Status Report

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New side test will have more impact

Pace of safety improvements picks up

2020 *TOP SAFETY PICK* criteria

NTSB calls for action on bike safety

IIHS prepares to launch a more challenging side crash test

The IIHS side crash test has led to lifesaving improvements in occupant protection since it was introduced in 2003. There's just one problem: The program has been so successful that the side ratings for current models are no longer helping consumers distinguish among vehicles or pointing the way toward further improvements.

An updated test should help. IIHS researchers and engineers have been weighing potential changes. A new test program with a higher impact speed and a heavier, more realistic movable barrier representing a more modern striking vehicle is expected to be launched next year.

In addition to identifying things that should change, the research has also clarified what aspects of the current evaluation work well. Measures collected from the test were found to correlate closely with fatality risk. Thus, the new test will likely use the same dummies and collect similar information as the current one.

"This is an opportunity to build on what we've learned in more than 15 years of side testing," says IIHS Senior Research Engineer Becky Mueller. "We'll update the things that need updating, but we don't need to throw out the things that still work well."

Crash test history

When IIHS developed its current side crash test, it filled a need that had emerged with the rise in popularity of SUVs. At the time, the National Highway Traffic Safety Administration (NHTSA) was conducting side tests as part of its consumer information program, using a movable barrier with the height of a car. That test, still part of NHTSA's ratings, doesn't reflect the much greater risk of head injury from impacts with taller vehicles.

The IIHS test proved more challenging than the NHTSA test because the movable barrier mimicked the height and shape of the front end of the typical SUV or pickup on the road at the time. IIHS also used dummies representing a small woman or 12-year-old child.

The combination of these two things meant that the barrier struck the vehicle at about the height of the dummies' heads.

To achieve a good rating in the test, automakers strengthened side structures and equipped vehicles with head-protecting side airbags ahead of a federal regulation that made them essentially mandatory. Only about 1 in 5 vehicles tested earned good ratings in the beginning. Today, 99 percent of rated vehicles earn a good rating, and the remainder are acceptable.

The improvements translated into better crash outcomes and lives saved. A 2011 study of 10 years' worth of crash data found that a driver of a vehicle rated good is 70

IIHS RESEARCH

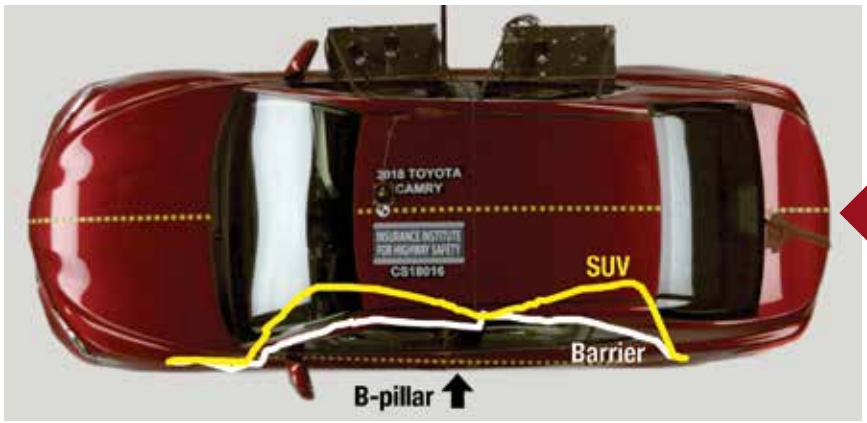
"The association between data collected in IIHS side crash tests and real-world driver death risk, and opportunities to improve the current test" by E.R. Teoh and R.A. Arbelaez

"Occurrence of serious injury in real-world side impacts of vehicles with good side-impact protection ratings" by M.L. Brumbelow et al.

To request these papers, email researchpapers@iihs.org.

Movable barrier: Test vehicle rolls away from striking barrier

SUV: Test vehicle rolls toward striking SUV



Movable barrier strikes vehicle: The barrier's uniform stiffness creates fairly uniform damage as it pushes into the side of the test vehicle.

SUV strikes vehicle: The SUV's variable stiffness creates an "M" shape, punching in on either side of the B-pillar at mid-door height.

percent less likely to die in a left-side crash than a driver of a vehicle rated poor.

But despite overwhelmingly good ratings for today's vehicles, people continue to die in side crashes. Side impacts accounted for 23 percent of passenger vehicle occupant deaths in 2018.

Comparing rating criteria to real-world outcomes

One question is whether the current side test measures the right things. To answer it, IIHS researchers conducted another study of real-world side crashes. This time they examined how well each of the test measurements that feed into the ratings correlates with death risk.

