
INSURANCE INSTITUTE FOR HIGHWAY SAFETY

NEWS RELEASE

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IMPRESSIVE CRASH TEST PERFORMANCE FOR VEHICLES WITH SIDE AIRBAGS THAT PROTECT OCCUPANTS' HEADS

ARLINGTON, VA — Many new cars, including not only luxury models but also some popular and less expensive cars, are being equipped with airbags designed to protect people's heads in side impacts. New Insurance Institute for Highway Safety crash tests of the BMW X5 and Volvo S80 — car-into-pole tests and vehicle-to-vehicle tests — demonstrate the important benefits afforded to occupants by these side airbag head protection systems.

Pickup truck into side of Volvo S80: The Institute conducted two crash tests in which the fronts of Chevrolet pickup trucks struck the sides of 1999 Volvo S80s. The S80 in one test included side airbag head protection, while in the other test the S80 did not (both S80s had side airbags for torso protection). In each test, the pickup was going 32 mph, the S80 16 mph. Results show the head airbags provide very important protection in addition to what is afforded by the torso bags.

In the test without the head protection airbag, the heads of the driver and rear passenger dummies were struck by the hood of the pickup truck. The forces recorded on the rear-seat dummy's head were high — in fact, sufficient to cause fatal head injuries. The driver dummy's head contact didn't produce high forces, but the fact that the contact occurred means the head barely escaped severe impact. In contrast, in the test with the head protection airbag both dummies recorded low head forces because the inflatable curtain provided a cushion between the dummies' heads and the hood of the pickup truck.

Injury measures taken from the dummies' torsos were similar in the two Volvo S80s, with and without head protection. In both cars, these measures were low except for abdomen compression on the rear-seat dummies, which were at levels at which a person could sustain serious, though survivable, injuries to the spleen, kidney, or colon.

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Crash test results: pickup (32 mph) into Volvo S80 (16 mph) with and without side airbag head protection

	Injury Reference Value	Crash Test Results			
		WITH HEAD PROTECTION		WITHOUT HEAD PROTECTION	
		Driver	Rear Pass.	Driver	Rear Pass.
Head injury criterion	700	140	561	167	1868
Neck compression (kN)	-4.0	-0.49	-0.12	-0.39	-0.17
Neck tension (kN)	3.3	0.8	1.4	1.6	2.6
Thoracic trauma index (g)	85	56	75	66	67
Abdomen compression (mm)	39	—	46	—	46
Lateral pelvic acceleration (g)	130	70	47	79	49

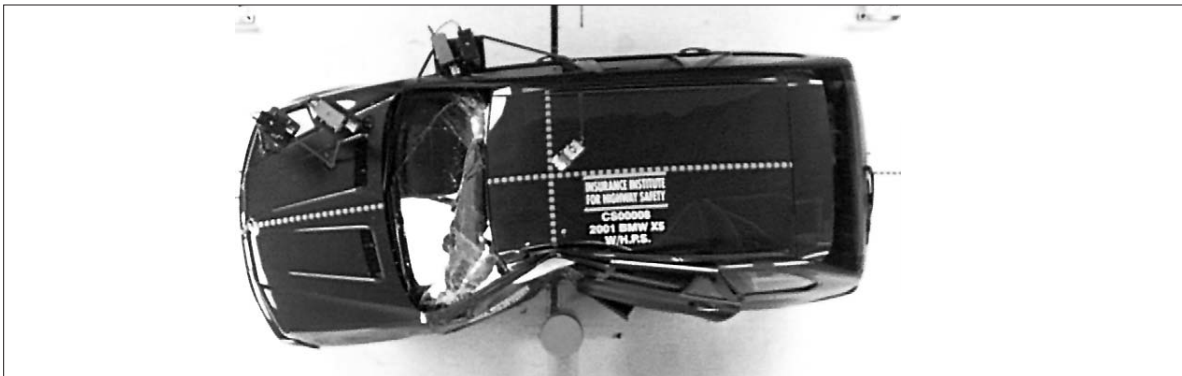
Bold: value exceeds threshold, indicated by injury reference, above which serious injuries are increasingly likely

Note: Driver dummies are SID H3s, a modified version of the dummy (SID) specified in Federal Motor Vehicle Safety Standard 214 (side impact); the head and neck of the SID H3 are from Hybrid III dummies used in frontal crash testing. Rear-seat dummies used in the above tests are BioSIDs, which are more advanced side impact dummies compared with SIDs; in particular, BioSIDs are designed specifically to measure both acceleration and compression of the chest and abdomen, while SIDs measure acceleration.

“These crash tests demonstrate that head airbags can make very serious vehicle-to-vehicle side impacts survivable by preventing the intruding vehicle structure from striking occupants’ heads. Without head airbags, serious or fatal head injuries become more likely,” says Institute president Brian O’Neill.

