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THE CONSULTANTS PERSPECTIVE

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VEHICLE EVENT DATA RECORDERS

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With advances in electronic control technology, vehicle component manufacturers are improving and expanding the use of computers which have modules or sensors that monitor vehicle systems. Some of these modules or sensors have storage capabilities, while others pass the data to other interconnected systems. The Event Data Recorder (EDR) is a subfunction of modules or sensors which store data.

The terminology of these modules/sensors continues to evolve with new technology, however some of these modules/sensors which commonly store data useful in Accident Reconstruction are the diesel engine Electronic Control Module (ECM), Vehicle Control Module (ECU), Power train Control Module (PCM), Air Bag Control Module (ACM), Sensing Diagnostic Module (SDM), Restraint Control Module (RCM), and Roll-over Sensor (ROS).

In addition to the OEM systems, several other EDRs are widely used in various applications. Collision avoidance systems, satellite communication systems and camera systems all can capture and store data in varying degrees.

All of these systems should be considered as soon as possible in a post crash investigation so that steps can be taken to preserve the data. An immediate call to our Crash Reconstruction Team hotline (800-877-3260) will put you in touch with our trained and certified personnel who can advise you on your particular situation.

Data storage space can be very limited in some EDRs and data from the event in question can be overwritten. Driving the vehicle, or in some cases turning on the ignition, can reset or corrupt the stored data, therefore knowledge of what systems are in your vehicle(s) at the beginning of the investigation allows for the proper steps to be taken to preserve the data. In the event that a vehicle owned by an adverse party has an EDR, it is important to communicate with the owner of the vehicle to put them on notice to preserve the data. Failure of either party to consider EDR data may give rise to a completely different claim.

Because of the wider voluntary use of EDR's in vehicles under 8500 pounds, the National Highway Traffic Safety Administration (NHTSA) has proposed a final rule, 49 CFR Part 563, which mandates standards on the type of data recorded, the format of the data recorded, the accuracy of the data recorded, and the ability of the EDR data to survive the crash. Heavy vehicle manufacturers are in the process of setting SAE standard, J2728, to mandate standards for heavy vehicle EDR's.

EDRs have also raised privacy and ownership issues. Several states have passed laws requiring disclosure of the presence of an EDR and clarification of ownership while others have not addressed these issues. It is generally accepted that the owner of the vehicle owns the data, however this may not be true in all cases, i.e., leased, rented or financed vehicles. Special consideration must be given to these issues and ownership should be clearly established along with obtaining permission prior to any data extraction.

LIGHT CARS AND TRUCKS

Light cars and trucks have several different systems which may have EDRs. The air bag systems in newer vehicles are controlled by differing sensors or modules based on the manufacturer, (ex: ACM, SDM, RCM). These systems sense changes in the vehicle's velocity versus time and determine when the trigger threshold is met to deploy the correct air bags, front or side.

The function and features of EDRs vary by manufacturer. On select GM and Chrysler vehicles air bag systems, there is capability to capture several seconds of pre-crash data as well as the status of several parameters, including brake switch, percent of throttle and seatbelt status. Some select sister/clone vehicles from Isuzu, Mitsubishi and Sterling may have stored data.

On other select GM models, the vehicle is equipped with a Roll Over Sensor (ROS). The ROS monitors the vehicles relationship with the elevation and upon sensing that the vehicle is going to roll over, deploys the side air bags. The ROS does have an EDR function which can capture data including vehicle speed.

On select Ford models, the RCM captures only the forward and lateral changes in velocity. Other select Ford models RCMs are connected with the Power train Control Module (PCM) and can capture 26 seconds of data, including vehicle speed.

The speed data stored in the EDRs is obtained from sensors on the drive train and is dependant on the status of the wheels of the vehicle. Loss of traction due to conditions such as wet or icy road surfaces, contact to the wheels by other vehicles or objects during the crash, or loss of contact with the road surface, can affect the accuracy of vehicle speed information shown in EDR reports. The size of the tires mounted on the vehicle unit as opposed to the

tire size programmed into the vehicles computer also has an effect on the speed data and should be considered.

COMMERCIAL VEHICLES

Electronic engine control for diesel truck engines was introduced in 1985. The technology has been refined over the years and based on the date of manufacture, Caterpillar, Cummins, Detroit Diesel, Mack and Mercedes Benz diesel truck engines have varied data which can be downloaded from the ECM. This data can include vehicle speed, engine RPM, percent of throttle, brake switch status, clutch switch status and cruise control status from hard brake/quick stop reports. This data is captured by the ECM when the vehicle decelerates at a set value in one second (typically 7 miles per hour). Detroit Diesel and newer Mack engines also capture this information from the vehicle's last stop, however, this information will be overwritten if the truck is driven after an incident.

