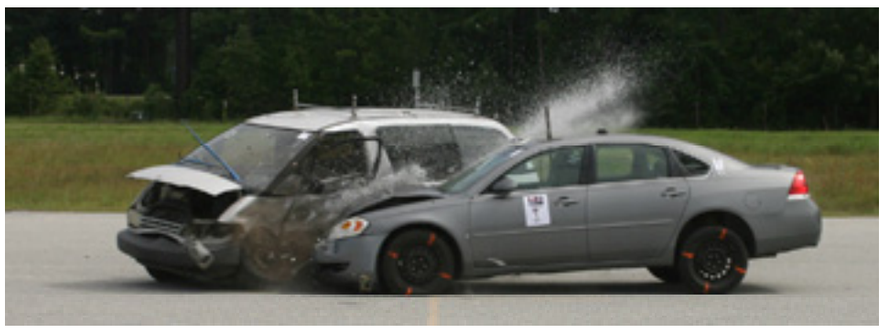
Ralph's Accident Reconstruction Newsletter: Volume 10, Number 4—Autumn 2011

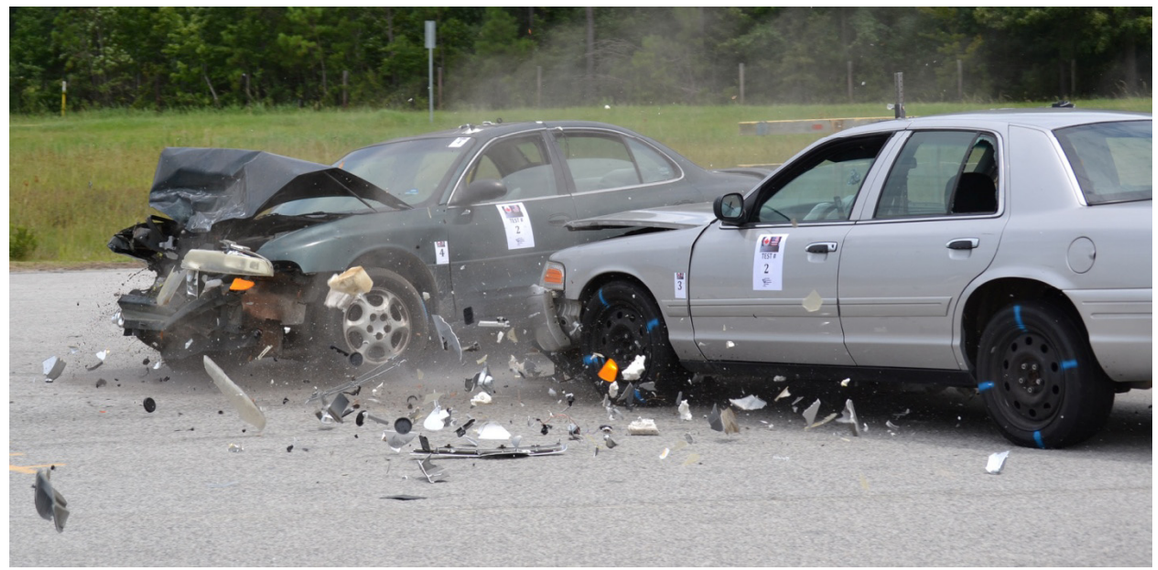
As I wrote in my previous newsletter, the airbag control modules (ACMs) in some Toyota vehicles are now accessible with the Bosch CDR Toolkit. As this newsletter is being written, the earliest model year of Toyota vehicles currently accessible with the Bosch system is 2006; some have extractable data in their ACMs. With subsequent software releases, access to earlier model years will be provided. By the 2010 model year, most vehicles of Toyota manufacture have ACMs which can be successfully interrogated with the Bosch system. More on Page 2.

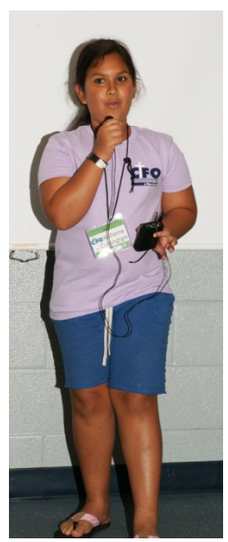
There was a joint crash conference of the South Carolina Association of Reconstruction Specialists (SCARS), the Southeast Accident Reconstruction Society (SeARS), and the International Association of Accident Reconstruction Specialists (IAARS) in Mt. Pleasant (Charleston), South Carolina, for the last full week of July. Monday, July 25th, was devoted to staged collisions and other outside work. Tuesday through Friday involved training sessions, with presentations given by a variety of people involved in reconstruction. I was a presenter for one morning session. I had given a presentation at last year's SCARS conference, and they apparently liked what I had to share with them, since I was invited to return as a speaker this year. There are photographs of some of the field activities at that conference in this newsletter.



