

# INSURANCE INSTITUTE FOR HIGHWAY SAFETY

July 17, 2001

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## **NEW CRASH TEST RESULTS: DODGE GRAND CARAVAN AND HYUNDAI ELANTRA EARN POOR RATINGS AFTER 3 TESTS EACH; FUEL LEAK IN GRAND CARAVAN FIXED**

ARLINGTON, VA — A recent series of frontal offset crash tests by the Insurance Institute for Highway Safety included multiple tests of each vehicle, a 2001 Hyundai Elantra (small car) and 2001 Dodge Grand Caravan (passenger van). The manufacturers of these vehicles requested the second tests because they believed the Institute's first tests didn't reflect the same performance as in tests conducted by the companies. In each case, however, the second test revealed new problems.

"In the case of the Grand Caravan, it was a fuel leak, and for the Elantra a late airbag deployment. These findings complicated the crashworthiness evaluations of both vehicles," explains Institute president Brian O'Neill. The Institute conducts frontal offset crash tests at 40 mph. Based primarily on the results of these tests, the Institute evaluates the crashworthiness of passenger vehicles, assigning each vehicle a rating from good overall to poor.

**Late airbag inflation and high leg injury measures compromise Elantra's crash test performance:** The Elantra's structural performance in all three of the Institute's offset tests was good, but there were clear indications of leg injury risk plus a late airbag deployment in the second and third tests. These are the problems that led to the car's poor overall crashworthiness evaluation — a worse rating than the previous Elantra design (1996-2000 models), which was rated acceptable overall.

After the first test of the Elantra, Hyundai engineers requested a retest, saying the leg injury measures recorded on the driver dummy in the Institute's initial offset test weren't typical of this car. In the Institute's second test of the Elantra,

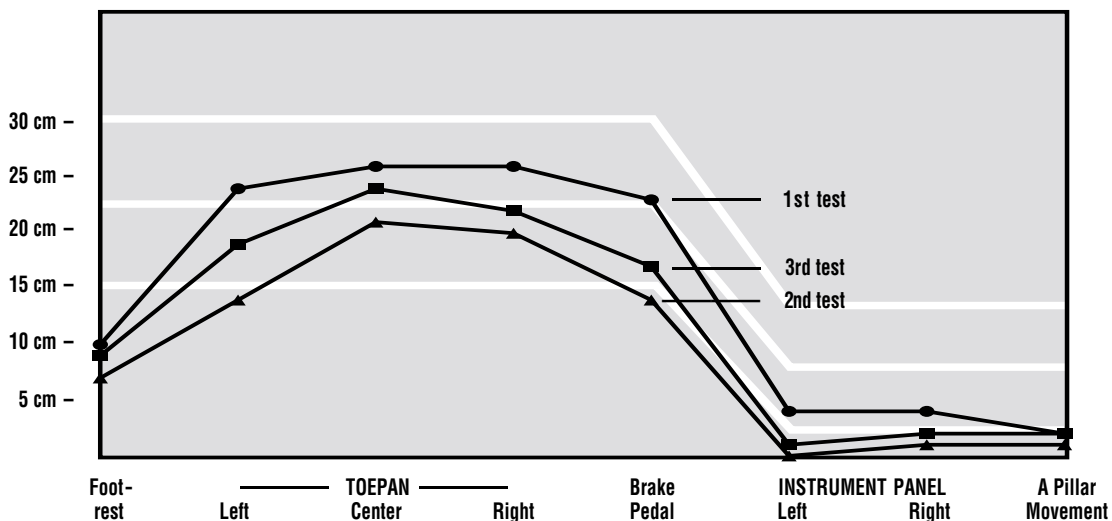
— MORE —

the leg injury measures were somewhat lower (better) but a new problem was revealed — the Elantra’s driver airbag deployed late in the impact (76 milliseconds into the crash compared with 28 milliseconds in the first test). The delay allowed the driver dummy’s head to strike the steering wheel, resulting in high head injury forces. In a third test, the airbag again deployed late (64 milliseconds into the crash), indicating that the result of the second test wasn’t an anomaly.

