STATUS REPORT
INSURANCE INSTITUTE FOR HIGHWAY SAFETY
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Tough Strong Durable

Child restraints take their punches in repeated crash tests at high speed

It's intuitively clear that a child restraint visibly damaged in a serious car crash should be replaced. But the need for replacement in less obvious cases has long been debated. A California law

requires insurers to cover the cost of replacing a restraint used by a child in any crash, regardless of crash severity or whether the damage is visible. Illinois is considering a similar law. But recent Institute crash tests indicate there's no objective reason to toss out all crash-involved restraints indiscriminately. Most child restraints are just as safe after a typical fender-bender as they are out of the box.

"There's no reason to assume child restraints become less effective just because they've been in a crash, especially a minor one," says Institute president Brian O'Neill. "On the contrary, child restraints are remarkably durable. Even when we have subjected them to successive crash tests at high speeds, most of the restraints kept their structural integrity despite minor damage."

The Institute conducted the vehicle crash tests with child restraints to determine the extent of the damage, if any, in high-speed impacts. Twelve different child restraint models, both toddler seats and rear-facing infant restraints, were tested in car-to-car frontal offset crashes, both vehicles traveling 30 mph. A dummy representing an infant or child was in each restraint. Some of the restraints came through one round of tests without damage, though most sustained minor damage. Four of the damaged restraints were then tested again in crashes at the same speed.

In the initial crashes, most of the child restraint damage was readily apparent from a visual inspection, but the damage was structurally insignificant — minor plastic deformation, slight fraying of the harness webbing, bending of harness buckle latch plates, and some minor cracking. These results add to existing evidence that blanket replacement laws overreach their goal of improving safety.

Much of the damage "wasn't different from what's typically seen with normal wear and tear," O'Neill notes. "This suggests that most effects of crash involvement aren't substantially different from the effects of extended use over a period of years." The four damaged restraints subjected to a second round of crash tests showed further damage similar to what was caused in the first round. But none of the twice-tested restraints failed catastrophically, and all succeeded in restraining the test dummies through the second impact.

Last year, the Insurance Corporation of British Columbia (ICBC) conducted similar investigations of restraint durability. Testing various child restraint types in offset barrier crashes, ICBC found most of them unlikely to be damaged in impacts at 30 mph or even subsequent crashes at 40 mph.

Even more dramatic are results of ICBC's low-speed testing. After 50 consecutive sled tests at about 9 mph, a selection of restraints representing major manufacturers and all seat types showed no visible damage at all. X-rays revealed no hidden damage lurking beyond the scope of visual inspection. And after 50 crashes, 3 of the restraints still passed a barrier test at 30 mph required by *(continues on p.6)*

Biggest threat to children in cars still is riding with no restraint at all

How child restraints perform doesn't matter if children aren't properly buckled up to begin with. Nonuse of restraints still is the biggest threat. The National Center for Injury Prevention and Control reports that restraint use, seating position, and death rates among children ages 4-8 changed little during 1994-98. Fewer than 40 percent of the children this age who died from crashes were restrained. More than half who survived fatal crashes were buckled up. According to earlier studies, restraint use is about 85 percent among infants younger than 1 but only about 60 percent among toddlers 1-4. Among kids who have outgrown child seats, the problem becomes nonuse of adult belts and booster seats. And despite lots of public attention to the risks, too many children still ride in front seats where airbags might harm them (see *Status Report*, Jan. 16, 1999; on the web at www.highwaysafety.org). In a random survey by the Harvard School of Public Health, 1 of every 4 cars with children younger than 13 included a child in the front seat. While crash tests by the Institute and Insurance Corporation of British Columbia should put to rest the idea that mandatory child seat replacement is a pressing need (see cover story), the real need is clear — getting kids into restraints and out of the front seat.

Damage to child restraints after 30 mph car-to-car crash tests:

Century Assura: Plastic deformation occurred after the first crash test and worsened after the second.

Century Room-to-Grow: After one crash test small cracks were observed at the base of structural stiffeners.

Kolcraft Secura: Structural stiffeners were observed pushing through restraint walls after one crash test.

