

INSURANCE INSTITUTE FOR HIGHWAY SAFETY

NEWS RELEASE

July 3, 2007

REAR CRASH PROTECTION IN SUVs, PICKUP TRUCKS, & MINIVANS: MOST OF THEIR SEAT/HEAD RESTRAINTS ARE MARGINAL OR POOR

ARLINGTON, VA — The designs of seats and head restraints in 21 current SUV, pickup, and minivan models are rated good for protecting people in rear impacts, but those in 54 other models are rated marginal or poor. Another 12 are rated acceptable. The latest evaluations of occupant protection in rear-end collisions by the Insurance Institute for Highway Safety found that the seat/head restraints in more than half of light truck and minivan models fall short of state-of-the-art protection from neck injury or whiplash.

The ratings of good, acceptable, marginal, or poor for 87 current models are based on geometric measurements of head restraints and simulated crashes that together assess how well people of different sizes would be protected in a typical rear crash.

Among the best performers are the seat/head restraint combinations in SUVs made by Subaru and Volvo and new designs from Acura, Ford, Honda, and Hyundai. Seat/head restraints in 3 minivan models from Hyundai and Ford earn good ratings. The redesigned Toyota Tundra is the only pickup model evaluated with seat/head restraints rated good for rear crash protection.

"In stop and go commuter traffic, you're more likely to get in a rear-end collision than any other crash type," says David Zuby, senior vice president of the Institute's Vehicle Research Center. "It's not a major feat of engineering to design seats and head restraints that afford good protection in these common crashes."

Rear-end collisions are frequent, and neck injuries are the most common injuries reported in auto crashes. They account for 2 million insurance claims each year, costing at least \$8.5 billion. Such injuries aren't life-threatening, but they can be painful and debilitating.

Good seat/head restraint designs keep people's heads and torsos moving together: When a vehicle is struck in the rear and driven forward, its seats accelerate occupants' torsos forward. Unsupported, an occupant's head will lag behind this forward torso movement, and the differential

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motion causes the neck to bend and stretch. The higher the torso acceleration, the more sudden the motion, the higher the forces on the neck, and the more likely a neck injury is to occur.

The key to reducing whiplash injury risk is to keep the head and torso moving together. To accomplish this, the geometry of a head restraint has to be adequate — high enough to be near the back of the head. Then the seat structure and stiffness characteristics must be designed to work in concert with the head restraint to support an occupant's neck and head, accelerating them with the torso as the vehicle is pushed forward.

SUVs improve: In the latest evaluations, the seat/head restraint combinations in 17 of 59 SUV models are rated good, 5 are acceptable, 14 are marginal, and 23 are rated poor. In minivans, seat/head restraints in 3 models are rated good, 2 are acceptable, 1 is marginal, and 5 are rated poor. In pickups 1 is good, 5 are acceptable, 5 are marginal, and 6 are rated poor.

While there hasn't been much overall improvement among pickups and minivans since the last time the Institute evaluated protection in rear crashes, the performance of the seat/head restraints in SUVs is much better. In 2006 those in only 6 of 44 SUV models earned a good rating.

"The reason may be that automakers have updated or introduced many new SUVs since 2006, but minivans and pickups are being updated more slowly," Zuby points out.

In the latest tests seat/head restraints in the Mitsubishi Outlander improved to good from the previous design that was rated acceptable. Those in the Acura MDX, Honda CR-V, Honda Element, Hyundai Santa Fe, and Kia Sorento improved from their previous ratings of poor to good. Those in the Honda Pilot and Mercedes M class improved from marginal to good. The seat/head restraints in the Toyota Tundra pickup improved to good from acceptable.

In contrast some manufacturers have introduced new models with subpar seat designs. The ones in the BMW X5, Dodge Nitro, and Suzuki XL7 are rated poor. Those in the new Mazda CX-7 and CX-9 are rated marginal.

Among the poor-rated seats in the new evaluations, those in 7 models didn't make it to the testing stage because the geometry of their head restraints is marginal or poor. This means they can't be positioned to protect many taller people, so the Institute doesn't test them. Among these lowest rated seats are those in the Cadillac SRX SUV, Nissan Quest minivan, and Ford Ranger pickup.