“Clearly the airbag sensors in the Elantra aren’t recognizing in time the severity of all of the crashes they need to,” O’Neill points out.

**Fuel leak compromises Grand Caravan’s crash test performance:** When the Institute conducted the first offset test of the Grand Caravan, there was more intrusion into the occupant compartment than DaimlerChrysler engineers said they had recorded in their tests of this vehicle. When the Institute conducted a second test, there was somewhat less intrusion, although the overall intrusion patterns were similar in both tests. However, a new problem was revealed in the second test — a part on top of the gas tank to which the

MEASUREMENTS OF OCCUPANT COMPARTMENT INTRUSION (cm),  
 2001 DODGE GRAND CARAVAN, 40 MPH FRONTAL OFFSET CRASH TEST



fuel pump is attached cracked during the impact, allowing fluid to leak from the fuel system (note: a less volatile fluid than gasoline is added to cars' fuel systems in crash tests to allow identification of leaks without the risk of fire). Examination of the gas tank from the Grand Caravan in the first offset test identified a similar problem, even though there wasn't any fuel leakage. Because of these findings, DaimlerChrysler redesigned the part that cracked in the Institute's tests. The third test, which was conducted with the part that will be on a few 2001 model Grand Caravans (those manufactured on or after July 6) and all 2002s, revealed no fuel system leakage nor any evidence of weakness around the redesigned part.

"The overall performance of the Grand Caravan was similar in all three tests, except for the fuel tank," O'Neill says. "Based on these tests, the 2001 models manufactured before the redesigned fuel systems are rated poor for crashworthiness because of the leak. The 2002 models with the fixed fuel systems and side impact airbags with head protection are rated acceptable."

**Structural design is key to good performance:** The Institute's frontal offset crash test into a deformable barrier is especially demanding of vehicle structure. The driver side hits the barrier, so a relatively small area of the vehicle's front-end structure must manage the crash energy. This means intrusion into the occupant compartment is more likely to occur than in a full-width test.

"Good structural design is the key to good performance in the offset test," O'Neill notes. "If a car's front-end structure absorbs and manages the crash energy so the occupant compartment remains largely intact, with little or no intrusion, then the dummy's movement is likely to be controlled, and injury measures are likely to be low. In contrast, poor structural design means greater likelihood of poor control of the dummy and high injury measures."

**Institute and government crash tests complement each other:** The Institute's crashworthiness evaluations are based primarily on results of the frontal offset crash test at 40 mph. Each vehicle's overall evaluation is based on three aspects of

performance — measurements of occupant compartment intrusion, injury measures from a Hybrid III dummy positioned in the driver seat, and analysis of slow-motion film to assess how well the restraint system controlled dummy movement during the test.

The federal government has been testing new passenger vehicles in 35 mph crash tests since 1978. This New Car Assessment Program has been a major contributor to crashworthiness improvements — in particular, improved restraint systems in new passenger vehicles. The Institute's offset tests, conducted since 1995, involve 40 percent of a vehicle's front end hitting a deformable barrier at 40 mph. This test complements the federal test involving the full width of the front end hitting a rigid barrier. Both tests are contributing to improvements in crashworthiness — in particular improved crumple zones and safety cages.

The same 40 mph offset crash test is used to evaluate new cars by the European Union in cooperation with motor clubs and by an Australian consortium of state governments and motor clubs.

