STATUS REPORT
INSURANCE INSTITUTE FOR HIGHWAY SAFETY
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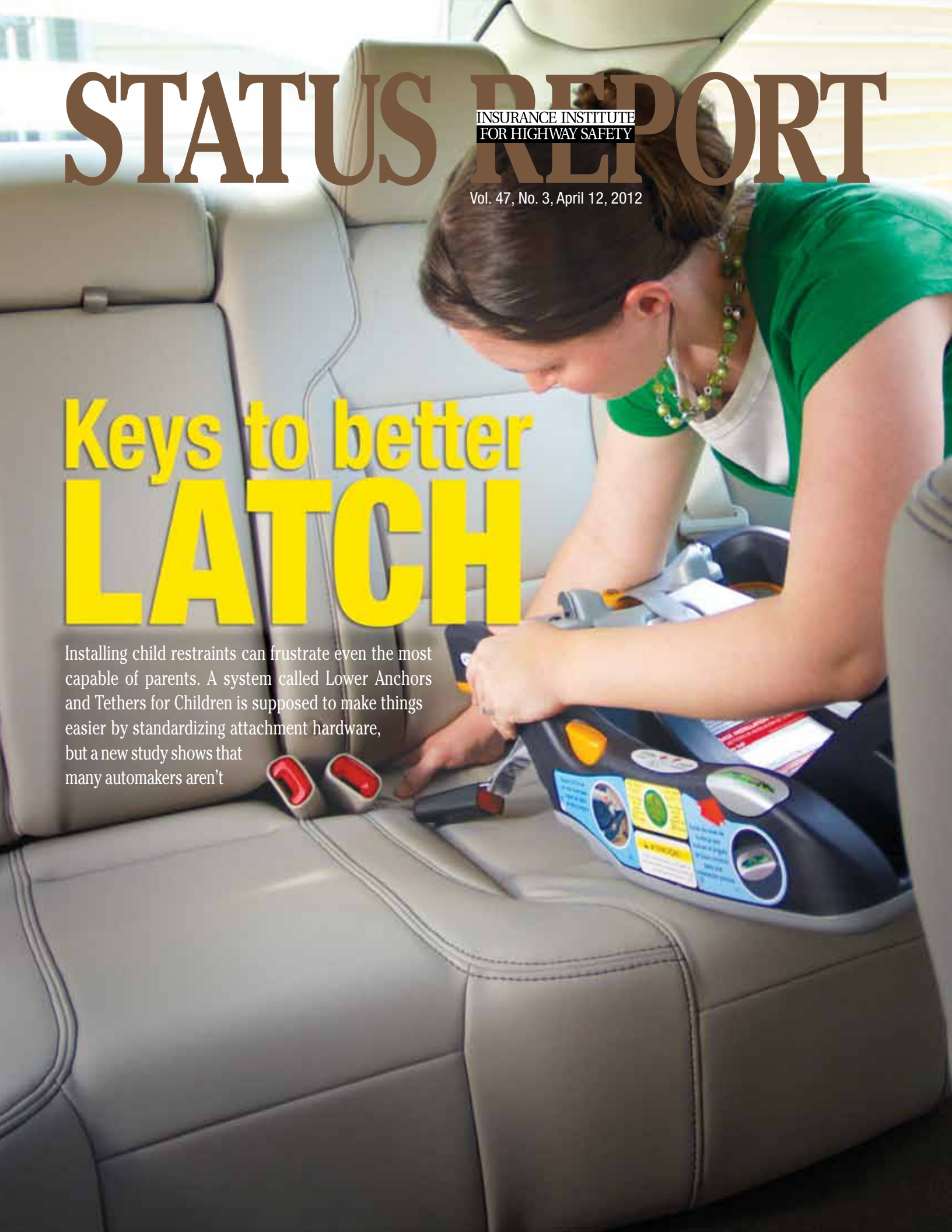


Keys to better LATCH

Installing child restraints can frustrate even the most capable of parents. A system called Lower Anchors and Tethers for Children is supposed to make things easier by standardizing attachment hardware, but a new study shows that many automakers aren't

paying attention to the key factors that make LATCH work. Only 21 of the 98 top-selling 2010-2011 model passenger vehicles evaluated have LATCH designs that are easy to use. This is the main finding of joint research conducted by the Institute and the University of Michigan Transportation Research Institute (UMTRI).

The researchers scrutinized LATCH hardware and rear seat designs in a range of passenger vehicles to determine the key vehicle characteristics that would help LATCH live up to its billing. The Institute, UMTRI and other safety groups have previously pointed out usability issues with LATCH (see *Status Report*, June 11, 2003; on the web at iihs.org).

