Status Report

Insurance Institute for Highway Safety | Highway Loss Data Institute

Safe passage

New ratings address pedestrian crashes

ALSO IN THIS ISSUE

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- Front autobrake systems could prevent a wider array of rear-end crashes
- IIHS to host national forum with GHSA to address neglected problem of speeding

Most small SUVs earn advanced or superior ratings for pedestrian crash prevention

Reducing pedestrian crashes is the goal of new IIHS ratings of automatic emergency braking systems that can detect and brake for people on foot. In the first tests of 2018–19 vehicles with this crash avoidance feature, 9 of 11 small SUVs evaluated earn an advanced or superior rating for pedestrian crash prevention.

The 2018–19 Honda CR-V, 2019 Subaru Forester, 2019 Toyota RAV4 and 2019 Volvo XC40 earn the highest rating of superior. Five models earn an advanced rating. They are the 2019 Chevrolet Equinox, 2018–19 Hyundai Kona, 2019 Kia Sportage, 2018–19 Mazda CX-5 and 2019 Nissan Rogue.

The ratings come amid renewed focus on the problem of crashes involving pedestrians. Autobrake systems that can detect and brake for pedestrians are one important countermeasure to address the rising death toll for these vulnerable road users.

The 2019 Mitsubishi Outlander is rated basic, and the 2018–19 BMW X1 doesn't receive any credit for a rating. Pedestrian detection is standard on the Forester, RAV4, Rogue, X1 and XC40.

The ratings come amid renewed focus on the problem of crashes involving pedestrians. Pedestrian deaths have risen 45 percent since reaching their lowest point in 2009 (see *Status Report*, May 8, 2018, at iihs.org). In 2017, 5,977 pedestrians died in crashes in the U.S., down 2 percent from 2016, which marked the most deaths since 1990.

Autobrake systems that can detect and brake for pedestrians are one important countermeasure to address the problem. A 2018 HLDI analysis 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 *Status Report*, May 8, 2018).

In general, pedestrian detection systems use a forward-facing mono camera or stereo cameras mounted near the rearview mirror plus radar sensors in the vehicle's front grille to continuously scan the roadway and horizon for pedestrians and, in some cases, bicyclists or animals, who might cross the vehicle's travel path. Algorithms classify the objects as people, bicyclists or animals, predict their travel path and determine the vehicle's speed in relation to them. If a collision is imminent, the system typically alerts the driver and can apply the brakes far faster than a human could react.

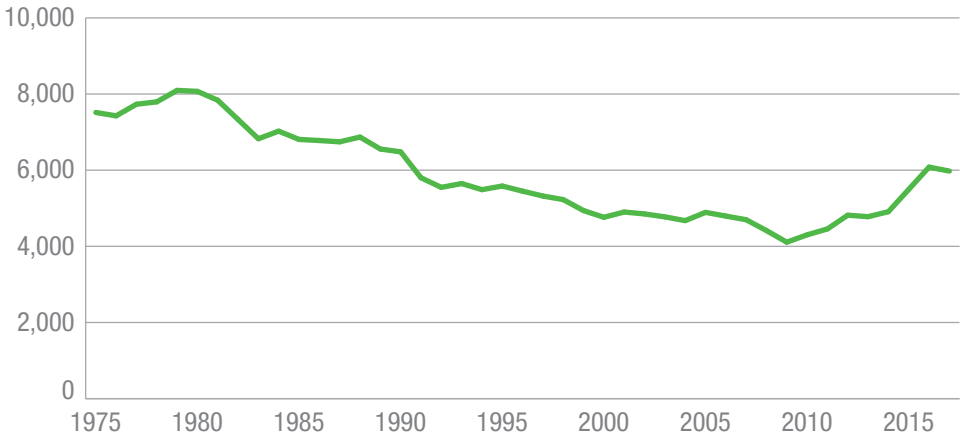
The pedestrian autobrake test is the fourth crash avoidance evaluation in the Institute's quiver of safety tests. IIHS began rating front crash prevention systems in 2013, headlights in 2016, and rear crash prevention systems in 2018. Under the new program, vehicles rate as basic, advanced