On a personal note, a musical theater talent contest for children and teenagers was held at Newton High School, in the adjacent county and not very far from where I live, this past summer. My ten-year-old daughter was chosen as a singer and as a clogger for the final production. (Clogging is a form of dance in which metal plates are loosely attached at the front and the rear of the soles of shoes—one might think of it as an unsophisticated tap dance.) I have been told by qualified singers (I don't have calibrated ears) that my daughter has perfect pitch (whatever that is). She loves to sing: I often hear her singing as she does her schoolwork or while she's taking a shower. She often lies in bed at night and sings herself to sleep. She has sung publicly at church and at Georgia Mountains Camp Farthest Out, a Christian retreat we attend each year as a family; the photo to the right of this text shows her singing "Somewhere Over the Rainbow" *a cappella* at Georgia Mountains CFO. She is also learning to play piano and keyboard, trumpet, guitar, and clarinet. She also takes tennis lessons when she's not otherwise occupied. This summer, she ran and finished her first Peachtree Road Race. We don't think she's interested in a career in music, dance, or sports, she simply enjoys those activities for fun. She is now in the fifth grade. Her favorite subjects, besides recess and lunch (like me), are science and English.

The photo in the column to the left shows an Impala-Previa collision shortly after first contact. The Previa was equipped with a six-degrees-of-freedom accelerometer, the first staged collision I've witnessed where such a device was available. It showed that the Previa rotated over 90 degrees in the first one second after impact, a very substantial initial angular velocity. Had there been any unrestrained occupants inside the Previa on the left side, it is very likely that they would have been ejected through windows on the left side of the minivan.





The photo above was taken shortly after the instant of off-center impact between the front of a Ford Crown Victoria as the bullet vehicle and an Oldsmobile Alero as the target vehicle. This Alero also exhibited substantial rotation in the first second after the instant of impact, but the angular velocity was not quite as high as that which had occurred in the Previa. Note the large volume of generally small pieces of debris, scattering over a large area, many of them not yet fallen to the pavement. The point of impact between these vehicles was behind the rear of the Ford as it is located at the instant this photograph was taken.

There was also a collision between the front of a Ford Crown Victoria as the bullet vehicle and an old Mercury Marquis as the target vehicle. Impact involved the left rear door and left side of the rear axle of the Marquis. There was surprisingly little visible damage to the front of the Ford after impact. This was one of those collisions which could not have been reconstructed using crush coefficients, because there was very little crush at the front of the Ford and no applicable coefficients for the side of the Mercury.

As I write this newsletter, Version 4.1 of the Bosch Crash Data Retrieval software has been released. It is my understanding, among other aspects of this and future Bosch releases, that all Toyota vehicles which had extractable data in their airbag control modules will eventually be added to the software releases. At this time, most late-model Toyota vehicles except the Corolla have accessible data. The data images from late-model Toyota vehicles have some very interesting and useful features.

The acronym for Toyota's airbag control module is CASA, for Center Airbag Sensor Assembly. This unit monitors for frontal impacts, side impacts, and rollovers. An event which causes the algorithm to awaken in order to decide whether or not to deploy one or more devices is a TRG, or trigger. A collision trigger is one in which the algorithm has awakened but no device was fired; essentially the same as what is called a non-deployment event by other manufacturers. A record trigger is one for which a deployment was commanded. A record trigger will freeze that event data so that the set cannot be overwritten and lock the CASA so that no further events will be recorded.

For typical modules which are capable of storing pre-crash data, two pages of data each for a frontal impact, side impact, and rollover can be recorded: one page of pre-crash data and a second page of crash data. The term "page" refers to a collection of data, not necessarily to what will be printed on one standard sheet of paper. One interesting feature of the modules which store pre-crash data is that the time between the last increment of sampling and the instant of the record trigger is specified in 100-millisecond intervals. For GM modules, all you know about "-1 second" is that it is the last incremental data set before Algorithm Enable; with the Toyota modules, the time between that last increment and the record trigger will be listed, and the preceding increments will appear in one-second steps, as, for instance, -0.7 second, -1.7 seconds, -2.7 seconds, -3.7 seconds, and -4.7 seconds.

Delta-v from crash data is given in 10-milliseond intervals for 20 data points; i.e., 200 milliseconds. For most crashes, 200 milliseconds after the record trigger will capture all delta-v associated with the collision; post-collision speed loss will have to be determined by some other means or method. But, where the time between record trigger and the most previous data set is known, one can generally determine the impact speed with very reasonable accuracy. Knowing the impact speed and delta-v will allow calculation of the post-impact speed, if the Principal Direction of Force (PDOF) forms a small angle with the front of the vehicle and can be reasonably determined from damages or other collision data. If you want to see a list of the vehicles supported by the Version 4.1 release of the Bosch CDR software, you can find one on my Web site at www.ralphcunningham.net/41list.pdf.

I am grateful for your interest in my services. Due to numerous misunderstandings about my invoices and the discount for payment within five business days, I have been forced to discontinue that feature. It worked well for several years, but that discount has recently caused more problems than it provided benefit. Please continue to call anytime you have a question.

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