Passenger vehicles sustain huge damage in 5 mph crash tests

Mazda promises improvement; Volvo studies airbag inflation

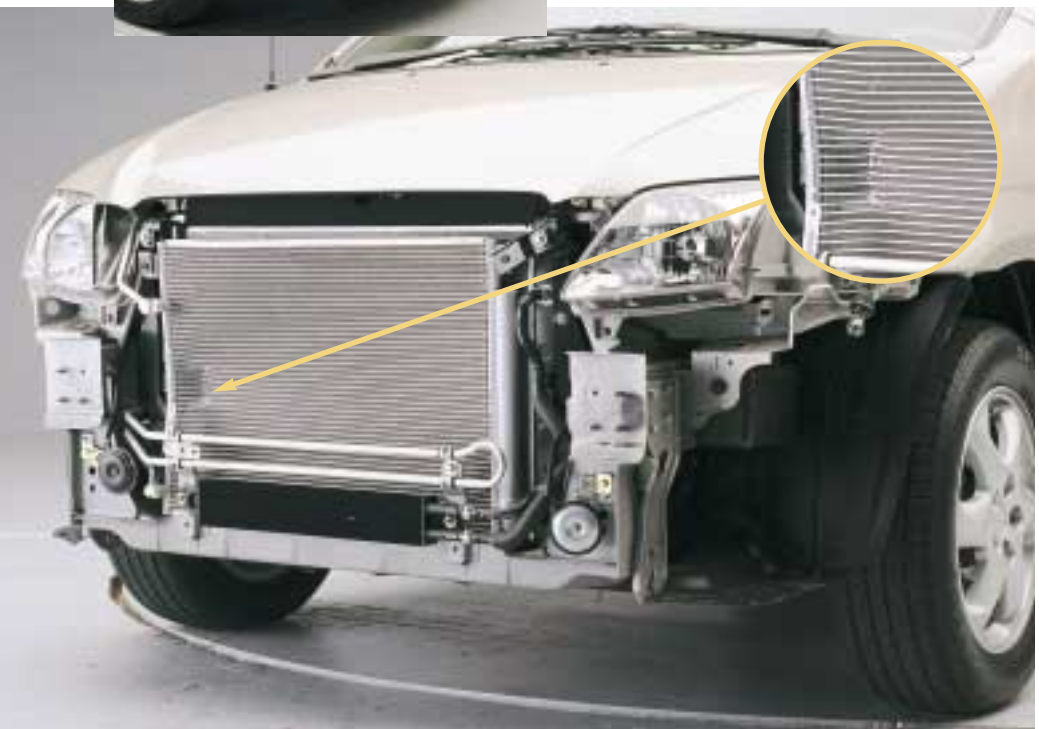
Seventeen new cars, all 1999 and 2000 models, turned in mostly disappointing results in 5 mph crash tests conducted to assess how well the bumpers resist costly damage in the kinds of impacts that frequently occur in commuter traffic and parking lots. Six of the 17 cars the Institute tested are previously untested midsize inexpensive models, 5 are midsize luxury models, and the other 6 are updated models the Institute previously tested.

In a series of 4 front and rear tests at 5 mph, the worst performers overall were the 2000 model Mazda MPV and Volvo S80. These vehicles sustained an average of more than $1,000 damage in each of the crash tests — front- and rear-into-flat-barrier, front-into-angle-barrier, and rear-into-pole.

"We were disappointed when our tests revealed the Mazda MPV had a very weak bumper," says Institute president Brian O'Neill. "In last year's tests, the Mazda Protege's rear bumper included a flimsy plastic bar that allowed about $2,800 damage in the rear-into-pole test. Stung by the negative publicity about this result, Mazda improved the bumper on the 2000 model Protege, and damage was reduced to about $500.

"Surprisingly the 2000 MPV, a brand new design, was introduced with an almost identical flimsy plastic bumper bar on the front end, which allowed more than $1,700 damage in the simple flat-barrier test at 5 mph," O'Neill adds.

MPV improvements are under way: After observing the MPV's test results, Mazda officials quickly went back to the drawing board, and the company already has a redesign of the front bumper in production. MPVs equipped with the improved bumper will begin arriving in dealer showrooms at the end of April. And in an unprecedented action, this automaker says it will "install front bumper reinforcement plates for vehicles currently in stock and for those customers who have already purchased 2000



The Mazda MPV sustained more than $1,700 damage in the 5 mph front-into-flat-barrier test, including a broken plastic bumper bar and a major dent in the air conditioner condenser, which had to be replaced.

