

Special issue: frontal crash test verifications

# STATUS REPORT

INSURANCE INSTITUTE  
FOR HIGHWAY SAFETY

Vol. 41, No. 3, March 29, 2006

## MAJOR CHANGE IN FRONTAL CRASHWORTHINESS EVALUATIONS

BASED ON SUCCESS OF THIS PROGRAM

Frontal offset crash tests conducted by the Institute since 1995 have prompted huge improvements in how vehicles protect people in frontal crashes. Now this consumer information program is undergoing a major change.

The Institute evaluates the crashworthiness of passenger vehicles based on 40 mph frontal offset crash

tests in which the driver side of the front of a vehicle strikes a deformable barrier. Institute researchers evaluate the test performance of each vehicle and assign comparative ratings of good, acceptable, marginal, or poor. More than 200 car, SUV, and pickup truck designs have been rated (see *Status Report*, March 20, 2001; on the web at [www.iihs.org](http://www.iihs.org)).

When the Institute began evaluating frontal crashworthiness by vehicle group, beginning in the mid-1990s, about half of the 80 vehicles that were tested earned marginal or poor ratings. More were rated poor than good.

Then manufacturers responded by changing the designs of their vehicles to improve frontal crashworthiness. The result has been a turnaround in the frontal ratings. Eighty-eight of the 106 current passenger vehicle designs the Institute has evaluated earn good ratings (see bar charts, pp. 4-5). None is poor, and only 2 of the 106 current designs are rated marginal.

“This program has been a huge success,” says Institute president Adrian Lund, “and because of this success frontal offset tests no longer are providing consumers

## VERIFICATION SELECTION OF VEHICLES



**GOOD RATINGS OF EARLIER CAMRY AND EXPLORER DESIGNS QUALIFY THESE MODELS AND SELECTED OTHERS FOR THE INSTITUTE'S NEW APPROACH TO FRONTAL RATINGS BASED ON MANUFACTURERS' TESTS. HOW WILL INSTITUTE RESEARCHERS KNOW IF THE TEST DATA SUBMITTED BY MANUFACTURERS FOR VERIFICATION ARE ACCURATE? BY CONDUCTING AUDIT TESTS. THE FIRST AUDIT WAS OF THE BUICK LUCERNE. WHEN INSTITUTE RESEARCHERS COMPARED THE RESULTS OF THEIR OWN TEST OF THE LUCERNE WITH RESULTS SUPPLIED BY GENERAL MOTORS, THE RATINGS WERE VERY SIMILAR. THE LUCERNE PASSED.**



with much useful information to differentiate among vehicles' frontal crashworthiness. We've reached the point where we can declare victory and move on."

**Details of test verification:** Moving on doesn't mean abandoning frontal offset crash protection. Instead the Institute is initiating a new approach involving evaluations based on manufacturers' own frontal tests of vehicles meeting requirements es-

# AUDIT TESTS

## BUICK LUCERNE

RESULTS OF INSTITUTE AUDIT TEST ARE VERY SIMILAR TO RESULTS SUBMITTED BY MANUFACTURER

	OVERALL	STRUCTURE	HEAD/NECK INJURY MEASURES	CHEST INJURY MEASURES	LEFT LEG/FOOT INJURY MEASURES	RIGHT LEG/FOOT INJURY MEASURES	RESTRAINTS
MANUFACTURER'S FRONTAL TEST	G	G	G	G	A	M	G
INSTITUTE'S AUDIT TEST	G	G	G	G	G	A	G

■ GOOD  
■ ACCEPTABLE  
■ MARGINAL  
■ POOR

established by the Institute. The manufacturers are providing detailed information from their offset tests, including video, and the Institute is assessing this information, assigning ratings, and conducting audit tests to verify manufacturers' results.

Only redesigned vehicles with immediate predecessors that earned the top rating of good in previous Institute tests are eligible for verification. Substantially redesigned

vehicles with significant changes in size, weight, or body style aren't eligible. The Institute will continue testing these vehicles.

