Status Report

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Small cars, big problem

Driver death rates by make and model

Making left turns safer for pedestrians

Partial automation needs stronger safeguards

Driver death rates remain high among small cars

Despite manufacturers' efforts to make them safer, the smallest late-model cars remain the most dangerous, according to the most recent IIHS study of driver death rates.

Small cars and minicars accounted for 15 of the 20 models with the highest death rates for model year 2017, while nearly half of the 20 models with the lowest death rates were luxury SUVs.

"Smaller vehicles offer less protection for the driver in crashes, and their lighter mass means that they take the brunt of collisions with larger vehicles," says Joe Nolan, IIHS senior vice president of vehicle research.

Very large SUVs have the lowest overall death rate of any vehicle category with 15 fatalities per million registered vehicle years. Minicars have the highest at 82.

The average driver death rate for all 2017 models increased to 36 deaths, compared with 30 for 2014 models. That's a further increase from a low of 28 for 2011 models following a steady decline since the 1970s. The rise is consistent with a larger number of U.S. traffic fatalities over the four-year period covered by this study, compared with the previous one. From 2015 to 2018 there were 147,324 fatalities, compared with 134,905 from 2012 to 2015.

The death rates for 2017 models vary widely from 0 for seven models to 141 for the worst performer, the 2017 Ford Fiesta, a 4-door minicar that earned a rating of "marginal" in the IIHS driver-side small overlap crash test. Including the Fiesta, half the 2017 models with the highest death rates were also among the worst for model year 2014, the last time IIHS looked at the data.

IIHS has been calculating driver death rates approximately every three years since 1989. The rates include only driver deaths because all vehicles on the road have drivers, but not all of them have passengers or the same number of passengers. The number of deaths is derived from the federal Fatality Analysis Reporting System. Registration data come from IHS Markit.

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Alongside vehicle safety ratings, driver death rates are another source of information consumers can use to inform their purchasing decisions.

The two types of information complement each other. IIHS ratings are designed to compare vehicles in the same size category. Frontal crash test results can't be compared across sizes because the kinetic energy involved in the test increases with vehicle weight.

In contrast, the driver death rates can be compared across vehicle classes. However, as a comparative tool, they have their own limitations. While the death rates are adjusted for driver age and gender, they don't capture other factors that might influence fatality rates, such as the speeds people drive, the number of miles they travel per day and the types of roads they use.

To look at the effect of one of those factors, this year IIHS also compared the driver death rates per 10 billion miles traveled. Through a cooperative agreement in place since 2015, HLDI was able to match Vehicle Identification Numbers from the HLDI database to odometer readings from CARFAX, which maintains a vehicle history database. Odometer readings came from multiple sources, including title transfers, yearly inspections, and routine maintenance service.

For the most part, the mileage data bolstered the original findings about vehicle size and explained some notable exceptions.

Sports cars and luxury cars, which traveled fewer miles per year than other models, showed relatively higher driver death rates by the alternative method. Death rates for pickups trended lower by miles driven.

Within each vehicle category, the order of individual vehicles did not change much. For this reason, IIHS has decided to stick with the usual registration-year method for the published make and model results.

By that method, nine of the 20 models with the lowest death rates are luxury SUVs, two more are midsize luxury cars, and four

Driver death rates by vehicle style and size

Registered vehicle years vs. mileage
2017 and equivalent earlier models, 2015-18

		Deaths per million registration years	Deaths per 10 billion miles	Average annual mileage
OVERALL		36	26	13,794
CARS		48	36	13,471
4-DOOR	Mini	108	78	13,897
	Small	62	45	13,772
	Midsize	43	30	14,468
	Large	52	36	14,618
2-DOOR	Mini	41	44	9,272
	Small	45	39	11,410
	Midsize	44	36	12,207
	Large	67	58	11,656
SPORTS	Midsize	51	63	8,045
	Large	48	50	9,529
LUXURY	Midsize	22	20	10,961
	Large	19	19	10,244
	Very large	20	19	10,478
STATION WAGONS	Mini	65	53	12,419
	Small	54	40	13,519
	Midsize	4	3	13,428
MINIVANS		22	15	14,939
SUVs		25	19	13,589
4-WHEEL DRIVE	Small	24	19	12,684
	Midsize	21	15	13,573
	Large	22	15	15,130
	Very large	7	4	17,969
2-WHEEL DRIVE	Small	42	31	13,774
	Midsize	34	24	14,429
	Large	26	17	15,510
	Very large	30	17	18,465
4-WHEEL DRIVE LUXURY	Small	25	23	10,629
	Midsize	9	7	11,827
	Large	5	4	12,476
	Very large	19	13	15,432
2-WHEEL DRIVE LUXURY	Small	44	40	11,121
	Midsize	11	9	12,056
	Large	26	18	14,841
PICKUPS		29	18	16,155
4-WHEEL DRIVE	Small	24	18	13,429
	Large	26	17	15,526
	Very large	27	15	18,817
2-WHEEL DRIVE	Small	31	21	14,644
	Large	38	23	16,551
	Very large	28	13	22,167