**End 4-page release on vehicle crashworthiness  
3-page attachment: crashworthiness ratings  
Video news release Tues., 7/17, 1-1:30 pm EDT  
(C) Telstar 6/Trans. 8; crash test footage & more**

**Internet: [www.highwaysafety.org](http://www.highwaysafety.org)**

# Evaluations

Small cars	OVERALL EVALUATION	Frontal Offset Crash Test Performance						Other Evaluations	
		Structure/Safety Cage	Injury Measures			Restraints/Dummy Kinematics	Head Restraint Design	Bumper Performance	
			Head/Neck	Chest	Leg/Foot Left, Right				
<b>HONDA CIVIC</b> 2001 models test vehicle wt. = 2,507 lbs.	G	G	G	G	G	G	G	A	
<b>VOLKSWAGEN NEW BEETLE</b> 1998-2001 models test vehicle wt. = 2,762 lbs.	G	G	G	G	G	G	A	G	
<b>FORD FOCUS</b> 2000-01 models test vehicle wt. = 2,707 lbs.	G	A	G	G	A	G	A	M	
<b>VOLKSWAGEN JETTA/GOLF</b> 2001 models test vehicle wt. = 2,932 lbs.	G	A	G	G	A	G	A	M	
<b>NISSAN SENTRA</b> 2000-01 models test vehicle wt. = 2,650 lbs.	A	A	A	G	G	A	G	M	
<b>TOYOTA COROLLA/ CHEVROLET PRIZM</b> 1998-2001 models test vehicle wt. = 2,504 lbs.	A	A	G	G	M	G	M	A	
<b>FORD ESCORT</b> 1997-2001 models test vehicle wt. = 2,538 lbs.	A	A	G	G	G	P	G	P	
<b>MERCURY TRACER</b> 1997-99 models									
<b>SATURN SL</b> 1995-2001 models test vehicle wt. = 2,434 lbs.	A	A	G	A	A	G	M	P	
<b>MAZDA PROTEGE</b> 1999-2001 models test vehicle wt. = 2,577 lbs.	A	A	G	G	M	P	A	M	
<b>DODGE/PLYMOUTH NEON</b> 2000-01 models test vehicle wt. = 2,659 lbs.	M	M	G	G	P	A	M	P	
<b>MITSUBISHI MIRAGE</b> 1997-2001 models test vehicle wt. = 2,407 lbs.	P	M	A	G	G	P	P	A	
<b>HYUNDAI ELANTRA</b> 2001 models avg. test vehicle wt. = 2,875 lbs.	P	G	P	G	M	M	P	A	
<b>KIA SEPHIA</b> 1998-2001 models test vehicle wt. = 2,593 lbs.	P	M	P	G	M	M	M	A	

best pick

best pick

NEWLY TESTED

G GOOD    A ACCEPTABLE    M MARGINAL    P POOR

Turn page for crashworthiness evaluations of earlier small car designs ▶

# Evaluations (small cars continued)

Small cars	OVERALL EVALUATION	Frontal Offset Crash Test Performance					Other Evaluations	
		Structure/Safety Cage	Injury Measures			Restraints/Dummy Kinematics	Head Restraint Design	Bumper Performance
			Head/Neck	Chest	Leg/Foot Left, Right			
Crashworthiness evaluations of earlier designs:								
<b>VOLKSWAGEN JETTA/GOLF</b> late 1999-2000 models test vehicle wt. = 2,932 lbs.	A	A	G	G	A	G	M P	G
								depends on seat
<b>HONDA CIVIC</b> 1996-2000 models test vehicle wt. = 2,416 lbs.	A	A	G	A	A	G	P	A
<b>HYUNDAI ELANTRA</b> 1996-2000 models test vehicle wt. = 2,643 lbs.	A	A	A	G	G	A	A	A P
								depends on model year
<b>MAZDA PROTEGE</b> 1995-98 models test vehicle wt. = 2,498 lbs.	A	A	G	G	G	M	P	M
<b>NISSAN SENTRA</b> 1998-99 models test vehicle wt. = 2,500 lbs.	A	M	A	G	M	G	M	G
<b>VOLKSWAGEN JETTA/GOLF</b> 1994-early 1999 models test vehicle wt. = 2,725 lbs.	M	M	A	G	P	A	P	G
<b>DODGE/PLYMOUTH NEON</b> 1995-99 models test vehicle wt. = 2,593 lbs.	P	M	G	G	M	P	M	G
<b>KIA SEPHIA</b> 1996-97 models test vehicle wt. = 2,584 lbs.	P	P	G	G	P	P	P	M