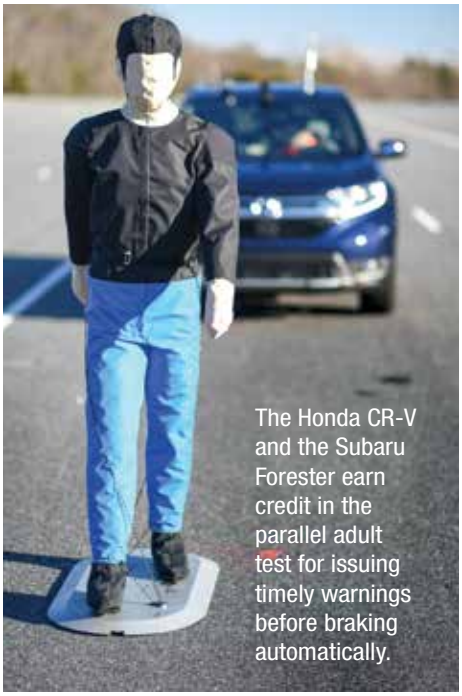
How small SUVs rate in new pedestrian test

SUPERIOR	2018–19 Honda CR-V
	2019 Subaru Forester
	2019 Toyota RAV4
	2019 Volvo XC40
ADVANCED	2019 Chevrolet Equinox
	2018–19 Hyundai Kona
	2019 Kia Sportage
	2018–19 Mazda CX-5
	2019 Nissan Rogue
BASIC	2019 Mitsubishi Outlander
NO CREDIT	2018–19 BMW X1

Vehicles rate as basic, advanced or superior, based on their ability to avoid or mitigate a crash with pedestrian dummies in three different test track scenarios run at different speeds.

Pedestrian deaths in crashes involving motor vehicles, 1975–2017





The Honda CR-V and the Subaru Forester earn credit in the parallel adult test for issuing timely warnings before braking automatically.

or superior, based on their ability to avoid or mitigate a crash with pedestrian dummies in three different test track scenarios run at different speeds. The Institute shared the test protocol with manufacturers in fall 2018 (see *Status Report*, Dec. 19, 2018).

Crash scenarios

The tests address three common pedestrian crash scenarios.

"The first scenario involves an adult pedestrian on the right side of the road entering the street in the path of an oncoming »

The X1, which comes with BMW's Daytime Pedestrian Detection system, didn't brake at all in the 37 mph parallel adult test, sending the dummy airborne. In the other tests, the luxury SUV didn't slow in time to avoid hitting the dummies.

BMW X1

(« *from p. 3)* vehicle. This is the most common type of crash involving a pedestrian," explains David Aylor, the Institute's manager of Active Safety Testing.

"The second test simulates a child darting into the street from behind two parked vehicles. As a dad, I know this is every parent's nightmare," Aylor says.

"The third test scenario replicates an adult walking in the vehicle's travel lane near the edge of the road. The adult's back is turned away from traffic."

Vehicles are scored according to their average speed reductions in five repeated test runs on dry pavement. Tests are conducted at 12 mph and 25 mph in the perpendicular adult and child scenarios, and at 25 mph and 37 mph in the parallel adult scenario.

The four superior-rated and five advanced-rated SUVs had significant speed reductions in every scenario. That meant the SUVs almost avoided and, in some cases, did avoid striking the pedestrian dummies.

"The best possible outcome is to avoid hitting a pedestrian altogether," Aylor says. "When a crash is unavoidable, sharply reducing a vehicle's travel speed would give someone on foot a far greater chance of surviving any injuries in a similar real-world encounter with a passenger vehicle."

When seconds count

The most challenging test is the perpendicular child scenario. The 45-inch-tall dummy, which represents an average-size 7 year-old, is hidden by a car and an SUV parked on the right side of the road as the test vehicle approaches. There is no clear line of sight for the camera until the dummy emerges from behind the parked vehicles when the test vehicle is about 2 seconds, or 35 feet, away in the 12 mph test or just under 2 seconds, or 65 feet, away in the 25 mph test. When the dummy enters the travel lane, the test vehicle is roughly 1.5 seconds away.

In the 12 mph perpendicular adult test, the vehicle is about 1 second, or 20 feet, away when the 6-foot-tall pedestrian dummy enters the travel lane, and in the 25 mph test, the vehicle is about 1 second, or 45 feet, away when the pedestrian enters the travel lane.

"It would be hard for human drivers to react quickly enough to brake in time if

they didn't see the pedestrian until he or she was already in the road," Aylor says.

Only the Forester and RAV4 avoided hitting the dummies in every perpendicular test. The XC40 avoided the adult dummy in the 12 mph and 25 mph tests and avoided the child dummy in the 12 mph test.

