Status Report

Insurance Institute for Highway Safety | Highway Loss Data Institute

Small overlap gap

Vehicles with good driver protection may leave passengers at risk

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Among seven small SUVs with good driver-side small overlap front ratings, only one would earn a good rating for passenger-side protection.

Drivers of vehicles with good small overlap front ratings from IIHS can expect to be protected well in a frontal crash involving the left corner of the vehicle. But how would the passengers sitting next to them fare in a right-side small overlap crash? A new study shows that good protection doesn't always extend across the front seat.

The Institute conducted 40 mph passenger-side small overlap tests on seven small SUVs with good driver-side small overlap ratings. Only one of the vehicles, the 2016 Hyundai Tucson, performed at a level corresponding to a good rating, and the others ran the gamut from poor to acceptable.

The results have prompted IIHS to consider instituting a passenger-side rating as part of its *TOP SAFETY PICK* criteria.

"This is an important aspect of occupant protection that needs more attention," says Becky Mueller, an IIHS senior research engineer and the lead author of the study. "More than 1,600 right-front passengers died in frontal crashes in 2014."

IIHS introduced the small overlap test in 2012, following the success of the moderate overlap front test in spurring automakers to make improvements. (Most models have earned good moderate overlap ratings for more than a decade, and it's been more than four years since a vehicle earned anything less than good.)

While the moderate overlap test involves 40 percent of the width of the vehicle, the small overlap test involves just 25 percent. It is designed to replicate what happens when the front corner of a vehicle collides with another vehicle or an object like a tree or utility pole.

Small overlap crashes pose a challenge because they bypass a typical vehicle's main front structure. Since the test was introduced, 13 manufacturers have made structural changes to 97 vehicles. Of these, nearly three-quarters earned a good rating after the changes.

IIHS conducts its tests for frontal ratings with a driver dummy and with the barrier overlapping the driver side. The reason is simple: Every vehicle on the road has a driver, but there isn't always a passenger riding along.

"It's not surprising that automakers would focus their initial efforts to improve small overlap protection on the side of the vehicle that we conduct the tests on," says David Zuby, IIHS executive vice president and chief research officer. "In fact, we encouraged them to do that in the short term if it meant they could quickly make driver-side improvements to more vehicles. As time goes by, though, we would hope they ensure similar levels of protection on both sides."

The recent passenger-side tests show how big the differences can be. In this group of small SUVs, most didn't perform as well when they were crashed into a barrier on the right side instead of the left. That was even true of models that appeared symmetrical after removing bumper covers and other external components.

"When structural improvements are visible only on the driver-side, there are large differences in performance," Mueller says. "But

Driver-side small overlap front ratings and provisional passenger-side ratings for small SUVs

	driver-side impact	passenger-side impact
2016 Hyundai Tucson	G	G
2015 Buick Encore	G	A
2015 Honda CR-V	G	A
2015 Mazda CX-5	G	A
2014 Nissan Rogue	G	M
2014 Subaru Forester	G	M
2015 Toyota RAV4	G	P

Good G Acceptable A Marginal M Poor P

the inverse is not true. Some vehicle structures look the same on both sides, but they don't perform the same. That's why we can't rely on visual analysis but need to monitor this issue and possibly begin rating vehicles for passenger-side protection."

The 2015 Toyota RAV4 and the 2014 Nissan Rogue were the only vehicles to appear asymmetrical. In the passenger-side test, the RAV4 was the worst performer. If the Institute issued ratings for passenger-side protection, the RAV4 would earn a poor rating. The Rogue would earn a marginal.

These two vehicles had the highest amount of passenger-side intrusion. Intrusion measures are important because they indicate how well the structure held up; the greater the amount of intrusion, the higher the likelihood of serious injuries.

Maximum intrusion in the passenger-side test was 13 inches more than in the driver-side test for the RAV4 and 10 inches more for the Rogue. The Rogue's door hinge pillar tore off completely, and the RAV4's door opened. In a real crash, an open door would leave the occupant at risk for ejection.

Two vehicles that appeared symmetrical, the 2014 Subaru Forester and the 2015 Mazda CX-5, also had »

Real-world passenger-side small overlap crash

National Automotive Sampling System

This 2008 Mazda 3 went off a curvy two-lane road after dark in heavy rain and crashed into a tree. A 16-year-old girl was sitting in the front passenger seat. Her femur, tibia, jaw and nose were broken, and she was hospitalized for five days.

