

STATUS REPORT

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HYBRID ADVANTAGE

Hybrids have a safety edge over their conventional twins when it comes to shielding their occupants from injuries in crashes, new research by the Highway Loss Data Institute (HLDI), an Institute affiliate, shows. On average, the odds of being injured in a crash are 25 percent lower for people in hybrids than people traveling in nonhybrid models.

“Weight is a big factor,” says Matt Moore, HLDI vice president and an author of the report. “Hybrids on average are 10 percent heavier than their standard counterparts.

This extra mass gives them an advantage in crashes that their



conventional twins don't have." He notes that other factors, such as how, when, and by whom hybrids are driven, also may contribute. Researchers included controls to reduce the impact these differences may have had on the results.

The new finding is more good news for green-minded drivers who don't want to trade safety for fuel economy. Not so long ago, car buyers had to choose between the two because fuel-efficient cars tended to be smaller and lighter. Now, consumers have more options than ever when it comes to picking an environmentally friendly — and crash-worthy — vehicle.

"Saving at the pump no longer means you have to skimp on crash protection," Moore says.

In the study, HLDI estimated the odds that a crash would result in injuries if people were riding in a hybrid versus the conventional version of the same vehicle. The analysis included more than 25 hybrid-conventional vehicle pairs, all 2003-11 models, with at least 1 collision claim and at least 1 related injury claim filed under personal injury protection or medical payment coverage in 2002-10.

Collision coverage pays to repair or replace an at-fault driver's vehicle after a crash with an object or another vehicle. Personal injury protection, or PIP, pays medical expenses for injuries insured drivers and other people in their vehicles sustain in a crash, no matter who is at fault in the collision. Medical payment, or MedPay, covers treatment costs when insured drivers or their passengers are hurt in crashes when the driver is at fault. PIP coverage is sold in states with no-fault insurance systems, and MedPay coverage is sold in tort states.

Hybrids' injury odds were 27 percent lower than their standard counterparts for collision claims with a related PIP claim and 25 percent lower than their twins for collision claims with a related MedPay claim.

Crash physics: It's well known that size and weight influence injury likelihood. In a crash involving two vehicles that differ in *(continues on p. 6)*



**HYBRIDS ARE ABOUT 10 PERCENT
THEIR STANDARD COUNTERPARTS.
MASS GIVES THEM AN EDGE IN
THEIR CONVENTIONAL TWINS**

HYBRIDS CHALK UP MORE INJURY CLAIMS FOR PEDESTRIANS

Hybrids may protect occupants in crashes better than their nonhybrid counterparts, but they also may be as much as 20 percent more likely to be involved in pedestrian crashes with injuries than their conventional twins, a new Highway Loss Data Institute (HLDI) analysis indicates.

Analysts examined how frequently bodily injury liability claims were filed for 17 hybrids and their nonhybrid counterparts when there was no related collision or property damage. Studied vehicles included 2002-10 full hybrid models and their standard twins during 2004-10 calendar years, totaling 25,382 bodily injury liability claims and 2.9 million years of exposure.

Bodily injury liability coverage insures against medical and other expenses for injuries that at-fault drivers inflict on occupants of other vehicles or others on the road.

Claim frequencies were defined as claims per 1,000 insured vehicle years (an insured vehicle year is 1 vehicle insured for 1 year or 2 for 6 months each, etc.). The analysis controlled for calendar year, rated driver age, rated driver gender, marital status, risk, registered vehicle density, garaging state, vehicle series, and vehicle age.

HLDI's finding is in line with 2009 and 2011 studies by the National Highway Traffic Safety Administration concluding that hybrids have a higher rate of pedestrian and bicyclist crashes than nonhybrids (see *Status Report*, Dec. 22, 2009; on the web at iihs.org).

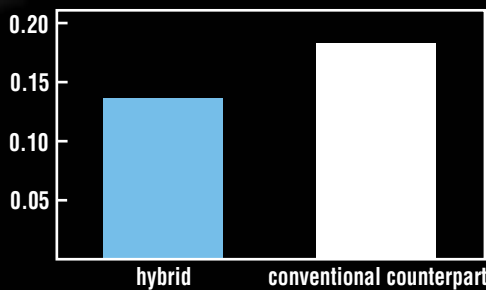
"When hybrids operate in electric-only mode pedestrians can't hear them approaching," says Matt Moore, HLDI vice president, "so they might step out into the roadway without checking first to see what's coming."