"The verification approach assures that automakers still pay attention to offset crash protection as they redesign their older models and introduce new ones. This approach is possible because of the manufacturers' actions during the past decade. They have incorporated offset crash test

performance plus government-required and other consumer information crash testing into their guidelines. They routinely conduct their own offset tests during the design process," Lund points out.

Recognizing this effort, the verification approach goes a step beyond an Institute policy that has been in place since the beginning of the frontal test program. Manufacturers always have been asked to confirm whether the

Institute's ratings could be carried over from one model year to the next. Based on this information, the Institute has been carrying over ratings for vehicles with no significant design changes.

"The manufacturers will assume a bigger role now that our frontal test is a de facto industry standard. This is how it should work. When most every vehicle passes the test, it's time to simply keep an eye out to make sure manufacturers continue the good work," Lund says. "In the meantime we'll keep the pressure on the manufacturers to improve crashworthiness in side impacts and to design seat/head restraints so they do a better job of reducing the risk of whiplash in rear crashes. We'll also look at other areas where crashworthiness improvements still can be made."

**Nine vehicles for verification:** The vehicles selected for the first round of test verification are all new or redesigned models for the 2006 or 2007 model year. These include a midsize moderately priced car (Toyota Camry), three large family cars (Buick Lucerne, Chevrolet Impala, and Hyundai Azera), one small SUV (Toyota RAV4), three midsize SUVs (Ford Explorer, Honda Pilot, and Mercedes M class), and a large pickup (Dodge Ram 1500).

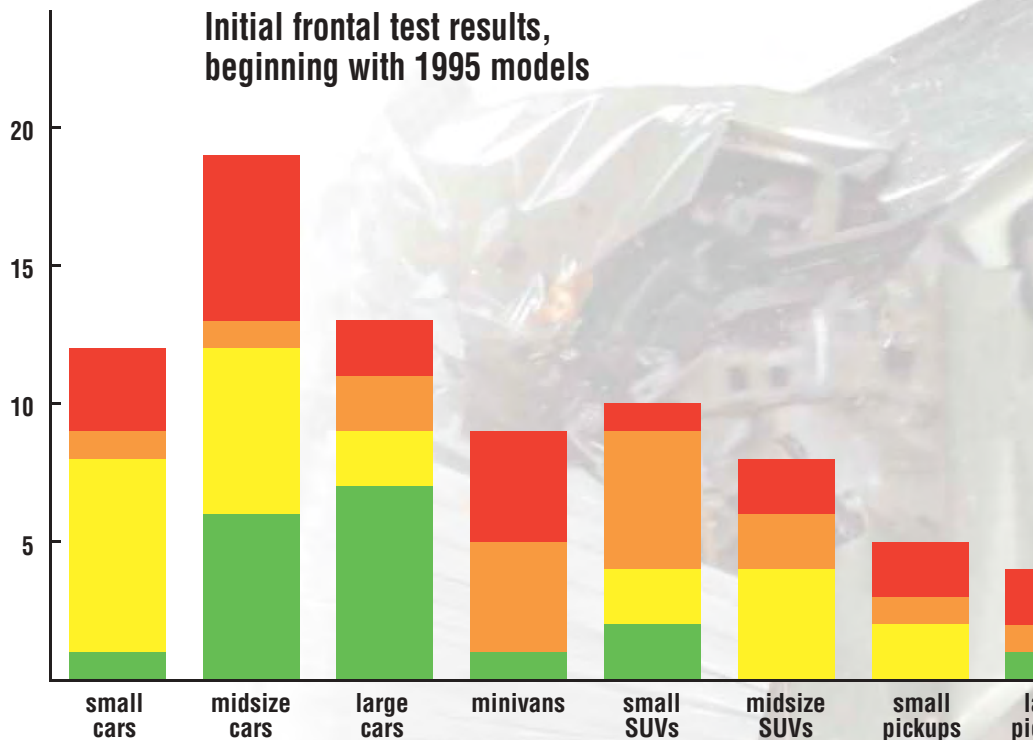
The manufacturers supplied information on basic vehicle and test parameters, measurements of intrusion into the occupant compartment, injury data recorded on a dummy representing an average-size man in the driver seat, and video of the tests. Institute engineers reviewed this information and rated the vehicles based on the same evaluation parameters that always have been used.