IIHS gives credit in the 37 mph parallel adult test to systems that issue a timely warning (greater than or equal to 2.1 seconds time-to-collision), upping the odds of a driver response. The CR-V and Forester are the only small SUVs in the group to earn credit for issuing a warning in the parallel adult test before automatically braking to mitigate the impact with the dummy.

The Outlander's autobrake system mitigated its speed by about 19 mph in the 25 mph parallel adult test and by 11 mph in the 12 mph perpendicular child test. The Outlander managed only minimal speed reductions in the other tests, despite earning a superior rating for front crash prevention in tests of its ability to avoid or mitigate collisions with other vehicles.

The X1, which comes with BMW's Daytime Pedestrian Detection system, didn't brake at all in the 37 mph parallel adult scenario. The luxury SUV had minimal to no speed reductions in the other tests. In front crash prevention tests, the X1 is rated advanced.

IIHS has a twofold aim in adding pedestrian crash prevention ratings to its test mix.

"We want to encourage manufacturers to include pedestrian detection capabilities as they equip more of their vehicles with automatic emergency braking systems," Aylor says. "We also want to arm consumers with information about these systems so they can make smart choices when shopping for a new vehicle."

A 2011 IIHS analysis of 2005–09 crash data estimated that pedestrian detection systems could potentially mitigate or prevent up to 65 percent of single-vehicle crashes with pedestrians in the three most common crash configurations and 58 percent of pedestrian deaths in these crashes if all vehicles were equipped with the systems (see *Status Report*, March 30, 2011).

Roughly two-thirds of front crash prevention systems offered on 2019 models have pedestrian detection capabilities. Many of these also can detect and react to bicyclists and, in some cases, animals, although IIHS didn't assess these capabilities. ■

Autobrake is good, but it could be better

When it comes to preventing typical front-to-rear crashes, automatic emergency braking is a proven winner. Extending its functionality to address less-common types of rear-end crashes involving turning, changing lanes or striking heavy trucks or motorcycles, for instance, would help maximize autobrake's benefits, a new IIHS study indicates.

Current autobrake systems are designed to address potential crash scenarios involving two passenger vehicles traveling in a line on a dry road at low speeds. The Institute's front crash prevention ratings program, which IIHS launched in 2013, assesses autobrake system performance in this kind of situation in which one vehicle is in danger of rear-ending another. Sixty-six percent of the autobrake systems IIHS has evaluated on 2019 models earn the highest rating of superior for front crash prevention, and nearly 8 percent earn an advanced rating.

Autobrake reduces the frequency of property damage liability claims by 13 percent, rates of rear-end crashes by 50 percent and rear-end crashes involving injuries by 56 percent, studies conducted by IIHS and HLDI have found. Property damage liability coverage pays for damage that an at-fault driver causes to another vehicle.

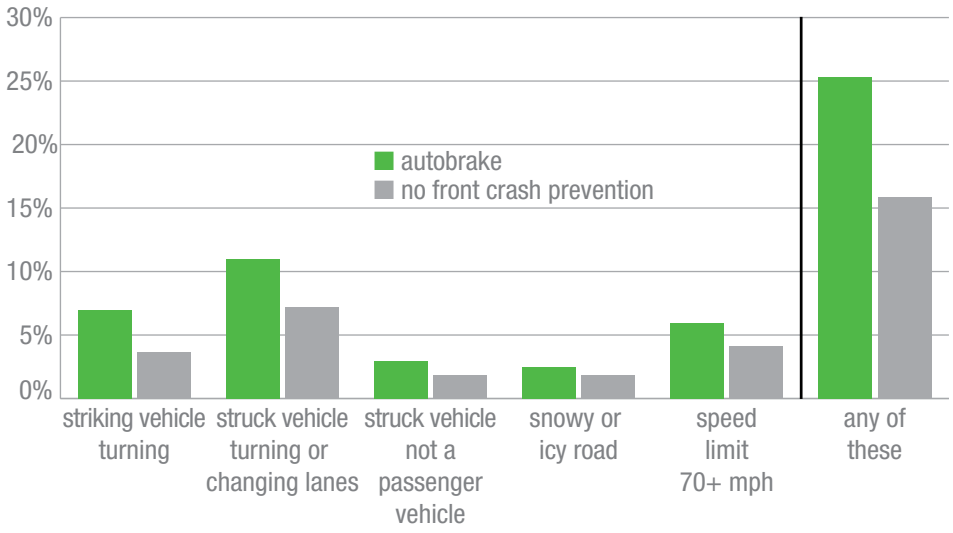
Although the reductions are impressive, there is more room for progress. IIHS estimates that autobrake could potentially prevent as many as 70 percent of front-to-rear crashes involving passenger vehicles as striking vehicles and 20 percent of all passenger vehicle crashes reported to police.