Car-into-pole crash tests: The Institute also conducted side-into-pole crash tests of a BMW X5 and Volvo S80, both equipped with side airbag head protection — an inflatable curtain in the Volvo and an inflatable tube-shaped airbag in the BMW. In each test, the vehicle was propelled sideways at 18 mph into a rigid pole.

The 18 mph speed of this test “might not sound like one at which a crash could be serious,” O’Neill says, “but impacts into rigid objects such as poles or trees at 18



2001 BMW X5 with side airbag head protection system: crash test results, 18 mph into pole

	Injury Reference Value	Test Result
Head injury criterion	700	439
Neck compression (kN)	-4.0	-0.47
Neck tension (kN)	3.3	1.5
Thoracic trauma index (g)	85	51
Abdomen compression (mm)	—	—
Lateral pelvic acceleration (g)	130	43

Note: test dummy (SID H3) doesn't record abdomen compression.

1999 Volvo S80 with side airbag head protection system: crash test results, 18 mph into pole

	Injury Reference Value	Test Result
Head injury criterion	700	265
Neck compression (kN)	-4.0	-0.16
Neck tension (kN)	3.3	1.0
Thoracic trauma index (g)	85	37
Abdomen compression (mm)	—	—
Lateral pelvic acceleration (g)	130	43

Note: test dummy (SID H3) doesn't record abdomen compression.

mph are, in fact, very severe." The intrusion into the X5 and S80 indicates the severity. The pole is relatively narrow, so there was major penetration into the side of each car. Yet the forces recorded on the dummies' heads in these tests were low.

"These tests demonstrate that people can survive serious side impact crashes in the real world because head airbags prevent their heads from striking rigid objects," O'Neill says. He adds that "side airbags with head protection represent a very important safety development that will save lives and prevent major head trauma in a range of serious side impact crashes."

All four crash tests involving Volvos and a BMW were conducted in cooperation with the vehicle manufacturers.

How big a problem are side impacts? Almost 10,000 occupant deaths occur each year in side impact crashes, and more than half of these deaths involve head injuries (Attachment 1: Side impacts with fatal head injuries caused when intruding vehicles struck occupants' heads). Head injuries are the cause of death in 51-74 percent of single-

Passenger vehicle occupant deaths in side impact crashes			
<u>Crash type</u>	<u>Single-vehicle</u>	<u>Multiple-vehicle</u>	<u>Total</u>
All	14,733	17,210	31,943
Side impact	2,957	6,700	9,657
Side impact with fatal head injury	1,500-2,200	2,700-4,300	4,200-6,500

Source: Fatality Analysis Reporting System, U.S. Department of Transportation, 1999

vehicle side impacts and 41-64 percent of multiple-vehicle side impacts (source: NASS/CDS, 1995-99).

Thirty-eight percent of single-vehicle side impact crash deaths occur when vehicles strike trees or poles on the dead occupants' side of the vehicle. In two-vehicle side impact crashes, 38 percent of car occupant deaths occur when a pickup or sport utility vehicle strikes the car (source: Fatality Analysis Reporting System, 1999).

Side airbag head protection systems in 2001 models: The designs of side airbag head protection systems in BMWs and Volvos aren't the same. The BMW design is a tubular structure that inflates from the roof to protect occupants' heads. Volvo's side airbags are curtain designs that deploy from the roof. Other side airbags in 2001 models deploy from the vehicle seat, inflating forward and upward to cushion occupants' heads and chests (Attachment 2: 2001 models with side airbag head protection systems).

"These new cars are being equipped with side airbags with head protection in the absence of any government requirement to do so. It's the market that's driving many of the important advances today," O'Neill says.

End five-page release on head airbags in side crashes
Attachment 1: side impact crashes w/ fatal head injuries
Attachment 2: 2001 cars with head protection airbags
Video news release Thurs., Dec. 14, 1:00-1:30 pm EST
(C) Telstar 6/Trans. 8; crash test footage, related video

Internet: www.highwaysafety.org

SIDE IMPACTS WITH FATAL HEAD INJURIES

caused when intruding vehicles struck occupants' heads



This 1993 Pontiac Grand Am was struck by a 1972 GMC full-size pickup truck. The Grand Am's 29-year-old female driver died from massive injuries to her head, neck, chest, and abdomen. A 72-year-old female passenger in the rear seat also was killed.

IIHS/UVa, 95-050 (1994)



This 1991 Chevrolet Geo was struck by a 1997 Ford pickup truck. The Geo's 23-year-old male driver was killed. His injuries included chest trauma plus fatal injuries when the hood of the intruding pickup struck his head.

