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# The Role of ECM Data in Accident Reconstruction

While the data contained inside a heavy truck Engine Control Module (ECM) can provide valuable information during a crash investigation, it is only one part of a complete reconstruction. The data must be analyzed appropriately and in conjunction with other available evidence to produce accurate and reliable results.

The following example illustrates how erroneous conclusions can be drawn from ECM data when not analyzed correctly and with other evidence.

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Ruhl Forensic was asked to investigate a tractor-trailer impact with a passenger car and review the ECM data in the crash. The crash occurred on a two-lane highway where the tractor-trailer impacted a car pulling out from a T-intersection. The tractor-trailer driver stated he never saw the car prior to impact, and that he slammed on the brakes the moment he saw the car appear in front of him. Questions were raised as to his attentiveness and alertness prior to impact.

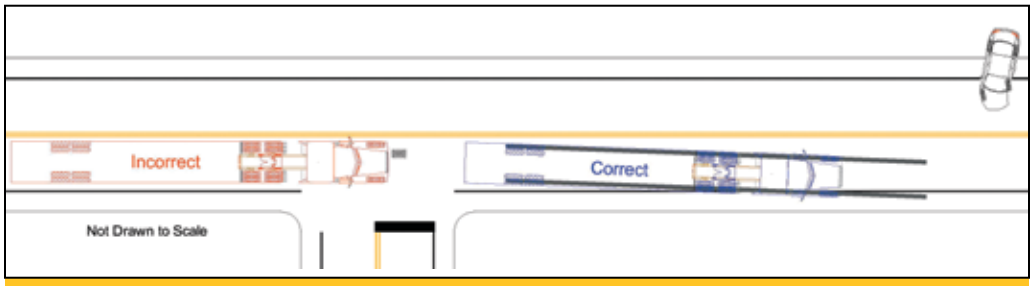
## The Opposing Expert's Scenario

Opposing counsel had retained a trucking industry safety expert to review the ECM data and perform an analysis of evidence. This expert opined that the tractor-trailer driver's statements that "the car just came out of nowhere" and "I didn't have time to react" held merit, and that the driver was attentive and alert behind the wheel.

He supported his case by pointing to the ECM data, as well as the physical evidence left behind as a result of the impact, but did not perform an accident reconstruction.

Using the configuration data from the ECM, he explained that hard brake reports are triggered by a decrease in speed of 7 miles per hour in one second. In his opinion, the impact with the car (time 0:00) slowed the tractor down enough to create the hard brake event; the hard brake trigger and the impact occurred simultaneously. He then pointed out that the ECM data showed brake application for 1 second prior to impact, validating the driver's theory that he was alert but did not have time to avoid the collision.

The expert also pointed to the skid marks left by the tractor-trailer at the scene as support for his conclusions. He explained that, after factoring in the air brake lag time, the front axle of the tractor-trailer lined up with the start of the tire marks thereby tying the roadway evidence to the ECM data.




*The drawing created by the accident reconstructionist shows the location of the tractor-trailer when the hard brake event data was created, according to each expert. Note that the opposing expert's incorrect location does not match the tire marks on the roadway.*

## Ruhl Forensic's Investigation

The opposing expert based all of his conclusions on the assumption that the hard brake event was created at the moment of impact. However, the vehicle's ECM has no ability to monitor for impacts, only for changes in the vehicle's speed.

In a collision between a tractor-trailer and a passenger car, the substantial difference in vehicle weight has a profound effect on the speed changes experienced by each vehicle.

***Dwayne Owen**, a certified accident reconstructionist, is experienced in reconstructing crashes involving all types of vehicles ranging from tractor-trailers to motorcycles. Mr. Owen is trained in the extraction of ECM data and its analysis for forensic use. He is also trained in the operation and maintenance of heavy vehicle air brake systems and components through Bendix.*

*He is co-author of the book,* Vehicle Accident Investigation: A Guide for Risk Managers and Claims Personnel *and a contributing author to* Truck Accident Litigation, Second Edition *published by the American Bar Association. He was also an invited presenter at the European Accident Reconstruction Conference in 2009 at Wildhaus, Switzerland.*

*Mr. Owen has a commercial driver's license and is a graduate of the SOS Big Rig Driving School. He is a board certified forensic examiner, a professional evidence photographer and a former nationally certified Motorcycle RiderCourse Instructor.*

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Based upon Ruhl Forensic's calculations, the passenger car's change in velocity was upwards of 30 mph, while the tractor-trailer only saw a speed change of approximately 2 mph. Since the hard brake trigger threshold of the tractor-trailer is 7 mph, the impact with the car would not have slowed down the semi enough to trigger the hard brake event. Therefore, the opposing expert's conclusion that the hard brake event was triggered by the crash was incorrect.

Knowing that the impact with the car did not trigger the recording of the hard brake event, Ruhl Forensic's reconstructionist then investigated the crash site data to determine what had triggered it.

Skid marks found beyond the area of impact matched the physical characteristics of the tires of the tractor-trailer, and showed that the tractor-trailer attempted to slow down as quickly as possible post-impact. This deceleration of the tractor-trailer post- impact would have been more than sufficient to create the hard brake report in the ECM.

Placing the last axle of the tractor-trailer at the start of the tire marks, not the first axle (as the opposing expert erroneously did), positions the truck driver well beyond the impact location when he reacted and applied the brakes.

Now that the physical location of the hard brake event was located, the ECM data could then be matched to the roadway evidence. The ECM data showed the driver applying the brakes at the time the hard brake was triggered; however, the physical evidence shows that the brake application was **post-impact!**

By working backwards through the ECM data and the physical evidence, it became apparent that the impact occurred at approximately -0:04 in the ECM data, **about 3 seconds prior to the application of the brakes!** The ECM data, when properly applied, supported the theory of inattentive driving.

| Time | Vehicle Speed (mph) | Engine Speed (rpm) | Brake | Clutch | |
|---|---|---|---|---|---|
| -0:10 | 43.5 | 1337 | No | No | |
| -0:09 | 43.0 | 1313 | No | No | |
| -0:08 | 42.5 | 1298 | No | No | |
| -0:07 | 42.0 | 1275 | No | No | |
| -0:06 | 42.0 | 1265 | No | No | |
| -0:05 | 41.5 | 1225 | No | No | |
| -0:04 | 42.0 | 1275 | No | No | Impact |
| -0:03 | 39.5 | 1205 | No | No | |
| -0:02 | 35.0 | 1028 | No | No | |
| -0:01 | 31.0 | 600 | Yes | Yes | |
| 0:00 | 22.0 | 599 | Yes | Yes | Hard Brake Trigger |
| +0:01 | 12.0 | 599 | Yes | Yes | |

*A correct interpretation of ECM data showed that the tractor-trailer driver applied the brakes about 3 seconds after the impact, not 1 second before as the opposing expert opined.*

Extracting data from the ECM requires equipment and software that is specific to the manufacturer of the engine; the location of the ECM and the manner of data extraction varies among the manufacturers. Ruhl Forensic staff are knowledgeable in the safe extraction of ECM data, its analysis, and its role in a comprehensive reconstruction.

For more information on this topic, please contact dgowen@ruhl.com or call the Champaign office at (800) 355-7800. Visit us on the web at www.ruhl.com.

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