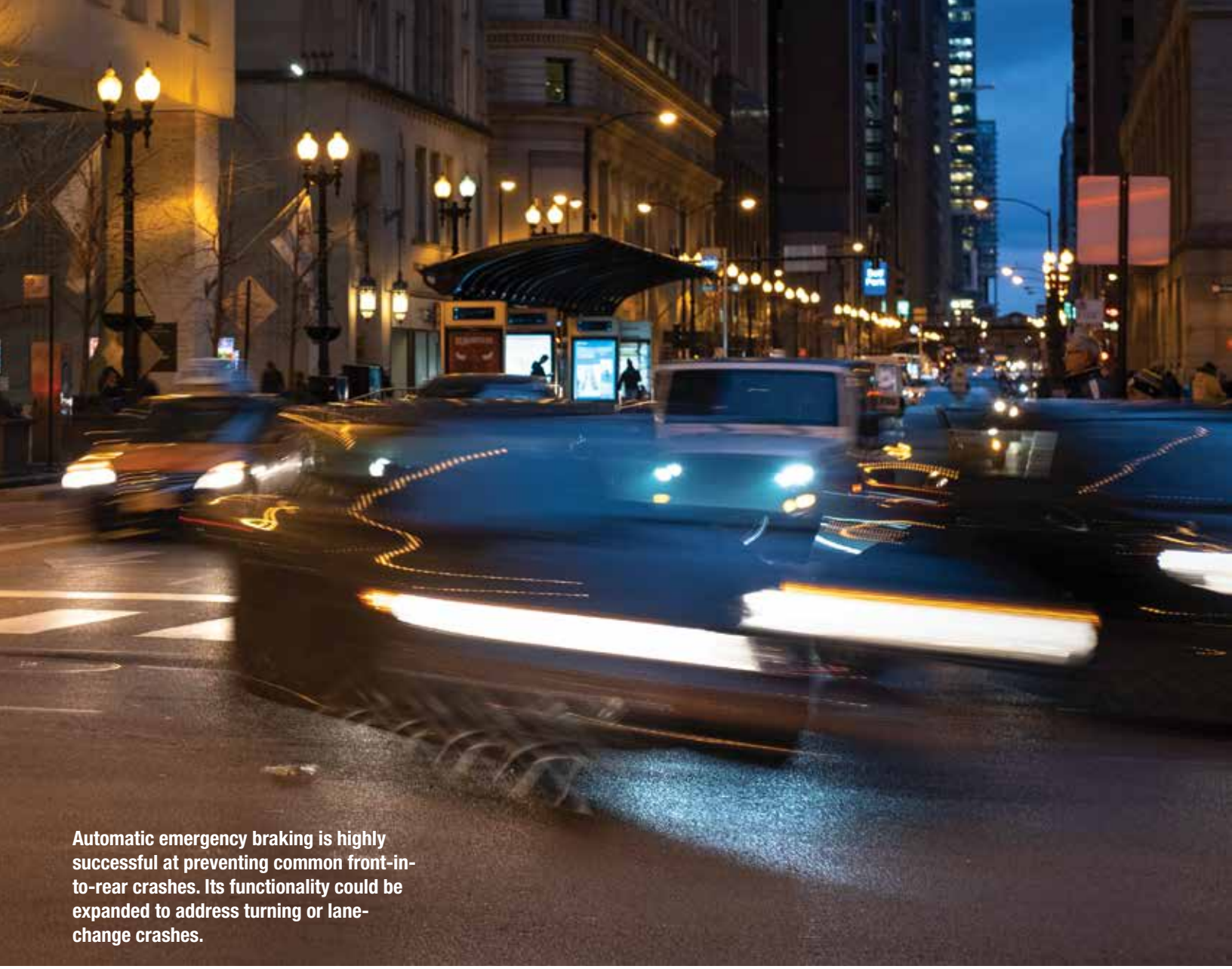
To see what types of rear-end crashes in which vehicles with autobrake are involved, IIHS researchers examined police crash-report data from 23 U.S. states during 2009–2016 for striking passenger vehicles with and without autobrake among models on which the system was optional. They controlled for driver demographics and vehicle features and used logistic regression to examine the odds that rear-end crashes with various characteristics involved a striking vehicle with autobrake. Autobrake was considered to be less effective at preventing the types of rear-end crashes that were overrepresented among vehicles with the feature and more effective at preventing crash types that were underrepresented.

