

State of EDR in the US

CDR Update Mar 2020

CDR Software Level 19.3.1
2020 EDR User Conf Update



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Introduction - Main Messages

1. EDR's improve recon **accuracy** & get to **causation** – use with **all other** available scene evidence –EDR is also **PRIMARY EVIDENCE**.
2. EDR strength is speed **PRIOR TO BRAKING OR LOSS OF CONTROL**, & DRIVER BEHAVIOR on gas and brake pedal. Modern ABS brakes **TOOK AWAY** your tire marks, only EDR can “give you back” speed prior to braking. Newer data elements give us **EVEN MORE INSIGHT** into precrash behavior.
3. Event Data Recording capability and data accessibility **varies widely** by **manufacturer, model and model year**. Coverage keeps growing with **MORE AND BETTER DATA** available with each new model released.

Main Messages

4. NHTSA Part 563 EDR rule Sept 2012 was a game changer – required **Minimum** Data in **US** vehicles equipped with EDR
5. EDR not required but 99% of US 2019 vehicles have one.
6. EDR's will NEVER replace human beings in figuring out what really happened.
7. US Driver Privacy Act Dec 2015 requires owner permission or a warrant to access.
8. AEB (auto braking) + other driver assist tech= fewer crashes + more data
9. If not already bought, budget for CDR 900 interface \$3800 and \$2500 new cables

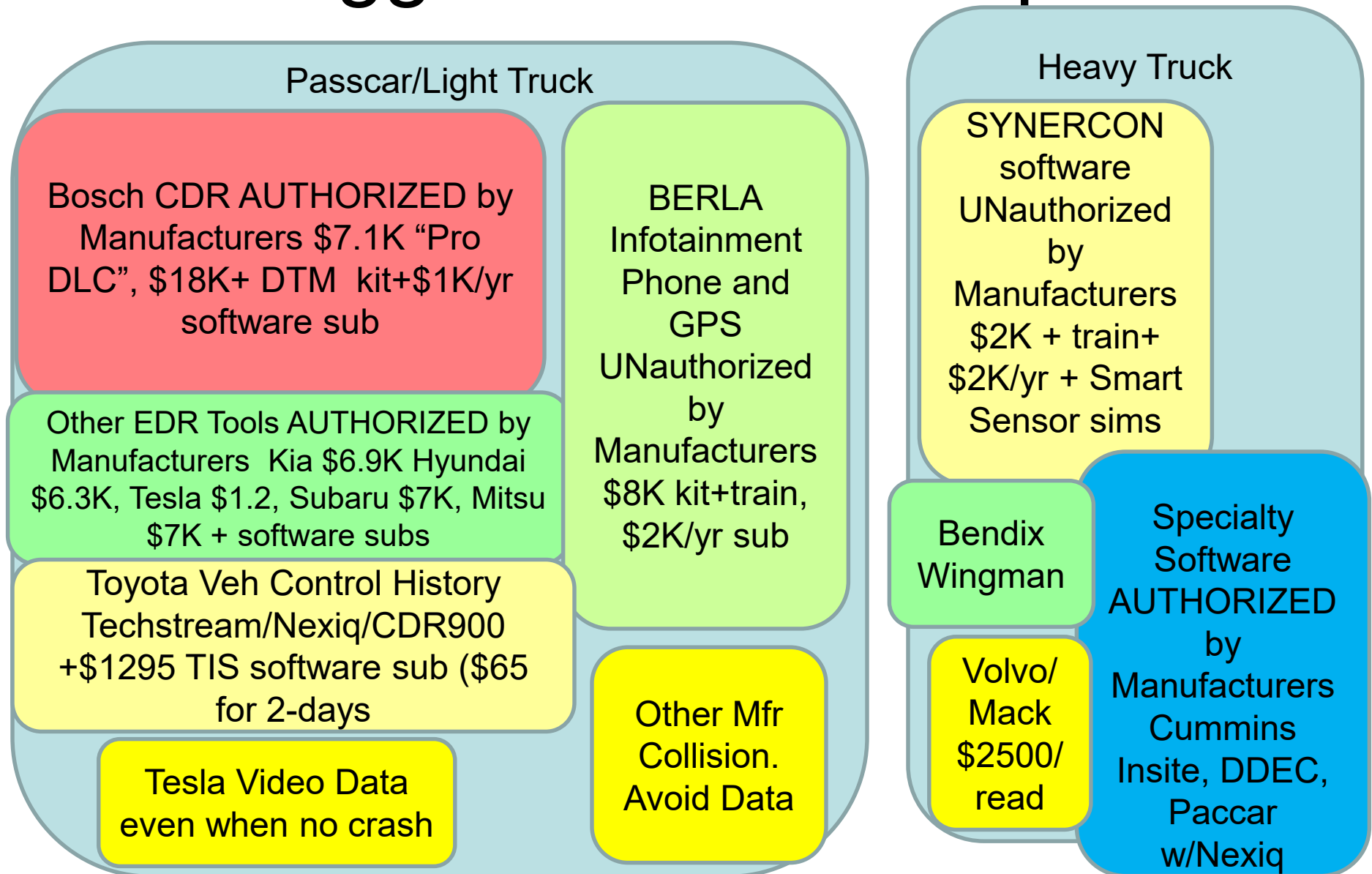
Keeping EDR's in Perspective

- There are 305 million vehicles registered in the US. **59%** have an EDR with data accessible **by the Bosch CDR system**
- 87+% of 2019's are supported by Bosch.
- Another 12% 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.

Worldwide EDR Investigators

- **New EU reg 3/2022** new design, 3/2024 old
- Europe and Australia – mostly Toyota, Volvo, FCA, Holden, 2018+ VW.
- New Korean reg Dec 2015.
- Japan 563 type reg, Tokyo police 50 kits.
- China making EDR reg now for 2021/23.

