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New attachments on child restraints and anchors in vehicles are making it easier to

LATCH KIDS IN CARS

but the task still isn't a breeze

A federal rule known as Lower Anchors and Tethers for Children, or LATCH, is supposed to be simplifying the process of installing infant and child restraints. The goal is to increase the number of children who ride properly restrained. Automakers have to install



Attachments on child restraints latch to lower anchors in vehicles

special anchors in vehicles, and infant and child restraints have to be made with lower and upper attachments that mate with the anchors. Then parents should be more likely to latch restraints into cars correctly and with less effort.

The process always has been a struggle. Child restraints used to be attached using vehicle safety belts. Too often the result was a loose fit, even when parents gave a diligent effort. A 1999 survey conducted by the National Safe Kids Campaign found that about half of inspected child restraints held in place by safety belts were too loose.

Do LATCH systems work any better? To find out, Institute researchers attempted to install 6 different restraints in 10 vehicles. The LATCH systems did make installation

easier, but it wasn't a breeze. Not all restraints were easy to install in all vehicles.

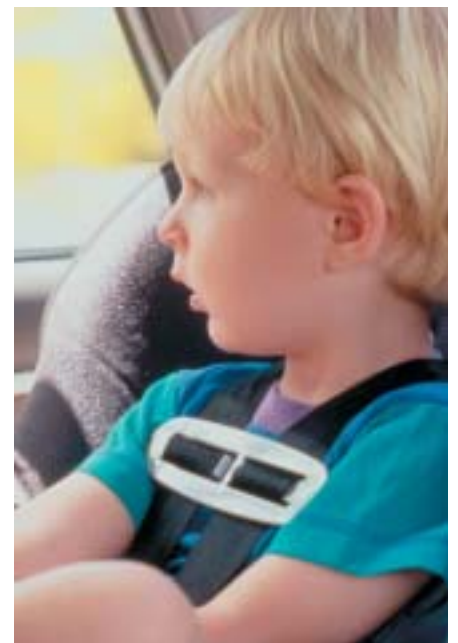
LATCH-compliant anchors became mandatory in new cars on September 1, 2002. Top tethers, designed to prevent excessive forward movement of forward-facing child restraints during crashes, became mandatory in 1999. Automakers have some leeway in the placement of the anchors, and vehicle seat designs vary from highly contoured to flat and bench-like. The result is a lot of variation in how child restraints fit, and gaining access to the new anchors in some vehicles can be difficult. A child restraint that fits easily into one vehicle may not fit very well, if at all, in another.

Institute researchers examined the wide range of child restraints on the market and

selected six representing the three available types of lower attachments. One rear-facing and one forward-facing restraint had rigid attachments that hook onto the lower anchors in vehicle seats. Three restraints, one rear-facing and two forward-facing, attached with flexible straps and hooks. The sixth child restraint, another forward-facing seat with flexible straps, attached with C-hooks.

After conducting a photo survey of the anchor points in more than 50 new vehicles, the researchers selected 10 test vehicles, all 2003 models — Cadillac CTS, Chevrolet Trail-Blazer, Chrysler Concorde, Dodge Grand Caravan, Ford Taurus, Honda Element, Hyundai Santa Fe, Lincoln Town Car, Pontiac Montana, and Toyota RAV4. These vehicles

Installation generally is easier and less complex with LATCH systems compared with the old way of



routing safety belts through restraints to attach them to cars. Still, LATCH doesn't always make it a simple click-in operation to install a child restraint.

represent a variety of designs for accessing the anchor points for child restraints in the back seats. Both the shapes of the vehicle seats and the placement of the anchors for securing the restraints contributed to the ease of access.

"Installation generally was easier and less complex with LATCH-compliant systems than the old way of routing safety belts through child restraints to attach them to cars," says Susan Ferguson, Institute senior vice president for research. "Still, LATCH doesn't always make it a simple click-in operation to install a restraint. Before buying one, parents should be sure to try fitting it in the vehicle they plan to use it in because not every restraint is going to fit into every vehicle."

The easiest fits were in the TrailBlazer, Grand Caravan, and RAV4. In contrast, it was difficult to secure any of the six child restraints in the Santa Fe or CTS.

