Kentucky Justice Association Seminar June 10, 2021 New Strategies for Successful Auto Litigation

Obtaining and Using Crash Computer Data





www.ruthconsulting.com

Presented by Richard R. Ruth, PE and Billy Johnson, Esq.

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Rick Ruth



Speaker Intros

- Ford Motor Company Product Development Engineering -Airbag Design and Field Performance 1973-2006
- Ford's lead field user of EDR's, Ford EDR policy committee, Ford Rep to SAE & EDR Committee, Ford Rep to Bosch CDR
- 2007-present, Ruth Consulting LLC Airbags and EDR in Recon
- Teach EDR tech, EDR Analyst 1 & 2 classes for IPTM and EDR for SAE. Presents regularly at national and regional conferences on reconstruction, on EDR's.
- Does research on EDR accuracy 19 publications
- Helps prosecutors and cops nationwide in EDR cases mostly for free (charge for written reports and testimony).
- Takes civil cases in airbags and EDR aspect of Recon mostly when referred by reconstructionists he has trained, who recognize when specialty expertise is needed.

Speaker Intros

Billy Johnson



- Practiced personal injury law in Pikeville, KY since 1998
- Car/truck wrecks, explosions, nursing home, wrongful death
- SuperLawyer
- Multi-Million Dollar Advocates Forum
- National Trial Lawyers Top 100 Lawyers
- KJA Board of Governors
- KJA Advocate's Club
- AAJ PAC Member

What is an EDR?

• Event Data Recorder (EDR) means a device or function in a vehicle that records the vehicle's dynamic time-series data during the time period just prior to a crash event (e.g., vehicle speed vs. time) or during a crash event (e.g., delta–V vs. time), intended for retrieval after the crash event. Data is typically stored in the airbag control module, but may also be in other modules.

Do we need EDR data?

- EDR data may be good or bad for your client usually good if they are telling the truth - but either way you need to know.
- In any auto case, you need to get EDR data from BOTH your client's EDR <u>and</u> EDR data from other vehicles involved in the crash, *BEFORE it is "lost".*
- Memory spaces in EDR's are limited, old events MAY be overwritten by new ones if vehicle is still being operated.
- If airbags deployed and vehicle is repaired, precious data may be lost if a new computer is installed or it is "re-set".

Purpose of EDR's

 The original purpose of EDR's was for the manufacturer to know if their safety equipment was performing properly

49 CFR Part 563 EDR Regulation

- Changed the purpose to be "for effective crash reconstruction"
- Effective 9/1/2012 (2013 Model Year)
- Did <u>NOT REQUIRE</u> EDR's but standardized minimum EDR content for manufacturers with EDR's (most of them)
- Specifies data accuracy
- Required creation of a publicly available tool to read the data within 90 days of first sale
- Requires disclosure of EDR in owner guide

EDR <u>NOT</u> Required?

- NHTSA issued a 'Notice of PROPOSED rule making" saying they intended to require EDR by 2015 model year, and to elevate the rule to a safety standard requiring recalls and making manufacturers self certify the EDR. Industry strongly objected (not to mandating EDR but to elevating the rule to a safety standard). The proposal was withdrawn in 2019.
- But 99% of new cars still have EDR's.

Typical Pre Crash Data <u>before</u> reg 1999-2012 GM – *once per second*

Seconds Before AE	Vehicle Speed (MPH)	Engine Speed (RPM)	Percent Throttle
-5	93	3200	25
-4	93	3136	20
-3	93	2752	0
-2	91	2880	8
-1	90	2688	0

Seconds Before AE	Brake Switch Circuit State					
-8	OFF					
-7	OFF					
-6	OFF					
-5	OFF					
-4	OFF					
-3	OFF					
-2	OFF					
-1	ON					

Minimum Pre Crash Data after reg

Every Half Second

Pre-Crash Data -5 to 0 sec [2 samples/sec] (Event Record 2)

(the most recent sampled values are recorded prior to the event)

Time Stamp (sec)	Speed, Vehicle Indicated (MPH [km/h])	Engine Throttle, % full	Service Brake (On, Off)
-5.0	22 [35]	0	On
-4.5	19 [31]	0	On
-4.0	17 [27]	0	On
-3.5	14 [23]	0	On
-3.0	12 [19]	0	On
-2.5	11 [17]	25	Off
-2.0	10 [16]	61	Off
-1.5	11 [17]	63	Off
-1.0	13 [21]	64	Off
-0.5	16 [26]	64	Off
0.0	18 [29]	45	Off



More Extensive Pre Crash Data 2013+

Pre-Crash Da	ata, -5 to 0	seconds (l	Most Rece	nt Event, T	RG 2)						Data
Time <mark>(</mark> sec)	-4.9	-4.4	-3.9	-3.4	-2.9	-2.4	-1.9	-1.4	-0.9	-0.4	0 (TRG)
Vehicle Speed (MPH [km/h])	93.8 [151]	93.2 [150]	92.6 [149]	92 [148]	91.3 [147]	88.2 [142]	80.2 [129]	69 [111]	62.8 [101]	49.1 [79]	46 [74]
Accelerator	Typical Data				0.0	0.0	0.0	0.0			
Pedal, % Full (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Percentage of Engine Throttle (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Engine RPM (RPM)	3,000	2,600	2,500	2,500	2,400	2,400	2,200	1,800	2,000	1,600	1,600
Motor RPM (RPM)	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid
Service Brake, ON/OFF	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	ON
	Extra Data										
Brake Oil Pressure (Mpa)	0.58	0.14	0.00	0.00	0.00	0.00	0.00	0.00	8.93	9.89	11.14
					Divide b	<u>y 12 get p</u>	percent br	aking			
Acceleration ,	-1.077	-1.005	-0.718	-0.933	-1.579	-2.225	-4.307	-2.153	-0.933	-8.973	-4.450
(m/sec^2)	510.0050.005				Divide I	by 10 get	G's of slo	wing	1.463655584331		2010/2019/04/2010
Yaw Rate (deg/sec)	-0.98	-1.46	-2.93	-6.34	-15.62	-20.50	-26.35	-1.46	1.46	26.84	16.10
Steering Input			Multiply Y	<u>′aw rate e</u>	ach interv	<u>al by 0.5</u>	<u>sec and a</u>	<u>dd up to c</u>	<u>et headin</u>	<u>g chabge</u>	
(degrees)	-6.0	-7.5	-13.5	-31.5	-37.5	3.0	130.5	55.5	-34.5	175.5	100.5

Crash Severity *change in velocity* vs time

We mostly care about the max number to use in speed at impact calculations,

but sometimes the shape is important.

Complete

107.5

250 -13.2 [-21.2] 238.5

> ON No

> > No

0.0

-5.0

-10.0

-20.0

End of

crash

24012 280

220

msec



Why do we need EDR's?

- The EDR may be the only objective witness in your case. It does not know or care who was at fault. It just records data of what was going on.
- Reconstructionists used skid marks to calculate speeds at the start of braking, but modern ABS brakes work so well only faint or no marks are left. Now only EDR pre-crash data can tell the speed prior to braking. One technology is offset by the other.
- Live witness memory is not always accurate. EDR's make reconstruction more accurate.

EDR's are evolving

- The amount of data available varies widely by manufacturer, model, and model year – but is increasing over time.
- In addition to the airbag control module EDR, a few manufacturers are saving collision avoidance data in other modules that may include PICTURES of what's ahead just before a crash.
- Sometimes the data is straightforward, but sometimes it can be confusing and takes a trained analyst to decipher.

What can you do with EDR's?

- Determine if the other guy was speeding
- Determine if your guy was speeding
- Determine speeds at impact for <u>both</u> vehicles
- Determine if driver was operating recklessly
- Determine when turns were initiated (if equipped w strg)
- See when crash avoidance maneuvers began (braking, steering) can identify inattentive drivers
- Figure out who hit who first in chain reaction crashes
- Some manufacturers provide enough data to determine sideways movement (lane changes, swerves, turns)

How EDR changed a case

- Curved road, limited visibility
- GMC coming from right, pulls out turning left across main road
- Mercedes on main road swerves left to avoid but tracks GMC perfectly, T boning it.









KENTUCKY UNIFORM POLICE TRAFFIC COLLISION REPORT - N	VARRATIVE		KSP 74	4 Revised 1/2000
		MASTER FILE #		
INVESTIGATING AGENCY PIKEVILLE POLICE DEPARTMENT	AGENCY ORI N	UMBER 0980100	LOCAL CODE 16-613	
Location: US23 North Bound at Johnson Memorial Date: 09-29-2016 Time: Approximately 15:18				

Unit 2 was traveling north bound on US 23 in the right lane. Unit 1 pulled out from Johnson Memorial to make a left turn onto US 23 south bound. The operator of unit 2 stated he swerved into the left lane to try to avoid hitting unit 1 as it pulled across US 23 north bound. At this time the front of unit 2 collided with the drivers side door of unit 1. The impact spun unit 2 around and the vehicle came to a stop facing south in the north bound lane. Unit 1 came to a rest facing north in the south bound lane against the curb. Upon arrival I observed very severe damage to both vehicles. The operator of unit 1 was trapped in the vehicle. He had labored breathing and was unresponsive. The passenger of unit 1 did complain of injuries but was not trapped in the vehicle. Pikeville Fire Department was able to mechanically extricate the operator of unit 1 from the vehicle. Both the operator and the passenger were transported to PMC for treatment. The operator of unit 2 did not complain of any injuries but was transported to PMC as a precaution due to the severity of the collision. Both units were disabled and were towed from the scene.

Plaintiff's Vehicle- Police Report- Unit 1- 2006 GMC

KENT	LICKY UNIFORM	POLICE TR	AFEIC COLLI			VO	V	-	-	_	-	-		-		-
				SION KEP	001-00		5	MAS7	ER FILE	#						
INVEST	TGATING AGENCY PI	KEVILLE POLICE	DEPARTMENT			AGENC	Y ORI I	UMBER	0980	1100	4	OCAL C	ODE	16-612		
<i>имт #</i> 1	TOWED? YES - ROSES WREC	KER SERVICE		TOWED DUE TO DISABLE YES	D? # OCCUPA D? 2	NTS P	PEDEST	RIAN FA	CTORS	100				10-013		
OPERAT	TOR'S LIC. NO.		STATE KY	LIC. CLASS D	ENDORSEM	ENT 0	PERATI	ORS LIC	ENSE RI	STRICT	IONS					
CDL OPERAT DAMRO DATE OI	NO OR NAME (LN, FN, MI) ON, VICTOR S F BIRTH ADDRESS	CO. RESIDENT	YES	OWNER Y	ES						10110					
	HELLIER, KI	41534	(U			CC	OMPLIA	NT	VES	_						
1. PRE-C 17 - MA 1. HUMA	OLLISION VEHICLE AC KING LEFT TURN N FACTORS 08 - FAII 14 - INA	TION LED TO YIELD RI TTENTION	GHT OF WAY	8. UNIT 08-LT	TYPE TRUCK(VAN)	SPOR	TS UT	LITY/I	PICKUP	<u>')</u>			C. FIR NO	E D	D. OVERT NO	TURNL
<i>H. EVEI</i> ST: 05	<i>YT COLLISION</i> - OTHER MOTOR VE	HICLE														
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UNDER	RIDE/OVERRIDE 0	1 - NO UNDERRI	DE/OVERRIDE													
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				DOE	3:	r 08	8,01	YES	01	02	08	01	01	02	01	01
			FEI	DOE	3.	0	02	YES	03	02	08	01	01	01	01	01

Defendant's Vehicle- Police Report- Unit 2- 2014 Mercedes

KEN	TUCKY UNIFOR	M POLICE TR/	AFFIC COLLIS	ION REF	ORILI	G MZ	U									
								MAS7	ER FILE	#						
INVES7	TIGATING AGENCY P	KEVILLE POLICE	DEPARTMENT			AGE	NCY ORI	NUMBER	0980	0100		LOCAL C	ODE	16-613		
UNIT # 2 OPERA	E TOWED? YES - ROBERTSON SERVICE TOR'S LIC. NO.	NS WRECKER	STATE L	OWED DUE O DISABLE YES IC. CLASS	D? # DCC	UPANTS 1 EMENT	PEDEST	RIAN FA	CTORS		l					
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F- <i>H. EVE</i> IST: 05	NT COLLISION - OTHER MOTOR VI	EHICLE														
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. UNDER	RRIDE/OVERRIDE	01 - NO UNDERRI	DE/OVERRIDE													
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			MAL	DO	В	1	08,01	YES	01	04	02	01	02	01	01	01

It looks bad for the GMC driver

- Momentum analysis indicates Mercedes under 55 mph speed limit at impact
- No skid marks documented from Mercedes to indicate it was going faster than 55 before impact
- Remember ALWAYS read the EDR of the other vehicle, even if it is not perceived to be the at fault vehicle
- Let's see what it says.....

Mercedes EDR shows 77mph in 55 zone on curve

Pre-Crash Data -5 to 0 sec (Record 1, Most Recent)

Time (sec)	Speed, Vehicle Indicated (MPH [km/h])	Accelerator Pedal (%)	Service Brake Activation					
-5.0	77 [124]	0	Off					
-4.5	76 [123]	0	Off					
-4.0	76 [122]	0	Off					
-3.5	75 [121]	0	Off					
-3.0	<mark>75 [</mark> 120]	0	Off					
-2.5	74 [119]	0	Off					
-2.0	73 [118]	0	Off					
-1.5	73 [117]	0	Off					
-1.0	71 [115]	0	Off					
-0.5	<mark>67 [</mark> 108]	0	On					
0.0	<mark>54</mark> [87]	0	On					

How does the 77 mph change things?

