

Crash injuries may be prevented, or caused, by **TENSION IN THE BELT**

In a frontal crash, you want your safety belt to hold you snugly so you'll slow down as the vehicle does instead of continuing to go forward until you slam into the already stopped steering wheel or dashboard. This is the well-established benefit of belts, but the optimal degree of belt tension during impact — that is, how forcefully a belt should hold you in place — isn't as clear.

A shoulder belt has to be tight enough to limit your movement. But if it doesn't give some during a crash, the belt itself can injure your chest. This is why restraints in newer cars include devices that reduce the forces on people's chests by allowing some belt webbing to tear or spool out of the retractor in severe crashes. On the other hand, too much spoolout can compromise effectiveness by allowing belted occupants to move enough to strike hard surfaces inside the vehicle.

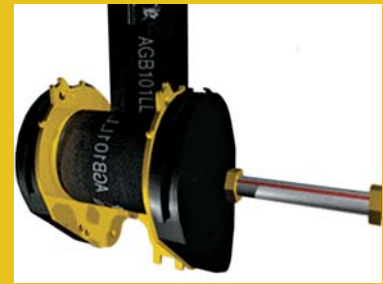
A new Institute study addresses this trade-off. Researchers compared death rates of belted front-seat occupants in head-on crashes of cars before and after the models were fitted with force limiters. The rates were higher in cars with the limiters.

"This suggests the devices may be allowing some injuries, even as they prevent others. And it's possible that the kinds of injuries the force limiters are preventing aren't as serious or numerous as the ones they're allowing," says Joe Nolan, Institute senior vice president and an author of the study, which focuses exclusively on occupant deaths in the crashes, not on serious but nonfatal injuries that also might have been influenced by the presence or absence of force limiters on safety belts.

The research was prompted by the observations of Nolan and other Institute engineers during 12 years of frontal crash testing. They noticed that force limiters allowed more movement of driver dummies during the tests. The dummies' heads more often went through the cars' airbags and struck the steering wheels.

The new study of real-world crashes backs up these observations with statistical evidence. The researchers calculated death rates per registered vehicle in several groups of cars before and after modifications to depower the frontal airbags and/or to limit shoulder belt force during crashes. Death rates were higher after the belt modifications in all except one group of cars. In the group with the most cars and the most time on the road — hence, the most accurate result — there was a 36 percent death rate increase in cars with both airbag and safety belt changes relative to death rates in cars in which the airbags had been changed but the belts hadn't.

Whether or not a force limiter is a safety benefit may depend on the type of crash and its severity. Limiters may prevent injuries in frontal crashes when occupants go directly forward into their airbags.



Belt tension and the force applied to occupants' chests may be limited by allowing webbing to tear (left) or spooling some webbing from the retractor (right). The issue is whether force limiters, whatever their mechanisms, protect people from injuries or allow them to occur.



But in angle crashes or frontal impacts that involve lots of vehicle rotation, there's more burden on the safety belts to prevent people from hitting the steering wheels and dashboards. Another factor in many of these crashes is increased intrusion into vehicles' occupant compartments that reduces the space left for people to move without hitting the vehicle interior.

Belt spoolout allowed by force limiters can mean there will be far too much occupant movement in frontal crashes that occur at an angle or with rotation or in crashes that involve more than one impact. Then a belt that spools out in the first impact may leave an occupant without enough restraint in the subsequent impacts. In these cases force limiters may do more harm than good.

"It was difficult to try to isolate the effects of the force limiters in the real-world crashes," Nolan says, "because so few vehicles were available to include in the study. Still the data indicate that we should look for ways to reduce belt-induced injuries such as going to four-point safety belts, instead of the current three-point ones, to spread the forces on occupants while still providing restraint that's tight enough."

The Institute report, "Effects of seat belt load limiters on driver fatalities in frontal crashes of passenger cars" by M.L. Brumbe-low et al., was presented in June at the International Technical Conference on the Enhanced Safety of Vehicles. For a copy write: Publications, Insurance Institute for Highway Safety, 1005 North Glebe Road, Arlington, VA 22201, or email publications@iihs.org.

New data, same finding: electronic stability control REDUCES CRASH DEATHS

A federal report finds that electronic stability control, or ESC, reduces fatal crashes involving a single car by 36 percent. The corresponding percentage for SUVs, pickups, and vans is 63 percent. Fatal single-vehicle rollover crashes are reduced even more — 70 percent for cars and 88 percent for the other vehicles.

These findings, published in July by the National Highway Traffic Safety Administration (NHTSA), update a 2004 agency report, which also showed ESC's life-saving benefits. Two Institute studies show similar effects (see *Status Report*, June 13, 2006 and Jan. 3, 2005).

ESC helps by monitoring vehicle response to steering and detecting when a vehicle starts to stray from a driver's intended path or the rear of the vehicle starts to spin out. Then ESC automatically brakes individual wheels to maintain the intended direction and, thus, driver control.

Responding to accumulating evidence of ESC's effectiveness, NHTSA issued a regulation in April to require this feature on passenger vehicles by the 2012 model year. In issuing the requirement, NHTSA estimated that 5,300 to 9,500 lives will be saved annually when every passenger vehicle is equipped with ESC. This is in line with the Institute's conclusion that ESC may save as many as 10,000 lives each year. Most of the benefit will be in rollover crashes, in which NHTSA predicts that deaths may be reduced by 4,200 to 5,500 annually.

Automakers may be moving faster than NHTSA requires. About 2 of every 3 new passenger vehicle models already have ESC. This proportion is expected to rise in the years before the federal rule takes effect.

"Statistical analysis of the effectiveness of electronic stability control systems: final report" (DOT HS 810 794) is available at <http://dmses.dot.gov/docimages/p102/479883.pdf>.

