Status Report

Insurance Institute for Highway Safety | Highway Loss Data Institute

Quick work

Better autobrake helps more models earn top IIHS ratings for front crash prevention

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IIHS awards 8 superior and 13 advanced ratings for front crash prevention in new round of evaluations

Less than a year into a new IIHS ratings program for front crash prevention, auto manufacturers are making strides in adopting the most beneficial systems with automatic braking capabilities and are offering the features on a wider variety of models. Twenty-one of 24 cars and SUVs, all 2014 models unless noted, earn an advanced or higher rating in the latest round of IIHS evaluations.

"We are already seeing improvements from automakers since the initial launch of our ratings last September," says David Zuby, IIHS executive vice president and chief research officer. "BMW and Lexus, for example, have added more braking capability to their systems, which has paid off in higher ratings."

Large family cars and large luxury cars make up the bulk of the test group. IIHS also tested four midsize luxury/near luxury cars, three midsize luxury SUVs and a midsize SUV.

Four vehicles earn perfect scores when equipped with certain options. They are the BMW 5 series large luxury car, BMW X5 midsize luxury SUV, 2015 Hyundai Genesis large luxury car and Mercedes-Benz E-Class large luxury car. In all, eight models earn the highest rating of superior, 13 earn advanced, and three earn a basic rating.

In addition to familiar luxury brands, consumers will find mainstream nameplates among the newest rated vehicles, including Buick, Chevrolet, Dodge and Toyota.

The Institute rates vehicles as basic, advanced or superior for front crash prevention depending on whether they offer autobrake and, if so, how effective it is in tests at 12 and 25 mph.

Forward collision warning systems that meet performance criteria set by the National Highway Traffic Safety Administration and autobrake systems that provide only minimal speed reduction in IIHS tests earn a basic rating. Vehicles that combine the warning with moderate speed reductions earn an advanced rating. It is possible to qualify for an advanced rating with an autobrake system that doesn't first warn the driver before taking action. Models that offer a warning and provide major speed reduction in IIHS tests earn a superior rating. Some models have multiple ratings because they are available with different versions of front crash prevention systems and their test performance varies. In the current group, this is the case with the BMW 3 series, 5 series and X5.

The rating system is based on HLDI research indicating that forward collision warning and autobrake systems help drivers avoid front-to-rear crashes (see *Status Report*, July 3, 2012, at iihs.org).

"We know that this technology is helping drivers avoid crashes," Zuby says. "The advantage of autobrake is that even in cases where a crash can't be avoided entirely, the system will reduce speed. Reducing the speed reduces the amount of damage that occurs to both the striking and struck cars and reduces injuries to people in those cars."

Front crash prevention systems use various types of sensors, such as camera, radar or laser, to detect when the vehicle is getting too close to one in front of it. Most systems issue a warning and precharge the brakes to maximize their effect if the driver responds by braking. Many systems brake the vehicle autonomously if the driver doesn't respond. In some cases, automatic braking is activated without a warning.

BMW offers an improved front crash prevention system on 2014 models that secures high marks for the X5, 5 series and 3 series. The X5 and 5 series earn superior ratings when equipped with a system that uses both a camera and radar. When the X5, 5 series and 3 series are equipped with an optional camera-only collision mitigation system, they are rated advanced for front crash prevention. The 2 series luxury coupe also earns an advanced rating.

