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NEWS RELEASE

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NEW CRASH TESTS DEMONSTRATE THE INFLUENCE OF VEHICLE SIZE AND WEIGHT ON SAFETY IN CRASHES; RESULTS ARE RELEVANT TO FUEL ECONOMY POLICIES

ARLINGTON, VA — Three front-to-front crash tests, each involving a microcar or minicar into a midsize model from the same manufacturer, show how extra vehicle size and weight enhance occupant protection in collisions. These Insurance Institute for Highway Safety tests are about the physics of car crashes, which dictate that very small cars generally can't protect people in crashes as well as bigger, heavier models.

"There are good reasons people buy minicars," says Institute president Adrian Lund. "They're more affordable, and they use less gas. But the safety trade-offs are clear from our new tests. Equally clear are the implications when it comes to fuel economy. If automakers down-size cars so their fleets use less fuel, occupant safety will be compromised. However, there are ways to serve fuel economy and safety at the same time."

The Institute didn't choose SUVs or pickup trucks, or even large cars, to pair with the micro and minis in the new crash tests. The choice of midsize cars reveals how much influence some extra size and weight can have on crash outcomes. The Institute chose pairs of 2009 models from Daimler, Honda, and Toyota because these automakers have

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micro and mini models that earn good frontal crashworthiness ratings, based on the Institute's offset test into a deformable barrier. Researchers rated performance in the 40 mph car-to-car tests, like the front-into-barrier tests, based on measured intrusion into the occupant compartment, forces recorded on the driver dummy, and movement of the dummy during the impact.

Laws of physics prevail: The Honda Fit, Smart Fortwo, and Toyota Yaris are good performers in the Institute's frontal offset barrier test, but all three are poor performers in the frontal collisions with midsize cars. These results reflect the laws of the physical universe, specifically principles related to force and distance.

Although the physics of frontal car crashes usually are described in terms of what happens to the vehicles, injuries depend on the forces that act on the occupants, and these forces are affected by two key physical factors. One is the weight of a crashing vehicle, which determines how much its velocity will change during impact. The greater the change, the greater the forces on the people inside and the higher the injury risk. The second factor is vehicle size, specifically the distance from the front of a vehicle to its occupant compartment. The longer this is, the lower the forces on the occupants.

Size and weight affect injury likelihood in all kinds of crashes. In a collision involving two vehicles that differ in size and weight, the people in the smaller, lighter vehicle will be at a disadvantage. The bigger, heavier vehicle will push the smaller, lighter one backward during the impact. This means there will be less force on the occupants of the heavier vehicle and more on the people in the lighter vehicle. Greater force means greater risk, so the likelihood of injury goes up in the smaller, lighter vehicle.

Crash statistics confirm this. The death rate in 1-3-year-old minicars in multiple-vehicle crashes during 2007 was almost twice as high as the rate in very large cars.

"Though much safer than they were a few years ago, minicars as a group do a comparatively poor job of protecting people in crashes, simply because they're smaller and lighter," Lund says. "In collisions with bigger vehicles, the forces acting on the smaller ones are higher, and there's less distance from the front of a small car to the occupant compartment to 'ride down' the impact. These and other factors increase injury likelihood."

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The death rate per million 1-3-year-old minis in single-vehicle crashes during 2007 was 35 compared with 11 per million for very large cars. Even in midsize cars, the death rate in single-vehicle crashes was 17 percent lower than in minicars. The lower death rate is because many objects that vehicles hit aren't solid, and vehicles that are big and heavy have a better chance of moving or deforming the objects they strike. This dissipates some of the energy of the impact.

Some proponents of mini and small cars claim they're as safe as bigger, heavier cars. But the claims don't hold up. For example, there's a claim that the addition of safety features to the smallest cars in recent years reduces injury risk, and this is true as far as it goes. Airbags, advanced belts, electronic stability control, and other features are helping. They've been added to cars of all sizes, though, so the smallest cars still don't match the bigger cars in terms of occupant protection.

Would hazards be reduced if all passenger vehicles were as small as the smallest ones? This would help in vehicle-to-vehicle crashes, but occupants of smaller cars are at increased risk in all kinds of crashes, not just ones with heavier vehicles. Almost half of all crash deaths in minicars occur in single-vehicle crashes, and these deaths wouldn't be reduced if all cars became smaller and lighter. In fact, the result would be to afford less occupant protection fleetwide in single-vehicle crashes.

Yet another claim is that minicars are easier to maneuver, so their drivers can avoid crashes in the first place. Insurance claims experience says otherwise. The frequency of claims filed for crash damage is higher for mini 4-door cars than for midsize ones.

