

Crash Compatibility and Consumer Testing for Safety

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I. Introduction

For decades U.S. car manufacturers believed that safety would not sell cars. This belief was based on Detroit folklore concerning 1956 model year Fords. In that year, faced with restyled Chevrolets, Ford made a last-ditch effort to salvage sales of its uncompetitive models by stressing safety in its advertising campaign. But Ford cars did not sell especially well, compared with Chevrolets, and this became the basis for the "safety doesn't sell" myth. The relatively poor showing of the 1956 Fords invariably is attributed to the "safety" advertising, even though it was reported that Ford officials themselves estimated that without the advertising campaign about 200,000 fewer Fords would have been sold.

What also has been overlooked about the 1956 Ford experience is that the company could not keep up with demand for the optional seat belts offered as part of its “safety” advertising effort. According to Ford, the belts generated a demand “considerably higher than originally anticipated,” and crash padding, which also was an option in 1956 Fords, had the most successful first-year sales of any optional feature. Still the myth took hold that safety cannot be sold. Except for companies like Volvo and Mercedes-Benz safety was not featured in marketing. It was not until 1987 that a Ford executive admitted that the myth about safety not selling was yesterday’s news — times have changed; people are interested. *Ford Executive Addresses Automotive News World Congress*, PR Newswire, Jul. 28, 1987.

Now virtually all automakers are moving faster on safety advancements than government regulations require. They are scrambling to design and install features like side airbags, for which federal requirements are not even being considered.

Table 1 illustrates why manufacturers are interested in marketing safety. This means that the marketplace now is driving the pace of advancement independent of — and much faster than — government regulation.

Table 1
Percentage of New Car Buyers for Whom
Safety Features are “Extremely” or “Very
Important” Reasons For Buying

1981	64%
1983	67%
1985	73%
1987	74%
1989	76%
1991	77%
1993	79%
1995	83%
1997	83%
1999	84%
2000	85%
2001	85%

Source: DaimlerChrysler New Vehicle Experience

II. Consumer Safety Information

“What is the safest car?” This is probably the most frequent question consumers ask vehicle safety professionals. There is no simple answer. Passenger vehicle occupants are not ever free from risk, no matter what vehicle they travel in. Defining the “safest” car is impossible because real crashes involve a range of speeds and configurations, and it simply is not possible to assess performance in all of them.

Inability to answer the ultimate question does not mean it is impossible for consumers to make informed safety choices when shopping for cars. Crash tests of new vehicles, which have been conducted for more than 20 years in the United States, have become an established source of comparative information to help consumers factor safety into their

purchases. Media coverage of the tests, especially those with poor results, and public reaction have proven effective in prompting automakers to improve crashworthiness, particularly in recent years when safety has become a more and more important marketing attribute.

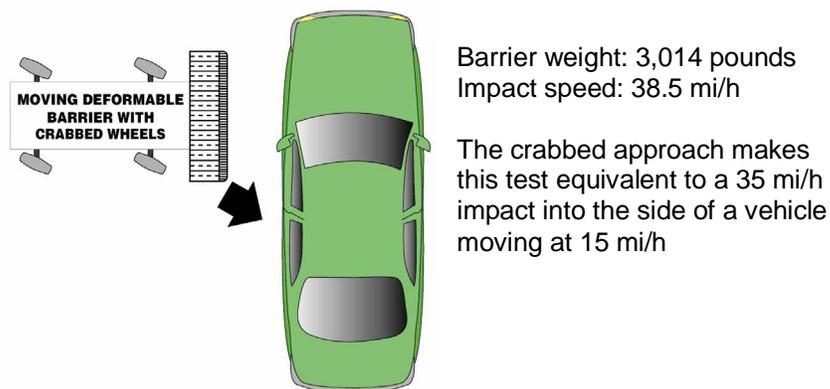
The first U.S. crash tests conducted for consumer information were the federal government's New Car Assessment Program (NCAP) impacts, begun in 1978. Frontal tests in this program are 30 mi/h full-width impacts against a flat, rigid barrier. Vehicle ratings are based on injury measures from belted Hybrid III dummies in the driver and right front passenger seats. These measures indicate the risk of serious and life-threatening injuries to the head or chest in serious frontal crashes. NCAP results are summarized in star ratings; 5 stars (★★★★★) represent the best performance, 1 star (★) the worst. www.nhtsa.gov/cars/testing/ncap/intro.html.

This program has produced important vehicle design improvements, in particular restraint system improvements. Even before the widespread installation of airbags, which lowered head injury criteria in NCAP tests, the test results had prompted many automakers to improve the way safety belts performed and how they interacted with steering columns, seats, and other restraint system components. For example, early NCAP tests identified a number of cars with steering columns that moved upward with great force into the faces of driver dummies. These poor designs were quickly improved.

Today most companies selling passenger vehicles in the U.S. market have established good NCAP frontal crash test performance as either an internal design requirement or a target. Thus, getting good NCAP ratings has become a de facto standard for much of the industry.

The program expanded in 1997 when side impacts were added to the frontal tests (Figure 1). U.S. NCAP side impacts use moving barriers with a deformable front end weighing 3,014 pounds representing the front of a car to strike the sides of the vehicles being assessed at 38.5 mi/h. www.nhtsa.gov/cars/testing/ncap/intro.html. As in the frontal tests, star ratings indicate the chance of life-threatening chest injury for the driver, front passenger, and rear passenger. This moving deformable barrier (MDB) was developed