Models with the highest and lowest rates of driver deaths

Lowest rates of driver deaths

Fewer than 9 driver deaths per million registered vehicle years, 2017 and equivalent earlier models, 2015-18

			Overall	MV	SV	SV roll
GMC Yukon XL 1500 4WD	SUV	Very large	0	0	0	0
Infiniti QX60 2WD	Luxury SUV	Midsize	0	0	0	0
Land Rover Range Rover Evoque 4WD	Luxury SUV	Small	0	0	0	0
Lexus NX 200t 4WD	Luxury SUV	Midsize	0	0	0	0
Mercedes-Benz C-Class sedan 4WD	Luxury car	Midsize	0	0	0	0
Porsche Cayenne 4WD	Luxury SUV	Large	0	0	0	0
Volkswagen Golf	4-door car	Small	0	0	0	0
Lexus GX 460 4WD	Luxury SUV	Large	3	0	3	4
Subaru Outback	Station wagon	Midsize	3	2	1	0
Acura RDX 2WD	Luxury SUV	Midsize	4	4	0	0
BMW X5 4WD	Luxury SUV	Midsize	4	2	2	0
BMW X3 4WD	Luxury SUV	Midsize	5	0	5	5
Nissan Leaf	4-door car	Small	5	0	5	0
Cadillac Escalade 4WD	Luxury SUV	Large	6	0	6	0
Lexus CT 200h	Luxury car	Midsize	6	6	0	0
Mitsubishi Outlander 4WD	SUV	Small	7	7	0	0
Toyota Sienna 4WD	Minivan	Very large	7	4	4	0
Toyota Tundra Crew Max 4WD	Pickup	Large	7	0	7	2
Chevrolet Suburban 1500 4WD	SUV	Very large	8	8	0	0
Honda Odyssey	Minivan	Very large	8	4	5	2

Highest rates of driver deaths

More than 65 driver deaths per million registered vehicle years, 2017 and equivalent earlier models, 2015-18

			Overall	MV	SV	SV roll
Ford Fiesta	4-door car	Mini	141	98	46	13
Hyundai Accent	4-door car	Mini	116	85	28	9
Chevrolet Sonic	4-door car	Small	98	64	34	10
Nissan Versa Note	Station wagon	Small	96	80	12	7
Fiat 500	2-door car	Mini	95	60	38	37
Hyundai Elantra	4-door car	Small	89	71	15	9
Kia Forte	4-door car	Small	89	63	24	2
Nissan Versa	4-door car	Small	88	49	42	14
Kia Rio	4-door car	Mini	87	51	38	0
Ford Mustang GT coupe	Sports car	Midsize	81	58	23	12
Hyundai Accent	Station wagon	Mini	81	64	17	9
Nissan Sentra	4-door car	Small	81	53	26	11
Chevrolet Sonic	Station wagon	Small	74	59	13	13
Chevrolet Trax 2WD	SUV	Small	73	40	37	20
Mitsubishi Mirage hatchback	4-door car	Mini	72	52	18	5
Kia Soul	Station wagon	Small	70	50	19	10
Buick Verano	4-door car	Midsize	68	35	33	14
Ford Focus	4-door car	Small	68	48	19	9
Nissan Maxima	4-door car	Midsize	68	33	38	4
Mitsubishi Outlander Sport 4WD	SUV	Small	67	45	21	5

KEY:
Overall: driver deaths per million registered vehicle years
MV: driver death rate in multiple-vehicle crashes
SV: driver death rate in single-vehicle crashes of all types
SV roll: driver death rate in single-vehicle rollovers (subset of SV)
2WD: 2-wheel drive **4WD:** 4-wheel drive

others are minivans or very large SUVs. The overall death rates for luxury vehicles are also substantially lower than the averages for nonluxury vehicles of the same sizes.

Luxury vehicles often come equipped with advanced safety features that aren't widely installed on less expensive ones, such as blind spot warning and lane departure prevention.

Notably, two small cars defy the average for their size and class, whether driver death rates are measured against registered vehicle years or miles traveled. The Volkswagen Golf and the Nissan Leaf have death rates of 0 and 5 per million registered vehicle years, respectively. Their rates per 10 billion miles were the same. For comparison, the overall rate for small cars was 61 deaths per million vehicle years and 45 per 10 billion miles.

The Golf's results are particularly remarkable, considering that the 2014 version was among the worst performers, with a death rate of 63 per million vehicle years, prior to a redesign for the 2015 model year.

Although the number of miles driven was not a factor, the results for the Leaf, an all-electric car, may reflect when and where electric vehicles are driven.