- Contributory Negligence
- Create animation of crash using EDR data from both vehicles
- Use animation to show if Mercedes had not swerved crash would not have occurred
- Use animation to show if Mercedes had been going speed limit that crash would not have occurred (even more)
- Use animation to show if Mercedes had been going speed limit AND BRAKED that crash would not have occurred (even more that above)

Mercedes speed based on ECU data Swerve to impact Overhead view

Mercedes speed based on ECU data Swerve to impact Mercedes view

Mercedes speed based on ECU data Swerve to impact GMC view

Mercedes speed based on ECU data Continue in right lane Overhead view Mercedes speed based on ECU data Continue in right lane Mercedes view Mercedes speed is constant 55 mph Continue in right lane Overhead view Mercedes speed is constant 55 mph Continue in right lane Mercedes view Mercedes speed is constant 55 mph Continue in right lane GMC view Mercedes speed is 55 mph / braking at 0.7g Continue in right lane Overhead view

How do you get the data?

- There are 305 million vehicles registered in the US.
 65+% have an EDR with data accessible by the Bosch Crash Data Retrieval (CDR system)
- 2. Approx. 90% of 2021's are supported by Bosch CDR
- Another 9% have EDR accessible by other tools.
 99+% have EDR.
- With *advanced* analysis techniques, we can get speed at impact for both vehicles even if only one has a 563 EDR.

What is the Bosch CDR system?

- Operator inputs a VIN into the computer program
- Computer is attached to an interface module
- Interface module connects to vehicle diagnostic port (or can connect directly to modules with data)
- The program makes a copy of the data inside the module and saves a raw data file encrypted for security.
- The program interprets the data into a report format intended for public consumption.
- (Insert picture of system and main screens)
Vehicles readable with Bosch CDR

Call your reconstructionist and ask, or

Get list for yourself at

Microsoft Word - CDR_v21.1_Vehicle_Coverage_List_R1_0_0.doc (boschdiagnostics.com)

CDR® Vehicle List CDR Software 21.1

Important Information about Vehicle Coverage



Or Use the colored charts provided in this presentation

Vehicles readable – want more info? download free "reader"software at

CDR Software Downloads | Bosch Diagnostics

CDR Help file identifies data available

Mkt	Year/Make	Model	Module		Vehicle Interface	OBD/DLC Connect Adapter/Cable	D2M Connect Adapter/Cable	Module Location
<u>13</u>	2020 Chevrolet	Aveo (<u>note</u> <u>6</u>)	ACM	<u>Data</u>	CANplus	F00K108287	F00K108454	Center tunnel
4	2020 Chouraint	Blazer	ACM	<u>Data</u>	<u>CANplus</u> or <u>CDR 900</u>	CANplus - F00K108287 <u>CDR 900 -</u> <u>click here</u>	CANplus - F00K108454 <u>CDR 900 -</u> <u>click here</u> <u>(use listed</u> <u>cable above</u>)	Center tunnel
	Chevrolet	(<u>note o</u>)	ASCM (<u>Note1</u>)	<u>Data</u>	<u>CDR 900</u>	<u>CDR 900 -</u> <u>click here</u>	<u>CDR 900</u> - Cable# 833	In the rear cargo storage area, under the left rear trim panel, at the front of the wheel well

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The bigger vehicle data picture



43

US Lt. Veh EDR & Tool Used

	Annual Sales		EDR First		
Manufacturer	4Q 18 to 3Q	Percent	Known		
	19		Use	<u>Tool?</u>	
GM (Chevy, Buick, GMC, Cadillac)	2,920,580	17.0%	1994	Bosch CDR	
Ford (Ford, Lincoln)	2,404,373	14.0%	1997	Bosch CDR 2001+	
Toyota (includes Lexus, Scion)	2,381,734	13.9%	2001	Bosch CDR	
Fiat Chrysler (includes Dodge, Ram, Jeep, Lancia	2,216,366	12.9%	2005	Bosch CDR	
Honda (includes Acura)	1,604,240	9.4%	2012	Bosch CDR 2012+	
Nissan (includes Infinity, Renault, EXCLUDES Mitsubishi)	1,413,835	8.3%	2006	Nissan Consult	CDR 2013+
Hyundai (Includes Kia, Genesis)	1,309,862	7.6%	2010	GIT tool co.	
Subaru	702,046	4.1%	2010	Denso +SSM	CDR 2019
BMW (incudes Mini, Rolls Royce)	640,003	3.7%	2013	Bosch CDR	
Volkswagen (Includes Audi, Porsche, Bentley)	355,692	2.1%	2014	Bosch CDR	
Daimler Benz (Mercedes, Smart	348,173	2.0%	2014	Bosch CDR	
Mazda	273,368	1.6%	2011	Bosch CDR 2011+	
Tesla	216,125	1.3%	2012	Tesla Tool	
Tata (Jaguar, Land Rover)	125,388	0.7%		Bosch SPX	
Mitsubishi (Part of Nissan Renault Alliance)	120,000	0.7%	2006	Bosch SPX	CDR 2019
Volvo	102,059	0.6%	early	Bosch CDR 2011+	
Industry Total	17,133,844.00	100.0%			

Who got EDR's when (update Mit/Sub)

Data is inc	omp	lete	for	sma	aile	er r	nfrs	wi	ťh	n	о р	uż	olic	tο	oi						
	Market																				
Make	Share	94 95	96 97 9	99 (0 1 2	2 3	4 5 6	7	8	9	10 1	1 12	2 13	14	15	16	17	18	19	20	21
GM (CADILLAC,CHEVY,BUICK,GMC)	17.6%	SOME	have EDR	All h	nave El	DR re	adable v	vith H	Boscł	n CD	R		FF	FF							
FORD (LINCOLN, formerly MERCURY)	15.0%		SOM	E, CDR	9	Some r	eadable	with B	osch	CDR			All								
TOYOTA (LEXUS, SCION)	14.3%				ę	Some			۸II ı	eada	ble wit	h Bos	sch CDI	R							
FCA (FIAT CHRYSLER, DODGE, JEEP, RAM, LA	13.0%						Sor	ne	All	rea	dable	e wit	th Bos	sch (CD	R					
HONDA (ACURA)	9.1%										? ?	'									
NISSAN (INFINITI)	8.6%							No	ot Bo	sch	CDR										
HYUNDAI (GIT tool)	4.4%									?	some		all								
KIA (GIT tool)	3.6%									?	some		all					_			
SUBARU (Hitachi then Denso tool)	3.3%										?										
BMW (MINI, ROLLS ROYCE)	2.3%											?	'						-		
DAIMLER(MERCEDES, MAYBACH, SMART)	2.2%								fre	eze	frame	dat	a ?								
VOLKSWAGEN & AUDI	2.0%								fre	eze	frame	dat	a ?								
MAZDA (Former Ford partner)	1.8%				Nor	n Boso	ch CDR	- sor	ne	?	S	ome					_				
MITSUBISHI (unique Bosch tool)	0.5%									?									?		
JAG/LAND ROVER (Tata Motors India - Former For	0.5%				Nor	n Boso	ch CDR	- sor	ne						. .			_	_		
PORSCHE (part of VW group) (Bentley 2016)	0.3%				_						~		No	EDI	≺ kr	nown			layca	an	
VOLVO (Former Ford)	0.3%					NON R	osch Ci	JR -	som	е?	?				_						
MASERATI (FCA group)	0.1%					_			_			_								_	
FERRARI (FCA group)	0.0%												No	EDI	≺ kr	nown				_	
SAAB (Hitachi HDS3000 system)	0.0%				_	_		_	_		_		_	_	_					_	_
LAMBORGHINI (VW group)	0.0%					_							NI-						?		
ABARTH (FCA group)	0.0%					_		_	_			_	NC N		K Kr	nown					
ALPHA ROMEO (FCA group)	0.0%												NC	EDF	×						
SUZUKI (out of US market in 2015)	0.0%							G	VI Clo	one									45		
		SOME	EDR, CDI	R ALL I	have E[DR, CE	R tool												40		
		SOME	EDR CDR	All ha	ave EDF	R but n	ot CDR to	loc													

Current Recording Capability

EDR Major Data Elements by Manufacturer (All Mfrs with EDR have the required 15 data elements, all are not listed)

Information is taken from Bosch CDR sample files, Ruth cases, and 2012 MY practice projected into 2019 model year

	Par	rt 56	3 Ta	able 1			Part 5	563 T	able 2							Beyor	id 56	3			
Mfr	Event Complete	Key Cycles	Long. ΔV	Speed/Brake/ Throttle or Accel		Multi Event	Lateral ΔV	RPM	Steering Angle	ACM Acceleration	ABS on/off	Roll Angle	ESC Long Accel	ESC Lat Accel	Yaw Rate	Tire Pressure	Panic Brake Assist	Wheel Speeds	Roll Rate	Brake Pressure	ОТНЕК
GM	X	X	X	5@0.5 T	A	X	Х	Х	SDM	50 <mark>, Z 300@2</mark>	Х	2.55	50	50	50	LO	ļ	50	<u>1 @ 10ms</u>	50	50 Day/date/time
Ford	X	X	X	5@0.5 /	A	X	X	Х	5@0.1	:	Х		5	@0.1	5@0.1	LO			5@0.1	**	2017 AB12 precrash 0.2 sec
Chrysler	X	X	X	5@0.1 T	A	X	Х	Х	5@0.1	:	Х				5@0.1	PSI	X	X		2018	ACC set speed 2018, Avoidance
Toyota	X	X	X	<u>5@0.5 T</u>	A	X	Side	Х	5@0.5			Peak&atTR(G 5	in roll	5@0.5		5		In Roll	5@0.5	Ped 2018, Veh history rpt
Honda	X	X	X	5@0.5 T	A	X	Х	Х	5@0.5	X, Y, Z 250@10	X	-1+5@0.1					•				AEmBrk. Lanekeep
Nissan	X	X	X	5@0.5	A .	X	Х	Х	5@0.5	X, Y 250@10		1	*		•		5	?			
Mazda	X	X	X	5@0.51		X	Х	Х		X, Y, Z 250@10											
Volvo	X	х	X	5@0.51	P .	X	2016 XC90	- 11 - E	2016 XC90	X,Y,Z 250@10	2016 XC90	-1+0.3@0.1	L								
BMW	X	X	X	5@0.5/	ŧ.	X		Х	5@0.5	X, Y 300@10ms	Х	15									
Mercedes	X	X	X	5@0.5/	A	X	2017	E cla	iss adds												
VW	X	X	X	5@0.5/	A -	X	X													19	Time of Crash
Hyundai/Kia	X	X	X	5@0.5		X	Х	Х	5@0.5	X,Y,Z 250@10	Х	-1+5@0.1					5			Forte	2
Subaru	X	X	X	<u>5@0.5</u> A		X	X	Х	5@0.5		Х								-1 to+1.5		Eyesight
Mitsubishi	X	X	X	5@0.5A		X	Х	Х	5@0.5	X, Y 250@10		-1+5@0.1									

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FOUNDATION: "BIG 4" WHICH EVENTS DID MY EDR RECORD?

- 1. Is this a complete, valid recording?
- 2. Do key cycles or some other measure of time say the recorded event occurred recently (or when reported?)
- 3. Does the Crash Pulse magnitude and direction match the physical crush damage on the vehicle?
- 4. Does the time series o Precrash data match the reported scenario?

overview

Is EDR speed data ACCURATE?

- The EDR simply writes down the same speed being calculated from drive wheel speed sensors sent to your speedometer. We all rely on our speedometers every day to operate our vehicles safely and within the law.
- Under normal operating conditions speedometers and EDR's are accurate. In 1999 GM estimated speed was within +/-4%. Test data indicates it is much better than that, usually within +2/-0 mph. The EDR regulation specifies +/-1kph (+/-0.6 mph) in new cars (does not include tire wear).

Can Speed Data in EDR be WRONG?

If the Speedometer is right the EDR Speed Data is right. Speed is calculated from wheel rpm.

Wheel rpm may not report speed correctly if:

- 1. Wheels locked by hard braking without ABS
- 2. Wheels slowed by heavy braking (w/ABS)
- 3. Wheels not in contact with ground (airborne)
- 4. Yaw Wheels scrubbing sideways
- 5. Ice/Snow/Hydroplaning/Burnouts wheels spinning relative to pavement torque to wheel exceeds traction available
- 6. In reverse or in a spin (pointing forwards/backwards/forwards)
- 7. Tire size has been changed (and on some, axle ratio).

6/10/2021

Can we check if EDR speed is right?

- Most EDR's also record engine RPM.
- Engine RPM is a completely different sensor.
- Under normal operating conditions, RPM is proportional to drive wheel speed and can be used as a way to further validate the EDR speed.
- (Exceptions: CVT's, during a shift, taking off from a stop)
- Some EDR's also record transmission input shaft rpm or individual wheel speeds that also independently confirm speed.
- Change in velocity can be used to calc speed at impact .50

Who hit who first: Use later event speed graph to infer timing and Delta V of overwritten events



Pre-Crash Data (2nd Prior Event)

Who hit who first: Read the rules for recording ("Data Limitations")

- There are many different makers of airbag control modules, many have different rules for what it takes to record an event, what the rules are to erase or overwrite a previously written event.
- If you follow the logic of the rules, you can figure out what got recorded and in what order.
- It's not always as easy as you might think especially in rollovers with MANY ground contacts.
- If there is any doubt, hire a trained analyst!!

What good is Change in Velocity?

- By itself, change in velocity is a measure of crash severity. But when combined with other commonly available data it becomes powerful in determining speed.
- In serious crashes cops measure distance from impact to final rest, and estimate the "drag factor" as the car slows. They calculate speed AFTER impact to use in momentum
- Speed after impact combined with change in velocity at impact gives speed before impact. If I hit something and slowed by 10mph, and was going 20mph after the hit, the vehicle must have been going 30mph before impact.

What good is Change in Velocity 2?

- Crash Forces are equal magnitude + opposite in direction.
- Changes in velocity are inversely proportional to weight and opposite in direction.
- If you know the vehicle weights and have and EDR in one vehicle with change in velocity, you can calculate the change in velocity of the other vehicle.
- Then you use the change in velocity of 2nd vehicle to get its speed at impact. Sweet.
- You should expect your recon to do this for you!

