Side-Impact Air Bags New on Safety Marquee

Opening in showrooms nationwide in the 1997 model year are side-impact air bags — further evidence that safety is helping drive the new-car marketplace. It took decades of regulatory struggles to get frontal air bags, but side bags will be in lots of cars very soon and without any government requirement for them.

Side air bags "aren't legally required, but people have developed a good opinion of air bags generally speaking, based on air bag performance in frontal impact systems," says Jim Karlow, director of inflatable restraint systems for Takata, an air bag supplier. "The halo effect you get from frontal air bags is now transferred to side impacts. I think people generally feel that since they do work so well in frontal impacts, side-impact air bags only make sense, too."

Side impacts account for about 30 percent of all passenger vehicle occupant deaths —
General Motors' 1997 Cadillac DeVilles will come equipped with door-mounted side-impact air bags (shown top left) starting this fall. BMW's side air bag system (left) includes a tubular unit positioned to protect people's heads in crashes as well as another side bag to protect their thoraxes for a total of six air bags — two frontal and four side-impact bags. Ford plans to use a combination head and thorax bag (above) in its vehicles.

second only to frontal crashes. Serious injuries to people in side impacts usually involve the head, chest, and abdomen.

Jim Chamberlin, vice president of technology planning and quality for TRW's occupant restraint systems group, says the market for side air bags has benefited from the recognition that safety is important to consumers. "Safety has become more and more a decision point for consumers. Because safety sells and because of the competitive nature of the marketplace, as one or two or three key car companies make the move to side bags, other car companies are at a disadvantage."

Volvo was first to offer standard side air bags for front-seat occupants in its 850 model for 1995. Audi will be first with four side-impact air bags to protect people in both front and rear seats (see "Automaker Plans for Side-Impact Air Bags," p.3).

Market Outlook Strong: Side air bags will be in 1,700,000 vehicles worldwide by the end of 1996 — about 300,000 of them in North America, Chamberlin says. TRW projects side bags will be in 5,000,000 vehicles worldwide in 1997. The next year, TRW expects side bags to be in about 10,500,000 vehicles worldwide — 6,000,000 in Europe and 4,000,000 in North America.

In comparison, more than 33,000,000 passenger vehicles since the 1987 model year have been sold with frontal air bags for drivers. Another 15,000,000 cars have passenger bags, too.

More cars in Europe will have side bags initially than in the United States, but the numbers should even out by 1999, Chamberlin says. In Europe, side bags are more likely to be optional. In the United States, they're usually standard, explains Jim Erickson of Morton International.

Morton has about 30 side air bag contracts in development now, and 8-10 are for 1997 model cars, Erickson says. TRW has 55 different contracts for side bags, including 33 for production and 22 for development. Four of the production contracts will come to market this year. Takata has about 12 contracts, and at least 1 is for a 1997 model car, Karlow says. Delphi Interior and Lighting Systems, a unit of General Motors, this year will provide one of its customers with air bags for a 1997 model vehicle, a spokesman says.

Breed Technologies' first production contract for a side-impact air bag is for a 1997 midsize car to be sold in Europe, says Michael Daly, vice president of engineering. Other contracts for air bag systems are in development, he adds.

Autoliv, Europe's largest manufacturer of air bags and safety belts, 

(cont'd on p.6)
When it made side-impact air bags standard in 850 models, Volvo became first to put this protection in cars sold in the United States (see Status Report, Vol. 30, No. 3, March 18, 1995). Since then, nearly every other automaker has announced plans to follow suit. Here's a rundown:

- Audi/Volkswagen will introduce side bags in its 1997 flagship sedan, the Audi A8, which will debut in September. This car will have four side air bags to protect people in both front and rear seats. Deployed by an electronic sensor, the bags will be seat-mounted. Audi will extend side bags to the A4 model sometime during the 1997 model year and then to the A6, which will be redesigned for 1998. On the Volkswagen side, "We do have ambitious plans," a spokesman says, but the company isn't ready to announce.

- BMW's 5- and 7-series for 1997 will have door-mounted thorax bags deployed by electronic sensors. In mid-1997 models, a head bag will be added (see photo, facing page). It will be stowed over the side window and under the trim of the A-pillar and headliner.

- Chrysler hasn't formally announced plans but is "really closely evaluating all of the various technology being developed and looking at the air bags themselves, as well as at the proper locations for them," a spokesman says.

- Ford will phase in seat-mounted side air bags across its vehicle line in North America and Europe beginning in two to three years. The combination bag (see photo, facing page) is designed to protect both the head and chest in a side-impact collision. The Jaguar line may initially get bags that protect the chest only and then switch to the combination head/chest bag, a Ford spokesman says. He declines to confirm or deny reports that side air bags will debut in the 1997 Lincoln Continental.