"Installing a child restraint isn't always as simple as a couple of clicks and you're done," says Anne McCartt, the Institute's senior vice president for research and one of the report's authors. "Sometimes parents blame themselves when they struggle with LATCH, but oftentimes the problem lies with the vehicle, not the user."

The goal of LATCH is to increase the number of children who ride properly restrained by making child restraints easier to install. Consumers who drive 2003 and later models likely have encountered the system. LATCH has two distinct components: lower attachments on child restraints that connect to anchors at the vehicle seat bight (where the bottom cushion meets the seat back) and top tethers on forward-facing restraints that attach to anchors on the vehicle's rear shelf, seat back, floor, cargo area or ceiling. Tethers help prevent child restraints from moving too far forward during crashes, putting children at risk of head or neck injuries.

UMTRI researchers reviewed LATCH hardware and rear seats in cars, minivans, pickups, station wagons and SUVs. To measure and assess how child restraints fit in each vehicle, they used a test fixture and other tools in line with 2009 draft guidelines developed by a Society of Automotive Engineers working group. They then picked 12 vehicles representing a range of LATCH setups and asked 36 volunteers to each install three different types of child restraints in three of the vehicles.

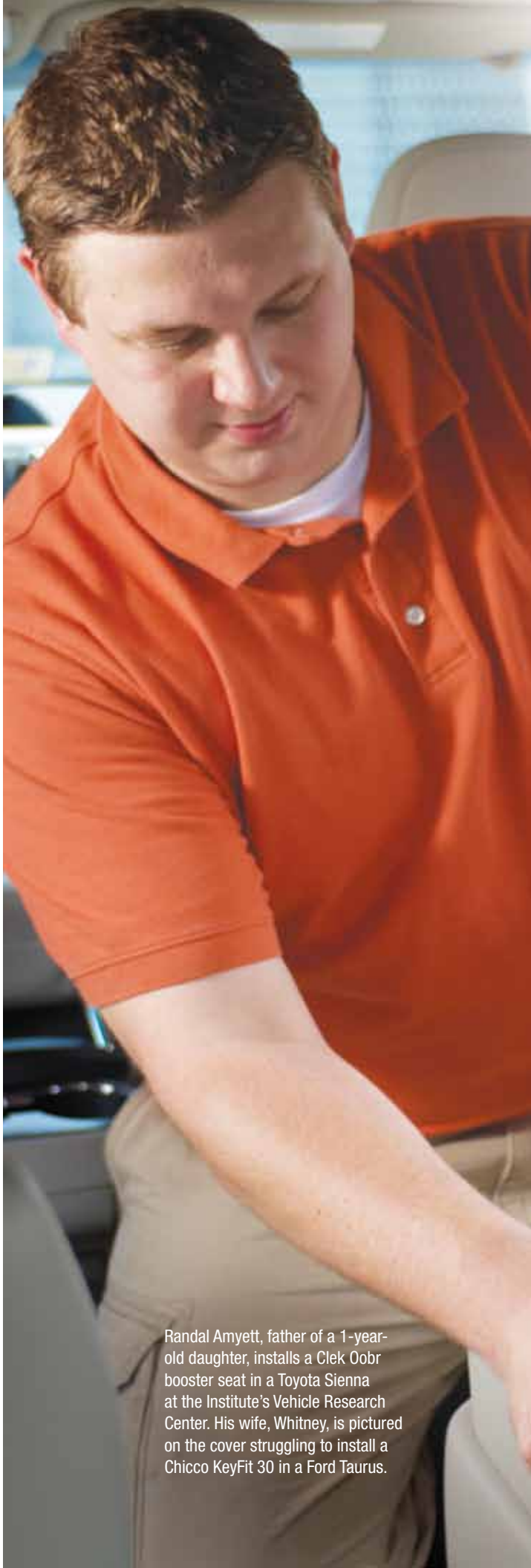
Researchers identified three factors associated with correct lower anchor use: depth, clearance and force.

■ Depth: Lower anchors should be located no more than 3/4 inch deep in the seat bight and should be easy to see.

■ Clearance: Nothing should obstruct access to the anchors. Safety belt buckles and other hardware plus the foam, cloth or leather material of the seats themselves shouldn't get in the way of attaching child seat connectors. There should be enough room around the anchors to approach them at an angle, as well as straight-on. This makes it easier to hook or snap on connectors and also tighten LATCH straps. In the study, a clearance angle of at least 54 degrees was associated with easier installation.

■ Force: Parents should be able to install child seats using less than 40 pounds of force. Some systems require lots of effort to properly connect child restraint hardware with lower anchors, in part because they are deep in the seat bight or surrounded by interfering parts of the vehicle seat.