What good is Change in Velocity 3?

- Once you have both vehicle's change in velocity, you can combine them together and get a closing speed between the two vehicles.
- Combine the closing speed and the speed of the vehicle with the EDR at impact, get the speed of the 2nd vehicle at impact. Closing speed use is limited to inline collisions. Offset collisions require mucho math.
- For intersection collisions, we use the Triangular Velocity Vector method. With an EDR in one vehicle and knowing the other vehicle departure speed or angle, we can calculate the 2nd vehicle speed at impact. (Mucho math).

SOLVING INTERSECTION CRASHES -TRIANGULAR VELOCITY VECTOR METHOD

APPOACH VELOCITY = V1

DEPARTURE VELOCITY = V3

CHANGE IN VELOCITY = ΔV

DEPARTURE ANGLE = β

PRINCIPAL DIRECTION OF FORCE (PDOF) ANGLE = α

THERE ARE 3 SIDES AND 3 ANGLES IN A TRIANGLE (6 THINGS). IF WE KNOW ANY 3 SIDES OR ANGLES WE CAN FIGURE OUT THE REST

(JUST GOOGLE "TRIANGLE SOLVER APP")



APPROACH VELOCITY V1

Solving for 2nd vehicle (no EDR) speed in intersection crash Use "PDOF Triangle" to get 2nd vehicle Triangle

- 1. Must know relative approach R_A
- 2. Get PDOF1 from V1 EDR
- 3. PDOF2=180- R_A -PDOF1
- 4. $\Delta V2 = -\Delta V1(W1/W2)$
- 5. Must have departure speed or angle (3rd piece) of V2 to solve
- 6. Use "triangle app" to solve V2

Note small inner triangles have a parallel edge (parallel PDOF's)

Outer triangle is the PDOF triangle.



EDR Data Admissibility Challenges

- Obtained legally?
 - Warrant or owner permission obtained?
 - Probable cause established for warrant?
- Evidence Preserved Properly?
- Recording from the event of interest?
- Meets standard used in that state or province for reliability?

The Driver Privacy Act of 2015

Any **data retained by an event data recorder**, regardless of when the motor vehicle in which it is installed was manufactured, <u>is the property of the owner</u>, or, in the case of a leased vehicle, <u>the lessee of the motor vehicle in</u> which the event data recorder is installed.

Note: Ownership often passes to the insurance company if a vehicle is "totalled"

DPA requires **written**, electronic, or recorded audio consent of the vehicle owner when accessing EDR data (or a court order)

CDR/EDR Training

- There is no "certification" your qualifications depend on your training and experience. Technician (reader) and Analyst (interpreter) skills are separate.
- 2. Training Providers
 - 1. Institute of Police Technology and Management (IPTM, part of UNF) (Rick Ruth+) analyst (live+online), tech (online)
 - 2. Crash Data Specialists (Brad Muir+)
 - 3. Collision Safety Institute (Rusty Haight)
 - 4. Northwestern (Muir/Russel).
 - 5. SAE (Rick Ruth) analyst live & virtual.
 - 6. Crash Data Group online tech
- 3. All trainers cover basics, but each has unique style and additional content –alternate who you train with

EDR Details by Manufacturer

Chevrolet SDM Phase In 87%

																	3	eve	nts		56	63					SL	DM	50
	GREE	N = 300	ms Longi	tudinal I	Delta V	Red = I	Precrash D	ata & 150	ms Longi	udinal Delta	V	Blue = F	recrash Data	a & 300ms XY I	Delta V		3 Events		Part 563	Intent							SDM50	GM	
Model	1994	1995	1996	1997	1998	- 1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	
Astro			2888	2888	2888	- 2888	2829	2829	2829	2829	2829	2829																	
Avalanche									2829	3003	3003	3003	3003	3320 ROS	3320 ROS	3320 ROS	454	454	454	454	*								
Aveo		-		-												3320	3320	3320		454	*				454				
Beat (India)	١		יח																		454	454							
Blazer	1	$\mathbf{\Lambda}^{-}$	D	V	88	- 2888	2829	2829	2829	2829	2829	2829*	•													454	454	454	
Bolt EV											000														454	454	454	454	
Camaro			2888	2888	2888	- 2829	2829	2829	2829		<u></u>						454	454	454	454	454	454	454	454	454	454	454	454	
Caprice	3002	3002	3002										$+ \vee$	'ח	\/			452	454	police	police	police	police	police	police				
Captiva	_				_			C	רכ	- -	<u>ר</u>		<u> </u>		V		454	454	454	454	*	Sport	Sport					_	
City Express	_						+	J	- E													780	780	780	780	780			_
Colorado												3003	3003	3003	3003	3003	3003	3003	3003			454	454	454	454	454	454	454	
Corvette	_			2888	2888	- 2829	2829	2829	2829	2829	2829	3003	3003	3003	3003	3003	3003	3003	3003	3003	454	454	454	454	454	454	845	845	
Cruze	_						_										454	454	454	454	454	454	454	454	454	454	454		
Equinox												3004	3004	3320 ROS	3320 ROS	3320 ROS	454	454	454	454	454	454	454	454	454	454	454	454	
Express			2888	2888	2888	- 2888	2888	<u>2829</u>	<u>2829</u>	3003	3003	3003	3003	3003	3320 ROS	3320 ROS	3320 ROS	3320 ROS	53320 RO	S <mark> 3320 RO</mark>	S 3320 RC	XS 3320 RO	S 454	454	454	454	454	454	<u> </u>
Impala		3002	3002			-	2829	2829	2829	2829	2829	2829	3320	3320	3320	3320	3320	3320	454	454	454	454	454	454	454	454	454		L
Kodiak					_					2829	2829	2829	2829	2829	2829	2829							201	6 20	17 20	18 20	19 202	0 202	1
Low Cab Fwd																										454			
Malibu	_	_	_	2888	2888	- 2888	2829	2829	2829	2829	3321***	3321 m	(3321	3321	3321	3321	3321	3321	3321	3321 (201	2,454	454	454	454	454	454	454	454	4
Matiz																			454	15.4	151								
Orlando				0000	0000	0000	1.057	0000	0000	0000	0000	-	0000	0000 D00t	0000 000	0000 000	154	154	454	454	454	154	151	151	151	15.4			_
SIVERADO			_	2888	2888	- 2888	MIX	2829	2829	3003	3003	3003	3003	3320 RUS^M	1X 3320 RUS	3320 RUS	404	454	454	454	454	454	454	454	454	454	454	454	-
Sonic																			404	404	404	404 454	404	404	404	404	454		-
opark		-		-	-			-	-	2002	20.02	2002	2002							404	404	404	404	404	404	404	454	454	-
JOK Suburban	-	-		0000	2000	1000	MIV	2020	2020	3003	3003	3003	2002	2220 000	2220 0.00	2220 000	454	AE A	454	AE A	AEA S	454	454	454	454	45.4	171	0.45	
JUDUIDan	-	-		2000	2000	- 2000	MIX	2829	2029	3003	3003	3003	2002	3320 KUS	3320 KUS	3320 KUS	404	404 454	404	404	404	404	404	404	404	404	454	845 0.45	<u> </u>
Tracker			DLC	2000	2000	- 2000	MIX	2029	2029	3003 DLC	JUUJ DLC	3003	3003	3320 RUS	3320 KUS	3320 KUS	404	404	404	404	404	404	404	404	404	404	454	645	<u> </u>
TrailPlazar			DLC	DLC	DLC	- DLC	DLC	DLC	2020	2020	2020	2202	2202	2002	2002	2002									404	404	454	454	<u> </u>
Traverse									2029	2029	2029	3293	9299	3293	5295	3293 3330 POS	454	454	454	454	454	45.4	454	454	454	454	454	454	<u> </u>
Tray												+	_			JJ20 NUO	404	404	404	404	404	404	404	404	404	404	454	434	<u> </u>
Volt																1		454	151	404	404	404	404	404	404	404	434	434	
VUIL														1				404	404	404	404	404	404	404	404	404			

All GM brands full chart printed in color available

GM EDR Evolution



GM EDR Evolution #2



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GM Auto Emergency Braking

- 1. AEB will prevent many crashes and reduce the severity of crashes still happening
- If there is still a crash, the AEB system may store up to 3 camera images:
 - a) 4 sec before event
 - b) At event
 - c) 4 sec after event
- 3. Not accessible with CDR must be requested with proper legal authority from GM

GM Adv Safety Control Module Data in addition to Airbag Module

Model	Location	Model Yea	r	2	·				2	
3 digits Bosch CD	R cable ID shown	2013	2014	2015	2016	2017	2018	2019	2020	2021
BUICK	E A	a 3		1 1	: (I	1		1	E S	
ENCLAVE	cargo left front of wheel well						833			
ENVISION	rear seat left trim by wheel wl				833					
LACROSSE	trunk left	15 15		9C		833				
REGAL	trunk left									
CADILLAC										
CT4	? Not in help file 19.6 yet								833?	
CT6 w/o UKL	Trunk right	0		2	2	833	without s	upercruis	e	
CT6 w/UKL	Primary right, secondary left				834		Supercruis	e Option C	ode UKL	
CTS SEDAN	trunk left		833							
CTS	trunk left				833					
ESCALADE	under left qtr window trim			833						
SRX	under left rear seat	833								
XT4	cargo left front of wheel well							833	V	
XT5	cargo left front of wheel well					833				
CHEVROLET	н м									
BLAZER	trunk left							833		
MALIBU	trunk left	0			833					
TRAVERSE	trunk right						833			
VOLT	trunk left	18 18			а — 31	833				
GMC										
ACADIA	cargo left front of wheel well			ľ Í		833				
Angeler in an annan fill 20 Anna 1977 Anna 1977				k	÷			1	T C	

GM Active Safety Module



- 1. Must be downloaded separately from ACM
- 2. Icon will appear after VIN input for any vehicle that MIGHT have ASCM
- Module /data will only be present if option "UKL" (Super Cruise) or "UGN" (Adv Driver Assist) has been purchased

GM Active Safety Module

- Data can be captured every 80 milliseconds and can record up to 50 records for a total of 4 seconds of data. The data recording window can be either 4 seconds before the end of an auto braking event or 4 seconds before an airbag deployment. ONE EVENT ONLY
- 2. Data is recorded in non-volatile memory at the next proper power-down of the module. Data may <u>not</u> be stored if the battery power is lost before the power-down.

Ford CDR 21.0 Coverage 69%

	Model Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
	500/Montego/Freestyle									CDR/PCM	-	-		5	62											
	Cmax													C	03			783								
	Crown Vic/Grand Marquis	NO	CDR	-	-	RCM				PCM/RCM																
	Econoline	CDR	-	-	-	-	-	-	-	CDR/PCM	-	-	CDR/PCM	384												384
	Ecosport																						823 RC8			
	Edge											PCM/RCM				384					783* ABI	OP			823	
	Escape/Mariner					RCM				CDR	-	-	-	384			384	783 AB1)P	783*					823	
	Expedition	NO			CDR	RCM		CDR	-	CDR/PCM	-	-	CDR/PCM	-	-	384				783 RC7			823			
	Explorer/Mountaineer	NO					CDR	-	CDR/PCM	-	PCM/RCM			CDR/PCM		384		783			783*				823	
	F150	NO		CDR	-	RCM			CDR/PCM	-	-	-	-	384						783* RC7		?				
	F250-F550 Super Duty		CDR	CDR	CDR	RCM				RCM/PCM**		PCM**	CDR/PCM	-	-	384						783*	RC7P			
	F650 750 Madium Duty																									
	Firsts	\mathbf{v}		11							SP	FF				39/			783 DC7							
	Flex			עי	✐									CDR	384	204			105 RC1							
	Focis				CDR	_	_	-	-			NUS	RCM/PCM.	CDR	504		597 AR10			783 AR10	P					
	Fusion/Milan				CDR						PCM/RCM		CDR	_	384		57711010	783* AR	10P	705 1101	1	823* AB	12			
	GT										I CAPITONI		CDR		001			100 110					783			
L.	Mustang	NO	NO	CDR	CDR	RCM			RCM	CDR/PCM			CDR/PCM	-	384					783*	RC7P					
2	Ranger	NO	CDR	CDR	CDR	RCM						CDR	_	-	384									823*		
ğ	Sport Trac (pickup bed)				00.5->	RCM		CDR	-	-		PCM/RCM		PCM/RCM		CDR		2								
E	Taurus/Sable	NO	CDR	CDR	CDR	RCM	CDR	÷	-	-			CDR/PCM	-	384			783 RC7								
ž	Transit T150-T350																					783	RC7			
2	Transit Connect											0			CDR	-	-	778*	783	RC7						823
5 F	Windstar/Freestar/Monterey	NO	NO	CDR	-	RCM			CDR	-	-	-														
														2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
	Aviator (Explorer)							CIND				CDR /PCM													823	
	Continental			CDR	-	RCM																823*			-	?
	MKC/Corsair (Escape Platform))						+2	5PE	:EL)									783*	AB10P				823*	
	MKS (Taurus Platform)							ln c	lenlov	monte					384			783				9	see aviato	r		
	MKZ, Zephyr (Fusion platform)							me	icpidy	menta	PCM/RCM		CDR/PCM	-	384			783	783*	RC7		823* AB	1			
Z,	MKT '10 (Flex Platform)													CDR/PCM	384	384										
ō	MKX/Nautilus (Edge Platform)											PCM/RCM				384					783*	AB10P		823		
Ž	Town Car (Cr Vic)	NO	CDR	-	-	RCM				PCM/RCM																
3	Navigator (Expedition)		NO		CDR	RCM		CDR	-	CDR/PCM	-	CDR/PCM	-	-	-	384				783	RC7		823			
	* DLC Readout requires 784 ads	anter																								T