The bigger vehicle data picture

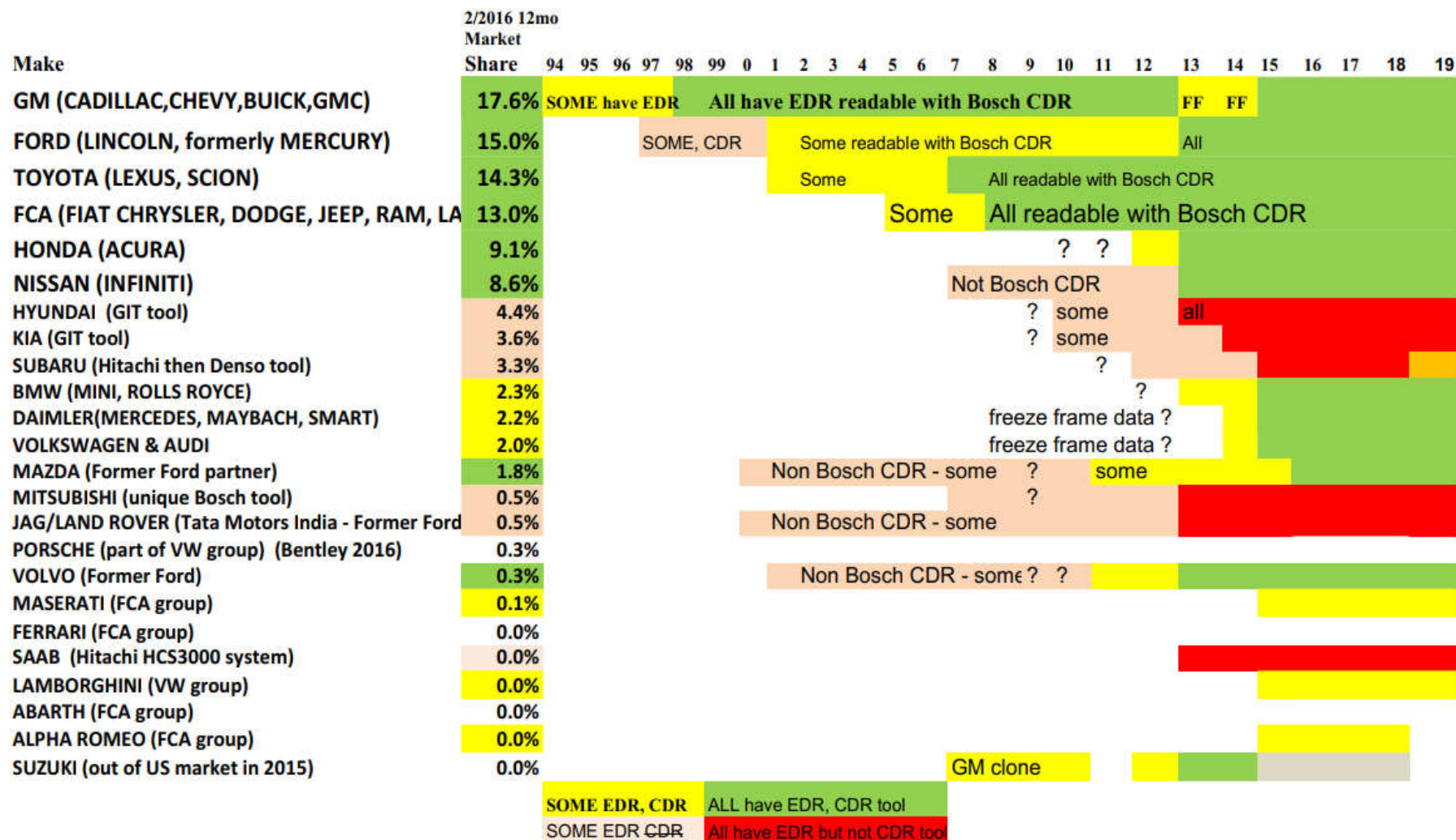


US Lt. Veh EDR & Tool Used

Manufacturer	Annual Sales 4Q 18 to 3Q 19	Percent	EDR First Known Use	Tool?	
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 (includes 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%			

EDR Phase-in by Mfr

Data is incomplete for smaller mfrs with no public tool



2020 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

[illegible]

Bosch CDR Hardware Update

- *New interface module CDR-900 kit with new communication protocols needed in newer vehicles (CAN-HD and Ethernet)
Bigger 19-pin connector needed (vs 15).*
- *New cables are being made with 19 pins, you will **NEED** a CDR 900 to read new manufacturers and models.*
- *The CDR900 is a derivative of a proven auto industry Bosch scan tool*
- *CDR 900 must be registered to your laptop (network device) before use.*



CDR 900 Upgrade Kit

\$4000

CDR900

- Initially for NEW vehicles
- Will eventually handle most legacy vehicles too.....

CDR900 Upgrade Kit



During Changeover

- Bosch is working to support “Legacy” vehicles with CDR-900.
- Legacy coverage will take more than 1.5 years to implement, test, and release – so the CAN+ interface may still be needed through 2021 (or longer???) .
- The help file clearly identifies which interface(s) will work with each vehicle
- CDR-900 comes with adapter to old 15-pin cables, they will still work.

New users need both CAN+ and CDR900



MSRP: **\$7300**

plus shipping & handling

Add to Cart >

Bosch CDR Pro Tool Kit

The CDR Pro Tool Kit is the heart and soul of the Bosch CDR Tool. This package contains all of the hardware required to perform a DLC/OBD retrieval of EDR data in Bosch supported vehicles. It includes both the CDR 900 and CANplus vehicle interface modules. This package also comes with a 1-year CDR software subscription. NOTE: this package does NOT contain any hardware to perform a "direct-to-module (D2M)" retrieval of EDR data. Please see the accessory cable/adaptor packages below for D2M options.

- CDR 900 vehicle interface module
- CDR 900 power cable
- CDR 900/CDR CANplus power supply cable
- CDR 900/CDR CANplus CDR cigarette power adapter
- CDR 900 DLC/OBD cable
- CDR 900 wireless dongles (2)
- CDR 900 extension cable
- CDR 900 legacy cable adapter
- CDR 900 USB cable
- CDR CANplus vehicle interface module
- CDR CANplus DLC/OBD cable
- CDR CANplus GM DLC/OBD cable
- CDR CANplus DLC/OBD adapters (3)
- CDR CANplus PCM adapter
- CDR CANplus USB to Serial port cable
- Deluxe repowering rig
- 1-year CDR software subscription
- Custom carrying case
- Coupon for **FREE online class**: How to Use the Bosch CDR Tool

CDR 900 details

- CDR900 integrates power management (no external relays/adapters).
- CDR900 uses the existing 2.5 amp current limited power supply, but new ACM's may drive bigger supply later.
- Includes WIRELESS laptop to interface
- CDR900 does NOT integrate the current CDR500 Flex Ray adapter – still needed!
- CDR 900 firmware must be flashed initially

CDR900 Tips

- CDR900 is a network device, VPN's do NOT LIKE other network devices, they are designed to keep them out. CDR900 does not like laptops with firewalls and other virus protection and lots of other programs – suggest using a *dedicated laptop* with few other programs installed.
- VCI Manager and CDR are *two different programs*, you MUST close VCI manager before CDR program will recognize CDR900!

HARDWARE CHECKLIST 19.3

Part Number	Description	Released
1699200596	Cable, ID828 CDR Nissan ACM	17.5
1699200618	Cable, ID829 CDR FCA ACM	17.5
1699200553	Cable, ID826 CDR Audi ACM (requires CDR 500 Adapter)	17.6
1699200646	Cable, ID830 CDR Volvo ACM (requires CDR 500 Adapter)	17.7
1699200630	Kit, CDR 900 Upgrade, with Wireless	17.8
1699200696	Cable, ID831 CDR Mazda ACM	17.8
1699200697	Cable, ID832 CDR Daimler ACM	17.8
1699200778	Cable, ID835, CDR Subaru ACM 1	19.0
1699200779	Cable, ID836, CDR Subaru ACM 2	19.0
1699200783	Cable, ID837, CDR Mitsubishi ACM 1	19.0
1699200784	Cable, ID838, CDR Mitsubishi ACM 2	19.0
1699200785	Cable, ID839, CDR Mitsubishi ACM 3	19.0
1699200786	Cable, ID840, CDR Mitsubishi ACM 4	19.0
1699200776	Cable, ID833, CDR GM ASCM 1	19.1
1699200777	Cable, ID834, CDR GM ASCM 2	19.1
1699200797	Cable, ID842, CDR VW Group ACM 4	19.1
1699200800	Cable, ID843, CDR Mazda ACM	19.1
1699200838	Cable, ID845, CDR GM ACM	19.1