It's a problem that's cropped up as hybrids have become more common, and it's one the National Highway Traffic Safety Administration is working to address. Earlier this year Congress gave the agency three years to come up with a requirement for equipping hybrids and electric models with sounds to alert unsuspecting pedestrians (see *Status Report*, March 30, 2011).

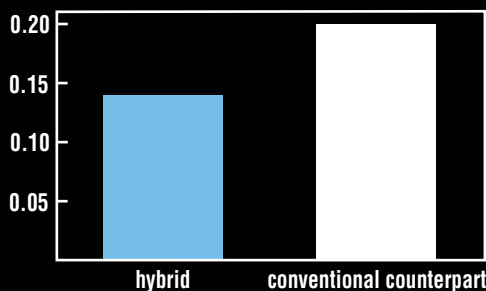
Moore points out that HLDI can't definitively tell from the data that a crash involved a pedestrian. Likewise, some pedestrian crashes may have been unintentionally excluded. For example, a crash in which a person was struck and injured and the vehicle also was damaged would have been omitted because a collision claim would have been filed for the vehicle. However, a sample of the claims suggests that these are mostly pedestrian injuries.



ESTIMATED INJURY ODDS UNDER COLLISION & PERSONAL INJURY PROTECTION COVERAGE



ESTIMATED INJURY ODDS UNDER COLLISION & MEDICAL PAYMENT COVERAGE



**HEAVIER THAN
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TEENS' CRASH RISK RISES WHEN THEY DRIVE MODELS BUILT FOR PERFORMANCE

No matter what they drive, teenagers are more likely than drivers their parents' age to crash. The extra risk is amplified for teens on motorcycles and in sports cars, a new analysis shows.

Crash rates among the generations vary least when driving very large SUVs and other big vehicles, the report from the Highway Loss Data Institute (HLDI) concludes. Those vehicles are among the least likely to crash no matter who is behind the wheel. As it happens, large vehicles also provide better protection when a crash does occur, so they are good choices for teen drivers in all ways.

"When you're riding a motorcycle or driving a sports car, there's a greater temptation to go fast and show off," says Kim Hazelbaker, senior vice president of HLDI, an Institute affiliate. "Teenagers are probably more susceptible to that than experienced drivers."

HLDI researchers looked at collision insurance claims for 2006-10 passenger vehicle and motorcycle models during calendar years 2005-10. They compared the frequency with which claims were filed for drivers ages 16-19 with the frequency for drivers ages 35-60, referred to in the study as prime-age drivers. The person considered the driver is the one assigned to a given vehicle for insurance purposes. Information on who was actually driving at the time of a crash isn't available in HLDI's database, which is based on reports from insurers representing about 80 percent of the market for privately insured vehicles.

The ratio of teen claim frequency to prime-age claim frequency shows how much more risky a given vehicle is for teens than for prime-age drivers. The researchers found the highest claim frequency ratio for supersport motorcycles. When these bikes are ridden by teens, claims are filed at a rate of 27.4 per 100 insured vehicle years — more than 4 times the rate for 35-60 year-olds on the same type of motorcycle. An insured vehicle year is 1 vehicle insured for 1 year, 2 for 6 months, etc. Sport motorcycles have the second-highest ratio of 2.7. Among teens, their claim frequency is 14.5 versus 5.3 for prime-age drivers.

Teenagers make up just 1 percent of insured motorcycle riders, though they represent 3 percent of motorcycle collision claims. When they do ride, they are more likely than not to be on a supersport or sport motorcycle — the types with the highest crash rates (see *Status Report*, Sept. 11, 2007; on the web at iihs.org). On average, teenagers on motorcycles have a claim frequency about 18 percent higher than teenagers driving automobiles.

Midsize sports cars have the third highest ratio of teen to prime-age-driver claim rates and the highest among automobiles. Their teen claim frequency of 14.9 is 2.5 times the rate for prime-age drivers.

Also high on the list are minicars and small cars, with teen claim rates that are about double those for prime-age drivers. These vehicles have high crash rates generally, despite the commonly held belief that they are less likely to crash because they are more maneuverable.



"We don't know exactly why small cars have high crash rates," Hazelbaker says. "It may be that greater maneuverability, rather than allowing drivers to avoid crashes, actually encourages them to make more sudden moves. Also, cars with shorter wheelbases are less stable and therefore less forgiving when drivers make mistakes. Both of these things are big concerns for teenage drivers because of their inexperience," he explains.