All three factors are related and are good predictors of how well people are able to correctly install child restraints. Vehicles meeting the criteria were 19 times as likely to have lower anchors used correctly by the volunteers compared with vehicles that don't meet any of the criteria.



Randal Amyett, father of a 1-year-old daughter, installs a Clek Oobr booster seat in a Toyota Sienna at the Institute's Vehicle Research Center. His wife, Whitney, is pictured on the cover struggling to install a Chicco KeyFit 30 in a Ford Taurus.

Parents were 19 times as likely to correctly install child seats in vehicles with easy-to-use hardware.

Percent of volunteers who used...

lower anchors correctly	60
top tether (forward-facing only)	48
top tether correctly (forward-facing only)	22

Percent of volunteers who installed seats with...

correct use of hardware	33
tight installation	31
correct child restraint angle	74
correct use of hardware and tight installation at correct angle	13

Lower anchor availability in surveyed vehicles

2 seats	82
3 or more seats	16

Top tether availability

2 seats	4
3 seats	84
4 or more seats	10

"These are things that automakers can do to improve child restraint installations, and most of them aren't hard," McCartt says. "Lower anchors can be designed so they are easy to use."

One common problem researchers encountered in the lab is that safety belt buckles, plastic housing or vehicle seats obscure or interfere with lower anchors. Another issue is that the anchors are sometimes buried deep within the back seats, so parents might have to dig around in the cushions to find them. Lower anchors were visible in just 36 of the 98 study vehicles. Researchers considered the anchors visible if they were easy to see or could be seen by removing a prominently marked cover.

Federal rules dictate the minimum number of seating positions that must have LATCH, the size of the lower anchors and how far apart they can be situated. If the lower anchors aren't visible, markers on the seats must indicate their location. Other design details are left up to automakers. For instance, the regulations don't specify anchor depth within the seat bight or limit how hard someone has to push on a child restraint to connect LATCH. Researchers found that these factors affect the likelihood that people will install child restraints correctly.

Another finding is that only seven of the 98 vehicles surveyed have dedicated LATCH anchors in the center, second-row seats, even though that is the safest place for children to travel. Nine vehicles allow borrowing of anchors from the outboard seats, and 82 have no center anchors at all. In the 21 minivans and SUVs with third rows, 11 have no lower anchors at all in these seats.

The National Highway Traffic Safety Administration requires passenger vehicles with rear seats *(continues on p. 4)*

2011 models that meet all 3 easy-installation criteria

Audi A4 Quattro
Cadillac Escalade
Chevrolet Equinox LT
Chevrolet Silverado 1500 crew cab LT
Chevrolet Suburban LT
Chevrolet Tahoe LS
Chrysler Town & Country (2010)
Dodge Caliber Mainstreet
Dodge Grand Caravan
Dodge Ram 1500 crew cab
Ford Escape XLT
Ford F-150 SuperCrew Cab
GMC Sierra 1500 crew cab SLE
Honda Pilot EX-L
Kia Sedona LX
Land Rover Range Rover Sport
Mercedes-Benz C300
Mercedes-Benz E350
Mitsubishi Eclipse coupe GS
Mitsubishi Lancer ES
Toyota Tacoma extended cab

2011 models that don't meet any easy-installation criteria

Buick Enclave CX
Chevrolet Impala LT
Dodge Avenger Express
Ford Flex SEL
Ford Taurus Limited
Hyundai Sonata Limited
Toyota Sienna XLE

(continued from p. 3) to have a minimum of two seating positions with lower anchors and three seating positions with tether anchors. Few passenger vehicles offer more than the minimum number of required anchors, researchers found. Only 16 of the 98 models surveyed had three or more pairs of lower anchors in back seats, while just 10 vehicles offered more than the three required tether anchors.

"People who buy larger vehicles often pick them because they need the room to haul multiple kids and gear or do carpool duty. So it's surprising that so many minivans and SUVs have only the minimum LATCH hardware," McCartt says.

"If there are no lower anchors, parents can use safety belts to secure child restraints, but there is no substitute for a tether anchor. Forward-facing child restraints, whether installed with safety belts or LATCH lower anchors, protect better with tethers."

Volunteer installations: Parents correctly used lower anchors 60 percent of the time in the study. Volunteers who correctly used anchors were more than three times as likely to get a tight fit as those who didn't use them the right way. When anchors were misused, common mistakes included not orienting the connectors properly, attaching them to the wrong hardware and not snapping them in all the way. Twisted straps also counted as an error.