The lower anchors in some vehicles are visible, while in other cases they're recessed into the seats. Visible anchors generally made installation easier, but not always. In the Ford Taurus, which has clearly visible anchors, the researchers had difficulty fitting two restraints because the position of the safety belt buckle impeded efforts to tighten the restraint straps.

In most cases, child restraints with rigid attachments were among the simplest to install and remove because they don't have any straps to tighten. On the other hand, researchers weren't able to install *(continues on p.6)*

Child restraints: how can they be improved to save more lives in crashes?

The answer is that it won't be easy. Many fatal crashes involving child occupants are so severe that better child restraints wouldn't have prevented the deaths. These are the conclusions of a new study of nearly 100 crashes in which children riding in restraints were fatally injured. Previous research has shown that child restraints provide excellent protection, reducing fatality risk by more than 70 percent for infants and more than 50 percent for toddlers.

For the new study, researchers identified crashes from the Fatality Analysis Reporting System in which a child was fatally injured

during 2001 while riding in a child restraint. Then the researchers obtained detailed police reports, often including photos from the crash sites, and attempted to determine the primary cause of the children's injuries. The idea was to get a better understanding of how child restraints are performing in fatal crashes.

"No one had really looked systematically at police reports to determine the sources of the fatal injuries," says Chris Sherwood, research scientist at the University of Virginia's Automobile Safety Laboratory and lead author of the research report. The study was conducted jointly by the Institute and the university group.

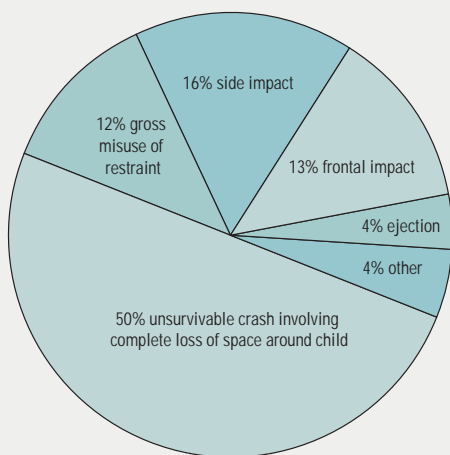
"To find opportunities to improve child restraints, we first have to find out whether they're failing and, if so, how," Sherwood adds.

Most of the children who died in the crashes (70 percent) were age 2 or younger, and they were riding in forward-facing restraints. More than 80 percent of the known fatal injuries were to the head.

Of the crashes examined, half were judged unsurvivable. Intrusion into the vehicle resulted in complete loss of survival space for the children who died. Where some space remained around a restrained child's seating position, the researchers considered additional factors.

Gross misuse of restraints — either failing to attach them to vehicles or attaching them too loosely — led to deaths in 12 percent of the cases. Ejection from restraints or contacts with other occupants or cargo accounted for another 8 percent. Twenty-nine percent of the crashes studied (16 percent side, 13 percent frontal) were judged potentially survivable, but it wasn't clear why the children didn't survive.

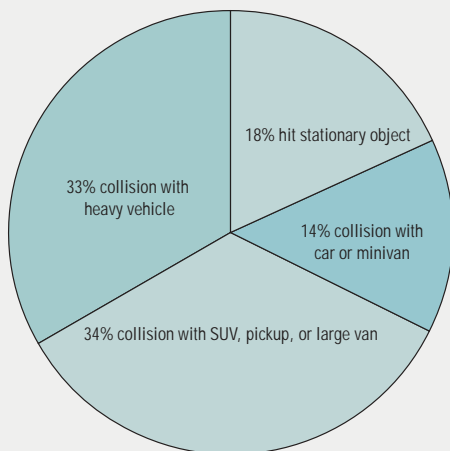
Two-thirds of the vehicles in which restrained children died were struck by heavy commercial vehicles, SUVs, pickup trucks, or vans. This compares with one-third of the deaths of fatally injured children who weren't in restraints.