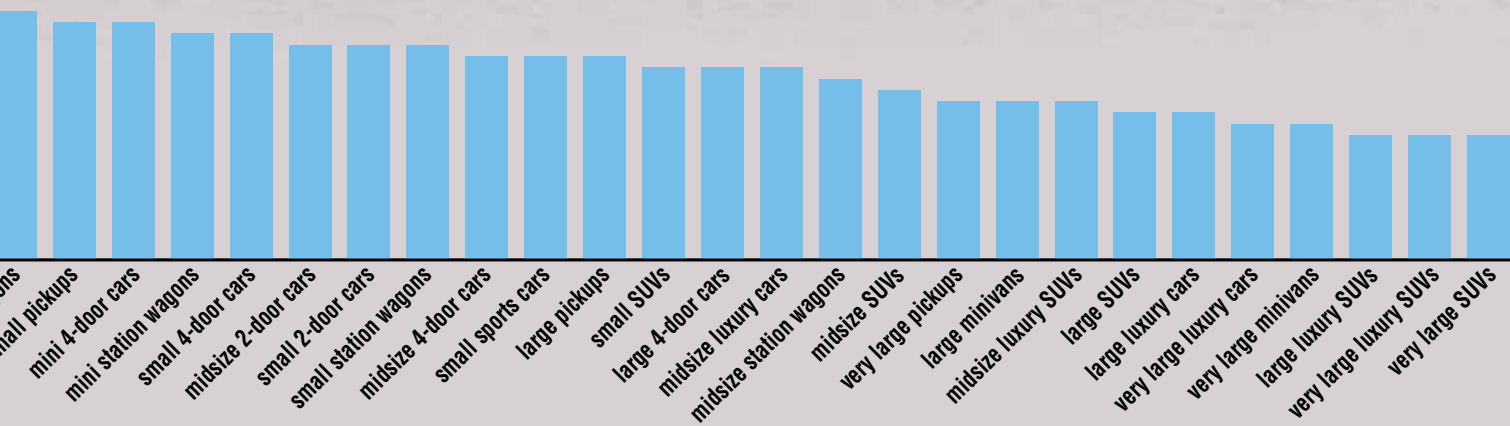
Although big vehicles generally crash less often, large station wagons appear to be an exception. They have high claim rates for both teens and prime-age drivers but are more than twice as likely to crash when the driver is a teen. However, today's large station wagons aren't anything like



COLLISION CLAIM FREQUENCY RATIO OF TEEN DRIVERS TO PRIME-AGE DRIVERS BY VEHICLE TYPE AND CLASS, 2006-10 MODEL YEARS

■ motorcycles ■ passenger vehicles

Note: "Other motorcycles" combines chopper, dual-purpose, scooter, sport touring, standard, touring, and unclad sport classes.



minivans or large cars. In fact, the category is comprised entirely of the Dodge Magnum, which has a powerful engine and a sporty image.

In contrast, large and very large SUVs, both luxury and nonluxury models, don't crash much more with teen drivers than they do with prime-age drivers. The ratio of teen claim frequency to prime-age claim frequency for these SUVs ranges from 1.1 to 1.3. Very large minivans, a category that includes most minivan models, and large and very large luxury cars fall within this range, too.

One reason SUVs have low teen claim rates might be that they're more likely than other types of vehicles to have been equipped with electronic stability control (ESC) in the study period. ESC, required in

all passenger vehicles as of the 2012 model year, made its way more quickly into SUVs than other vehicles. Earlier, HLDI found the technology reduces collision claims in SUVs by 8 percent and overall collision losses by 18 percent. ESC also reduces the likelihood of a deadly crash in all vehicles by 33 percent (see *Status Report*, June 19, 2010).

The HLDI analysis deals only with claim frequency. The likelihood of a serious or fatal injury if a crash were to occur is a separate matter, but on that front SUVs look good, too. Their bigger size and weight keep their occupants better protected. That size/weight advantage, combined with the advent of ESC, helps explain why today's SUVs have lower driver death rates than cars or pickups (see *Status Report*, June 9, 2011).