New 3-digit Part ID

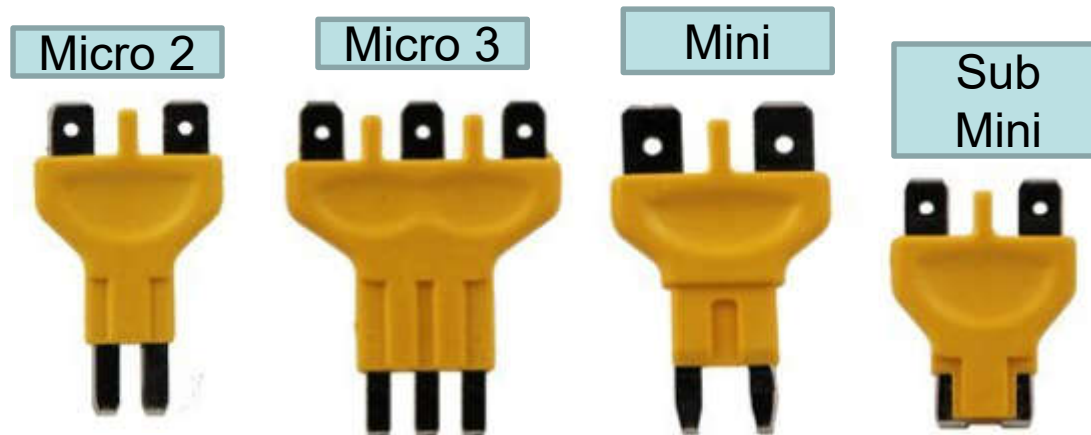
Gen 4 Pop Up Hood

2019

software to use them not out yet

New Back Powering Gear Needed

- Manufacturers are replacing mini and micro fuses with Micro 2 and Micro 3 fuses to pack more fuses into smaller spaces. The complete back power kit must now have several different yellow clips to fit all the different vehicles on the road. GM started it, Ford followed, more to come. Mini fits into sub mini, don't need sub mini.



- Buy General Technologies Corp GTC063 set of 6 (including 2 bigger ones you don't really need) at the site below for \$19.95

https://www.amazon.com/General-Technologies-Corp-GTC063-Connector/dp/B0787JKMTH?ref_=bl_dp_s_web_9003703011

EMERGING TRENDS

- More manufacturers are becoming concerned about **cyber security**, of hackers trying to take over vehicle control systems.
- Many are installing “gate-way” modules or features to protect ECU’s from hacking.
- For CDR DLC users, “back powering” may have to power ACM fuse AND cyber security (gateway) module fuse. Of course Direct to module is still an alternative.
- Recently needed on 2017 RAM 3500

Recent CDR Software Updates

- 17.8 – July 31, 2018 – **CDR900** + more 19's
- 17.9 – Sept 18, 2018 – DLC GM ASCM
- 17.10 Dec. 20, 2018 – 2018-19 VW/Audi Worldwide, more 2019's, some GM 2020's
- 18.0 Feb 20, 2019 **Subaru** 19 Forstr/Acsendr
- 19.0 June 6, 2019 **Mitsubishi** Outlanders
- 19.1 Sept. 20, 2019, 15+ Subaru Outback, GM ASCM reports, more 2020's
- 19.2 Dec. 6 Legacy GM ASCM's, + 2020's
- 19.3 –Dec.23 – CDR900 Toyota support
- 19.3.1 Feb 13, 2020 removed 30 sec delay²⁷

The Bosch CDR Story

- New CDR 900 interface – old interface lasted 13 years – technology has changed!
- New GM active safety control module gives access to semi-autonomous vehicle data
- VW/Audi going worldwide with EDR
- The covered vehicles on the road with CDR is 63% and climbing **about 3%/yr.** The total available including mfrs with non-CDR tools is much more!!
- Subaru new models in CDR, legacy to follow, Mitsubishi added June 2019.

What's Coming?

- 8 new DTM cables (budget \$2,000) – Subaru 2020 Legacy/Outback (June), Honda, Daimler.
- Back model Subaru coverage expected in 19.4 end of March 2020
- **New Toyota EDR (Cable 827) coming in 19.4**
- **CDR900 support for Honda, Nissan, Mazda**
- **2020 Porsche Taycan coverage (and other newer Porsche models with time)**

CDR Budgeting

Two approaches to a budget

Add one time new CDR900
\$3,800

	Staying up to date with everything	A minimal Approach	
Initial Expenses			
Initial Technician Training	\$395	\$395	
Hardware (Cabels Etc...)	\$18500	\$3650	DLC Kit + Accesory Kit
Software			
Popular Cables	Included	TBD	
Analyst Training (Travel Extra)	\$700	\$700	
Sub Total	\$19495	\$4350	
Estimated Annual Recurring Expenses			
Software Updates	\$1050	\$ 1050	
New Cables	\$2500	\$TBD	
Unexpected Cables	Included	\$300	Reserve for new adapter
Analyst Training Updates(Travel Extra)	\$350	\$350	\$700 every other Year
Sub Total	\$3900	\$1880	

New Tool for Insurance?

- Collision Sciences based in Toronto has developed a DLC only tool and Bluetooth software that runs from your phone to read EDR data from vehicles with functioning electrical systems.
- Entry price for the hardware is only \$150
- Raw data is uploaded to cloud, teaser preview can be seen
- Full reports cost \$300 but include analysis and risk of fraud and injury assessment.
- Developers are talented hackers - they are not getting decoding data from manufacturers
- Works on Kia/Hyundai and most CDR supported vehicles

CDR/EDR Training

- Bosch Training Provider Page lists IPTM (Rick Ruth+), Crash Data Specialists (Brad Muir+), CSI (Rusty Haight), CDR-training.com (CSI tech 1&2 trainers) and Northwestern (thru CSI). SAE (Rick R) not listed, teaches analysis only.
- There is no “certification” – your qualifications depend on your training and experience
- IPTM has ONLINE technician training \$395
- New online tech basic from Crash Data Group
- All trainers cover basics, but each has unique style and additional content -try them all!

Additional EDR training available

- IPTM has a “Level 2” analyst class which goes into greater depth on how to use the law of sines and cosines to solve Velocity Vector triangles, offset collisions w/EMR, ground forces & new data elements.
- IPTM EDR Analyst 1 now ONLINE as of April 15, 2019.

Analysis Update: Speed Data

- Accuracy: We typically apply +/-4% to speed data based on 1999 GM paper
- Part 563 reg requires speed data be accurate to **+/-1 kph** (0.6 mph) for as sold vehicles, does not include tire wear adding 2% to speed.
- SAE 2016-01-1497 “**Compendium** of Passenger Vehicle EDR Literature and Analysis of Validation Studies” by Bortles et al, Kineticorp concludes speed within 2mph