CHARACTERISTICS OF THE FATAL CRASHES

DEATHS OF CHILDREN RIDING IN INFANT AND CHILD RESTRAINTS

STRUCK OR STRIKING VEHICLE OR OBJECT



CHARACTERISTICS OF THE CRASHES IN WHICH CHILDREN DIED Side impacts accounted for more deaths of restrained children than any other crash configuration. Two-thirds of the vehicles in which restrained children died were struck by heavier vehicles including commercial trucks, SUVs, pickups, and vans.

"These findings confirm that child restraints are doing a very good job. Most deaths of properly restrained children occur in crashes so severe that there's really no room left for survival," says Susan Ferguson, Institute senior vice president for research. The severity of the crashes studied is apparent from the number of other deaths in the vehicles in which the children died. In 80 percent of the crashes that researchers deemed unsurvivable for a child, at least one other occupant also was killed. This compares with 37 percent of the crashes that researchers judged potentially survivable.

Side impacts accounted for the largest number of child deaths (40 percent). Frontal impacts accounted for another third of the deaths. Almost half of the side impacts were deemed unsurvivable, and the remainder involved at least some intrusion into the child's survival space. Only 12 percent of the fatal crashes studied were rear

impacts, but 80 percent of these were considered unsurvivable due to massive intrusion into the child's survival space.

The misuse of restraints that led to some of the child deaths could have resulted from well-known installation problems. There's widespread incompatibility between child restraints and vehicle seats and between restraints and the safety belts that have been used to attach them (see *Status Report*, Jan. 16, 1999; on the web at www.highwaysafety.org). To reduce incompatibilities, all new restraints and vehicles are required to have a universal attachment system known as LATCH (see p.1).

These requirements "are intended to increase the number of children who ride properly restrained, and increasing restraint use still is key to saving lives. It could be more difficult to find effective ways to improve the restraints," Ferguson says.

A federal standard requires child restraints to meet performance requirements in a 30 mph frontal sled test. The National Highway Traffic Safety Administration has requested comments about options for testing restraints in side impacts. Given that so many of the child deaths in potentially survivable crashes occurred in side impacts, improving the performance of restraints in such crashes "should be a priority for future upgrades to the standard. This may require time because there aren't yet any side impact test dummies representing children. Nor are there established procedures for representing the intrusion to which child restraints are exposed in severe side impacts," Ferguson points out.

Head injuries in frontal impacts potentially could be reduced by increasing the use of top tethers, which limit the distance a child travels forward in frontal crashes. This could prevent facial and head injuries from contact with seatbacks or instrument panels, but tethers aren't being widely used (see p.6).

For a copy of "Factors Leading to Crash Fatalities to Children in Child Restraints" by C.P. Sherwood et al., write: Publications, Insurance Institute for Highway Safety, 1005 N. Glebe Rd., Arlington, VA 22201, or email publications@iihs.org.



NO POTENTIAL FOR SURVIVAL IN MOST OF THE CRASHES IN WHICH CHILDREN DIED

A 3-year-old child in the left rear seat of a station wagon was killed in a frontal crash with a pickup truck (top). The driver and a 5-year-old passenger also died. In a frontal crash with a large truck (above), the driver of a Nissan Maxima and a 6-month-old child in the front seat were killed. When a tractor-trailer struck the back of a Nissan Sentra (below), a 1-year-old child in the back seat died.



(continued from on p.3) either of the two restraints with rigid attachments in the Hyundai Santa Fe. The geometry of this vehicle's back seat was such that the researchers couldn't line up the attachments on the restraints with the anchors buried deep in the vehicle seat, and the inflexibility of the attachments left little room for maneuvering.

Researchers couldn't install one of the two child restraints with rigid attachments in the Cadillac CTS, either.

Removal of child restraints also could be difficult. The release buttons on restraints with rigid and C-hook attachments made them easy to remove. Releasing the flexible hook required depressing it and then rotating it when the anchor was buried in the vehicle seat.

Other problems were associated with top tethers. Especially in SUVs and minivans, these could be hard to use. Anchors for tethers weren't always clearly marked. Sometimes the anchor points were on the backs of vehicle seats, which had to be folded down before a tether could be installed. In some cases, a head restraint had to be removed to accommodate a tether.