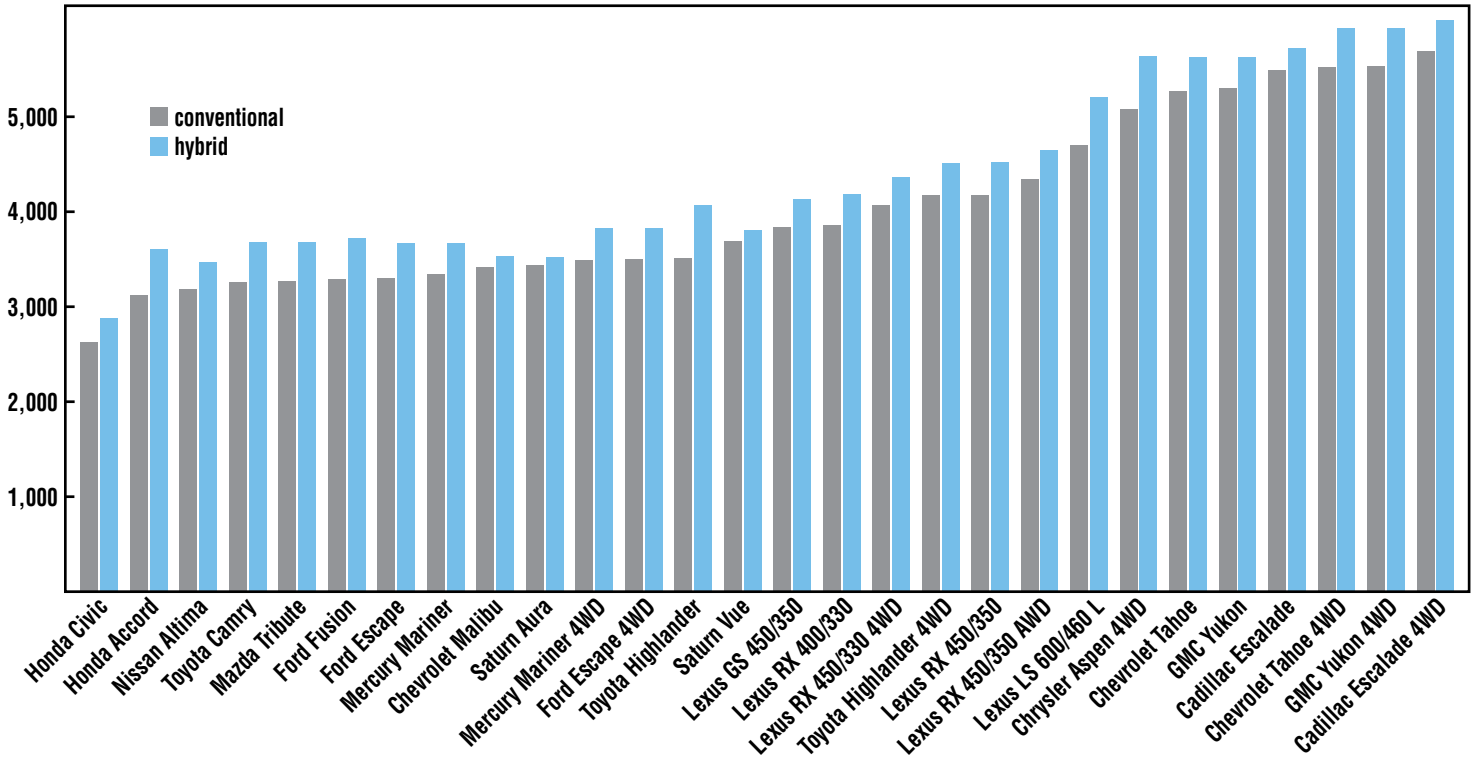
(continued from p. 2) size and weight, the people in the smaller, lighter vehicle will be at a disadvantage. The bigger and heavier vehicle will push the smaller, lighter one backward on impact. This means less force on people in the heavier vehicle and more

of the added heft of battery packs and other components used in dual-power systems. At about 3,600 pounds, a hybrid Honda Accord midsize sedan, for example, can weigh as much as 480 pounds more than a conventional Accord. A hybrid Toyota Highlander,

can be done to examine the effects of mass independent of size,” Moore says.

Researchers excluded the Toyota Prius and Honda Insight from the study because they are only sold as hybrids. The analysis controlled for calendar year, rated driver

CURB WEIGHT IN POUNDS BY MODEL, HYBRID VS. CONVENTIONAL COUNTERPART



on the people in the lighter one. Greater force means greater risk, so people in the smaller, lighter vehicle are more likely to be injured. Even in single-vehicle crashes, heavier vehicles have an advantage because they are more likely to move, bend, or deform objects they hit (see *Status Report*, April 14, 2009; on the web at iihs.org).

Even with advances in occupant protection, larger vehicles still are safer choices than smaller ones. That’s why downsizing vehicles to improve fuel efficiency has traditionally resulted in safety trade-offs. The trend among automakers nowadays is to boost fuel economy by designing more efficient internal combustion engines and by adding hybrids to their fleets.

Although hybrids share the same footprint and structure as their conventional counterparts, they outweigh them because

a midsize SUV, weighs about 4,500 pounds, compared with about 4,170 pounds for the conventional Highlander.

