RUDNY & SALLMANN FORENSICS NEWS

Summer 2019 Newsletter

EVOLUTION OF ACCIDENT RECONSTRUCTION

Rudny and Sallmann have been analyzing and reconstructing vehicle accidents since 1991. Although the same principles of physics apply today as in 1991, advances in computers and digital equipment have changed the methods we use to investigate and analyze crashes. Developments in the last 28 years include:

- Airbag control modules, heavy truck engine control modules, and brake control modules capable of recording crash event data to a high degree of accuracy; more recent model years record more data
- Faster computers permit more complex analyses
- Advanced simulation software allows for videos from the driver's perspective as well as a bird's-eye view
- Downloadable satellite images of the Earth provide scale photographs of roads and roadway features useful for creating accident scene diagrams and studying crash sites
- Surveillance videos from traffic signal cameras and other sources provide real time videos of many crashes
- Digital cameras with higher resolution than film cameras provide enhanced information for computer analyses
- 3D Scanners provide images of vehicles and crash scenes
- Computer photogrammetry applications provide the reconstructionist enhanced ability to analyze crash scene and vehicle photographs
- High Definition (HD) video cameras provide much improved resolution for more precise analyses
- Improved computer-based survey instruments permit measuring crash scenes without the need to enter heavily travelled roadways; and measurements can be made with only one person
- Aerial drones can be used for photographing and video recording crash scenes

These new and improved tools help us to analyze crashes more accurately and to provide our clients with information that previously was not possible.

EVENT DATA RECORDER (EDR) UPDATE

Automotive

Federal Regulation 49 CFR 563.3 states that if vehicles are equipped with an event data recorder and manufactured on or after September 1, 2012, then the recorded data must be accessible with commercially available systems.

More than 150 million vehicles manufactured between 1994 and present day have accessible event data via their EDRs.

New vehicles are covered each year, 88% of 2017 model year vehicles are covered by the Bosch CDR Tool and another 11% use a manufacturer specific tool.

In a two-car collision, at least one of the vehicles is likely to have an event data recorder. Analysis techniques can be used to determine the speed at impact of both vehicles utilizing data from only one vehicle.

The number of parameters saved by the event data recorder has grown beyond the original Delta-V and pre-impact speeds. Many vehicles record steering wheel angle, cruise control and braking activation, accelerator pedal position, anti-lock brake system (ABS) activity, electronic stability control system activity, etc. These parameters, and others, can help in determining vehicle dynamics before and during an accident.

Figure 1. Passenger car EDR imaging via Bosch CDR Tool

Commercial Trucks and Trailers

In contrast to an automotive event data recorder, the commercial vehicle electronic control unit (ECU) or electronic control module (ECM) was primarily developed for fleet management, tracking driver efficiency, and vehicle diagnostics.

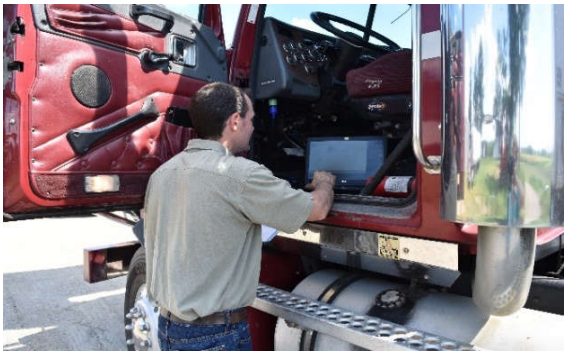

Figure 2. Commercial truck ECM imaging

Commercial vehicles are generally a la carte and may have options for engine, transmission, brake, and telematics

systems from various manufacturers. Each of these systems may have its own ECM that can potentially record data. These ECMs may be imaged to retrieve recorded data such as vehicle speed, engine RPM, gear selected, cruise control activated, clutch/brake/engine brake activated, etc. Also, engine ECMs may record a braking event if the change in speed surpasses a threshold value set in the ECM. Many newer trucks also record events that trigger electronic stability control and anti-roll over systems. Typically, up to three events can be recorded and these events may be capable of saving more than 60 seconds of data before an event as well as data after an event.

Anti-lock Brake Systems (ABS) on trailers may also be imaged to obtain data similar to trucks.

FAILURE ANALYSIS

Failure analysis in forensic engineering is the practice of investigating and gathering data related to materials, products, or components that have failed. Typically, failure analysis is focused on establishing liability or implementing corrective actions. An investigation into a component or product failure generally involves inspections, collection of evidence, creation of analytical models, comparison to exemplar products, and performing experiments to recreate the failure and validate models.

Figure 3. Aluminum alloy wheel fracture

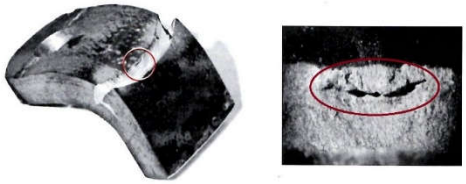

Figure 4. Trailer Hitch bending fracture with pre-existing crack

Much like any other investigation of an accident, preservation of evidence is paramount in a failure analysis investigation.

What to do:

- Collect pertinent information, related to the failure, of who, what, when, where, why, and how
- Document accident scene and failed components through photographs and/or video
- Collect failed components, label pieces as necessary and create a log of pieces
- Gather maintenance records, usage records, user/owner's manuals, and any work instructions
- Determine environmental conditions during the failure or accident: indoors/outdoors, temperature, humidity, lighting, daylight/nighttime
- Interview witnesses of the accident and operators of the equipment or similar equipment
- Determine if there is a history of failures for the product

What *NOT* to do:

- Do not touch fracture surfaces

  Disturbance of, or contamination of, the fracture surfaces can ruin valuable evidence regarding how the fracture occurred.
- Do not put broken pieces back together

  Similar to touching the fracture surfaces, putting the broken pieces of a fracture back together can mar the surfaces and ruin evidence of how the fracture occurred.
- Do not clean the components

  If the components of a fracture are cleaned, evidence of contamination contributing to the failure or presence of lubrication, or lack thereof, may be lost.
- Do not jump to conclusions

  One of the most important concepts to remember in a failure analysis is to let the evidence lead to the root cause of the failure. Jumping to conclusions and preconceived notions may lead to a misdiagnosis of the failure.

Figure 5. Cooper water pipe fracture due to over-pressure event

We hope you will find this information helpful. As always, if you have any questions about any of the topics presented, we will be happy to speak to you without obligation.

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