Safety ratings and government rules are driving the changes: Some manufacturers are making changes to the seat/head restraint designs in their vehicles to earn the Institute's *TOP SAFETY PICK* award. Other improvements are being spurred by changes to federal safety rules. Front-seat head restraints will have to extend higher and fit closer to the backs of people's heads under a rule issued by the National Highway Traffic Safety Administration in 2004. Originally set to go into effect for front-seat head restraints in September 2008, the agency recently delayed the effective date in response to petitions for reconsideration. Under the new phase-in schedule, manufacturers must start to fit better front-seat head restraints in 80 percent of their models beginning in September 2009. Front-seat head restraints in all new vehicles made after September 2010 must comply.

"There's lots of room for improvement in the designs of seats and head restraints," Zuby says. "We know many manufacturers are trying to fit better head restraints in their vehicles, and some have been working with us to boost their ratings as they introduce new models. Some manufacturers were waiting for resolution of regulatory issues before fitting better designs in their vehicles. And some didn't get changes made in time for the Institute's tests. For example, BMW plans to redesign the seats in the X5 and X3 SUVs to earn better ratings for the 2008 model year."

The Institute's procedure for evaluating the geometry of seat/head restraints is used worldwide by the Research Council for Automobile Repairs, an international consortium of insurance-sponsored research centers. US federal crash test ratings don't evaluate seat/head restraint designs, but the National Highway Traffic Safety Administration has expressed interest in exploring adding the Institute's seat/head restraint ratings to its website that publishes New Car Assessment Program results. In Europe, the European New Car Assessment Programme is considering adding a head restraint evaluation component to new vehicle assessments.

"The Institute's evaluations of seat/head restraint designs suggest that the worldwide attention is yielding results," Zuby says. "We're seeing more seat/head restraints rated good and acceptable than we used to. It's clear that many foreign and domestic automakers are moving in the right direction."

Sled test simulates rear-end collision: Seat/head restraint ratings are based on a 2-step evaluation.

In the first step restraint geometry is rated using measurements of height and distance from the back of the head of a mannequin that represents an average-size man. Seats with good or acceptable geometric ratings are subjected to a dynamic test conducted on a crash simulation sled. This sled test replicates the forces in a stationary vehicle that's rear-ended by another vehicle of the same weight going 20 mph, which accelerates the struck vehicle to 10 mph. The sled is a movable steel platform that runs on fixed rails and can be programmed to re-create the accelerations that occur inside vehicles during real-world crashes.

A dummy specially designed to assess rear-end crash protection, BioRID, is used to measure the forces on the neck during the simulated crashes. Researchers also measure how hard the seatback pushes on the dummy's back and how quickly the head restraint supports the head.

The Institute's dynamic ratings of good, acceptable, marginal, or poor are derived from two seat design parameters (peak acceleration of the dummy's torso and time from impact initiation to head restraint contact with the dummy's head) plus neck tension and shear forces recorded on BioRID during the test. The sooner a restraint contacts the dummy's head and the lower the acceleration of the torso and the forces on BioRID's neck, the better the dynamic rating. A seat/head restraint's dynamic evaluation is combined with its geometric evaluation to produce an overall rating.

**End of 4-page news release on designs of seat/head restraints
2 attachments: rear crash ratings of SUVs, pickups, & minivans**

**VNR Tues. 7/3/07 at 10:30-11 am EDT (C) G26/Trans. 5 (dl3800V)
repeat at 1:30-2 pm EDT (C) G26/Trans. 5 (dl3800V); dedicated**