Figure 1
U.S. Side Impact Test

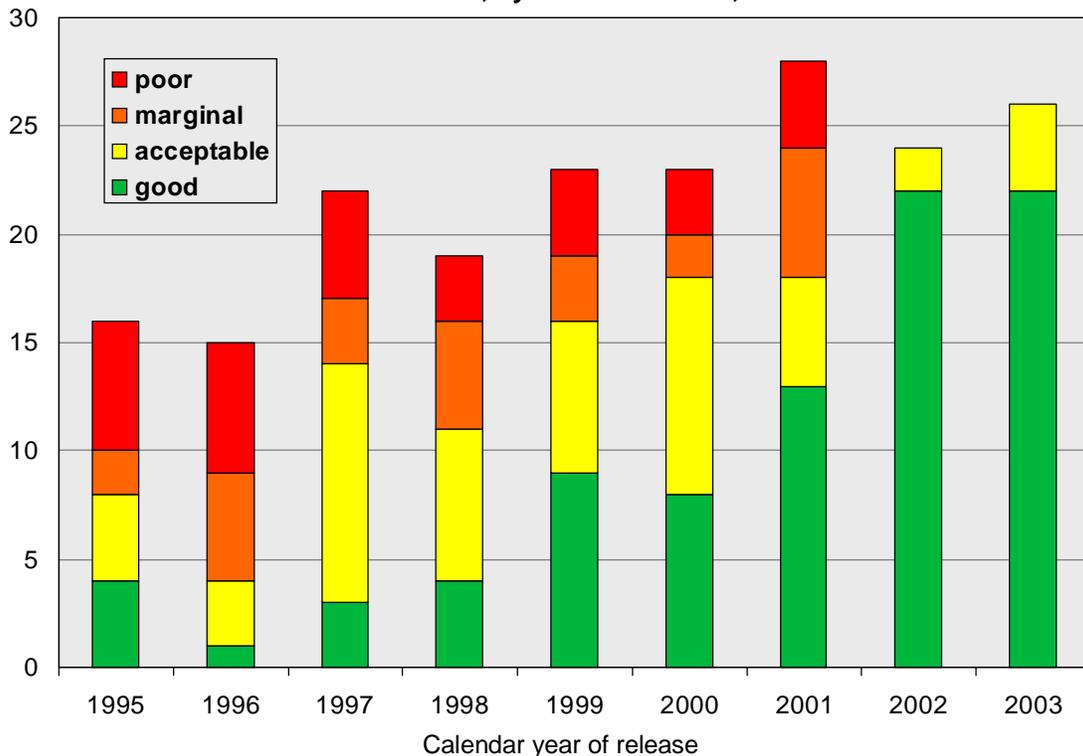


in the early 1980s, when cars represented most vehicles on the road. The height of the barrier's front end is below the heads of the dummies that measure injury risks in the side-struck vehicles. As a result, these tests do not assess the risks of head injury from impacts with taller vehicles like sport utility vehicles (SUVs) and pickups, which now are common on U.S. roads.

In 1995 the Insurance Institute for Highway Safety (IIHS) began frontal offset crash tests of new passenger vehicles to provide additional consumer information about crashworthiness. In these tests 40 percent of a car's front-end width strikes a barrier with a deformable element at 40 mi/h. Each car's overall evaluation is based on three aspects of performance. Foremost is structural performance based on measures indicating the amount and pattern of intrusion into the driver space. This aspect indicates how well the front-end crush zone manages the crash energy and prevents intrusion into the safety cage. Injury risk indicators are obtained from a belted 50th percentile male Hybrid III driver dummy. How well the restraint system controls dummy movement during the crash also is assessed. Each tested car gets an overall evaluation (good, acceptable, marginal, or poor) based on these three aspects of performance. www.iihs.org/vehicle_ratings/ce/offset.htm.

As with U.S. NCAP, this offset test program has quickly produced improvements in vehicle performance. In 1995 when the program began and for several years, many of the vehicles tested were poor performers. But almost all tested vehicles in 2002 and 2003 were good performers, with a few acceptable and no poor or marginal ratings (Figure 2).

Figure 2
IIHS Frontal Crashworthiness Ratings, Number
of Vehicles Tested, by Year of Release, 1995-2003

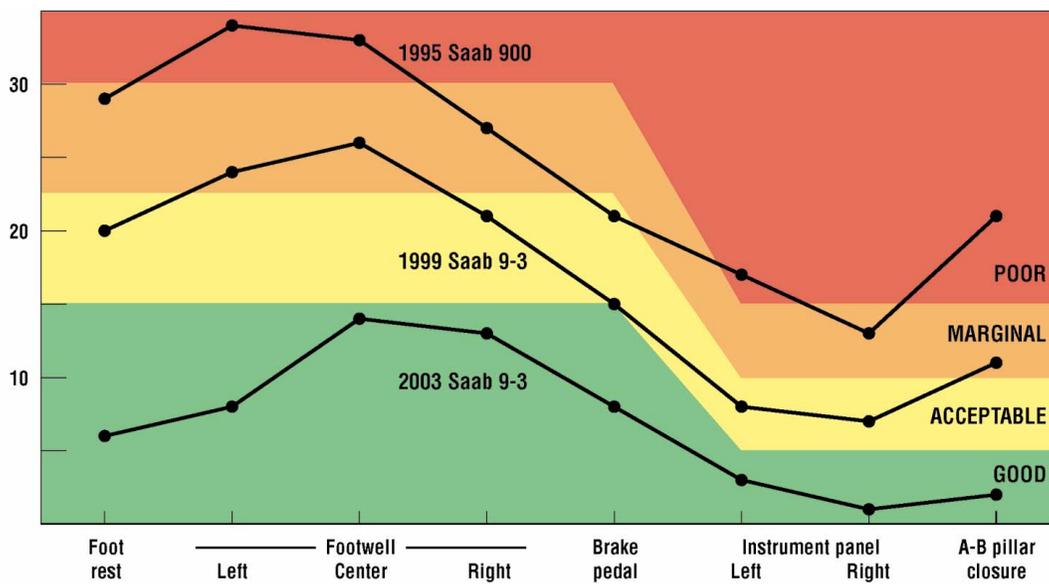


A good illustration of the progress resulting from the frontal offset test involves the various tests of Saab midsize cars (Figures 3 and 4). In 1995 when the program began, the Saab 900 had a very poor structural design. The next variant, the 1999 Saab 9-3, was somewhat improved, with less intrusion into the compartment. The most recent design, the 2003 Saab 9-3, was an exemplary performer with a very good structural design, and as a result low dummy injury measures and good control of dummy movement during the crash.