Front crash prevention ratings

2014 large and midsize cars and midsize SUVs

	Autobrake points		Forward collision warning points	Total points
	12 mph test	25 mph test		
SUPERIOR				
BMW 5 series (Collision Warning with braking function)	2	3	1	**6**
BMW X5 (Collision Warning with braking function)	2	3	1	**6**
Hyundai Genesis (2015; Automatic Emergency Braking)	2	3	1	**6**
Mercedes-Benz E-Class (Pre-Safe Brake)	2	3	1	**6**
Buick Regal (Automatic Collision Preparation)	2	2	1	**5**
Cadillac CTS (Automatic Collision Preparation)	2	2	1	**5**
Cadillac XTS (Automatic Collision Preparation)	2	2	1	**5**
Chevrolet Impala (Collision Mitigation Braking)	2	2	1	**5**
ADVANCED				
BMW 2 series (Collision Warning with City Braking function)	2	1	1	**4**
Buick LaCrosse (Automatic Collision Preparation)	2	1	1	**4**
Lexus IS (Pre-Collision System)	2	1	1	**4**
Audi A3 (2015; Audi Pre Sense Front)	2	0	1	**3**
Audi A6 (Audi Pre Sense Front)	2	0	1	**3**
BMW 3 series (Collision Warning with City Braking function)	1	1	1	**3**
BMW 5 series (Collision Warning with City Braking function)	1	1	1	**3**
BMW X5 series (Collision Warning with City Braking function)	1	1	1	**3**
Dodge Durango (Forward Collision Warning with Crash Mitigation)	1	1	1	**3**
Lexus GS (Pre-Collision System)	1	1	1	**3**
Mercedes-Benz CLA (Collision Prevention Assist Plus)	2	0	1	**3**
Infiniti QX50 (Intelligent Brake Assist)	0	1	1	**2**
Infiniti QX70 (Intelligent Brake Assist)	0	1	1	**2**
BASIC				
BMW 3 series (Collision Warning with braking function), Infiniti Q70 (Intelligent Brake Assist), Toyota Avalon (Pre-Collision System)	0	0	1	**1**

SUPERIOR
Models earning a total of 5 to 6 points, based on performance in autobrake tests and credit for forward collision warning.

ADVANCED
Models earning a total of 2 to 4 points, based on performance in autobrake tests and credit for forward collision warning.

BASIC
Models earning 1 point for forward collision warning or in 1 of 2 autobrake tests.

Point system based on autobrake performance

speed reduction (mph)	points
12 mph test	
less than 5	0
5 to 9	1
10 or more	2
25 mph test	
less than 5	0
5 to 9	1
10 to 21	2
22 or more	3

For details on individual vehicles, go to iihs.org

In comparison, the 2013 model 3 series was rated basic. The earlier model's system braked for a stopped car ahead only if sensors first detected the car moving before it stopped. The same system is still available on certain 2014 models, and these cars continue to earn a basic rating.

Lexus enhanced its radar-based systems to provide more braking capability, garnering an advanced rating for the GS large luxury car and IS midsize luxury/near luxury car. Likewise, Toyota made changes to systems on the Highlander midsize SUV and Prius small car to earn advanced ratings in results published earlier at iihs.org. The Toyota Avalon is rated basic because the large family car's autobrake system provided minimal braking in IIHS tests.

The Buick Regal, Cadillac CTS, Cadillac XTS and Chevrolet Impala earn the highest rating of superior when equipped with GM's forward collision warning and autobrake system. The 2014 Buick LaCrosse earns an advanced rating when it has the same system. All of these cars also are available with a warning system only, which earns a basic rating. The cars join the superior-rated Cadillac ATS and SRX, which were included in the first round of tests in 2013 (see *Status Report*, Sept. 27, 2013).

The Institute's initial batch of front crash prevention ratings covered 74 midsize cars and SUVs. Results for a dozen more models followed last winter, with four earning superior ratings, six earning advanced and two earning basic. Besides the Institute, the European New Car Assessment Programme also rates front crash prevention systems and has so far published ratings for nine models sold in Europe (go to euroncap.com for details).

Most front crash prevention systems have to be purchased as part of an optional package, but consumers will find that availability is growing, especially for autobrake. More than 20 percent of 2014 models in HLDI's vehicle features database offer a front crash prevention system with autobrake capabilities, twice as many as in 2012. Forward collision warning is offered as an option on nearly 40 percent of 2014 models.

"Sorting through the various trade names and features can be confusing, even if you're looking at models from the same manufacturer. Before buying, consumers should consult the IIHS ratings to find out if the specific model they are considering comes with a top-rated front crash prevention system," Zuby advises.

To see ratings by make and model go to iihs.org/ratings, and to check availability of crash avoidance features go to iihs.org/crash_avoidance.

Acura, Mercedes-Benz and Volvo sell the systems as standard equipment on certain models. An advanced-rated autobrake

The 2014 Honda Accord EX-L V-6 sedan comes with forward collision and lane departure warning.