Ford w/Stability Control Data 21.0

Model Year	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
500/Montego/Freestyle													
Cmax					783								
Crown Vic/Grand Marquis													
Econoline	384												384
Ecosport										823 RC8			
Edge			384					783* AB	10P			823	
Escape/Mariner	384			384	783 AB1	0P	783 *					823	
Expedition	-	-	384				783 RC7			823	i		
Explorer/Mountaineer	CDR/PCM	-	384		783		_	783*				823	
F150	384						783* RC7	,	?				
F250-F550 Super Duty	_	_	384						783*	RC7P			
F650 750 Madium Duty								1					
F050-750 Medium Duty			201			792 DC7							
Flesta	CDP	294	304			703 KC7							
Fiex	CDK	304		507 AR1	n		783 AB10	D					
rocus Fusion/Milan		384		397 ADI	783* AB	1AD	705 ADI	Л	823* AF	212			
	-	504			705 AD	101	1		023 AL	783			
G1 Mustang		394					783*	DC7D		100			
Ranger		384					705				823*		
Sport Trac (nickup had)	PCM/PCM	504	CDP								020		
Taurus/Sablo		394	CDK		783 DC7								
Transit T150 T350	-	504			703 KC7		793	DC7					
Transit Connect		CDP			779*	783	PC7	RC/					077
Windstay/Fragstay/Montayoy		CDR	-	-	110	705							023
windstai/Freestai/Wonterey	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2010	2020	2021
Aviator (Evplorer)	2009	2010	2011	2012	2013	2014	2013	2010	2017	2010	2019	2020	2021
Continental									823*			023	,
MKC/Corsair (Escano Platform)							783*	ARIAD	023			823*	
MKS (Taurus Platform)		394			783		785	ADIUI		soo aviata		023	
MK7 Zonbyr (Eusion platform)		294			703	792*	PC7		823* AF	see aviato	<mark>/4</mark>		
MKT '10 (Flox Platform)	CDP/PCM	384	384		103	105	KC/		023 A				
MKY/Nantilus (Edgo Platform)	CDR/TCM	304	384					783*	AD40D		000		
Town Cor (Cr Vic)			304					705	ABIUP		623		
Navigaton (Expedition)			294				792	DC7					
* DLC Deedout as guine - 794 - J	-	-	304				/03	KU/		823			

Ford Part 563 EDR Subfamilies



Ford Global Real Timer

Added for AB12/ RC7P/RC8

Timer starts when car is built, is hooked to battery, runs continuously

Month of build is on door jamb sticker (exact day/time is not

- ask Ford dealer for build day)

Can be used to tie your recording to your crash

Great for knowing a more precise time between events when not within 5 seconds

Pre-Crash Data	-1 sec (F	irst Record)
----------------	-----------	--------------

Ignition cycle, Crash	1,782
Frontal Air Bag Waming Lamp, On/Off	Off
Safety Belt Status, Driver	Belted
Seat Track Position Switch, Foremost, Status, Driver	Rearward
Seat Track Position Switch, Foremost, Status, Front Passenger	Rearward
Safety Belt Status, Front Passenger	Unbelted
Brake Telitale	Off
ABS Telitale	Off
ESC/TC Teltale	Off
ESC/TC Off Telitale	Default Mode
Powertrain Wrench Telitale	Off
Powertrain Malfunction Indicator Lamp (MIL) Telltale	Unchanged Off
Global Real Time (seconds)	47,951,087

09+ Ford Stability Control Data

	Pre-Cra	s <u>h Data -5 t</u>	<u>) 0 se</u>	<u>ec [10 sar</u>	np	les/sec] (F	First Record)
	Times (sec)	Stability Control Lateral Acceleratio (g)		Stability Control ongitudina cceleration (g)	ıl n	Stability Control Y Rate (deg/s	/ aw sec)
1	- 1.4	0.086		-0.045		0.12	
	- 1.3	Integrate lat		-0.031	Rea	ction 1.5	Integrate yaw
	- 1.1	- accel - get		-0.75		-2.5	approach
	- 1.0	integrate again		-0.709		-1.5	angle
	- 0.9	get		-0.763		-1.5	change!!
	- 0.8	displacement		-0.826		-1.5	Take tangent
	- 0.7			-0.792		-0.75	of cumulative
	- 0.6	-0.007		-0.895	n	ag <u>1.25</u>	angle, multiply
	- 0.5	0.014		-0.83	62	ctor: 1.87	by speed, get
	- 0.4	0.03		-0.835	1	0.75	sideways
	- 0.3	0.022		-0.607		0.37	movement –
	- 0.2	0.107		-0.653		0.75	
	- 0.1	0.05		-0.823		-3.37	went!!
	0.0	-0.004		-0.811		-3.75	

Available on my website Getting EDR Data from unsupported Fords

Richard R. Ruth, P.E.

(this copy has been updated 2021, after the original presentation at the 2016 CDR Summit)



FCA 19.6 CDR Coverage 64%

Last 3 digit	s of Bosch CDR DTM a	adpater/cable number	2005	2006	2007	2008	2009	2010	2011	2012	2013	<u>2014</u>	2015	<u>2016</u>	<u>2017</u>	2018	2019	2020	2021
Chrysler	300	Center stack		228 0,5	228 5		C.	6	387/598		30//310		3011103						
Chrysler	Aspen	Console, aft of			226 4	226						SSIS Street	c			1			
Chrysler	Cirrus (not sold in us,	Call	2					387/516 °				T ON	2			i			
Chrysler	Grand Voyager	Center			-		15 17	387/385 ⁸			50	P			0000533			387/70	
Chrysler	Pacifica	Center stack		(228 ⁵						\sqrt{V}				387/785			· NS)
Chrysler	PT Cruiser	Console, fwd of			228 07	228 5				~10									
Chrysler	Sebring	Console, aft of			226 ⁴	226		387/516 ⁸									Der		
Chrysler	Town & Country	Center stack				385 ⁶		387/385 ⁸			387/785					NOI			
Dodge	Avenger	Console, aft of				226		387/516 ⁸	387/790/5	16	387/516				63				
Dodge	Caliber	Call		í í	226 ⁴	226		387/516 ⁸	387/790/5	16					ריפ	387/821			
Dodge	Caravan	Center			1	385 6		387/385 ⁸			387/785		1						
Dodge	Challenger	Center stack	?			228	i		387/228 1	387/228			387/598						
Dodge	Charger	Center stack		1228 5.5	228 5		-		387/598										
Dodge	Dakota/Raider	Center stack			228°				228	Mex Only	1	24 	ñ.						
Dodge	Dart	Center Stack									387/785					[
Dodge	Durango	Console, aft	226 2.4	2262.4	226 2,4	2262	2262		387/228 10	387/228		387/598							
Dodge		Console, fwd of	15							s		387/385							
22	Journey	shifter					385	387/385 ⁸			387/385	+516PPT				387/821			
Dodge	Magnum	Center stack		228	228 5				bister										
Dodge	Nitro	Console, aft of			227 4	227		387/516 ⁸											
Dodge/Ram	Promaster City		onlo	JY_									387/802	+ 709 DL	C Adapter				
Dodge/Ram	Promaster (Big Van)	ntal	CP.									387/829 n	ew 17_4	+ 709 DL	C Adapter				
Dodge/Ram	Ram Cab Chassi	ronnone	с. 	226 ⁴				387/453 ⁸											
Dodge/Ram	Ram Pickup (25-3	CF Seat/console		226 *			226 °	387/453 °											
Dodge/Ram	Ram Pickup (1500)	CF Seat/console	5	226 *		226	453 °	387/453 °	387/453		387/785								
Dodge/Ram	Ram Van	Center Stack									387/785				and the set				
Dodge/SRT	Viper	Center Stack					<i>c</i>				387/785								
Jeep	Commander	Console, aft	÷.	228-35	228 ⁵								1			1	Grand con	nmander ch	ina only
Jeep	Compass/Patriot	Center stack			226 4	226		387/516 ⁸	790/516		387/516	2	387/ 808 0	OR 819			819		9
Jeep	Grand Cherokee	Console, aft of		228-25	228 5				387/228	387/228+	387/228	387/598							
-	Gladiator			anl	NO			4 4	10 10	72								821	
Jeep	Liberty/Cherokee	Console, aft of	le L	Jeh		227		387/516 ⁸			3	387/785							
Jeep	Renegade	ental/Sil									0.07/5 (0)			387/819*			007/004		
Jeep	Wrangler	abittor			007.6						387/546						387/821		
		shiner	10		227 *	227		387/546°											

Wrangler Unlimited Jeep 3 WE 1993

....

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Chrysler Data – More than Most!!

- Precrash Data every 0.1 second!
- Includes Steering and Yaw rate
- 4 individual wheel speeds
- Brake pressure on some 2018


Toyota EDR Evolution





Toyota EDR Evolution cont'd



Toyota Pedestrian Protection Module

(read in addition to airbag module)

System Status at Pedestrian Event (1st Prior Event, TRG 1)

TRG Count (times)	1
TRG Count not for Pedestrian (times)	SNA
Ignition Cycle, Crash (times)	353
Odometer signal (miles [km])	1,195 [1,923]
Trip count (times)	392
Time count (msec)	1,283,900
Time count input system	Normal
Airbag Warning Lamp, On/Off	OFF
Pedestrian Warning Lamp, On/Off	OFF
Time from Previous TRG (msec)	32767 or greater
Time from Pre-Crash to TRG (msec)	300
Time between TRG not for Pedestrian and TRG for Pedestrian (msec)	SNA
TRG Establishment not for Pedestrian, within 5 sec.	ON
Freeze Signal	ON
Recording Status, Pre-Crash	Complete
Recording Status, Crash Info.	Complete
Recording Status, EDR Correlation Info.	Complete

Deployment Command Data (1st Prior Event, TRG 1)

Front Pop-Up Hood, Time to Deploy (msec)	3.0
Rear Pop-Up Hood, Time to Deploy (msec)	3.0
Airbag for Pedestrian Deployment, Time to Deploy (msec)	SNA

DTCs Present at Time of Event (1st Prior Event, TRG 1)

Recording Status, Diagnostic	Complete
Ignition Cycle Since DTC was Set (times)	0
Warning ON Time Since DTC was Set, for Pedestrian (min)	0
Diagnostic Trouble Codes	None

Pedestrian Event Crash Pulse (1st Prior Event, TRG 1)

Recording Status, Time Series Data	Complete
Time from TRG to Next Sample (msec)	1

VCH Freeze Frame Data 2013+

- New feature in 2013+ Rav 4 and 2014+ Highlander & Lexus IS, 2015+ Lexus NX & RC, "<u>V</u>ehicle <u>C</u>ontrol <u>H</u>istory"
- Triggers EDR-style recording if accel pedal is rapidly depressed or other conditions that might occur during an alleged sudden or unintended acceleration or lane excursion. 26 triggers including crash avoidance, ESC.
- Accessible only with Toyota Techstream service tool not part of Bosch CDR system. Annual s/w subscription or 2 day subs available.
- Space in memory for MANY events can show a history of erratic driver behavior
- Details in SAE 2016-01-1495 Appendix D. New 2019-01-0632 "Reconstructing Vehicle Dynamics from On-Board Event Data" discovered VCS has data 6.6 times per second in ABS events vs 2 times in hard accel events).
- Photos stored by pre-collision braking system may be accessed with Techstream system! Photos are not in early VCH, they come with "Toyota Safety System 2.0".

	TOYOTA/LEXU	JS Vehi	cles with	n Vehic	le Conti	rol Histo	ory Data	1	
		2013	2014	2015	2016	2017	2018	2019	2020
	CT200h								
	ES								
	GS								
S	GX								
S	IS		250 and 350						
ω	LS								
_									
	NX								
	RC								
	RX								
	Avalon								
	Camry								
	Corolla								
	Prius			C and V	and Prius	and Prime			
\mathbf{A}	Highlander								
5	Land Cruiser								
\mathbf{X}	4Runner								
0	Tacoma								
	Tundra								
	Sequoia								
	RAV4								
	Sienna								
	Yaris								
SCION	iM								

Honda 21.0 CDR Coverage

		IIM	J									M.	_	1	_
Model	<u>Locat</u>	<u>ion</u>										U			
			<u>##</u>	<u>2012</u>	<u>2013</u>	<u>2014</u>	<u>2015</u>	<u>2016</u>	<u>2017</u>	<u>2018</u>	<u>2019</u>	<u>2020</u>	<u>2021</u>	<u>2022</u>	
ACURA			Last	3 digits	of Bosch	CDR cat	ole number	Gen 2		Gen 3			Gen 4		-
RL	Under dashbo	2011		547											
TL	Under dashbo	2011-		547											
TSX	Under dashbo	NO		547											
ZDX	Under dashbo	time		547											
MDX	Under dashbo	series		547		387/789			387/810					846	
NSX	Under dashbo	EDR							387/789						
RDX	Under dashbo	But			547			387/789		387/825					
ILX	Under dashbo	may			547			387/789							
RLX	Under dashbo	have				387/789									
TLX	Under dashbo	Delte \	,				387/789				387/810		846		
	-		/												-
HONDA		single		<u>2012</u>	<u>2013</u>	<u>2014</u>	<u>2015</u>	<u>2016</u>	<u>2017</u>	<u>2018</u>	<u>2019</u>	<u>2020</u>	<u>2021</u>	<u>2022</u>	
ACCORD	Under dashbo	value			387/789			387/810		387/825					
CIVIC 2 DR	Under dashbo			547				387/810							
CIVIC 4 DR	Under dashbo	Honda	a	547	387/789			387/810							
CLARITY		onlv											387/810		
CROSSTOUR	Under dashbo	assists	.	547											
CR-V	Under dashbo	law		547				387/789	387/810						
CR-Z	Under dashbo	anform		547											
FCX Clarity	Under dashbo	eniorce	3						387/810						
FIT	Under dashbo	-ment		EV 547			387/789		387/810						
HR-V		volunta	ır					387/789		387/810					
INSIGHT	Under dashbo	ily		547							387/810				
ODYSSEY	Under dashbo			547		387/789			387/810						
PASSPORT	Under dashbo										387/810				
PILOT	Under dashbo			547				387/789	387/810						
RIDGELINE	Under dashbo			547					387/810						