- General Motors will equip all 1997 Cadillac DeVilles with door-mounted side bags that primarily provide thorax protection (see photo, facing page). Side bags mounted in the seat will be standard on the new Catera starting in spring 1997. General Motors declines to reveal plans for additional makes and models, but industry sources say a 1997 or early 1998 Saturn will have seat-mounted side bags. Sources also say the 1997 Buick Park Avenue will come with door-mounted side bags, and 1998 models will have bags mounted on seats. A General Motors spokesman says any announcement would come only a month or so before side air bags are available to consumers.

- Honda declines to talk about its plans, but a spokesman says the company is "investigating the market."

- Hyundai has no current plans for side air bags, a spokeswoman says.

- Mazda isn't revealing specifics. According to a spokesman, "we're investigating a number of different approaches, side air bags being one of them."

- Mercedes offered side bags beginning with 1996 SL- and E-series models. These are door-mounted thorax bags deployed by electronic sensors. For the 1997 model year, side bags will be in the S-class, followed by C-class cars.

- Nissan will introduce side bags in a luxury model sold in Japan this summer and make them available in all cars sold in Japan by fall 1998. A spokesman says the company isn't prepared yet to announce plans for models sold in the United States. Its products will have seat-mounted thorax bags that use electronic sensors.

- Saab is targeting side bags for the 1998 model year. Still in development, they'll be seat-mounted.

- Subaru is developing side bags that will be available on some existing models within the next two years, a company spokesman says.

- Toyota will introduce seat-mounted side air bags in a 1997 model premiering this fall. The bag will provide chest protection and use an electronic sensor.

- Volvo equips all of its models with side air bags. The first was the 850 sedan in 1995, followed by the 960 line for 1996. Concealed in the outside seam of front seat backs, the side bags are triggered by a mechanical sensor.
Enforcement of Purchasing Age Laws Often Not High Priority

Minimum purchasing age laws for alcohol have led to crash reductions among young people, but the laws aren't well enforced by officials who may perceive their communities don't put high priority on curbing underage drinking. These are the findings of two studies from University of Minnesota researchers.

Enforcement by police and state alcohol control agents typically focuses on the underage drinker instead of people who sell or provide them with alcohol, whether a commercial outlet or an individual, researchers found in their analysis of 1988-90 liquor law violations in 295 counties in four states — Kentucky, Michigan, Montana, and Oregon. Interviews also were conducted with law enforcement officials in 15 city and county agencies in the four states, all of which prohibit alcohol sales to people younger than 21 and ban minors from possessing alcohol.

Eighty-eight percent of the counties examined during the three-year period recorded arrests of adults charged with furnishing alcohol to minors. Interviews reveal that few officials feel pressure from the community to increase enforcement of laws against underage drinking, compared with other enforcement activities. Most officials reported a certain degree of acceptance of underage drinking and indicated that parents often consider it a relatively minor offense.

A majority of officers cited personnel and resource shortages as hindrances to enforcing the legal alcohol purchasing age. Short staffing means officers often give priority to other areas, so relatively few underage drinking arrests are made.

Courts frequently don't mete out appropriate punishments after arrests are made, most officers believe. Sanctions against merchants should be more severe. They should include suspension or revocation of licenses, officers said.

There's also strong support for increasing sentencing options for youth, such as rescinding driving privileges and providing for community service.


Drivers Voice Support For Zero Tolerance, Graduated Licensing

Parents of Teenage Children Voice the Strongest Support, Also Favor Driving Curfews

Fewer motorists now admit to driving under the influence of alcohol than did a decade ago. There's strong support for zero tolerance laws and graduated licensing laws for beginning drivers. These are the findings of a new study from the Insurance Research Council.

In a national survey, 21 percent of licensed drivers reported driving after drinking, compared with 37 percent in 1985. Men are more than twice as likely as women to report such behavior.

The survey found overwhelming support for zero alcohol tolerance laws for young drivers. Seventy-six percent of respondents favor these laws for drivers younger than 21 who, under zero tolerance, would lose all driving privileges if caught driving with any alcohol in their blood.

Zero tolerance laws are particularly supported by parents of teenage children. Eighty-two percent of respondents with children 13-17 years old rate the idea as excellent or good. Parents also support graduated licensing programs (see Status Report, Vol. 29, No. 13, Dec. 17, 1994) and nighttime driving curfew laws for people younger than 18. They support a licensing age of 18 or older.

Sixty-nine percent of parents of children 13-17 said they favor graduated licensing. The same percentage favor night driving curfews for teenagers. Sixty percent of parents said making teenagers wait until age 18 or older for their licenses is an excellent or good idea.

