

Status Report

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New pedestrian crash prevention ratings

Lane-centering systems don't inspire trust

Pickups lag SUVs in compatibility progress

Driver surveys often contradict drug test results





New IIHS ratings show pedestrian crash prevention is gaining ground

More and more automakers are offering pedestrian crash prevention systems on their latest models, often as standard equipment. But the performance of the different systems varies widely, the latest round of testing by IIHS shows.

Out of 16 midsize cars that IIHS rated, four luxury and two nonluxury models earn a superior rating for their pedestrian crash prevention systems. Four nonluxury cars earn only a basic rating or no credit. Another six cars earn an advanced rating.

Annual pedestrian fatalities have increased 53 percent since reaching a low point in 2009 (see “Study highlights rising pedestrian deaths, points toward solutions,” May 8, 2018). More than 6,000 pedestrians were killed in 2018.

Technology could be part of the solution. Many manufacturers are upgrading the automatic emergency braking systems they have agreed to install by 2022 to recognize pedestrians, in addition to other vehicles. These systems scan the path ahead and automatically apply the brakes to avoid hitting people in the roadway.

About two-thirds of the vehicles that IIHS rates included pedestrian detection in 2019, in many cases as standard equipment. Among the vehicles evaluated in this current round of testing, pedestrian crash prevention is standard on all six luxury cars and six out of 10 nonluxury cars.

When they work correctly, such systems can help avert tragedy. A 2017 HLDI analysis, for instance, found that Subaru’s EyeSight system with pedestrian detection cut the rate of likely pedestrian-related insurance claims by 35 percent, compared with the same vehicles without the system (see “Subaru crash avoidance system cuts pedestrian crashes,” May 8, 2018).

“Pedestrians are the most vulnerable road users, so it’s encouraging that pedestrian crash prevention systems are standard equipment in 12 out of the 16 midsize cars we tested, including five out of six superior-rated systems,” says IIHS President David Harkey.

Most pedestrian crash prevention systems use one or two forward-facing cameras as mounted near the rearview mirror and/or radar sensors in the front grille to scan

the roadway for pedestrians poised to enter the vehicle’s path. Algorithms determine if the detected objects are pedestrians. In some cases, they can recognize bicyclists or animals too. If the software calculates that a collision is imminent, it alerts the driver and applies the brakes faster than a human can react.

The performance of the systems varies widely, the latest IIHS ratings show.

The Audi A4, BMW 3 series, Mercedes-Benz C-Class, Nissan Maxima, Subaru Outback and Volvo S60 have systems that earn superior ratings. They avoided collisions or slowed substantially in track tests.

“Car makers often roll out these kinds of advanced systems in more expensive luxury lines or as expensive options, so the superior performance of the standard systems on the more mainstream Maxima and Outback is noteworthy,” Harkey says.

At the other end of the spectrum, the Ford Fusion, Hyundai Sonata and Kia Optima earn no credit because they failed to slow significantly in multiple scenarios.

The C-Class, 3 series and Chevrolet Malibu each offer two different pedestrian

crash prevention systems. On the C-Class, the optional system earns a superior rating, while the standard one earns a basic rating. On the 3 series, the standard system surprisingly earns a higher rating of superior, while the more costly optional system earns an advanced rating. Both of the Malibu's optional systems — one consisting of a camera only and the other a camera plus radar — earn basic ratings.

About the tests

IIHS launched its pedestrian ratings in February. In the first round of testing, four out of 11 small SUVs earned a superior rating, while another five earned an advanced rating (see “New ratings address pedestrian crashes,” Feb. 21, 2019).

IIHS tests performance in three scenarios: an adult pedestrian stepping into the street in the path of the oncoming vehicle with an unobstructed view, a child darting into the street from behind two parked cars, and an adult pedestrian near the side of the road in the travel lane, facing away from traffic. The two perpendicular tests are conducted at 12 and 25 miles per hour, and the test simulating a pedestrian walking in a parallel path to the vehicle is conducted at 25 and 37 mph.

In each of these tests, the system has 1 or 2 seconds to stop the car to avoid hitting the pedestrian dummy.

Unpacking the ratings

To determine the ratings, points are tallied based on the average speed reduction the vehicle achieves in five repeated test runs. The vehicle's performance in the four tests

in which the dummy crosses or darts out into the road perpendicularly account for 70 percent of the score. Each test is performed in full daylight on dry pavement. Systems might not perform as well during the nighttime hours that account for most pedestrian fatalities, though if paired with good-performing headlights, they should be able to detect pedestrians.