Certified child passenger safety technicians evaluated the installations. They deemed them tight if the restraint didn't move more than an inch sideways or back and forth when pulled. All of the participants currently used child seats in their own vehicles. If they had questions about how to install the seats in the study they could consult owners' manuals but received no other assistance.

Child restraints used in the study included the Chicco KeyFit 30, a rear-facing infant seat with push-on lower connectors, and the Cosco Alpha Omega Elite convertible seat and Evenflo Maestro forward-facing seat, both with hook-on lower connectors.

Tethers aren't optional: Volunteers used top tethers just 48 percent of the time with forward-facing child restraints. When tethers were used, 54 percent of the installations were incorrect. Leaving too much slack in the strap was a common error. Another was attaching tethers to the wrong hardware.

Overall, parents and caregivers correctly installed seats with lower anchors and top tethers to get a tight, secure fit at the right angle in just 13 percent of the cases.

"With tethers, the main issue is use, not usability," says Kathy Klinich, assistant research scientist at UMTRI and the study's lead author. "Many parents don't realize they are supposed to use the tether."

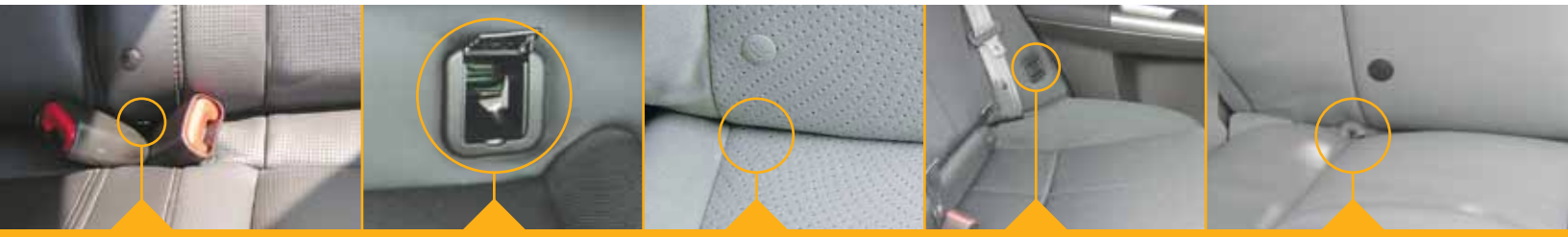
Previous studies have shown that many people neglect to use tethers. A 2010 Institute survey found tethers in use 43 percent of the time, about the same as in the mid-1970s (see *Status Report*, Sept. 8, 2010).

"Tethers should be used with all forward-facing child restraints, even if parents opt to secure seats with safety belts instead of lower anchors," Klinich says. "We need to better educate people about tether use."

Making LATCH easier to use might encourage more parents to use child restraints and install them correctly, McCartt says. In 2010, 29 percent of children 1-3 years old and 12 percent of infants younger than 1 who died in crashes were riding unrestrained. Those numbers mark a sharp improvement over 1985, when 71 percent of children ages 1-3 and 35 percent of infants killed in crashes were unrestrained.

"Getting kids into the right restraints for their age and size is the first step," McCartt says. "The next is to install the seats correctly because research shows this improves protection. This is where LATCH can help."

For a copy of "Vehicle LATCH system factors associated with correct child restraint installation" by K.D. Klinich et al., email publications@iihs.org.



Using LATCH can be difficult if lower anchors are hard to find or obscured by safety belt buckles, plastic casing or seat material.

The Ford Taurus' two sets of anchors aren't in the typical places on either side of a seating position. One is in the middle of the outboard seat, while its match is partially hidden by belt buckles in the center.

The Mini Cooper Clubman has plastic surrounding the lower anchors, making it difficult to push up far enough and at the right angle to attach child restraint connectors.

Stiff leather around recessed lower anchors can interfere with installation. This was the case in the Toyota Prius. Researchers had a hard time making a connection because leather got in the way.

Contoured seats can be an issue. The outside edges of the Subaru Forester's back seat are sloped in such a way that researchers couldn't connect the child seat test fixture in the lab.

Researchers had to apply more than 100 pounds of force to secure connectors in the Toyota Sienna. The anchors are buried, and the leather is snug around them, so there is little room for connectors.

Parents' struggles show shortcomings of LATCH

Sliding her hands along the back seat of a 2011 Ford Taurus, Whitney Amyett struggled to find LATCH anchors to connect a child restraint. Something that looked like an anchor was sticking out, but it was in such an unexpected spot that she figured it had a different purpose. And the second anchor was nowhere to be seen.

It took several more minutes of searching and consulting the vehicle manual before Amyett spotted the child restraint symbols on the seat back above the anchors and was able to install the Chicco KeyFit 30 infant restraint.