Honda warning system trims insurance claims

A combined forward collision and lane departure warning system available on the Honda Accord is reducing insurance claims, a new HLDI analysis shows. The results are even better than expected based on previous studies of such technology on luxury vehicles.

In the first real-world study of a crash avoidance system on a high-volume, nonluxury vehicle, Honda's system was found to reduce insurance claims for damage to other vehicles by 14 percent. It cut claims for injuries to occupants of the equipped vehicles by 27 percent and claims for injuries to other road users by 40 percent.

"This was our first opportunity to study advanced crash avoidance technology on a high-volume vehicle, and the results are impressive," says HLDI Vice President Matt Moore. "This is a warning system only, but the claim frequency reductions are similar to what we saw earlier for systems with automatic braking."

Previous analyses of forward collision warning without autobrake showed more modest claim reductions. Lane departure warning was associated with increases in claims in earlier studies, though none that were statistically significant (see *Status Report*, July 3, 2012, at iihs.org).

Advanced crash avoidance technologies first appeared on luxury vehicles but now are being offered as options on mainstream cars and SUVs. IIHS provides front crash prevention ratings for many models, and a basic or higher rating is a requirement for the Institute's highest award, *TOP SAFETY PICK+*. A forward collision warning system like the Accord's that meets government criteria qualifies for a basic rating. Systems that include an autobrake function can earn an advanced or superior rating, based on performance in two IIHS track tests.

For the study of the Honda features, HLDI looked at both 2-door and 4-door versions of the 2013 Accord, as well as the 2013 Crosstour, an SUV built on the Accord platform. The crash avoidance features are standard on certain trim levels. Losses under different types of insurance were compared for Accords and Crosstours with and without the features.

The BMW 5 series brakes for the target in an IIHS test. The car earns a superior rating when equipped with an optional camera and radar system.

system is standard on the Volvo S60, S80 and XC60. Basic-rated forward collision warning is standard on the Acura RLX and ZDX, plus the Mercedes-Benz CLA, E-Class and M-Class.

The Institute will require an advanced or better rating for front crash prevention as one of the criteria needed to win a 2015 *TOP SAFETY PICK+* award. For the current 2014 award cycle, models can qualify with a basic rating. Vehicles also must earn good ratings in the moderate overlap front, side, roof strength and head restraint tests, plus a good or acceptable rating in the small overlap front crash test. ■

The rate of property damage liability (PDL) claims was 14 percent lower for vehicles with forward collision and lane departure warning than for those without. PDL covers damage caused by the insured vehicle to someone else's vehicle or property. Claims for front-to-rear crashes that forward collision warning systems are intended to address are common for this type of insurance, and previous studies of front crash prevention systems found statistically significant reductions in PDL claim frequency.

In the earlier studies, forward collision warning systems without autobrake from Mercedes-Benz and Volvo resulted in PDL frequency reductions of 7 percent. Systems that included autobrake had reductions of 10-14 percent.

The impressive results for a system that lacks autobrake could mean that Honda's forward collision warning works better than the warning systems evaluated earlier. Another possible explanation is that the Honda lane departure warning component is providing a benefit, unlike lane departure warning systems from Buick and Mercedes-Benz that were studied in 2012. In the earlier studies, only Volvo's lane departure warning was associated with PDL claim frequency reductions, but it was combined with forward collision warning with autobrake, and the effect wasn't statistically significant. Forward collision warning is still relatively new, so the benefits of the various systems may turn out to be more similar to one another after additional data are collected.

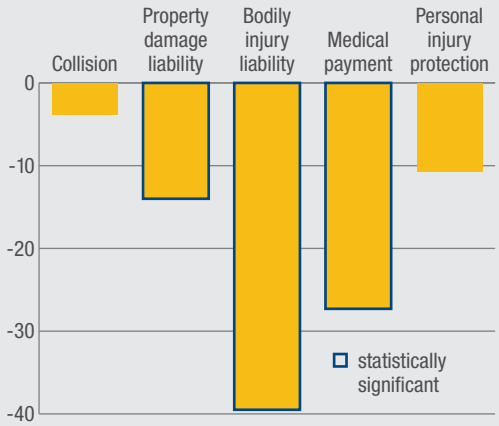
Claim frequency under collision coverage, which pays for damage to the insured vehicle, was 4 percent lower with Honda's warning system, though the reduction wasn't statistically significant. Effects on collision claims would be expected to be weaker than the effects on PDL because collision claims include many single-vehicle crashes that wouldn't be addressed by the technology. That pattern was observed in the earlier analyses of front crash prevention systems as well.