Among the midsize cars evaluated, the six superior-rated vehicles reduced their speed dramatically in all six tests and in most cases avoided hitting the pedestrian dummy, eliminating or greatly reducing the risk of severe injury. The Nissan Maxima, a nonluxury car on which pedestrian crash prevention is standard equipment for 2020, excelled in all six tests. The Maxima avoided hitting the pedestrian in all six scenarios.





The advanced-rated systems also achieved major speed reductions, though somewhat less consistently.

Systems that earn a basic rating failed to slow the vehicle significantly in one or more of the tests, while those that earn no credit failed in multiple scenarios.

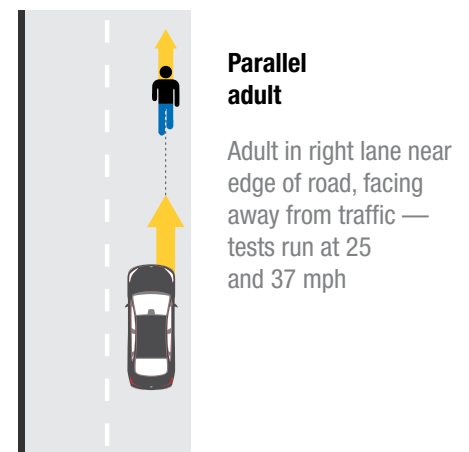
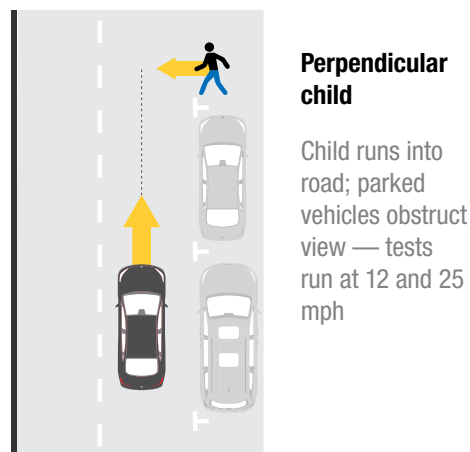
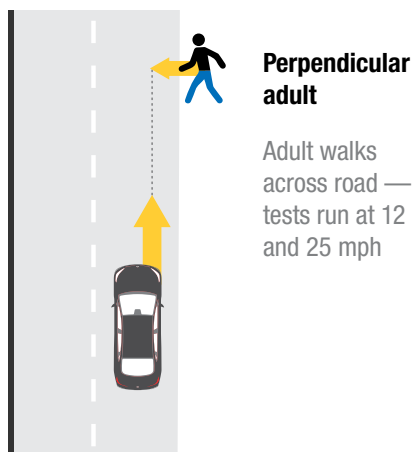
The Ford Fusion, for instance, which receives no credit, did not slow at all in the tests simulating a child darting across the road and only slowed slightly in the scenarios approximating an adult stepping into the street.

“The child running out from behind parked cars is a very challenging test,” says Harkey. “But that’s precisely the kind of situation where a system that’s faster and more vigilant than a human driver can have the most impact.” ■

Pedestrian crash prevention ratings Midsize cars

SUPERIOR 	2019 Audi A4 standard
	2019-20 BMW 3 series standard
	2020 Subaru Outback standard
	2019-20 Mercedes-Benz C-Class optional
	2019-20 Nissan Maxima optional for 2019/standard for 2020
2019-20 Volvo S60 standard	
ADVANCED 	2019-20 BMW 3 series optional
	2019-20 Honda Accord standard
	2019-20 Lexus ES 350 standard
	2019 Mazda 6 standard
	2019-20 Nissan Altima optional
	2019-20 Tesla Model 3 standard
BASIC 	2019-20 Chevrolet Malibu optional camera only
	2019-20 Chevrolet Malibu optional camera + radar
	2019-20 Mercedes-Benz C-Class standard
	2019-20 Toyota Camry standard
NO CREDIT 	2019-20 Ford Fusion standard
	2019 Hyundai Sonata optional
	2019-20 Kia Optima optional

Pedestrian test scenarios



Lane-centering problems may limit drivers' acceptance of automated systems

Road warriors may wish for automated technologies that take the stress and boredom out of the daily commute. But current systems designed to keep vehicles from drifting over the center line or onto the shoulder still don't all work well enough to inspire trust, according to a new IIHS study.

Based on the results of brief test drives by 20 of their coworkers, IIHS researchers found that most drivers were relatively confident in the performance of adaptive cruise control systems, which function like traditional cruise control but also adjust the vehicle's speed to maintain a minimum following distance from the vehicle ahead. However, testers had less faith

distance from the vehicle ahead of them than their ability to keep them safely in the center of their lane," says IIHS Senior Research Scientist Ian Reagan, the lead author of the paper. "But how well they perceived the lane-centering technology to work had a bigger impact on how they rated the overall experience."

