

# SAFETY

## IN NUMBERS

*You could learn a lot from a dummy.*

## Our Family Works to Protect Your Family

To protect you and your family during a crash, we have to understand what happens to your bodies during that fraction of a second of crash impact. To ask you, your spouse, or your kids to voluntarily crash a car into a solid concrete wall would be unthinkable. But that doesn't mean another very important family can't lend a helping hand.


Meet NHTSA's family of crash test dummies, working to better protect you and your family. It takes a myriad of crash test dummies to understand how we fare during frontal impact crashes, side impacts, rear impacts, and air bag deployment. This family of dummies helps us understand and measure the human body's movement, vehicle performance, and the performance of various safety features during a crash. And since each member of your family differs in size, weight, and movement, each crash test dummy is shaped differently as well. NHTSA's family of dummies ranges from newborn infants to 10-year-old children to small females and average males. NHTSA also is involved in worldwide development and evaluation of crash test dummies even more advanced than those we use now.

Design, instrumentation, and testing with these crash test dummies help ensure the safety of your family in the unfortunate event that a crash occurs by encouraging safety improvements to vehicles to provide better occupant protection.

**For more information, visit:**

**[www.NHTSA.gov/VRTC](http://www.NHTSA.gov/VRTC)**

### Milestones for NHTSA's Dummies

- 1966** • Department of Transportation founded by Congress and given the authority to issue Federal Motor Vehicle Safety Standards. 
- 1970** • The Highway Safety Act of 1970 combines three agencies into the National Highway Traffic Safety Administration.
- 1973** • NHTSA creates a repository for crash test dummy specifications (Part 572, Title 49, Code of Federal Regulations) and issues a regulation for occupant crash protection (FMVSS No. 208) that incorporates performance requirements for an adult-size crash test dummy.
- 1985** • The standard for child restraint systems (FMVSS No. 213) incorporates performance requirements for child-size crash test dummies.
- 1990** • The standard for protection during side impact crashes (FMVSS No. 214) incorporates performance requirements for crash test dummy designed specifically to measure injury during side impacts.
- 1993** • Additional dummies designed to represent children of different ages are incorporated into the standard for child restraint systems.
- 1995** • The regulation designed to protect people from injury by hitting interior components of the vehicle (FMVSS No. 201) uses the free-motion headform and later adds an adult-size male dummy for side impact testing.
- 2003** • Additional dummies represent different size occupants such as children and small women in the occupant protection standard and the child restraint system standard.
- 2006** • A female dummy and a more advanced adult male dummy are incorporated into the standard for side impact crash protection.
- 2007** • The regulation for head restraints (FMVSS No. 202a) uses an adult male test dummy to increase safety of head restraints.












## Did You Know?

In addition to helping improve seat belts, air bags, and child passenger restraints, crash test dummies are important to the improvement of the following safety devices.

- **Head restraints.** Contrary to popular belief, head restraints are not just for comfort. Head restraints are designed to keep the body more in its natural alignment during a rear impact crash, thus minimizing the potential for whiplash injury. During testing, the movement of the dummy's head relative to the dummy's torso is measured and must stay below a certain limit.
- **Air bags and collapsible steering columns.** In a front-end crash, a driver's body moves forward toward the steering wheel. Instruments in the dummy measure the impact to the chest during the crash. Air bags and collapsible steering columns help to decrease the impact.
- **Knee bolsters.** The dashboard near the driver's knees is a high-impact point during a frontal crash. The dummies have special instruments that measure this impact. Vehicles are required to meet specific standards to reduce injury to the knees and legs.
- **Pretensioners.** As part of many seat belt assemblies, a pretensioner activates before the crash. Sensors detect sudden deceleration of your car immediately before a frontal crash and trigger the pretensioner to take out the slack in your seat belt. During this fraction of an instant, the seat belt brings you closer to the seat back to provide maximum benefit of the safety systems.
- **Load limiters.** Also part of many seat belt assemblies, this device limits the force exerted on a person's chest during an impact. Crash dummies tell how effective the load limiter is by measuring the amount of chest compression during a crash test.

## Meet NHTSA's Crash Test Dummy Family

The following crash test dummies are used in NHTSA's Federal Motor Vehicle Safety Standards (FMVSS).