Fortunately, this was just a demonstration at the Institute's Vehicle Research Center. In real life, a parent who is in a hurry or whose baby is crying might not take the time or have the patience to figure it out.

The experience was frustrating, said Amyett, 22, and the mother of a 1-year-old girl. "I kept feeling underneath, and I couldn't find anything," she said. The problem is that the sedan's two sets of LATCH anchors aren't in the typical places on either side of a seating position. Instead, one anchor is in the middle of the outboard seat, while its match is hidden among the vehicle belt buckles in the center.

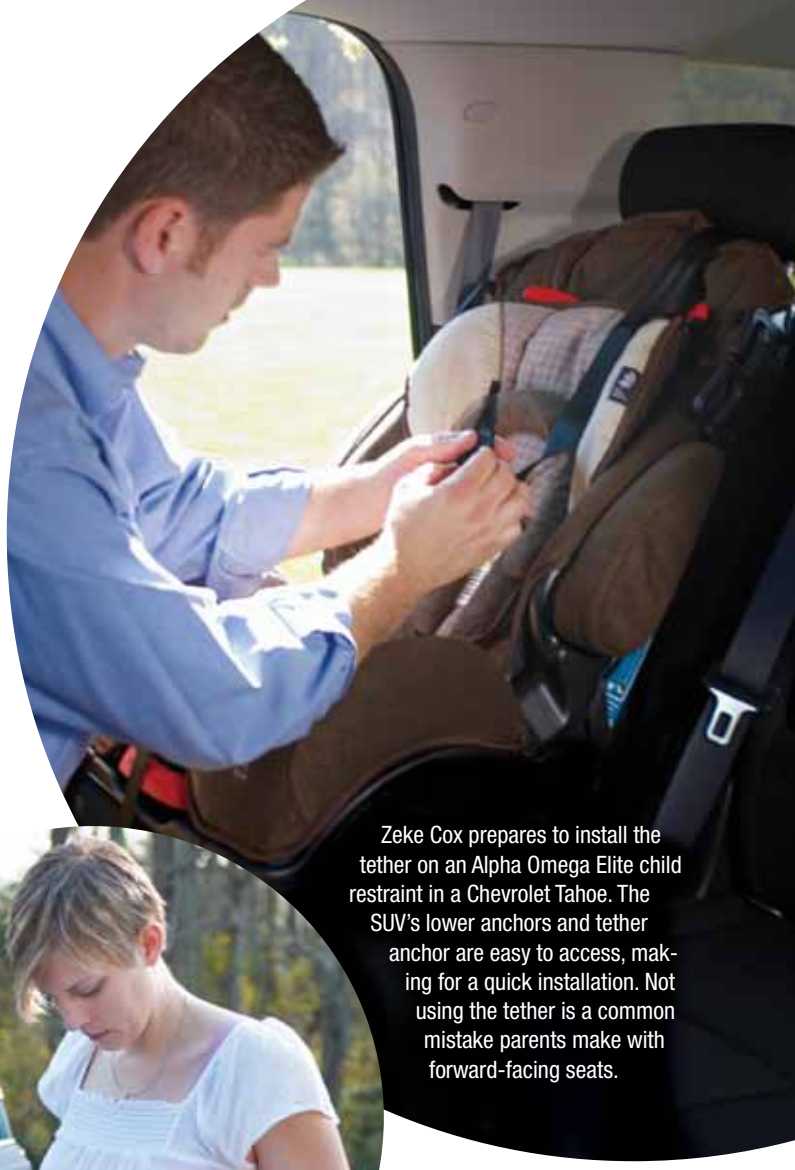
The Institute invited several parents of young children to try installing child seats in four vehicles, two with easy-to-use LATCH systems and two difficult. The demonstrations illustrated some of the problems with vehicles highlighted in the Institute's joint study with the University of Michigan Transportation Research Institute, as well as frustrations and misconceptions that many parents share.

In the case of the Taurus, Amyett's difficulties came as no surprise, based on the research. She had a much easier time installing the KeyFit in the Dodge Grand Caravan. That also was expected because the anchors on that minivan are easy to find.

Amyett's husband, Randal, was tasked with installing the Clek Oobr booster seat in the Toyota Sienna and had to resort to an unusual workaround. The Oobr has rigid LATCH connectors, so the seat needs to be held at an angle to install it. Because the Sienna's anchors are slightly buried, installing the Oobr in highback mode is impossible unless you do what Randal Amyett did and recline the minivan's seat to get the right angle. Then he removed the head restraint and straightened the seat back.