Eight of the nine vehicles earn good frontal crashworthiness ratings. The Impala is acceptable. A major benefit of this program is that the Institute can provide these and subsequent frontal ratings to consumers earlier in the model year.

**Audits keep automakers on up and up:** To ensure the auto manufacturers' good faith participation in the new evaluation procedures, the Institute is conducting audit tests. Institute engineers selected the Buick Lucerne for the first audit, and the results of this test confirm the data sup-

# SUCCESS OF FRONTAL CRASH TEST PROGRAM

**NUMBER OF VEHICLES RATED GOOD, ACCEPTABLE, MARGINAL, AND POOR BY VEHICLE GROUP, INITIAL TESTS VERSUS TESTS OF CURRENT DESIGN**



## IN THE FIRST ROUND OF FRONTAL CRASH TESTING, THE RATINGS FOR MOST VEHICLES WERE FAR FROM GOOD

When the Institute began conducting 40 mph frontal offset crash tests for consumer information, beginning in the mid-1990s, about half of the vehicles tested were rated marginal or poor. More were rated poor than good. No small SUVs or small pickup trucks earned good ratings. Only one minivan and one pickup truck earned good ratings. Media coverage of these subpar performance prompted auto manufacturers to begin improving the designs of their vehicles to protect people better in frontal crashes.

# FRONTAL CRASH

## POOR SIGNS



### **BIG TURNAROUND IN FRONTAL EVALUATIONS: NOW MORE THAN 80 PERCENT OF VEHICLES EARN GOOD RATINGS IN OFFSET CRASH TESTS**

No current vehicle designs are rated poor for frontal crashworthiness, based on Institute tests. Only two are marginal, and more than four of every five are rated good. All current minivan designs are rated good or acceptable — a big turnaround from the first round of tests, when only one was rated good and the rest were poor or marginal. This dramatic improvement in the ratings across all vehicle groups paved the way for the Institute to begin verifying vehicles' frontal crash test performances instead of testing every new vehicle design.

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2004 MITSUBISHI GALANT



1995 MITSUBISHI GALANT



1999 MITSUBISHI GALANT

plied by the manufacturer from its own test (see p.3). The Lucerne's structure held up with little deformation of the safety cage in the test. Most of the injury measures recorded on the driver dummy were low. The car is rated good.

"This level of performance is the norm now," Lund notes.

**How vehicles have been improved:** The Institute's test primarily assesses how well a vehicle's front-end crush zone absorbs energy during a crash and, in turn, how well the occupant compartment, or safety cage, holds together. If the compartment remains largely intact, then the restraint systems can control the motion of the crash test dummy and help keep injury measures low. But if there's significant deformation of the safety cage and intrusion into the compartment, then the restraint systems are less likely to keep the measures low.

Newer vehicles have much stronger occupant compartments, in large part because of the steps automakers have taken in the past decade to earn good ratings in the In-

## EXAMPLE: MITSUBISHI IMPROVES THE GALANT'S DESIGN

**The 1995 Galant was one of the poorest performers in the Institute's first round of frontal offset crash tests. The redesigned 1999 model improved. There was much less safety cage deformation, and more room was preserved around the driver dummy. The 2004 design shows even more structural improvement.**

stitute's frontal tests. An example of this improvement is the Mitsubishi Galant.