Notably, collision claim severity, or average loss payment per claim, fell by $409 with the warning system. This indicates that many crashes that aren't prevented by the feature are mitigated. Previously studied warning systems didn't show declines in collision severity, and the difference may have to do with the location of the equipment on the vehicle. Honda's system relies on a camera located inside the vehicle, while the other systems use external radar sensors that can be easily damaged, pushing up repair costs in crashes that aren't avoided.

Injury claim frequencies also fell with the warning system. Bodily injury liability coverage, which pays for injuries to occupants of other vehicles or other people on the road, declined 40 percent. Medical payment insurance, which covers injuries to occupants of the insured vehicle, fell 27 percent. Personal injury protection, which is sold in states with no-fault insurance systems and covers injuries to occupants of the insured vehicle regardless of who is at fault, fell 11 percent, but the result wasn't statistically significant.

For a copy of "Honda Accord collision avoidance features: initial results," email publications@iihs.org. ■

Percent differences in claim frequency for Honda Accords with forward collision and lane departure warning



The side curtain airbag and driver airbag deploy in the Hyundai Genesis during an IIHS side test. The car's side curtain airbags also are designed to deploy in a rollover crash.

Side airbag benefits extend to people in rollover crashes

Side curtain airbags that deploy in rollover crashes help reduce front-seat occupant deaths in first-event rollovers by 41 percent, the National Highway Traffic Safety Administration (NHTSA) estimates in a preliminary look at the benefits of this relatively new type of airbag. In the report, the agency also updates estimated benefits for four other types of side airbags, adding to the evidence that they are saving lives and reducing injuries.

Curtain airbags designed to deploy in rollovers and remain inflated longer began to appear in 2002 models, and by the 2014 model year about 38 percent of new passenger vehicles had them. These rollover airbags are expected to become the norm as manufacturers work to meet a new ejection mitigation standard that began phasing in with 2014 models (see *Status Report*, April 26, 2011, at iihs.org).

Vehicles roll over in less than 3 percent of all crashes, but these crashes account for more than a third of passenger vehicle occupant deaths.

Other types of side airbags have been available on U.S. passenger vehicles since 1996. These include curtain airbags designed to deploy from the roof or door in side crashes; torso airbags, which deploy from the seat; combination head/torso airbags; and curtain plus torso airbags. Curtain plus torso airbags are the most common, found in 83 percent of 2014 models, HLDI estimates.

Based on analysis of data from the Fatality Analysis Reporting System, NHTSA estimates that curtain plus torso airbags reduce the risk of a driver or right front-seat passenger dying in a near-side crash by 31 percent, and combination head/torso airbags reduce the risk by 25 percent. Curtain airbags alone lower the risk by 16 percent, while torso airbags trim the risk by 8 percent. The agency's estimated benefits of side airbags are in line with earlier research by the Institute and other groups (see *Status Report*, Oct. 7, 2006, and Dec. 20, 2012).

In side-impact crashes, the side structure of the struck vehicle or the structure of the striking vehicle can injure even properly

belted occupants. In some cases, occupants collide with nearby objects, such as utility poles. Side airbags cushion and spread the load of these impacts to prevent any part of an occupant's body from sustaining concentrated impact forces. Side airbags that offer head protection are particularly important because they may be the only thing between a person's head and the front of a striking vehicle, a tree or other object, or the ground in the event of a rollover.

All of the vehicles that earn good ratings in the Institute's crash test assessing occupant protection in side impacts have head-protecting side airbags. These vehicles also have side structures that resist major intrusion into the occupant compartment. NHTSA doesn't mandate side airbags specifically but does require a high level of head and torso protection for occupants in side crashes.