The latest rates are based on fatalities that occurred from 2015 to 2018 for vehicles from the 2017 model year, as well as earlier models with the same designs and features. The numbers represent the estimated risks for 2017 models, but the data include models from as far back as 2014 if the vehicles have not been substantially redesigned over the intervening period. Including these older, equivalent vehicles makes the sample size larger and therefore increases the reliability of the results. To be included, a vehicle must have had at least 100,000 registered vehicle years of exposure from 2015 to 2018 or at least 20 deaths. ■

	DEATH RATES Overall	MV	SV	SV roll	Model years	Exposure
ALL PASSENGER VEHICLES	36 (34-37)	22	13	5	2014-17	111,257,469
4-DOOR CARS						
Mini						
Mitsubishi Mirage hatchback	72 (28-115)	52	18	5	2014-17	171,842
Kia Rio	87 (40-134)	51	38	0	2014-17	204,326
Hyundai Accent	116 (74-158)	85	28	9	2014-17	417,171
Ford Fiesta	141 (94-189)	98	46	13	2014-17	357,492
Small						
Volkswagen Golf	0 (0-34)	0	0	0	2015-17	108,084
Nissan Leaf	5 (0-14)	0	5	0	2014-17	164,259
Volkswagen GTI	11 (0-27)	11	0	0	2015-17	137,682
Nissan Juke 2WD	12 (0-29)	6	6	6	2014-17	126,805
Acura ILX	26 (0-56)	20	5	0	2014-17	162,116
Mazda 3 hatchback	27 (7-46)	12	16	2	2014-17	348,619
Mitsubishi Lancer 2WD	31 (3-58)	25	6	0	2014-17	124,110
Mazda 3 sedan	39 (22-55)	27	13	1	2014-17	602,393
Hyundai Elantra GT	44 (7-82)	19	27	0	2014-17	174,343
Honda Civic	46 (29-62)	30	15	4	2016-17	912,043
Chevrolet Cruze	49 (24-75)	35	13	5	2016-17	351,592
Toyota Corolla	54 (27-81)	40	15	3	2017	309,773
Subaru WRX	54 (25-83)	31	24	4	2015-17	196,935
Nissan Juke 4WD	65 (2-127)	22	48	0	2014-17	115,704
Ford Focus	68 (52-84)	48	19	9	2014-17	1,329,370
Nissan Sentra	81 (65-96)	53	26	11	2014-17	1,950,927
Nissan Versa	88 (66-111)	49	42	14	2014-17	828,218
Hyundai Elantra	89 (44-133)	71	15	9	2017	267,872
Kia Forte	89 (64-114)	63	24	2	2014-17	778,579
Chevrolet Sonic	98 (64-132)	64	34	10	2014-17	418,163
Midsize						
Subaru Legacy	14 (3-25)	9	5	2	2015-17	329,025
Ford Fusion plug-in hybrid	15 (0-36)	0	15	0	2014-17	100,620
Ford Fusion 4WD	22 (0-45)	11	11	0	2014-17	135,342
Ford Fusion hybrid 2WD	34 (10-58)	28	5	6	2014-17	294,573
Toyota Camry	34 (28-41)	23	11	4	2014-17	3,622,339
Honda Accord	34 (26-41)	24	9	3	2014-17	3,203,032
Kia Optima	37 (15-58)	15	23	10	2016-17	302,125
Ford Fusion 2WD	39 (30-49)	29	10	3	2014-17	2,181,340
Toyota Camry hybrid	41 (16-66)	35	5	0	2014-17	298,667
Mazda 6 2WD	41 (22-61)	24	18	4	2014-17	569,238
Hyundai Sonata	48 (34-62)	25	23	8	2015-17	1,151,787
Chrysler 200 2WD	52 (34-69)	21	32	3	2015-17	784,265
Volkswagen Jetta	53 (38-67)	34	19	4	2014-17	1,298,283
Nissan Altima	59 (49-68)	37	21	5	2014-17	3,228,915
Chevrolet Malibu	61 (34-87)	36	24	13	2016-17	479,411
Buick Verano	68 (34-102)	35	33	14	2014-17	332,522
Nissan Maxima	68 (27-109)	33	38	4	2016-17	226,899
Large						
Chrysler 300 4WD	14 (0-31)	10	5	0	2014-17	158,207
Dodge Charger 4WD	28 (0-56)	14	14	0	2014-17	107,515
Chrysler 300 2WD	46 (24-69)	32	14	7	2014-17	337,115
Buick Regal 2WD	50 (14-86)	24	29	24	2014-17	161,880
Chevrolet Impala	57 (39-75)	39	16	9	2014-17	905,014
Dodge Charger Hemi 2WD	58 (21-95)	17	43	8	2014-17	199,434
Dodge Charger 2WD	62 (41-84)	27	39	13	2014-17	607,436
2-DOOR CARS						
Mini						
MINI Cooper	10 (0-24)	10	0	0	2014-17	149,663
Fiat 500	95 (25-165)	60	38	37	2014-17	123,127
Small						
Volkswagen Beetle	11 (0-28)	6	6	6	2014-17	132,929
Hyundai Veloster	63 (10-116)	39	25	19	2014-17	123,455
Midsize						
Honda Accord	48 (14-82)	18	30	0	2014-17	235,384
Large						
Dodge Challenger 2WD	65 (42-87)	34	30	12	2014-17	521,293
SPORTS CARS						
Midsize						
Ford Mustang coupe	45 (20-70)	42	3	0	2015-17	279,661
Chevrolet Corvette coupe	54 (20-87)	4	53	13	2014-17	192,396
Ford Mustang GT coupe	81 (43-119)	58	23	12	2015-17	202,978
Large						
Chevrolet Camaro coupe	39 (10-69)	6	35	18	2016-17	134,504

