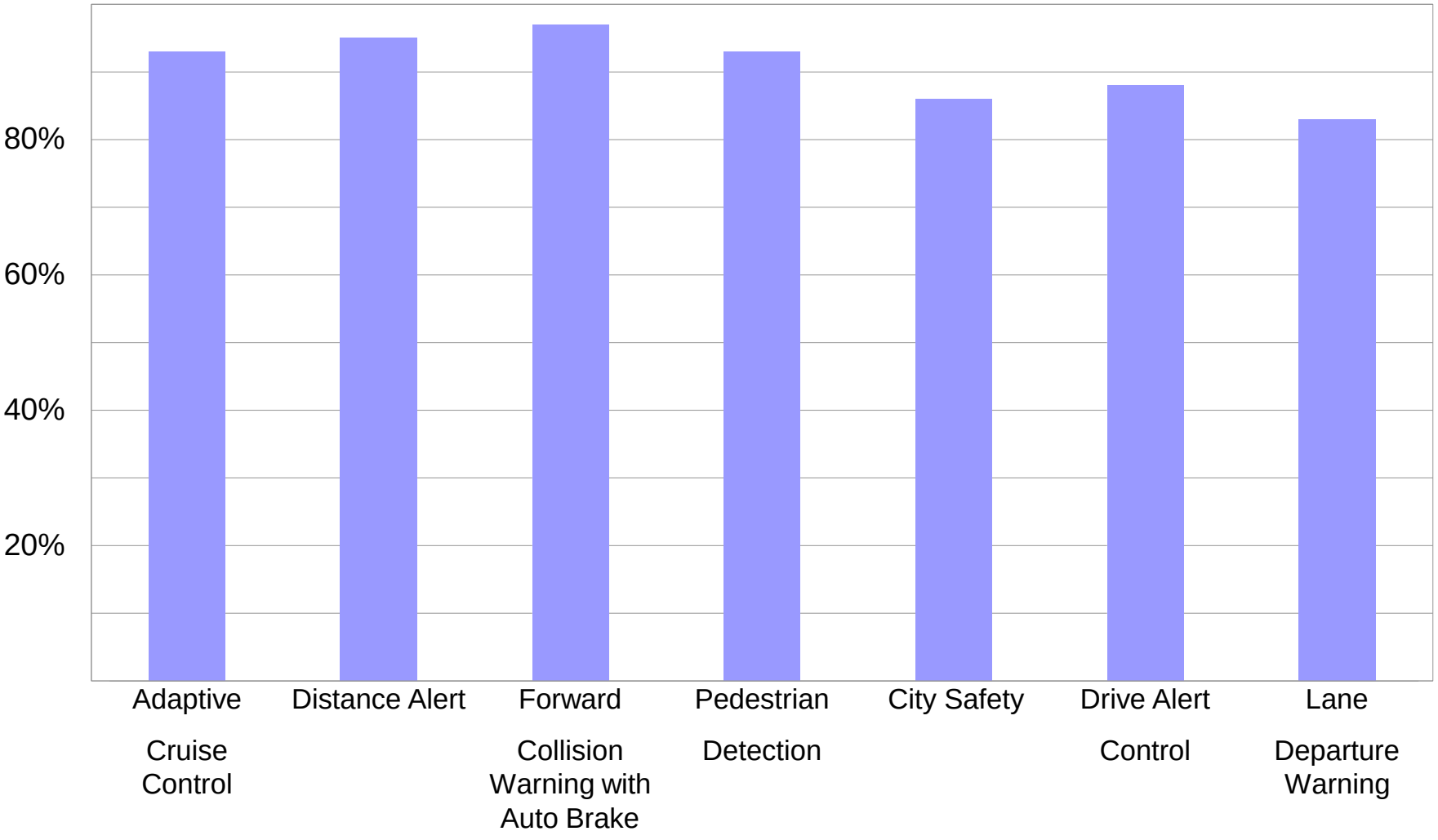


Percent of owners who believe systems helped prevent a crash (City Safety)



Percent of owners who want system on next vehicle

Among all owners with the system (City Safety)