Honda Gen 2 EDR

If equipped may have semi autonomous vehicle data elements

Pre-Crash Data -5 to 0 sec [2 samples/sec] (Event Record 1) - Table 2 of 3

Time Stamp (sec)	PCM Derived Accelerator Pedal Position, % full	Forward Collision Warning (Not Warning/ Warning)	Collision Mitigation Braking System (Not Engaged/ Engaged)	Collision Mitigation Braking System, Forward Collision Warning (On/Off)	Lane Departure Warning (Not Warning/ Warning)	Road Departure Mitigation (Not Engaged/ Engaged)	Road Departure Mitigation, Lane Departure Warning (On/Off)
-5.0	16	Not warning	Not engaged	On	Not warning	Not engaged	Off
-4.5	8	Not warning	Not engaged	On	Not warning	Not engaged	Off
-4.0	11	Not warning	Not engaged	On	Not warning	Not engaged	Off
-3.5	13	Not warning	Not engaged	On	Not warning	Not engaged	Off
-3.0	18	Not warning	Not engaged	On	Not warning	Not engaged	Off
-2.5	18	Not warning	Not engaged	On	Not warning	Not engaged	Off
-2.0	17	Not warning	Not engaged	On	Not warning	Not engaged	Off
-1.5	0	Warning	Engaged	On	Not warning	Not engaged	Off
-1.0	0	Warning	Engaged	On	Not warning	Not engaged	Off
-0.5	0	Warning	Engaged	On	Not warning	Not engaged	Off
0.0	0	Warning	Engaged	On	Not warning	Not engaged	Off

Honda Gen 2 Semi Auton cont'd

Pre-Cra	sh Data -5 to	0 sec [2 s	amples/sec	(Event Re	cord 1) - Ta	ble 3 of 3
Time Stamp (sec)	Adaptive Cruise Control (Not Engaged/ Engaged)	Adaptive Cruise Control (On/Off)	Lane Keeping Assist (Not Engaged/ Engaged)	Lane Keeping Assist (On/Off)	Cruise Control (Not Engaged/ Engaged)	Cruise Control (On/Off)
-5.0	Not engaged	On	Not engaged	On	Not Engaged	On
-4.5	Not engaged	On	Not engaged	On	Not Engaged	On
-4.0	Not engaged	On	Not engaged	On	Not Engaged	On
-3.5	Not engaged	On	Not engaged	On	Not Engaged	On
-3.0	Not engaged	On	Not engaged	On	Not Engaged	On
-2.5	Not engaged	On	Not engaged	On	Not Engaged	On
-2.0	Not engaged	On	Not engaged	On	Not Engaged	On
-1.5	Not engaged	On	Not engaged	On	Not Engaged	On
-1.0	Not engaged	On	Not engaged	On	Not Engaged	On
-0.5	Not engaged	On	Not engaged	On	Not Engaged	On
0.0	Not engaged	On	Not engaged	On	Not Engaged	On

Reminders: UNIQUE TO HONDA

- Most manufactures record the speed calculated in the powertrain control module as it is being sent TO the speedometer on the CAN bus.
- 2. Honda records the speed being displayed **ON** the speedometer, after the PCM calculated speed has been dampened or "smoothed".
- The last data point labeled 0.0 is sampled at AE. -0.5 is -0.01 to -0.50. While sampled at AE, speedometer processing delays what is being reported, so it lags the true speed at impact during hard braking.

NISSAN EDR's 19.3 (CDR 51%)

Model	Location																
Last 3 digits of Bo	osch CDR cable number	<u>2006</u>	<u>2007</u>	<u>2008</u>	<u>2009</u>	<u>2010</u>	<u>2011</u>	<u>2012</u>	<u>2013</u>	<u>2014</u>	<u>2015</u>	<u>2016</u>	<u>2017</u>	<u>2018</u>	<u>2019</u>	2020	
INFINITI																	
G CONVERTIBLE	TUNNEL BETWEEN SEATS				*		Jul-12	2	780								
G COUPE	TUNNEL BETWEEN SEATS		*	Yellow =	Proprie	tary Co	nsult Too	ol Only	780								
G SEDAN	TUNNEL BETWEEN SEATS		* No dire	ect to mo	dule cal	bles	Jul-12	2	780								
м	TUNNEL BETWEEN SEATS								780								
Q30		Ye	llow	are	a no	ot							780	780	780	780	
Q40	TUNNEL BETWEEN SEATS					_					780						
Q50	TUNNEL BETWEEN SEATS	CO/	/ered	d bv	CD)R			780	780	780	780	780	780	780	780	
Q60	TUNNEL BETWEEN SEATS			e j					780	780	780		780	780	780	780	
070	TUNNEL BETWEEN SEATS								780	780	780	780	780	780	780		
FY	TUNNEL BETWEEN SEATS			Dealors		have sn	ocial sof	twaro	780			100	100		100		
	TUNNEL BETWEEN SEATS			roquirod				lware	700								-
	TUNNEL BETWEEN SEATS			requireu	lureau	EDK			700								
JX35 OX50-80	TUNNEL BETWEEN SEATS								780	780	780	780	780	50 60 80	50 60 80	50.60	<u> </u>
QX30	TUNNEL BETWEEN SEATS							<u> </u>	100	100	100	700	598	598	598	598	
NISSAN	TOILLEE BETTTEEN OEATO	0000	0007	0000	0000	0440	0044	0040	0040	0044	0045	0040	0047	0040	0040	0000	-
MODAN		2006	2007	2008	2009	2030	2011	<u>2012</u>	2013	2014	2015	2016	<u>2017</u>	2018	2019	2020	_
370Z	TUNNEL BETWEEN SEATS		*				Aug-12	2	780	780	780	780	780	780	780	780	_
ALTIMA COUPE	TUNNEL BETWEEN SEATS			*					780	INCLUDE	D IN SEDA	N BELOW					_
ALTIMA SEDAN	TUNNEL BETWEEN SEATS		*	Yellow =	Proprie	tary Co	nsult Too	ol Only	780	780	780	780	780	780	780	780	
ARMADA	TUNNEL BETWEEN SEATS	*		No direc	t to moo	dule cab	les		780	780	780	?	780	780	780	780	
CUBE	TUNNEL BETWEEN SEATS				*				780	780							
FRONTIER	TUNNEL BETWEEN SEATS	*					Oct-12	2	780	780	780	780	780	780	780		
GT-R	TUNNEL BETWEEN SEATS				*					780	780	780	780	780	780	780	
JUKE	TUNNEL BETWEEN SEATS								780	780	780	780	780				_
KICKS														780	780	780	
LEAF	TUNNEL BETWEEN SEATS								780	780	780	780	780	780	780	780	
MAXIMA SEDAN	TUNNEL BETWEEN SEATS		*						780	780	780	780	780	780	780	780	L
MICRA	Check Manual										780	780	780	780	780		_
MURANO	TUNNEL BETWEEN SEATS		*		*				780	780	780	780	780	780	780	780	_
MURANO CROSS C	TUNNEL BETWEEN SEATS								included	in above							_
NV200	TUNNEL BETWEEN SEATS								780	780	780	780	780	780	780	780	
PATHFINDER	TUNNEL BETWEEN SEATS	*							780	780	780	780	780	780	780	780	
QUEST	CTR CONSOLE NEAR FRONT		*						780	780	780	780	780				<u> </u>
ROGUE, R SPORT	Check Manual			*					780	780	780	780	780	+Qashqai	780	780	
SENTRA	IUNNEL BETWEEN SEATS								780	780	780	780	780	780	780	780	<u> </u>
TITAN	TUNNEL BETWEEN SEATS								780	780	780	780	780	780	780	780	<u> </u>
VERSA SEDAN	TUNNEL BETWEEN SEATS		*						780	780	780	780		780	780	780	_
VERSA NOTE HB	TUNNEL BETWEEN SEATS						Sep-12		780	780	780	780	780	780	780		
XTERRA	TUNNEL BETWEEN SEATS	×					Oct-12	2	780	780	780						

Nissan Pre-Crash Data a -5 to 0 sec [2 samples/sec] (Event Record 1)

Pre-Crash Data -5 to 0 sec [2 samples/sec] (Event Record 1)

(the most recent sampled values are recorded prior to the event)

	Speed, Vebicle	Accelerator		~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	Wordt in ten	Steering
Time Stamp (sec)	Indicated (MPH [km/h])	Pedal, % full	Engine RPM	Motor Kr IVI	Service Brake (On, Off)	Input (deg)
-5.0	24 [39]	16	2650	0	Off (Brake Not Activated)	-32
-4.5	23 [37]	11.5	1750	0	Off (Brake Not Activated)	-2
-4.0	21 [34]	9	1200	0	On (Brake Activated)	28
-3.5	15 [24]	9	1150	0	On (Brake Activated)	14
-3.0	13 [21]	4	950	0	On (Brake Activated)	4
-2.5	11 [17]	4	950	0	On (Brake Activated)	4
-2.0	5[8]	4	900	0	On (Brake Activated)	-48
-1.5	3 [5]	4	850	0	On (Brake Activated)	-98
-1.0	1 [2]	4	850	0	On (Brake Activated)	-160
-0.5	3 [5]	10.5	1100	0	Off (Brake Not Activated)	-194
0.0	6[9]	16	1150	0	Off (Brake Not Activated)	-218
A	AE					

<mark>- not rq'd</mark>

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Mazda CDR 19.6 Coverage 44%

Model	Location														
Last 3 digits of	Bosch CDR cable number sho	owr <u>2009</u>	<u>2010</u>	<u>2011</u>	<u>2012</u>	<u>2013</u>	<u>2014</u>	<u>2015</u>	<u>2016</u>	<u>2017</u>	<u>2018</u>	<u>2019</u>	<u>2020</u>	<u>2021</u>	
MAZDA				All Mazda use	e 387 adapti	er for direct to r	nodule								
CX-3	TUNNEL BELOW IP	Law							812						
Tribute/CX-5	TUNNEL AFT SHIFTER	Enforc Contac	ement :t Your	Read as Escape		779			811	812					
CX-9	TUNNEL BELOW IP	Instruc	tors -	778					811						
CX-30		Data availat	ole										843		
Mazda 2	TUNNEL AFT SHIFTER	from p	re-	792				not listed	812	not listed					
Mazda 3	TUNNEL AFT SHIFTER	CDR A	CM's Nazda		779				811			843			
Mazda 5	TUNNEL BELOW IP	or Ma	ida		778					not listed					
Mazda 6	TUNNEL BELOW IP	supplie	ers.	792			779		811		831				
MX-5 Miatta	TUNNEL BELOW IP					no coverage			812						
Memo: The Mazo	da Tribute was sister to the Ford B	Escape th	ru 2011.	. A 2011 Tribu	ite was rea	d using a 201	1 Escape	e VIN.							

Typical Mazda Precrash Data

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۲	Pre-Grash Data -5 to 0 sec [2 samples/sec] (Event Record 1)											
<u>(t</u>	<u>ne most rec</u>		<u>t sampled va</u>	<u>lues are recor</u>	ded prior to th	e e∨ent)						
		ious										
		é	Speed,									
		ת	Vehicle	Engine	Service	Minimum						
'	Time Stamp		Indicated	Throttle,	Brake	winning						
	<u>(sec)</u>	22	(MPH [km/h])	% full	(On, Off)	Regulatory						
		19	19 [31]	0	On	r togalator y						
	-4.5	17	17 [27]	0	On	Content						
	-4.0	14	14 [23]	0	On							
	-3.5	12	12 [19]	0	On							
	-3.0	11	11 [17]	25	Off	Recording						
	-2.5	10	10 [16]	61	Off	rtoooranig						
	-2.0	11	11 [17]	63	Off	threshold						
	-1.5	13	13 [21]	64	Off	<5mph						
	-1.0	16	16 [26]	64	Off	Silipii						
	-0.5	18	17 [27]	0	Off							
	0.0		4 [6]	0	Off							

This is a second event – last data pt at impact

Volvo CDR 19.5 Coverage 32%

Model	Location												
Last 3 digits	of Bosch CDR cable number sho	<u>2010</u>	<u>2011</u>	<u>2012</u>	<u>2013</u>	<u>2014</u>	<u>2015</u>	<u>2016</u>	<u>2017</u>	<u>2018</u>	<u>2019</u>	<u>2020</u>	<u>2021</u>
VOLVO		All Volv	o use 387	Adapter for	r DTM ima	ges							
S40													
S60	CTR TUNNEL UNDER CONSOLE		799							500/830		?	
S80, S80L	CTR TUNNEL UNDER CONSOLE												
S90	CTR TUNNEL UNDER CONSOLE								816				
V40	CTR TUNNEL UNDER CONSOLE								816 Euro)			
V60	CTR TUNNEL UNDER CONSOLE		799							500/830		?	
V70	CTR TUNNEL UNDER CONSOLE				799								
V90	CTR TUNNEL UNDER CONSOLE								816				
XC40	CTR TUNNEL UNDER CONSOLE									500/830		?	
XC60	CTR TUNNEL UNDER CONSOLE				799								
XC70	CTR TUNNEL UNDER CONSOLE				799								
XC90	CTR TUNNEL UNDER CONSOLE							816				?	
The source data f Always consult th Copyright Ru	or this chart is the Bosch CDR help file for Version e latest help file for the most accurate coverage Jth Consulting LLC 2020 - Authorize	n 19.5 ed for di	istribution	by UNF-IF	PTM,								
	Old Volvo DV or Enf only call V	nly L /olvo	.aw D			202	0 со	vera	age ju 21.1	ist ad	ded i	n	

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2016+ XC90 Sample Volvo File (vs. 2013 Volvo with minimum data)

Pre-Crash Data -1 Sec (Event Record 1)

