

Event Data Recorders (EDRs) in Australia: A New Source of Pre-Crash Speed and other Crash Data

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Abstract

Speed is one of the pillars of the Safe System approach to road safety. In recent years Event Data Recorders (EDRs) have allowed public access to safety related crash data from some Australian vehicles. The Centre for Automotive Safety Research (CASR) began to download EDR data from vehicles in 2014 as part of its ongoing in-depth crash investigation activities. This extended abstract describes the data provided by the 15 EDR downloads to date. EDR data provides pre and post-crash information on a range of variables that are useful for road safety research. These include, but are not limited to: travel speed, impact speed, change in velocity (DeltaV) belt use and brake use.

Background

Speed, one of the pillars of the Safe System, can usually only be determined after a crash by performing a detailed investigation and a highly qualified individual performing a reconstruction. Modern vehicles are equipped with many sensors. Since the 1990's some vehicles have used event data recorders (EDR) to record selected sensor data in the event of a crash (Bellion, 2002), including speed. In recent years a publicly available tool that can download EDR data began supporting some Australian vehicles, including many Holdens models from 2007 onwards and Toyotas built as early as 2002. The Centre for Automotive Safety Research (CASR) has recently started using this tool to download EDR data from vehicles as part of its ongoing in-depth crash investigation activities. This extended abstract details early experiences with EDR downloads, focusing on the data, such as speed, that can be gained using this resource.

Method

CASR started downloading EDR data in its most recent series of in-depth crash investigations, beginning in October 2014. If an involved vehicle was supported, an attempt was made to download the EDR data. Trial downloads were also conducted separate to in-depth crash investigations. In some instances, supported vehicles could not be downloaded from, due to lack of permission or technical reasons. The data of particular interest for road safety is presented in this paper.

Results

Table 1 summarises the data available in 15 EDR downloads, by vehicle, and Figure 1 provides examples of the pre-crash data in the actual download. Speed was recorded in all but one of the EDR files. Pre-crash data was usually recorded at a rate of 2Hz, though it varied from 1 to 10Hz, for 2.5 to 5 seconds prior to the crash. Earlier models of Toyota only provide accelerator position as a voltage. Steering wheel angle, yaw rate and longitudinal acceleration appear to be limited to more recent models of Toyota, and the Jeep (minus the acceleration), while Holdens lack this data. Earlier models did not provide information on belt use, while in recent Toyotas it is listed as 'SNA', signal not available. Lateral change in velocity was not provided for earlier Toyota models, and one recent Toyota. Roll rate and angle are not shown in the table as they were only recorded on certain vehicles, potentially only when a possible rollover was sensed. Ignition cycles (at crash and at download) validate that the data is from the crash in question. This information was only lacking in early Toyota models.

Table 1. A summary of EDR data by vehicle

Vehicle	Impact type	EDR Data												
		General data from EDR					EDR Pre crash data (presence and time span in seconds)							
		Passive Safety deploy	Long ΔV km/h	Lat. ΔV km/h	Ignition cycles	Belt use	Data Rate (Hz)	Speed	Acc. pedal %	Brake Use	Cruise Control	Steer angle	Yaw rate	Long. Acc.
In-depth crash investigation EDR data downloads														
2007 Toyota Yaris	Corner	Yes	14.3	No	No	No	1	4.8	V**	4.8	No	No	No	No
2008 Toyota Yaris	Front	Yes	31.7	No	No	No	2	4.3	V**	4.3	No	No	No	No
2009 Toyota Aurion	Front	Yes	21.8	11.2	No	Yes	2	4.3	V**	4.3	No	No	No	No
2011 Toyota Camry	Front	Yes	23.2	6	Yes	SNA*	2	5	5	5	5	5	5	5
2012 Toyota Yaris	Front	Yes	23.4	2.7	Yes	SNA*	2	SNA	4.55	4.55	No	No	No	No
2014 Toyota Corolla	Front	Yes	38.9	3.1	Yes	SNA*	2	4.85	4.85	4.85	4.85	4.85	4.85	No
2015 Toyota Camry	Rear	Yes	19.3	No	Yes	SNA*	2	4.65	4.65	4.65	4.65	4.65	4.65	4.65
2009 Holden Commodore	Front	Yes	13.49	2.25	Yes	No	2	2.5	2.5	2.5	1	No	No	No
2010 Holden Commodore	Side	Yes	0***	0***	Yes	Yes	2	2.5	2.5	2.5	1	No	No	No
2014 Holden Commodore	Front	Yes	15	9	Yes	Yes	2	5	5	5	2	No	No	No
2013 Mazda 3****	Side	Yes	0***	0***	Yes	Yes	2	5	No	Yes	No	No	No	No
2013 Jeep Grand Cherokee	Rear	Yes	7.0	0.0	Yes	Yes	10	5	5	5	5	5	5	No
Trial EDR data downloads														
2007 Toyota Camry	Rear	Yes	17.4	No	No	Yes	1	4.2	V**	4.2	No	No	No	No
2008 Toyota Landcruiser	Roll	Yes	2.8	3.2	No	Yes	1	4.2	V**	4.2	No	No	No	No
2016 Holden Cruze	Front	Yes	24	2.5	Yes	Yes	2	5	5	5	2	No	No	No