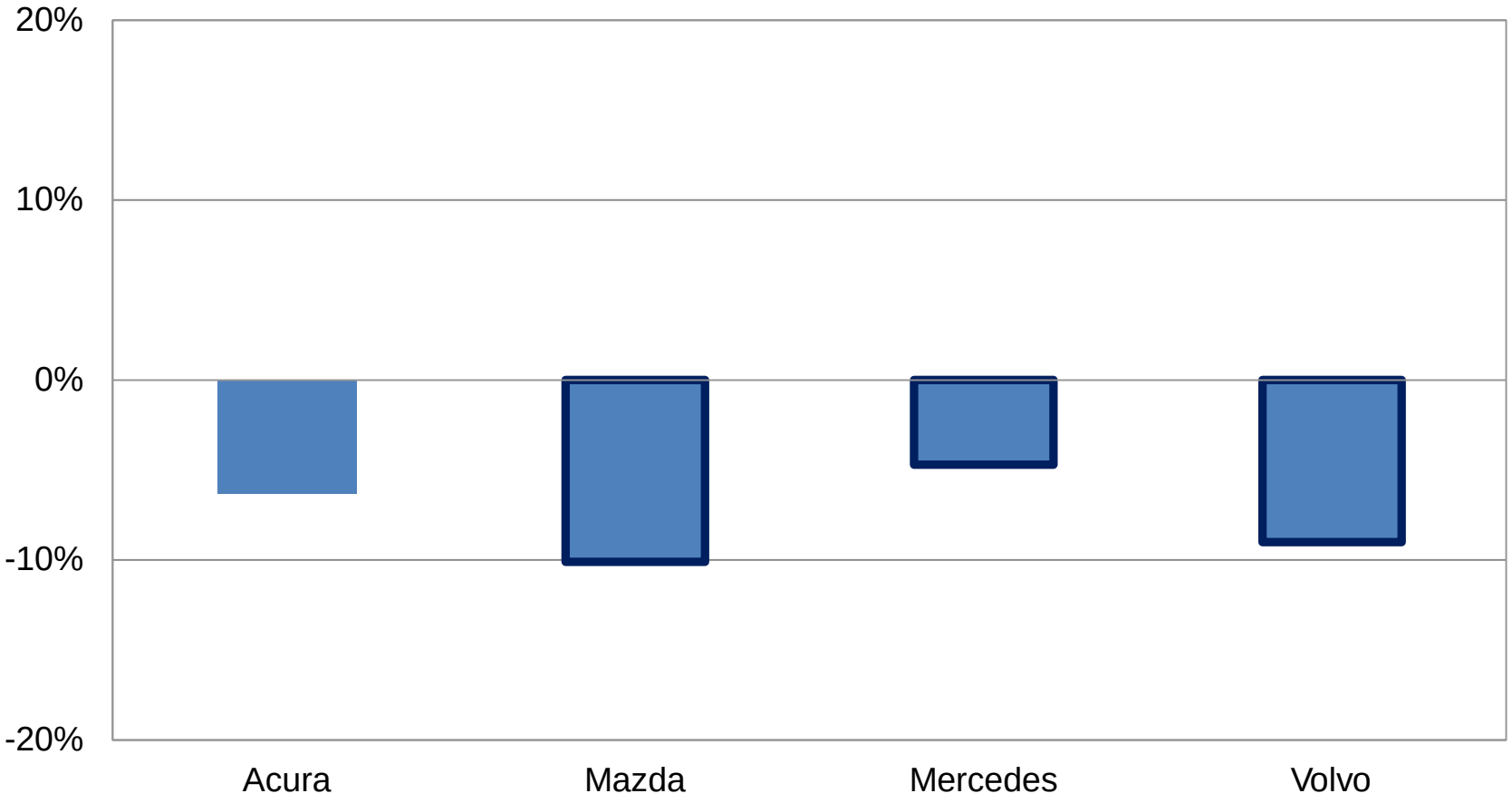


Assistive Functions
Effectiveness-Adaptive Headlights

- **HLDI** vehicles equipped with adaptive headlights had nearly 10 percent fewer property damage claims when compared against vehicles with fixed systems.
  - Matt Moore, vice president of HLDI, commented on these in a press release saying "All four adaptive headlight systems we looked at show benefits for most insurance coverages, and many of these estimated reductions are statistically significant. These lights appear to help in more situations than we anticipated, though we don't yet know why."