	DEATH RATES Overall	MV	SV	SV roll	Model years	Exposure
LUXURY CARS						
Midsize						
Mercedes-Benz C-Class sedan 4WD	0 (0-15)	0	0	0	2015-17	254,085
Lexus CT 200h	6 (0-19)	6	0	0	2014-17	118,081
Acura TLX 2WD	21 (0-42)	13	10	0	2015-17	240,896
Mercedes-Benz C-Class sedan 2WD	28 (0-56)	10	17	9	2015-17	179,762
Cadillac ATS 2WD	31 (6-56)	21	11	6	2014-17	146,586
Infiniti Q50 4WD	39 (8-70)	0	39	11	2014-17	218,675
BMW 320i 2WD	42 (4-80)	17	29	0	2014-17	137,322
Lincoln MKZ 2WD	55 (5-106)	32	25	6	2014-17	126,721
Infiniti Q50 2WD	60 (31-90)	18	44	19	2014-17	213,505
Large						
Audi A6 4WD	16 (0-33)	4	13	9	2014-17	184,986
Very large						
Cadillac XTS 2WD	21 (0-41)	21	0	0	2014-17	147,596
STATION WAGONS						
Mini						
Honda Fit	48 (23-73)	31	17	4	2015-17	412,993
Ford Fiesta	65 (33-97)	58	5	0	2014-17	289,093
Hyundai Accent	81 (41-121)	64	17	9	2014-17	184,081
Small						
Subaru XV Crosstrek	18 (7-28)	10	8	2	2014-17	769,213
Toyota Prius v	19 (3-34)	19	0	0	2014-17	244,190
Fiat 500L	24 (0-62)	24	0	0	2014-17	112,469
Ford C-Max hybrid	37 (0-78)	37	0	0	2014-17	115,963
Ford Focus	60 (42-78)	34	26	6	2014-17	841,734
Kia Soul	70 (52-87)	50	19	10	2014-17	1,346,860
Chevrolet Sonic	74 (36-111)	59	13	13	2014-17	244,549
Nissan Versa Note	96 (65-127)	80	12	7	2014-17	600,256
Midsize						
Subaru Outback	3 (0-6)	2	1	0	2015-17	769,921
MINIVANS						
Very large						
Toyota Sienna 4WD	7 (0-18)	4	4	0	2014-17	206,725
Honda Odyssey	8 (2-14)	4	5	2	2014-17	1,289,578
Toyota Sienna 2WD	20 (10-31)	16	4	2	2014-17	1,067,897
Kia Sedona	21 (4-38)	7	14	11	2015-17	215,030
Chrysler Pacifica	27 (0-58)	21	5	0	2017	156,682
Dodge Grand Caravan	41 (28-54)	26	15	5	2014-17	1,226,909
SUVs						
Small						
Mitsubishi Outlander 4WD	7 (0-22)	7	0	0	2014-17	101,350
Honda HR-V 4WD	9 (0-21)	0	9	5	2016-17	177,447
Toyota RAV4 4WD	10 (0-30)	10	0	0	2017	197,926
Nissan Rogue 4WD	13 (7-20)	9	5	3	2014-17	1,202,111
Jeep Renegade 2WD	13 (0-27)	8	4	0	2015-17	180,718
Subaru Forester	17 (10-24)	9	9	2	2014-17	1,477,741
Hyundai Tucson 4WD	18 (0-47)	12	5	0	2016-17	148,722
Honda CR-V 2WD	18 (0-54)	18	0	0	2017	110,439
Ford Escape 4WD	24 (15-33)	16	7	4	2014-17	1,351,272
Volkswagen Tiguan 2WD	24 (3-46)	10	15	5	2014-17	156,404
Honda CR-V 4WD	25 (0-50)	20	4	0	2017	202,094
Jeep Renegade 4WD	26 (4-48)	22	2	2	2015-17	341,425
Toyota RAV4 2WD	28 (0-59)	28	0	0	2017	153,216
Volkswagen Tiguan 4WD	29 (0-62)	16	16	0	2014-17	145,607
Ford Escape 2WD	29 (20-38)	22	6	2	2014-17	1,768,510
Jeep Patriot 4WD	36 (18-54)	24	12	2	2014-17	503,880
Jeep Compass 4WD	40 (15-64)	21	20	8	2014-17	401,789
Mitsubishi Outlander Sport 2WD	43 (9-77)	32	12	12	2014-17	197,002
Chevrolet Trax 4WD	45 (2-88)	15	33	0	2015-17	166,173
Jeep Wrangler 2-door 4WD	46 (25-68)	23	23	20	2014-17	438,061
Honda HR-V 2WD	50 (4-95)	36	11	6	2016-17	140,934
Nissan Rogue 2WD	51 (32-70)	38	11	1	2014-17	891,138
Jeep Compass 2WD	55 (25-85)	40	15	0	2014-17	321,269
Mitsubishi Outlander 2WD	55 (5-104)	31	22	15	2014-17	105,863
Jeep Patriot 2WD	60 (35-85)	49	8	5	2014-17	618,728
Hyundai Tucson 2WD	61 (18-103)	37	21	9	2016-17	185,863
Mitsubishi Outlander Sport 4WD	67 (12-122)	45	21	5	2014-17	152,405
Chevrolet Trax 2WD	73 (32-114)	40	37	20	2015-17	233,527