For more information go to www.iihs.org

ATTACHMENT 1: P. 1 of 5
DYNAMICALLY TESTED SEAT/HEAD RESTRAINTS

PICKUP TRUCKS Make/model	Seat type tested	OVERALL RATING	DYNAMIC RATING	GEOMETRY OF SEAT/HEAD RESTRAINT
CHEVROLET COLORADO GMC CANYON 2004-07 models	BUCKET SEATS	M	M	G
CHEVROLET COLORADO GMC CANYON 2004-07 models	BENCH SEATS	M	M	G
CHEVROLET SILVERADO GMC SIERRA 2007 models	MOST POPULAR SEAT OPTION	A	A	G
DODGE DAKOTA 2005-07 models MITSUBISHI RAIDER 2006-07 models	SEATS WITHOUT LUMBAR	A	A	G
DODGE DAKOTA 2005-07 models MITSUBISHI RAIDER 2006-07 models	SEATS WITH LUMBAR	P	P	G
DODGE RAM 1500 2006-07 models	SEATS WITH LUMBAR	P	P	A
FORD F-150 2004-07 models	SEATS WITHOUT INTEGRATED SEATBELT	M	M	G
FORD F-150 2004-07 models	SEATS WITH INTEGRATED SEATBELT	P	P	G
ISUZU i-series 2006-07 models	ALL SEATS	M	M	G
NISSAN FRONTIER 2005-07 models	SEATS WITHOUT LUMBAR (ACTIVE HEAD RESTRAINTS)	P	P	A
NISSAN FRONTIER 2005-07 models	SEATS WITH LUMBAR (ACTIVE HEAD RESTRAINTS)	P	P	G
NISSAN TITAN 2005-07 models	ALL SEATS (ACTIVE HEAD RESTRAINTS)	A	A	A
TOYOTA TACOMA 2005-07 models	BUCKET SEATS	M	M	G
TOYOTA TUNDRA 2007 models	MOST POPULAR SEAT OPTION	G	G	G

G GOOD
A ACCEPTABLE
M MARGINAL
P POOR

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For each seat/head restraint, REAR-END CRASH PROTECTION is an assessment of occupant protection against neck injury in rear impacts at low to moderate speeds. Such injuries usually aren't serious, but they're frequent. OVERALL RATINGS are based on a 2-step evaluation. In the first step head restraint geometry (distance behind and below the head of a seated average-size man) is rated good, acceptable, marginal, or poor. Seats with good or acceptable restraint geometry then are subjected to a dynamic test simulating the forces in a stationary vehicle that's rear-ended by another vehicle of the same weight going 20 mph. Seat/head restraints with marginal or poor geometry aren't tested dynamically because they cannot protect taller people in rear-end crashes. These seats are rated poor overall. In the dynamic test, measurements are recorded on a dummy (BioRID) representing an average-size man. BioRID is designed specifically for rear-end testing at low to moderate speeds. The DYNAMIC RATINGS are derived from 2 seat design parameters (peak acceleration of the dummy torso and time from impact initiation to head restraint contact with the dummy head) plus tension and shear forces recorded on BioRID's neck during the test. Overall ratings are based on both geometric measurements and dynamic results.

ATTACHMENT 1: P. 2 of 5
 DYNAMICALLY TESTED SEAT/HEAD RESTRAINTS

MINIVANS Make/model	Seat type tested	OVERALL RATING	DYNAMIC RATING	GEOMETRY OF SEAT/HEAD RESTRAINT
BUICK TERRAZA CHEVEROLET UPLANDER SATURN RELAY 2005-07 models	ALL SEATS	P	P	A
CHRYSLER TOWN & COUNTRY DODGE CARAVAN 2004-07 models	SEATS WITH LUMBAR	A	A	A
CHRYSLER TOWN & COUNTRY DODGE CARAVAN 2004-07 models	SEATS WITHOUT LUMBAR	P	P	A
FORD FREESTAR 2005-07 models	SEATS WITH ADJUSTABLE HEAD RESTRAINTS	G	G	G
FORD FREESTAR 2004-07 models	SEATS WITH FIXED HEAD RESTRAINTS	G	G	G
HONDA ODYSSEY 2005-07 models	ALL SEATS	M	M	A
HYUNDAI ENTOURAGE 2007 models KIA SEDONA 2006-07 models	ALL SEATS (ACTIVE HEAD RESTRAINTS)	G	G	G
TOYOTA SIENNA 2005-07 models	SEATS WITH LUMBAR	P	P	A