"Our goal was to identify additional opportunities to increase the effectiveness of autobrake," says Jessica Cicchino, IIHS vice »

Vehicles with autobrake are overrepresented in some types of rear-end crashes

Proportion of rear-end crashes with various characteristics by type of striking vehicle





Automatic emergency braking is highly successful at preventing common front-in-to-rear crashes. Its functionality could be expanded to address turning or lane-change crashes.

(« *from p. 5)* president for research and a study co-author. "The findings will help guide future modifications to our front crash prevention tests to take into account some of these other crash scenarios."

More than two-thirds of the crashes during the study period occurred when the road surface was dry, the striking vehicle was moving straight, or the struck vehicle was slowing or stopped. More than half of crashes occurred at speed limits of 45 mph or below, and about half of the vehicles struck were cars. These are the typical scenarios that current automatic emergency braking systems address.

The remainder of the crashes studied involved less-typical situations. Crash-involved vehicles with autobrake were more likely to be turning, to strike a vehicle that was turning or changing lanes, to strike a nonpassenger vehicle or special-use vehicle (medium or heavy trucks or motorcycles, for example), crash on a snowy or icy road, or on a road with a 70 mph or higher speed limit than control-group vehicles. Researchers examined speed limit as a proxy for vehicle speed.

"No crash avoidance technology is designed to address every possible crash scenario," Cicchino says. "Designers have rightly focused on the most common kinds of crashes. As automatic emergency braking matures, manufacturers are expanding functionality to account for collisions involving pedestrians and bicyclists, for example.

"At the same time, designers have to be mindful not to build in sensitivities that would irk drivers or put them in potentially risky situations by intervening in situations in which the driver is in control of the vehicle," she adds.

There is a clear need for autobrake systems that reliably detect other motor vehicles. IIHS research indicates that autobrake could potentially prevent up to 13 percent of passenger vehicle crashes with motorcycles (see *Status Report*, Oct. 19, 2017, at iihs.org).

Autobrake systems that reliably detect large trucks could prevent underride crashes. Twelve percent of U.S. passenger vehicle occupant deaths in 2017 were in crashes with large trucks, and 1 in 5 of these deaths occurred when a passenger vehicle struck the rear of a large truck.

For a copy of "Characteristics of rear-end crashes involving passenger vehicles with automatic emergency braking" by J.B. Cicchino and D.S. Zuby, email StatusReport@iihs.org. ■

NATIONAL FORUM SEEKS TO ADDRESS NEGLECTED PROBLEM OF SPEEDING

Speeding is a factor in the deaths of approximately 10,000 people each year in the U.S., but the problem isn't being addressed comprehensively. IIHS and the Governors Highway Safety Association (GHSA) will convene a speeding forum **April 15–16** with a diverse group of stakeholders to identify strategies to reduce speeding, prevent crashes and save lives.

High speeds make a crash more likely because it takes longer to stop or slow down. They also make collisions more deadly because crash energy increases exponentially as speeds go up. If the U.S. is to attain the goal of zero traffic fatalities, the persistent problem of speeding must be addressed.

Higher speed limits contribute to the problem. People often drive faster than the speed limit, and if the limit is raised they will go faster still. Research shows that when speed limits are raised, speeds go up, as do fatal crashes.

Determined at the state level, maximum speed limits have been on the rise since 1995. The maximum speed limit is 75 mph in 12 states and 80 mph in six states. Texas allows speeds as high as 85 mph. In the 2019 legislative session, at least seven states have introduced bills to raise limits to 75 mph or higher.

The National Transportation Safety Board's 2019 Most Wanted List includes a call to implement a comprehensive strategy to reduce speeding-related crashes.

The April 15–16 speeding forum will be held at the IIHS Vehicle Research Center in Ruckersville, Virginia. For more information, contact Chamelle Matthew at cmatthew@iihs.org. ■

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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.

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