

Status Report

A woman with a joyful expression is holding a young child. In the foreground, a child car seat is visible, featuring various safety labels and a cup holder. The scene is set inside a vehicle, with the car's interior and a window showing a glimpse of the outdoors.

Insurance Institute for Highway Safety | Highway Loss Data Institute

LATCH ratings improve

Automakers make strides on child restraint installation hardware

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September 1, 2016

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Buckling precious cargo into a late-model vehicle has gotten a bit easier in the past year, the Institute's LATCH ease-of-use ratings show.

IIHS launched its ratings of child seat installation hardware in vehicles in June 2015 (see *Status Report* special issue: LATCH ratings, June 18, 2015, at iihs.org). Out of 102 vehicles rated at that time, the majority were poor or marginal. Today, a total of 170 current models have been evaluated, and most are good or acceptable. Three models — the Audi Q7, Lexus RX and Toyota Prius — earn the top rating of good+, a distinction that no vehicle achieved last year.

A properly installed, age-appropriate child restraint can protect a child much better in a crash than a safety belt alone. LATCH, which stands for Lower Anchors and Tethers for Children, is intended to make it easier for caregivers to install child restraints properly. Child restraints installed with LATCH are more likely to be put in correctly than restraints installed using the vehicle safety belt, IIHS research has shown (see *Status Report*, April 8, 2014).

Even with LATCH, installation errors are common. Research by IIHS and the University of Michigan Transportation Research Institute studied what kinds of mistakes were made with varying LATCH set-ups (see *Status Report*, April 12, 2012, and Feb. 20, 2014). This allowed researchers to identify key ease-of-use criteria that can minimize mistakes, and these criteria form the basis for the IIHS ratings.

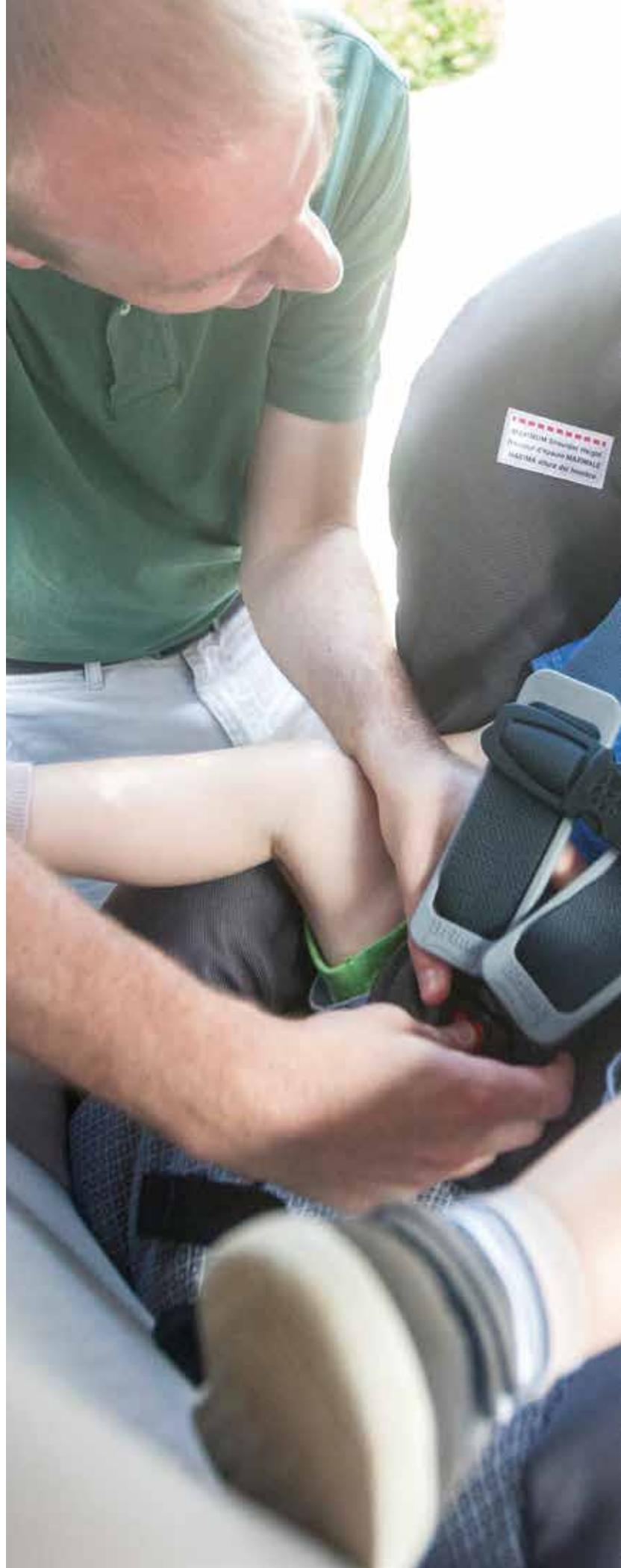
“Frustrating child seat installations have become a familiar rite of parenthood,” says Jessica Jermakian, an IIHS senior research engineer. “Unfortunately, these frustrations lead to mistakes that can have real consequences in the event of a crash. We're pleased to see automakers taking this issue seriously and making improvements in response to our ratings.”