How structure varies within the same vehicle

When engineers removed bumper covers of SUVs being tested for passenger-side small overlap protection, some had structural differences between the right and left sides. Others looked symmetrical but didn't always perform similarly.

2016 Hyundai Tucson

Symmetrical appearance, similar performance

Driver-side small overlap test

Passenger-side small overlap test

2015 Toyota RAV4

Asymmetrical appearance, poor passenger-side performance

Driver-side small overlap test

Passenger-side small overlap test

2014 Subaru Forester

Symmetrical appearance, marginal passenger-side performance

Driver-side small overlap test

Passenger-side small overlap test

Good G Acceptable A Marginal M Poor P

(« *from p. 3)* substantially more intrusion in the passenger-side test than in the driver-side test.

Earlier research by Mueller into how manufacturers improve vehicle structure for small overlap protection showed that the most common change is to strengthen the occupant compartment (see *Status Report*, Dec. 23, 2014, at iihs.org). To achieve this, manufacturers might use a different type of material or add a few millimeters of thickness — changes that can't be discerned from a visual examination. It's likely these types of modifications were made to the Forester and CX-5, but only on the driver side.

The other three vehicles tested had relatively similar structural performance on both sides of the vehicle.

The 2015 Buick Encore's structural performance was virtually identical on both sides of the vehicle, but it would receive an acceptable overall rating in the passenger-side test because the driver dummy's head slid between the driver and passenger front airbags, putting it at risk of hitting the dash.

The Tucson would receive a good rating for passenger-side small overlap protection, though its structural rating would be acceptable instead of good, as it is in the driver-side test. The 2015 Honda CR-V also had slightly more intrusion on the passenger side than on the driver side and would receive an acceptable rating overall.

The differences between driver-side and passenger-side performance in the Tucson and the CR-V are small enough that they could be a result of normal variability in test results.

Another factor is that vehicles are to a certain extent inherently asymmetrical. For example, structures to secure the steering wheel and pedals may provide additional bracing around the driver-side toepan, which prevents some intrusion. That same toepan area on the passenger side without those structures is where the highest intrusion measures occurred on the passenger side of the CR-V and Tucson.

In addition to the seven passenger-side small overlap tests, Institute engineers conducted two passenger-side moderate overlap tests to make sure there weren't any differences in performance in that type of crash. One visually symmetrical vehicle, the CR-V, and one asymmetrical vehicle, the RAV4, were chosen for these tests. There was little difference from the driver-side moderate overlap tests, and both vehicles would receive a good passenger-side moderate overlap rating.

"We conducted the moderate overlap tests as a spot check, and we weren't surprised that both vehicles performed well," Mueller says. "Many of today's models are designed for the global market and are subject to driver-side moderate overlap tests in right-hand-drive countries. With small overlap, there isn't the same incentive for symmetrical design because we're the only organization conducting the test."

IIHS passenger-side small overlap ratings would remedy that situation. The Institute could start such a program next year and make it a requirement for one of its safety awards as early as 2018.

For a copy of "Comparison of vehicle structure and occupant responses in driver- and passenger-side IIHS small overlap frontal crash tests" by B.C. Mueller and J.M. Nolan, email publications@iihs.org. ■

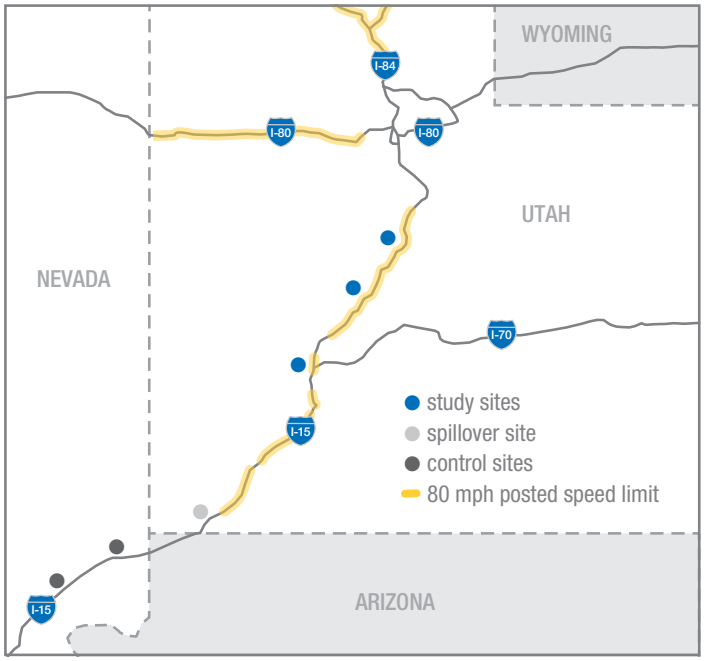
Average speeds increase after Utah raises limit to 80 mph