The study included 1999-2016 model year passenger vehicles with standard head-protecting side airbags that had been rated by IIHS for side protection. The researchers looked at the rate of driver deaths per left-side crashes for each model. They compared these rates with 10 specific intrusion and dummy injury measures that go into the ratings, finding that each one was correlated with driver death risk in left-side crashes.

For example, the authors estimated that each additional centimeter of B-pillar intrusion was associated with a 3 percent increase in death risk. Each additional millimeter of rib deflection, one of the measures recorded by the dummies in the test, was associated with a 1 percent increase in death risk.

"This tells us that the current side crash test measures the right things," says Eric Teoh, IIHS director of statistical services and the lead author of the paper. "We know that we don't need to go in a completely different direction or upgrade to expensive new dummies as we update the test."

Optimizing test conditions

An earlier IIHS study looked at side crashes in good-rated vehicles that resulted in deaths or serious injuries. That study showed that many of those crashes were more severe than the IIHS test and also had a more forward impact location.

The severity of a side crash depends on both the weight of the striking vehicle and its speed. The movable barrier currently used in the IIHS side test weighs 3,300 pounds. At the time the test began, many SUVs on the road were close to that weight, but they have gotten much heavier since then.

To better reflect the higher-severity crashes occurring in the real world, Mueller and other IIHS engineers began a series of research tests at a higher speed — 37 mph instead of the 31 mph speed used in the current side rating test. They also made the movable barrier heavier, increasing its weight to nearly 4,200 pounds, the average weight of a 2019 model SUV.

"These changes might not sound like a big deal, but the 6 mph speed increase alone produces 42 percent more crash energy," Mueller says. "Together with the weight increase, the modified test configuration has 82 percent more energy than our current side rating test."

IIHS engineers also conducted tests with a more forward impact location on the struck vehicle, but that change didn't appear to lead to higher injury risk. In fact, the injury measures from the dummies were lower in the forward configuration »

(« *from p. 3)* than in the standard one.

The goal of these research tests was to see how well crashes at the higher speed with the heavier barrier resembled crashes using a real SUV or pickup in place of the barrier.

For the initial round, the team selected four good-rated vehicles — a Toyota Camry, Volkswagen Atlas, Honda Accord and Infiniti QX50 — to subject to a variety of impacts. The test vehicles were struck by a popular pickup, SUV and car, as well as by the 4,200-pound movable barrier. Tests were conducted at the current side test speed of 31 mph and also at 37 mph.

The crashes with the movable barrier weren't identical to the crashes with a second vehicle. Video footage showed that the struck vehicles rolled away from the barrier but toward the striking vehicles.

The damage also differed. The striking vehicles' frame rails — the stiffest part of a vehicle front — punched into the middle of the struck vehicles' doors, wrapping around the B-pillar.

Engineers are trying to improve the movable barrier used in the test to better replicate damage from an SUV.

In contrast, the movable barrier has uniform stiffness and strikes the vehicles more evenly. That means the B-pillar can absorb a larger proportion of the crash energy in the test than it would in a real-world crash.

The engineers are now experimenting with changes to the barrier's honeycomb face to try to better replicate the interaction of vehicles in a real-world crash involving a late-model SUV or pickup as the striking vehicle. They are altering the honeycomb shape and varying the stiffness within it, just as it varies on the front of a real SUV.

"Our goal is to create a barrier that creates the same type of damage as a typical late-model SUV or pickup would in a 37 mph crash," Mueller says. "That way, we can be confident that the changes automakers make in hopes of achieving good ratings in the new side test will result in better protection for vehicle occupants in real-world crashes." ■

Automakers accelerate push to make vehicles safer

Carmakers are making vehicles more crashworthy about 3 times faster today than they did in the mid-1990s, but those improvements and new safety features still take decades to filter into most vehicles on the road.

Government mandates, voluntary manufacturer commitments and independent safety ratings can have dramatic influence on how quickly automakers make such improvements and how quickly they become widespread in the U.S. fleet, new studies from HLDI show.

"The speed at which manufacturers are improving crashworthiness and rolling out new safety features has increased markedly in recent years," says Matt Moore, senior vice president of HLDI. "But the advancements make their way into the broader fleet at varying rates."

HLDI RESEARCH

"IIHS crashworthiness evaluation programs and the U.S. vehicle fleet — a 2019 update"

"Predicted availability and fitment of safety features on registered vehicles — a 2019 update"

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The HLDI analysis looked at four of the IIHS ratings evaluations: moderate overlap front, side, roof strength and driver-side small overlap front.