Ignition Cycle, Crash	2,764
Safety Belt Status, Driver	On, Belted
Safety Belt Status, Passenger	On, Belted
Frontal Airbag Warning Lamp	Off
Frontal Airbag Suppression Switch Status, Front Passenger	On
Seat Track Position Switch, Foremost, Status, Driver	Not Equipped
Seat Track Position Switch, Foremost, Status, Front Passenger	Not Equipped
Occupant Size Right Front Passenger Child	Not Equipped

2020 still not added to other models

Added Data for XC90

Pre-Crash -5 to 0 sec (Event Record 1)

Time (sec)	Speed, Vehicle Indicated (MPH [km/h])	Accelerator Pedal, % Full (%)	Service Brake (On, Off)	Steering input	ABS Activity	Stability control status
-5.0	43.5 [70.0]	100.0	Off	0.0	Off	On
-4.5	47.8 [77.0]	100.0	Off	0.0	Off	On
-4.0	52.2 [84.0]	100.0	Off	2.0	Off	On
-3.5	55.9 [90.0]	100.0	Off	3.0	Off	On
-3.0	58.4 [94.0]	100.0	Off	3.0	Off	On
-2.5	61.5 [99.0]	100.0	Off	11.0	Off	Engaged
-2.0	62.8 [101.0]	100.0	Off	6.0	Off	Engaged
-1.5	65.2 [105.0]	100.0	Off	-9.0	Off	Engaged
-1.0	67.1 [108.0]	100.0	Off	-8.0	Off	Engaged
-0.5	69.6 [112.0]	100.0	Off	-9.0	Off	Engaged
0.0	70.2 [113.0]	100.0	Off	-13.0	Off	Engaged

BMW CDR US 19.5 Coverage See help file for Rolls Royce

Model	Location												
Last 3 digits of Bosch CD	R adapter/cable number shown		<u>2012</u>	<u>2013</u>	<u>2014</u>	<u>2015</u>	<u>2016</u>	<u>2017</u>	<u>2018</u>	<u>2019</u>	<u>2020</u>	<u>2021</u>	
BMW	All BMW require 387 Adapter for D	тм											
1 Series						not covere	ed - Europe	Only					
2 Series	Driver side, behind IP, rt of strg				7	Furor	ne only	v not i	cover	ed			
2 Series xdrive	Center console between seats							y not v				<mark>500/822</mark>	
3 Series	Passenger side, behind the glove	box		796								500/822	
Active Hybrid 3	Driver side, behind IP, rt of strg				796								
4 Series	Passenger side, behind the glove	box		796					500/822				
5 Series	Passenger side, behind the glove	box		796								500/822	
6 Series	See Service Manual									500/822			
6 Series GT	Passenger side, behind the glove	box		796			500/796	500/822					
7 Series	Passenger side, behind the glove	box								500/822			
8 Series	Passenger side, behind the glove	box		796								500/822	
X3 xDrive	Center Tunnel, Between Seats	No	bacl	k 📗	796					500/822			
X5	Center Tunnel, Between Seats	m	odel"			798	500/798	500/807		also X2			
X1, X2	See Help File - Various	CO/	verage	e		796			500/822			500/807	
X3, X4	Center Tunnel, Between Seats					796						500/822	
X6	See Service Manual	<mark>)∩–f</mark>	lov r							500/822			
Х7	Center Tunnel, Under Dash	<u>1–0(</u>		ay		798				500/822			
Z4	See Service Manual					798				500/822			
i3, i8					<mark>500/807</mark>								
The source data for this chart i	s the Bosch CDR help file for Version	19.5											
Always consult the latest help fi	le for the most accurate coverage			SVE									
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BMW Sample Pre-Crash

rie-Viasii Dala -V lo V sec (Necolu I, most Necelii	Pre	-Crash	Data -5	to 0	sec	Record 1	, Most	t Recent
---	-----	--------	---------	------	-----	----------	--------	----------

Time (sec)	Speed, Vehicle Indicated (MPH [km/h])	Accelerator Pedal, % Full (%)	Engine RPM	Steering Input (deg)	Service Brake, On/Off	ABS Activity (Engaged, Non- engaged)	Stability Control (On Engaged, Non-engaged)
-5.0	55 [89]	16	1500	0	Off	No ABS Activity	Non-engaged
-4.5	55 [89]	17	1500	0	Off	No ABS Activity	Non-engaged
-4.0	55 [89]	19	1500	0	Off	No ABS Activity	Non-engaged
-3.5	55 [89]	19	1500	0	Off	No ABS Activity	Non-engaged
-3.0	55 [89]	19	1500	0	Off	No ABS Activity	Non-engaged
-2.5	55 [89]	8	1500	0	Off	No ABS Activity	Non-engaged
-2.0	55 [89]	7	1500	0	Off	No ABS Activity	Non-engaged
-1.5	55 [89]	14	1500	0	Off	No ABS Activity	Non-engaged
-1.0	55 [88]	19	1500	0	Off	No ABS Activity	Non-engaged
-0.5	55 [89]	0	1500	0	Off	No ABS Activity	Non-engaged
0.0	45 [73]	0	1300	10	On	ABS Activity	Non-engaged

BMW EDR Evolution

- 1. Basic EDR 2013
- 2. "Extension" 2014
- 3. Some driver assist mid-2015 timing
- Auto Steering (autonomous vehicle) views 4 fps

Cameras all

Not intended for CDR,

only BMW can access

5. Clock and odometer in 2019 Mini Cooper

More data elements in 2020 X5 "ACSM5"

 Recent files show day/date/time of crash and second/third row seat belt use. more

Multi-Event, Number of Events	1. Event
Time From Previous Event to Current Event (msec)	Data Not Available
Time From Last Speed Data Sample (Precrash) to Time Zero (msec)	57
Time From Initial Event to Current Event (msec)	Data Not Available
Complete File Recorded, Public, Prio 1 Data	Completed Successfully
Ignition Cycle, Crash (Cycle)	1,315
Ignition Cycle, Download (Cycle)	1,316
Vehicle Clock, Date and Time at Event (YYYY-MM-DD, HH:MM:SS)	2020-12-18, 09:03:54
Vehicle Mileage (km)	13,285
Operating Time (min)	20,794
Safety Belt Status, 2nd Row, Left Side	Not Belted
Safety Belt Status, 2nd Row, Center	Not Belted
Safety Belt Status, 2nd Row, Right Side	Not Belted
Safety Belt Status, 3rd Row, Left Side	Data Not Available
Safety Belt Status, 3rd Row, Center	Data Not Available
Safety Belt Status, 3rd Row, Right Side	Data Not Available

Mercedes CDR Coverage 19.2 36%

Model	Start of Sales	2042	-	044		204	-	2046	2047	2040	2040	2020
Last 3 digits of Bosch CDR DTN	able number	2013	2	014		201	<u>5</u>	2016	2017	2018	2019	2020
Mercedes	EDR Start	All Mercedes	s use 3	87 adapter	for direct t	o modul	e downlo	ads				
A-Class Limo			_					000			832	
B-Class EV	after 4/1/2014				509			800				-
B-Class	after 6/2/2014				598							832 Lim
C Class Sedan	after 9/1/2014					801						
C Class Coupe	start of 2015 M.Y.				800			801				
CLA Class	after 6/2/2014				598							832
CLS-Class					800							801
E Class (includes coupe)	after 4/1/2013		8	300						801 w st	eering da	ita
EQC			<mark>~ "</mark>	o ola								801 w s
G Class	after 11/1/2014		ן ר	Jack	100		598				801	
GL Class	after 7/11/2014	n	\mathbf{n}	יוסר <u>"</u>	598			?	?			
GLA Class	after 6/2/2014		100		598							
GLC Class		CO	ve	rade				598		801		
GI E Class			10	ugo				598				832
GLK	after 12/2012			800				2	2			
GLS Class	alter 12/2013	·		000	-	1		509	3.6			022
CT CT						-		390			0.04	032
G			-	_						-	801	-
G wagon			_									801
Maybach S600				16 S	-			801				
ML-Class	after 7/11/2014				598			?				
S-class Sedan	after 9/2013		8	01								
S-Class Coupe	after 9/1/2014				801							
SL	after 12/2013		1	800					y			
SLC										800		
SLK	after12/2013			800								
Sprinter											832	
Vito								598				
Smart & 2016 with "E"	after 9/1/2014					809						
Smart with VIN 4th "F"								820				
Smart for two, coupe, cat	orio									820		
Metris										598		

VW/Audi 19.6 US Coverage 34+%

Model	Location			See help	file for	Rolls	Royce						
Last 3 digits of Bo	osch CDR adapter/cable num	bei <u>20</u>	009-13	<u>2014</u>	20) <u>15</u>	2016	<u>2017</u>	<u>2018</u>	<u>2019</u>	2020	<u>2021</u>	
All VW/Audi Requ	ire the 387 Adapter to read [отм		Gold = US o	nly (Ca	nada no	ot covered)		Yellow=Wor	ldwide			
VW													
Arteon	UNDER CENTER STACK								805				
Atlas	UNDER CENTER STACK								805				
Beetle	UNDER CENTER STACK				8	04			Canada ado	ded			
CC	UNDER CENTER STACK				8	04							
Crafter	UNDER CENTER STACK								805				
EOS	UNDER CENTER STACK			806									
Golf, eGolf	UNDER CENTER STACK				8	05			Worldwide				
Jetta	UNDER CENTER STACK				8	04			805				
Neo													
Passat			r N/i	nivon	Sid	tor			805				
Polo		Sle		nivan	<u> 3151</u>	lei			805				
Routan	UNDER CENTER STACK		785										
Sportwagen + Al	ltrack				Golf p	latform	not called o	ut separtely i	n help file				
T-Roc	UNDER CENTER STACK									805			
T-Cross	UNDER CENTER STACK								805				
Tiguan	UNDER CENTER STACK			ha "ha		\4		805					
Touareg	UNDER GEAR SELECTOR		INC	Jua	JN	4				500/826			
Touran	UNDER CENTER STACK		n	مطما	"				805				
AUDI			- 11	louei		5	<u>2016</u>	2017	<u>2018</u>	<u>2019</u>	2020	2021	
A1	Under Center Stack		~~	vora	Ar					805			
A3,S3, RS3	Under Center Stack		UU	vera	၂င	0 5					842		
A4, S4, A4 allroa	Tunnel between 1st/2nd row se	eats			8	04		500/813					
A5, R5, S5, RS5	Tunnel between 1st/2nd row se	eats			8	04			500/813				
A6, A6L, S6, Ava	Tunnel between 1st/2nd row se	eats			8	04			500/826				
A7, S7, RS7	Tunnel between 1st/2nd row se	eats			8	04			500/826				
A8, A8L, S8	Tunnel between 1st/2nd row se	eats			8	04			500 /826				
Q2	Under Center Stack								805				
Q3	Under Center Stack				8	04				805			
Q5, SQ5	Tunnel between 1st/2nd row se	eats			8	04			500/813				
Q7 0°	Under Center Stack				_			500/813	500/820		500/826		
R8	Under Center Stack				_			804	500/626				
TT. TTS					not co	vered :	at this time	~~~					
eTron	Under Center Stack									500/826			

VW/Audi Details

- 1. Same data set for all event types
- 2. Time from last precrash to AE noted
- 3. Recorder holds up to 6 ND events in Chronological order.
- 4. New modules will use Flex Ray
- 5. Date/Time of Crash from clock (GPS if clock not set) in 2015+ Audi models, phasing into VW models
- 6. Newer models require hood to be open to read through DLC

TESLA



- Remember the definition of an EDR is something that records a time series of data <u>as</u> <u>a result of a crash</u>.
- 2. Tesla may record information as a result of turning the key on, but that is not an event data recorder. More on this later.
- 3. Tesla did not have any EDR in the ACM of its original 2008 Roadster models.
- 4. Tesla has installed EDR in The 2012+ Model S, the 2015+ Model X, and the 2017 Model 3.
- 5. Effective March 2018, Tesla announced they will sell a publicly available tool to download the Tesla EDR

Tesla EDR

Coverage



TESLA

- More information is available on their website <u>https://edr.tesla.com</u>
- See "Other sources" later

Order Cables

Order the cables needed to retrieve EDR data. Note that a USB-to-CAN adapter is also required in order to retrieve EDR data. See the help page for more information.

ORDER CABLES

Download the Tesla EDR Retrieval Program

This free software program is used to retrieve EDR data.



The Tesla EDR Tool

- Tesla provides the software free of charge on their website that installs on your laptop. No special computer is needed.
- 2. The hardware kit sells for a list price of \$1200.00.
- The equivalent of the Bosch CDR interface manual is the "PCAN-USB" adapter. It is very small, and reminds you more of a USB to serial adapter, just a slight bit larger.



Converting Raw Data to a Report

The Tesla software extracts a raw data file. To convert the raw data to a report, you must upload the raw data to the Tesla Server. A report is immediately returned in the latest version of software.

Generate a Report

Create a MyTesla account in order to upload an EDR data file and generate a report in PDF format.