Figure 3
Frontal Offset Tests of Saab Midsize Cars



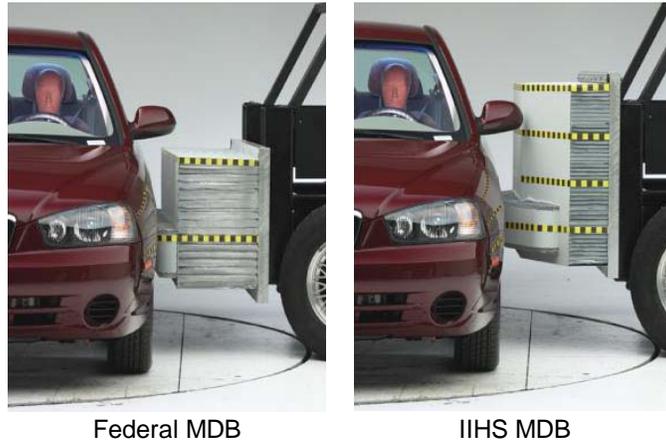
Figure 4
Comparison of Three Saab Models: 1995, 1999, and 2003
Measured Intrusion (cm) in 40 mi/h Frontal Offset Test



The changing vehicle mix in the United States resulting from the growing numbers of SUVs and pickups and high risks to occupants of side-struck vehicles when the striking vehicles are taller (such as SUVs or pickups) led IIHS to develop a new side impact test program for consumer information. For this program the federal MDB was modified so the front end now represents the higher geometry of a typical SUV or pickup. The resulting barrier is higher off the ground, taller, and contoured compared with the federal MDB (Figure 5).

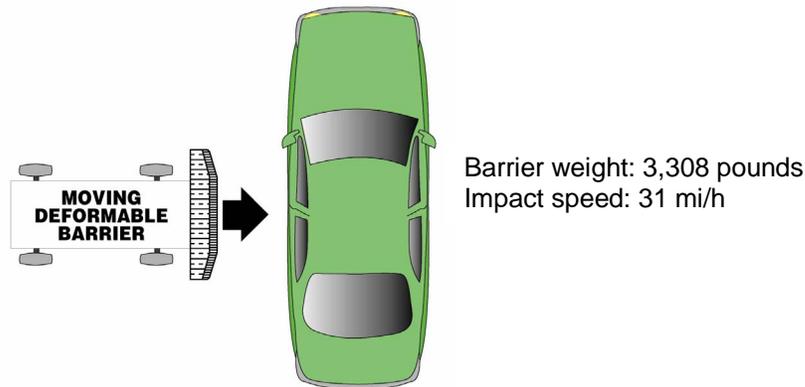
The test configuration is a 31 mi/h perpendicular impact into the driver side of a passenger vehicle (Figure 6). The MDB striking the test vehicle weighs 3,308 pounds.

Figure 5
Typical Passenger Car and Barriers
IIHS Barrier Taller and Rides Higher, Contoured Edges



In each side-struck vehicle are two instrumented SID-IIs dummies representing small (5th percentile) females, one in the driver seat and the other in the rear seat behind the driver. www.iihs.org/vehicle_ratings/ce/side_impact.htm.

Figure 6
IIHS Side Impact Test



This is the first consumer information test program to use a dummy representing small females. There are two reasons for this choice. One is that data from serious real-world side impacts indicate that women are more likely than men to suffer serious head injuries. The other reason is that the head of the smaller SID-IIs driver dummy is in the window area where people's heads are more vulnerable to being struck by the front end of a striking vehicle in a real-world side impact.

The IIHS side impact test is severe. Given today's vehicle designs, it is unlikely that people in real crashes as severe as this test would emerge uninjured. But with good side impact protection, people should be able to survive crashes this severe without serious injuries. This program, begun in 2003, already has prompted manufacturers to begin improving side impact protection. Changes under way include improved structural designs and accelerated introduction of side airbags with head protection.

Some car manufacturers have criticized consumer crash test programs on grounds that to get good ratings vehicles are becoming stiffer, and it is claimed that this will make vehicles, especially SUVs and pickups, more hazardous to the occupants of other vehicles, especially cars, with which they may collide. Brian T. Park et al., *The New Car Assessment Program: Has it Led to Stiffer Light Trucks and Vans Over the Years?*, SAE Technical Paper Series 1999-01-0064 (1999). This claim first was raised about the federal New Car Assessment Program (NCAP) frontal crash tests and the stiffnesses of heavier cars. More recently the criticism has been extended to include IIHS frontal offset testing, and specifically the stiffness of redesigned SUVs. Joseph M. Nolan & Adrian K. Lund, *Frontal Offset Deformable Barrier Crash Testing and its Effect on Vehicle Stiffness*, Proceedings of the 17th International Technical Conference on the Enhanced Safety of Vehicles (CD-ROM), Nat'l Highway Traffic Safety Admin. (2001). See also, Mukul K. Verma et al., *Perspectives on Vehicle Crash Compatibility and Relationship to Other Safety Criteria*, Proceedings of the 18th International Technical Conference on the Enhanced Safety of Vehicles (CD-ROM), Nat'l Highway Traffic Safety Admin. (2003). The issue of the risks for occupants of both vehicles in two-vehicle collisions is referred to as crash compatibility.

One specific claim about potentially adverse consequences for compatibility resulting from improved frontal offset crash performance involves the 2002 Chevrolet TrailBlazer. The 40 mi/h frontal offset test of its predecessor model, the 1996 Chevrolet Blazer, produced major collapse of, and intrusion into, the occupant compartment. The redesigned TrailBlazer was significantly improved (Figure 7). However, as indicated by the federal NCAP tests of these same two vehicles, the overall stiffness of the new TrailBlazer was higher than that of the Blazer (Figure 8). This difference in stiffness has been used to support claims of potentially adverse consequences for compatibility when heavier vehicles are designed with improved self protection. Verma et al., *supra*.

