

MYTHS OF LOW-SPEED REAR-END IMPACTS **REVEALED!**

by Gary A. Presswood, PE

Abstract: *The following article exposes popular and often used fallacies in expert testimony regarding low-speed, rear-end impacts. Evidence given in court is often based on unscientific studies, misinterpretation of published documents, or studies having no statistical relevance. As a result, improper inferences are made, contrary to scientific standards and evidence as mandated by the Federal Courts.*


Myth \ 'mith\ n. 1: a usu. legendary narrative that presents part of the beliefs of a people or explains a practice or natural phenomenon 2: an imaginary or unverifiable person or thing. (Source: The New Meriam-Webster Dictionary, Miriam-Webster Inc., Springfield, Massachusetts, 1989)


A serious lack of scientific credibility exists in our courts today. Alarmingly, this problem has likely existed since the very first expert witness was called upon to testify. The dilemma is one of "junk science," or nonscientific opinions, often the result of misinterpretation of published studies; occasionally, even these referenced studies fail to meet acceptable levels of scientific reliability and credibility.

Vehicle accident reconstructionists are often retained to analyze what has been popularized as "low-speed rear-end impacts." Based on popular and all too often, statements found in expert reports, it is my position that the problem of unscientific reliability is expanding at what appear to be near exponential rates.

The substance of this article addresses this unique but common type of vehicle accident and will (1) expose a few of the most popular unscientific statements, interpretations and analyses, and (2) suggest methods the reader may use in discovering these errors. Essentially, the practicing attorney, insurance professional, and expert witness should be constantly and keenly aware of what constitutes scientific evidence and reliability, as opposed to accepting incorrect and somewhat mythical conjecture.

Many litigators have accepted expert testimony as fact, when, in reality, the statements are unscientific and clearly biased. As an example, a sample expert's report may contain deceptive and fallacious statements such as:

 *Since the impact speed of the striking vehicle was found to be extremely low, virtually no energy was transferred to the occupants of the struck vehicle.*

 *Based on a calculated impact speed of less than 3 MPH [miles per hour], no injury could have occurred.*

● *Lacking physical evidence of any damage, the striking speed could not have exceeded 5 MPH, which equates to no potential for physical injuries to the vehicle's occupants.*

Supporting data for such statements is typically provided by XYZ Engineering Company (an assumed name) who, (as an illustration), tested a very small and limited number of willing and physically fit volunteer subjects, an equally small number of passenger cars (often structurally altered in order to preserve the test vehicle for repeated tests). These studies typically have a certain, albeit limited benefit to the scientific community in that they record observed and measured test events. Occasionally although not often, the author(s) may caution the reader against extracting improper conclusions due to inherent biases of limited sample population, altered vehicles, etc. Instead, an expert, searching for data to support his client's claim, all too often, will frequently extract improper, self-serving conclusions which clearly do not meet federally mandated criteria for scientific evidence.

The intent of this article is not to address the legal principles of scientific reliability and validity as portrayed by *Fed. Rules of Evidence, Frye, Daubert, etc.*, other than to hopefully reaffirm the courts' edict for truthful and valid scientific testimony. It is, however, my intent (by examination of the above sample, popular statements) to expose when court mandated scientific standards have not been met. A review and discussion of each sample statement follows:

● *Since the impact speed of the striking vehicle was found to be extremely low, virtually no energy was transferred to the occupants of the struck vehicle.*

Energy is **always**, without question, transferred to a struck vehicle **and to its occupants** in an impact. Granted, the quantity of energy transfer may be at issue and could, conceivably require further, detailed analysis of injury causation; however, if an impact occurred, energy was transferred to the impacted vehicle and all occupants. Energy transfer can, and often does, result in vehicle damage and/or apparent physical damage to occupants of a vehicle.