Ease-of-use criteria

In the IIHS ratings system, LATCH hardware is considered good if it meets the following criteria:

- ▶ The lower anchors are no more than $\frac{3}{4}$ inch deep within the seat bight or slightly deeper if there is open access around them.
- ▶ The lower anchors are easy to maneuver around. This is defined as having a clearance angle greater than 54 degrees.
- ▶ The force required to attach a standardized tool representing a child seat connector to the lower anchors is less than 40 pounds.
- ▶ Tether anchors are on the vehicle's rear deck or on the top 85 percent of the seatback. They shouldn't be at the very bottom of the seatback, under the seat, on the ceiling or on the floor.
- ▶ The area where the tether anchor is found doesn't have any other hardware that could be confused for the tether anchor. If other hardware is present, then the tether anchor must have a clear label located within 3 inches of it.

To earn a good rating, two LATCH positions in the second row must meet all five criteria, and a third tether anchor must meet both tether criteria.





The good+ rating is for vehicles that meet the criteria for a good rating and provide additional LATCH-equipped seating positions. For a two-row vehicle, that means having a third good or acceptable LATCH seating position. The third position may use either dedicated anchors or anchors borrowed from other positions. In many vehicles that have lower anchors in the second-row outboard seating positions, LATCH can be used in the center position by “borrowing” one anchor from each side. Some vehicles have one dedicated anchor for the center seat and rely on a borrowed anchor for the other side.

For a three-row vehicle to earn a good+ rating, it must have one additional good or acceptable LATCH position (without borrowing) and tether anchors in all rear seating positions. The additional tether anchors must meet at least one of the two tether anchor criteria. If the vehicle has a second-row center seating position, it must have good or acceptable LATCH there (with or without borrowing).

The good+ designation is intended to encourage manufacturers to give parents greater flexibility when seating children in a vehicle.

Summary of 2016-17 LATCH ratings

good+	3
good	9
acceptable	77
marginal	73
poor	8
Total	170

For more information go to iihs.org/ratings

The Audi Q7, Lexus RX and Toyota Prius are rated good+ for easy-to-use LATCH hardware with additional seating flexibility. No models earned the distinction in 2015.



“We’re especially interested in making it possible for more parents to use LATCH in the second-row center position,” Jermakian says. “Parents are repeatedly told that is the safest place for children to ride, so we want them to have the option of an easy installation there.” »

Toyota made improvements to existing vehicles to earn better LATCH ratings. The automaker also kept LATCH ease of use in mind as it redesigned models.