The vehicle speed is obtained from the vehicle speed sensor located on the output shaft of the transmission, thereby making the speed data dependent on the status of the wheels. As with the EDRs, loss of traction due to conditions such as wet or icy road surfaces, contact to the wheels by other vehicles/ objects during the crash, or loss of contact with the road surface (rolling over or becoming airborne), can affect the accuracy of any vehicle speed information shown in ECM reports. The size of the tires mounted on the unit as opposed to the tire size programmed into the ECM also has an effect on the speed data and should be considered.

Another factor in determining the use of ECM data is the recorded information's relationship to the subject incident. Each ECM report has the date/time and mileage stamped by an internal clock within the ECM. The ECM clock is subject to time loss/gain during normal operation and can be set to accommodate different time zones. During the data extraction, the differences between real time, ECM time and PC time MUST be documented. The ECM mileage can also vary from the vehicle's odometer because the ECMs mileage is calculated based on set values programmed into the ECM.

ECMs control the engine functions and are mounted on the engine thereby subjecting the units to damage from the crash. It has been our experience that in some instances, damaged ECMs can be downloaded and valid information can be extracted, however crashes which disrupt the electrical system of the vehicle can prevent the ECM from capturing data and can produce anomalies and/or invalid data. Any use of the ECM data without a complete accident reconstruction by a qualified accident reconstructionist can lead to erroneous conclusions. (For a list of available ECM information by manufacturer, see the charts on page 3 & 4.)

Electronic data from various vehicle components can have valuable information which can be utilized in the investigation of vehicle incidents including, but not limited to crashes. This information should be utilized as one tool in a comprehensive investigation/reconstruction. Like all tools, it requires a skilled, knowledgeable and experienced user to ensure that results are accurate and defensible.

It should be noted that this topic is much too broad for complete coverage in this forum. Please contact us at 800-877-3260 for questions or further discussion of your particular situation.

Note: Portions of this paper are related to and have appeared in "Use of Electronic Data in Accident Reconstruction" by the same authors.

ABOUT THE AUTHORS

Steve Chewning is Forcon's Traffic Accident Reconstruction Coordinator and Will Partenheimer is a Senior Reconstructionist on Forcon's Accident Reconstruction Team. Both started their careers in law enforcement followed by extensive specialized training in traffic accident reconstruction which is being updated and expanded upon on an on-going basis. They have each investigated hundreds, if not thousands of traffic accidents and both have a proven record as testifying experts. Their complete resumes are available at www.Forcon.com under the Richmond office.

FORCON'S DATA RETRIEVAL CAPABILITY

Forcon International is committed to staying current with evolving technology. Our certified reconstructionists have the equipment and expertise to retrieve and analyze electronic data from supported Caterpillar, Cummins, Detroit Diesel, and Mercedes Benz diesel truck engines. They also are experienced with the proper procedures for recovering and requesting data extraction by Mack and Eaton Vorad of their proprietary modules. Our reconstructionists also recover and analyze data from all the modules covered by the Bosch Crash Data Retrieval Tool in select Chrysler, Ford, GM, Isuzu, Mitsubishi, Sterling, and Suzuki vehicles.

EDR Seminar

FORCON offers a four hour accident reconstruction seminar that discusses in greater detail vehicle event data recorders. For more information on the seminar, please contact Bob Dwyre at 727-409-5701. The seminar is approved for adjuster continuing education credits in FL, GA, NC and TX.