Figure 7
Occupant Compartment Intrusion (cm),
2002 Chevrolet TrailBlazer vs. 1996 Chevrolet Blazer

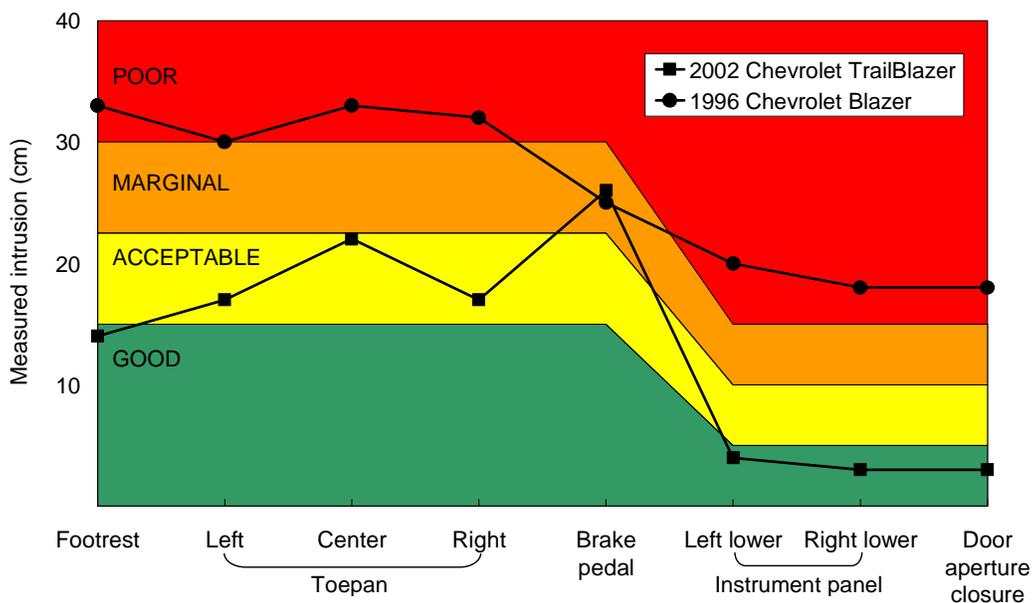
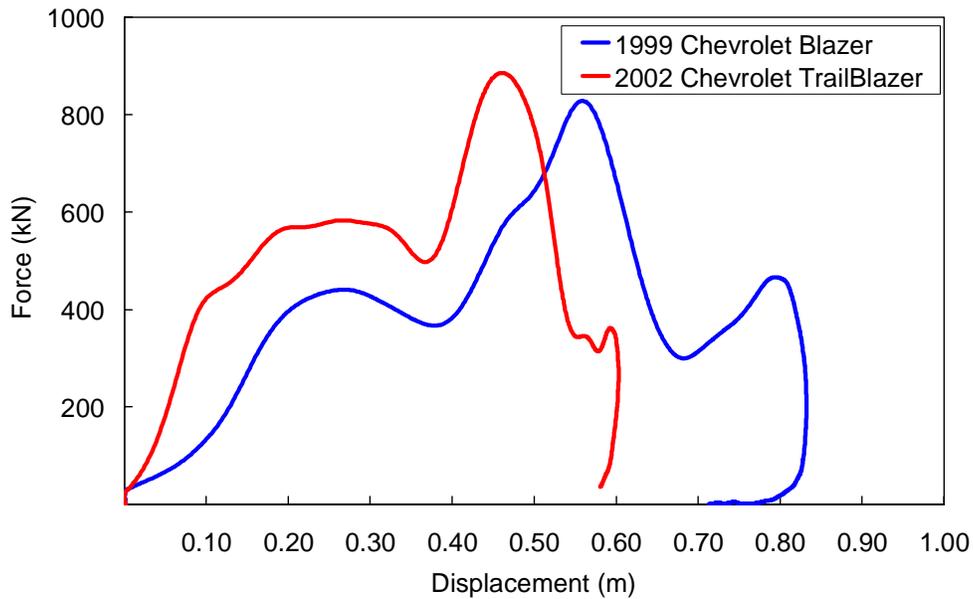
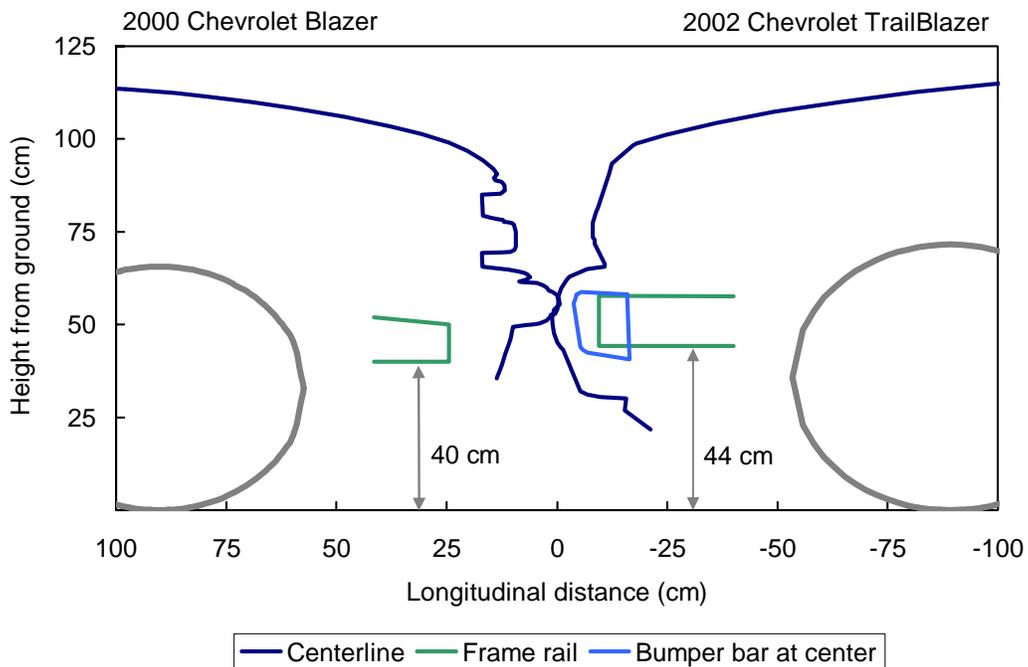


Figure 8
Load Cell Barrier Forces in NCAP Tests,
1999 Chevrolet Blazer and 2002 Chevrolet TrailBlazer