"Parents need to read two manuals, the one that comes with the restraint and the vehicle owner's manual, to make installation go more smoothly, particularly when it comes to top tethers," Ferguson says. "But even this won't guarantee success because the manuals aren't always helpful. For example, some don't say what to do when a seatback or head restraint gets in the way."



WILL TETHERS BE USED? ONLY ABOUT HALF OF THE TIME, SURVEYS SUGGEST

For years some child restraints have included top tethers, but the tethers never have been widely used. They were required on child restraints in the early 1980s, but then the National Highway Traffic Safety Administration backed away from the requirement. Some automakers did provide anchors for tethers, but use rates still were low. A 1974 Institute survey indicated that available tethers were being used only about half of the time. What's new since last September is that both tethers and corresponding anchors in vehicles are required (see p.1). But use rates don't appear to be going up. When Institute researchers recently surveyed child restraint use in Maryland parking lots, they found a tether use rate of 47 percent among forward-facing restraints known to have tethers.

Cars that are good performers in tests also protect people in real crashes

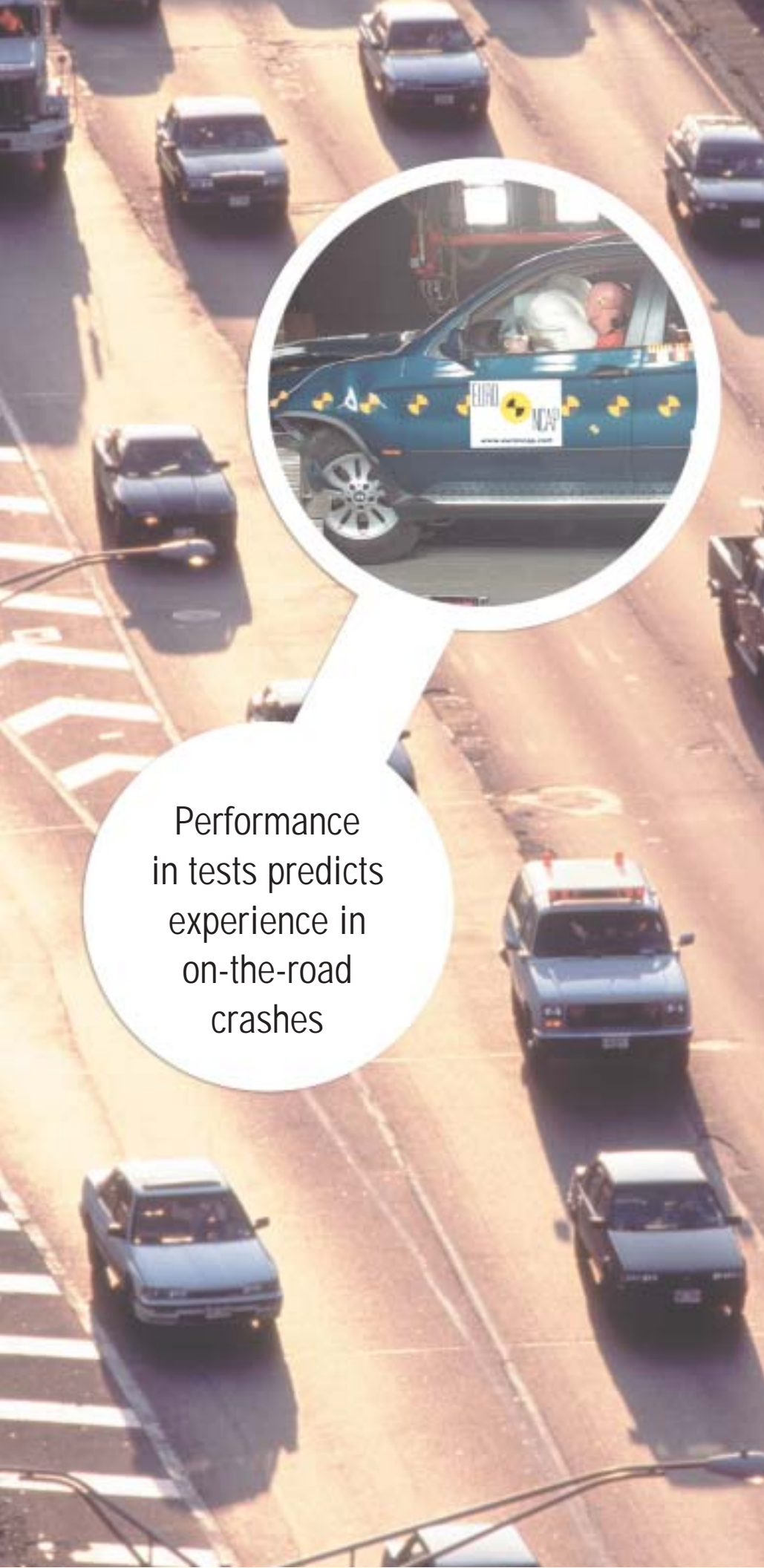
Drivers of vehicles that earn ratings of four stars in the European New Car Assessment Program (EuroNCAP) are about 30 percent less likely to be severely injured in a crash than drivers of cars with one-star ratings. This is the main finding of a Swedish study that compares real-world crash outcomes with crash test results.