In 1687, English philosopher and scientist Isaac Newton, published (in his *Philosophiae naturalis principia mathematica* or, *Mathematical Principles of Natural Philosophy*) what has become recognized as "Newton's Principles of Motion." Effectively, these principles have defined, for the past 300 years, the study of physics and engineering, and have served to explain and predict the motion of objects (including vehicular motion). Newton's second principle (as it applies to a two-vehicle collision) basically says that an object will move in the direction of a striking force, relative to the weight of the object being moved and the force generated onto the struck object. (The stated principle is considerably more complex but this simplified and greatly annotated definition accurately serves to portray energy transfer between two vehicles in an accident.)

Note that nowhere does this principle state that an object will **not** move if struck. **Impact energy causes motion**. If a vehicle is at rest on a roadway and no impact occurs (e.g., energy from a striking auto), the vehicle will remain at rest and will not move. This principle of motion clearly states that if a force is applied (for example, by a rear vehicle striking a leading or forward positioned auto stopped for a traffic light), the front vehicle will move as a result of the impact

forces. Again, **impact energy causes motion**. That same energy causes motion both on impacted vehicles and all occupants.

● ***Based on a calculated impact speed of less than 3 MPH [miles per hour], no injury could have occurred.***

I first caution the reader that any statement of potential injury causation is appropriate **only** when made by a qualified medical expert. I further suggest that too many "expert's" claim to be "biomechanical engineers." A thorough review of the expert's qualifications (hopefully prior to *voir dire*) should serve to expose the expert's potentially limited experience regarding physical injury causation. Experience in injury causation expertise acquired by many experts is unfortunately meager and often based on relatively brief seminar type courses. Unfortunately, popular seminar courses, computer programs, and other devices particularly aimed at the growing vehicle accident reconstruction community, fail to adequately train many experts. Noticeably, pseudo-medical/technical seminars have now expanded into areas of injury causation analysis.

Expert opinions are often erroneously endorsed by placing emphasis on carefully selected supporting published studies. These articles are numerous and often portray results of staged vehicle collisions with willing volunteers, mechanical dummies and even cadavers (strange, but remarkably true). Typically, the studies provide useful although limited information; however, the most essential and basic statistical analysis methods dictate that one cannot extract opinions applicable to an entire population based on a non-statistical analysis of a few individuals (known as a small sample population)! This faulty analysis is comparable to emphasizing predictably biased results of a (60's era) presidential poll taken in Dallas, Texas with LBJ as the leading candidate!

The expert witness typically states his/her case while brandishing published documents which detail results of a particular study concluding no significant injury to the test subject(s). What the expert often fails to divulge are other reports which define the threshold of possible injury causation threshold at anywhere from 1.55 MPH to 8 MPH, (based on actual studies).

Perhaps the least meaningful and most misunderstood of these studies compare the effects to a "hearty slap on the back", "hopping from a single step", "plopping down in a chair", or the results of "being bumped while standing in line." Many of these forces are not directly present in vehicle accidents unless supplied by a "knee jerk" type reaction of being unexpectedly impacted from behind. Medical experts have advised that these reports often compare "apples and oranges" and often analyze living "non typical," "non average" human beings. It soon becomes apparent that an expert's reliance on such studies, conveniently ignore important variables such as age, sex, alertness, position of head restraints, and countless uncontrollable variables.

I do however, applaud the relatively few authors who caution the reader of the numerous variables which exist, often resulting in potential limitations of applicable data. Essentially, one cannot extract valid, scientifically meaningful information based on, as an example, a limited test which may have tested the physical motion of a 25 year old healthy male being struck from behind in his 1987 Mazda by a 1990 Lincoln Towncar traveling at 7 miles per hour (unless of

course, the case involves the specific aforementioned 25 year old male who happens to be driving a similar model Mazda, etc.). To illustrate this point, I suggest it is highly probable that an 80 year old, barely 100 lb. grandmother is considerably more susceptible to injuries resulting from a low-speed, rear-end impact than a 300 lb. tight end for the Green Bay Packers although many experts apparently insist otherwise, based on his/her chosen study.