G GOOD
A ACCEPTABLE
M MARGINAL
P POOR

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ATTACHMENT 1: P. 3 of 5
DYNAMICALLY TESTED SEAT/HEAD RESTRAINTS

SUVs		Seat type tested	OVERALL RATING	DYNAMIC RATING	GEOMETRY OF SEAT/HEAD RESTRAINT
Make/model					
2007 models (mfg. after May 2007)	ACURA MDX	MOST POPULAR SEAT OPTION (ACTIVE HEAD RESTRAINTS)	G	G	G
2007 models	ACURA RDX	ALL SEATS (ACTIVE HEAD RESTRAINTS)	G	G	G
2004-07 models	BMW X3	SEATS WITH LUMBAR	P	P	A
2007 models	BMW X5	COMFORT SEATS	P	P	G
2004-07 models	BUICK RAINIER	ALL SEATS	P	P	A
	CHEVROLET TRAILBLAZER				
	GMC ENVOY				
2003-07 models	ISUZU ASCENDER				
2004-07 models	BUICK RENDEZVOUS	ALL SEATS	M	M	A
2005-07 models	CHEVROLET EQUINOX	ALL SEATS	M	M	G
2006-07 models	PONTIAC TORRENT				
2004-07 models	CHRYSLER PACIFICA	ALL SEATS	P	P	A
2007 models	DODGE NITRO	MOST POPULAR SEAT OPTION	P	P	G
2007 models (mfg. after Jan. 2007)	FORD EDGE	MOST POPULAR SEAT OPTION	G	G	G
	LINCOLN MKX				
2005-07 models	FORD ESCAPE	ALL SEATS	A	A	G
	MERCURY MARINER				
2006-07 models	FORD EXPLORER	ALL SEATS	P	P	A
2007 models	FORD EXPLORER SPORT TRAC				
2006-07 models	MERCURY MOUNTAINEER				
2005-07 models	FORD FREESTYLE	ALL SEATS	G	G	G
2007 models	HONDA CR-V	ALL SEATS (ACTIVE HEAD RESTRAINTS)	G	G	G
2007 models	HONDA ELEMENT	MOST POPULAR SEAT OPTION	G	G	G
2006-07 models	HONDA PILOT	EX SEATS	G	G	G
2006-07 models	HONDA PILOT	LX SEATS	G	G	G
2006-07 models	HUMMER H3	MOST POPULAR SEAT OPTION	P	P	A

G GOOD
A ACCEPTABLE
M MARGINAL
P POOR

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ATTACHMENT 1: P. 4 of 5
DYNAMICALLY TESTED SEAT/HEAD RESTRAINTS

SUVs Make/model	Seat type tested	OVERALL RATING	DYNAMIC RATING	GEOMETRY OF SEAT/HEAD RESTRAINT
HYUNDAI SANTA FE 2007 models	MOST POPULAR SEAT OPTION (ACTIVE HEAD RESTRAINTS)	G	G	G
HYUNDAI TUCSON 2006-07 models	ALL SEATS	P	P	G
HYUNDAI VERACRUZ 2007 models (mfg. after May 2007)	MOST POPULAR SEAT OPTION (ACTIVE HEAD RESTRAINTS)	A	A	G
INFINITI FX35/FX45 2003-07 models	ALL SEATS (ACTIVE HEAD RESTRAINTS)	M	M	A
JEEP COMPASS JEEP PATRIOT 2007 models	MOST POPULAR SEAT OPTION	A	A	G
JEEP GRAND CHEROKEE 2005-07 models	ALL SEATS	G	G	G
JEEP LIBERTY 2002-07 models	SEATS WITH FIXED HEAD RESTRAINTS	P	P	A
JEEP LIBERTY 2002-07 models	SEATS WITH ADJUSTABLE HEAD RESTRAINTS	P	P	A
JEEP WRANGLER 2007 models	MOST POPULAR SEAT OPTION	M	M	A
KIA SORENTO 2007 models	MOST POPULAR SEAT OPTION (ACTIVE HEAD RESTRAINTS)	G	G	G
KIA SPORTAGE 2005-07 models	ALL SEATS	P	P	G
LAND ROVER LR3 2005-07 models	ALL SEATS	G	G	G
LEXUS GX 470 2003-07 models	ALL SEATS	P	P	A
LEXUS RX 2004-07 models	ALL SEATS	P	P	A
MAZDA CX-7 2007 models	MOST POPULAR SEAT OPTION	M	M	G
MAZDA CX-9 2007 models	MOST POPULAR SEAT OPTION	M	M	G
MERCEDES M CLASS 2007 models	SEATS WITHOUT AUTO-ADJUST HEAD RESTRAINTS (ACTIVE HEAD RESTRAINTS)	G	G	G
MITSUBISHI OUTLANDER 2007 models	MOST POPULAR SEAT OPTION	G	G	G
NISSAN MURANO 2006-07 models	ALL SEATS (ACTIVE HEAD RESTRAINTS)	M	M	G
NISSAN PATHFINDER 2005-07 models	ALL SEATS (ACTIVE HEAD RESTRAINTS)	M	M	G
NISSAN XTERRA 2005-07 models	ALL SEATS (ACTIVE HEAD RESTRAINTS)	P	P	G