These survey findings are included in Public Attitude Monitor 1995. For a copy ($10 each), write: Insurance Research Council, 211 South Wheaton Avenue, Wheaton, IL 60187.
Teenagers Use Their Safety Belts More But Still Not as Much as Older People

During the 1980s, Institute researchers surveyed safety belt use among students arriving at six Maryland high schools, finding that fewer young drivers were buckling up than adults in the surrounding communities. Revisiting five of these schools last year, the Institute discovered that more teenage drivers are using belts now, and differences between their belt use rates and those of adult drivers in the surrounding communities have narrowed.

Driver belt use among students attending Maryland high schools was higher in 1995 at four of the five schools surveyed in both 1988 and 1995 (see Status Report, Vol. 25, No. 1, Jan. 27, 1990). “Although safety belt use has increased, it still remains too low, particularly when you consider that teenage drivers have the highest crash rates,” says Institute Senior Vice President Allan F. Williams.

“This is a cause for concern because teenage passengers have a very high death rate too, with many killed in cars driven by other teenagers. We know that about 40 percent of passenger vehicle occupant deaths of 16-19 year-olds involve passengers.”

High school driver belt use rates ranged widely, the researchers found, from 36 percent to 91 percent. Rates for right front-seat passengers ranged from 24 percent to 74 percent.

A strong relationship was found between driver and passenger safety belt use. In vehicles with both a driver and right front passenger, 70 percent of the passengers were belted if the driver buckled up. If the driver wasn’t belted, only 22 percent of the passengers used their belts.

Females were more likely to buckle up than males. Seventy-four percent of all female high school drivers and right front passengers were using belts, compared with 57 percent of males.

Safety belt use corresponded to each community’s socioeconomic status. Schools where researchers observed high driver belt use rates are located in areas with high median household incomes. Schools where low safety belt use was observed are located in communities where the incomes are correspondingly low.

Primary enforcement of safety belt use laws would get more teenagers to buckle up, Williams points out, and it would be a valuable addition to the graduated licensing programs under consideration in a number of states. Most states, including Maryland, have secondary belt law enforcement provisions, meaning another violation has to be detected before an officer can issue a citation for not using a belt.

For a copy of “Variations in High School Safety Belt Use” by A.F. Williams et al., write: Publications, Insurance Institute for Highway Safety, 1005 North Glebe Road, Arlington, VA 22201.
developed the world's first side-impact air bag for the Volvo 850. The company has air bag contracts with virtually every carmaker in Europe as well as orders from major U.S. manufacturers, Autoliv President Gunnar Bark reveals.

Luxury cars generally will get side bags first, and midsize cars will follow. Small cars will get them, too, but on a more limited basis, suppliers say. The first side bag for a small car will debut in a 1997 model, says Rick Bogdanski, Breed's program manager for side-impact development.

**Seat-Mounted Bags Will Dominate:** Side air bags are mounted either in the door like those in Mercedes or in the seat like Volvos. Door-mounted systems designed primarily to protect the thorax or chest were the focus when side bags were being developed in the early 1990s. But "by the time we got to introduction, there was a shift," Chamberlin notes. "The great majority of applications are seat-mounted."

Erickson explains that, in seat-mounted systems, the "bag moves with the seat and stays with the occupant. Therefore you don't have to cover as wide of an area with the bag as you do with a door-mounted bag." He adds that "keeping the size and amount of gas generated and the aggressivity down is key to making it also acceptable for out-of-position occupants."

**Protecting the Head:** Thorax bags provide some head protection by keeping people's bodies from slamming into the door, B-pillar, or window, Volvo says. But side air bags designed to more fully protect the head are on the horizon. BMW, for example, will use door-mounted side bags to protect the thorax and a separate inflatable tubular structure to protect the head. This system will be in 5- and 7-series BMWs beginning with mid-1997 models. Ford plans an integrated thorax and head protection seat-mounted bag in some models in about two years (see photos, p.2).

More than 15,000 fatal or serious head injuries per year occur in side impacts. These injuries are from contact with the side window, B-pillar, and external objects. Serious injuries to the chest and abdomen occur when the force of a side-impact crash drives a door into an occupant.

"At Morton, we've really worked on developing the combination head/thorax bag diligently because we believe the biggest benefit of side air bags is head protection," Erickson says. "I know a lot of companies that are providing thorax protection are also looking at a separate head bag. Car companies are working on that, but the technology is coming along a little slower."

Breed sees "head impact bags to be the future," Daly says. "We'll start off with a thorax bag in production, and as the market increases we'll be replacing those with a head and thorax protection bag."

**Milliseconds to Deploy:** Side-impact air bags will primarily use electronic sensors located in the crush zone to trigger deployment. Because there's not much space between the door frame, where crash sensors typically are located, and occupants, the sensors have to recognize a crash and deploy the bags considerably faster than in a frontal crash.

In frontal crashes, front car parts crush to absorb crash energy before it reaches the occupant compartment and injures people riding inside. But in side impacts, there's very little crush zone, so the object striking the car, whether another vehicle or an object like a pole, quickly intrudes into the occupant compartment space.