Vehicles roll over in less than 3 percent of all crashes, but these crashes account for more than a third of passenger vehicle occupant deaths. When vehicles do roll, side curtain airbags can prevent an occupant's head and upper body from contacting the ground and also keep unbelted people inside the vehicle. In addition, safety belts hold occupants in their seats and inside the vehicle when people use them, while strong roofs that resist occupant compartment intrusion reduce the risk of serious injury and death.

NHTSA notes that its preliminary estimate of the benefits of curtain airbags that deploy in rollovers is based on limited data of the fatal crash experience of 2011 and earlier model vehicles. This type of airbag didn't begin to see rapid growth in installations until the 2010 model year.

For a copy of "Updated estimates of fatality reduction by curtain and side air bags in side impacts and preliminary analyses of rollover curtains" by C.J. Kahane, go to www-nrd.nhtsa.dot.gov/Pubs/811882.pdf. ■

To see side airbag availability by make and model year go to: iihs.org/iihs/ratings/safety-features).

Rearview camera rule aims to reduce backover crashes

Nearly all new passenger vehicles are expected to have rearview cameras by May 2018 under a new rule issued by the National Highway Traffic Safety Administration (NHTSA).

The regulation is designed to reduce backover crashes involving children and other pedestrians and was several years in the making. Congress directed the agency in 2008 to expand the required field of view behind a vehicle.

The rule, which applies to vehicles weighing less than 10,000 pounds, doesn't explicitly require cameras. However, many of the requirements currently can be met only with cameras. The field of view must include a 10-foot by 20-foot zone directly behind the vehicle and must display specific portions of seven 32-inch-tall cylinders placed along the perimeter of that zone. The rule also includes specific requirements for image size, default view and other characteristics.

A recent IIHS study indicated that rear cameras could help prevent backover crashes involving people in a vehicle's blind zone. The study, which relied on volunteer drivers, showed that cameras are more effective than parking sensors at helping drivers see and avoid a child-size object placed behind the vehicle (see *Status Report*, March 13, 2014, at iihs.org).

An estimated 267 people are killed and 15,000 injured each year by drivers who back into them, usually in driveways or parking lots. Young children and elderly people are most likely to be killed in such crashes. About 210 of the fatalities involve vehicles under 10,000 pounds. NHTSA estimates that 58 to 69 lives will be saved each year once every vehicle under 10,000 pounds on the road is equipped with a rear visibility system.

NHTSA also expects the systems to reduce crashes that result in property damage only. HLDI studies of insurance data for Mazda and Mercedes-Benz vehicles equipped with rear cameras didn't show consistent reductions in claims (see *Status Report*, July 3, 2012).

Rearview cameras are becoming common in new vehicles. NHTSA estimates that even without the rule, 73 percent of the vehicles covered by it would have been sold with rear camera systems by 2018. However, some automakers may have been incorporating the technology in anticipation of the requirement, rather than as a result of market demand.

The rise of rear cameras has prompted automakers to contemplate more comprehensive camera systems that could take the place of side mirrors. Removing side mirrors would reduce a vehicle's aerodynamic drag, improving fuel economy. The Alliance of Automobile Manufacturers and Tesla Motors recently petitioned NHTSA to allow camera systems as a compliance option to meet the performance requirements for mirrors.

"Cameras are a great tool for enhancing rear visibility, but if they are going to replace side mirrors, they have to work properly in all kinds of weather and lighting conditions," says David Zuby, IIHS executive vice president and chief research officer. "There also needs to be more research into how drivers use camera information to make sure they would be able to adjust safely to this change."

Current camera systems aren't perfect. In the Institute study, for example, drivers frequently hit a stationary object when it was in the shade even if they were looking at the camera display.

A certain amount of direct visibility by means of over-the-shoulder glances also is important. In comments to NHTSA, the Institute has cautioned against cameras being used as a justification for vehicle designs that limit visibility (see *Status Report*, March 13, 2014). Many drivers still rely on direct glances to get their bearings before backing up.

The rear camera requirement will be phased in beginning May 1, 2016. Ten percent of vehicles manufactured the first year must meet the field-of-view requirement only, and 40 percent must meet it the following year. All vehicles produced after May 1, 2018, must meet the field-of-view requirement, as well as all the other performance requirements. ■

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The **Highway Loss Data Institute** 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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