Summary by mfr/gen of speed at impact inputs

Time from last data point to impact															
(Time available for possible braking between last data point and impact)															
<u>MANUFACTURER</u>	<u>Model year</u>														
GM Gen 1	92-02	No precrash data													
GM Gen 2	99-12	0 to 1 interval between data points, 1 second													
GM Gen 3	2005-2012	0 to 1 interval between data points, some 0.5						some 1.0 second							
GM Gen 4	2012-present	0 to 1 interval between data points, 0.5 second													
Ford ACM Gen 1	97-07	No precrash data													
Ford PCM	2003-2011	0 to 1 interval between data points, 0.2 seconds													
Ford ACM Gen 2	2005-2012	0 to 1 interval between data points, 1 second													
Ford Gen 3 RC6	2009-2010	more than 1 interval between data points, use 1 second													
Ford Gen 3 RC6_2011 & Bosch AB10	2011+	0 to 1 interval between data points, 0.5 seconds													
Ford Gen 3 RC7	2013+	0 to 1 interval between data points, 0.5 seconds													
Ford Gen 3 AB12	2017+	? Data point interval only 0.2 sec though, use that													
Fiat.Chryslers	2006+	0 to 1 interval between data points, 0.1 sec (0.2 some minivan 2010-2012)													
Toyota Gen 1 and 2	2001-2012	Last data point taken at impact				but 0 to 0.5 sec old									
Toyotoa Gen 3 & 4	2013+	Last data point taken at imapct, within 24ms (use zero)													
Honda	2011+	Last data point taken at impact, within 0.1 sec of impact, but 0.3 sec delay for analog speedometer										0.9 sec for Digital speedo			
Nissan	2013+	Last data point taken at impact, within 0.1 sec?													
Mazda	2011+	Last data point taken at impact, within 0.1 sec ?													
Volvo	2011+	0 to 1 interval between data points, 0.5 second													
BMW	2013+	0 to 1 interval between data points, 0.5 second													
Mercedes	2014+	0 to 1 interval between data points, 0.5 second													
Volkswagen	2015+	File gives time since last data point 0.0 to 0.4 sec - use that													
Kia/Hyundai	2010+	Last data point taken at imapct, within 0.1 sec?													
Subaru	2012+	Last data point taken at imapct, within 0.1 sec?													
Mitsubishi (Chrysler clone)	2009+	? Assume 0 to 1 interval between data points, 0.1 sec													
Mitsubishi (Part 563)	2013+	? Assume 0 to 1 interval between data points, 0.5 sec													

Analysis Update: Delta V Usage

VEHICLE WITHOUT EDR

VEHICLE WITH EDR

- Inline w/departure

$$V1 = V3 - \Delta V_x$$

- Angled with Departure

$$V1 = V3 \cos \beta - \Delta V_x$$

Note no assumptions about whether collision was **central** or vehicles reached a **common velocity**

- Inversely Proportional ΔV

at centers of mass $\Delta V_1 = -\Delta V_2 \frac{W_2}{W_1}$

- Closing Speed **Central** Inline

- Closing Speed = $\left[\frac{1}{1+e} \right] [|\Delta V_1| + |\Delta V_2|]$ w/common vel.

- Closing Speed **Offset Inline** w/com vel.

$$\text{ClosingSpeed} = \left[\frac{1}{1+e} \right] \left[\frac{|\Delta V_1|}{\gamma_1} + \frac{|\Delta V_2|}{\gamma_2} \right]$$

- Intersection inline approximation (new)

- V1/V3/ ΔV Triangle Vel Vectors

- V1/V2/Closing Speed Triangle

(relatively new)