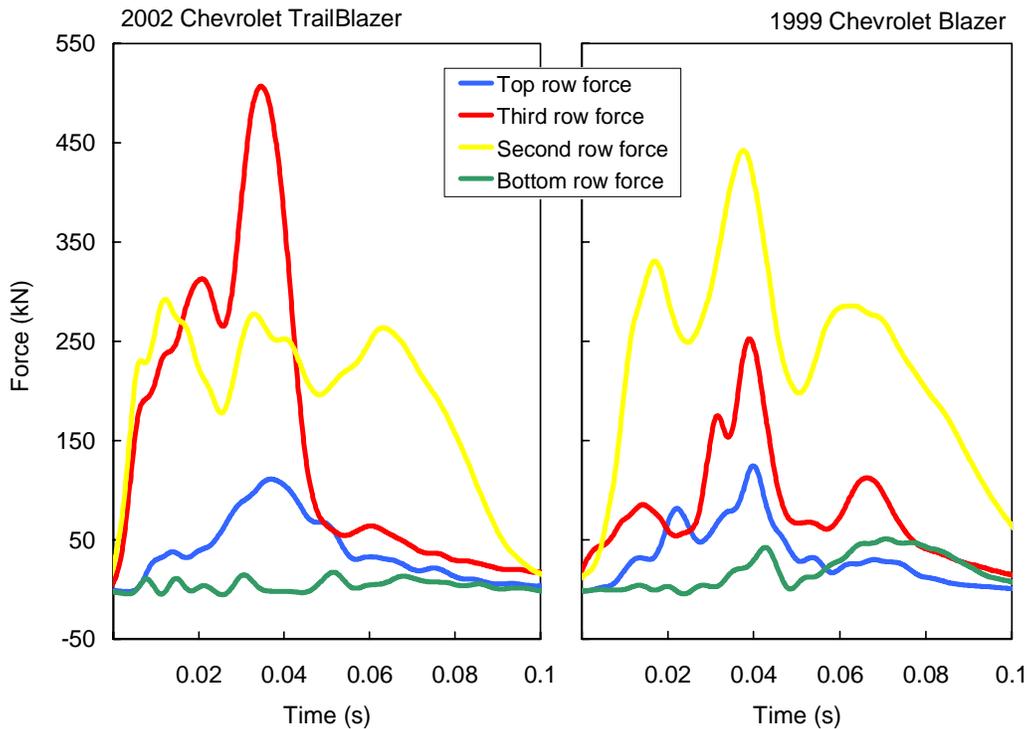
How credible are these claims? First it is important to understand that other significant design changes between the Blazer and TrailBlazer are directly relevant to compatibility. In particular, the bottoms of the TrailBlazer's framerrails are 4 cm higher than the corresponding structures on the Blazer (Figure 9). As a result the peak loadcell barrier forces measured during the NCAP tests of the TrailBlazer were much higher up on the

Figure 9
Geometry, 2000 Chevrolet Blazer vs. 2002 Chevrolet TrailBlazer



barrier face (Figure 10). Any stiffness differences are unlikely to play an important role in front-to-front crashes if the principal energy-absorbing structures override and underide. Thus, the fact that the increased framerail height of the TrailBlazer moves the peak loadcell forces higher up is much more likely to have adverse consequences for crash compatibility than the increased overall stiffness. Furthermore, examination of the stiffnesses, as measured by NCAP tests, of other SUV designs that were contemporaries of the 1996 Blazer reveal that the Blazer was atypical, allowing more occupant compartment displacement in NCAP tests than other designs.

Figure 10
Loadcell Barrier Forces by Row in NCAP Tests,
2002 Chevrolet TrailBlazer and 1999 Chevrolet Blazer



Overall vehicle stiffness as measured in NCAP tests is not likely to be the most relevant measure for most front-to-front crashes between light trucks and cars. Ideal design characteristics in this regard would be front-end stiffnesses for both cars and light trucks that are similar and less stiff than their occupant compartments. Then in a front-to-front crash between a car and a light truck, if the front structures engage and stay engaged during the crash, both front ends would crush, in effect sharing the energy absorption, and the stronger compartments should prevent intrusion, preserving the space for the restraint systems to protect their occupants.

III. Crash Compatibility Issues

Even though the claims that consumer testing is making some vehicles more hazardous for occupants of other vehicles can be refuted, there are vehicle design features that increase the risks for occupants of other vehicles. So an important issue is how to

improve the protection vehicles offer their own occupants, often referred to as self protection, without increasing the risks to the occupants of other vehicles, sometimes referred to as crash partner risks.

This issue has received attention in recent years because of the popularity of SUVs and their perceived “aggressivity” in collisions with cars. What are the crash compatibility issues related to SUVs and what can be done to reduce their effects?

First, it is well known that weight differences between vehicles in crashes create differences in risks for the occupants of the vehicles. Everything else being equal, the occupants of lighter vehicles will be at greater risk of injury, and this simply is due to the laws of physics. Brian O’Neill, *The Physics of Car Crashes and the Role of Vehicle Size and Weight in Occupant Protection*, 12 *Physical Med. and Rehabilitation: State of the Art Reviews* 23-28 (1988).

SUVs as a group are heavier than cars, so their mass is a cause of incompatibility in crashes with cars. But, as noted earlier, other design features of SUVs such as ride height and front-end stiffness can contribute to crash incompatibilities. To assess the importance of this, it is useful to review the statistics from real-world crashes of SUVs and cars, considering both self protection and crash partner risks.

The numbers of occupants killed in SUVs or cars per million of them registered is a measure of the “self” protection afforded occupants of these vehicles in all crashes.

The numbers of car occupants killed in two-vehicle crashes in which SUVs are the other vehicles, per million SUVs registered, is a measure of the risks SUVs pose to car occupants in two-vehicle crashes; this death rate is the “crash partner” rate.

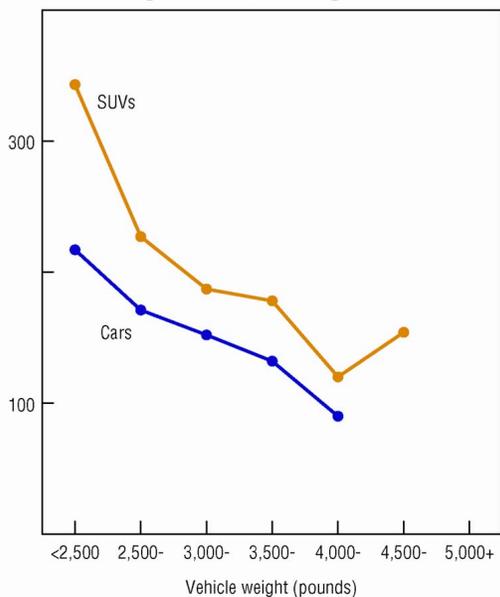
Because vehicle weight affects both self protection and crash partner risks, it is important to compute both types of death rates for each vehicle type by weight categories to isolate the effects of vehicle weight. By computing death rates in weight categories for each vehicle type, it is possible, for example, to compare the rates of death for occupants of heavy SUVs with the rates of death for occupants in crash partner cars in collisions with heavy SUVs. Differences between the car crash partner rates when the other vehicles are SUVs and cars in the same weight class indicate that effects besides weight affect the outcomes for the car crash partners.