That's important because past research has shown that collision-avoidance systems can eliminate or mitigate many crashes — most of which are the result of driver error. Systems that automate certain driving tasks might go further, preventing risky situations from developing in the first place by increasing following distance, for example. But for technologies to make driving

Each volunteer drove the vehicles just once over one of two varied routes near the Institute's offices in Virginia. One location, Arlington, is more urban. The other, Ruckersville, is rural. For the study, the drivers also used the systems on portions of the routes that included off-ramps, intersections and other road features that manufacturer disclaimers warned they might not be able to handle.

The results confirmed findings from a similar 2018 study that showed people feel more comfortable with systems that make smooth, gradual speed or steering adjustments, as well as an earlier one that found drivers had greater faith in adaptive cruise control than active lane-centering systems



Drivers complained that the lane-centering systems steered them toward obstacles or seemed to fight back against their efforts to steer the vehicle back on course.



in lane-centering systems, which provide sustained steering control to keep the vehicle in its lane, and that colored their overall impressions of the vehicle's automation.

"Across all the vehicles we tested, the drivers had more faith in the automated systems' ability to maintain a steady speed and a safe

safer, drivers have to accept them and use them correctly.

To learn more about the connection between acceptance of automated systems and driver perceptions of how well the technologies function, IIHS researchers analyzed test drives conducted by 20 IIHS-HLDI employees in five vehicles: a 2017 Mercedes-Benz E300 sedan, a 2019 Infiniti QX50 SUV, a 2018 Volvo S90 sedan, a 2017 BMW 530i sedan and a 2016 Tesla Model S sedan. All five were equipped with adaptive cruise control and lane-centering.

(See "Drivers prefer automated systems that operate smoothly," Feb. 14, 2018 and "IIHS-HLDI test drives uncover driver assistance system quirks," Nov. 10, 2016).

Across all vehicles, more than three-quarters of participants agreed that the automated systems accelerated and decelerated the vehicle smoothly and detected moving vehicles ahead. But fewer than half agreed that the technologies consistently detected lane markings on the roadway, detected stopped vehicles ahead, or that they knew whether the automation detected lane markings on

IIHS RESEARCH

"Driver acceptance of partial automation after a brief exposure" by I.J. Reagan et al.

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

the roadway. And those factors played a more important role in their general perception of how well the system performed.

“Better performance in detecting lane lines, detecting vehicles ahead and making smooth, gentle steering corrections translated into stronger agreement that the automation improved the overall driving experience,” Reagan says.

Drivers were mostly neutral about whether automation improved the overall driving experience. That’s partly because they didn’t feel that the systems drove like they do when they’re in control.

“I didn’t like how this computer could just randomly decide to correct my driving when there was nothing wrong with where I had the car,” one driver said. “When they would correct my driving, I felt kind of insulted by the car.”

Quirks or system failures might also have been a factor. Various drivers complained that the automation steered them toward obstacles or seemed to fight back against their efforts to steer the vehicle back on course.

“We got onto a smaller, two-lane country road that had some dips and curves,” another driver recalled. “I remember going through a right-hand curve and feeling like the BMW was steering me too far over the center line. The Tesla, through the same sorts of curves, felt like it was bringing me too close to the guardrail on the right side of the car.”

As might be expected, such problems were about twice as common on state highways and secondary roads, where the road features are less uniform, than on interstate highways. Moreover, many were connected with road features that owner manuals warn against relying on automation to navigate, such as hills and intersections. But because those manuals are long and complicated, people don’t always read them. When they do, the information is not always clear. Some manuals use the more ambiguous term “highways” to denote limited-access, divided freeways, for example.

“As carmakers improve this technology, features that ensure that people can only use it where it’s designed to work will be vital to safety and will also make drivers more confident in the automation,” Reagan says. ■

SUVs no longer pose outsize risk to car occupants

It may feel intimidating to be a car driver surrounded by taller vehicles, but today’s SUVs aren’t a major threat to occupants of smaller vehicles, new IIHS research shows. Pickups, on the other hand, still represent an outsize danger when they crash with cars, and the weight imbalance is a likely reason.

The improved compatibility of late-model

SUVs and cars represents a major shift since the 1990s, when occupants of cars and minivans were far more likely to die in crashes with SUVs than in crashes with other cars and minivans. In contrast, in 2013-16, car occupants were only slightly more likely to die in collisions with 1-4-year-old SUVs than with cars of the same age, relative to the number of each vehicle type on the road.