That solution, which isn't mentioned in the vehicle manual, was something Amyett, a 26-year-old plumber, had previously stumbled upon when installing his daughter's infant seat in a Honda Element.

Next, Amyett installed the Oobr in a Chevrolet Tahoe SUV. As predicted, the installation was quick and simple. "The anchors are really accessible and very easy to just click right in," he noted afterward. "I didn't have to hunt for them."



Zeke Cox prepares to install the tether on an Alpha Omega Elite child restraint in a Chevrolet Tahoe. The SUV's lower anchors and tether anchor are easy to access, making for a quick installation. Not using the tether is a common mistake parents make with forward-facing seats.

Jackie Meurer checks the Ford Taurus manual to see how to use LATCH in this sedan.

Even when installations are quick, they aren't always correct. Jackie Meurer, a 33-year-old nurse and mother of two, had no trouble finding the lower anchors in the Taurus and the Grand Caravan. However, both times she neglected to use the Evenflo Maestro's top tether, an essential part of any forward-facing restraint. Meurer said she knew about the tether but, like many parents, thought it was optional.

Zeke Cox, a small business owner with four kids, complained about the hook-style connectors on the Safety 1st Alpha Omega Elite, preferring push-on ones that click onto anchors. Cox, 32, correctly installed the child seat in the Tahoe and Sienna and remembered to use the tether.

Both Meurer and Whitney Amyett said they had trouble making their installations tight enough. After the demonstration, Meurer watched as Institute senior research engineer Chris Sherwood adjusted the child restraints in Meurer's own vehicle.

"I wish there was a better way to make it tighter," she said. "He's stronger. I made it as tight as a I could, and he goes in there and makes it tighter."

Study confirms wisdom of linking fuel economy to a vehicle's footprint

Automakers can shed a few pounds to help meet fleetwide fuel economy standards without sacrificing safety if they concentrate their weight loss in the heaviest vehicles, a recent federal analysis concludes.

The study by the National Highway Traffic Safety Administration provides additional support for the approach the agency took when it updated fuel economy standards in 2010. Those standards are in effect for 2012-16 models and require the industry to reach an estimated fleetwide 34.1 mpg in the final year. NHTSA and the Environmental Protection Agency now are working on standards for model year 2017 and beyond.

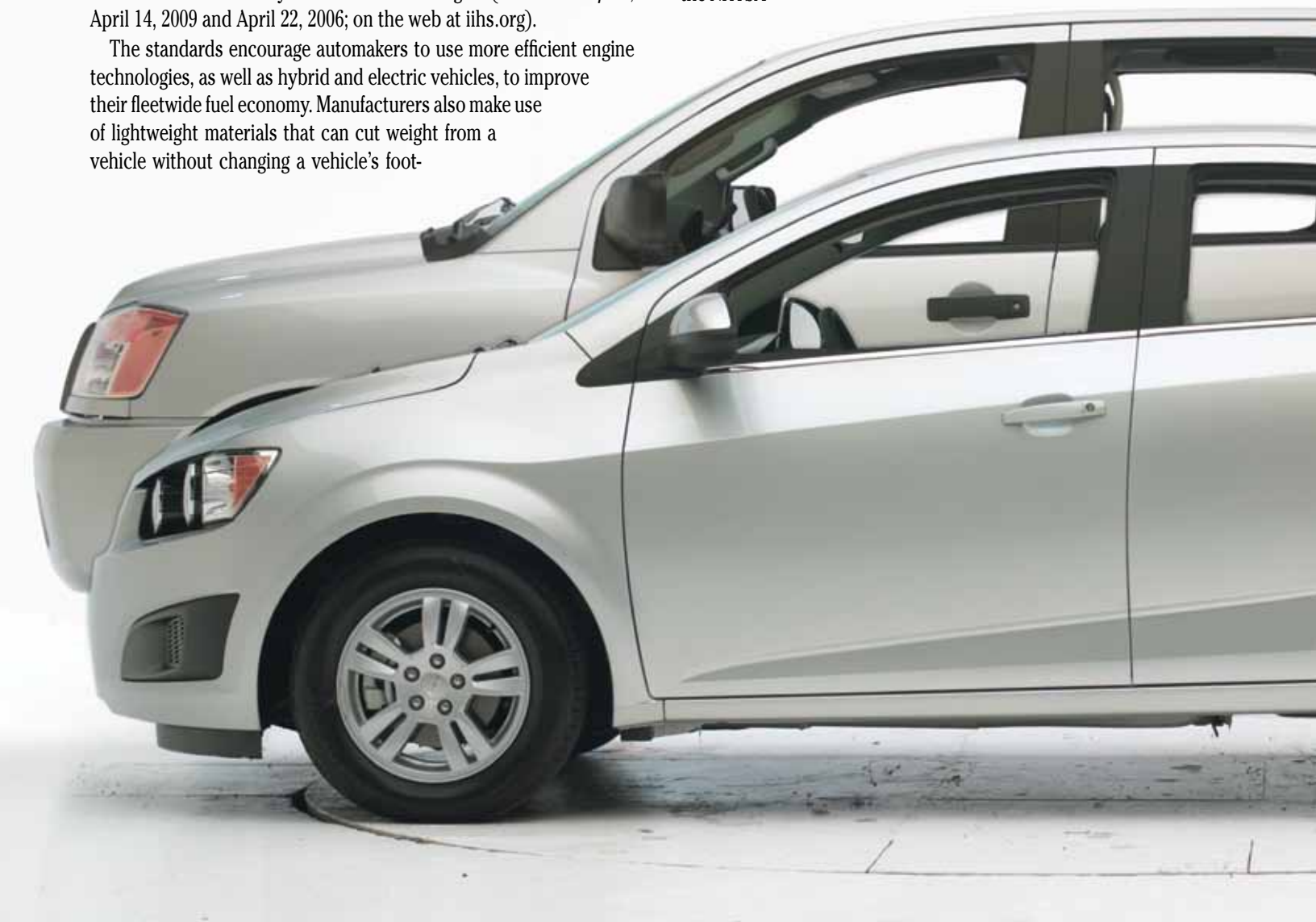
The current standards are a departure from previous ones because they tie fuel economy to a vehicle's footprint, roughly equivalent to the square footage outlined by the wheels. A vehicle with a smaller footprint now has to adhere to more stringent fuel economy standards. That removes the incentive for automakers to simply sell more small cars as a way to meet fleetwide targets (see *Status Report*, April 14, 2009 and April 22, 2006; on the web at iihs.org).