The combination of self and crash partner death rates, which includes both deaths inside particular vehicle types in all crashes and deaths in their crash partner cars, provides a more complete assessment of occupant safety than is obtained by considering only self-protection rates.

A. Self-Protection Death Rates

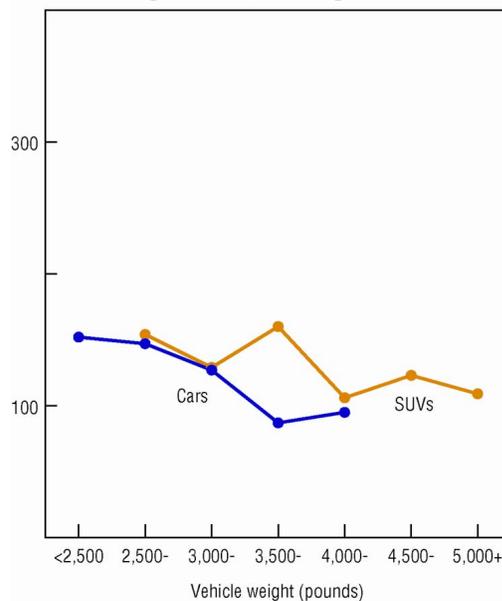
Figures 11a-b show self-protection death rates per million registered vehicles 1 to 4 years old during calendar years 1990-91 and 2000-01. For each vehicle type, the highest death rates were for the lightest vehicles, but the rates also varied by vehicle type. In each vehicle weight category, occupant death rates for vehicles 1 to 4 years old during calendar

Figure 11a
Occupant Deaths in 1987-89 Model
Cars and SUVs, per Million
Registered, during 1990-91



Sources: Nat'l Highway Traffic Safety Admin., *Fatality Analysis Reporting System, 1990-91*, U.S. Department of Transp. (1991-92); R.L. Polk and Company, *National Vehicle Population Profile, 1990-91*, Southfield, MI (1991-92)

Figure 11b
Occupant Deaths in 1997-99 Model
Cars and SUVs, per Million
Registered, during 2000-01



Sources: Nat'l Highway Traffic Safety Admin., *Fatality Analysis Reporting System, 2000-01*, U.S. Department of Transp. (2001-02); R.L. Polk and Company, *National Vehicle Population Profile, 2000-01*, Southfield, MI (2001-02)

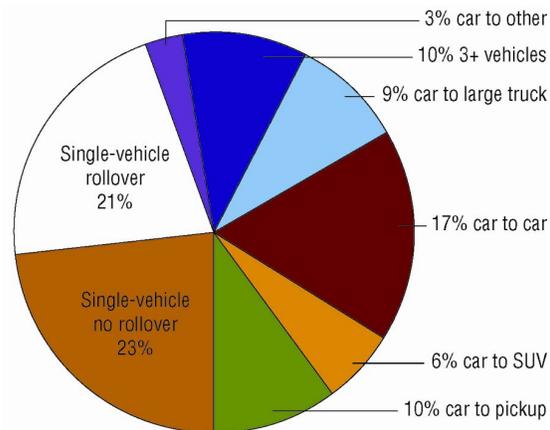
years 1990-91 were lower in cars than in SUVs. A decade later (2000-01) the patterns had changed somewhat. Most noticeable is that occupant death rates were substantially lower across the board for cars and SUVs in every weight category. Consider, for example, vehicles weighing 3,000 to 3,499 pounds. During 1990-91 the self-protection death rate for cars was 152 per million registered cars. The corresponding rate for SUVs was 187 deaths per million. By 2000-01 these rates had dropped to 127 (cars) and 129 (SUVs).

There still were relationships between occupant death rates and vehicle weights during 2000-01, but these relationships were less pronounced than they had been a decade earlier. The biggest changes occurred in the death rates for the lightest cars (those weighing less than 2,500 pounds). This reflects in part the fact that cars in this weight category got heavier. Fifty-four percent of 1987-89 car models in the lightest group weighed less than 2,250 pounds. R.L. Polk and Company, 1990-91, *supra*. A decade later, fewer than 9 percent were as light. During this same period, as cars were getting heavier so were SUVs. The average weight of recent model SUVs in 2000 and 2001 increased by about 350 pounds. So even as the proportion of SUVs in the fleet was increasing and as they were getting heavier, the occupant death rates for cars dropped substantially.

Comparisons of death rates by vehicle type reveal other changes from 1990-91 to 2000-01. During the more recent years, the differences in the death rates for cars and SUVs 1 to 4 years old were much smaller than in 1990-91.

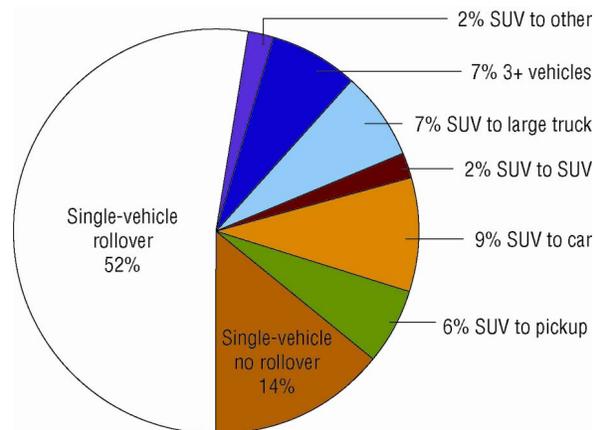
Although self-protection death rates are similar for recent model cars and SUVs, deaths in these vehicles are not occurring in the same kinds of crashes. During 2000-01 single-vehicle crashes accounted for about 44 percent of car occupant deaths in recent model cars, and about half of these crashes were rollovers (Figure 12a). In contrast, the corresponding percentage of SUV occupant deaths that occurred in single-vehicle crashes was 66 percent, and almost 80 percent of these were rollovers (Figure 12b). Crashes that directly relate to compatibility concerns between cars and light trucks (SUVs and pickups) accounted for about 16 percent of car occupant deaths.