● ***Lacking physical evidence of any damage, the striking speed could not have exceeded 5 MPH, which equates to no potential for physical injuries to the vehicle's occupants.***

Lack of damage is not an accurate indicator of impact speed. Consumer Reports and test results tendered by the Insurance Institute for Highway Safety, often report zero damage to bumpers from barrier impact tests (at typically 5 MPH) suggesting at least a 5 MPH effective bumper rating (i.e., without damage). True, automobile bumpers are rated by the manufacturer's in accordance with federally required test standards; however, **lack of bumper damage is not among those standards!**

The Federal Vehicle Information and Cost Savings Act of 1972, required the U. S. Dept. of Transportation to implement a property damage bumper standard. That standard was originally set at 5 MPH (for passenger cars) which generally meant that a vehicle should be able to sustain an impact into an immovable barrier at 5 MPH without significant damage to the doors, trunk lid, gas tank, etc. This impact standard was later reduced to 2.5 MPH but since manufacturer's had essentially met the 5 MPH criteria by the date the reduced standard was adopted, the 5 MPH bumper effectively remained as the manufacture's standard of performance.

This 2.5 MPH standard versus the 5 MPH effective bumper illustrates my point that, although a bumper may be rated at a certain standard (e.g., 5 MPH), it often performs at a much higher barrier impact speed (i.e., equal to or greater than 5 MPH). If a 5 MPH standard was originally mandated, it makes perfect sense that a bumper designer would include a factor of safety and "over design" in an effort to guarantee the standard is met. For this reason, bumpers often exceed the rated and mandated design standard. As a result, **lack of bumper damage is not an effective and accurate indicator of impact speed.**

Inadequately trained vehicle accident reconstructionists often and incorrectly use equivalent barrier damage in order to determine impact speed. This method should not be used in low-speed rear-end impacts since the forces are minor compared to those resulting from (metal damage induced) higher speed impacts used to establish barrier impact coefficients. King, et al. states, "Because of the higher coefficients of restitution in low-speed impacts, the BEV (Barrier Equivalent Velocity) or EBS (Equivalent Barrier Speed) typically used in higher speed collisions cannot be used to describe the impact severity of low-speed collisions.... The speed change of low-speed impacts is always greater than the BEV." (Source: King, David J., Siegmund, Gunter P., Mark N., MacInnis Engineering Assoc., Ltd., SAE Technical Paper No. 930211, SAE International, Warrendale, PA, 1993.)

One acceptable alternative would be to measure the bumper isolator compression (if so equipped, although performance of certain isolators may not be repeatable and predictable). The distance the bumper isolator(s) compresses can be a function of the relative impact speed. An alternative

vehicle reconstruction analysis method may be to utilize basic work/energy equations utilizing such elements as known weights and measured distance traveled after impact.

CONCLUSION

Statements and opinions found in expert reports and even those made in front of arbitrators, judges and juries, are often misleading, clearly in error and not supported by adopted scientific principles. Presumably, many of these errors result from inadequate training on behalf of the expert witness and or a misguided zeal to serve his/her client's needs. Often, published studies fail to issue appropriate cautions regarding improper use, but whatever the reason, many of the expert's opinions and relevance to published articles should be questioned. Verification should be obtained. Review from the scientific community is encouraged and is one of the tests for scientific reliability as recognized by the US Justice Department. Use it!

I suggest the courts, attorneys, insurance industry, and expert witnesses reconsider offering false statements under the guise of "scientific evidence." A great deal of current expert testimony is simply not scientific! Much testimony is however, myth!

Unfortunately, many experts are not adequately trained or apparently fail to realize when published studies do not meet scientific muster. Myths are for storytellers, not for expert testimony. Truly scientific principles must be respected if scientific testimony is to truly provide technical information and educate the "trier of fact."

Gary A. Presswood & Associates is a professional engineering firm specializing in the forensic sciences and may be reached at:

Gary A. Presswood & Associates, Ltd.
777 N. Rainbow, 2nd Floor
Las Vegas, Nevada 89107
Office: (702) 256-7859 ~ FAX: (702) 214-2209