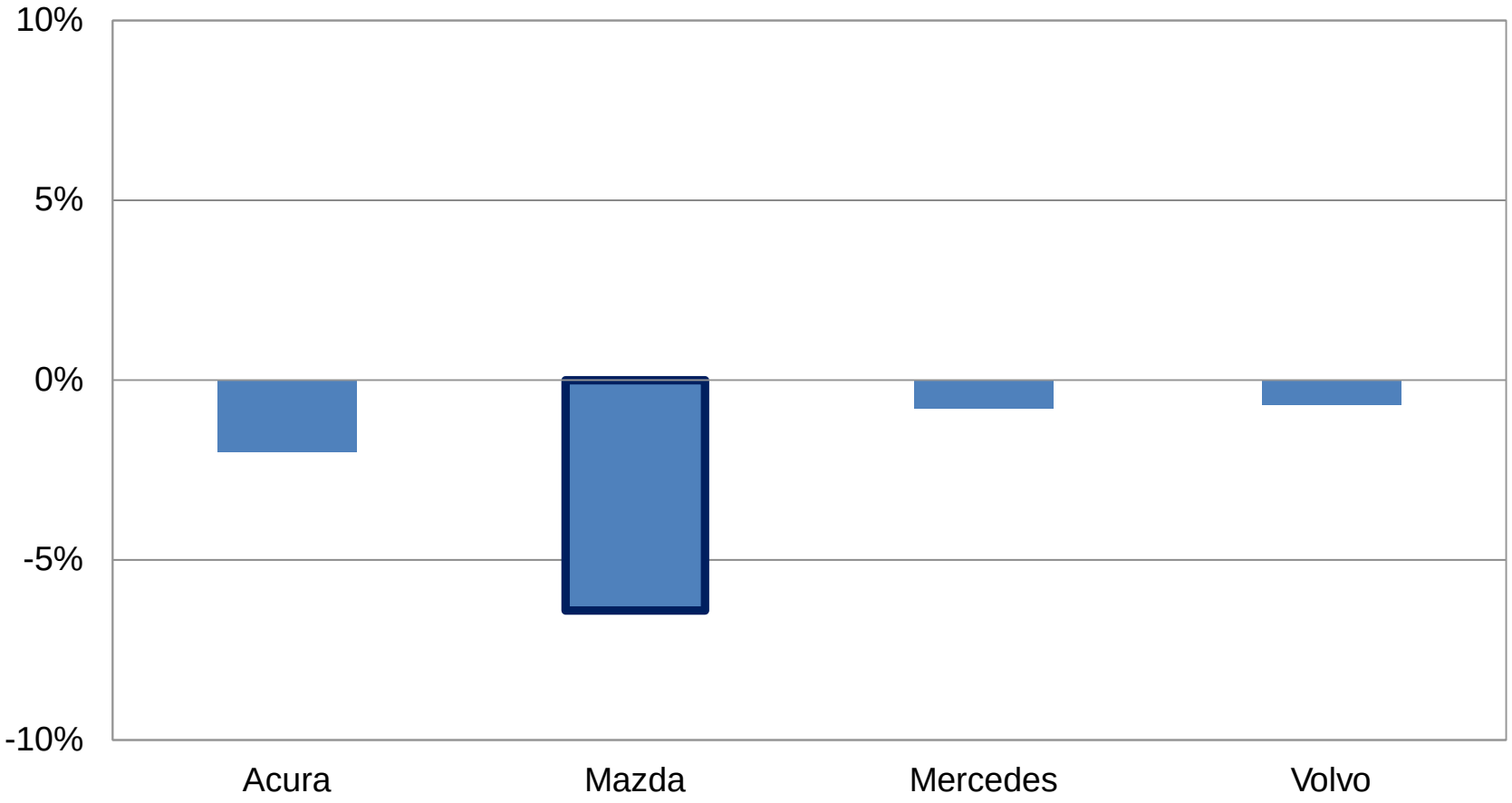
Adaptive headlights

Property damage liability claim frequency by manufacturer



Adaptive headlights

Collision claim frequency by manufacturer



Assistive Functions
Adaption

- **HLDI** typically takes 3 decades for a promising safety feature first introduced in a few luxury cars to spread through the fleet.
  - It will take at least 30 years before 95% of vehicles on the road could have a given feature either because it came as standard equipment or was offered as an option.
  - **Example**-It won't be until 2016 that 95% of all registered vehicles could have frontal airbags, even though manufacturers began adding frontal airbags in meaningful numbers during the mid-1980s

Assistive Functions
Adaption

- **Safety features never become universal in the real world.**
  - Collectors own and drive classic vehicles, and some people keep very old cars for sentimental reasons
  - It would take a minimum of 24 years for the fleet to completely turn over under current conditions of approximately 240 million registered passenger vehicles and about 10 million new vehicles registered a year. In reality, it takes longer because not every new vehicle replaces one of the oldest.
  - Federal mandates, safety ratings that reward certain features, and other factors can speed up the rate at which technology ends up in new models and therefore in registered vehicles.
    - **Example**, if all new vehicles were equipped with forward collision warning starting in 2013, it would take until 2034 instead of 2049 for 95 percent of vehicles to have been sold with that feature available.

Assistive Functions
Conclusions

- **General** Assistive features will proliferate in the near term;
  - However it will take a considerable amount of time before these features are “near universal”
  - Effective integration of these features into the driving environment requires recognition that many drive while mind is wandering
    - Key Question-How to supply drivers the information they need and want without distracting them from the driving task?
- **IIHS** Most owners
  - Leave assistive functions on despite annoyance
  - Want assistive functions in next car
- Some owners report safer driving habits; accident avoidance