**G** GOOD      **A** ACCEPTABLE      **M** MARGINAL      **P** POOR

# Evaluations

	OVERALL EVALUATION	Frontal Offset Crash Test Performance						Other Evaluations		
		Structure/Safety Cage	Injury Measures			Restraints/Dummy Kinematics	Head Restraint Design	Bumper Performance		
			Head/Neck	Chest	Leg/Foot Left, Right					
<b>Passenger vans</b>										
<b>best pick</b>	<b>TOYOTA SIENNA</b> 1998-2001 models test vehicle wt. = 3,937 lbs.	G	G	G	G	G	G	G	P	M
	<b>HONDA ODYSSEY</b> 1999-2001 models test vehicle wt. = 4,251 lbs.	G	A	G	G	G	G	A	M P	A
	<b>FORD WINDSTAR</b> 1999-2001 models test vehicle wt. = 4,131 lbs.	G	A	G	G	A	G	A	A P	A
	<b>MAZDA MPV</b> 2000-01 models test vehicle wt. = 3,657 lbs.	A	A	A	G	G	P	G	A	P
	<b>DODGE GRAND CARAVAN</b> <b>CHRYSLER TOWN &amp; COUNTRY</b> avg. test vehicle wt. = 4,224 lbs.									
NEWLY TESTED	2002 models	A	A	A	G	A	P	A	A	P
	2001 models	P	P	A	G	A	P	A	A	P
	<b>CHEVROLET ASTRO</b> <b>GMC SAFARI</b> 1996-2001 models test vehicle wt. = 4,350 lbs.	P	P	G	G	P	G	M	M P	P
	<b>NISSAN QUEST</b> <b>MERCURY VILLAGER</b> 1999-2001 models test vehicle wt. = 3,982 lbs.	P	P	A	G	P	A	P	M P	G
	<b>PONTIAC TRANS SPORT/MONTANA</b> <b>OLDSMOBILE SILHOUETTE</b> <b>CHEVROLET VENTURE</b> 1997-2001 models test vehicle wt. = 3,783 lbs.	P	P	P	G	P	P	M	A M	P
	Earlier designs:									
<b>best pick</b>	<b>FORD WINDSTAR</b> 1995-98 models test vehicle wt. = 3,816 lbs.	G	G	G	G	G	G	G	P	A
	<b>MAZDA MPV</b> 1996-98 models test vehicle wt. = 3,799 lbs.	M	M	G	G	M	A	M	M	P
	<b>DODGE GRAND CARAVAN</b> <b>PLYMOUTH GRAND VOYAGER</b> <b>CHRYSLER TOWN &amp; COUNTRY</b> 1996-2000 models test vehicle wt. = 4,046 lbs.	M	A	G	G	P	P	A	M P	P
	<b>HONDA ODYSSEY</b> 1995-98 models test vehicle wt. = 3,422 lbs.	M	P	G	G	A	P	A	M	A
	<b>ISUZU OASIS</b> 1996-99 models									
	<b>NISSAN QUEST</b> <b>MERCURY VILLAGER</b> 1996-98 models test vehicle wt. = 3,834 lbs.	M	A	A	G	P	P	M	M	M
	<b>FORD AEROSTAR</b> 1992-97 models test vehicle wt. = 3,699 lbs.	P	P	A	G	P	G	M	P	P
	<b>TOYOTA PREVIA</b> 1994-97 models test vehicle wt. = 3,810 lbs.	P	M	M	G	M	P	P	A M	P

depends on seat

depends on seat

depends on seat

depends on seat

depends on seat

depends on seat

depends on seat