

# STATUS REPORT

INSURANCE INSTITUTE  
FOR HIGHWAY SAFETY

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## Styling recalls 1960s Safety is up-to-the-minute '90s

The Volkswagen Beetle of the 1960s is a pop culture icon to which the 1998 New Beetle pays homage, right down to the built-in bud vase in the dashboard. But the reincarnated Beetle's crashworthiness performance is as up-to-the-minute as its styling is retro. In fact, the New Beetle sets the standard among small cars for how well it protects its occupants

in serious crashes, as measured in the Institute's frontal offset crash test at 40 mph.

The original Beetle didn't earn safety kudos. In 1966, Ralph Nader told a Senate subcommittee that "it is hard to find a more dangerous car." That may have been true in the 1960s, but the 1998 New Beetle is a whole different story.

**Best performer:** The Institute has evaluated 16 small cars for crashworthiness, “and the New Beetle is the best by far,” Institute President Brian O’Neill points out. Here’s what’s special about this car compared with other small 1997-98 models the Institute has evaluated:

1. The Beetle is the only model to earn an overall evaluation of good and a “best pick” designation. Among the other 15

OVERALL  
CRASHWORTHINESS  
EVALUATIONS,  
SMALL CARS



VOLKSWAGEN NEW BEETLE 1998 models	G
HONDA CIVIC 1996-98 models	A
TOYOTA COROLLA CHEVROLET PRIZM 1998 models	A
FORD ESCORT MERCURY TRACER 1997-98 models	A
HYUNDAI ELANTRA 1996-98 models	A
SATURN SL 1995-98 models	A
MAZDA PROTEGE 1995-98 models	A
NISSAN SENTRA 1998 models	A
VOLKSWAGEN JETTA/GOLF 1994-98 models	M
MITSUBISHI MIRAGE 1997-98 models	P
DODGE/PLYMOUTH NEON 1995-98 models	P
KIA SEPHIA 1996-97 models	P

GOOD	G
ACCEPTABLE	A
MARGINAL	M
POOR	P

models, 9 are rated acceptable, 2 are marginal, and 4 are poor overall. This also is the only model among the 16 to earn a good evaluation for structural performance in the Institute’s frontal offset crash test — impressive because the test is so demanding of vehicle structure, or safety cage.

2. The Beetle is the only model among the 16 with head restraint geometry rated good, indicating the restraint is high enough and close enough to the back of an average-size male’s head to limit relative head and torso movement in rear-end collisions. Such movement often causes whiplash injuries.

3. The Beetle sustained by far the least amount of damage in four low-speed (5 mph) crash tests — a total of \$134 damage compared with more than \$1,000 damage to most small cars and more than \$3,000 damage to the worst performer (see “Bumpers are excellent,” p.5).

4. The Beetle is one of only a few small car models with airbags to protect people in side impacts. It’s also one of the few with shoulder belt crash tensioners to prevent slack from allowing excessive forward movement in a crash and devices to limit belt force on occupants.

Crashworthiness evaluations are based primarily on performance in a 40 mph frontal offset crash test. All vehicles are rated in three categories and then assigned overall evaluations of good, acceptable, marginal, or poor. Head restraint design and bumper performance in low-speed crash tests don’t affect the overall evaluations but are considered when establishing vehicle rankings within each group (small cars, midsize four-door cars, etc.).

“The Beetle’s excellent crashworthiness design plus its bumpers that resist damage indicate the commitment Volkswagen’s senior management — Rudiger Schmidt in particular — has made to becoming a leader in this area,” O’Neill points out. “Now this commitment of Volkswagen is paying off with two 1998 car models — the Passat as well as the (continued on p.6)





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98 VW NEW BEETLE  
CF98010

INSIDE THE OCCUPANT  
COMPARTMENT, ONLY  
THE DEPLOYED AIRBAG  
INDICATES THE  
SERIOUSNESS OF  
THE OFFSET IMPACT.  
THE DRIVER SPACE  
WAS MAINTAINED  
EXCEPTIONALLY WELL.



# IMPROVED



1998 PASSAT

1995 PASSAT

With the 1998 Passat, Volkswagen corrected problems evident in the previous model. One of these was poorly controlled dummy movement due in part to excessive floor buckling and seat tipping. When the 1995 model was tested, the dummy's head finished between the roof rail and door frame (left). In the 1998 Passat test, dummy movement was well controlled (above).