Figure 12a
Distribution of Car Occupant Deaths by Crash Type, 1997-99 Models during 2000-01



Source: Nat'l Highway Traffic Safety Admin., 2000-01, *supra*.

Figure 12b
Distribution of SUV Occupant Deaths by Crash Type, 1997-99 Models during 2000-01



Source: Nat'l Highway Traffic Safety Admin., 2000-01, *supra*.

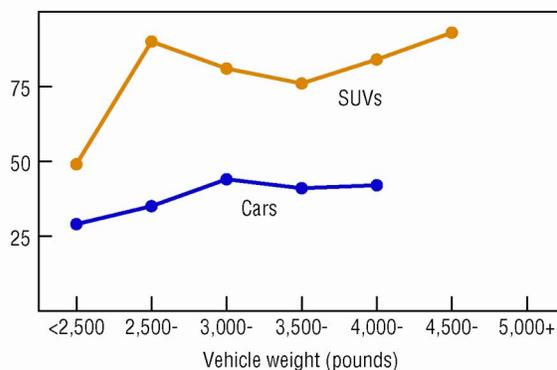
B. Crash Partner Car Death Rates

Figures 13a-b show the crash partner car (all model years) death rates for 1-to-4-year-old SUVs and cars during calendar years 1990-91 and 2000-01. The car partner death rates are significantly lower than the occupant (self-protection) death rates shown in Figures 11a-b, reflecting the fact that such crashes account for a relatively small minority of all car occupant deaths.

In general, the heavier the weights of the SUVs or cars involved in crashes in which deaths occur in crash partner cars, the higher the partner car death rates. Plus, in every vehicle weight group except one the death rate for crash partner cars (all model years) is lower when the other vehicle in the collision is another car than when it is an SUV. This overall pattern is apparent for relatively new vehicle models during both 1990-91 and 2000-01. However, during the intervening decade the death rates for crash partner cars went down, regardless of whether the other vehicles in the collisions were other cars or SUVs. Another change during 2000-01, compared with 1990-91, was that the differences in partner car death rates were smaller when the other vehicles were cars versus SUVs.

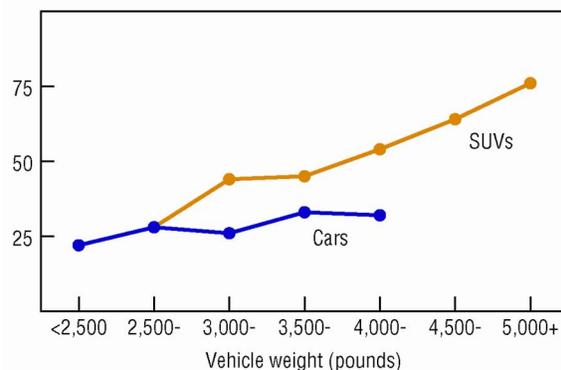
Comparing self and partner death rates for each vehicle type shows that more occupant deaths occur even in the heavier SUVs than in their crash partner cars. In SUVs

Figure 13a
Car Crash Partner Occupant Deaths (All Model Years) in Crashes with SUVs and Cars (1987-89 models), per Million Registered, during 1990-91



Source: Nat'l Highway Traffic Safety Admin., 1990-91, *supra*. See also, R.L. Polk and Company, 1990-91, *supra*.

Figure 13b
Car Crash Partner Occupant Deaths (All Model Years) in Crashes with SUVs and Cars (1997-99 models), per Million Registered, during 2000-01



Source: Nat'l Highway Traffic Safety Admin., 2000-01, *supra*. See also, R.L. Polk and Company, 2000-01, *supra*.

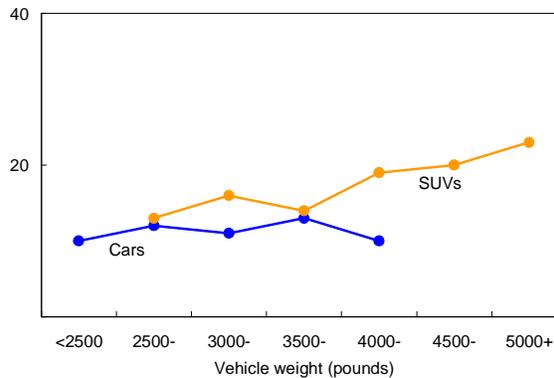
weighing 4,000-4,500 pounds, for example, the occupant death rate for 1-to-4-year-old models during 2000-01 was 123. Their car crash partner death rate was 64, so there were twice as many deaths in the relatively heavy vehicles as in their crash partner cars.

These results illustrate the importance of maintaining an appropriate balance between self protection and risks for occupants of crash partner cars. The risks for people in crash partner cars has decreased substantially in recent years, primarily because of improved self protection in cars as opposed to improvements in the crash compatibility of SUVs. For example, in recent years many more car occupants buckle up, many more cars have airbags, and the weights of cars have increased. All of these factors improve self protection, but the self-protection benefits of increasing weight diminish as vehicles get heavier and heavier. At the same time, the disbenefits for occupants of crash partner cars do not decrease as the other vehicles get heavier and heavier. So at some point heavy vehicles cost more lives in crash partner cars than they save inside the heavy vehicles.

In each weight category, compared with cars SUVs have more car crash partner deaths. This illustrates that, even after controlling for weight, the risks are greater for car occupants when they collide with SUVs, compared with colliding with other cars.

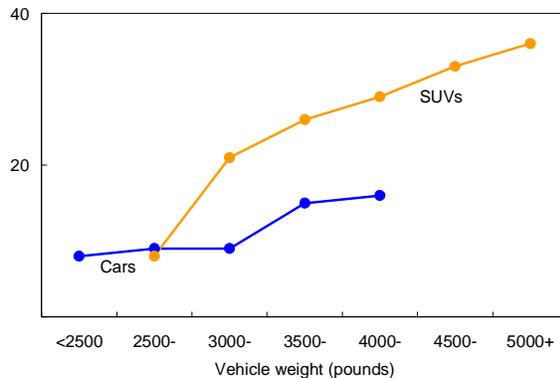
To better understand why SUVs pose extra risks to car occupants, it is useful to look at car crash partner rates by type of crash. Figure 14a shows the rates for front-to-front crashes between two cars and cars and SUVs. In front-to-front crashes, the crash partner rates for SUVs are slightly higher than for cars. Figure 14b shows corresponding results when crash partner cars are struck in the side. In this case, crash partner rates for SUVs are much higher than for cars. Figures 14a-b show that in crashes involving two cars, crash partner deaths are split about evenly between front-to-front and front-to-side impacts. But the split is very different when the other vehicle is an SUV. In these crashes, occupant deaths in crash partner cars are much more likely in side than in frontal impacts.

