

STATUS REPORT

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FOR HIGHWAY SAFETY

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HUGE COST OF **BUMPER MISMATCH**

It's a frequent occurrence in urban traffic — a low-speed collision in which one vehicle hits the back of another. The vehicles often sustain expensive damage. Bumpers can reduce this damage, but only if they

line up so the initial contact in an impact is bumper to bumper. Then the bumpers on the colliding vehicles have to absorb the crash energy, keeping damage away from expensive sheet metal, lights, and other components.

Car bumpers are required by a federal standard to match up reasonably well (see p. 5). However, no such requirements apply to SUVs, and some of these vehicles don't even have bumpers. So mismatches in crashes are increasing, and the resulting re-

"We paired vehicles from a single manufacturer because we thought that, at a minimum, automakers should be paying attention to the compatibility of the bumpers across their own fleets," Institute chief operating officer Adrian Lund explains.

In the crash tests, a car going 10 mph struck the back of its paired SUV, which was stopped. Then the configuration was reversed, with the SUV striking the back of its paired car. Results of these low-speed im-



Ford Taurus Ford Explorer



Ford Explorer Ford Taurus



Volvo S40 Volvo XC90



Jeep Grand Cherokee Dodge Stratus

DAMAGE REPAIR COSTS 10 MPH FRONT-INTO-REAR CRASH TESTS

CAR INTO SUV	Car damage	SUV damage	Total damage
Ford Taurus into Explorer	\$1,784	\$824	\$2,608
Chevrolet Malibu into TrailBlazer	\$3,163	\$937	\$4,100
Dodge Stratus into Jeep Grand Cherokee	\$3,256	\$1,279	\$4,535
Nissan Altima into Murano	\$4,507	\$1,188	\$5,695
Volvo S40 into XC90	\$4,984	\$1,096	\$6,080

SUV INTO CAR	SUV damage	Car damage	Total damage
Ford Explorer into Taurus	\$701	\$555	\$1,256
Volvo XC90 into S40	\$1,695	\$2,361	\$4,056
Chevrolet TrailBlazer into Malibu	\$1,851	\$2,316	\$4,167
Nissan Murano into Altima	\$2,517	\$2,485	\$5,002
Jeep Grand Cherokee into Dodge Stratus	\$2,848	\$3,281	\$6,129

Note: Except for the Altima, cars and SUVs are 2004 models. The Altima is a 2005. Repair costs reflect July 2004 parts and labor prices.

pair costs from low-speed collisions are escalating. The Institute's new series of 10 mph front-into-rear crash tests demonstrates this mismatch problem.

Car-into-SUV and SUV-into-car crash tests: The tests involved five pairs of vehicles, each composed of a car and a midsize SUV from the same manufacturer. The pairs included a Ford Taurus and Explorer, a Chevrolet Malibu and TrailBlazer, a Dodge Stratus and Jeep Grand Cherokee (both DaimlerChrysler products), a Nissan Altima and Murano, and a Volvo S40 and XC90.

pacts varied widely, from a total of about \$1,250 damage in one of the tests to more than \$6,000 damage to the paired vehicles in two other tests.

In some cases, the low-speed crash damage included major leaks from broken radiators. In real-world collisions like these, the motorists couldn't even drive away. If they did, their vehicles could overheat and the engines could be permanently damaged. So in addition to paying for costly repairs, the drivers would face the aggravation of having to get their vehicles towed.

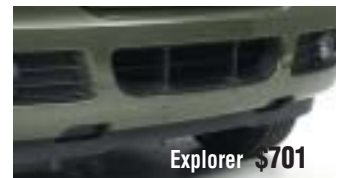
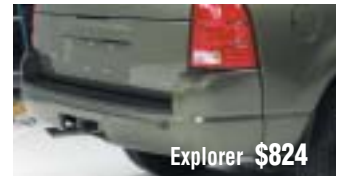
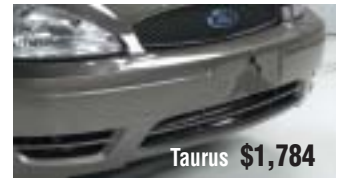
The plastic covers on bumper systems obscure the mismatch problem by hiding the positions of the bumper bars, which are main energy-absorbing components. When the covers are removed (photos, left), it becomes obvious that the bumper bars on many cars and SUVs don't line up.