## New model designs show automakers focus on offset testing

Since the early 1990s, automakers have designed new vehicles to do well in federal New Car Assessment Program (NCAP) full-width crash tests, but the manufacturers haven't always focused on improving performance in frontal offset tests like the ones the Institute conducts.

This is changing. Two automakers in particular — Toyota and Volkswagen — have made great strides in building more crashworthy cars than they did in the past. These and other import and domestic automakers now routinely do frontal offset testing using deformable barriers during the new car development process. Offset test programs providing consumers information on vehicle crashworthiness also are conducted in Australia, Europe, and Japan. Even the U.S. government is contemplating offset tests to complement NCAP full-width rigid barrier tests.

“There's a recognition now among automakers that the best way to assess vehicle frontal crashworthiness is with both test configurations — offset plus full-width,” says Brian O'Neill, Institute president.

Full-width barrier tests like NCAP's are good measures of restraint system performance, but they aren't as demanding of vehicle structure. Offsets are demanding of occupant compartment integrity but not as demanding of restraints. In offsets, only part of the front end hits the barrier so a smaller part of a car's structure must manage the crash energy.

When the Institute in 1992 asked 17 automakers about their test programs, 8 manufacturers — all imports — said in addition to compliance and NCAP tests, they were doing some type of offset crash (see *Status Report*, Vol. 27, No. 15, Dec. 19, 1992). Various types of barriers, offset an-

gles, and test speeds were used. Now the most common offset configuration is 40 percent of a vehicle's front end into a deformable barrier.

Volkswagen's New Beetle is designed to perform well in a range of crash tests, including offset frontal and full-width tests and low-speed bumper performance evaluations. This small car is the first of its size class to earn a crashworthiness “best pick” rating from the Institute.

Earlier this year another Volkswagen, the redesigned 1998 Passat, earned the same top rating. This is a marked improvement over the poor performance of the 1995 Passat (see *Status Report*, Vol. 33, No. 2, March 7, 1998).

Toyota proved this year that it's working to improve offset test performance. The 1996 Previa van got a poor overall rating from the Institute, but the all-new 1998



OLD DESIGN

1998 SIENNA  
1996 PREVIA

Crash performance differences between Toyota's 1996 Previa minivan and its newly designed 1998 Sienna are easy to see. There was a lot of occupant compartment intrusion in the Previa (above), and too much slack in the driver belt. In the Sienna test (left), the dummy stayed in position, and the occupant space held up well.

Sienna is the best minivan the Institute has ever tested. The redesigned 1997 Camry earned a "best pick" rating, too, after its predecessor 1995 model was rated acceptable. Likewise, Toyota modified the structure of the 1998 Avalon to do better in frontal offset tests. The car improved from marginal in 1996 to acceptable in 1998.

"We expect to see bigger improvements in models from other automakers, too, as they introduce new designs," O'Neill says. "It's easier to incorporate structural improvements in vehicles when new models are being developed than it is to modify structures without changing the entire design of the car."

## Bumpers are excellent Damage to VW's New Beetle is minimal in low-speed crash tests

The New Beetles now arriving at dealer showrooms are equipped with excellent bumpers. Both front and rear bumpers will prevent much of the damage that can occur in low-speed collisions, the kind of crash that frequently happens in congested urban traffic. This is the finding of a series of four Institute crash tests conducted at 5 mph — little more than walking speed — to assess bumper performance.

In all four tests, damage to the Beetle totaled only \$134. "This is way below what we typically see," Institute President Brian O'Neill says. "There was much less damage than to any other 1997 or '98 small car we tested. In fact, the Beetle is the only car the Institute has tested that begins to compare with the 1981 Ford Escort, which sustained no damage in any of the four tests at 5 mph."

In comparison, the second best performer among 1997-98 small cars was the Saturn SL, which sustained more than

\$600 damage in the same four tests. All other small cars except the Toyota Corolla sustained more than \$1,000 damage. The worst performer, the Hyundai Elantra, sustained more than \$3,000 damage.

The Institute's low-speed crash test series includes front and rear flat-barrier impacts plus two localized impacts, front-into-angle-barrier and rear-into-pole.

