

Ralph's Accident Reconstruction Newsletter—Volume 6, Number 4—October 2007



This dramatic photograph was taken at the SCARS Conference in North Charleston, South Carolina, immediately after first contact in the fourth staged collision of the first day of the 2007 conference. This collision involved a Chevrolet Suburban as the bullet vehicle and a Dodge Intrepid as the target vehicle. Despite the Suburban's obvious differences in momentum and weight, it had three wheels in the air when this photograph was taken.

The diagram to the right shows the vehicle positions and orientations at impact, post-impact paths, and final positions. There were many interesting aspects to and outcomes resulting from this staged collision.

Looking at how the vehicles were oriented at impact, one might anticipate that the Suburban would be directed to its left at impact, sliding long the right side of the Intrepid as it moved forward. Obviously, it didn't. The impact force was applied to the right side of the front of the Suburban, and that force combined with its forward momentum to cause it to pivot slightly clockwise, ultimately resulting in a steering to its right. Note from the tire marks identified and mapped on the diagram that each vehicle's initial movement during and very shortly after impact was directly in line with the original velocity vector of the Suburban but that damages

and impact forces resulted in steering effects for each vehicle. This clearly shows the importance of determining the immediate post-impact trajectory of each vehicle whenever one wants to apply conservation of momentum principles to reconstruct a collision.

The impact speed of the Suburban was 48 mph. The Suburban was a 4x4; its weight at the time of impact was 4565 pounds. The weight of the Intrepid was 3520 pounds.

Delta-v is the term used for the large speed loss which occurs during the in-contact portion of a collision sequence. When vehicles collide, the process of interaction between the two usually lasts only 100 to 150 milliseconds (0.100 to 0.150 second). During that tenth of a second, the vehicles undergo a significant change in velocity due to very high accelerations; the rate of acceleration/deceleration to a vehicle in a crash may exceed 20 times the acceleration of gravity for a brief period of time. It is that large value of acceleration/deceleration which produces the large velocity change, and that large velocity change, called delta-v, is the single most important factor in evaluating the likelihood of occupant injury severity. Below a delta-v of about 15 mph, the likelihood of serious occupant injury is low. Starting at a delta-v of about 25, the likelihood of serious occupant injury increases. Above a delta-v of 45 mph, serious or fatal injuries become likely. For seatbelted occupants with the additional protection of an airbag, the likelihood of serious injury is greatly reduced. The Suburban's delta-v in this crash was 22 mph; Rusty Haight of Collision Safety Institute, famous for having been the driver of the bullet vehicle in over 850 staged collisions, was wearing the seat belt in the Suburban, and its airbag deployed. For Rusty Haight, it was simply a fun ride. If he had not been restrained, he would probably at least have received some significant bruises. The delta-v