In the moderate overlap frontal test, which is the oldest IIHS test and was introduced in 1995, a vehicle traveling at 40 miles per hour crashes into a fixed barrier with 40 percent of its front width. In the side-impact test, which began in 2003, a 3,300-pound projectile shaped like the front of an SUV hits the driver side of the test vehicle at 31 mph. In the roof strength test, introduced in 2009, a metal plate pushes down on the test vehicle's roof until it crushes 5 inches. And in the driver-side small overlap test begun in 2012, the test vehicle hits a barrier at 40 mph with 25 percent of its front width.

While the percentage of the tested vehicles that earn a good rating in the oldest test — the moderate overlap — has increased an average of 2 percentage points per year, the rate of increase has accelerated to 6 percentage points per year for

the newer driver-side small overlap test, HLDI's analysis shows.

"As independent safety ratings gain prominence, they have become an important marketing tool for carmakers, resulting in faster rollouts," says Moore.

Nevertheless, it still takes decades for improvements to impact the entire fleet of registered vehicles. Drivers don't immediately abandon older vehicles when automakers make safer ones.

Even 23 years after its introduction, the percentage of the U.S. fleet with a good rating in the moderate overlap test is only 64 percent. Six years after the introduction of the driver-side small overlap test, only 14 percent of the fleet earns a good rating in that evaluation.

A parallel study of the speed at which advanced safety features make their way into the overall U.S. fleet suggests that government mandates and voluntary manufacturer commitments also have a powerful impact on the pace of change.

In this study, researchers looked at the estimated availability and installation of rear cameras, rear parking sensors, blind spot monitoring, forward collision warning, front automatic emergency braking, lane departure warning and curve-adaptive headlights from the years these features were introduced through calendar year 2050.

With the exception of curve-adaptive headlights, these features have been filtering into the broader fleet at a faster rate in recent years than happened earlier. But two features that are required by government mandate or slated for universal adoption by a voluntary manufacturer commitment — rear cameras and front autobrake — are spreading even faster since those measures were announced.

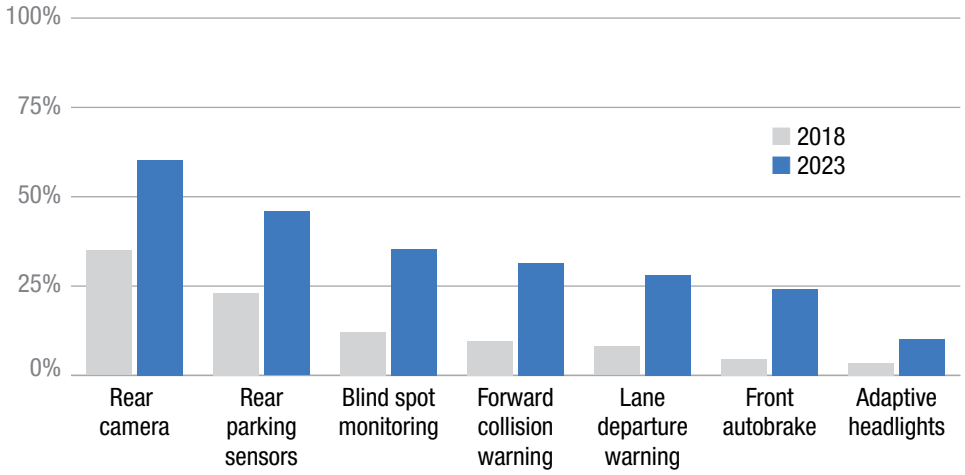
Even features that are rapidly becoming more common will take a long time to spread through the registered-vehicle fleet. Only rear cameras, which were first introduced in model year 2002 and are now required on all new vehicles, are expected to be installed on more than half of all registered vehicles by 2023.

The percentage of the fleet equipped with front autobrake, which was introduced in model year 2006, is expected to increase nearly fivefold to 24 percent in 2023 from about 5 percent in 2018.