“Park any of these pairs side by side and you can’t tell the hybrid from the traditional vehicle just by looking at them,” Moore points out. “But you could if you were to put them on a scale.”

Disentangling size and mass: Moore says the study is unique in its ability to examine how vehicle mass affects injury rates. One question safety advocates long have grappled with is, how much does size affect crashworthiness as compared with weight? These two factors have separate effects, but they are highly correlated. Disentangling them requires keeping one variable constant while modifying the other.

“What we ended up with was a study that may be as good a natural experiment as

age and gender, marital status, vehicle density (number of registered vehicles per square mile), garaging state, vehicle series, and vehicle age.

Hybrids’ driver death rates: HLDI’s findings complement other Institute research into how vehicle size and weight affect crash injuries. A recent study found that driver death rates for 2005-08 models with at least 100,000 registered vehicle years decreased as vehicle weight increased (see *Status Report*, June 9, 2011).

Every hybrid in the analysis had a lower driver death rate than its conventional twin. For example, the Honda Civic Hybrid had an overall driver death rate of 53 per million registered vehicle years, compared with 55 for the nonhybrid Civic. The hybrid Toyota Camry had a driver death rate of 36, while the standard Camry’s rate was 10 points higher.

TOUGH CRITERIA IN RACE TO BUILD NEW INTERLOCK

Developers of advanced in-vehicle alcohol detection technology have two years to come up with a system that can reliably determine the amount of alcohol in a driver's bloodstream in a third of a second.

That's the task in the second phase of a joint government-industry effort to develop a highly accurate and unobtrusive technology that would prevent anybody with a blood alcohol concentration (BAC) of 0.08 percent or higher from starting a vehicle. Two contracts have been awarded to develop systems for a test vehicle.

Devices to keep an impaired driver from starting a vehicle are in use in many states, but these ignition interlocks are designed for people who already have been convicted of driving under the influence. They require a driver to blow into the device and take at least 30 seconds to compute the person's BAC from the breath sample.

In contrast, the Driver Alcohol Detection System for Safety (DADSS) program is seeking a system that would be quick and virtually invisible, able to accurately measure BAC without inconveniencing sober drivers on every trip. It would need to work consistently in all conditions and without maintenance (see *Status Report*, July 11, 2009; on the web at iihs.org).

"Our performance specifications far exceed what already exists," says DADSS program manager Susan Ferguson.

Despite great strides in reducing impaired-driving deaths over the past 30 years, little progress has been made since the mid-1990s. Institute researchers estimate that more than 7,000 deaths could have been prevented in 2009 if all drivers with BACs of 0.08 percent or higher were kept off the roads.

The DADSS initiative is a partnership of the National Highway Traffic Safety Administration and the Automotive Coalition for Traffic Safety, a consortium of automakers. The Institute is part of an expert advisory panel.



In the first phase of the project, prototypes of a breath-based system and a touch-based system were developed and tested, including with human subjects. The developers are expected to improve the speed and precision of their systems in the second phase. The systems will be tested to ensure they are durable enough to install in a vehicle. That means they must be able to withstand wide variation in temperature, vibration, humidity, dust, and electromagnetic radiation, among other things.

Both systems will then be installed in a single test vehicle. The project is funded up to that point, but more vehicles and field testing likely would be necessary before either system makes its way into vehicles on a dealer lot.

The breath-based system is being developed by Autoliv, a Swedish maker of automotive safety systems. It uses multiple sensors to measure the alcohol content of the driver's exhaled breath inside the vehicle. The position of the sensors ensures the reading reflects the breath of the driver and not passengers.

The touch-based device is being developed by Takata, a Japanese supplier of auto safety systems, and TruTouch Technologies, a New Mexico company that makes alcohol detection systems for the workplace. The system uses tissue spectroscopy to estimate a person's BAC based on infrared light absorption by the skin.

A 2009 Institute survey showed the public is ready for this kind of in-vehicle alcohol-detection technology. About two-thirds of respondents said they think it is a good idea, and more than 40 percent said they would want it in their own vehicles (see *Status Report*, Sept. 17, 2009). A more detailed survey to gauge how people would respond to the specific technologies is planned as part of DADSS.

Any system to emerge from the project and be adopted by vehicle manufacturers would likely be offered initially as optional equipment. Ferguson notes that some consumers, such as parents of teenagers and employers of commercial drivers, could be expected to embrace it quickly.

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Hybrids' injury odds are lower than their gasoline-powered twins due to their heavier weight1

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