The trend toward increased compatibility of SUVs with cars and minivans was documented by IIHS researchers in 2011. They attributed the change to stronger structures and side airbags in cars and minivans and to newer SUV designs that lowered the vehicle’s front-end to better align with cars’ »

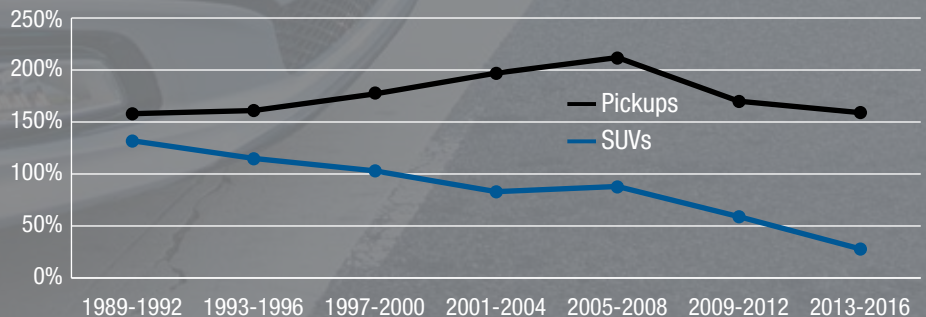
IIHS RESEARCH

“Trends in aggressivity and driver risk for cars, SUVs, and pickups: vehicle incompatibility from 1989–2016” by S.S. Monfort and J.M. Nolan

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



Percentage by which the car driver death rate in crashes with SUVs and pickups exceeds the car driver death rate in crashes with other cars



(« from p. 5) energy-absorbing structures. These more compatible designs were the result of a 2003 voluntary commitment by automakers that the Institute helped broker.

“For a long time, the front ends of SUVs were so high that they bypassed the energy-absorbing structures of the fronts of cars,” says Joe Nolan, IIHS senior vice president for vehicle research and a co-author of both the earlier study and the new one. “The changes prompted by the voluntary commitment largely resolved that issue.”

The trend toward better crash compatibility between cars and SUVs has continued, the new study shows. In 2013-16, the rate at which car drivers were killed in crashes with 1-4-year-old SUVs was just 28 percent higher than the rate that car drivers were killed in crashes with other cars, also between 1 and 4 years old. That compares with 132 percent in 1989-92 and 59 percent in 2009-12.

“The fact that car-SUV compatibility has continued to improve long after the voluntary commitment is probably a result of improved crashworthiness in the smallest vehicles,” Nolan says. “Small cars and minicars used to have the worst ratings in our crash tests but have made big strides in recent years.”

Although the voluntary commitment resulted in more compatible pickup designs too, pickup-car compatibility is still lacking. The car driver death rate in crashes with pickups increased steadily between 1989 and 2008, relative to the car driver death rate in crashes with other cars. This gap began to close over the last decade but remains large. In 2013-16, car and minivan drivers died in crashes with pickups 2½ times as often as they were killed in crashes with other cars.

To see how much of the remaining problem is due to weight differences versus design issues, the researchers repeated their analysis with only vehicles weighing between 3,500 and 4,000 pounds. The car driver death rate in crashes with light pickups in this weight range was just 23 percent higher than it was in crashes with cars of similar weight. The car driver death rate in crashes with light SUVs of this weight was slightly lower than in crashes with cars. These results point to weight differences as a likely source of continued incompatibility

But would shedding weight make pickups and SUVs less protective of their own occupants? To find out, researchers also looked at death rates among the pickup and SUV drivers themselves. For the earlier years, the death rates among light pickup and light SUV drivers were much higher compared with their full-sized counterparts. In 2013-16, however, lighter vehicles were not associated with as much of an increase in driver death rates. In other words, higher curb weight doesn't seem to play as big a role in protecting SUV and pickup occupants as it once did.

“More sophisticated designs that do a better job of managing forces in a crash, along with electronic stability control and other crash avoidance features, have made the sheer weight of a vehicle less important,” Nolan says. “This suggests that reducing the weight of the heaviest vehicles for better fuel economy — for example, by switching from steel to aluminum — can improve safety for other road users without sacrificing occupant protection.” ■

Roadside drug tests often contradict driver statements

A new study comparing self-reported drug use with drug test results has confirmed what most people might expect: Drivers aren't especially eager to admit taking drugs within 24 hours of getting behind the wheel — even when those drugs are legal.

Based on an analysis of the two most recent national roadside surveys, a new study from IIHS found that far from all drivers who later tested positive for drugs had reported taking them in their responses to questionnaires. The finding underlines the importance of conducting blood or saliva tests to understand the extent of the drug-impaired driving problem.

