



Human Factors of Driving Automation

Consumer Reports - Who we are

- 501(c)(3) non-profit founded in 1936
- 6 million members
- ~2,800 products and services each year, spanning 142 categories
- 9,000+ ratings and reviews of products on CR.org







Consumer Reports - Auto Testing

- 327-acre auto test track facility in Colchester, CT
- Cars, child seats, tires
- Over 2 miles of paved roadway
- Secret shoppers purchase consumer vehicles
- ~80 test cars per year, ~80 tests per car



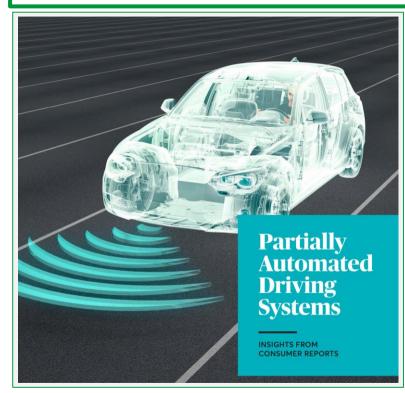


How we score vehicles





Advanced Vehicle Technology



Advanced Vehicle Technology

- Connected (V2X)
- Automated (ADAS)
- In-vehicle electronics Usability (HMI)

- Marketing and Advertising
- Public Perception, Surveys



Current Technology on Consumer Vehicles

<u>Warnings</u>

Assistance

- Forward Collision Warning (FCW)
- Rear Cross Traffic Warning (RCTW)
- Lane Departure Warning (LDW)
- Blind Spot Warning (BSW)

- Automatic Emergency Braking (AEB)
- Rear AEB
- Lane Keeping Assist (LKA)
- Adaptive Cruise Control (ACC)



Who Has What?

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	July	y 2019	ACC	ACC LDW LKA		AEB Ped RCTW FCW BSW			1													
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		Alfa Romeo	_	_				<u>,</u>	<u> </u>	~	~ ,		Model Year 2019									
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	_	Mitsubishi	_	_	X			Ş.	<u>v</u>	~	\		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		
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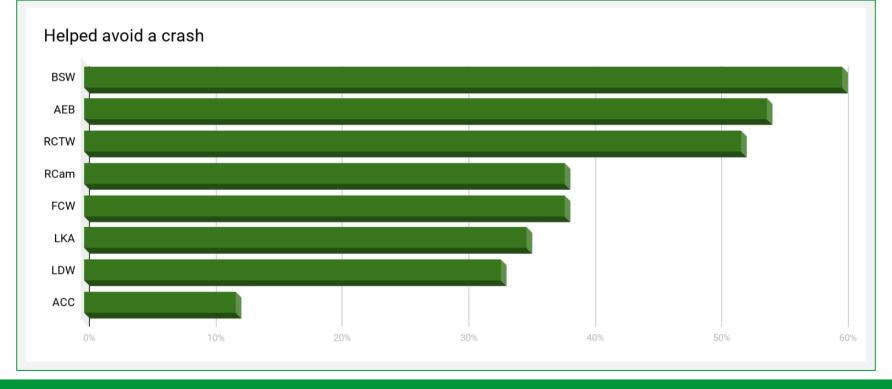


What do they do?

Insert video



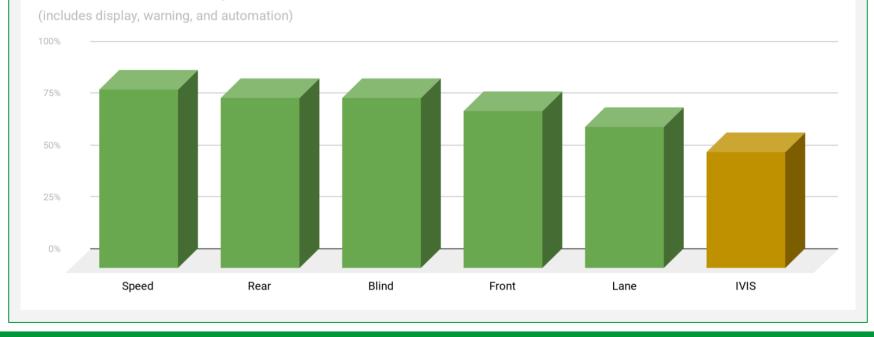
Are these safety systems?