(« from p. 3) The second-row center is safest because it is far from the hard surfaces of the vehicle interior and from the striking vehicle in a side crash. However, a properly restrained child is very safe in any rear seating position.

How one automaker improved

Toyota Motor Corp. has two of the three vehicles with good+ ratings and none of the eight poor-rated models. That is a big improvement over last year, when it had three vehicles on the poor list.

Like other manufacturers, Toyota improved its LATCH ratings through a combination of small tweaks and big overhauls.

The Toyota Sienna, which went from poor to acceptable, is an interesting case. The 2015 Sienna’s poor rating was noteworthy because, as a minivan, the Sienna is often bought to ferry children around.

Toyota’s first step was to add a better label for the Sienna’s tether anchors. That nudged the minivan’s rating up to marginal.

The next step was to open up access to the lower anchors by adjusting the seat trim and foam, says Jennifer Pelky, senior engineer in interior safety and crashworthiness at Toyota. Those changes reduced the force needed to attach the connectors, resulting in an overall rating of acceptable for Siennas built after March 2016.

The company also made changes to the Lexus ES, which went from poor to acceptable, and the Toyota Tundra extended cab, which improved to marginal.

The redesigned Prius, meanwhile, comes with an innovative approach to LATCH hardware. Locating the lower anchors so that they are not too deep within the seat is a particular challenge in sedans. Toyota solved it by carving out large openings around each anchor to give free access to the anchors. The openings are covered by a flap with a Velcro closure.

Creating those openings was a better option for the Prius than bringing the anchors further forward, Pelky says. Government regulations limit how far forward the anchors can be, and there are other considerations too, she noted.

“You can imagine that as an adult riding in that seat, if you feel a wire poking you in the back on even a short trip, it’s going to make you fairly upset with your vehicle,” Pelky says. “Of course, we put a great deal of effort into making sure our efforts meet the needs of our smallest passengers, our children, but we also need to keep those adults comfortable as well.” ■



The Toyota Sienna’s anchors are at the very bottom of the seatback, near a lot of potentially confusing hardware. In the 2015 model (left), the problem was compounded by the lack of a clear label. In the 2016 Sienna (right), the tether anchors are in the same spot, but a new label makes them more obvious.



Toyota used an innovative approach to allow better access to the lower anchors in the redesigned Prius. There are large openings around each lower anchor, and everything is covered by a flap with a Velcro closure.



An unhelmeted rider and his helmet-wearing passenger travel U.S. Route 127 in Michigan in July. Most motorcyclists are exempt from wearing helmets in the Midwestern state.

Head injuries rise as riders ditch helmets in Michigan

Fewer riders in motorcycle crashes are wearing helmets, and trauma centers are seeing an increase in head injuries and a change in injury types following Michigan's partial repeal of its motorcycle helmet-use law, new research from the University of Michigan and IIHS indicates.

Michigan rolled back its helmet law to cover only riders younger than 21, effective April 2012. Motorcyclists 21 and older may ride without a helmet if they have either passed a motorcycle safety course or have held the motorcycle endorsement on their driver's license for at least two years. In addition, riders who choose not to wear helmets must have at least \$20,000 in medical coverage.

IIHS, HLDI and other groups have been studying the effect of the law change, and, predictably, initial results haven't been positive. A 2013 analysis by HLDI found that the average insurance payment on a motorcycle injury claim rose substantially in Michigan after the state changed its helmet law to exempt most riders (see *Status Report*, May 30, 2013, at iihs.org). The upshot of HLDI's analysis is that motorcyclist crash injuries have become more serious.

For a look at how the partial helmet law repeal has affected motorcyclist crash

injuries and helmet use statewide, IIHS teamed up with researchers at the University of Michigan Injury Center, University of Michigan School of Medicine and University of Michigan Transportation Research Institute. Researchers analyzed police-reported motorcycle crash deaths and head-injury data from a statewide trauma registry 12 months before and after the law change. The study looked at both drivers and passengers and included 7,235 riders involved in crashes and 1,094 riders hospitalized at trauma centers.