5 MPH CRA

	Front Into Flat Barrier	Rear Into Flat Barrier
MIDSIZE INEXPENSIVE CARS		
2000 Saturn LS	$0	$138
2000 Nissan Altima	$380	$17
1999 Mazda 626	$143	$526
1999 Chevrolet Malibu	$656	$369
1999 Pontiac Grand Am	$0	$256
1999 Daewoo Leganza	$281	$413
MIDSIZE LUXURY CARS		
1999 Audi A6	$0	$0
1999 Saab 9-5	$92	$116
2000 BMW 328i	$0	$999
1999 Cadillac Catera	$809	$660
2000 Volvo S80	$5,137	$347
UPDATES OF CARS PREVIOUSLY TESTED:		
Subaru Legacy midsize inexpensive car		
2000 models	$378	$92
1995 models	$336	$304
Ford Taurus large family car		
2000 models	$62	$0
1996 models	$0	$0
Toyota Avalon midsize moderately priced car		
2000 models	$326	$377
1998 models	$486	$310
Nissan Maxima midsize moderately priced car		
2000 models	$1,042	$339
1998 models	$250	$177
Mazda Protege small car		
2000 models	$174	$318
1999 models	$174	$645
Mazda MPV passenger van		
2000 models	$1,710	$1,031
1996 models	$676	$1,387

Repair costs reflect January 2000 prices. Front bumpers on 2000 were introduced since the previous model year.

MPVs." O'Neill notes that "this is an encouraging response, and we commend it. We also hope next time the automaker will simply install effective bumpers to begin with."

ASH TEST RESULTS

Front Into Angle Barrier	Rear Into Pole	Total Damage 4 Tests	Average Damage Per Test
$390	$295	$823	$206
$299	$668	$1,364	$341
$924	$178	$1,771	$443
$588	$619	$2,232	$558
$1,262	$947	$2,465	$616
$1,081	$799	$2,574	$644
$1,012	$1,017	$2,029	$507
$1,087	$803	$2,098	$525
$759	$672	$2,430	$608
$935	$1,358	$3,762	$941
$1,028	$1,550	$8,062	$2,016
$688	$332	$1,490	$373
$754	$710	$2,104	$526
$839	$634	$1,535	$384
$707	$671	$1,378	$345
$656	$572	$1,931	$483
$693	$293	$1,782	$446
$423	$734	$2,538	$635
$651	$323	$1,401	$350
$1,017	$549	$2,058	$515
$1,017	$2,872	$4,708	$1,177
$1,730	$1,198	$5,669	$1,417
$1,396	$560	$4,019	$1,005

Mazda Protege weren't tested because no design changes

Volvo airbags inflate: In the 5 mph flat-barrier test of the Volvo S80 "we saw something this year we've never seen before," O'Neill points out. "There was about $500 damage to the front end of the vehicle, most of it hidden under the bumper cover. In addition — and this is what was so surprising — both airbags deployed, resulting in another $4,500 in repair bills. The Institute and Volvo are working together to try to understand the significance of the airbag deployment in this impact. Obviously, airbags shouldn't deploy in low-speed crashes."

Volvo's investigation leads the company to conclude this particular deployment was a rare quirk, and the automaker believes the test result won't translate into frequent airbag deployments in low-speed crashes on the road. The Institute is studying real-world crash deployments in S80 models, and "if low-speed deployments are rare," O'Neill says, "then we would agree with Volvo. But if we find many low-speed deployments, then Volvo should redesign the airbag sensors for the S80."

Midsize inexpensive cars: The best performer among all 17 vehicles the Institute tested is the Saturn LS, an inexpensive midsize car that sustained an average of about $200 in repair costs per bumper test. "There was no damage whatsoever in the front-into-flat-barrier test and very little damage in the rear, which is what we expect from a good bumper system," O'Neill says. In contrast is the Daewoo Leganza, which averaged about $650 in repair costs per test. This includes about $800 damage in the rear-into-pole test and more than $1,000 damage in the front-into-angle-barrier test.

Midsize luxury cars: As a group, these cars fared even worse. Besides the problem with the Volvo airbags, which multiplied the overall cost of repairs, the Cadillac Catera sustained an average of more than $900 damage per test. The car in this group with the least damage overall is the Audi A6. It allowed no damage in either flat-barrier test, but it did allow more than $1,000 damage in each of the other two impacts, front-into-angle-barrier and rear-into-pole.

"When you spend more than $30,000 for a new car, you ought to get bumpers that prevent damage in low-speed impacts like our tests," O'Neill says, "but two of the five luxury models we tested failed — the Catera and Volvo S80 are rated poor. Two other models are marginal, and only the A6 is rated acceptable."

After the airbags deployed in the flat-barrier test of the Volvo S80, the Institute began studying real-world crash deployments in this car. If such deployments are rare, the Institute will agree with Volvo's conclusion that the crash test deployment was a rare quirk. But if many such deployments are occurring in real crashes, Volvo should redesign the airbag sensors.

Cosco Booster: After one crash test at 30 mph, there was damage from the restraint harness straps. After a second test, additional deformation of the plastic was observed in places not previously damaged.

(continued from p.2) the Canadian government. These results are particularly impressive given that some of the child restraints were up to 5 years old.