* SNA stands for signal not available

** The accelerator pedal percentage is given in Volts rather than a true percentage.

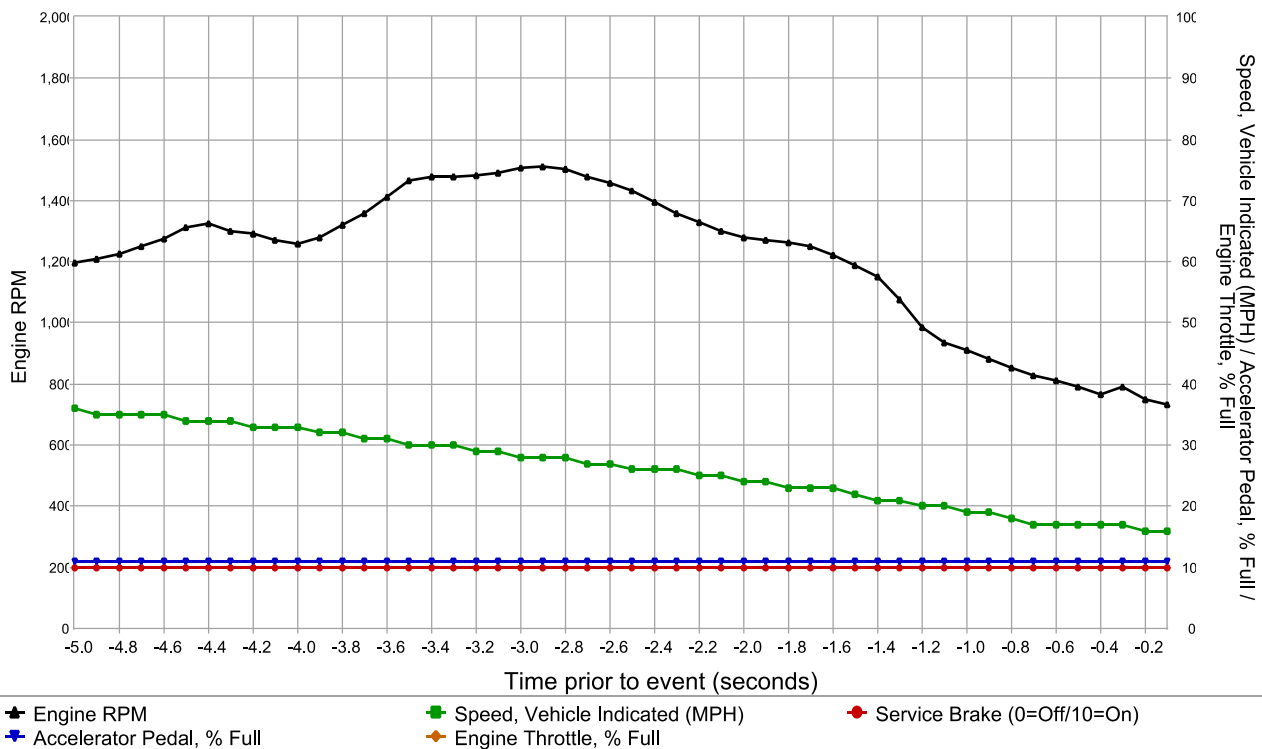
*** These ΔV values are clearly incorrect