Although there was no significant change in the motorcyclist fatality rate statewide, the fatality rate among unhelmeted motorcyclists in crashes across both time periods was nearly twice as high as the rate among helmeted riders (5.4 percent vs. 2.8 percent).

What is more, the percentage of hospitalized trauma patients with a head injury rose 14 percent in the post-repeal period. Doctors noted a shift in head injury patterns, too. The proportion of head injuries that were concussion-related fell 17 percent, while the proportion of head injuries due to skull fractures increased 38 percent. Trauma patients with head injuries were more likely to need costly hospital services,

including intensive-care unit stays, ventilation and neurosurgical interventions than patients without head injuries.

The finding is in line with prior studies of the high costs of caring for motorcyclists with head injuries. A study of a single Michigan trauma center published in *The American Journal of Surgery* in 2016 found the average acute care cost of unhelmeted riders was nearly \$28,000, 32 percent higher than for helmeted riders.

"Head injuries can have a devastating impact on the long-term health of motorcyclists and their families after a crash," says Dr. Patrick Carter, an emergency physician and injury researcher at the University of Michigan Injury Center and the lead author of the study. "The 14 percent increase in head injuries observed in our study is consistent with the negative public health impact we have witnessed following similar repeals in other states and should be considered as part of the policy debate regarding the importance of universal helmet laws for preventing injury."

Patients with head injuries were more likely to be intoxicated and less likely to be wearing a helmet. Alcohol-impaired riders in general are more likely to exceed speed limits, ride without a license and be involved in single-vehicle crashes. In 2014, 30 percent of fatally injured motorcycle drivers in the U.S. had a blood alcohol concentration (BAC) at or above 0.08 percent. In single-vehicle crashes, 43 percent of motorcycle drivers had 0.08 or higher BACs. »

Drivers who drift from lane and crash often dozing or ill

Drivers who crash as a result of drifting out of their lanes often are asleep, suffering a medical emergency, or blacked out due to drug or alcohol use, IIHS researchers have found. Among the lane-drift crashes studied, incapacitation reportedly played a role in 34 percent of collisions and 42 percent of crashes resulting in fatal or serious injuries.

The finding is important for the development of crash avoidance technology. If lane-drift crashes are a result of incapacitation, lane-keeping assist systems will need to do more to prevent crashes than simply nudge vehicles back into their lane.

Single-vehicle crashes in which vehicles left the roadway accounted for 40 percent of fatal crashes and 21 percent of nonfatal injury crashes in 2014. Head-on collisions and sideswipes, which also can be caused by lane departures, accounted for another 12 percent of fatal crashes and 10 percent of injury crashes.

Crash avoidance technology that can help drivers stay in their lanes has the potential to prevent many of those deaths and injuries. Lane departure warning — which tracks a vehicle's position and alerts the driver if the

vehicle strays across lane markings without the turn signal being activated — has become an increasingly common feature. So far, the crash reduction results for lane departure warning have been disappointing (see *Status Report*, July 3, 2012, at iihs.org).

Just as automatic braking was the next logical step after forward collision warning was developed, systems that actively keep vehicles in their lanes instead of or in addition to issuing a warning have started to appear on vehicles. Many more such lane-keeping assist systems are in development.

Whether or not these systems can prevent a crash depends in part on why the lane departure occurred and how the system responds if the driver doesn't take control after the system has intervened.

"If drivers are letting their vehicles drift from the lane because they are momentarily distracted, lane-keeping assist could help," says Jessica Cicchino, vice president for research at IIHS and the study's lead author. "However, if drivers are physically unable to control the vehicle, it's not enough to only nudge the car back into the lane. In such cases, a crash avoidance



system would need to bring the vehicle to a stop on the side of the road."

One way to accomplish that would be to combine lane-keeping technology with in-vehicle driver monitoring that can detect the onset of a physical event, the authors note.