NASS 79-123 (1999)



This 1997 Plymouth Breeze was struck by a 1985 Chevrolet Blazer. The Breeze's 30-year-old female driver was killed. Her injuries included head trauma when the intruding Blazer's hood struck her head.

NASS 75-143 (1999)

2001 MODELS WITH SIDE AIRBAG HEAD PROTECTION SYSTEMS

AUDI			LINCOLN		
A4	standard	inflatable curtain	Continental	standard	dual-chamber thorax bag
A6	standard	inflatable curtain	LS	standard	dual-chamber thorax bag
A8	standard	inflatable curtain	Navigator	standard	dual-chamber thorax bag
allroad	standard	inflatable curtain	Town Car	standard	dual-chamber thorax bag
S4	standard	inflatable curtain	MAZDA		
TT	standard	dual-chamber thorax bag	626	optional	dual-chamber thorax bag
BMW			Millenia	standard	dual-chamber thorax bag
3 series (exc. convertible)	standard	inflatable tubular structure	MPV	optional	dual-chamber thorax bag
5 series	standard	inflatable tubular structure	Protege	optional	dual-chamber thorax bag
7 series	standard	inflatable tubular structure	Tribute	optional	dual-chamber thorax bag
X5	standard	inflatable tubular structure	MERCEDES		
BUICK			CL class	standard	inflatable curtain
Century	optional	dual-chamber thorax bag	C class	standard	inflatable curtain
Regal	optional	dual-chamber thorax bag	E class	standard	inflatable curtain
CADILLAC			S class	standard	inflatable curtain
Seville	standard	dual-chamber thorax bag	MERCURY		
CHEVROLET			Cougar	optional	dual-chamber thorax bag
Impala	optional	dual-chamber thorax bag	Mountaineer	optional	dual-chamber thorax bag
Monte Carlo	optional	dual-chamber thorax bag	Sable	optional	dual-chamber thorax bag
Venture	standard	dual-chamber thorax bag	NISSAN		
CHRYSLER			Altima	optional	dual-chamber thorax bag
300M	optional	dual-chamber thorax bag	Maxima	optional	dual-chamber thorax bag
Concorde	optional	dual-chamber thorax bag	Pathfinder	optional	dual-chamber thorax bag
LHS	optional	dual-chamber thorax bag	Sentra	optional	dual-chamber thorax bag
PT Cruiser	optional	dual-chamber thorax bag	OLDSMOBILE		
Sebring 4-door	optional	inflatable curtain	Silhouette	standard	dual-chamber thorax bag
Town & Country	optional	dual-chamber thorax bag	PLYMOUTH		
Voyager	optional	dual-chamber thorax bag	Neon	optional	dual-chamber thorax bag
DODGE			PONTIAC		
Caravan/Grand Caravan	optional	dual-chamber thorax bag	Montana	standard	dual-chamber thorax bag
Intrepid	optional	dual-chamber thorax bag	PORSCHE		
Neon	optional	dual-chamber thorax bag	911	standard	dual-chamber thorax bag
Stratus 4-door	optional	inflatable curtain	Boxster	standard	dual-chamber thorax bag
FORD			SAAB		
Escape	optional	dual-chamber thorax bag	9-3	standard	dual-chamber thorax bag
Expedition	optional	dual-chamber thorax bag	9-5	standard	dual-chamber thorax bag
Explorer	optional	dual-chamber thorax bag	SATURN		
Focus	optional	dual-chamber thorax bag	L series	optional	inflatable curtain
Taurus	optional	dual-chamber thorax bag	S series	optional	inflatable curtain
Windstar	optional	dual-chamber thorax bag	TOYOTA		
HYUNDAI			Sequoia	optional	inflatable curtain
Elantra	standard	dual-chamber thorax bag	VOLKSWAGEN		
Sonata	standard	dual-chamber thorax bag	Cabrio	standard	dual-chamber thorax bag
XG300	standard	dual-chamber thorax bag	Golf	standard	inflatable curtain
INFINITI			Jetta	standard	inflatable curtain
G20	standard	dual-chamber thorax bag	Passat	standard	inflatable curtain
I30	standard	dual-chamber thorax bag	VOLVO		
Q45	standard	dual-chamber thorax bag	C70	standard	dual-chamber thorax bag
QX4	standard	dual-chamber thorax bag	S40/V40	standard	inflatable curtain
JAGUAR			S60	standard	inflatable curtain
S type	standard	dual-chamber thorax bag	S80	standard	inflatable curtain
XK	standard	dual-chamber thorax bag	V70	standard	inflatable curtain
LEXUS					
LS 430	standard	inflatable curtain			
GS 300/430	standard	inflatable curtain			