G GOOD
A ACCEPTABLE
M MARGINAL
P POOR

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ATTACHMENT 1: P. 5 of 5
DYNAMICALLY TESTED SEAT/HEAD RESTRAINTS

SUVs Make/model Seat type tested		OVERALL RATING	DYNAMIC RATING	GEOMETRY OF SEAT/HEAD RESTRAINT
SAAB 9-7X 2006-07 models	ALL SEATS	P	P	G
SATURN VUE 2002-07 models	ALL SEATS	M	M	G
SUBARU B9 TRIBECA 2006-07 models	ALL SEATS (ACTIVE HEAD RESTRAINTS)	G	G	G
SUBARU FORESTER 2006-07 models	ALL SEATS (ACTIVE HEAD RESTRAINTS)	G	G	G
SUZUKI GRAND VITARA 2006-07 models	ALL SEATS	M	M	G
SUZUKI XL7 2007 models	MOST POPULAR SEAT OPTION	P	P	A
TOYOTA 4RUNNER 2003-07 models	ALL SEATS	P	P	A
TOYOTA FJ CRUISER 2007 models	ALL SEATS	M	M	G
TOYOTA HIGHLANDER 2004-07 models	SEATS WITH FIXED HEAD RESTRAINT TILT, NO LUMBAR	M	M	A
TOYOTA HIGHLANDER 2004-07 models	SEATS WITH HEAD RESTRAINT TILT AND LUMBAR	P	P	A
TOYOTA RAV4 2006-07 models	ALL SEATS	M	M	G
VOLVO XC90 2005-07 models	ALL SEATS	G	G	G

G GOOD
A ACCEPTABLE
M MARGINAL
P POOR

end of Attachment 1

ATTACHMENT 2: P. 1 of 1
SEAT/HEAD RESTRAINTS NOT DYNAMICALLY TESTED BECAUSE OF INADEQUATE GEOMETRY

PICKUP TRUCKS		OVERALL RATING	DYNAMIC RATING	GEOMETRY OF SEAT/HEAD RESTRAINT
Make/model	Seat type tested			
CHEVROLET SILVERADO 1500 CLASSIC GMC SIERRA 1500 CLASSIC 2001-07 models	SEATS WITH ADJUSTABLE HEAD RESTRAINTS	P	not tested (see note)	M
CHEVROLET SILVERADO 1500 CLASSIC GMC SIERRA 1500 CLASSIC 2001-07 models	SEATS WITH FIXED HEAD RESTRAINTS	P	not tested (see note)	P
DODGE RAM 1500 2006-07 models	SEATS WITHOUT ADJUSTABLE LUMBAR	P	not tested (see note)	M
FORD RANGER MAZDA B SERIES 2006-07 models	ALL SEATS	P	not tested (see note)	M
GMC SIERRA 1500 CLASSIC 2001-07 models	SEATS WITH HEAD RESTRAINT TILT LOCK	P	not tested (see note)	M

MINIVANS		OVERALL RATING	DYNAMIC RATING	GEOMETRY OF SEAT/HEAD RESTRAINT
Make/model	Seat type tested			
NISSAN QUEST 2004-07 models	ALL SEATS	P	not tested (see note)	M
TOYOTA SIENNA 2005-07 models	SEATS WITHOUT ADJUSTABLE LUMBAR	P	not tested (see note)	M

SUVs		OVERALL RATING	DYNAMIC RATING	GEOMETRY OF SEAT/HEAD RESTRAINT
Make/model	Seat type tested			
CADILLAC SRX 2004-07 models	ALL SEATS	P	not tested (see note)	M
MITSUBISHI ENDEAVOR 2007 models	MOST POPULAR SEAT OPTION	P	not tested (see note)	M

G GOOD
A ACCEPTABLE
M MARGINAL
P POOR

end of Attachment 2

Note: Seat/head restraints with marginal or poor geometry aren't tested dynamically because they cannot protect taller people in rear-end crashes. These seats are rated poor overall. Seat/head restraints with good or acceptable geometry are tested dynamically (see Attachment 1).