Hyundai/Kia Tools

- There is no DLC only kit. Hyundai kit comes with 13 DTM cables thru #24, Kia with 15 DTM cables thru #23. 10 Cables are in both. New cables cost \$250. #25-30 for 2019-2021's not yet included.
- Hyundai: Call GIT America Tool Company order Part G0ZHDMN001 \$6450 does not include software.
- GIT now also sells Kia tool, (was Snap On),order part GIT0ZKDMN001 \$6950 + tax+ship
- Software updates \$495/yr per brand from GIT Tool Company. Software V#40 Hyundia/ V#37 Kia released 2021. New \$1120 CAN-FD adapter for GV80 backorder.
- Dan Portillo@gitamerica.com(888) 549-4977

The Hyundai EDR Reader



Officially Supported 2013+ Models V37/40

Madal		Ma	del Veere										
KIA	2010	2011	2012	2013*	2014	2015	2016	2017	2018	2019	2020	2021	
CADENZA (Azera sister)					19(VG)	19	19	13(YG)	13	13			
	40	40	40	40 (TD)					10	24(80m)	24	24	
	10	10	10	10 (10)	6 (TD)	0	0	12(1D,1DW)	12	21(60111)	21	21	
К5												26(D3LA)	
K900						11 (KH)	11	11	11	21(RJ)	21		
NIRO (DE EV, DE HEV, DE PHEV)								21(DE)	21	21	21	21	
OPTIMA	No	4	4	4 (TF/QF)	4	4	14 (JF,JFA)*	14	14	14(JFA)	14	?	
OPTIMA HYBRID	No	4	4	4 (TF HEV)	4	4	4	23(JF HEV)	23	23	23	?	
RIO	No	No	8	8(UB)	8	8	8	8	21 (SC)	21	21	21	
RONDO (Canada only 2011 MY+)	No	No	9	(not officially su	upported sind	ce non-US, re	ad as a Kia Rio)						
SEDONA	No	No	No	No	10(VQ)	12(YP)	12	12	12	12	12	12	
SELTOS												28(SP2)	
SORENTO	No	3	3	3(XM)	3,7(XM)	3,7	13 (UMA)	13	13	13	13	29+CFCI	(MQ4)
SOUL	1 ^{see note 1}	1 ^{see note 1}	1	1(AM)	12(PS)	12(PSEV)	12	12	12	12,26(SK3 EV)	26 (SK3)	26	
SPORTAGE (SL)	No	Yes	2	2(SL)	2	2	2	13(QL)	13	13	13	13	
STINGER (CK)									21 (CK)	21	21	21	
TELLURIDE (ON)											25(ON)	25	
HYUNDAI	2010	2011	2012	2013*	2014	2015	2016	2017	2018	2019	2020	2021	
ACCENT (RB)	No 10	No?	5 ^{see note 2}	5(RB)	5	5	5	5	21(HC)	21	21	21	
AZERA (HG)		likely	Yes	7(HG)	7	7	7	7					
ELANTRA Coupe(JK), Sedan(UD/M	D No	Yes	8	8(JK/UD/MD)	8	8	8	21(AD, ADA)	21	21	21	Hyb 28 (Cl	N7)
ELANTRA GT (GD) (aka "i30")	old mode	4	new model	6/12(GD)	6,12	6,12	6,12	6,12	21(PD)	21	21	21	
EQUUS (VI)(stretch genesis)	?	yes?	yes?	9,11(VI)	9,11(VI)	9,11(VI)	9,11(VI)						
CENESIS (Course BK, Sodan BH/DI	9 shave	9 shave	2			42/040	42						
GENESIS (Coupe BK, Sedan Bh/Dr	T) Keyway	кеуwау	ŕ	9(DN, DN)	9	13(DH)	13						
GENESIS G70										21,25(IK)	21,25		
GENESIS GV70												29+CFCI (J	K1)
GENESIS G80								13(DH)	13	13	13	29+CFCI (R	G3)
GENESIS GV80											29+CFCI	(JX1)	
GENESIS G90								13(HI)	13	13	13	13	
IONIQ EV and HEV								21(AE)	21	21	21	21	
KONA (i20, Rio sister)small SUV)									24 (OS)	24	24	24	
KONA EV	_									27 (OS EV)	27	27	
NEXO										26 (FE)	26	26	
PALISADE											25(LX2)	25	
SANTE FE	9 shave keyway note 3	9 shave keyway	9 shave keyway	7(NC,DMA)	7	7	7	7	7	25 (TMA)	25	25	
SONATA		4	?		4	14 (LF) 4 (HEV)	14 (LF HEV)	14	14	14	25(DN8A)	25	
TUCSON	Yes	Yes	2	2(LM)	2	2	13(TL)	13	13	13	13	30+CFCI (N	X4)
VELOSTER coupe	out of p	roductio	?	5(FS)	5	5	5	5	5	14 (JS)	14	14	,
VELOSTER N				_						28(JSN)	28	28	
VENUE											30(QX)	30	

Kia/Hyundai Tool Issues

- You input VIN, it prints what you entered in report. VIN is not stored in the ACM. Do sufficient documentation to prove your readout came from your vehicle.
- The K/H report is a PDF file. There is no raw data file. If K/H ever discovers an error and updates software, you will have to re-read the module. The software version at time of readout prints in the report.
- 3. Recommended: **Secure module** as evidence

Pre-2013 Kia Hyundai may have data

			Mo	del Years	
Model	Vehicle Size, Descrip	2010	2011	2012	2013*
KIA	i i i	Cable #	Cable #	Cable #	Cable #
CADENZA (VG, 2014) (Azera sister)	112.0" WB	YG requi	res cable	13 per softw	are
FORTE (TD 2013, YD 2014))	104.3"WB, compact	10	10	10	10 (TD)
K900 (KH 2015)	119.9"WB				
NIRO					
OPTIMA (2013 TF QF, 2016 JF, JFA)	110.0" WB sedan	No	4	4	4 (TF/QF)
OPTIMA HYBRID	110.0" WB sedan	No	4	4	(TF HEV)
RIO (UB)	94.5"WB, compact	No	No	8	8(UB)
RONDO (Canada only 2011 MY+)		No	out of pro	duction	· · · · · · ·
SEDONA (VQ '14, YP '15)	113.8/118.9" WB miniv	No	No	No	No
SORENTO (XM to 2015)(UMA 2016)	106.3" WB, crossover	No	3	3	3(XM)
SOUL (AM 2013, PS 2014+)	100.4" WB	1 see note 1	1 see note 1	1	1(AM)
SPORTAGE (SL)	103.9" WB, crossover	No	Yes	2	2(SL)
HYUNDAL			6N		
ACCENT (RB)	94.5"WB, compact	No 10	No?	5 ^{cee note 2}	5(RB)
AZERA (HG)	109.4"WB, sedan		likely	Yes	7(HG)
ELANTRA Coupe(JK), Sedan(UD/MD)	104.3"WB, compact	No	Yes	8	8(JK/UD/MD)
ELANTRA GT (GD) (aka "i30")	former Elantra Touring	old model		new model	6(GD)
EQUUS (VI)(stretch genesis)	119.9" WB, luxury seda	?	yes?	yes?	9(VI)
GENESIS (Coupe BK, Sedan BH/DH))	115.6" WB, luxury seda	9 chave keyway	9 shave keyway	?	9(BK, BH)
GENESIS G90					
SANTE FE (Sport DMA, NC)	106.3" WB, crossover	9 shave keyway note 3	9 chave keyway	9 chave keyway	7(NC,DMA)
SONATA (YF sedan, YF HEV)	110.0" WB sedan		4	?	4(YF)
TUCSON (LM to 2015)(TL in 2016)	103.9" WB, crossover	Yes	Yes	2	2(LM)
VELOSTER coupe (FS)	104.3"WB, compact	out of pr	roduction	?	5(FS)
		1			

2010-2012 EDR Access

- 1. The tool requires VIN input and only allows read of 2013+ VINS.
- 2. Input surrogate 2013 VIN to communicate with 2010-2012 models. Report will list surrogate VIN used.
- 3. Decoder changed slightly for 2013. Not all data decodes properly.
- 4. 2010-12 file admissibility must be presented skillfully (get help).
- 5. Data successfully admitted in Virginia, Florida, and California.

K/H 2010-2012 data reliability?

- 1. In 50+ NHTSA crashes, speed, delta V and belt use appear OK (one exception)
- 2. Steering angle, and accel data appear implausible on some
- 3. Key cycles at download not in all models
- 4. SAE 2014-01-0502 has details.
- 5. Additional testing on 2012 Soul reported in SAE 2015-01-1445.
- 6. Admitted to court in VA, CA, one other
Subaru EDR Availability (update)

Model	Bosch CDF	R900 Interfac	e Required for true Su	ubaru models	6						
	Cables 614										
	<u>2011</u>	<u>2012</u>	<u>2013</u>	<u>2014</u>	<u>2015</u>	<u>2016</u>	<u>2017</u>	<u>2018</u>	<u>2019</u>	<u>2020</u>	<u>2021</u>
SUBARU US Models											
Ascent	Not in prod	uction							835		
BRZ	n/a	n/a	Read as Toyota	brand 86	model wi	ith Cable	e 614 (CA	N+ or C	DR900 inf	terface)	
Crosstrek	n/a	n/a	616								
Forester	No	No	616						835		
Impreza	No	614		614/616	6						Japan
Legacy	No	No	614		836					844	
Outback	No	No	614		836					844	
WRX/STI	No	No	No	No	614		616	614/616	SSM4 w	/DSTi	
Tribeca	No	No	No	No	Discont	inued					
NON-US Models											
Exiga (Australia, Japan)			614								
XV (Europe)		614					<mark>614/616</mark>			616	
Levorg (Japan)					<mark>614</mark>		614/616			?	
NOTE: Bosch CDR coverage phased in	from software ve	rsions 19.1 to 1	9.4 to 19.6								

CDR 2015+ Outback Precrash Data

Pre-Crash Data -5 to 0 Sec (Record 1)

Time (sec)	-5.0	-4.5	-4.0	-3.5	-3.0	-2.5	-2.0	-1.5	-1.0	-0.5	0.0
Speed, Vehicle Indicated (MPH [km/h])	21.1 [34]	22.4 [36]	23.6 [38]	24.9 [40]	24.9 [40]	23.0 [37]	19.3 [31]	16.2 [26]	10.6 [17]	7.5 [12]	6.8 [11]
Accelerator Pedal, % Full (%)	23	28	24	0	0	0	0	0	0	0	0
Service Brake, On/Off	OFF	OFF	OFF	OFF	ON	ON	ON	ON	ON	ON	ON
Engine RPM (RPM)	1,900	2,100	2,300	1,800	1,300	1,100	1,200	1,100	1,000	1,000	1,000
ABS Activity	OFF	OFF	OFF								
Stability Control (On, Off, Engaged)	ON	ON	ON								
Steering Input (deg)	0.0	0.0	0.0	0.0	0.0	-2.5	-2.5	-5.0	-5.0	-2.5	-2.5

124

MITSUBISHI 0.5% market share

- Bosch CDR now covers 2011+ Outlander Sport, 2014+ Outlander & 2017+ Eclipse Cross. *More expected in 21.1 2020/21 CDR coverage not listed in help file – does it work?? Accepts VIN.*
- 2. Pre-Bosch Mitsubishi EDR only tool based on dealership a Panasonic Touchpad. Cost to \$6380.
- 3. The kit is made to work only on vehicles with a functioning electrical system thru the **DLC**.
- 4. Some Mitsubishi have an "ETACS" gateway module (interior fuse box) that must be included in circuit to make it work DTM (Brad Muir has built a DTM circuit).
- 5. Some incomplete files retrieved (no data).

Mitsubishi EDR's May 2021 Most now supported by CDR, some not

	Model	<u>2007</u>	<u>2008</u>	<u>2009</u>	<u>2010</u>	<u>2011</u>	<u>2012</u>	<u>2013</u>	<u>2014</u>	<u>2015</u>	<u>2016</u>	<u>2017</u>	<u>2018</u>	<u>2019</u>	<u>2020</u>	<u>2021</u>	<u>2022</u>	
	Delica D5 (Japan)	839 Bosc	h CDR											839/837	837			
	/		Part MU	<u>141170</u>														
	Eclipse (PS Platform)		<u>4/2005 t</u>	o 8/2011	Proprieta	ary EDR Too	Production	n ends 8/20 ⁻	11									
	Eclipse Spyder Conv.			?	Data in d	leployments	only?											
	Eclipse Cross (SUV)						-					837 Bosc	h CDR					
	EK Wagon/EK Space (Japan)							840	Bosch C	DR								
	Endeavor SUV (PS Platform)			?			Productior	n ends 8/20 ⁻	1 replace	ed by Out	lander							
	Expander (Phillipines)									•			853	3				
	Galant Fortis		839 Bos	ch CDR														_
	iMiEV			Not sold in	US		838	838										
	Lancer		839 Bos	ch CDR								839				8	339	
	Lancer Evolution & Evo X		839 Bos	ch CDR								839				8	339	
	Lancer Sportback			839 Bosch	CDR													
	Mirage, Attrage (subcompact)	Not in pro	oduction						838 Bos	ch CDR			838 US, 853	3 ROW				
F			- [A208 Read	w/CDR	A208/A304	mix. A208	٦	000 200	on obre			000 00, 000		828			
	Outlander SUV & PHEV			as 09 Calib	oer 226	Read as 09	Caliber 226	839	838 Bos	ch CDR					(Nissan)			
	Outlander Sport, RVR, ASX					838 Bosch	CDR	T i										
	Paiero/Montero (SE Asia only)										853/83	8 Triton P	latform					
\mid	Raider pickup					Not in prod	uction				000/000							
	(Dodge Dakota sister)	228 CAN+	Bosch															
	Triton pickup (non-US)									838 EU,	853 WW	1						
	The source of this data is the Mitsubishi ED	R tool flyer fro	om Bosch D	iagnostics and	CDR help file	e version 21.1 &	other available indu	stry data - best	info avialabl	le, not guara	anteed							
	Acknowledgement to Brad Muir of Crash Dat	a Specialists	for providing	many details	on models ar	nd data available	•											
	Copyright Ruth Consulting LLC	2021 - Aut	thorized	for distribut	ion by UN	VF-IPTM &	SAE											

Typical Mitsubishi CDR Data

Pre-Crash Data -5 to 0 Sec (Record 1)

Time (sec)	Speed, Vehicle Indicated (MPH [km/h])	Accelerator Pedal, % Full (%)	Service Brake, On/Off	Engine RPM (RPM)	Steering Input (deg)
-5.0	3.1 [5]	0	On	797	4.5
-4.5	2.5 [4]	0	On	751	4.5
-4.0	1.9 [3]	0	On	648	4.0
-3.5	1.2 [2]	0	On	593	4.0
-3.0	0.6 [1]	0	On	641	4.0
-2.5	0.6 [1]	60	Off	719	4.5
-2.0	1.2 [2]	71	Off	1,297	14.0
-1.5	4.3 [7]	75	Off	1,840	46.5
-1.0	7.5 [12]	77	Off	2,010	90.0
-0.5	9.9 [16]	76	Off	2,180	124.5
0.0	11.2 [18]	72	Off	2,206	146.0

- +Long & Lat Delta V and Acceleration
- +Roll Angle -1 to +5 sec @ 0.1 sec interval

Jaguar/Land Rover

- Jag/LR have EDR's, they are read with a dedicated laptop and software. Tool only retrieves hex data, must be sent to England for interp. Only Robert Willer in FL has the tool (and he will help others).
- 2. <u>insur@jaguarlandrover.com</u> for private, <u>govn@jaguarlandrover.com</u> for law enf.
- 3. They are now referring requesters to suppliers. (call to find out who supplier is)
- 4. Some Mid 2000's have *PCM data (*like Ford) but *not spoofable* with CDR.