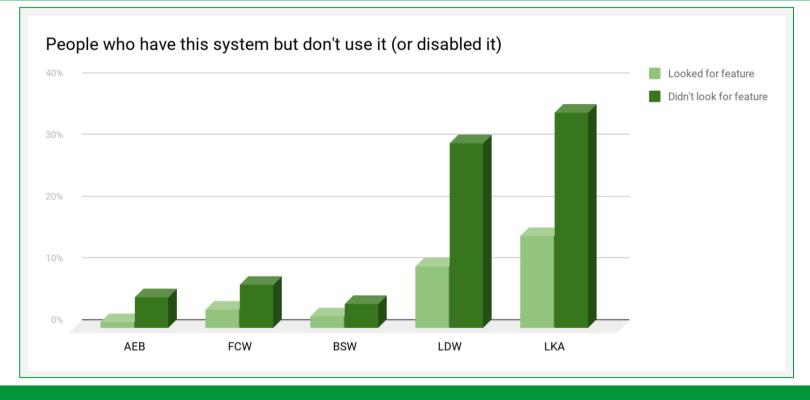
Do consumers like them?

Satisfaction with each system



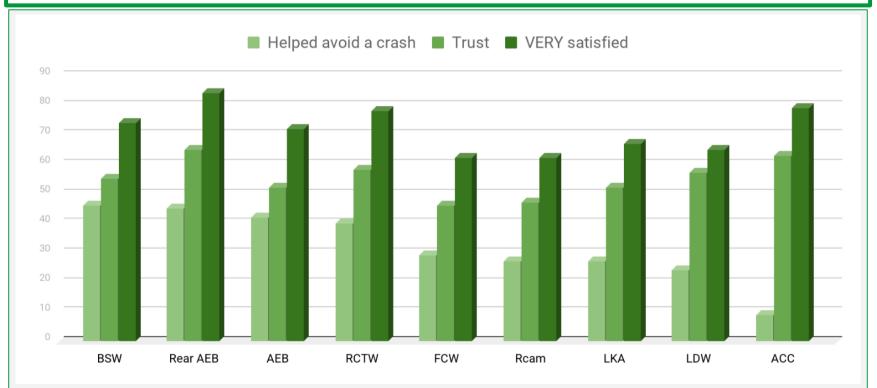


Are consumers using these systems?





Are consumers benefiting?





Do consumers like LDW and LKA?

, , , ,	to me. Every time that I intent rians, etc) it beeps so I leave tl - 2018 Toyota Highl	The system is annoying. When activated its constant beeping and tugging at the wheel are obnoxious.					
	eel of the wheel fighting keep the system disabled - 2018 Jeep Cherokee	It jerks the st	-	vheel, which i in reassuring 2015 Audi A3	Have disabled it beca more of a hindrance	use it was	
	I will sometimes "fight" w keep the car where			roads, and it ca	dible warning gets annoying especially on narrow ads, and it can't be turn it off unless both LKA and LDW are turned off. I like to keep LKA on. - 2016 Acura RDX		
-	wheel is annoying when ware of what I'm doing - 2017 Honda CR-V		•	•	teering, it can be scary hat you are passing. 2017 Mercedes-Benz SL		



What are consumers' expectations?

The self steering functionality allows the car to "pin ball" from edge-toedge of the lane. Also, the system will unexpectedly "loose" the lane markings and then it's not able to accurately steer the vehicle.

Extremely annoying and does not function as expected. Does not always keep you in the lane which is annoying and dangerous.

2015 Lincoln MKZ

2018 BMW 5 Series

Steering is only mildly trying to keep me firmly in my lane, but it doesn't actually do it. Can feel a slight centering at the steering wheel. - **2017 Toyota Prius Prime**

When I enable it, I expect that the vehicle will be kept in its current lane, but it really doesn't do a good job of this. - **2017 Subaru Forester** The system helps to keep the vehicle in lane, but not as well as I would expect it to. I like it, but question it's overall value until the technology can be improved to truly keep the vehicle in the lane.

Very unreliable. Drifts from one side to the other and gets progressively worse as it

tries to correct lane centering. Often loses sight / location of lane designator stipe.

2017 Honda Ridgeline

2018 GMC Sierra 1500

It does not have adequate self steering and you can easily cross the line. Not a satisfying system and would not prevent most out of lane accidents. - **2018 Ford Explorer**

Not very useful, as it will just bounce the car between lane markers like a ping pong ball.