When the Institute tested a 1995 model, the occupant compartment virtually collapsed. The dummy's movement wasn't well controlled, in part because the safety cage crumpled. The dummy moved around the left side of the inflating airbag, and its left shoulder hit the sharp edge of the buckling window frame. Its left knee pushed through the instrument panel and hit the steering column's attachment hardware, gashing the dummy's vinyl "skin" at the knee.

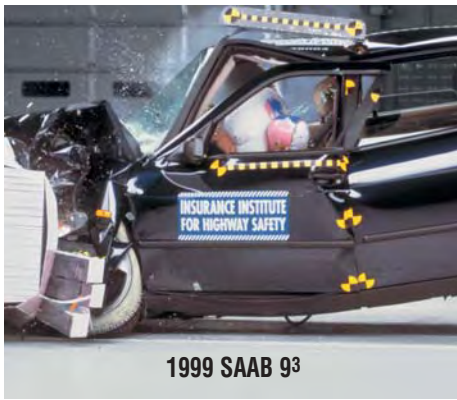
The dummies in tests of many other vehicles in the mid-1990s didn't fare much better

than in the Galant. But this car has been improved since then, and so have other vehicles. The 1999 Galant's performance represented a big improvement. There was much less deformation of the safety cage. The rating of the structure improved to acceptable, and injury measures weren't as high as in the 1995 test. Even more improvement is apparent in the redesigned 2004 Galant.

"The new model shows what Mitsubishi and other manufacturers have done to improve frontal crashworthiness," Lund says. "From the leading edge of the 2004's front door backward, virtually no deformation occurred in the test. The driver's sur-



1995 SAAB 900



1999 SAAB 93



2003 SAAB 93

### EXAMPLE: SAAB IMPROVES 93 DESIGN COMPARED WITH 900

**When the Institute tested the 1995 Saab 900, the occupant compartment all but collapsed. Then Saab improved the structure when it introduced the 93 in 1999. This design's occupant compartment held up better than the 900's, and the subsequently redesigned 2003 model sustained virtually no compartment deformation.**

vival space held up very well, leaving room for the airbags and belts to do their jobs.”

Some cars have been good performers from the beginning of the Institute's program. Three successive designs of the Ford Taurus earned the highest rating in the frontal test. But the rating for the recently tested Ford Fusion isn't good. The structure of this car, a brand new design, held up well, but the frontal evaluation is acceptable because of high forces on the dummy's right leg.

“We think this will be rare,” Lund says. “Automakers have figured out how to design cars to protect people in frontal crashes, and they're not likely to backslide.”

**Risk is lower in vehicles rated good:** The improved designs of newer vehicles are doing more than earning manufacturers good ratings in the Institute's crash test. They're also saving lives.

Research shows that drivers of vehicles with good ratings, based on the Institute's frontal offset test, are at significantly lower risk of fatal injuries in real-world frontal crashes, compared with drivers of vehicles rated poor. Institute chief statistician Charles Farmer first reported this in 2004 (see *Status Report*, Feb. 7, 2004; on the web at [www.iihs.org](http://www.iihs.org)) and since then has updated his analysis based on more data.

The new analysis examines 14 years of federal records on crash deaths and identifies passenger vehicles that have been rated good, acceptable, marginal, or poor based on the Institute's crash test. Then Farmer related the frontal ratings to fatality risk in real-world crashes.

Controlling for differences in vehicle weight, driver age and gender, and other factors, he found that drivers of vehicles rated good are about 46 percent less likely to die in a frontal crash than drivers in the poor-rated vehicles they crash into. Drivers of vehicles rated acceptable or marginal are about 33 percent less likely to die than the motorists in the poor-rated vehicles.

“To ensure that real-world risks continue to diminish, we've got to preserve the vehicle design improvements that have been made in response to our frontal crash test program. This is what test verification is all about. It's about making sure manufacturers continue to design cars that will protect their occupants in serious frontal crashes,” Lund concludes.