In the most demanding of the four tests, rear-into-pole, the Beetle sustained no damage at all. Only the Saturn matched this performance. In contrast, the Elantra sustained more than \$1,700 damage in the same test.

The Beetle's superior bumpers "show what can be accomplished when a manufacturer decides to make damage resistance a priority," O'Neill points out. He adds that the flimsier bumpers on competing models "mean lots of unnecessary damage in minor impacts, higher insurance bills, deductibles paid out of consumers' pockets, and the major inconvenience of doing without a car while it's in the shop to repair damage that likely wouldn't have occurred to the Beetle in the same low-speed collision."

DAMAGE REPAIR COSTS: 1997-98 SMALL CARS, 5 MPH TESTS

	Front Into Barrier	Rear Into Barrier	Front Into Angle Barrier	Rear Into Pole	Total Damage
Volkswagen New Beetle	\$16	\$0	\$118	\$0	\$134
Saturn SL2	\$105	\$50	\$501	\$0	\$656
Toyota Corolla LE	\$0	\$316	\$283	\$250	\$849
Nissan Sentra GXE	\$368	\$0	\$624	\$37	\$1,029
Dodge Neon Highline	\$132	\$81	\$331	\$494	\$1,038
Volkswagen Jetta GL	\$141	\$0	\$718	\$236	\$1,095
Honda Civic LX	\$55	\$80	\$797	\$460	\$1,392
Ford Escort LX	\$237	\$148	\$757	\$642	\$1,784
Mazda Protege LX	\$599	\$135	\$461	\$700	\$1,895
Mitsubishi Mirage DE	\$562	\$243	\$856	\$972	\$2,633
Kia Sephia LS	\$353	\$438	\$727	\$1,298	\$2,816
Hyundai Elantra	\$228	\$386	\$717	\$1,711	\$3,042

Repair costs reflect March 1998 prices

(continued from p.2) Beetle — that earn good overall crashworthiness ratings.”

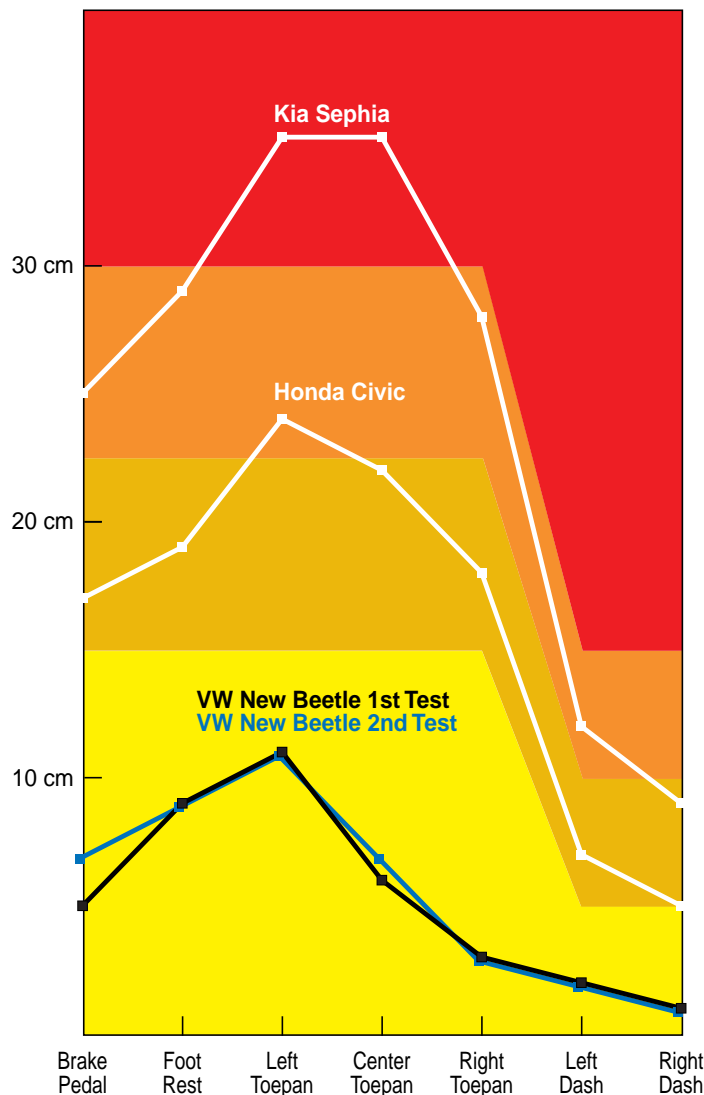
The Institute tested the New Beetle twice at 40 mph. In the first test, it earned a good overall evaluation. But following discussions with Volkswagen about restraint system performance, the automaker reduced the size of the airbag vent hole and requested a second test. The Institute’s crashworthiness evaluation covers both tests, but the ratings are based on the second test because the airbag design change will be introduced in this model year.

