40 Years! As of mid-January of 2012, I have been working in the field of forensic consulting for 40 years. In January of 1972, I went to work for Cerny and Ivey Engineers, without any prior knowledge or experience in the business of forensic consulting. They needed to hire someone, since their volume of business was increasing, and I needed a job. At that time, I had no plans or intentions of making a career with them. As I was exposed to and involved in virtually everything they did, I enjoyed the jobs related to automobiles, and I worked on specializing in accident reconstruction and vehicle component failure evaluations, enjoying the work and the challenges more with each passing year. As a Senior Staff Engineer, I was ultimately in charge of all automotive-related business for the firm before I left in 2001 to begin my self-employed phase of work. Now, it's been over ten years on my own and 40 years total. I guess it's time for me to consider whether or not to make a career in this field. ☺

Although J. Stannard Baker (at Northwestern University) is considered the grandfather of modern accident reconstruction, the early scientific tests and experiments which led to the development of computer programs and other aspects of numerical analysis of automotive collisions were conducted at UCLA and at Calspan (initially, Cornell Aeronautical Labs). As collision data collections were studied from a numerical standpoint, scientific principles were applied to those collections. Early works included SAE 740565, "Energy Basis for Collision Severity," by Kenneth Campbell, and SAE 760776, "Computer Aids for Accident Investigation," by Raymond McHenry, which discussed the computer-based programs SMAC (Simulation Model of Automotive Collisions) and CRASH (Calspan Reconstruction of Accident Speeds on the Highway). Other common acronyms in the reconstruction field which were developed or presented during that period or earlier include RICSAC (Research Input for Computer Simulation of Automotive Collisions), NTSB (National Transportation Safety Board), NHTSA (National Highway Traffic Safety Administration), and HVOSM (Highway Vehicle Object Simulation Model). With passing time, and considering the advent of crash-test requirements and the resulting substantial data base, numerical evaluation of collision data has been greatly refined in accuracy and repeatability when compared with the early works and results.

As I've written before, there are two basic principles of physics on which the science of accident reconstruction is based: conservation of energy and conservation of momentum. In most collision situations, the only energy we need to consider is the kinetic energy initially possessed by the vehicles, which is ultimately converted to vehicle damages at impact and post-impact travel(s). The value of the kinetic energy of any moving object is one half of the product of the mass times the velocity squared. Momentum is similarly related to a vehicle's speed, but it is a different property than energy. Momentum is the product of the vehicle's mass times its velocity, where the velocity is a vector; i.e., it has both magnitude and direction. It is the vector property of momentum which makes it particularly useful in many collision evaluations. Although we can define a direction for kinetic energy, it is essentially a scalar; i.e., its direction is not a fundamental component of its description. Although the calculations can sometimes become extremely complicated, these principles are relatively easy to understand.

Another common acronym in accident reconstruction is EBS, which stands for Equivalent Barrier Speed, the speed at which a given vehicle would have to be driven into an immovable, unyielding barrier to produce the same damage as is observed after a collision with some other object. This is also sometimes expressed at Barrier Equivalent Velocity (BEV). Another common term is delta-v, which is the sudden change in velocity which occurs during the brief period when the colliding objects are in contact with each other. EBS and delta-v are almost never the same value. The mathematical justification for that statement can be found in SAE 850437, "Barrier Equivalent Velocity, Delta-V, and CRASH3 Stiffness in Automobile Collisions," by Phillip V. Hight, D. Bruce Lent-Koop, and Robert A. Hight. As you can probably imagine or have already learned, the single most important factor which indicates the likelihood of severe occupant injury in a collision is the delta-v.

The photograph on the left, above, shows the results of a staged collision. The photograph on the right shows the permanent damage to the red car. For this collision, the speed of the silver Ford was known. Where speeds are not known, however, and where crush coefficients are available for the vehicles, the crush damage to each can be measured, and those measurements will result in calculations which will define the closing speed of the striking vehicle, usually to a very good degree of accuracy.

As is intuitively obvious, vision is the most critical sense involved in driving a motor vehicle. Although most of us see very well in daylight, many people believe they see better at night by their headlights than they actually do. I came across some data from some visibility tests that John Cerny (of Cerny and Ivey Engineers) and I conducted thirty or more years ago. The test vehicle was a 1971 Ford Maverick with headlights adjusted to legal requirements. All targets were 72 inches high by 84 inches wide and were positioned with the bottom edge 12 inches above the pavement. These tests were conducted at night, two hours after sunset, on an unlighted, rural road paved with asphalt. The pavement was wet from a light rain. There were two parameters of vision: first sighting, when it was evident from the driver's seat of the Maverick that there was something in the road ahead, and recognition, when the size and shape of the object were readily discernible to the driver. For the white target, first sighting was at 240 feet, with recognition at 98 feet. For the silver target, first sighting was at 150 feet, with recognition at 98 feet. For the black target, first sighting and recognition were both at 81 feet. And we were looking for something we knew was in the road ahead of us! For a vehicle traveling at 60 mph, that 81 feet would have been covered in less than one second. For someone driving at night who isn't aware that there is an object in the road ahead and that object has very low contrast with the environment, impact may occur at about the same instant that the driver realizes there is something in his path, or he many never see the object—the impact may be his first awareness of the presence of a hazard. Those observations of the rectangular targets were made with the headlights in low-beam mode; visibility distances increased in high-beam mode.

Starting with the 2013 models of vehicles, all manufacturers of cars and light trucks which store crash data in on-board modules will be required to record a minimum, standardized set of that crash data, and it will have to be accessible with a commercially available system. The standard provides for a six-month time span between the release of the model year and the requirement to have commercially available, public access to stored data. The trees are being shaken—it will be interesting to see what falls out in the next year or so. Although Bosch (and previously Vetronix) have been marketing a Crash Data Retrieval Toolkit for roughly fifteen years, this is still an emerging technology. With unpredictable frequency, there are new issues of software, patches for previous issues of software, new hardware components, and Internet posts about interrogations that didn't proceed as expected. I now have ten years of experience with the Vetronix/Bosch system, and I maintain the latest software and always buy new hardware as soon as it becomes available. Crash data from a module can be an incredibly useful augmentation to a reconstruction, and it can also be quite useful in cases where brake failure or some other failure is alleged by a driver. (If the data set shows that the brake pedal was applied and that the vehicle decelerated at an average rate of 0.7 g in the three seconds preceding the crash, guess whose brakes didn't fail! If the data set shows that the accelerator pedal was at or near 100 percent and the brake pedal was not applied for five one-second intervals before the crash, guess whose foot was on the wrong pedal! Talk about stuff falling out of trees!) As of this writing, Honda has signed an agreement with Bosch for EDR access in new models of Honda and Acura; there apparently will never be Bosch CDR access to earlier versions of those vehicles. The cable to download ACMs in some of the 2012 Hondas in the United States has become available for pre-order, and I have ordered it. The software to work with those downloads is reportedly planned for an April 2012 release. In years past, there was a running joke among CDR users that started when a release that had been scheduled for March was still not available in August. So, when will it become available? In March. For a while, that was the standard answer whenever anyone asked about the availability date for any new cable or software—"In March."

Bosch is also in serious talks with three other manufacturers, and there may be as many as nine new brands with EDR access within the next year or so. Woo-hoo! I have learned that Nissan vehicles have EDRs which record a large amount of crash data, starting with the 2004 model year. It will be interesting to see if Nissan will cooperate with Bosch. Stay tuned to this channel for further developments. And please contact me anytime you have a question.

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