FORD BUMPERS MATCH UP

The bumper bars on this pair of Fords, a Taurus and an Explorer, line up. This is the main reason these vehicles sustained much less damage than four other vehicle pairs in 10 mph front-into-rear crash tests. The Ford bumpers engaged and absorbed most of the crash energy, keeping damage away from expensive-to-repair sheet metal and other parts.



When the Explorer hit the back of the Taurus, it initially appeared that no damage had occurred. In fact, there was some damage to both vehicles hidden underneath their bumper covers. After many real-world collisions like this 10 mph test, such damage would go undetected and unrepaired.



VOLVO BUMPERS DON'T MATCH UP



When a Volvo S40 car struck the back of a Volvo XC90 at 10 mph, the car's front bumper slid under the SUV. There was nothing to keep the energy of the impact away from the car body. The result was that the S40's hood buckled. Its front fenders also crumpled, and the headlights broke. The repair bill for the S40 totaled \$4,984.



DAIMLERCHRYSLER'S DON'T EITHER



The bumpers on the Jeep Grand Cherokee and Dodge Stratus don't line up at all, and the striking SUV overrode the bumper on the Stratus in a 10 mph test. The car's trunk lid and rear fenders crumpled. The bumper sustained costly damage, too. Combined damage to the two vehicles totaled \$6,129, more than in any other test involving a car and SUV.



Less damage to Fords: In both car-into-SUV and SUV-into-car tests, the vehicles with the lowest repair costs, by far, were the Fords. This is almost entirely because the bumpers on the two Fords match up better than the bumpers on the other vehicles.

Virtually none of the damage from the Explorer-into-Taurus impact was apparent during a cursory inspection after the crash. The damage was hidden underneath the plastic bumper covers.

"It's likely that motorists involved in collisions like this would assume there wasn't

any damage," Lund says. "An owner would have to go to a repair shop for disassembly of the bumper system to determine whether damage had occurred and how much. So in many cases the damage would go undetected and unrepaired. This shouldn't pose a safety problem but could worsen the damage in any subsequent low-speed collision."

Pattern of damage: The other pairs of vehicles sustained much more damage than the Fords, mostly because their bumpers don't line up. The bumpers on some vehicle pairs completely bypassed each other in the tests.

"This was the pattern," Lund points out. "When there was underride and override between the car and SUV bumpers, that's when we saw a lot more expensive-to-repair damage than most people would associate with a 10 mph impact. Bumps at this speed involving Volvos and DaimlerChryslers produced more than \$6,000 damage to the vehicles."

Most of the repair costs from these tests weren't because a heavy SUV inflicted damage on a lighter car. The SUVs also sustained expensive damage. Even when one SUV hit another SUV, the damage was costly.

UNDERRIDE AND OVERRIDE: NISSAN ALTIMA GOES UNDER MURANO IN 10 MPH IMPACT

The bumpers on these two Nissans bypassed each other when the Altima hit the back of the Murano. Largely because of this mismatch, there was \$4,507 damage to the car's hood, fenders, and underlying structure as well as its bumper. The damage was so extensive that a car in a real-world collision like this couldn't be driven away. It would have to be towed to a body shop.



THERE'S NO REAR BUMPER AT ALL ON TOYOTA RAV4

In a 10 mph front-into-rear crash test, the spare tire on the tailgate of this small SUV caused extensive damage (\$4,380) to the striking RAV4's hood and grille.

The spare tire on the struck RAV4 also crushed its tailgate (damage: \$3,230).



Toyota RAV4 strikes RAV4: The Institute conducted another 10 mph crash test to show that the problem isn't confined to crashes between cars and SUVs. In this impact, the front of a Toyota RAV4, a small SUV, hit the back of another RAV4, producing more damage than in any of the car-into-SUV or SUV-into-car crashes.

"When one RAV4 struck the other, it didn't engage the rear bumper because this SUV doesn't have a rear bumper. Instead the striking RAV4 hit the spare tire mounted on the tailgate," Lund says. "This spare tire was the 'antibumper.' It didn't absorb any energy. It didn't prevent any damage. In fact, it caused most of the damage to both of the vehicles. The spare damaged the hood and grille of the striking RAV4. It also crushed the tailgate on the struck RAV4."