Here's how the pairs of cars fared in the Institute's new crash tests:

Honda Accord versus Fit: The structure of the Accord held up well in the crash test into the Fit, and all except one measure of injury likelihood recorded on the driver dummy's head, neck, chest, and both legs were good. In contrast, a number of injury measures on the dummy in the Fit were less than good. Forces on the left lower leg and right upper leg were in the marginal range, while the measure on the right tibia was poor. These indicate a high risk of leg injury in a real-world crash of similar severity. In addition, the dummy's head struck the steering wheel through the airbag. Intrusion into the Fit's occupant compartment was extensive. Overall, this minicar's rating is poor in the front-to-front crash, despite its good crashworthiness rating based on the Institute's frontal offset test into a deformable barrier. The Accord earns good ratings for performance in both tests.

Mercedes C class versus Smart Fortwo: After striking the front of the C class, the Smart went airborne and turned around 450 degrees. This contributed to excessive movement of the dummy during rebound — a dramatic indication of the Smart's poor performance but not the only one. There was extensive intrusion into the space around the dummy from head to feet. The instrument panel moved up and toward the dummy. The steering wheel was displaced upward. Multiple measures of injury likelihood, including those on the dummy's head, were poor, as were measures on both legs.

"The Smart is the smallest car we tested, so it's not surprising that its performance looked worse than the Fit's. Still both fall into the poor category, and it's hard to distinguish between poor and poorer," Lund says. "In both the Smart and Fit, occupants would be subject to high injury risk in crashes with heavier cars." In contrast, the C class held up well, with little to no intrusion into the occupant compartment. Nearly all measures of injury likelihood were in the good range.

Toyota Camry versus Yaris: There was far more intrusion into the occupant compartment of the Yaris than the Camry. The minicar's door was largely torn away. The driver seats in both cars tipped forward, but only in the Yaris did the steering wheel move excessively. Similar contrasts characterize the measures of injury likelihood recorded on the dummies. The heads of both struck the cars' steering wheels through the airbags, but only the head injury measure on the dummy in the Yaris rated poor. There was extensive force on the neck and right leg plus a deep gash at the right knee of the dummy in the minicar. Like the Smart and Fit, the Yaris earns an overall rating of poor in the car-to-car test. The Camry is acceptable.

Fuel economy implications: One reason people buy smaller cars is to conserve fuel. Gasoline prices skyrocketed last year, and there's no telling what the price at the pump might be next week. Meanwhile, the gears are turning to hike federal fuel economy requirements to address environmental concerns. The conflict is that smaller vehicles use less fuel

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but do a relatively poor job of protecting people in crashes, so fuel conservation policies have tended to conflict with motor vehicle safety policies.

A problem with the current structure of fuel economy standards for cars is that the target of 27.5 miles per gallon is applied to an automaker's whole fleet, no matter the mix of cars an individual automaker sells. This encourages manufacturers to sell more smaller, lighter cars to offset the fuel consumed by their bigger, heavier models. Sometimes automakers even sell the smaller — and less safe — cars at a loss to ensure compliance with fleetwide requirements.

In response, the Obama administration announced it is boosting the fuel economy standard for cars, beginning with 2011 models, and instituting a size-based system to set fuel economy targets like the one already in effect for SUVs, pickups, and vans. This system will mandate lower fuel consumption as cars get smaller and lighter, thus removing the incentive for automakers to downsize their lightest vehicles to comply. It also could mean that technology currently used to enhance horsepower would go instead to reduce gas consumption — a direct safety benefit because less powerful cars have lower crash rates.

Another way to conserve fuel, and serve safety at the same time, is to set lower speed limits. Going slower uses less fuel to cover the same distance. The national maximum 55 mph speed limit, enacted in 1974, saved thousands of barrels of fuel per day. It also saved thousands of lives. Highway deaths declined about 20 percent the first year, from 55,511 in 1973 to 46,402 in 1974. The National Research Council estimated that most of the reduction was due to the lower speed limit, and the rest was because of reduced travel. By 1983 the national maximum 55 mph limit still was saving 2,000 to 4,000 lives annually.

"Fifty-five was adopted to save fuel, but it turned out to be one of the most dramatic safety successes in motor vehicle history," Lund concludes. "The political will to reinstate it probably is lacking, but if policymakers want a win-win approach, lowering the speed limit is it. It saves fuel and lives at the same time."

End 5-page news release on car size/weight, safety, fuel economy
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