Figure 14a
Car Crash Partner Deaths (All Model Years)
in Front-to-Front Crashes with SUVs
and Cars (1997-99 Models), per Million
Registered, during 2000-01



Source: Nat'l Highway Traffic Safety Admin., 2000-01, *supra*. See also, R.L. Polk and Company, 2000-01, *supra*.

Figure 14b
Car Crash Partner Deaths (All Model Years)
in Front-to-Side-of-Car Crashes with SUVs
and Cars (1997-99 Models), per Million
Registered, during 2000-01



Source: Nat'l Highway Traffic Safety Admin., 2000-01, *supra*. See also, R.L. Polk and Company, 2000-01, *supra*.

IV. Looking to the Future

The growth in sales of SUVs in recent years has provoked many people to criticize these vehicles as serious threats to other road users and the environment. Keith Bradsher, *High and Mighty* (PublicAffairs, 2002). See also, Malcolm Gladwell, *Big & Bad: How the S.U.V. Ran over Automobile Safety*, New Yorker, Jan. 12, 2004 at 28. The results presented in this paper do show that in front-to-side crashes, in particular, SUVs with their “tall” front ends pose extra risks to the occupants of cars struck in the side by such vehicles. There also is evidence that the “mismatch” of front-end structures between cars and light trucks contributes to increased risks in head-on crashes. Essentially the same risks are posed by pickup trucks, which have been big selling vehicles much longer than SUVs. What can and should be done to reduce the risks attributable to design differences between cars and light trucks, and in particular the risks related to height differences? The simple answer is that changes are needed to both cars and light trucks to improve self protection and reduce crash partner risks.

Not surprisingly, given the animosity of many people toward SUVs, there have been calls for legislation and/or litigation to change the designs of SUVs to improve crash compatibility. Some groups are advocating that the National Highway Traffic Safety Administration promulgate rulemaking to regulate SUVs and other light trucks to make them more compatible with cars in crashes. However, the present state of knowledge is insufficient to specify *performance* requirements for light trucks that would improve crash compatibility.

This past December the world’s largest automobile manufacturers, representing almost 100 percent of the vehicle sales in the United States, announced a voluntary commitment to improve vehicle compatibility by, among other things, specifying some *design* constraints on the front-end geometry of light trucks. This announcement followed months of discussion in working groups of which IIHS was an active member.

For front-to-front crash compatibility improvements, the manufacturers have agreed to improve the geometric matching between the front structural components of cars and light trucks (including SUVs). Under this agreement the principal energy-absorbing structures on the fronts of light trucks will be designed so they overlap at least 50 percent of the federally mandated passenger car bumper zone. Alternatively manufacturers may choose a secondary energy-absorbing structure such as “blocker” beams that overlap the car bumper zone. By September 2009, all participating manufacturers’ light trucks will meet the criteria of one of these options. This will mean the front ends of light trucks will be more likely to engage those of cars in front-to-front crashes instead of overriding the cars. The increased engagement will enhance the ability of the front ends of both vehicles to absorb crash energy and keep damage away from the occupant compartments. The manufacturers also plan to conduct follow-up research to develop performance requirements that should lead to better matching of the frontal stiffness characteristics between cars and light trucks. This research will include a series of barrier and vehicle-to-vehicle crash tests. These should lead to dynamic performance requirements that go beyond the initial geometric *design* requirements.

To improve the situation in front-to-side crashes, manufacturers will begin with improved self protection for occupants of side-struck vehicles. By September 1, 2007, there is agreement to enhance self protection in at least 50 percent of each participating manufacturer’s vehicles by meeting either the currently optional side impact pole test specified by the federal safety standard for interior impact protection, 49 C.F.R. § 571.201, or the criteria used to achieve an acceptable or good head injury rating in IIHS’s new side impact crash test program. By September 1, 2009, the manufacturers have agreed to meet or exceed the head injury criteria used in IIHS’s side impact test for all vehicles. To meet these requirements automakers likely will have to install airbags designed to protect drivers’ heads. These head-protecting airbags reduce the risk of death by as much as 45 percent. Ins. Inst. for Highway Safety, *Side Airbags: Are They Also Saving Lives in Real-World Crashes?*, 38:8 Ins. Inst. Status Rep. 3 (Aug. 26, 2003) (available at www.highwaysafety.org). Automakers have agreed to accelerated research to assess appropriate dummy injury criteria for body regions in addition to the head. Researchers also will investigate the potential benefits in front-to-side crashes of modifying the structural designs of vehicle fronts as well as their sides.

Perhaps surprisingly, there has been almost no litigation or legal attention focused on the issue of vehicle incompatibility. Lawsuits have been filed on behalf of those injured in SUVs when they have rolled over, but no major suits have been filed by occupants of vehicles hit by an SUV claiming that its size, height, and/or weight were a major or sole cause of injury. Howard Latin & Bobby Kasolas, *Bad Designs, Lethal Profits: The Duty to Protect Other Motorists Against SUV Collision Risks*, 82 B.U.L. Rev. 1161 (2002). So far one court has found that manufacturers owe “no duty” to crash victims for injuries caused by an SUV. *de Veer v. Morris*, No. GC 020209, slip op. (Cal. Super. Ct. Mar. 28, 2000). However, as crash compatibility issues become more public we may begin to see more product liability lawsuits based on the premise that manufacturers of light trucks have a duty to market reasonably safe products for individuals other than buyers because it is reasonably foreseeable that people other than the buyers may be harmed by the vehicle. Latin & Kasolas, *supra*.

Crash compatibility problems caused by design differences between cars and light trucks will be reduced, especially as countermeasures to address geometric and stiffness effects are implemented. However, crash compatibility problems never will be eliminated; there will always be weight differences, for example. This means that improvements in self protection, which will benefit occupants in single-vehicle and two-vehicle crashes, should continue to have a high priority.

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