Dummy Name		What does the dummy represent?	What is the dummy's specialty?
Hybrid III – full family		50th percentile male, 5th percentile female, 10-year-old child, 6-year-old child weighted, 6-year-old child unweighted, 3-year-old child	Upper and lower body movement, head impact, neck force, chest compression, impact to legs; Used in frontal impact crash tests and child restraint systems tests
Q3s		3-year-old child	Head and neck movement; Developed for side impact testing; Used at NHTSA for side impact testing with child restraint systems
ES2re		50th percentile male with upper arms only	Upper and lower body movement, chest, abdominal, and pelvic impact; Used in side impact crash tests
SID IIs		5th percentile female with upper arms only	Upper and lower body movement, head and pelvic impact; Used during side impact crash tests
Free Motion Headform		Head shape of an adult 50th percentile male (without a nose)	Measures the impact force to the head as it comes into contact with specific locations inside the vehicle
CRABI		12-month-old child	Upper body movement; Used in child restraint testing and frontal impact occupant protection testing
CAMI Newborn		Weight and size of the average newborn baby	Dummy has no instrumentation but is weighted and sized to be used in child restraint systems

## Development of new crash test dummies

- **THOR (Test device for Human Occupant Restraint)** – In development and evaluation, these advanced dummies have more human-like response throughout the body (neck, chest, shoulder, spine, thighs/pelvis, lower legs, and abdomen) as well as advancements in instrumentation that will help assess more advanced restraint systems.
- **WorldSID** – Currently in development by an international group of experts, the WorldSID dummy has more instrumentation to detect possible injury during a side impact crash. A 50th percentile male and a 5th percentile female dummy are being evaluated.
- **BioRID II (a 50th percentile male)** – Currently being assessed for improved rear impact protection, this dummy has increased instrumentation to assess loading of the human spine.
- **Advanced frontal 6-year-old/10-year-old child dummies** – New frontal impact child dummies are in development, designed to have improved human-like response (neck, thorax, spine, abdomen) and instrumentation for assessing interactions with child seats and vehicle restraints to include improved assessment for submarining-related injuries (sliding below the lap belt of a seat belt).





**Figure 1. Crash test before, during, and after. Measurements from the test dummy are used to predict the risk of injury to each part of the body.**



## “You Could Learn a Lot From a Dummy.”

This famous tag line was the foundation of a popular NHTSA safety campaign from the 1980s and 1990s urging people to wear their seat belts. Vince and Larry, the loveable crash test dummies, encouraged seat belt use through TV, print, and radio ads.

In 2010, Vince and Larry were inducted into the Smithsonian Institution’s Museum of American History as part of an exhibit on the evolution of automobile safety – along with authentic crash test dummies.

## Adult THOR dummy under worldwide assessment.

Removal of chest covers show intricacies of the chest regions of the dummy.



## Fun Facts

- The first season of the TV show *MythBusters* used a Hybrid II crash test dummy nicknamed Buster to test myths. The show’s tests often exceeded the severity of the crashes Hybrid II was designed for and Buster was later replaced with a more easily repairable wood-and-silicone version.
- In 2012, the Discovery Channel crashed a full-size passenger airplane into a remote and uninhabited desert. On board were three crash test dummies to understand the impact of the crash on the human body.
- NASA is evaluating the THOR dummy as a potential device to be used for occupant safety standards for the next generation of space vehicles.
- In 2008, the program *Fight Science* compared the force from punches and kicks to a Hybrid III dummy given by trained martial arts and boxing professionals.

# WHAT YOU CAN DO

## You Could Learn a Lot From a Dummy:

Like how to properly sit in a vehicle to maximize your safety and the safety of your family.

## Adults and Children 13 and Older

- Sit facing forward with your feet on the floor in front of you (don't put your feet on the dash or out the window).
- Drivers sit at least 12 inches from the steering wheel (pedal extenders are available to provide good contact with the pedals while also allowing you sufficient distance from the air bag in the steering wheel).
- Wear your seat belt's lap belt low on your hips and the shoulder strap flat across your collar bone.
- Minimize the time that you are out of position. Place items you may need

during travel nearby so they are within arm's reach and you can quickly return to the correct seating position.

- Position your head restraint so it is higher than the top of your head and as close as possible to the back of your head.

## Children 12 and Younger

- Sit in the back seat of the vehicle.
- Use the appropriate car seat, booster, or seat belt for your child's age and size.
- Rear-facing and forward-facing child safety seats should be securely installed in the vehicle. Parents can go to a certified child passenger safety technician or to an inspection station (see locator at [www.safercar.gov/cpsApp/cps/index.htm](http://www.safercar.gov/cpsApp/cps/index.htm)) to learn correct installation and have the restraint system checked.
- For children who have outgrown their harnessed car seat, use a booster seat to make sure the seat belt is in the correct

position. Move to the adult seat belt only when it fits the child properly.

- Don't horse around and get out of position in the seat. Face forward with knees and legs over the front of the seat.

## Government Safety Ratings Program

- NHTSA's New Car Assessment Program created the 5-Star Safety Ratings Program to provide consumers with information about the crash protection and rollover safety of new vehicles beyond what is required by Federal law. One star is the lowest rating; five stars are the highest. More stars equal safer cars.
- Each year, new vehicle models are tested using certain crash test dummies to measure a vehicle's occupant protection performance in frontal and side impacts.
- Find out more information about vehicle safety ratings and other vehicle-related safety information at [www.safercar.gov](http://www.safercar.gov).



For more information, visit:  
[www.NHTSA.gov/VRTC](http://www.NHTSA.gov/VRTC)

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