EuroNCAP rates cars based on two tests, a 40 mph frontal offset test like the Institute's plus a side impact. New cars in Europe earn one to five stars based on performance in these tests. Four stars typically is the highest rating. To earn a fifth star, a car must pass an additional side-into-rigid-pole test (see *Status Report*, Feb. 9, 2002; on the web at www.highwaysafety.org). None of the cars assessed in the Swedish study earned five stars.

The researchers examined police-reported injuries to 12,214 drivers in car-to-car crashes in Sweden over six years, comparing the results with vehicles' EuroNCAP ratings. With each decrease in rating stars, the severe injury risk increased significantly.

"These findings lend additional validity to programs that rate vehicle crashworthiness based on the results of crash tests," says Institute president Brian O'Neill.

The study was conducted by researchers at the Swedish National Road Administration and Australia's Monash University. Similar results are reported in another Monash study conducted with the Institute. The researchers compared injury data reported from real crashes with results of both the Institute's frontal offset crash tests and the federal government's full-front tests. Using crash



Performance
in tests predicts
experience in
on-the-road
crashes

data from three states (Florida, Ohio, and Pennsylvania), the researchers found fewer deaths and police-reported serious injuries in vehicles with good test ratings.

However, the results were not robust, and the strongest correlation between crash test and real-world crash performance was for nonfrontal crashes. "These weak relationships likely reflect the lack of detail and fundamental difference in injury information in police crash reports compared to that used in deriving crashworthiness ratings," the researchers say.

An advantage of the Swedish data was that severe injuries were defined as those requiring hospitalization. In the U.S. study, they were defined as injuries recorded by police as serious. Studies have shown that most police-reported serious injuries actually are minor, so the Swedish researchers were better able to identify serious injuries of the kind measured in the crash tests. However, even the Swedish data didn't include information about the types or severities of specific injuries.

O'Neill explains that "detailed data on crash and injury severities are available only for a limited number of crashes for which special investigations are conducted — for example, crashes included in the National Automotive Sampling System. But the sample sizes in these datasets are inadequate for studies relating to individual vehicle models, so they don't allow us to say whether a specific model that earns good crash test results also does a good job of protecting its occupants in real crashes. On the other hand, the much larger samples of police-reported data have their own limitations. They typically include few if any reliable details on injury or crash severity."

The Swedish study, "How Do EuroNCAP Results Correlate with Real-Life Injury Risks?" by L. Lie and C. Tingvall, is in *Traffic Injury Prevention* 3:288-93. For a copy of "U.S. Consumer Crash Test Results and Injury Risk in Police-Reported Crashes" by S. Newstead et al. write: Publications, Insurance Institute for Highway Safety, 1005 N. Glebe Rd., Arlington, VA 22201, or email publications@iihs.org.

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On the inside

LATCH rules are helping, but not solving, child restraint installation problemsp.1

When restrained infants and children die in crashes, it usually isn't because their restraints failedp.4

Top tethers on child restraints were used only about half of the time before LATCH rules and aren't in use more often nowp.6

Crash tests predict injury likelihood in real-world collisionsp.6

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