The standards encourage automakers to use more efficient engine technologies, as well as hybrid and electric vehicles, to improve their fleetwide fuel economy. Manufacturers also make use of lightweight materials that can cut weight from a vehicle without changing a vehicle's footprint. The NHTSA study looks at what happens to safety when the last strategy is used.

It is an important question because, other things being equal, larger and heavier vehicles provide better occupant protection than smaller and lighter ones. Both size and weight play a role. Size is important because a longer crush space allows more crash energy to be absorbed before it reaches the occupant compartment. Weight matters because when two vehicles collide, the heavier one pushes the lighter one backward on impact, resulting in greater forces on the people inside the lighter vehicle.

Exactly how much of the advantage of bigger vehicles is due to size and how much to weight is hard to disentangle. The Institute's affiliate, the Highway Loss Data Institute, recently shed some light on the issue when it compared hybrid vehicles with their conventional counterparts and found that the odds of being injured in a hybrid are 25 percent lower than for people in nonhybrid vehicles. In effect, that study looked mostly at weight while controlling for footprint because the hybrids have identical structures to those of their conventional twins but are heavier, thanks to their battery packs (see *Status Report*, Nov. 17, 2011).

In contrast to the HLDI study, which looked at injury rates for people in those vehicles,
the NHTSA



researchers were looking at the societal impact of weight variations in fatal crashes. That is, their analysis included not only fatalities of people inside a given vehicle, but also deaths among occupants of other vehicles that collide with it, as well as pedestrians.

The researchers derived their predictions from calculations of fatality rates by mass and footprint per billion vehicle miles traveled, using data on crashes in 2002-08 involving 2000-07 models. They took into account that all new models will have electronic stability control, a requirement as of 2012.

The study first looked at the effect on fatality risk of an across-the-board 100-pound weight reduction while maintaining vehicle footprint. Cutting 100 pounds from cars weighing less than 3,106 pounds would result in a 1.4 percent increase in fatalities associated with those cars, the researchers found. Hypothetical reductions in weight in other vehicle categories yield slight increases or decreases in fatalities, but those estimates aren't statistically significant. The overall effect for the entire fleet would be a 0.5 percent increase, though, again, the estimate isn't significant.

The researchers also examined what would happen if the weight reduction varied among vehicle classes with more of the decrease coming from heavier SUVs and pickups and less of it coming from small cars.

If the lightest cars drop only 70 pounds and heavier vehicles take a bigger cut, the fatality increase shrinks to 0.3 percent. A combination of weight reductions that takes only 18 pounds off the lightest cars wouldn't affect fatality rates at all. Finally, the researchers estimate that taking none of the weight decrease from the lightest cars and an even bigger chunk from the heavier ones, including 274 pounds from the heaviest SUVs and pickups, would shave off a 0.1 percent sliver of fatalities.