Death rates by make and model

Driver deaths per million registered vehicle years

These rates are for 2017 models, but results are included for earlier model years as far back as 2014 if the vehicle wasn't substantially redesigned during that time.

Exposure is the number of registered vehicle years. A registered vehicle year is one vehicle registered for one year.

Rates are adjusted for driver age and gender.

Information on deaths is from the National Highway Traffic Safety Administration's Fatality Analysis Reporting System. Data on vehicle registrations come from IHS Automotive.

	DEATH RATES Overall	MV	SV	SV roll	Model years	Exposure
Midsize						
Honda Pilot 4WD	11 (0-27)	11	0	0	2016-17	354,126
Kia Sorento 4WD	12 (0-25)	4	8	8	2016-17	192,211
Toyota 4Runner 4WD	13 (1-25)	4	11	7	2014-17	667,774
Toyota Highlander 4WD	13 (0-30)	0	13	0	2017	120,591
Ford Explorer 4WD	13 (2-24)	10	3	1	2016-17	604,755
Hyundai Santa Fe 4WD	13 (0-31)	0	13	7	2014-17	116,678
Jeep Grand Cherokee 4WD	16 (10-23)	11	6	3	2014-17	1,901,695
Hyundai Santa Fe 2WD	16 (0-47)	0	16	0	2014-17	126,743
Honda Pilot 2WD	17 (0-43)	5	15	14	2016-17	161,750
Jeep Grand Cherokee 2WD	17 (3-31)	11	5	0	2014-17	465,291
GMC Terrain 4WD	18 (6-31)	12	6	4	2014-17	369,005
Nissan Murano 4WD	19 (0-42)	19	0	0	2015-17	251,049
Nissan Murano 2WD	19 (0-43)	19	0	0	2015-17	184,170
Nissan Pathfinder 4WD	20 (3-37)	7	14	12	2014-17	450,004
Ford Edge 4WD	20 (6-33)	10	11	5	2015-17	445,718
Jeep Cherokee 4WD	20 (10-30)	12	7	2	2014-17	1,233,091
Ford Edge 2WD	21 (2-41)	11	12	0	2015-17	269,325
Dodge Journey 4WD	23 (2-44)	20	3	0	2014-17	247,043
Nissan Pathfinder 2WD	25 (5-45)	20	4	2	2014-17	386,988
Jeep Cherokee 2WD	26 (12-41)	19	8	1	2014-17	601,120
Chevrolet Equinox 4WD	29 (15-43)	20	9	2	2014-17	795,787
Jeep Wrangler 4-door 4WD	31 (21-41)	15	17	10	2014-17	1,480,243
Kia Sorento 2WD	32 (5-58)	12	22	0	2016-17	244,783
GMC Terrain 2WD	33 (16-51)	22	10	1	2014-17	595,721
Ford Explorer 2WD	33 (8-58)	21	11	6	2016-17	279,681
Toyota 4Runner 2WD	34 (0-67)	23	10	0	2014-17	235,145
Ford Flex 2WD	38 (0-75)	38	0	0	2014-17	166,244
Hyundai Santa Fe Sport 4WD	39 (8-69)	9	35	15	2014-17	296,306
Chevrolet Equinox 2WD	45 (33-57)	32	12	6	2014-17	1,523,947
Dodge Journey 2WD	45 (25-65)	26	19	12	2014-17	728,704
Hyundai Santa Fe Sport 2WD	51 (24-78)	26	26	15	2014-17	421,969
Large						
Dodge Durango 2WD	11 (0-28)	7	3	3	2014-17	248,854
Dodge Durango 4WD	15 (0-30)	2	15	9	2014-17	414,697
Ford Expedition 4WD	17 (0-36)	6	11	6	2014-17	137,374
Chevrolet Tahoe 4WD	19 (3-35)	12	6	4	2015-17	412,450
Buick Enclave 2WD	20 (2-38)	15	4	2	2014-17	349,535
Buick Enclave 4WD	24 (0-49)	24	0	0	2014-17	254,700
GMC Yukon 4WD	27 (0-53)	14	14	13	2015-17	232,618
Chevrolet Traverse 2WD	27 (11-44)	16	11	3	2014-17	636,416
Chevrolet Tahoe 2WD	28 (5-51)	13	17	7	2015-17	322,663
Chevrolet Traverse 4WD	29 (9-49)	19	9	2	2014-17	435,946
GMC Yukon 2WD	40 (0-88)	0	40	26	2015-17	119,156
Ford Expedition 2WD	55 (5-104)	24	29	15	2014-17	105,353
Very large						
GMC Yukon XL 1500 4WD	0 (0-20)	0	0	0	2015-17	186,403
Chevrolet Suburban 1500 4WD	8 (0-18)	8	0	0	2015-17	278,088
Ford Expedition EL 4WD	16 (0-47)	16	0	0	2014-17	126,577
Chevrolet Suburban 1500 2WD	25 (0-57)	0	25	0	2015-17	141,444
LUXURY SUVs						
Small						
Land Rover Range Rover Evoque 4WD	0 (0-35)	0	0	0	2014-17	104,037
Buick Encore 4WD	44 (9-79)	10	39	24	2014-17	221,553
Buick Encore 2WD	46 (20-72)	34	11	7	2014-17	423,729
Midsize						
Lexus NX 200t 4WD	0 (0-28)	0	0	0	2015-17	133,129