TRIANGULAR VELOCITY VECTOR METHOD

APPROACH VELOCITY = $V1$

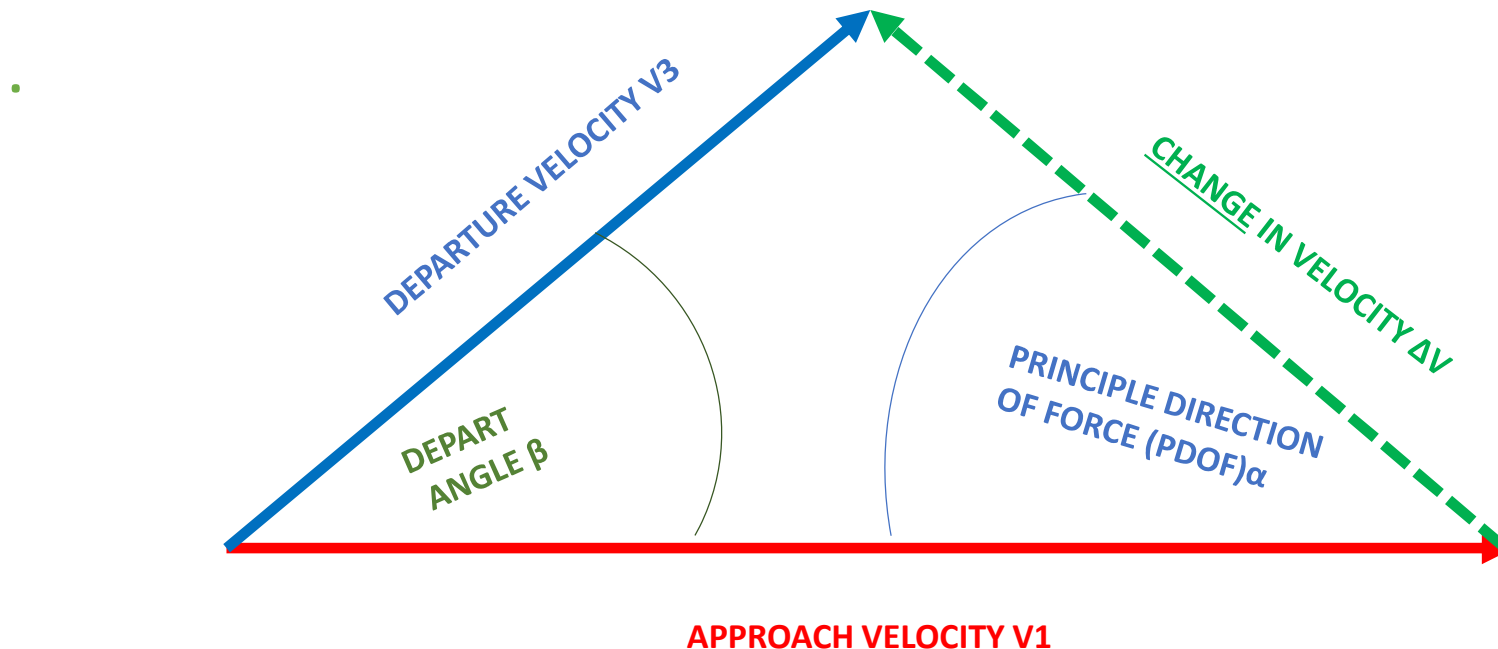
DEPARTURE VELOCITY = $V3$

CHANGE IN VELOCITY = ΔV

DEPARTURE ANGLE = β

PDOF = α

SIDES AND OPPOSITE ANGLES (PAIRS) ARE SHOWN IN THE SAME COLOR

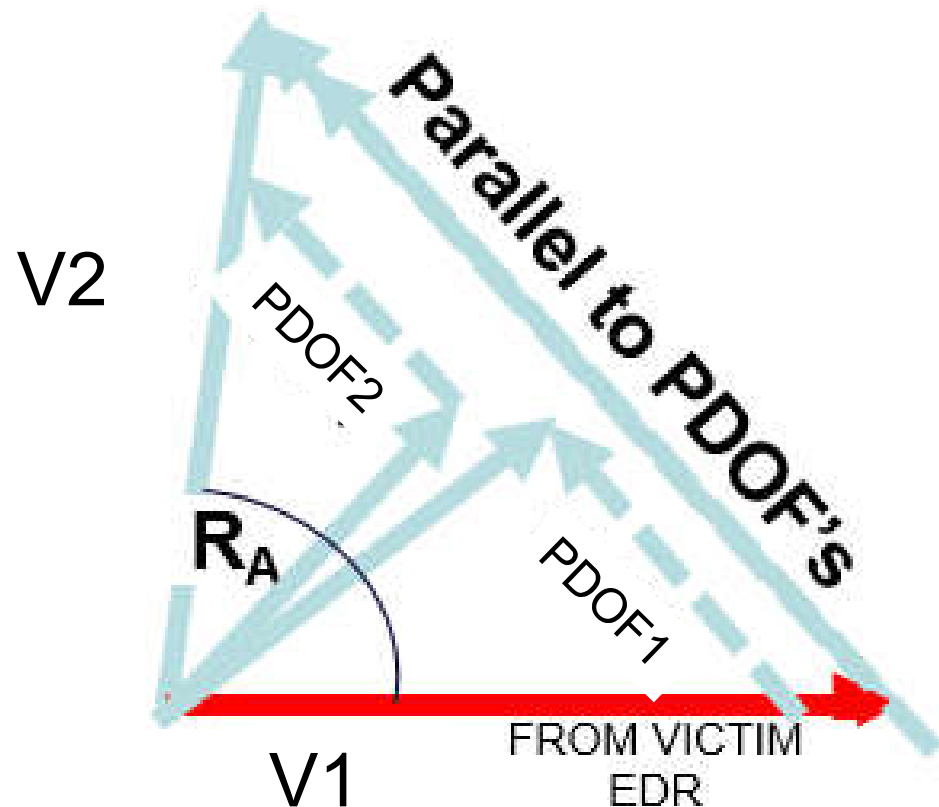


PDOF Triangle -2nd Triangle

- Must know relative approach R_A
- Get PDOF1 from Vic EDR
- $PDOF2 = 180 - R_A - PDOF1$
- $\Delta V2 = -\Delta V1(W1/W2)$
- Must have departure speed or angle (3rd piece) to solve
- Use law of sines

Note small inner triangles have a parallel edge

Delta V's. Outer triangle is the PDOF triangle.



Closing Speed Triangle

ANOTHER WAY TO FIND V1 AT IMPACT

- The definition closing speed is the difference between the V1 and V2 approach velocity vectors
- From R_A , **V1**, and **CS** find V2
- Use law of sines

Note angles in other corners

Are NOT the PDOF's

The “inline” closing speed formula

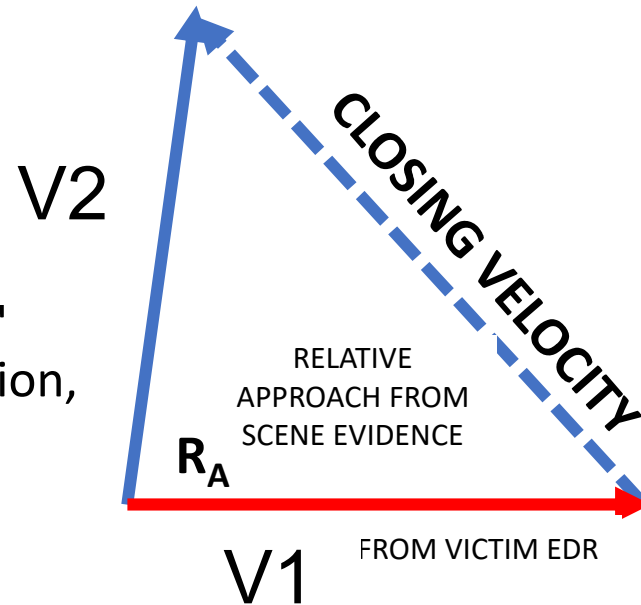
Shown earlier is CS in PDOF direction,

True CS is higher

We may not have enough info to

Determine closing velocity in the

Correct direction



Analysis Updates

- Closing speed adjustment for Offset collisions assumes ACM is on center of gravity.
- Additional adjustment may be required for ACM location away from CG.
- Look for pending publications from Bob Scurlock and Andy Rich

Analysis Update: Delta V Data

- **Ground Forces** were typically ignored in reconstruction
- In small ΔV 's (ped/mc) ground forces **become significant**
- If car locks up brakes before hitting ped, Long. ΔV of ped hit is overstated
- If MC t-bones car, Lat ΔV understated
- ΔV is multiplied by big weight ratio, Closing speed error gets bigger

NEW NHTSA CISS DATABASE

- <https://crashviewer.nhtsa.dot.gov/CISS/SearchIndex>
- In 2018 NHTSA loaded 125 2016 Crash Investigation Sampling System cases. 2,068 2017 cases were uploaded late Sept, 2019. 2018 cases expected 6/2020.
- Searchable by manufacturer, model year, model, EDR data available, driver assist technology available, etc
- Great source of info on what to expect in your vehicle's EDR, confirmation of EDR polarity, etc.

Details by Manufacturer

Honda/Acura CDR 19.3 Covr'g 45%

Model	Location	Connector	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
ACURA			Last 3 digits of Bosch CDR cable number									
RL	Under dashboard	2011- NO time series EDR But may have Delta V single value		547								
TL	Under dashboard			547								
TSX	Under dashboard			547								
ZDX	Under dashboard			547								
MDX	Under dashboard			547		387/789			387/810			
NSX	Under dashboard								387/789			
RDX	Under dashboard				547			387/789		387/825		
ILX	Under dashboard				547			387/789				
RLX	Under dashboard						387/789					
TLX	Under dashboard							387/789				387/810
HONDA			2012	2013	2014	2015	2016	2017	2018	2019	2020	
ACCORD	Under dashbord c	Honda only assists law enforce -ment voluntar ily			387/789			387/810		387/825		
CIVIC 2 DR	Under dashbord c		547				387/810					
CIVIC 4 DR	Under dashbord c		547	387/789			387/810					
CROSSTOUR	Under dashbord c		547									
CR-V	Under dashbord c		547				387/789	387/810				
CR-Z	Under dashbord c		547									
FCX Clarity	Under dashbord c							387/810				
FIT	Under dashbord c		EV 547			387/789		387/810				
HR-V							387/789		387/810			
INSIGHT	Under dashbord c		547								387/810	
ODYSSEY	Under dashbord c		547		387/789			387/810				
PASSPORT	Under dashbord c										387/810	
PILOT	Under dashbord c		547				387/789	387/810				
RIDGELINE	Under dashbord c		547					387/810				

The source data for this chart is the Bosch CDR help file for Version 19.3

Honda EDR Evolution

- One set of DL's thru 2015
 - Roll rate polarity varies by supplier – polarity added under graph
 - Accel data instantaneous
- 2nd set of data limitations for recent models
- 2016-17 adds “Honda sensing” & Cruise
- 2018 – 3rd Gen to include “ig switch status”
 - Airbag deploys even if ign off until car stops
 - Markets outside US/Japan do not get precrash data

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-Crash Data -5 to 0 sec [2 samples/sec] (Event Record 1) - Table 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.
- Honda records the speed being displayed **ON** the speedometer, after the PCM calculated speed has been dampened or “smoothed”.
- The last data point before impact may be delayed more than it is from other manufacturers.

New Defense Allegation

- NHTSA has opened an “EA” investigation on frontal airbags not deploying in crashes due to electrical interference overloading an ASIC (chip) handling front sensor inputs in TRW supplied modules.
- Kia, Hyundai, and Chrysler have recalled ACM’s for SOME affected units. Toyota has 2 reported incidents. Mitsubishi and Honda also use TRW.
- Defense claims all TRW EDR’s 2010 to 2019 are bad. It’s bullshit.