The sensors in side bag systems must detect an impact within 4-5 milliseconds, compared with 15-20 milliseconds in a frontal crash. They also must inflate faster — within 20 milliseconds after initial impact compared with 60-75 milliseconds.

Side air bags typically are smaller than frontal bags, too. They're 6-20 liters versus 40-70 liters for a driver air bag and an average 150 liters for a passenger bag.

**Benefits Are Promising:** Side air bags aren't in many cars yet, so their real benefits haven't been measured. But projections based on lab tests plus anecdotes suggest side bags will be beneficial.

Frontal air bags have reduced driver deaths by about 20 percent in front and front-angle crashes (see Status Report, Vol. 30, No. 3, March 18, 1995). Tests conducted by air bag suppliers and automakers indicate side bags provide a 40-60 percent reduction in the dummy injury criteria for the head and chest, Chamberlin says. "In some cases, we may end up with lower numbers, but generally it'll be in the higher percentages," he says. Takata says its tests have shown up to an 80 percent improvement in head injury scores with a head/thorax bag.

**Potential Hurdles:** There may be barriers to widespread use of advanced restraints like side-impact air bags for the head and chest. Some automakers believe the National Highway Traffic Safety Administration's new head impact protection standard conflicts with the use of alterna-
tive head protection systems, including side air bags (see Status Report, Vol. 30, No. 10, Dec. 2, 1995). BMW, Mercedes, Volkswagen, and Volvo have asked that the rule be changed to allow compliance alternatives for vehicles with such dynamic protection systems. The federal agency is treating these requests as rulemaking petitions and reviewing comments.

Even Bigger Plans: Regardless of possible regulatory hurdles, air bag suppliers and auto manufacturers are not only proceeding with side bags but also with plans for other kinds of air bags. Morton is developing an inflatable bolster to protect the knees and lower legs, which can be seriously injured in frontal crashes while the upper body, protected by a frontal air bag, remains unharmed. The knee bolster should appear for the first time in 1997 Kia Sportage utility vehicles.

In addition to a knee bag, TRW is developing an inflatable head restraint to protect people from common whiplash injuries. Other bags proposed by suppliers would protect people in rollover crashes. An external air bag would cushion the vehicle itself in a crash.

What about side-impact bags for people in rear seats? Audi is going with them in a luxury model, but widespread adoption may be constrained by economics as well as the low occupancy rate in the rear seats of passenger vehicles on U.S. roads. The big issue, Karlow notes, "is going to be the cost. All of a sudden your basic car starts to run over $20,000, and you begin to put it out of the ability of many people to own. That's why they're probably going to be slower to put them in rear seats."

### Urban Freeway Speeds

**Jump In First States to Raise Speed Limits**

Motorists in two states that raised their posted speeds right after the federal maximum speed limit was abolished are driving faster and breaking the new speed limits on urban freeways, data collected by the Institute reveal.

Using photo radar technology, researchers monitored traffic speeds on urban freeways in two communities — Houston, Texas and Riverside, California — just before the limits were raised and three months after they were raised. Speed limits in Texas climbed to 70 mph from 55 mph, and California's limits rose to 65 mph from 55.

There were substantial increases in average speeds on these roads plus increases in the percentages of cars traveling faster than 70 mph, 75 mph, and even 80 mph in both states.

"What's particularly alarming is that drivers on congested urban roads increasingly are traveling faster than these roads were designed to handle safely," Institute Senior Vice President Allan F. Williams points out. "Some of the roads have intersections, short merge lanes, and substandard roadside safety features."

Before Texas' higher speed limits took effect, 12-19 percent of car drivers on three urban freeways and an urban interstate highway were traveling faster than 70 mph. After the limit was set at 70, cars went even faster — 27-48 percent were traveling faster than 70 mph. Before the speed limit was raised, 2.5-5 percent of cars were traveling faster than 75 mph, but this proportion jumped to 5-14 percent after the law changed.

Compared with Texas, California had higher baseline travel speeds measured before the new speed limits took effect. Motorists traveling faster than 70 mph before the law change ranged from 23 to 36 percent. After the speed limit was raised, 28-46 percent of drivers exceeded 70 mph, even though the new speed limit was set at 65.

Telephone surveys of residents in communities where researchers monitored speeds reveal respondents' perceptions of speed and speed enforcement. More than 80 percent in both communities said they're concerned about the speeds of other vehicles on the roads.

In both communities, the majority of respondents said enforcement of speed limits hasn't changed since the limits were raised. Slightly more than half of those surveyed said a driver exceeding the speed limit by 10 mph would be ticketed. About 85 percent said a driver going 20 mph faster than the speed limit would get a ticket.

When asked if they'd ever received a speeding ticket on freeways in their area, 19 percent of Riverside respondents and 25 percent in Houston said yes.
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