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## SPECIAL ISSUE

This special issue focuses on frontal crash test ratings. Recent special issues have focused on:

Crash incompatibilities	40:5 (2005)
Alcohol-impaired driving	40:4 (2005)
Driver death rates	40:3 (2005)
Rear crash protection	39:10 (2004)
Side impact crash tests	39:5 (2004)
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Side impact crash tests	38:7 (2003)
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# CHANGES IN THE WORKS

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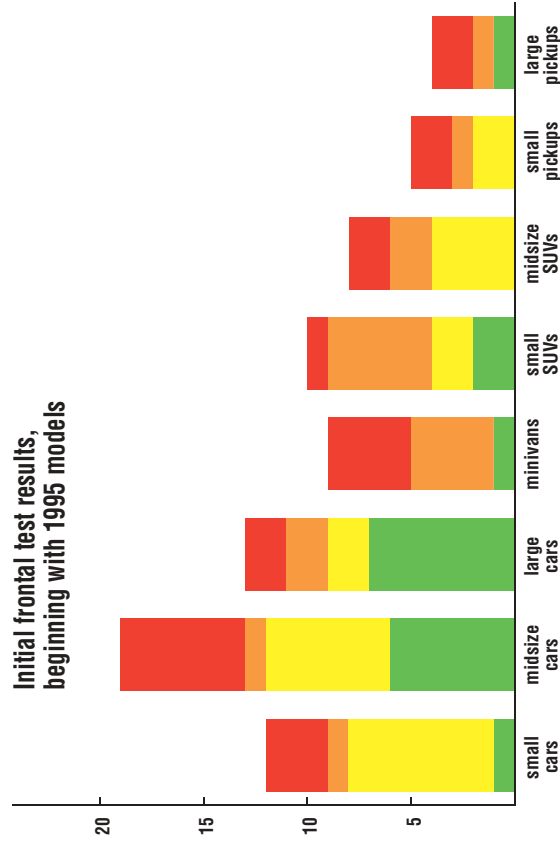
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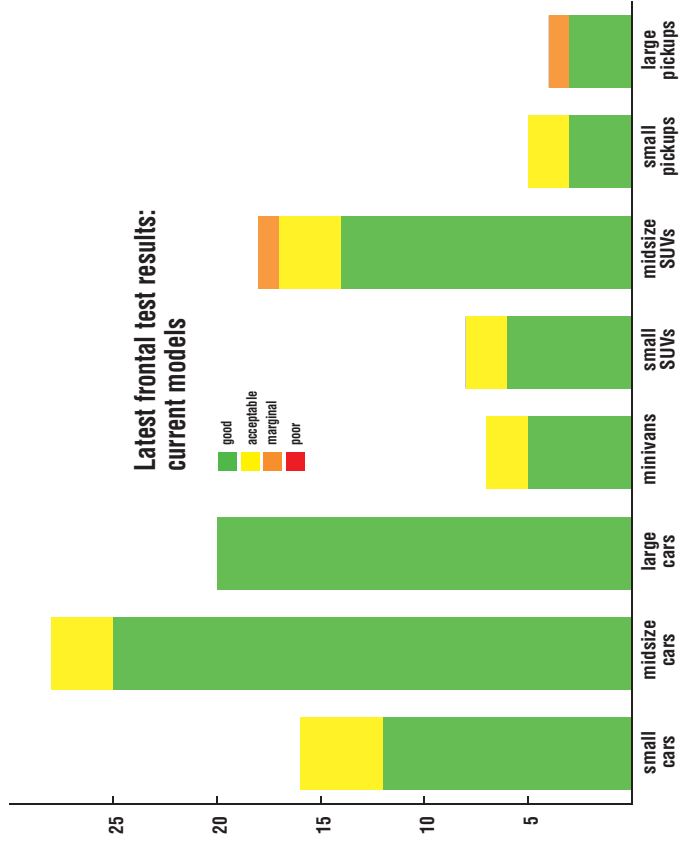
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