Rules apply to cars only: A federal standard specifies a zone on cars for bumper protection extending from 16 to 20 inches off the ground. This means car bumpers line up reasonably well. When two cars collide at low speeds, the bumpers are more likely to engage. Then they have a chance to absorb energy and prevent damage. But no such bumper requirements apply to SUVs, pickup trucks, or minivans, so these vehicles often have flimsier bumpers than cars. The heights of their bumpers often are different from the mandated heights for car bumpers.

As SUVs have proliferated in recent years, so has bumper mismatch. Now SUVs account for about one of every four passenger vehicles sold in the United States. Together pickups and SUVs account for almost half.

Change the federal bumper rules:

Because SUVs don't have to meet the bumper requirements established for cars, automakers are free to equip these vehicles with minimal bumpers or, like the rear of the RAV4, no bumper at all. If an SUV does have bumpers, they aren't required to line up with those on cars.

"The federal rules should be changed to make SUVs and cars more compatible. The manufacturers already are working on this for high-speed collisions, and they ought to be doing it for low-speed impacts like these tests. SUVs can have the same utility they do today and still be equipped with decent bumper systems that extend down to where they match up with those on cars," Lund concludes. "Until then, motorists who bump into mismatched vehicles, even at very low speeds, will have no choice but to open their wallets."



REAL-WORLD PROBLEM

These cars and SUVs were damaged in real-world collisions similar to the Institute's 10 mph tests. In many cases there's clear evidence of underride and override between colliding vehicles. This problem increases damage and, hence, repair costs in low-speed crashes.



Consumers gain new information about side airbags that meet rules to reduce inflation injury risk

A voluntary agreement among automakers to test side airbags, using a set of performance requirements, is helping to assure that these features won't injure children and out-of-position occupants in crashes. The National Highway Traffic Safety Administration (NHTSA) is identifying vehicle models with side airbags that meet the specifications of the agreement.

About 60 percent of 2004 model passenger vehicles with side airbags now meet the agreement (see facing page). These vehicles are recognized in NHTSA's consumer guide, "Buying a Safer Car."

The performance specifications were developed to ensure that hazards similar to those that have been associated with frontal airbags wouldn't also compromise the occupant protection benefits of side airbags. More than 240 deaths, including many unrestrained or out-of-position children and infants, have been attributed to the inflation of frontal airbags in crashes that otherwise would have been minor (see *Status Report*, Aug. 1, 2004; on the web at www.iihs.org).

In 1999 then-NHTSA administrator Ricardo Martinez challenged the auto industry to develop test procedures to assess the injury risks from side airbags (see *Status Report*, Oct. 2, 1999; on the web at www.iihs.org). In response, the industry convened a technical working group of safety experts representing the automobile manufacturers, restraint suppliers, and researchers with expertise in crash testing. This group developed tests to assess the potential injury risks.

Airbags that pass these tests don't pose significant injury risks, even to small children and adults.

Specifications of the tests: The agreement specifies the types of tests, dummies, positions, and injury measure thresholds to be used to verify that the side airbags in new vehicles meet the performance requirements.

Under the agreement, tests are conducted with dummies representing a three year-old, a six year-old, and a small woman. Occupants of these sizes are thought to be the most vulnerable to injuries when they're out of position in their vehicles.

The tests are conducted with the dummies in a variety of positions, including un-



Auto manufacturers volunteered to conduct tests with dummies in positions where inflating side airbags might pose a hazard to children and out-of-position occupants in real-world crashes. Airbags that pass these tests don't pose any significant risks.

likely ones for real people in real vehicles. These positions were chosen to reflect worst cases — for example, where a child might lie down and go to sleep in a vehicle — and to measure what happens when the dummies are subjected to the full force of deploying airbags. Target measures from the dummies are low enough to assure that, even among people riding out of position in their vehicles, the risk of serious injury is low.

“Real-world experience indicates that the risk is, indeed, very low,” says Adrian Lund, Institute chief operating officer and chairman of the group that produced the requirements. “There have been no deaths from inflating side airbags, and since 1999 there has been only one confirmed case of significant injuries potentially caused by a side airbag. These were rib fractures sustained by an elderly driver.”

What the agreement does, Lund adds, “is to standardize test procedures for side airbags and ensure they’re in place to keep the risk very low. This is important as more and more cars are equipped with side airbags.”

Automakers developed and implemented the voluntary test procedures faster than would have been possible under the federal regulatory process. The procedures were delivered to NHTSA in just 15 months, while federal rulemaking typically takes years and then phases in over time.