To determine the role that physical factors play in lane departures, the researchers looked at 631 lane-drift crashes from a detailed federal database of serious crashes in which at least one passenger vehicle was

The increase in serious head injuries shows the dangers that come with repealing helmet-use laws. Unhelmeted motorcyclists are 40 percent more likely to suffer a fatal head injury and 15 percent more likely to suffer a nonfatal head injury than helmeted riders.

(« from p. 5) In a companion study, researchers estimated that three-quarters of motorcyclists statewide wore helmets following the law change, based on analysis of police-reported crashes in 2012-14 and a May-September 2014 roadside observational survey. That is down from 99 percent of helmet wearers observed in a 2006 statewide survey conducted by the Michigan Office of Traffic Safety Planning.

Still, the 75 percent estimated helmet-use rate in Michigan outstrips use rates in states with similar helmet laws. The authors point to

the experience of Texas and Kentucky, where observed helmet-use rates dropped to about 65-66 percent from about 95-96 percent following the partial repeal of their helmet laws.

"The benefits of motorcycle helmets are well-established, so Michigan is fortunate that most riders are still wearing them. But the increase in serious head injuries among motorcyclists in crashes shows the dangers that come with repealing helmet-use laws," says Jessica Cicchino, IIHS vice president for research and a study co-author.

Boosting tourism is one rationale helmet law opponents cite for watering down or abolishing use laws, and there is some evidence that fatalities among out-of-state riders have increased in states following helmet-law changes. In Michigan, however, researchers didn't find any evidence that riders were traveling to the Great Lakes state to take advantage of cruising helmetless. Instead, 95

percent of motorcyclists involved in crashes were riding a bike registered in the state, about the same percentage as when helmets were required for all riders. That might be because the states that border Michigan already had lax helmet laws or none at all.

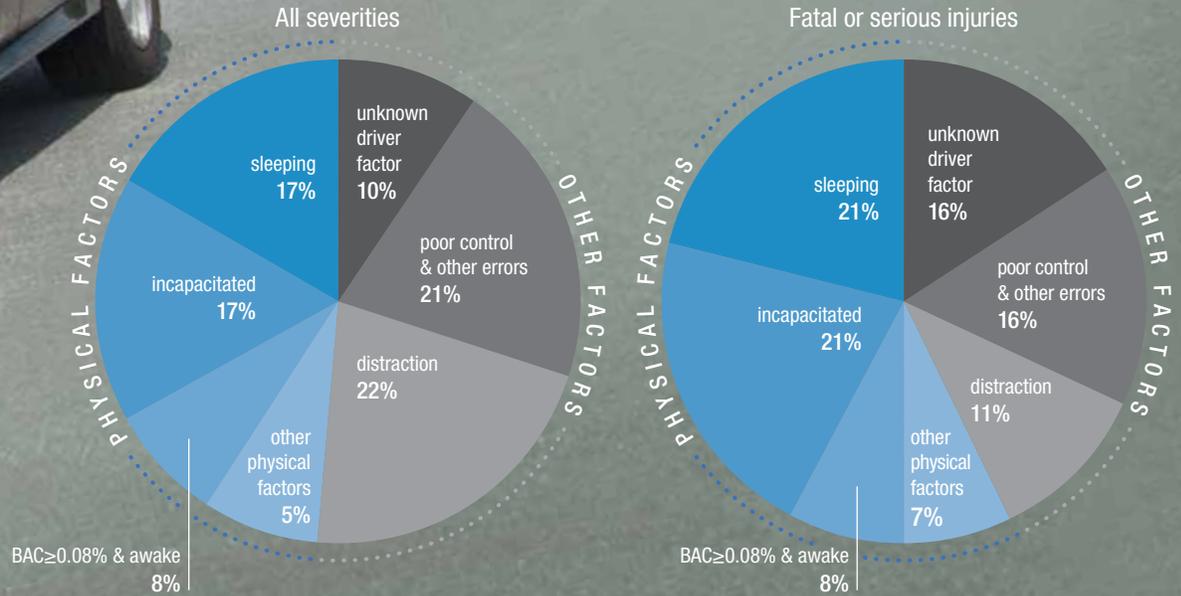
Michigan is one of 28 states with helmet laws covering only younger riders. Only 19 states and the District of Columbia require helmets for all riders.