2018 Chrysler Pacifica



Majority believe designed to stay in lane center

Tesla	Model X	100% (21/21)	Subaru	Legacy	73% (46/63)
	Model S	100% (31/31)		Impreza	72% (18/25)
	Model 3	97% (142/147)		Forester	69% (277/402
кіа	Stinger	94% (16/17)		Crosstrek	69% (68/99)
	Niro	87% (26/30)		Outback	6496 (311/486)
Audi	A4	94% (17/18)	Chrysler	Pacifica	61% (48/79)
	Q7	84% (67/80)	GMC	Acadia	65% (15/23)
	Q5	8396 (48/58)		Sierra 1500	55% (17/31)
	A5	81% (17/21)		Terrain	45% (10/22)
Acura	MDX	85% (28/33)	Buick	Enclave	59% (24/41)
	RDX	6696 (21/32)	Cadillac	XT5	56% (18/32)
	TLX	5296 (12/23)	- Ford	F-150	74% (29/39)
Genesis	G80	87% (46/53)	Ford	Explorer	50% (14/28)
Honda	Clarity	90% (36/40)		Edge	50% (24/25)
	Pilot	86% (36/42)		Escape	45% (9/20)
	Odyssey	84% (124/147)	Mazda	CX-5	59% (38/64)
	Accord	80% (156/196)	IVIdZUd	3	38% (8/21)
	Ridgeline	79% (53/67)	Chevrolet	Traverse	66% (27/41)
	Accord Hybrid	67% (14/21)	Chevrolet	Silverado 1500	63% (10/16)
	Fit	61% (14/23)		Equinox	53% (39/73)
Hyundai	Sonata	90% (18/20)		Volt	25% (4/16)
Mercedes-Benz	S-Class	87% (13/15)	Tevete	Avalon Hybrid	53% (10/19)
	GLC	86% (19/22)	Toyota	Highlander Hybrid	51% (22/43)
	E-Class	73% (19/26)		Corolla	49% (27/55)
Volvo	XC90	84% (27/32)		RAV4	49% (27/35)
	XC60	82% (50/61)		Highlander	49% (135/277)
Volkswagen	Tiguan	87% (13/15)		C-HR	47% (7/15)
<u> </u>	Atlas	75% (42/56)		Camry	44% (115/260)
Nissan	Leaf	100% (16/16)		Avalon	41% (21/51)
Lexus	RX Hybrid	94% (17/18)		Sienna	40% (18/45)
	RX	78% (35/45)			38% (26/68)
	NX	51% (22/43)		RAV4 Hybrid	37% (7/19)
BMW	X3	73% (41/56)		Prius Prime	
	5 Series	7196 (27/38)		Prius	36% (12/33)
Jeep	Grand Cherokee	65% (26/40)		Camry Hybrid	35% (45/127)



Initial ADAS testing - Oct 2018

- Autopilot
 - Tesla Model X/S/3
- SuperCruise
 - Cadillac CT6
- ProPILOT Assist
 - Nissan Leaf
 - Infiniti QX50
- Pilot Assist
 - Volvo XC40/XC60

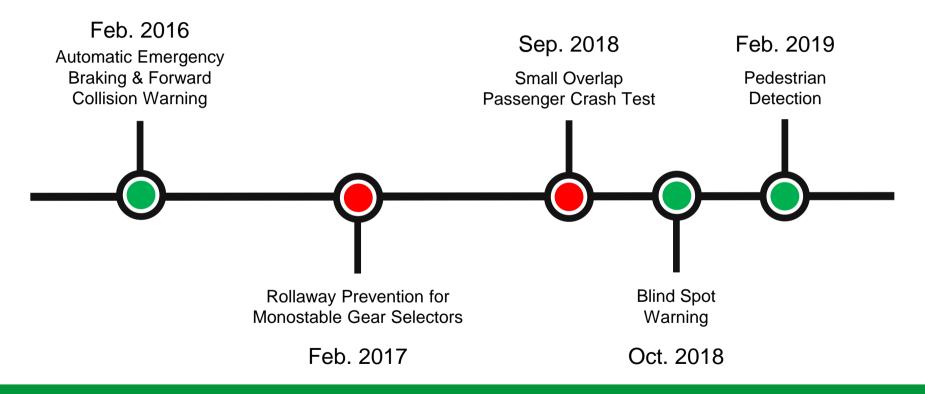




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System Name	Overall Automation System Rating	Capability & Performance	Ease of Use	Clear When Safe to Use	Keeping Driver Engaged	Unresponsive Driver	Vehicles Teste	
Super Cruise	\bigcirc	0	\bigcirc	8	\bigcirc	0	Cadillac CT6	
Autopilot	0	0	0	©	8	1	Tesla X/S/3	
ProPilot Assist	©	O	©	©	0	1	Infiniti QX50/ Nissan Leaf	
Pilot Assist	8	8	8	8	0	8	Volvo XC40/ XC60	



How CR influences the market







CR Consumer **CR.org**

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