In both tests, there was minimal intrusion into the driver footwell area. Dummy movement was reasonably well controlled during both tests at 40 mph, although the airbag and safety belt system did allow the dummy’s head to contact the steering wheel through the airbag late in both crashes.

Measures taken from the dummy’s neck, chest, and both legs in the offset tests indicate low risk of injury to these body regions. However, forces on the head from hitting the steering wheel in the first test were high enough to indicate the possibility of minor head injury — rated acceptable. In the second test, the forces recorded from head contact were lower.

“The structural performance was impressive,” O’Neill explains. “The front-end crush zone managed the crash energy very well so that damage was kept away from the occupant compartment. The driver space was maintained so well that, after the 40 mph crash tests, the deployed airbags were the only obvious indications inside the occupant compartments that the impacts had been serious. Later, when

**Intrusion measurements, 40 mph offset crash test, three small cars**



we measured the precise amounts and pattern of the intrusion into the New Beetle’s occupant compartment, our initial assessment was confirmed. There was much less intrusion than in the other small cars we previously tested” (see graph, above).

**How performance is assessed:** Institute researchers use a 40 mph offset crash test to evaluate three important aspects of passenger vehicle crashworthiness. The first is how well the front-end crush zone manages crash energy and the safety cage limits occupant compartment intrusion. The second is injury risk measured on a dummy representing an average-size male

in the driver seat. The third aspect is how well the dummy’s movement is controlled during the impact.

Vehicle structure, injury measures, and occupant restraints are evaluated separately in the Institute’s 40 mph frontal offset crash test — even though these three aspects are related — because good performance in any one of the three categories by itself in a single test isn’t sufficient to reliably indicate good crashworthiness. The same 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.

The Institute’s crashworthiness evaluations also reflect the adequacy of front-seat head restraint designs and bumper performance in four crash tests at 5 mph.

**Complementary tests:**

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, the improved restraint systems in new passenger vehicles.

The Institute’s frontal offset test, which involves 40 percent of a vehicle’s front end hitting a deformable barrier at 40 mph, complements the federal test involving the full width of the front end hitting a rigid barrier. The government’s test is especially demanding of vehicles’ restraint systems but not so much so of vehicle structure. An offset test is more demanding of vehicle structure.



55

65

75

## Fatal crashes rise with highway speed limits

Findings of new federal report reinforce Institute's 1997 speed limit study

When Congress repealed the national maximum speed limit in 1995, it told the U.S. Department of Transportation to monitor the impact of higher limits and report back. Now the report is in, and results "follow the historical pattern," the government says — deaths are up where speed limits are up.

"States that increased speed limits in 1996 experienced approximately 350 more interstate fatalities than would have been expected based on historical trends — about 9 percent above expectations," the report says. "Concurrently,

the interstate fatalities in states that did not increase speed limits in 1996 were consistent with pre-1996 trends."

Last year, the Institute analyzed the effect of higher speed limits on urban and rural freeways during the last 9 months of 1996 and found fatal crashes were up 12 percent over what was expected (see *Status Report*, Vol. 32, No. 8, Oct. 11, 1997).

There are some analytical differences between the two reports. For example, the Institute study focused on 12 states that raised speed limits prior to August

1996 and included other freeways as well as interstate highways. The federal report covered 32 states, some not raising speed limits until August 1996, and was restricted to interstates only.

But neither these nor other differences obscure the bottom line — the significant evidence of an increase in fatalities following the latest round of speed limit increases.

For more, see "Report to Congress: The Effect of Increased Speed Limits in the Post-NMSL Era," U.S. Department of Transportation, February 1998.

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