Chevrolet Recent Changes **87%** 563

1 animation

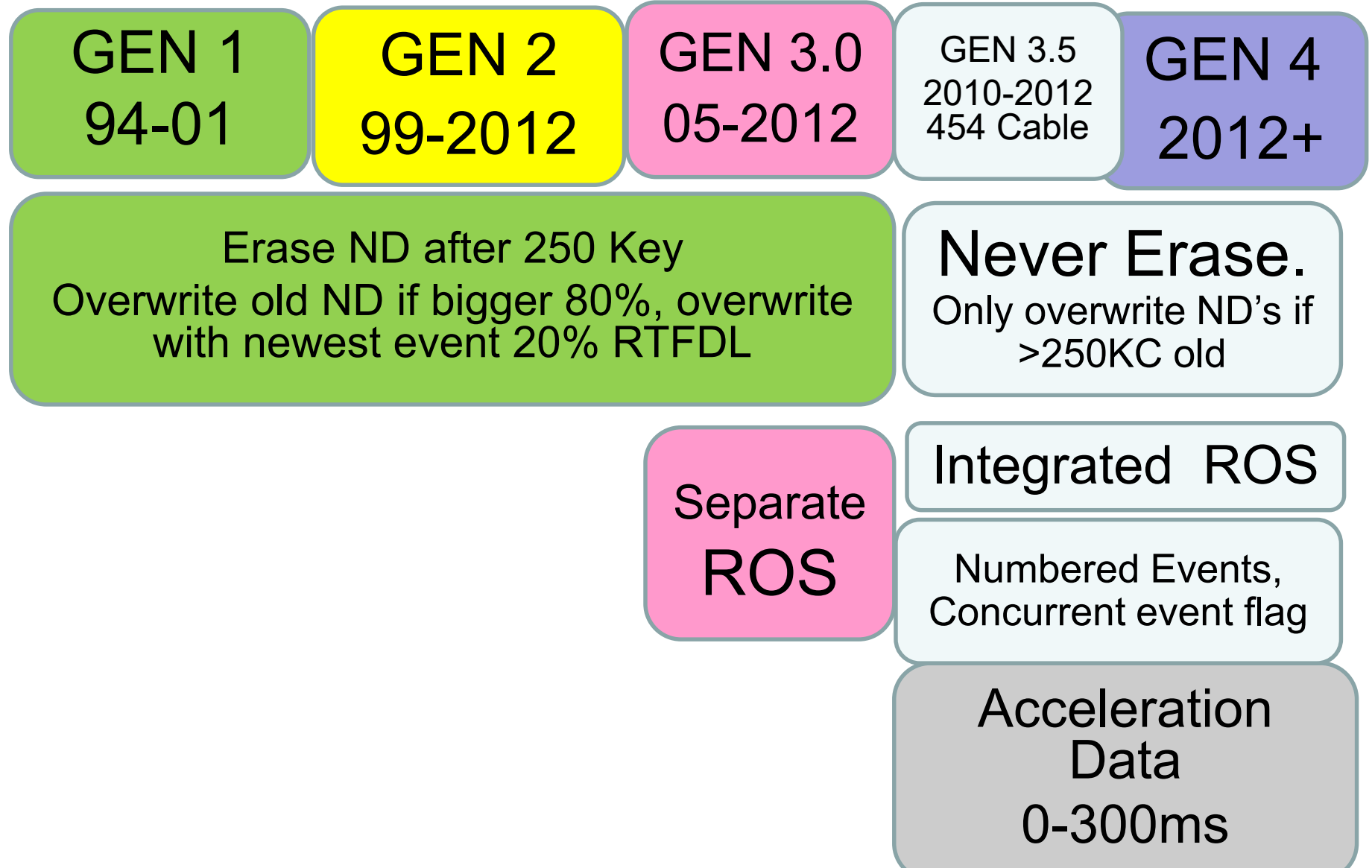
	Gen 3.5 - 3 Events			Part 563 Intent								
Model	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Avalanche	3320 ROS	454	454	454	454	*						
Aveo	3320	3320	3320		454	*				454	454	454
Beat (India)						454	454					
Blazer											454+ASCM	454
Bolt EV										454	454	454
Camaro		454	454	454	454	454	454	454	454	454	454	454
Caprice			452	454	police	police	police	police	police	police	?	
Captiva		454	454	454	454	*	Sport	Sport				
City Express							780	780	780	780	780	
Cobalt	3321	3321										
Colorado	3003	3003	3003	3003			454	454	454	454	454	454
Corvette	3003	3003	3003	3003	3003	454	454	454	454	454	454	845
Cruze		454	454	454	454	454	454	454	454	454	454	454
Equinox	3320 ROS	454	454	454	454	454	454	454	454	454	454	454
Express	3320 ROS	3320 ROS	3320 ROS	3320 ROS	3320 ROS	3320 ROS	3320 ROS	454	454	454	454	454
HHR	3321	3321	3321									
Impala	3320	3320	3320	454	454	454	454	454	454	454	454	454
Kodiak	2829											
Malibu	3321	3321	3321	3321	3321 (2012 454)	454	454	454+ASCM	454	454	454	454
Matiz				454								
Orlando				454	454	454						
Silverado	3320 ROS	454	454	454	454	454	454	454	454	454	454	454
Silverado HD											454	
Sonic				454	454	454	454	454	454	454	454	454
Spark					454	454	454	454	454	454	454	454
SSR						SS	454	454	454			
Suburban	3320 ROS	454	454	454	454	454	454	454	454	454	454	454
Tahoe	3320 ROS	454	454	454	454	454	454	454	454	454	454	454
Tracker										454	454	454
TrailBlazer	3293											
Traverse	3320 ROS	454	454	454	454	454	454	454	454	454+ASCM	454	454
Trax					454	454	454	454	454	454	454	454
Uplander	3293 w/AW9											
Volt			454	454	454	454	454	454	454+ASCM	454+ASCM	454+ASCM	60
PHASE IN	82% Pre + XY	91% Pre + XY	92% Pre + XY	22% 563	96% 563	100% 563	100% 563				2019	2020

No Precrash in 2013-5 Express/Savanna

GM EDR Evolution

GEN 1 94-01	GEN 2 99-2012	GEN 3.0 05-2012	GEN 3.5 2010-2012 454 Cable	GEN 4 2012+
No Precrash	Precrash 5 @ 1 sec for BOTH events	Precrash 5 @ 0.5 or 1 sec ONE SET of precrash	Precrash 5 @ 0.5 or 1 sec For each event	Precrash 10 @ 0.5 sec
2 EVENTS - FIRST D, One ND/ DLE, replace SDM after D			3 Events ND's or D's, replace after 3D's	
Record on frontal airbag algo wakeup		Record on 5mph X or Y DV,		
300ms XDV from wakeup, must be neg	150ms XDV, must be neg, 50ms before D 100 after	300ms X+Y DV, Neg or Pos, some D's -70 to +220, some 300ms after wakeup		

GM EDR Evolution #2



GM Generation 3.5 Features

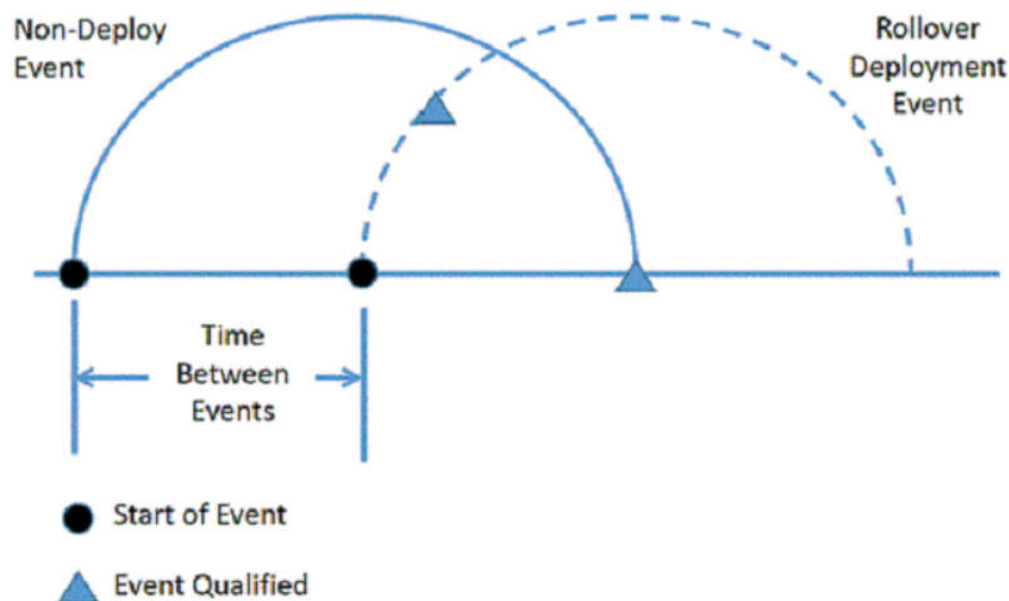
- 2010 454 cable SDM's do not require replacement after a D (until 3 D's).
- Events & deployments all numbered vs. labeled D/ND.
- Events may not be in order they started, they are in the order they qualified for recording (see graphic next page)
- **Align precrash data for all events to see relationship**
- Black plastic SDM housings
- Accelerometer max values listed in DL's⁶³