Infiniti QX60 2WD	0 (0-26)	0	0	0	2014-17	144,301
BMW X5 4WD	4 (0-11)	2	2	0	2014-17	348,071
Acura RDX 2WD	4 (0-12)	4	0	0	2014-17	189,668
BMW X3 4WD	5 (0-11)	0	5	5	2014-17	334,302
Infiniti QX60 4WD	9 (0-20)	0	9	3	2014-17	243,080
Audi Q5 4WD	12 (0-24)	4	8	4	2014-17	412,963
Acura RDX 4WD	12 (0-27)	12	0	0	2014-17	293,285
Lexus NX 200t 2WD	15 (0-46)	0	15	0	2015-17	130,217
Volvo XC60 4WD	29 (0-66)	0	29	25	2014-17	122,100
Large						
Porsche Cayenne 4WD	0 (0-26)	0	0	0	2014-17	140,637
Lexus GX 460 4WD	3 (0-10)	0	3	4	2014-17	226,966
Cadillac Escalade 4WD	6 (0-19)	0	6	0	2015-17	120,388
Land Rover Range Rover 4WD	15 (0-45)	0	15	18	2014-17	130,863
PICKUPS						
Small						
GMC Canyon Crew Cab 4WD	15 (0-36)	7	8	0	2015-17	102,690
Chevrolet Colorado Ext. Cab 2WD	15 (0-36)	0	15	8	2015-17	101,049
Chevrolet Colorado Crew Cab 2WD	16 (0-35)	5	11	6	2015-17	141,790
Nissan Frontier Crew Cab short bed 4WD	21 (4-39)	7	15	0	2014-17	212,739
Toyota Tacoma Double Cab short bed 4WD	21 (5-36)	12	9	3	2016-17	255,258
Toyota Tacoma Double Cab short bed 2WD	29 (0-61)	17	11	0	2016-17	147,758
Chevrolet Colorado Crew Cab 4WD	32 (5-59)	21	10	7	2015-17	240,560
Nissan Frontier King Cab 2WD	42 (10-75)	37	4	5	2014-17	172,775
Nissan Frontier Crew Cab short bed 2WD	58 (30-87)	49	11	7	2014-17	220,126
Large						
Toyota Tundra Crew Max 4WD	7 (1-14)	0	7	2	2014-17	510,093
Ford F-150 Supercab 4WD	11 (2-21)	2	10	2	2015-17	395,598
Toyota Tundra Double Cab short bed 4WD	13 (1-25)	5	8	0	2014-17	287,843
Ram 1500 Crew Cab long bed 4WD	16 (0-32)	8	8	9	2014-17	188,357
Toyota Tundra Double Cab short bed 2WD	17 (0-35)	13	4	0	2014-17	174,791
GMC Sierra 1500 Ext. Cab 4WD	20 (7-33)	13	7	0	2014-17	343,354
Ford F-150 Supercab 2WD	23 (4-43)	12	12	0	2015-17	193,828
Chevrolet Silverado 1500 Ext. Cab 4WD	24 (16-32)	13	11	3	2014-17	1,152,425
Ford F-150 Crew Cab 4WD	25 (17-34)	11	15	7	2015-17	1,552,783
Chevrolet Silverado 1500 Crew Cab 4WD	26 (19-33)	15	11	4	2014-17	1,769,896
GMC Sierra 1500 Ext. Cab 2WD	27 (0-54)	27	0	0	2014-17	112,477
GMC Sierra 1500 Crew Cab 4WD	29 (18-40)	14	15	5	2014-17	871,192
Ram 1500 Quad Cab 4WD	30 (15-45)	24	6	5	2014-17	605,424
Ford F-150 Crew Cab 2WD	30 (15-45)	20	9	3	2015-17	498,303
Chevrolet Silverado 1500 2WD	32 (12-52)	19	13	3	2014-17	236,798
Toyota Tundra Crew Max 2WD	34 (10-59)	22	13	0	2014-17	176,345
Chevrolet Silverado 1500 Ext. Cab 2WD	37 (18-56)	24	13	6	2014-17	432,361
Ram 1500 Crew Cab short bed 2WD	37 (19-56)	21	17	10	2014-17	416,552
Ram 1500 Crew Cab short bed 4WD	39 (28-50)	17	22	10	2014-17	1,209,652
Ram 1500 Quad Cab 2WD	41 (20-62)	16	25	5	2014-17	346,230
Ford F-150 2WD	42 (8-77)	36	7	8	2015-17	107,246
Ram 1500 short bed 2WD	44 (8-79)	22	22	16	2014-17	103,962
GMC Sierra 1500 Crew Cab 2WD	48 (21-74)	33	15	6	2014-17	264,813
Chevrolet Silverado 1500 4WD	51 (15-87)	26	26	14	2014-17	119,212
Chevrolet Silverado 1500 Crew Cab 2WD	54 (35-74)	30	25	3	2014-17	713,318
Very large						
Chevrolet Silverado 2500 Ext. Cab 4WD	15 (0-32)	10	5	0	2015-17	150,684
Chevrolet Silverado 3500 Crew Cab 4WD	15 (0-32)	0	15	5	2015-17	151,813
Chevrolet Silverado 2500 Crew Cab 4WD	17 (7-27)	13	4	2	2015-17	526,309
GMC Sierra 2500 Crew Cab 4WD	22 (6-38)	11	11	3	2015-17	274,346
Ford F250 Crew Cab 4WD	30 (6-55)	15	15	0	2017	150,292
Ram 2500 Crew Cab short bed 4WD	30 (18-43)	13	17	6	2014-17	580,038
Ram 3500 Crew Cab long bed 4WD	32 (12-52)	19	13	3	2014-17	239,085
Ram 2500 Mega Cab 4WD	47 (0-105)	18	31	0	2014-17	100,187
Ram 2500 Crew Cab long bed 4WD	63 (27-99)	26	38	11	2014-17	144,323