As the report notes, "any combination of mass reductions that maintain footprint and are proportionately somewhat higher for the heavier vehicles may well be safety-neutral or better."

"Relationships between fatality risk, mass, and footprint in model year 2000-2007 passenger cars and LTVs — preliminary report" by C.J. Kahane is available at regulations.gov.

Institute responds to criticism of red light camera research

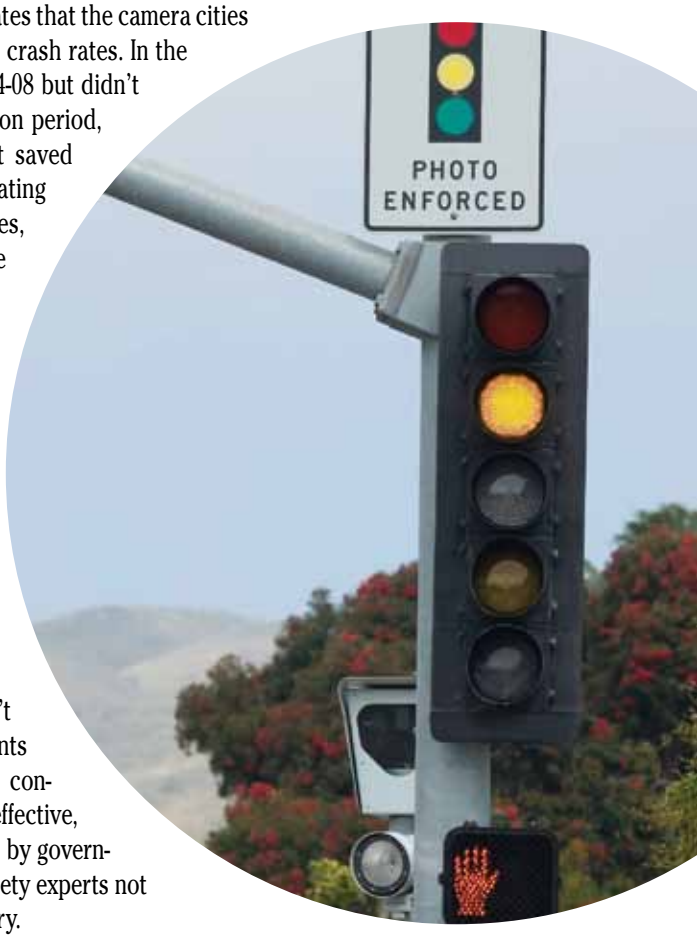
A report published by the *Florida Health Review* criticizes a 2011 Institute study that found red light cameras in 14 large cities significantly reduced fatal red light running crash rates (see *Status Report*, Feb. 1, 2011; on the web at iihs.org).

The report by University of South Florida professor Barbara Langland-Orban alleges the finding is incorrect and the research suspect because the Institute is supported by insurers.

The Institute examined fatal crashes before and after the cities implemented red light camera programs, and then compared the results to 48 cities without cameras. The idea was to see how the rate of fatal crashes changed after the introduction of photo enforcement. The independent, peer-reviewed *Journal of Safety Research* published the study in August 2011.

The Langland-Orban report argues that rather than making a before and after comparison, researchers should have zeroed in on the difference in crash rates between the camera and noncamera cities after photo enforcement was implemented. Langland-Orban says that because crash rates were 25 percent higher in the "after" period in the camera cities compared with those without, the cameras must be to blame for the higher rate. It is true that crash rates were 25 percent higher, but Langland-Orban ignores the fact that they were 65 percent higher in the "before" period.

The measure that matters is what happened to fatal crashes after photo enforcement was implemented, compared with what would have been expected without it. The Institute's study demonstrates that the camera cities experienced a bigger drop in fatal crash rates. In the 14 cities that had cameras in 2004-08 but didn't have them in an earlier comparison period, automated red light enforcement saved 159 lives. Had cameras been operating during the period in all large cities, a total of 815 deaths would have been prevented.



Langland-Orban says the Institute is biased because insurers benefit from photo enforcement by raising rates on ticketed drivers. However, in most jurisdictions, including Florida, there is no insurance consequence from photo enforcement. Florida law prohibits insurers from using the violations to set rates, and in most other states tickets from cameras don't go on driver records, and no points are assessed. Many studies have concluded that red light cameras are effective, and most of them were conducted by government agencies and other traffic safety experts not connected to the insurance industry.

Red light running is a serious traffic safety problem that kills about 700 people and injures an additional 130,000 each year. Solid, published research by the Institute and other experts demonstrates that red light cameras save lives.

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