GM Data Limitations

- Many updated in 17.9 – new timing graphic added for gen 3.5 and higher

Example of a Concurrent Event:

A Non-Deployment event begins. Before the Non-Deployment event is qualified, a Rollover Deployment event begins and is qualified. Sometime after the Rollover event is qualified, the Non-Deployment event is qualified. The Rollover event will be recorded in the first open record even though the Non-Deployment event is enabled before the Rollover event. The Non-Deployment event will be recorded in the next open record. The "Concurrent Event Flag Set" parameter will indicate "Yes" for the Non-Deployment event. The "Time Between Events" parameter will indicate the time from the start of the Non-Deployment event to the start of the Rollover event.



Event Record #1	Event Record #2
Event record Type = Rollover	Non-deployment
Concurrent Event Flag = No	Concurrent Event Flag = Yes
Time Between Events = N/A	Time Between Events = XX seconds

When Concurrent Event Flag is Yes, Overlay Precrash Data from all events

- The event number gives when the event QUALIFIED for recording, not when I started
- Time between events is time between consecutive wake-ups, NOT always time between qualifying events
- Recap Delta V or, if rollover, event type over precrash data to assist understanding

Record 1 -57X, 39Y Event 1 of 5 Time Between Events NA	Record 2 Rollover Event 2 of 5 Time Between Events 0.75	Record 3 +1X, -5Y Event 4 of 5 TBEv 1.01
	47 [75]	Speed, Vehicle Indicated (Vehicle Speed) (MPH [km/h])
45 [73]	45 [73]	
44 [71]	44 [71]	
43 [69]	43 [69]	
41 [66]	41 [66]	41 [66]
38 [61]	38 [61]	38 [61]
31 [50]	31 [50]	31 [50]
30 [49]	30 [49]	30 [49]
30 [49]	30 [49]	30 [49]
23 [37]	23 [37]	23 [37]
11 [17]		11 [17]
		17 [27]
		Data Not Available
		Data Not Available

Other New GM News

- Some product liability data elements not relevant to reconstruction ***moved*** from CDR main report into **Engineering Translation Reports**. Other elements do not display if not equipped (used to say “if equipped”)
- Euro Pedestrian protection coming to US
- Some 2011-16 Autoliv had single stage airbags (severity status NO for stage 2)
- Known “Features” noted in Data Lims
- Occupant classification only child vs adult (no midsize or large adult classification)⁶⁶

Important Aug 2016 Bug Fix

- **Some 2010-2012 GM (specifically all Autoliv SDM 10 & 11) interpreted before 17.0 misinterpreted some data**
- Brake status was reported ***backwards***
- Precrash was reported ***out of proper time order***
- **Fixed** in Software version 17.0
- As ALWAYS, be SURE to ***reinterpret data in the latest version of software!!!!***

Specific models affected by brake and time order:

- **2010: SRX, Equinox, Terrain, Enclave, Captiva Sport, Traverse, Acadia, Outlook**
- **2011: SRX, Equinox, Terrain, Cruze, Volt, 9-4x, Enclave, Captiva Sport, Traverse, Acadia**
- **2012: Caprice, Impala, *Enclave, Captiva Sport, *Traverse, *Acadia**

- **Check closed cases????**

Important Aug 2016 Bug Fix 2

- In SDM 10 and 11 Autoliv, plus a few additional Autoliv models, the Roll Rate polarity if interpreted before 17.0 may be the opposite of SAE polarity
- **Affected models include Autoliv SDM-10/10i, SDM-10P, SDM-11, SDM-11e, SDM-11P and SDM-30.**

Important Dec 2017 Bug Fix

- SDM-30 modules read in 17.6 did not read properly.
- Modules must be re-read in 17.6.1 or higher
- 17.6 files attempting to be reopened will warn that the file is invalid (the whole file)
- Think about securing all ACMs in evidence...

Important Bug Fix 4 & Other GM News

- One module family Conti SDM-30 comes out misinterpreted – data is scrambled
- Must send to Conti for manual readout and interp. (ask instructors for how)
- Foreign coverage – China since 99 (but only Gov't/NPS can use CDR),
Australia/Korea/Thailand since 07
- South America not covered or spoofable

GM Auto Emergency Braking

- 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:
 1. 4 sec before event
 2. At event
 3. 4 sec after event
- Not accessible with CDR – must be requested with proper legal authority from GM

GM Active Safety Control Module

- First installed in 2013 Cadillac ATS
- Only with GM option UGN or UKL
- Initially released in CDR 17.9 to get raw data file only for future interpretation.
- Interpretation capability added in 19.1
- REQUIRES CDR 900 interface!
- Some vehicles have TWO ASCM modules.

GM Active Safety Control Module

Mkt	Year/Make	Model	Module		Vehicle Interface	OBD/DLC Connect Adapter/Cable	D2M Connect Adapter/Cable	Module Location
4	2018 Cadillac	ATS (note 6)	ACM	Data	CANplus	CANplus - F00K108287	CANplus - F00K108454	Center tunnel
			ASCM (Note1)	Data	CDR 900	CDR 900 - click here	CDR 900 - Cable# 833	In the luggage compartment, left side, near rear, on outboard side of brace, behind trim
6	2018 Cadillac	ATS-L (note 6)	ACM	Data	CANplus	CANplus - F00K108287	CANplus - F00K108454	Center tunnel
4,6	2018 Cadillac	CT6 (note 6)	ACM	Data	CANplus or CDR 900	CANplus - F00K108287 CDR 900 - click here	CANplus - F00K108454 CDR 900 - click here (use listed cable above)	Center tunnel
			ASCM (Note2) how to image	Data	CDR 900	CDR 900 - click here	CDR 900 - Cable# 834	In the luggage compartment, right center, mounted to the right side in the battery well. The secondary ASCM is on the left.
			ASCM (Note1)	Data	CDR 900	CDR 900 - click here	CDR 900 - Cable# 833	In the luggage compartment, right center, mounted to the right side in the battery well

GM Active Safety Module

ASCM active



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

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
- Data is recorded in non-volatile memory at the next proper power-down of the module. Data may not be stored if the battery power is lost before the power-down.

