

Ralph's Accident Reconstruction Newsletter—Volume 2, Number 1—February 2003

In the field of accident reconstruction, conservation of momentum is, in theory, the best way to reconstruct a collision. Proper application of the principles of momentum, however, requires precise and accurate knowledge of the pre-impact direction of travel of both vehicles, accurate knowledge of their weights, and some method to observe, document, or determine their initial trajectories at the instant of post-impact separation, among other bits and pieces of evidence. Often, skid marks and/or intersection geometry will define the pre-impact trajectories of each vehicle, and impact weights are generally not hard to determine, but precise determination of the post-impact direction of travel can be quite difficult. In general, it is NOT adequate, sufficient, or correct to take the lines between the positions at the point of impact and the points of rest of the vehicles as their post-impact trajectories. Conservation of energy, however, is not a vector property, and therein lies its very useful application to motor vehicle accident reconstruction.

In the basic situation where two moving vehicles collide, each will have some energy of motion, called kinetic energy. That energy is usually dissipated in doing damages to the vehicles; any kinetic energy remaining after the vehicles collide and crush into each other will appear as post-impact travel of one or both. It is a basic principle of physics that energy and work are but two manifestations of the same property. In other words, the kinetic energy of a crashing vehicle can be dissipated by the force applied to the other vehicle acting through some distance (the total deformation). Generally, the impact forces are quite high, but the distances are short. Because conservation of energy principles do not require precise vectors, conservation of energy can be more universally applied to available crash data.

Many sources are available to explain the principles of relating measured crush on a vehicle to work. This newsletter is too short to provide a list of reference materials; you may contact me if you desire a bibliography. But application of these basic principles to the wealth of crash and crush data now available due to government-mandated crash testing means that, for virtually any late-model passenger car or light truck, there are crash results which can be used to relate a measured amount of crush on a particular vehicle to an equivalent barrier speed.



These two photographs show a late-model pickup truck which was involved in a collision with another motor vehicle. Many details of this particular collision are not available for dissemination, but these photographs are of general interest and provide some measure of anonymity to the involved parties to allow me to incorporate them in this newsletter. As you can see, there is substantial impact damage at the front of this truck, concentrated at the right side.



Measurement of vehicle crush does not require any special equipment: in most situations, it can be accomplished using a set of five steel tapes. It is very helpful to have knowledge of the vehicle's undamaged dimensions before beginning to make the crush measurements, but it is not necessary. A reference rectangle can be created around the outside of the crashed vehicle, the dimensions of that rectangle can be recorded, and its location with respect to some undamaged portion of the vehicle can also be recorded. For a vehicle which is so severely damaged that there is no undamaged portion, measurements to any and all points need to be made from the reference rectangle established around the wreckage which are sufficient to allow a plan (bird's-eye) view drawing of the as-damaged car to be prepared by any other person. Regardless of the method by which measurements are made and recorded, they should allow the creation of a plan view of the damage pattern(s) of the vehicle, to scale. Both the extent of the crush and the location of that crush from some reference (the left side, the right side, the center of the rear axle, etc.) should be measured and recorded for a variety of points. Six such points are commonly measured by accident reconstructionists.

If you would like more information on this topic, please write your name plus your telephone number or email address: _____

Or, you may contact me directly with your questions, by the method of your choosing.

If you have any comments, questions, or suggestions regarding content of this or future newsletters, I welcome them. You may use this form to comment by filling in the lines and mailing it, or, as always, you are welcome to contact me by any method of your convenience: _____