

Myth: A Helmet Is Designed to Protect Only Up to a 13-MPH Impact Speed

Advocates for helmet repeal regularly say that helmets are tested at impact speeds of only 13 MPH and imply that helmets are not effective in protecting the head and brain in crashes with pre-crash speeds higher than 13 MPH. As an example, statements similar to this were made by Michigan ABATE representatives regarding HB 4608 at the September 14, 2011, meeting of the House Committee on Transportation.

While this statement is partially true, it is deceptive. The 13-MPH value is the approximate impact speed that results from the “drop test” helmets are subjected to during Department of Transportation (DOT) testing, but it is highly misleading and intentionally deceptive to imply that this means that helmets are not effective at speeds above 13 MPH. In the drop test, a helmet is placed on a headform, which is a standardized metal form that is more or less in the shape of a human head. The design and weight of each headform is very specific and is specified in the DOT standard. Helmets are dropped, from a specified distance, on various metal devices, or “anvils,” to measure the amount of energy absorbed by the helmet and liner.

These tests are also usually preceded by “conditioning” of the helmets; that is, the helmets must first be subjected to standard environmental conditions, including moisture, a range of temperatures, and even solvents. This helps ensure that the helmet and the helmet shell will be tested under conditions similar or worse than might be experienced in the field when used by consumers. The shapes upon which the helmets are dropped are designed to represent road obstructions, such as flat surfaces, curved or hemispherical surfaces, curbs, and other obstructions that might be encountered as the rider is sliding down the road after being separated from the motorcycle.

The 13 MPH value was not chosen as being the highest speed at which a helmet is effective; the speed is the result of the chosen six-foot drop-test height. The six-foot height is derived from the accident type identified in the Hurt Report of 1981 and verified numerous times since. It is the 90th percentile. In other words, in 90 percent or more of real-life motorcycle crashes, the rider suffers a blow to the head by falling off the motorcycle from approximately a six-foot height, thus hitting the ground at approximately 13 MPH. This impact speed holds true regardless of the pre-crash speed of the motorcycle.

Other tests include visor/face-shield–penetration tests, chin-strap retention, and helmet roll-off tests. A PDF version of the applicable DOT motorcycle-helmet standard can be found here: http://edocket.access.gpo.gov/cfr_2002/octqtr/pdf/49cfr571.218.pdf.

The actual drop-test standard is shown below:

S7.1.4 (a) The guided free fall drop height for the helmet and test headform combination onto the hemispherical anvil shall be such that the minimum impact speed is 17.1 feet/second (5.2 m/sec). The minimum drop height is 54.5 inches (138.4 cm). The drop height is adjusted upward from the minimum to the extent necessary to compensate for friction losses. (b) The guided free fall drop height for the helmet and test headform combination onto the flat anvil shall be such that the minimum impact speed is 19.7 ft./sec or 6.0 m/sec. The minimum drop height is 72 inches (182.9 cm). The drop height is adjusted upward from the minimum to the extent necessary to compensate for friction losses.

These two values can be converted to MPH, resulting in the claim of approximately 13 MPH, using a conversion chart found at www.asknumbers.com/SpeedConversion.aspx. Go to www.youtube.com/watch?v=dtRdMEoeQbc&feature=related to see a video demonstration of how this works.

Helmets work as a kind of shock absorber for your head and brain. To quote Dr. Harry Hurt Jr., the lead investigator of the foundational research on motorcycle-helmet effectiveness, “The typical motorcycle accident involves a motorcycle rider falling on his head and shoulder from 5 or 6 feet. This is just exactly what a good helmet is designed to take. Actually, it can do much, much more.” (Motorcycle Accident Cause Factors and Identification of Countermeasures – US DOT National Highway Traffic Safety Administration video report)

During a fall or crash, a rider’s head is traveling at a certain speed. Since the head has weight and is moving, there is a certain amount of energy associated with the moving head. When the helmeted head impacts an immovable object like a wall, a curb, or the ground, the hard shell of the helmet takes the energy generated by the falling helmeted head and spreads it over a larger portion of the helmet, specifically the internal foam liner. The foam liner then starts to crush and break, which absorbs a lot of the energy, keeping it from reaching the head inside. A helmet will effectively reduce the speed of the head by breaking and crushing, which reduces the amount of energy transferred to the brain. The whole process takes only fractions of a second and can turn a potentially deadly blow into a survivable one.

The drop test is specifically designed to replicate the scenario of a typical fall and to cover 90 percent or more of crash scenarios. This means that as opposed to the implication made by advocates for repeal that helmets are not effective for crash speeds over 13 MPH, the truth is that the testing is designed to cover almost all crash scenarios.

An excellent article by Dr. Voyko Banjac, titled “Crash Science: The Myths and Realities of Motorcycle Helmets,” which explains the facts about the 13-MPH claim, along with facts related to eight other myths about helmets, can be found on the Gear Up page of the SMARTER Web site or by going to <http://www.independencepolice.org/pdf/CrashScienceJune06.pdf>.