Commercial Vehicle Data Recorders: The Black Boxes of the Trucking Industry

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In the past few years, most people involved in adjusting and litigating accident claims have become familiar with event data recorder technology as it applies to airbag deployment in passenger cars and light trucks. However, many tractor trailers, buses and other large commercial vehicles are currently being equipped with a similar technology.

The event data recorder in a large commercial vehicle is part of the engine control module, a small computer mounted in the engine compartment that monitors and controls several engine functions. The engine control module manages the operation of the engine and controls some parameters, such as fuel supply. In addition, some maintenance and diagnostic data, such as oil pressure and coolant temperature, are recorded when the vehicle is in operation. However, the engine control module also monitors and records several other parameters, such as vehicle speed, throttle position and braking. This data is saved in memory and can later be downloaded and reviewed to determine how the vehicle was being operated at a particular time.

PHOTO COURTESY OF GORD JENISH

The original intent of these data recorders was primarily to help trucking companies optimize vehicle fuel economy and reduce engine exhaust emissions. However, as time went on, engine manufacturers began adding more features to the data recorders that would allow trucking firms to monitor other useful data, such as hours of operation, trip history, excessive braking and other driver performance parameters. As could be expected, the ability to download objective data showing how the vehicle was being driven eventually led to interest in the accident reconstruction community.

The data that are usually of most interest when reconstructing a crash are the vehicle speed and the extent of braking by the driver prior to the collision. While the engine control and diagnostic data are continually recorded at discrete intervals, more precise data are recorded with respect to vehicle speed change and braking when the engine computer is triggered by a sudden, rapid vehicle deceleration. Most commercial vehicle data recorders will record and store an event that involves a sudden deceleration of the vehicle exceeding a preset limit considered harder-than-normal braking. These events are typically referred to as hard braking events or sudden deceleration events. Emergency braking by the driver would typically be sufficient to trigger the recording of an event, as would a collision of sufficient severity.

The data recorded during a hard braking event usually includes up to one minute of data prior to the point at which the event was triggered, and an additional 15 seconds of data once the event is triggered. In other words, if the driver applies emergency braking, and then is involved in a collision, the event data recorder will save up to a minute of data prior to the application of the brakes and about 15 seconds of data subsequent to the brake application. This data will generally be sufficient to analyze the operation of the vehicle as it approached the emergency situation and as the vehicle then travelled to final rest.

The data recorded in a hard braking event typically include vehicle speed, engine speed, engine load, throttle position, clutch position and braking. The data may also include whether or not the cruise control was engaged, as well as some diagnostic data. A hard braking report is normally time- and date-stamped and will also include the vehicle odometer reading and VIN number. The data can be viewed in both tabular and graphical form. (A sample of the graphical data is shown in Figure 1.) While these data do log the throttle position by way of the percentage of throttle, the braking data are limited to a record of whether the brakes were "applied" or "released." However, in most cases, some assessment of the level of braking can be made based on the vehicle speed data recorded, combined with information from the accident site.

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Other data recorded as part of the normal vehicle operation can also be downloaded and may be useful in assessing how the vehicle was being operated prior to a specific event. Trip reports typically summarize several operational parameters for a given trip, including trip distance, trip time, idle time, average vehicle speed and fuel economy. These reports may also include such specific information as the maximum speed attained during the trip and the percentage of the travel time in which the vehicle speed was above a predetermined limit. In addition, some trip reports will include the percentage of the travel time in which the cruise control was engaged and the number of hard braking applications during the trip.

Although much of the data recorded during a trip and during an emergency situation may be useful to police or engineers investigating a crash, the

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Print Date: Nov 27, 2001 04:34 PM (EST)