Low-speed crashes like those conducted by ICBC occur far more often than the high-speed crashes simulated in the Institute's testing. So while minor damage did occur at high speeds, no damage at all occurred in the repeated tests representing the much more common kind of crash.

One argument used to justify replacing restraints after even minor crashes is that a greater rate of replacement would help get old or recalled child restraints off the road. Old seats may be more prone to crack due to exposure to extreme temperature changes or sunlight or simply due to wear and tear. But as the ICBC tests show, restraints continue to perform well even after significant years of use.

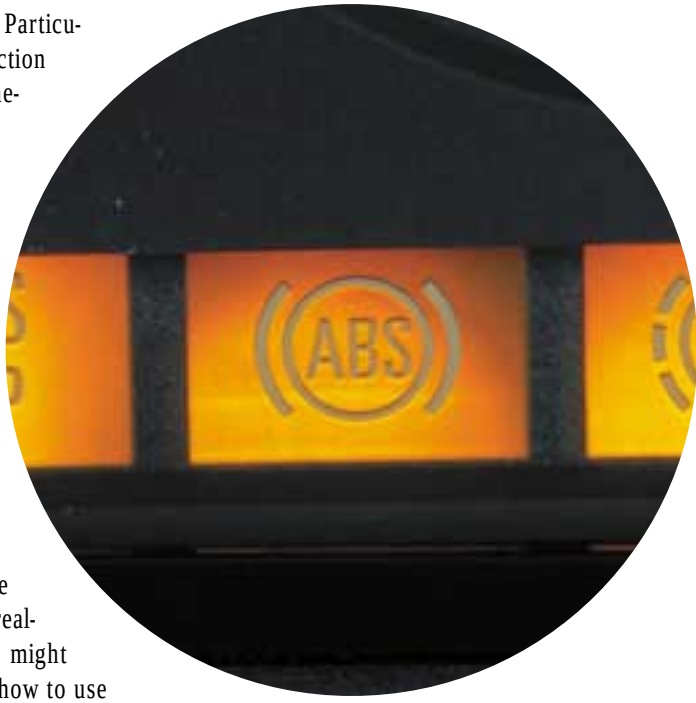
The bottom line is that child restraints shouldn't have to be replaced after most crashes. A restraint always should be inspected carefully after a crash and replaced if there's visible damage or, to be cautious, even in the absence of visible damage if the crash was severe.

Cars with antilock brakes no longer are overinvolved in fatal crashes

Puzzle of poor initial experience with antilocks hasn't been explained

New evidence suggests that cars with antilock braking systems no longer are disproportionately involved in certain types of fatal crashes. However, antilocks still aren't producing reductions in overall fatal crash risk. These findings come from the latest Institute study of antilock brakes, which updates a 1996 analysis (see *Status Report*, Dec. 7, 1996).

Fatal crash risk was calculated for a set of antilock-equipped vehicles by comparing their crash experience with that of otherwise identical vehicles without antilocks from preceding years. The new data, which cover calendar years 1996-98, indicate positive changes. As before, vehicles with antilock brakes were less likely than cars with standard brakes to be in crashes fatal to the occupants of other vehicles. At the same time, the vehicles with antilocks no longer were found to be overinvolved in crashes fatal to their own occupants. Particularly important is the reduction in single-vehicle, run-off-the-road crashes.



The poor early experience of cars with antilocks never has been explained, so the changes suggested by the more recent data are puzzling. If the improvements in fatal crash risk are lasting, they could reflect positive changes in driver behavior. Experience, or perhaps exposure to information about the real-world effects of antilocks, might have helped drivers learn how to use these brakes properly. Some motorists may have learned not to overcompensate with riskier driving. But there's no clear evidence yet that this has happened. Even with the recent findings, the real-world advantages of antilock brakes are unproven. Over the long term, vehicles with such brakes have fared no better in overall fatal crash experience than vehicles without antilocks.