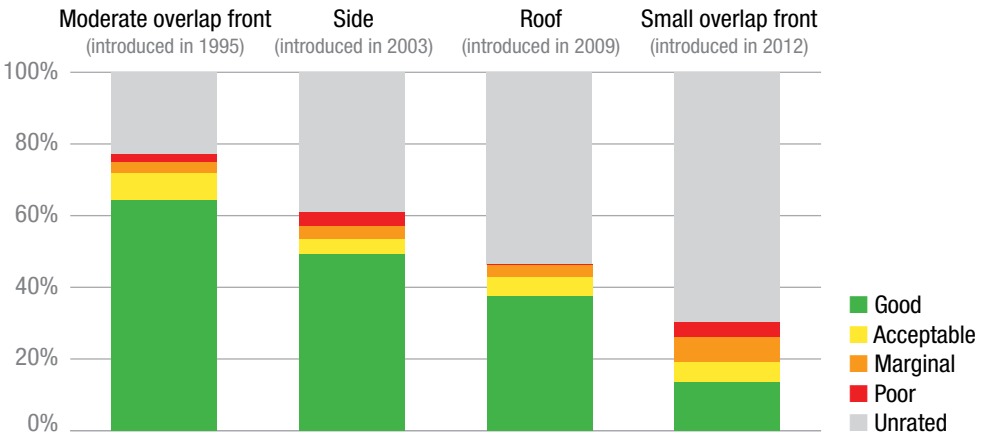
The speedier rollout of these two features is welcome. IIHS studies show that both reduce police-reported crashes (see "Rearview cameras reduce police-reported backing crashes," Nov. 17, 2016, and "Front crash prevention slashes police-reported rear-end crashes," Jan. 28, 2016).

On the other hand, curve-adaptive headlights, which, according to HLDI data, lower claim rates, will grow only 1 percentage point a year to reach 10 percent by 2023. ■

Predicted registered vehicles equipped with advanced safety features by calendar years 2018 and 2023



Crash test ratings for all registered vehicles in calendar year 2018



IIHS announces tougher criteria for 2020 safety awards

Good or acceptable headlights need to be standard equipment next year for a vehicle to qualify for *TOP SAFETY PICK+*, the highest award given out by IIHS.

In addition, front crash prevention that earns at least an advanced rating in both the vehicle-to-vehicle and vehicle-to-pedestrian evaluations will have to be available. Previously, only the vehicle-to-vehicle rating was required.

2020 *TOP SAFETY PICK*

- Good crashworthiness (six tests)
- Available superior or advanced front crash prevention (vehicle-to-vehicle and vehicle-to-pedestrian)
- Available good or acceptable headlights

2020 *TOP SAFETY PICK+*

Same criteria, but good or acceptable headlights must be standard

The front crash prevention requirements will also apply to the second tier of awards, *TOP SAFETY PICK*. Available good or acceptable headlights will be required for that award too, though, like this year, they won't need to be standard.

Both awards will require good crashworthiness ratings across the board. That includes the passenger-side small overlap front test. For 2019, an acceptable rating in the passenger-side test was sufficient for a *TOP SAFETY PICK* award.

In a departure from early years, the initial crop of 2020 award winners will not be announced until early next year. Previously, the next year's first winners were announced in November or December.

"As we do nearly every year, we're making it a little tougher to earn our awards," says IIHS Chief Research Officer David Zuby. "We hope these changes will encourage automakers to stop equipping vehicles with inferior headlights and speed the adoption of technology that can help protect pedestrians."

IIHS launched its headlight ratings in 2016. Only three headlight systems from the 2016 model year earned a good rating out of 224 evaluated by IIHS. Another 36 earned an acceptable rating. Since then, the number of good and acceptable ratings has greatly increased. In the 2019 model year, 68 out of 461 systems evaluated were rated good, and 102 were rated acceptable.

However, many of those good- or acceptable-rated headlights are available only as part of optional packages or on higher trim levels. Consumers need to pay special attention if they want to buy a vehicle equipped with them.

IIHS is aiming to address this problem by requiring 2020 *TOP SAFETY PICK+* winners to be available only with good or acceptable headlights. The requirement applies equally to expensive lighting options and base headlights.

"Decent headlights should be a given, and we hope this change to our criteria will push manufacturers to make them standard across their lineups," Zuby says.

Next year will be the first year that pedestrian crash prevention ratings will factor into the awards. Vehicle-to-vehicle front crash prevention has been factored into one or both awards since 2014.

IIHS introduced its pedestrian crash prevention ratings this year. IIHS tests vehicles in three scenarios, each at two speeds. This technology is important to help address the growing problem of pedestrian fatalities in the U.S., which recently reached their highest levels in more than a quarter century.

Requiring a good rating in the passenger-side small overlap front evaluation completes a phase-in of that crash test. The passenger-side test was introduced in 2017 after IIHS research showed that changes aimed at improving protection in small overlap crashes were not always applied to both sides of the vehicle. IIHS had been conducting driver-side small overlap tests since 2012.

