Collision Data Recorders: What Can Big Brother See?

By Jason Young, B.E.Sc., M.A.Sc., P.Eng., Sayf Gani, B.Eng., and Brett Weltman, Advantage Forensics, Toronto

The recording of collision data on Event Data Recorders (EDRs) in cars and trucks, commonly referred to as the 'black box', has made significant advances in recent years.

EDRs provides collision investigators information that, when validated by supporting physical evidence, offers a reliable "window" to the past regarding the circumstances of a collision in dispute.

EDRs have been a standard component of vehicles for well over a decade, recently, the downloading of the recorded data has become a regular component of collision investigation techniques. Surprisingly, after years of public awareness campaigns and media articles, the vast majority of the Canadian public is still unaware of their existence. Their most common concern after becoming aware of the fact is in regards to their privacy and the ownership of the data contained within.

EDR data is now accessible for all newly manufactured passenger cars, pickup trucks and SUVs. Furthermore, the resolution and complexity of the data being recorded increases with continuous improvements to vehicle safety systems. For claims adjusters, the issue of evidence preservation of EDR data has become of critical importance. EDRs provides collision investigators information that, when validated by supporting physical evidence, offers a reliable "window" to the past regarding the circumstances of a collision in dispute.

Over the past two decades, there have been significant advances in the quality and quantity of collision-related data recorded by EDRs. In September 2012, a NHTSA (National Highway Traffic Safety Administration) regulation came into effect requiring all new passenger vehicles sold in North America to have publically-downloadable EDRs. This ruling changed the future of collision investigations.

Prior to the 2012 NHTSA rule, collision reconstructionists and Police

had access to EDRs from only a select group of domestically manufactured vehicles. If one or both of the vehicles involved in a claim were imports, forensic investigators and Police would have no way of accessing that data, aside from getting a judicial ruling ordering the vehicle manufacturer to conduct the download and provide the data.

The historical development of the use of data recording technology in vehicles is fascinating. Before modern EDRs were utilized in vehicles, 'impact recorders' were used in the 1960s and 1970s as electro-mechanical devices to measure the gravitational force applied to shipping containers. These recorders were used in order to discover methods of transport that would reduce impact forces on shipped goods to reduce damage, and to research impact dynamics. Black boxes on aircraft (which incidentally are orange, not black) also became standard in the 1960s to record pre-crash information.

Beginning in the early 1990s, EDRs were introduced in a select group of commercially-available automobiles and light trucks manufactured by GM. The original purpose of these early EDRs was to monitor and record the functioning of a new vehicle safety feature – the airbag system. The recording of the airbag computer's decision-making process was intended as a legal safeguard against airbag malfunction claims. The first few generations of EDRs recorded only a limited amount of information, but EDRs quickly became a core component of airbag systems in all vehicles. **As such, every vehicle with an airbag has an EDR**.

Originally, only GM provided the download software to the public. Other manufacturers maintained proprietary control. In 2001, Ford began providing public access to the EDR data in some of their vehicles with Chrysler following suit in 2005. In 2006, hearings between GM and the US Congress led to the 2012 NHTSA ruling and encouraged the development of more sophisticated EDRs to record lateral accelerations, rollover accelerations, and multiple impacts.

To ensure that airbags are deployed at the correct time, the airbag computer is constantly monitoring vehicle accelerations and examining the data for early signs of any collision severe enough to require airbag deployment.

To ensure that airbags are deployed at the correct time, the airbag computer is constantly monitoring vehicle accelerations and examining the data for early signs of any collision severe enough to require airbag deployment. The EDR only begins recording that data if a collision is sensed. **When a collision is sensed, the monitored data is saved regardless of whether or not the airbags actually deploy**. While all EDR designs are different, most EDRs approach the preservation

of data in the following manner:

- recorded 'non-deployment' events are typically overwritten by subsequent 'non-deployment' or 'deployment' events;
- 'deployment' events cannot typically be overwritten

Some EDR models will also delete non-deployment events after a certain number of ignition cycles. It is therefore critically important for the claims adjuster to have the EDR evidence downloaded and preserved as soon as possible following a collision.

We are often asked 'how much of my personal information is being recorded while I am driving?' The type and amount of information recorded by different EDRs varies, and continues to increase with newer vehicle designs. Currently, almost all categories of personal information are not recorded by EDRs. The minimum amount of information recorded on an EDR is the change-in-velocity due to the impact itself and the driver seatbelt status (used or not-used), which could be considered personal information in terms of a claim. Most current EDRs also record speed and accelerator/brake pedal position for 2.5 to 5.0 seconds before impact. The sophistication of information recorded will generally increase with the sophistication and number of airbags provided (i.e. front, side, curtain, two-stage, etc.). A key point to remember is that on passenger vehicles, no data is recorded on the EDR unless a collision occurs [1]. On fleet tractor-trailers, a driver-monitoring setting can sometimes be activated by the owner to record speed and hard stop count history, even without a collision occurring.

The ownership of the EDR data following a collision is an ongoing debate best left to legislators. To the engineering expert, EDR data is just another fingerprint imprinted upon a vehicle during a collision, no different than the crush damage depth which is available for measurement by all. Both require further analysis and both will lead to the same answer. Retrieving data from an EDR does not provide a 'quick fix' solution to collision reconstruction. The retrieved data must be analyzed in conjunction with the other collision evidence to validate its reliability, as stated by the disclaimer on any download. One classic example of this is pre-impact speed data, which is measured from wheel axle rotation and is therefore unreliable if the wheels are slipping or airborne. Another common problem with interpreting EDR data is the lack of a universal reference clock in the data, making it challenging to analyze data from multi-impact collisions.

The efficacy of EDR data was put to the test following the 2009 Toyota 'unintended acceleration' issue. From 2009 to 2011, Toyota's reputation was severely marred by allegations that electrical or mechanical components in their vehicles were causing unintended acceleration. The US government tasked NHTSA, with the aid of NASA scientists, to investigate those collisions. The EDR data was carefully reviewed, along with electrical testing of the vehicles. In all cases, no engine faults or electrical faults were found. The EDR data clearly showed that the accelerator pedal was being depressed in all of those cases for some reason, resulting in the focus of the investigations shifting to "sticky" accelerator pedals and floor mat designs.

In summary, EDR data collection, which was once only used for overseas shipping and aircraft, is now a standard component of collision claims investigation and will continue to play an increasing role in the future of criminal and tort cases. As the amount and type of data being recorded increases with continuous improvements to airbag systems, the issue of evidence preservation for EDR data will become more important than ever.

Jason Young, P.Eng., is the President of Advantage Forensics in Toronto and is a recognized leading expert in collision reconstruction and human factors with extensive court experience. Jason lectures regularly to insurers, lawyers, and municipalities across Ontario, and has been a featured expert commentator regarding nighttime pedestrian collisions on Global News and CBC Metro Morning.

Sayf Gani, B.Eng., is a Collision Reconstructionist at Advantage Forensics and specializes in vehicle systems, multi-vehicle collisions, and computer simulation of complex collisions.

Brett Weltman completed a co-op internship in Collision Reconstruction at Advantage Forensics in 2012 and after having graduated from his degree program in Criminal Justice, is now continuing his career education in Police Enforcement.

1 Engine control modules and vehicle service diagnostics can also record vehicle performance or error codes, which are unrelated to collision data recorders and are beyond the scope of this article.

WP