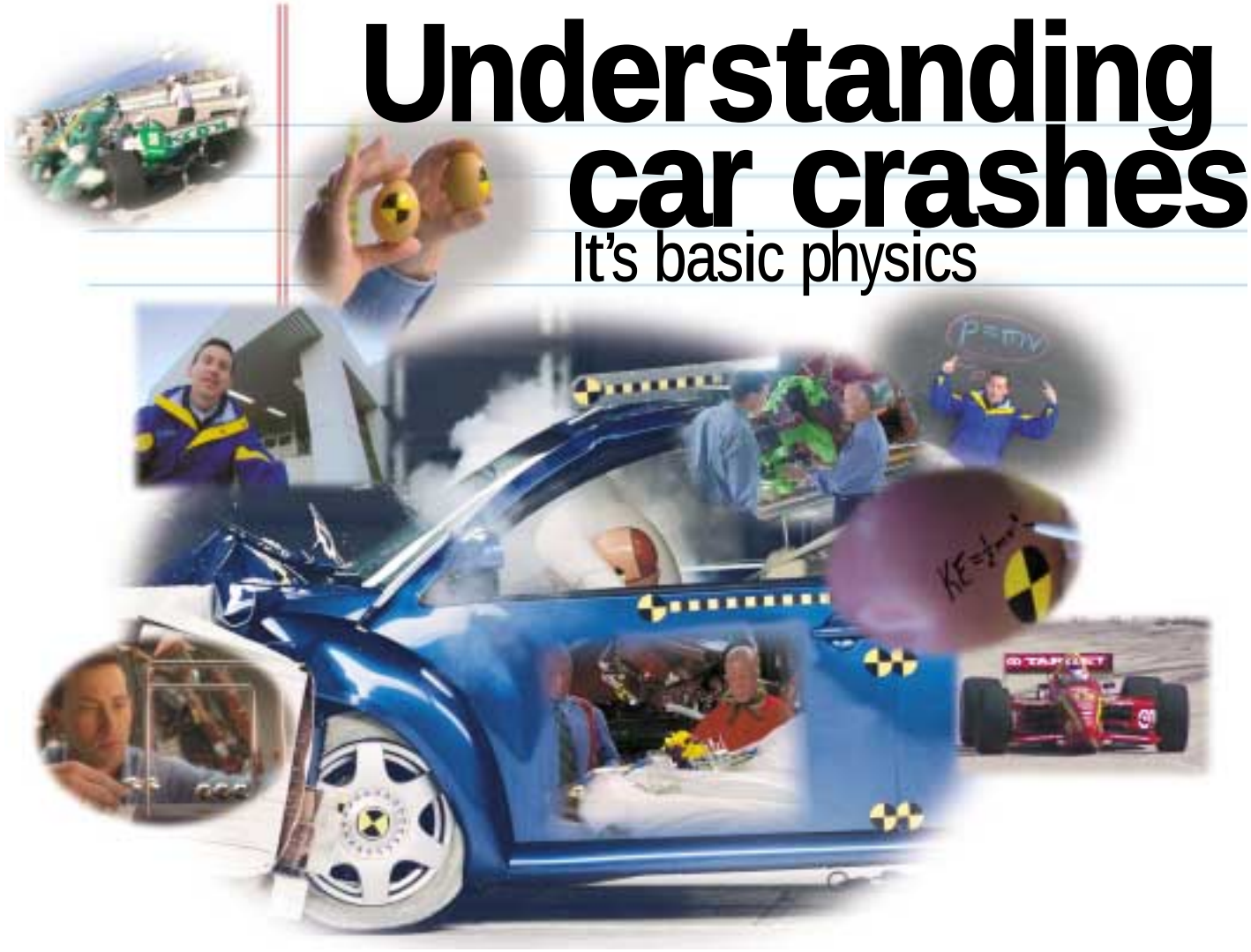
"Despite their impressive performance on the test track, there still is no evidence that antilock brakes are producing overall safety benefits," says Institute president Brian O'Neill.

For a copy of "New evidence concerning fatal crashes of passenger vehicles before and after adding antilock braking systems" by C.M. Farmer, write: Publications, Insurance Institute for Highway Safety, 1005 North Glebe Road, Arlington, VA 22201.

Available soon

Understanding car crashes

It's basic physics



What happens to vehicles and their occupants in crashes is determined by science. "You can't argue with the laws of physics," says Griff Jones, a high school physics teacher who goes behind the scenes at the Institute's Vehicle Research Center to explore the basic science behind car crashes. Using a series of vehicle maneuvers on a test track plus filmed results of vehicle crash tests, Jones explains in anything but lecture style the concepts of inertia, the relationship between crash forces and inertia, momentum and impulse, and a lot more. He shows why speed and vehicle weight are critical elements in the outcomes of car crashes and how basic physics explains why safety belts and airbags protect people in crashes. Throughout the video, Jones relates classroom physics to the real world of cars and car crashes, explaining why some of the choices we make about the cars we drive — and how we drive them — can make a difference in whether we survive on the highway. It all comes down to physics. To purchase "Understanding car crashes: it's basic physics" ($35), call the Institute at 703/247-1500, fax your order to 703/247-1588, or order online at www.highwaysafety.org.

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1005 N. Glebe Rd., Arlington, VA 22201
703/247-1500 Fax 247-1588
Internet: www.highwaysafety.org

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