A good or acceptable passenger-side rating was required for the top award in 2018. For 2019, a good or acceptable rating was required for a *TOP SAFETY PICK*, while a good rating was needed to achieve the "plus." ■

NTSB calls for action to curb spike in bicycle fatalities

The National Transportation Safety Board is calling for a major policy overhaul to combat the rise in bicyclists killed in crashes with motor vehicles.

The NTSB sounded the alarm Nov. 5 after completing its first study of bicyclist safety since 1972. The board called for safer roadway designs, new standards for rider visibility, and measures to speed the rollout of crash avoidance systems capable of detecting bicyclists.

The agency also urged state governments to pass laws requiring bicyclists of all ages to wear helmets.

"If we do not improve roadway infrastructure for bicyclists, more preventable crashes will happen and more cyclists will die in those preventable crashes," NTSB Chairman Robert Sumwalt said in his opening address at the NTSB's November board meeting. "If we do not enhance bicyclist conspicuity, more bicyclists will die in preventable crashes. If we do not act to mitigate head injury for more bicyclists, additional bicyclists will die."

According to the National Highway Traffic Safety Administration's most recent census of fatal motor vehicle crashes, 854 bicyclists were killed in collisions with motor vehicles in 2018. That's a 38 percent increase since the low point in 2010 and the highest number of fatalities in 30 years. Including pedestrian fatalities, which are up 46 percent over the same period, people outside of motor vehicles now account for a fifth of all traffic deaths.

NTSB researchers looked for ways to reverse that trend. They reviewed the latest scientific literature and analyzed data from motor vehicle crashes involving more than 5,000 bicyclists. They also interviewed road designers, law enforcement personnel, bicycle safety advocates and other stakeholders.

Based on their findings, the board called on various federal agencies to update their standards and undertake new initiatives, issuing 11 new recommendations and reiterating 10 others.

Most motor vehicle collisions with bicycles occur at intersections. However, crashes are more often fatal at midblock locations, where vehicles are generally traveling faster, the board noted. It called on the Federal Highway Administration (FHWA) to include protected bike lanes and safer intersection designs in its list of proven safety countermeasures.

IIHS research suggests that protected bike lanes vary in terms of injury risk (see "Some protected bike lanes leave cyclists vulnerable to injury," Aug. 15, 2019). Researchers found that protected bike lanes that are raised from the roadway are safer than those on the same level as the street, for example.

The board also recommended implementing road diets — reducing the number of vehicle travel lanes, often to make room for bike lanes. Road diets help slow vehicles in high-speed, high-volume areas. They were added to the FHWA's list of proven safety countermeasures in 2012.

Apart from infrastructure changes, the NTSB noted that the requirements for reflectors and other features to make it easier for drivers to see bicycles have not been updated since 1980. It called on the U.S. Consumer Product Safety Commission to look into revising its standards to make use of advances in materials and technologies.

The board said that delays in updating NHTSA's New Car Assessment Program have likely slowed the rollout of features designed to protect pedestrians and bicyclists. It called on the agency to incorporate a test of crash avoidance technology capable of detecting bicyclists in its updated ratings.

Twenty automakers have committed to installing automatic emergency braking systems in the vehicles they produce for the U.S. market with gross vehicle weights of 8,500 pounds or less by 2022. Many of these systems are capable of detecting and avoiding pedestrians as well. IIHS began rating pedestrian detection systems in February 2019 and issued its latest ratings for 16 midsize cars this October (see "Performance of pedestrian crash prevention varies among midsize cars," Oct. 29, 2019). Some manufacturers say their pedestrian crash prevention systems are also capable of avoiding bicycles. However, IIHS has not evaluated these claims.

The safety board reiterated its earlier recommendation that NHTSA tighten requirements for headlights. More than half of the bicyclist fatalities in 2018 occurred in the dark or during dawn or dusk.

Automakers have made broad improvements since IIHS began rating the headlights of passenger vehicles in 2016. However, poor or marginal headlights still prevent many vehicles from receiving the Institute's *TOP SAFETY PICK* and *TOP SAFETY PICK+* awards. On others, good-rated headlights

are only available as expensive options (see "Headlights improve, but base models leave drivers in the dark," Nov. 29, 2018).

The board also recommended that NHTSA work with stakeholders to promote helmet use and called on states to pass universal bicycle helmet laws. Currently, most states have no bike helmet requirements, and no state requires bicycle helmets for adult riders. The National Association of City Transportation Officials and several bicycle advocacy groups pushed back against that recommendation because of concerns that it would discourage people from riding. ■

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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.

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

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