“Although we expected drug use to be underreported, it was surprising how inconsistent the results were from one survey year to another. These findings suggest that self-reported drug use is not a good measure for monitoring trends in drug use in this population,” says IIHS Senior Research Scientist Angela Eichelberger, the lead author of the paper.

Currently, researchers simply don't have good data on the prevalence of drug-involved driving nationwide, she notes. Biological measures are not collected regularly, and the information on drug use from the Fatality Analysis Reporting System, a census of fatal crashes on U.S. roads, is problematic. Many drivers involved in fatal crashes are never tested for drugs, and when they are tested, inconsistencies in testing procedures among different states and different time periods make it difficult to accurately estimate trends.

A potentially better source of data is the national roadside survey of alcohol and drug use by drivers, which has been conducted five times since it began in 1973. To gather results, researchers work with local police to safely stop drivers, who are asked to participate anonymously. Drivers who are found to be impaired do not face charges. However, they are provided with alternative transportation.

The first three times it was conducted, survey workers used breath testing and a brief interview to estimate the prevalence of alcohol-impaired driving. In the most recent two surveys, workers asked about drug use too. They also collected saliva and blood samples, and those who agreed to provide them received a small payment.

In the 2007 and 2013-14 surveys, workers collected anonymous data from 300 locations across the continental U.S., gathering both biological and self-reported information from more than 7,000 drivers during each survey. For the IIHS study, researchers looked specifically at the results related to cannabis, opioids, cocaine, antidepressants and benzodiazepines, which include such drugs as Valium and Xanax.

IIHS RESEARCH

“Measuring drug use among drivers: How accurate is self-reported use?”

by A.H. Eichelberger and T. Kelley-Baker

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



For the national roadside survey, workers interview drivers, conduct breath tests for alcohol, and collect saliva and blood samples to test for drugs. Many drivers who say they haven't used drugs test positive. The results aren't consistent from one survey year to the next, which suggests that relying on self-reports isn't the best way to monitor trends.

Photos: Pacific Institute for Research and Evaluation

Results varied for the different types of drugs. In both surveys, fewer than 1 in 5 respondents who tested positive for cocaine reported taking it within the past 24 hours in their answers to the questionnaire. The proportion of marijuana-positive drivers who said they had taken the drug within the past 24 hours increased from a quarter to nearly 40 percent between 2007 and 2013-14 — likely due to broader social acceptance following its legalization in several states.

For prescription drugs, the reporting rate was somewhat higher: more than 40 percent for opioids and more than 70 percent for antidepressants in both surveys and better than half for benzodiazepines in 2013-14. These higher rates may reflect lower social stigma associated with these drugs or less fear of legal consequences.

It's possible that some drivers who tested positive but said they hadn't used drugs in the past 24 hours were telling the truth. Chemical indicators of marijuana and other drugs can in some circumstances remain in the blood longer than that.

Curiously, not all of the drivers who reported taking drugs over the past 24 hours tested positive. Only 21 percent of respondents who reported taking antidepressants in 2013-14 tested positive, for instance, most likely because the biological tests didn't cover the complete range of those medications. On the other hand, 64 percent of respondents who admitted using cocaine and 82 percent who admitted using marijuana tested positive for those drugs.

"The discrepancies could indicate that drivers might have been

mistaken about when they took the drug or mistaken about the kind of medication they had taken," Eichelberger says. "These drugs also take varying lengths of time to disappear from your system."

That means both biological testing and self-report data can be useful. The biological tests provide important objective information. But the self-reports can provide details about drug use that the tests can't measure, such as frequency of use and mode of administration.

Researchers are eager for more robust data than are currently available. Almost a third of all motor vehicle fatalities have been alcohol-related for more than a decade, but the most recent national roadside surveys showed a drop in the proportion who tested positive for alcohol and an increase in the proportion who tested positive for illegal drugs and medications.

Although roadside surveys are useful for tracking changes in drug use among drivers, it is not clear how many of the drivers were impaired by drugs other than alcohol, since there are no evidence-based standards to establish impairment based on a drug test.

Meanwhile, trends like the increasing acceptance of marijuana and the opioid crisis make it even more important to develop a better understanding of drug-impaired driving.

Studies by IIHS and HLDI, for instance, showed crashes increased as much as 6 percent following the start of retail sales of recreational marijuana in Colorado, Nevada, Oregon and Washington (see "Crashes rise in first states to begin legalized retail sales of recreational marijuana," Oct. 18, 2018). ■

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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