A new study on the effects of speed limit increases in Utah adds to the abundant evidence that raising speed limits results in higher travel speeds and more vehicles exceeding the new limit. It also undercuts the claim that raising limits reduces speed differences among vehicles on the same road.

A Utah law allowing for limits higher than 75 mph on rural interstate highways went into effect in May 2008. The first sections of roadway were changed to an 80 mph limit in January 2009, and more were added in November 2010 and October 2013.

The study looks at the effects of the 2010 and 2013 increases. IIHS Senior Research Transportation Engineer Wen Hu collected speed data for passenger vehicles and large trucks on several stretches of Interstate 15 before and after the speed limit changed from 75 mph to 80 mph. She also looked at a

Utah 80 mph speed limit zones as of October 2013 and study sites



"spillover" location about 1 mile down I-15 from an 80 mph speed zone, as well as more distant control sites where the speed limits remained 75 mph.

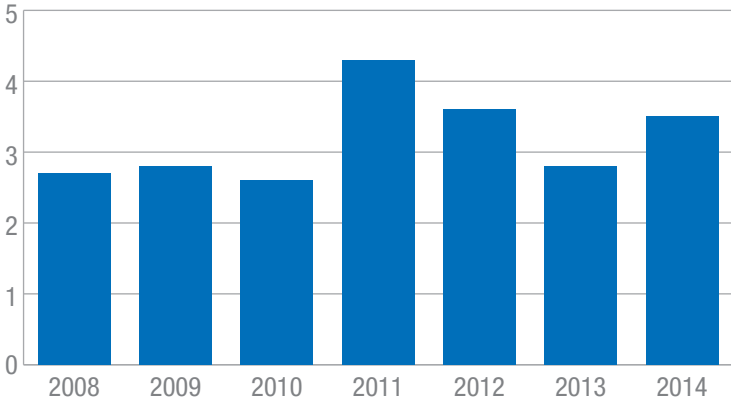
Hu found that average passenger vehicles speeds within the 80 mph speed zones and at the spillover location were about 3 mph higher after the speed limit increase than would have been expected without it — 78 mph instead of 75 mph.

The likelihood that a passenger vehicle was traveling over 80 mph within the 80 mph zones was more than 120 percent higher than would have been expected without the speed limit change. At the spillover site, the probability was nearly 90 percent higher. »

The high cost of hail: Total payouts for vehicle damage top $7 billion for 2008-14

The spring and summertime forecast is a familiar one — severe thunderstorms with damaging winds and hail are on the way. Already in 2016, Texas in particular has been walloped by bigger-than-baseball-size hail that shattered windows, busted roofs and dinged vehicles in March and April. An updated analysis by HLDI of insurance losses to vehicles shows that 2011 and 2014 were the costliest years for hail-related claims in the U.S. during the 2008-14 study period, and losses were concentrated in the country's midsection.

Total frequencies for hail-related vehicle claims during 2008-14 for 10 most current model years



When hail damages vehicles, any insurance claim owners file would fall under the comprehensive coverage provision of their auto insurance policies. This type of coverage insures against theft or physical damage to insured people's own vehicles that occurs for reasons other than crashes.

HLDI has been studying the frequency, severity and cost of these claims for several years. Using information from insurers about weather-related losses under comprehensive coverage, HLDI analysts matched the dates of those claims to hail events recorded by the National Oceanic and Atmospheric Administration to determine which vehicle claims were for hail damage. The analysis excluded any hail storms that accompanied tornadoes, since it isn't possible using HLDI's data to determine which weather event caused the damage that led to the claim. Motorcycle claims also were excluded.

Hail claims data are from the 31 companies that specify weather as a cause of loss when supplying information to HLDI. These companies' exposure represents 87 percent of the comprehensive coverage exposure in HLDI's database. Results for the latest analysis were based on more than 491 million insured vehicle years and more than 1.5 million claims.