KEY:

Overall: all crash types; numbers in parentheses are 95 percent confidence bounds
MV: driver deaths in multiple-vehicle crashes
SV: driver deaths in single-vehicle crashes
SV roll: driver deaths in single-vehicle rollovers (subset of SV)
2WD: 2-wheel drive **4WD:** 4-wheel drive

Simple infrastructure changes make left turns safer for pedestrians

Bollards and rubber curbs that prevent drivers from cutting across intersections at a diagonal can make streets safer for pedestrians, according to a new IIHS study.

Such "centerline hardening" forces drivers to turn more slowly at close to a right angle by blocking the diagonal path through the crosswalk. In Washington, D.C., the infrastructure changes reduced the number of times drivers had to swerve or brake suddenly or pedestrians had to dodge out of the way by 70 percent, says IIHS Senior Research Transportation Engineer Wen Hu, the author of the paper.

"This study suggests that simple infrastructure changes can deliver big benefits," Hu says. "Communities looking for ways to make pedestrians safer should add centerline hardening to their toolbox."

The calming infrastructure also resulted in a reduction in average left-turn speeds and decreased the odds that drivers made the turn at speeds exceeding 15 mph.

A little more than half of all crashes involving pedestrians took place at intersections in 2018, resulting in more than 6,700 serious injuries to pedestrians and more than 1,500 pedestrian fatalities.

In one of the more common scenarios, a driver making a left turn crashes into a pedestrian who is crossing the road that the driver is turning onto. These left-turn crashes accounted for nearly a third of all pedestrian-involved crashes at intersections in 2018.

To combat the problem, some cities have begun installing left-turn traffic-calming measures. New York City has used these methods at more than 300 intersections since 2016. The District of Columbia began a similar effort in 2018, with plans to target 85 intersections by the end of this year. One turn-calming technique the city uses is centerline hardening, which consists of rubber curbs and bollards installed on the yellow center line.

To determine how effective the practice is, Hu collected data from 10 D.C. intersections before and after the infrastructure changes and compared them with eight control sites where no centerline-hardening features were installed.

IIHS RESEARCH

"The effects of left-turn traffic-calming treatments on conflicts and speeds in Washington, D.C." by W. Hu and J.B. Cicchino

To request this paper, email researchpapers@iihs.org.