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Data as of 05-05-08	Detroit Diesel	Caterpillar	Cummins	Mack
ECM Data Available	DDEC IV, V & VI *Some information is available from DDEC III, however the DDEC III does not record the Hard Brake or Last Stop report which is generally most useful data in accident reconstruction. Will also extract data from MBE 900 and MBE 4000.	Information available is dependent on engine model and date of manufacture.	Information available is dependent on engine model and date of manufacture. Factory flashing of ECM required to capture more information on logged events including vehicle speed utilizing PowerSpec program.	Mack utilizes 2 ECM's and refers to them as ECU's, the engine ECU and the vehicle ECU. Data currently only extractable by Mack and requires that both ECU's be removed from the vehicle and sent to Mack. Turnaround time is approximately 6 to 8 weeks. The minimum cost of this service is currently $2,300 for litigation purposes. Information available in some 1997, 98, 99, and all 2000 and above. Aquired by Volvo. See Volvo info.
Hard Brake	Hard brake report captures data for 1 minute before 15 seconds after trigger, vehicle speed, engine rpm, brake/clutch status, engine load, % throttle, cruise control status, and diagnostic code status. The factory default trigger setting is 7 mph deceleration in one second. Records last two.	Referred to as a Quick Stop Event. Once triggered, the time, date and a snapshot of all ECM recorded vehicle and engine conditions are logged into the ECM memory. This snapshot can be replayed for 44 seconds before and 15 seconds after the trigger. The default setting is 0 mph which is off and no information is collected. The factory recommendation for setting is 7 mph. Will only store last quick event and total number of quick stops.	Referred to as Sudden Decelerations and defines them as panic stops. Records the number of sudden decelerations in Insite and Speed, RPM, Engine Load, Throttle, Brake/Clutch/Cruise/Lamp Status in PowerSpec. The default setting is 9 mph deceleration in 1 second. See additional information on RoadRelay 4 below.	Hard Brake captures data for 15.8 seconds prior to an incident and 16 seconds after. Information available includes vehicle speed, rpm, status of the service and park brakes, status of the clutch, status of the engine brake, cruise control, and the position of the key switch. Events are logged when there is a change of engine RPM of +50 RPM or -50 RPM.
Last Stop Record	Last stop record is triggered when the vehicle speed changes from the drive state to the stop state (defined as greater or equal to 1.5 mph and an engine rpm of greater than 0 to less than 1.5 mph or ignition off and remaining in stop state for more than 15 seconds). Records same data as Hard Brake Report for 1 minute 45 seconds before trigger and 15 seconds after.	None	None	Last Stop Record introduced in the 2006 model year. Replaces one of the Hard Brake reports.
Daily Engine Usage	Stores last 30 days in which the engine was started in 2 hour blocks. Information recorded includes date, start time, odometer, distance traveled, fuel used, fuel economy, and average speed.	See Trip Data	None	See Trip Data
Trip Data	Data is available. Length of the data is user defined. Some examples of the data available is hours in use, fuel used, fuel economy, maximum engine speed, idle hours, idle fuel, % idle hours, average load factor, average speed and maximum speed.	Data is available. Length of the data is user defined. Some examples of the data available is hours in use, fuel used, fuel economy, maximum engine speed, idle hours, idle fuel, % idle hours, average load factor, average speed and maximum speed.	Data is available. Length of the data is user defined. Some examples of the data available is hours in use, fuel used, fuel economy, maximum engine speed, idle hours, idle fuel, % idle hours, average load factor, average speed and maximum speed.	Data is available. Length of the data is user defined. Examples of the data available is hours in use, fuel used, fuel economy, maximum engine speed, idle hours, idle fuel, % idle hours, average load factor, average speed and maximum speed.
Vehicle Speed Histograms	Data is available for the user defined entire trip. Vehicle speed break down can be changed by the user.	Data is available for the user defined entire trip. Vehicle speed break down can be changed by the user.	None	None
Engine Load Histograms	Data is available for the user defined entire trip.	None	None	None
Over Speed/Over Rev Histograms	Data is available for the user defined entire trip.	None	None	None
*** Optional Data Recording Devices**	ProDriver- Will record some of the data recorded by DDEC IV when used with a DDEC III. DDEC III does not record Hard Brake or Last Stop data. ProDriver will work with any engine.	CatID- In cab display of most trip information. Programmable to reset trip information.	RoadRelay4- In cab display records trip and route information including panic stops with 75 seconds of detailed vehicle data. Data recorded includes MPH, RPM, brake and clutch status, time and date for the last 3 panic stops.	Co-Pilot- In cab display of most trip information.

Data as of 05-05-08	Navistar International	Volvo	Mercedes Benz
Other Engine Manufacturers	Manufactures medium duty engines with ECMs. The ECM controls engine function, logging fault codes only and provides no trip, or speed data useful in accident reconstruction. Currently in production of a wireless system for fleet managers to extract fault code. Will also use GPS to transmit vehicle location. They are also working on adding vehicle speed data in the future.	Manufactures a heavy duty truck engine (VE D12) with ECM. The ECM controls engine fuction, logging fault codes only and provides no trip, or speed data useful in accident reconstruction. Aquired Mack Trucks. Volvo and Mack are in development of a new chassis with electronic controls which will be the base for both companies. Our sources have indicated that extraction will require control module(s) be sent to the factory.	Owned by DailmerChrysler, which also owns Detroit Diesel. Detroit Diesel Diagnostic Link and DDEC Reports will extract data from MBE 900 and MBE 9000. Most new engines require version 6.1 to read. Utilizes a VCU and a PLD. Data is stored in the VCU.

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VEHICLE EVENT DATA RECORDERS
Including Chart of Available Information

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