The National Highway Traffic Safety Administration estimates that helmets cut the risk of a motorcycle fatality by 37 percent.

For copies of "The impact of Michigan's partial repeal of the universal motorcycle helmet law on helmet use, fatalities, and head injuries" by P.M. Carter et al., and "Observation of motorcycle helmet use rates in Michigan after partial repeal of the universal motorcycle helmet law" by L. Buckley et al., email publications@iihs.org. ■



Critical reasons behind lane-drift crashes



towed from the scene and emergency medical services were called. The crashes studied occurred during 2005-07.

Crash details came from interviews with drivers, passengers, witnesses and first responders; inspections of vehicles and crash scenes; and medical records.

In 17 percent of the crashes, the driver was sleeping, and in another 17 percent, the driver was otherwise incapacitated. The latter category includes drivers who lost consciousness

due to drugs or alcohol, seizures, heart attacks, strokes or diabetic shock.

In the 124 lane-drift crashes resulting in fatal or serious injuries, 21 percent of drivers were asleep. The same percentage were otherwise incapacitated.

When conscious drivers with blood alcohol concentrations of 0.08 percent or higher or other physical conditions were included, lane-drift crashes involving driver physical factors totaled 47 percent of all severities

and 56 percent of ones with fatal or serious injuries.

One limitation of the study is that the database used includes only crashes that occur between 6 a.m. and midnight, while many crashes that result from sleeping or blacked-out drivers occur after midnight.

For a copy of "Prevalence of driver physical factors leading to unintentional lane departure crashes" by J.B. Cicchino and D.S. Zuby, email publications@iihs.org. ■

Life-saving benefits of ESC continue to accrue

Electronic stability control (ESC) saved an estimated 4,100 lives in 2010-14, the National Highway Traffic Safety Administration (NHTSA) says in an updated analysis.

In 2014 alone, ESC saved 1,580 lives, the agency says. That is more than double the 682 lives saved during 2010 before the U.S. regulator required the groundbreaking technology on passenger vehicles.

ESC is an extension of antilock brake technology that helps drivers maintain control of their vehicles on curves and slippery roads. It is especially effective at preventing rollover crashes. The technology is standard on 2012 and later passenger vehicles.

The benefits of ESC are expected to keep growing as the technology spreads through

the general fleet of vehicles on the road. During 2014, 47 percent of registered vehicles had ESC as standard or optional equipment at the time of manufacture, analysis by HLDI shows. HLDI predicts that the proportion of vehicles sold with available ESC won't reach 95 percent until 2032 (see HLDI Bulletin, 32:16, September 2015).

IIHS studies indicate that ESC reduces fatal single-vehicle crash risk by about half and fatal multiple-vehicle crash risk by 20 percent for cars and SUVs. Many single-vehicle crashes involve rolling over, and ESC's effectiveness in preventing rollovers is even more dramatic. It reduces the risk of fatal single-vehicle rollovers by 75 percent for SUVs and by 72 percent for cars.

NHTSA estimates the installation of ESC reduces fatal single-vehicle crashes of cars by 38 percent and fatal single-vehicle crashes of SUVs by 56 percent. The agency's updated



estimates include only vehicles with standard ESC and not vehicles that may have been equipped with optional ESC. The estimates also don't take into account lives saved in multivehicle crashes.

For a copy of "Estimating lives saved by electronic stability control, 2010-2014" by C. Webb, go to www-nrd.nhtsa.dot.gov/Pubs/812277.pdf. ■

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**Vol. 51, No. 7
September 1, 2016**

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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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