Insurers in HLDI's database paid $5.37 billion in total hail claims for 2008-14. The biggest payouts were in 2014 ($968.9 million) and 2011 ($948.3 million). The actual payout by all insurers is likely higher and estimated to be $7.26 billion ($1.33 billion in 2014 and $1.28 billion in 2011). This takes into account that not all companies are represented in HLDI's database and not all data suppliers submit weather information.

The results showed a frequency of 3.2 claims per 1,000 insured vehicle years during 2008-14, a claim severity of $3,428 and overall losses of $11 per insured vehicle year. Across the study period, 2011 had the highest claim frequency of 4.3, while 2014 had the highest claim severity at $4,169 and overall loss at $15 per insured vehicle year.

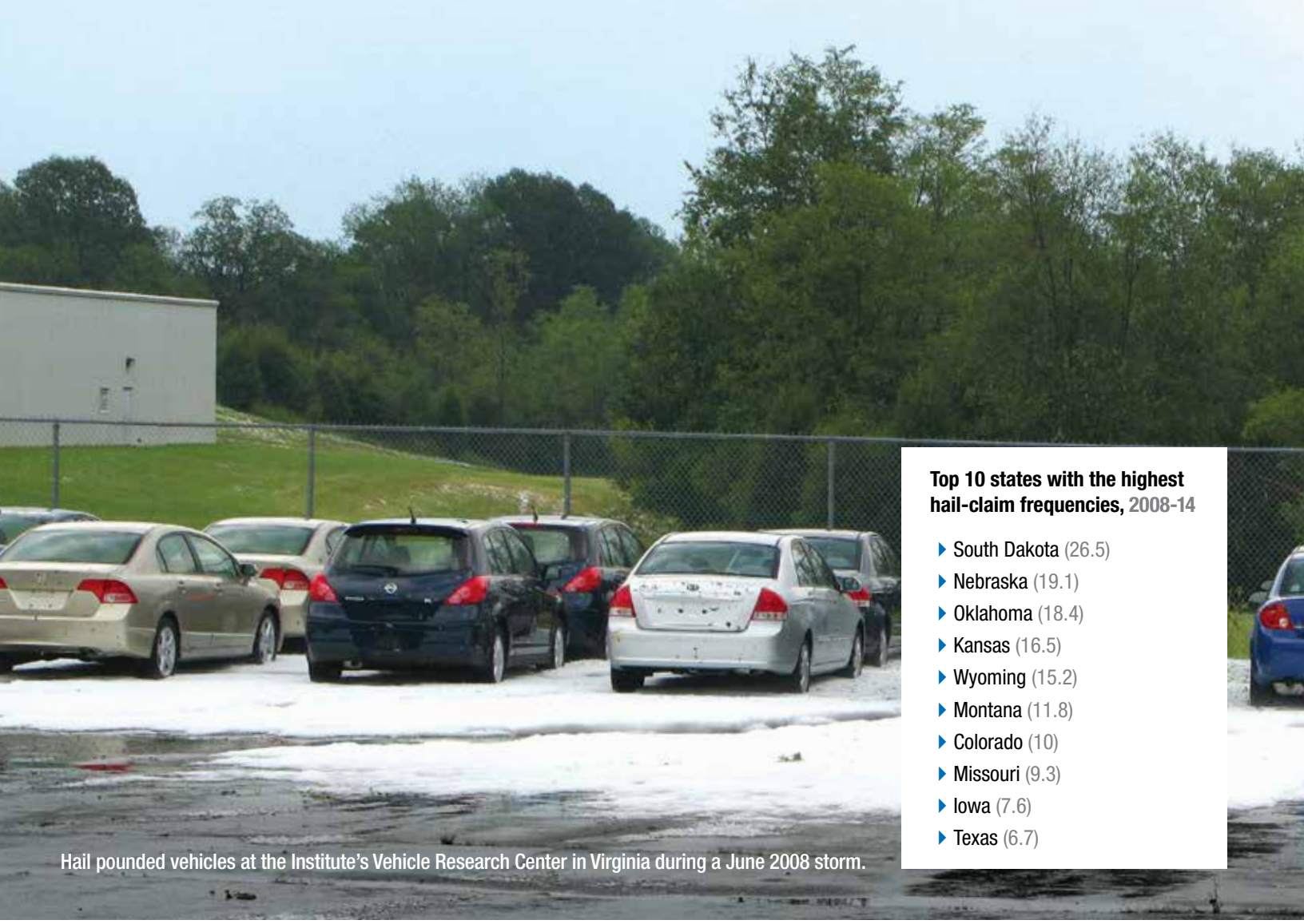
The states with the highest claim frequencies during 2008-14 are South Dakota (26.5), Nebraska (19.1), Oklahoma (18.4) and Kansas (16.5). Other states in the top 10, by order, are Wyoming (15.2), Montana (11.8), Colorado (10), Missouri (9.3), Iowa (7.6) and Texas (6.7).