Agreement serves as a model: A copy of the agreement, under which all automakers pledge to design airbags for new vehicles according to the recommendations, was submitted to NHTSA in August 2000. This initiative marks the first time auto manufacturers voluntarily agreed to meet safety performance targets.

Based on the success of this approach, current NHTSA administrator Jeffrey Runge more recently challenged automakers to address the issue of SUV incompatibility. He asked for this voluntary initiative even as the agency was pursuing its own rulemaking activity and research. In less than a year, automakers brought an agreement to Runge to address vehicle incompatibilities in front and side crashes (see *Status Report*, Jan. 3, 2004; on the web at www.iihs.org).

Consumers access the information:

Once automakers submitted the agreement on side airbag testing in 2000, NHTSA began to seek ways to hold the manufacturers accountable for their commitments and to alert consumers to the benefits of choosing passenger vehicles with airbags in compliance with the agreement.

Runge characterizes this agreement as “a very positive step forward to ensure the safety of side airbags. But to be effective, automakers must adhere to the agreement, and the public should be confident that any vehicle they purchase will have airbags that meet those requirements. NHTSA will do its duty to encourage compliance by making the information public on its website and testing vehicles to ensure that the information we publish is correct.”

NHTSA tests vehicles on a random basis to determine whether those the manufacturers say are in compliance do, in fact, meet the agreement. An automaker who wants the agency to identify one of its vehicles as meeting the agreement must submit test data to NHTSA for each side airbag in the vehicle model. If all side airbags in a model meet the test specifications, then NHTSA will distinguish that vehicle model with an “M” for “Meets” in the crash test results section of “Buying a Safer Car.”

This information became available to consumers for the first time in the 2004 edition of the consumer guide. “Buying a Safer Car 2004” is available at <http://www.nhtsa.dot.gov/cars/testing/NCAP/BSC2004/index.htm>.

Models with side airbags that meet the VOLUNTARY AGREEMENT

Models listed here may have side airbags in front seats only or in front and rear seats. All side airbags (front only or front and rear) meet the agreement. A few models aren’t listed because only the rear-seat side airbags meet the agreement. NHTSA recognizes only vehicles in which all side airbags comply.

Acura	3.2 TL, MDX, RSX, TSX
Audi	A4/S4, A6, A8, Allroad
BMW	5 series, X3, Z4 Roadster
Buick	Century, Rainier, Regal, Rendezvous
Cadillac	CTS, SRX, Seville, Escalade, Escalade ESV/EXT, XLR Roadster
Chevrolet	Avalanche, Cavalier, Colorado, Impala, Malibu, Monte Carlo, SSR, Suburban, Tahoe, TrailBlazer, TrailBlazer EXT
Chrysler	300M, Concorde, Pacifica
Dodge	Durango, Intrepid, Ram pickup
Ford	Crown Victoria, Escape, Expedition, Explorer, Explorer Sport Trac, Freestar
GMC	Canyon, Envoy, Envoy XL/XUV, Yukon, Yukon XL
Honda	Accord, Civic 4dr, CR-V, Element, Pilot
Hyundai	Accent 4dr, Elantra, Sonata, Tiburon, XG350
Infiniti	FX series, G35, M45, Q45
Jaguar	XJ series, X-Type
Jeep	Liberty
Kia	Spectra, Amanti
Lexus	ES 330, GS 300/430, GX 470, IS 300, LS 430, LX 470, RX 330, SC 430
Lincoln	Aviator, Navigator, Town Car
Mazda	Tribute
Mercury	Grand Marquis, Monterey, Mountaineer
Mitsubishi	Eclipse, Endeavor, Galant, Lancer except Evolution, Montero except Sport, Outlander
Nissan	350Z, Altima, Maxima, Murano, Pathfinder, Pathfinder Armada, Quest, Titan, Xterra
Oldsmobile	Bravada
Pontiac	Grand Prix, Sunfire
Saab	9-3
Saturn	ION, VUE, L series
Scion	xA
Subaru	Forester, Impreza, Legacy/Outback
Toyota	4Runner, Avalon, Celica, Camry, Camry Solara, Corolla, Echo, Highlander, Land Cruiser, Matrix, Prius, RAV4, Sequoia, Sienna
VW	New Beetle, Jetta, Passat, Phaeton, Touareg

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