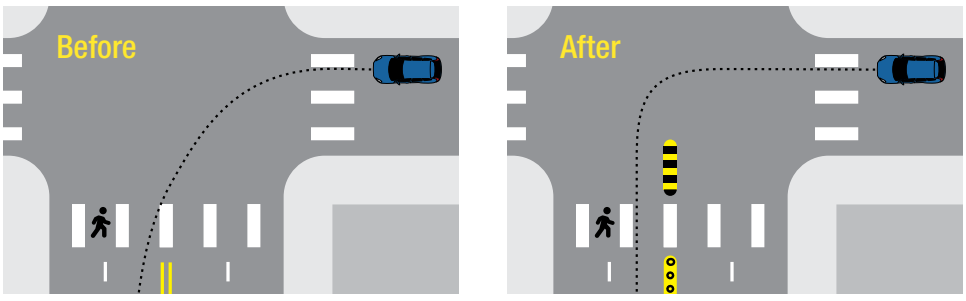
She tabulated both the numbers of conflicts between left-turning vehicles and pedestrians and the speeds that left-turning vehicles traveled in the before and after periods. A conflict was defined as any time a driver had to brake or swerve suddenly to avoid a pedestrian or a pedestrian had to stop short or dodge out of the way to avoid being hit by a vehicle.

At the 10 intersections where the hardening infrastructure was installed, the average number of conflicts between vehicles and pedestrians fell from seven to two. At the eight intersections where no centerline hardening was implemented, the number of conflicts remained unchanged at around one over the two study periods.

Hu found that the average turning speed dropped 7 percent after the installation of the centerline-hardening features. The average turning speed at the control sites increased 3 percent. The proportion of drivers who made the turns at speeds greater than 15 mph fell 36 percent at the modified intersections. ■

Full story at go.iihs.org/centerline-hardening

How centerline hardening works



Centerline hardening makes intersections safer for pedestrians by encouraging drivers to make left turns at slower speeds. Bollards and rubber curbs block the diagonal path through the intersection.

IIHS recommends new safeguards for partially automated driving systems

IIHS has issued a set of research-based safety recommendations on the design of partially automated driving systems. The guidelines emphasize how to keep drivers focused on the road even as the vehicle does more of the work.

Today's partially automated systems still need the driver to be involved at all times. That means they need robust methods of monitoring driver engagement and more effective ways of regaining the driver's attention when it wanders. Designs should also be based on a principle of shared control, and they should have built-in limits that prevent them from being used on roads and under conditions where it isn't safe to do so, IIHS researchers say.

As part of that philosophy of shared control, partially automated systems shouldn't change lanes or overtake other vehicles without driver input. They should also be responsive to driver steering input even when automatic lane centering is engaged.

"Unfortunately, the more sophisticated and reliable automation becomes, the more difficult it is for drivers to stay focused on what the vehicle is doing," says IIHS President David Harkey. "That's why systems should be designed to keep drivers actively engaged."

Under the classification system developed by SAE International, there are five levels of automation, ranging from 0 (no automation) to 5 (fully self-driving). The highest level available in production vehicles today is Level 2. These systems continuously control acceleration, braking and steering to keep the vehicle traveling at a set speed in the center of its lane while maintaining a selected following distance from the vehicle ahead. They require the human driver to remain vigilant and ready to intervene in the event that the system encounters a situation it cannot handle.

Despite these limitations, some designs make it too easy for the driver to rely heavily on the system and lack safeguards to make sure he or she remains actively engaged in the driving.

The IIHS researchers reviewed dozens of academic studies to develop a series of recommendations for how manufacturers can better ensure that users remain focused on what's happening on the road.

One key recommendation is for a specific series of attention reminders to bring the driver's focus back to the road as outlined in the graphic below. ■

IIHS RESEARCH

"Addressing driver disengagement and system misuse: human factors recommendations for Level 2 driving automation design" by A.S. Mueller, I.J. Reagan and J.B.Cicchino

To request this paper, email researchpapers@iihs.org.

Full story at go.iihs.org/automation-safeguards

Recommended escalating attention reminders for Level 2 automation

STEP 1
Visual reminder

STEP 2
More urgent visual reminder + an audible or physical alert

STEP 3
Visual + audible + physical alerts

STEP 4
Visual + audible + physical alerts + pulse braking

STEP 5

If the driver fails to respond, the automated system should deploy the hazard lights and gradually slow the vehicle to a stop. The driver should be locked out from accessing the system for the remainder of the drive.

Insurance Institute for Highway Safety
Highway Loss Data Institute

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Status Report

IIHS is an independent, nonprofit scientific and educational organization dedicated to reducing the losses — deaths, injuries and property damage — from motor vehicle crashes.

HLDI shares and supports this mission through scientific studies of insurance data representing the human and economic losses resulting from the ownership and operation of different types of vehicles and by publishing insurance loss results by vehicle make and model.

Both organizations are wholly supported by auto insurers and insurance associations.

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Inquiries/print subscriptions:
StatusReport@iihs.org

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Editor: Sarah Karush

Writer: Jason Overdorf

Art Director: Steve Ewens

Photographers: Steve Ewens, Craig Garrett, Dan Purdy

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