"HLDI periodically does studies to document the effects of weather on insurance losses," says Matt Moore, HLDI vice president. "Hail storms can be devastating events for vehicle owners. Given the recent news from Texas, as soon as the final numbers are available, we will be updating this study." Moore adds that "2011 and 2014 were bad years for hail storms, but it looks like 2016 may be worse."

(« *from p. 6)* Average large truck speeds increased by nearly 2 mph within the 80 mph zones. However, the increase in the likelihood of trucks exceeding 80 mph wasn't statistically significant. There were hardly any trucks exceeding 80 mph before the speed limit increase, and only 2 percent were traveling that fast afterward.

Higher speeds have been shown to lead to more frequent and more deadly crashes. Based on a previously developed model that quantifies the effects of speed on crash risk, Hu estimated that an increase in speed from 75 mph to 78 mph would raise the rate of fatal crashes by 17 percent.

"Six states now have maximum speed limits of 80 mph, and Texas allows speeds as high as 85 mph," says Chuck Farmer, IIHS vice president for research and statistical services. "These extreme speeds



Hail pounded vehicles at the Institute's Vehicle Research Center in Virginia during a June 2008 storm.

Top 10 states with the highest hail-claim frequencies, 2008-14

- South Dakota (26.5)
- Nebraska (19.1)
- Oklahoma (18.4)
- Kansas (16.5)
- Wyoming (15.2)
- Montana (11.8)
- Colorado (10)
- Missouri (9.3)
- Iowa (7.6)
- Texas (6.7)

So far in 2016, severe thunderstorms have pummeled Texas, Kansas, Missouri and Oklahoma with large hailstones. Vehicle damage estimates for three springtime Texas storms alone top $1 billion, according to the Insurance Council of Texas. Some of these losses may be due to other weather factors, such as high winds.

Although Great Plains and Midwestern states predominate HLDI's hail claims' list, the most extreme hail events often occur in other regions, and this was the case in 5 of the 7 years examined. While it is true that spring is prime time for destructive hail events, HLDI analysts uncovered another outlier. The worst hailstorm in terms of insurance losses to vehicles occurred in the fall in the Southwest during the study period. Vehicle damage from the Oct. 5, 2010, Arizona storm was concentrated in three counties: Gila, Maricopa and Yavapai. Of the three counties, Maricopa had the highest hail-loss tally for the day, with nearly 39,000 claims and more than $157 million in payments.

For a copy of the HLDI Bulletin "Hail-related claims under comprehensive coverage — an update," email publications@iihs.org. ■

shave off a few minutes of travel time at the expense of people's lives."

A recent nationwide study by Farmer found that 33,000 fatalities could have been avoided if there had been no speed limit increases between 1993, when all states had maximum limits of 65 mph or 55 mph, and 2013 (see *Status Report*, April 12, 2016, at iihs.org).

Proponents of higher limits often argue that speed variation, not speed, is the actual cause of increased crash risk. They claim that higher limits improve safety by bringing all vehicles up to the same speed.

It is true that less speed variation is associated with fewer crashes because it cuts down on passing maneuvers and lane changes. However, in the Utah study, the new 80 mph limit didn't lead to more vehicles traveling at similar speeds. In fact, speed variation was higher than would have been expected without the speed limit change both within the 80 mph zones and at the spillover site, though these increases weren't statistically significant, possibly because of the small sample size.

IIHS researchers first looked at the effect of Utah's 80 mph limit in a study of the sections of I-15 where the limit was raised in 2009. They found that travel speeds actually decreased from 2008 to 2010 at the sites where the speed limit went up, though not by as much as at the sites where the limit stayed the same. The unexpected decreases were likely a result of the economic recession, which caused a shift in driving patterns around the country.

For a copy of "Raising the speed limit from 75 to 80 mph on Utah rural interstates: effects on vehicle speeds and speed variance" by W. Hu, email publications@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 crashes on the nation's roads.

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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