**** This vehicle is not officially supported in Australia. The data downloaded did not appear to be related to the crash

Pre-Crash Data -5.0 to -0.5 sec (Event Record 1)

Times (sec)	Accelerator Pedal, % Full (Accelerator Pedal Position)	Service Brake (Brake Switch Circuit State)	Engine RPM (Engine Speed)	Engine Throttle, % Full (Throttle Position)	Speed, Vehicle Indicated (Vehicle Speed) (MPH [km/h])
-5.0	0	Off	1472	10	55 [88]
-4.5	0	On	1472	10	55 [88]
-4.0	0	On	1472	10	54 [87]
-3.5	0	On	1472	13	53 [86]
-3.0	0	On	1472	12	53 [86]
-2.5	0	On	1408	12	53 [85]
-2.0	0	On	1408	12	52 [84]
-1.5	0	On	1408	12	52 [83]
-1.0	0	On	1088	15	41 [66]
-0.5	0	On	1024	16	36 [58]

Pre-Crash Data (Most Recent Event)



Pre-Crash Data, -5 to 0 seconds (Most Recent Event, TRG 2)

Time (sec)	-5	-4.5	-4	-3.5	-3	-2.5	-2	-1.5	-1	-0.5	0 (TRG)
Vehicle Speed (MPH [km/h])	15.5 [25]	15.5 [25]	15.5 [25]	15.5 [25]	13.7 [22]	11.8 [19]	9.9 [16]	9.9 [16]	9.9 [16]	11.8 [19]	13 [21]
Accelerator Pedal, % Full (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	30.0	28.5	0.0
Percentage of Engine Throttle	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.5	14.5	0.0
Engine RPM (RPM)	1,000	1,100	1,100	1,000	1,000	900	800	700	1,000	1,900	1,500
Motor RPM (RPM)	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid
Service Brake, ON/OFF	ON	ON	ON	ON	ON	ON	ON	OFF	OFF	OFF	ON
Brake Oil Pressure (Mpa)	0.34	0.29	0.43	1.44	1.49	1.49	1.49	0.00	0.00	0.00	5.66
Longitudinal Acceleration	-0.646	-1.005	-0.861	-2.297	-2.297	-2.297	-2.369	-0.287	0.000	1.651	-6.245
Yaw Rate (deg/sec)	3.42	3.42	2.44	2.93	1.46	1.46	1.46	-0.98	-6.34	-5.86	-1.46
Steering Input (degrees)	27	27	24	24	18	18	15	-9	-60	-45	-15

Figure 1. Examples of selected pre crash data from a Holden (top), Jeep (middle) and Toyota (bottom)

Discussion and Conclusion

EDR data is currently only available from a limited number of vehicle models, and is further limited to crashes with a change in velocity above approximately 7km/h. To date only 12 of the 131 light vehicles involved in crashes investigated by CASR have had EDR data successfully downloaded. An ADR, similar to the rule in the United States (NHTSA 49 CFR Part 563), that specifies that manufacturers must make vehicles equipped with an EDR downloadable by commercially available tools could greatly increase the availability of EDR data in Australia.

EDR data provides pre and post-crash information on a range of variables that are useful for road safety research. These include, but are not limited to: travel speed, impact speed, change in velocity (DeltaV) belt use and brake use.

Future Work

CASR has just begun a pilot study to download a much larger sample of EDR data from vehicles that have been crashes and written off, or have been involved in a fatal crash. This will provide further insight into the data available and its uses.

References

Bellion, P. (2002). Event Data Recorders: What Do They Tell Us? in *Operations, Transport and Safety: Outside the Square: Institute of Transportation Engineers International Conference, 2002, Melbourne, Victoria, Australia*.