Jaguar/Land Rover Data

- Recent reports from Autoliv/Veoneer have full Part 563 Content
- Recent reports from Bosch have only a single value of speed and no time series of Delta V data, which means it does NOT meet the definition of an EDR.
- 3. This is the first known instance of a manufacturer that had an EDR pulling the EDR out.

EDR Admissiblity and Case Law Detail

- These slides will likely not be presented due to time
- They are included in the PDF copy for your reference

Kentucky Admissibility

The Supreme Court of Kentucky has held that for expert testimony to be admissible under KRE 702 at trial, the testimony must be both relevant and reliable. *Goodyear Tire and Rubber Company v. Thompson*, 11 S.W.2d 575, 578 (Ky. 2000) (citing *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509 U.S. 579, 589 (1993); *Mitchell v. Commonwealth, Ky.*, 908 S.W.2d 100 (1995).

Expert opinion evidence is admissible so long as

(1)the witness is qualified to render an opinion on the subject matter,

- (2)the subject matter satisfies the requirements of *Daubert v. Merrell Dow Pharmaceuticals, Inc.*,
- (3)the subject matter satisfies the test of relevancy, subject to the balancing of probative value against prejudice, and

(4)the opinion will assist the trier of fact.

Brosnan v. Brosnan 359 S.W.3d 480 (Ky. App. 2012).

Kentucky Daubert 1

Making a determination of whether the testimony of an expert is reliable, requires "assessment into the validity of the reasoning and the methodology upon which the expert testimony is based." *Id.* The Supreme Court of Kentucky has made clear that the purpose of *Daubert* as adopted by *Mitchell* is to allow a trial court "discretion to choose among reasonable" means of excluding expertise that is *false* and science that is *junky*." *Id.* at 583 (quoting Kumho Tire Company v. Carmichael, 526 U.S. 137, 158 (1999)) (emphasis added). Additionally, the overarching emphasis of Rule 702 "is the scientific validity of the principles that underlie the proposed submission. The focus, of course, must be solely on principles and methodology, not on the conclusions that they generate." *Daubert* 509 U.S. at 594-595. 133

Kentucky Daubert 2

• The four factors that a court may examine in determining the reliability of an expert's testimony include, but are not limited to:

(1) whether a theory or technique can be and has been **tested**;

- (2) whether the theory or technique has been subjected to **peer review and publication**;
- (3) whether, with respect to a particular technique, there is a high known or potential **rate of error** and whether there are **standards** controlling the technique's operation;
- (4) whether the theory or technique enjoys **general acceptance** within the relevant scientific, technical, or other specialized community.

Goodyear Tire and Rubber Co. v. Thompson, 11 S.W.3d 575, 578-79 (Ky.2000) (citing Daubert, 509 U.S. at 592-94).

1. Tested or Testable Hypothesis

- Manufacturers test during product development crash tests
- NHTSA conducts crash tests regularly, collects the EDR data and periodically compares it to reference instrumentation.
- Independent Researchers have artificially created crash signals to get EDR recordings and tested data versus reference instrumentation.
- For Ford PCM EDR, you can drive down the road at 60 mph, time yourself between 2 mile markers at 60 seconds, then pull over and shut the key off. Read the PCM and confirm to yourself the vehicle was reported as traveling 60 mph with accelerator pedal at cruise and that you then hit the brake.

2. Published and Peer Reviewed

- Chidester "Recording Automotive Crash Event Data" at Intn'I Symposium on Transportation Recorders-1999
- Lawrence "The accuracy of pre-crash speed captured by event data recorders" SAE 2003-01-0889.
- Niehoff "Evaluation of Event Data Recorders in full system crash tests" 19th International Technical Conference on Enhanced Safety of Vehicles (2005).
- Gabler et al, "Preliminary Evaluation of Advanced Air Bag Field Performance Using Event Data Recorders" NHTSA 2008 Report DOT HS 811 015
- Tsoi et al, "Validation of Event Data Recorders in High Severity Full-Frontal Crash Tests", SAE 2013-01-1265
- 49CFR Part 563 published 2006 effective 9/1/2012
- (these are oldest and most cited, many more are available)

3a. Known Error Rate – (Speed)

- 1999 Chidester: GM EDR speed data accuracy +/- 4%.
- 2003 Lawrence created artificial crash signals during normal driving and found the GM EDR speed to be under reported by 1.5 kph (about 1 mph) at low speeds and over reported by 3.7 kph (about 2.3 mph) at high speed.
- 2005 Niehoff reported 28 crash tests from 40 to 64 kph and determined the average error rate in GM EDR pre-impact speed was 1.1% with a maximum of 3.7%.
- 2008 Gabler reported 48 crash tests from 25-40 mph and determined pre-crash speed was within 3% except for one test where speed was under-reported by 7mph.
- 2008 Ruth reported 18 test runs each on 3 vehicles with Ford PCM EDR steady state speed data within approximately +/-1% in the 30 to 70 mph range.
- For vehicles produced after 9/1/2012, 49CFR Part 563 requires speed accuracy to be +/- 1 kph.

3b. Existence & Maintenance of Standards

- The National Highway Traffic Safety Administration (NHTSA) issued final rule 49CFR Part 563 in 2006 setting minimum content, resolution, and accuracy for EDR data elements, effective 9/1/2012.
- The Society of Automotive Engineers (SAE) published recommended practice J1698 for EDR's in 2004, recently updated.
- The International Standards Organization has an EDR document.

4. General Acceptance

- Auto manufacturers install EDR's and rely upon the EDR data to investigate field concerns and to give feedback to product development on current product performance to influence future designs.
- In 1997 the National Transportation Safety Board called for EDR's to be installed in all vehicles (REFERENCE "H97-18"). Reaffirmed 2004.
- National Highway Traffic Safety Administration (NHTSA) estimated that 65 to 90 percent of new vehicles already had some type of recording capability in 2004. In 2017, 99% of all new cars and light trucks are equipped with an EDR.
- NHTSA proposed requiring EDR's in all cars by 9/2014 and making it a Federal Motor Vehicle Safety Standard #405 which requires self certification and recalls (withdrawn in 2019 because it was unnecessary with 99% voluntary compliance).

4. General Acceptance cont'd

- Vetronix Corporation (now Bosch), began making a tool to read EDR's in 2000, over 2,000 are in use today.
- For over 13 years there has been an annual Crash Data Retrieval User's "Summit" (conference) with 2018 drawing 298 attendees.
- There is a user group with over 1300 participants on Yahoo (subsequently moved to groups.io) known as "CDR Tool" which has been in operation since 2000 and logged over 23,400 message posts.
- Since 2011 Society of Automotive Engineers World Congress had a technical session dedicated exclusively to Event Data Recorders.
- There is an EDR Westlaw Document 17_19_46 briefing attorneys on EDR use in legal matters.

Pre-EDR Prior Law re: Reconstruction

Buckler v. Com., 541 S.W.2d 935 (Ky. 1976) held that experts may testify and rely upon information which is "customarily" relied on in the practice of their profession.. Before EDR data was available or common, Kentucky courts had held that a qualified accident reconstruction expert can testify to factors such as the speed of vehicles. *See Kentucky Farm Bureau Ins. v. Vanover*, 506 S.W.2d 517 (Ky. 1974). This testimony was permissible so long as it was calculated by a reliable method.

This may explain there are not typically challenges to the admissibility of EDR data – it is well accepted within the field of accident reconstruction

KY criminal law experience to date

- KSP Lt. Hunter Martin has testified about EDR and has been asked about his EDR training and experience.
- He has identified how KSP determined the recording was from the event under investigation (Recited "Big 4")
- Typically there are no further challenges.
- So far criminal defense expert Joey Stidham has mostly agreed with KSP interpretation. One case w/hard braking rear tires locked up and speed went to zero experts agreed on speed before lockup. Another case defendant went airborne, experts agreed to use speed prior to takeoff.

2014-Michael Hardy- Hardy was convicted and sentenced to 20 years. He was DUI, speeding (89/35), and rear-ended the victim. EDR evidence was admitted in trial. This case was appealed but affirmed.

Articles:<u>https://www.bgdailynews.com/news/officer-driver-had-a-lot-of-alcohol-before-deadly-crash/article_7cec8b8f-ab27-5a8c-8479-afe7bb537998.html</u>

2011-Convicted in 2014 Charles Hansen: Hansen was operating a 2010 GMC when an elderly couple pulled out in front of him; both were killed in the crash. EDR had him 73 mph 3.0 seconds before the crash. The speed limit was 35. Hansen was <u>not</u> DUI. He was convicted of reckless homicide and sentenced to 1 year. This is the first speed-only conviction in KY known to Lt. Martin. News

Article:<u>https://www.kentuckynewera.com/news/article_eafdc018-</u>9ba8-11e4-a59c-77d9e092345a.html

2017-Commonwealth Vs. Daniel Greis

Greis was convicted of wanton murder. He was DUI and passing in a no-passing zone on a hill crest when he hit a family of 5 head-on, killing all of them. The EDR evidence was introduced at the trial. The EDR data was interesting because the vehicle was airborne at the last second, which resulted in the speed increasing from 86 to 96 in a second.

This case was appealed and affirmed by a higher court, but the EDR evidence was not challenged.

https://local12.com/news/local/testimony-begins-in-trial-of-a-drivercharged-with-five-counts-of-murder-for-fatal-crash

2018-Commonwealth V. Brent Bostic

Bostic was convicted of Manslaughter 2nd Degree, Assault 2^{nd,} and DUI. The EDR evidence was introduced at the trial. The rear tires locked up prior to impact resulting in a 0 mph EDR reading in the seconds leading up to the crash.

On appeal, the criminal defendant argued that Commonwealth failed to present sufficient evidence that the crash that resulted in the death was the result of anything more than malfunctioning brakes. The Court discussed the EDR data that was testified to by an accident reconstruction expert. *Bostick v. Com.*, 2020 WL7418116 (Ky. App. 2020).

https://maysville-online.com/top-stories/170546/bostick-sentencedto-15-years-in-lewis

Kentucky Criminal EDR Experience

- Only known case where EDR was suppressed was based on an improper search warrant issue
- 3 or 4 agencies in state have Bosch CDR EDR equipment
- KSP often downloads for locals does not do analysis for them. KSP advises proper analyst evaluation is required.
- KSP was once asked to analyze & testify at last minute. KSP declined. Case was pled down or dismissed.
- KSP reads 100-150 EDR's per year

MA v Zimmerman 2007 (Daubert state): "Although as yet there are not many decisions on the admissibility of EDR data, most seem to support admission."

See, e.g.,

- Matos v. State, 899 So.2d403, 407 (Fla. Dist.Ct.App.2005) (holding that hearing pursuant to Frye v. United States, 293 F. 1013,1014 [D.C.Cir.1923,] was unnecessary where sensing diagnostic module [SDM] data was not novel technique or method, and where State demonstrated that SDM data, when used as tool of automotive accident reconstruction, is generally accepted in relevant scientific field);
- **Bachman** v. General Motors Corp., 332 III.App.3d 760, 781 (2002) ("trial court did not abuse its discretion by [1] finding that the process of recording and downloading SDM data is sufficiently established to have gained general acceptance in the relevant community, and, thus [2] determining that the **Frye** admissibility standard had been satisfied");

Additional Considerations

 One case was reported where a CDR report was offered as evidence with no supporting expert testimony. The judge would not allow it to be admitted without supporting testimony.

Use EDR as stand alone evidence?

- Whenever possible "Use EDR in the context of a situationally complete crash reconstruction". EDR is *just one more tool* in the crash reconstructionist's tool belt.
- We used momentum "stand alone" when it was the only tool available (before EDR).
- EDR actually gives <u>several</u> possible additional tools speed from speedometer, speed from engine RPM, speed at impact from Delta V and postcrash travel, speed at impact from Delta V and closing speed.

Use EDR as Stand Alone evidence?

- Sometimes the right circumstances are not present to use all the tools, or sufficient on scene data was not collected, or could not be clearly identified to use all the tools. (i.e., skid marks may not be visible with newer ABS)
- If EDR is the <u>only</u> tool available, it can still be used, but to the extent possible, EDR speed data should be cross checked by other data elements within the EDR (RPM, Delta V, etc.).
- The more tools that are used and agree, the greater the credibility of the conclusion.

EDR Stand Alone?

- Criminal prosecution in fatal crashes requires proof beyond a reasonable doubt – the highest standard. Officer must testify to what DID happen. Cross check conclusions as many ways as possible!
- Civil litigation more likely than not
- Insurance claims –In low speed crashes police are *unlikely* to document physical evidence on scene, so traditional "complete" reconstructions *may not be possible or economically practical after the fact* EDR and post crash photos of vehicle damage are only evidence available. May not be enough to say with certainty what *DID* happen but are enough to say crash *did NOT* happen as claimed (i.e., fraud).

Kentucky Justice Association Seminar June 10, 2021 New Strategies for Successful Auto Litigation

Obtaining and Using Crash Computer Data





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