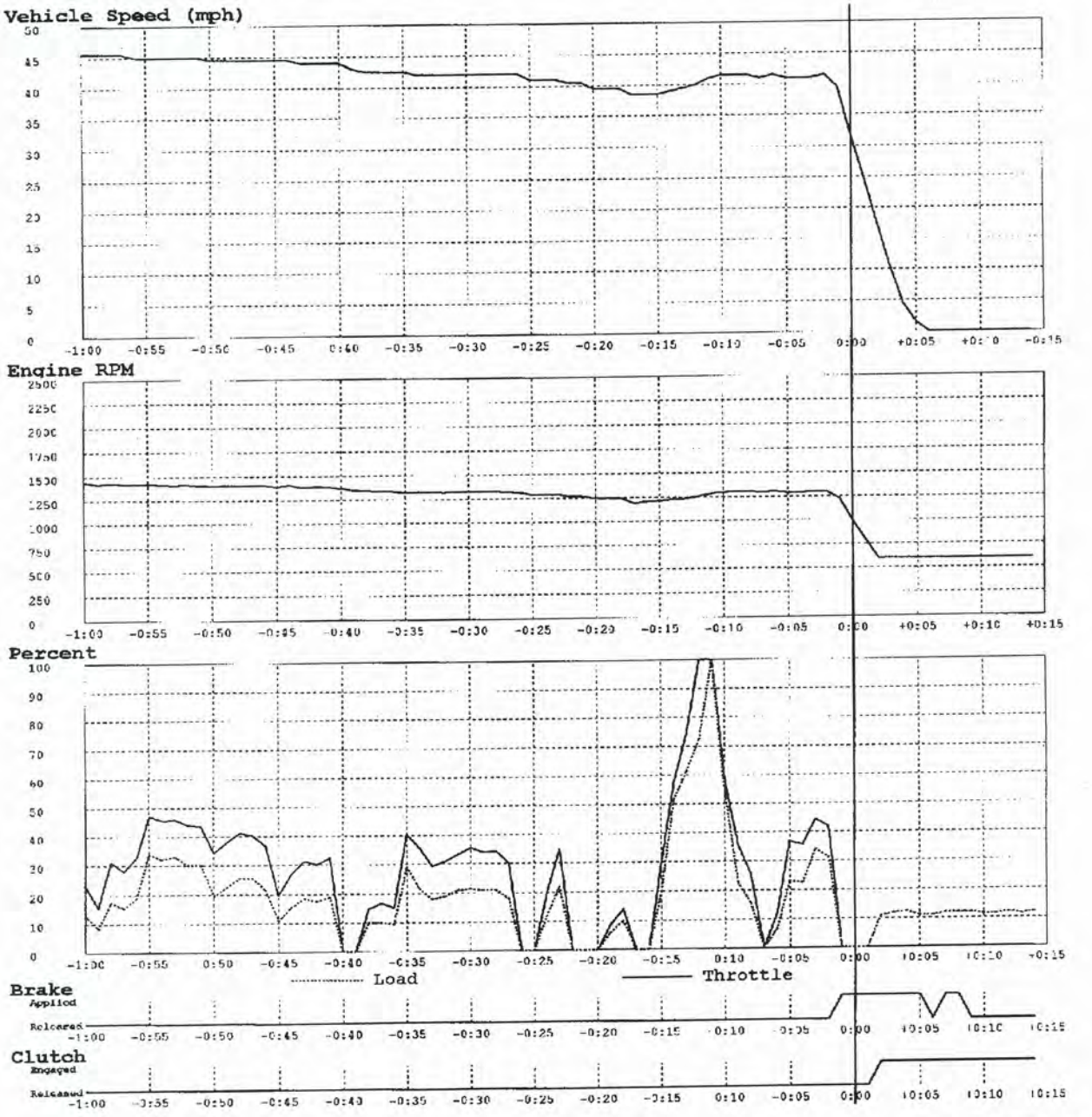
Detroit Diesel Corporation
13400 Outer Drive, West
Detroit, MI 48239
(313) 592-5000

Trip: 06/06/2000 to 08/16/2001 (EST)
Vehicle ID: 2314
Driver ID:
Odometer: 158086.4 mi

Trip Distance	158086.4 mi	Trip Time	4385:16:26
Trip Fuel	22542.88 gal	Fuel Consumption	5.14 gal/h
Fuel Economy	7.01 mpg	Idle Time	1370:05:50
Avg Drive Load	45 %	Idle Percent	31.24 %
Avg Vehicle Speed	52.4 mph	Idle Fuel	1010.63 gal

Incident Time: 08/15/2001 00:14:25 (EST)

Incident Odometer: 157719.5 mi



08161YAA.XTR Engine S/N: 06R0601517 ECM S/W: 28.00 Version 3.10 Page 1

Figure 1

primary usage of the data is by trucking firms. Companies use the data to monitor the operations of their fleets and thereby optimize fuel efficiency, reduce tire and brake wear and schedule maintenance. The trucking firms also use the data to monitor driver performance, especially with respect to safety consciousness. The number of hard braking applications and the amount of travel time in which the vehicle speed was above the predetermined limit can be used to assess a driver's risk of a crash. While this may seem like "big brother" watching over the driver's shoulder, it is an effective way to reduce collisions, and has proved effective in rooting out bad drivers. Given the capital costs that trucking firms have invested in their equipment, and the increasing cost of liability insurance, it is not surprising that the industry has welcomed the opportunity to better monitor the operation of their vehicles.

Some technical aspects that may limit the amount of data that can be downloaded and the information recorded. Trip data and diagnostic data are continually written to memory during a trip and will generally be available for download until a trip is cleared from memory. However, most data recorders only record one or two hard braking events, and one of the existing records will be overwritten by the next hard braking event. Therefore, if the vehicle is driven for some time after an incident in which this type of information was recorded, the hard braking event of interest may be overwritten by a subsequent hard braking event. In addition, the manner in which the data are recorded can be tailored to the vehicle owner's requirements, by changing the default settings. In this case, some data that would be useful in reconstructing a crash may not be recorded, depending on the initial settings input by the vehicle owner.

The extent to which data can be downloaded will also depend on the vehicle manufacturer. The data recorders installed by some manufacturers log more data than others; some record only diagnostic data and no trip, hard braking, or speed information. In addition, some manufacturers will supply the equipment required to download data to third parties interested in utilizing this technology, whereas others require that the engine control module be removed from the vehicle and sent to them for analysis. In addition, privacy issues may limit the extent to which third parties can access the information downloaded from a vehicle.

As with many new technologies, commercial event data recorders are an evolving technology and will no doubt play an increasing role as an investigative tool in reconstructing commercial vehicle accidents. More importantly, this technology will no doubt improve road safety in the long run by identifying high-risk drivers before they cause an accident, and by exposing carriers who cut corners on maintenance or vehicle safety.

Gord Jenish is a professional engineer and is president of Jenish Engineering Limited in Oshawa, a forensic engineering firm specializing in accident reconstruction and analysing motor vehicle claims. While previously working for engineering firms in the Ottawa area, Mr. Jenish gained a wide range of experience in accident reconstruction, vehicle defect investigations, vehicle safety research, and analysis of personal injury claims. Throughout his 16 years in the business, Mr. Jenish has worked in the forensic engineering field and has testified as an expert witness on several occasions. He can be reached at (905) 404-9285.

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