GM RPO Sticker Change

- GM formerly had a sticker with 3 digit RPO (Regular Production Option) codes printed in the glove box or trunk
- 2018-ish switched to a “QR code”
- Google search QR code reader and install one on your phone. Some free, some cost

Apps

Windows apps on Microsoft Store

	Scan - QR Code and Barcode Reader Scan is the fastest and most user-friendly QR reader and barcode scanner available. If your computer came with a built-in scanner, ... 3/5 ★★★★★ (188) · \$1.99	Get
	QR Scanner+ // QR Code and Barcode Reader QR Scanner+ is the most comprehensive app when it comes to scanning/reading QR codes! No matter if the QR code contains a ... 4.5/5 ★★★★★ (215) · \$2.49	Get
	QRReader QRReader it's an app to read the two-dimensional code QR code (Quick Response Code). to use it, you've just to capture the QR ... 2/5 ★★★★★ (207) · Free	Get

Ford CDR 17.8 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
500/Montego/Freestyle									GDR/PCM	-	-												
Cmax																							
Cougar	NO		CDR	-	-	-																	
Crown Vic/Grand Marquis	NO	CDR	-	-	RCM				PCM/RCM														
Econoline	CDR	-	-	-	-	-	-	-	GDR/PCM	-	-	CDR/PCM	384										
Ecosport (small SUV)																							
Edge																							
Escape/Mariner					RCM				CDR	-	-	-	384			384	783		783*				
Escort/ZX2	NO	CDR	-	-	RCM																		
Excursion				CDR	RCM																		
Expedition	NO			CDR	RCM		CDR	-	GDR/PCM	-	-	CDR/PCM	-	-	384				783			823*	
Explorer Sport (2 dr)				00.5 ->	RCM		CDR																
Explorer/Mountaineer	NO					CDR	-	GDR/PCM	-	PCM/RCM			GDR/PCM	-	384		783		783*				
F150	NO		CDR	-	RCM			GDR/PCM	-	-	-	-	384						783*	?	?		
Fiesta															384			783					
Flex													CDR	384									
Focus				CDR	-	-	-	-	-	-	-	RCM/PCM				597			783				
Fusion/Milan										PCM/RCM		CDR	-	384			783*				823*		
GT																							783*
Mustang	NO	NO	CDR	CDR	RCM			RCM	GDR/PCM			CDR/PCM	-	384					783*				
Ranger	NO	CDR	CDR	CDR	RCM						CDR	-	-	384									823*
Sport Trac (pickup bed)				00.5 ->	RCM		CDR	-	-			PCM/RCM		PCM/RCM	CDR								
Super Duty F250+		CDR	CDR	CDR	RCM				RCM/PCM**		PCM**	CDR/PCM	-	-	384						783*		
Taurus/Sable	NO	CDR	CDR	CDR	RCM	CDR	-	-	-	-		CDR/PCM	-	384			783						
T-bird	NO	NO			RCM			RCM/PCM															
Transit																						783	
Transit Connect															CDR	-	-	778*	783				
Windstar/Freestar/Monterey	NO	NO	CDR	-	RCM			CDR	-	-	-												
Aviator (Explorer)							CDR	-	-			GDR/PCM											
Continental			CDR	-	RCM																	823*	
LS				CDR	RCM		GDR/PCM	-	-	-													
Mark LT (F150 platform)										GDR/PCM	CDR/PCM	-											
MKC (Escape Platform)																				783*			
MKS (Taurus Platform)																							
MKZ, Zephyr (Fusion platform)															384		783						
MKT '10 (Flex Platform)															384		783	783*			823*		
MKT '10 (Flex Platform)															384	384							
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Ford w/Stability Control Data 19.3

Model Year	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
CMAX					783							
ECONOLINE	384 RC6											
ECOSPORT										823*		
EDGE			384					783*				823*
ESCAPE	384			384	783		783*					823*
EXPEDITION	-	-	384				783			823*		
EXPLORER		-	384		783	RC7		783*				823*
F150	384						783*			RC7P		
FIESTA			384			783						
FLEX		384										
FOCUS				597 Bosch AB10			783					
FUSION		384			783*			AB10P	823*			
GT										783*		
MUSTANG		384					783*				RC7P	
RANGER		384									823*	
SUPER DUTY F250-550		-	384						783* RC7P			
TAURUS/SABLE		384			783 RC7							
TRANSIT (big van)									783			
TRANSIT CONNECT (small)					778*	783						
AVIATOR (Explorer platform)												823*
Continental									823*			
MKC/CORSAIR (Escape Platform)							783*					823*
MKS (Taurus Platform)		384			783							
MKZ, Zephyr (Fusion platform)		384			783	783*			823* AB12			
MKT '10 (Flex Platform)		384	384									
MKX/NAUTILUS (Edge platform)			384					783*			823*	
NAVIGATOR (Expedition platform)			384				783			823*		8

Ford Part 563 EDR Subfamilies

Autoliv RC6
2009 Escape
384 Cable
+RC6_2011
(RC6X)

Bosch AB10
2012 Focus
597 Cable

Autoliv RC7
2013 Taurus
783 Cable
+RC7P upgrade

Bosch
AB10P
2015
Focus
783 Cable

RC7P

Bosch AB12
2017 Fusion
823 Cable

Precrash 5 sec @0.5 sec intervals, 250msec X&Y DV

2nd
DV
graph

Precrash
5 sec
@ 0.2 sec

Stability Control Sys Data 5 sec @0.1 sec intervals

RC6 last speed data
0.5 sec plus delay
RC6_2011 0.5 sec

Last data point within 0.5
sec

?

?

Within
0.2
sec

Incomplete Data
Limitations

Fairly Complete Data
Limitations

Ford EDR evolution

- Autoliv/Veoneer RC5(06)-RC6(09)-RC6X(11)-RC7(13), RC7P
- Bosch AB9(05)-AB10(12)-AB10P, AB12(17)
- Chrysler had stability control yaw rate and steering earlier, but Ford upped the game in 2009 with RC6 longitudinal and lateral accel data at 0.1 second intervals pre-crash
- Fords have rich data, but are skimpy on data limitations until the 2013 Taurus Autoliv RC7.
- Critical info only found in training materials 80

Identifying Ford EDR families

- At the end of the data limitations section, just below the last paragraph, on the left, Bosch puts what version of data limitations is being printed. For Ford, most data limitations by family.
- No difference between DL 2009 RC6 and 2011 RC6X.
- Open cdrx copy in notepad, see RC6_2011

Data Sources:

The Restraints Control Module (RCM) can

1. Internal to the RCM such as internal sensors, calculated and stored internally.

2. External to the RCM but with a direct connection to the RCM, measured, calculated and stored internally.

3. External Modules to the RCM such as ABS, Airbag, etc. via RCM via Vehicle Communication Network

02014_RCM **AB10** PCD4-2_r001

Polarity on Stability Control 09+

- The steering and yaw rate are opposite the normal right hand rule as documented in SAE 2014-01-0504.
- The paper reported lateral acceleration may be OK, but subsequent empirical data showed lateral acceleration is **also** backwards. In a hard right swerve, all 3 are negative.
- New RC7 and AB12 DL's show the polarity as stated above, all 3 backwards

09+ Ford Stability Control Data

Pre-Crash Data -5 to 0 sec [10 samples/sec] (First Record)

Times (sec)	Stability Control Lateral Acceleration (g)	Stability Control Longitudinal Acceleration (g)	Stability Control Yaw Rate (deg/sec)
- 1.4	0.086	-0.045	0.12
- 1.3		-0.031	1.5
- 1.2		-0.647	-1.5
- 1.1		-0.75	-2.5
- 1.0		-0.709	-1.5
- 0.9		-0.763	-1.5
- 0.8		-0.826	-1.5
- 0.7		-0.792	-0.75
- 0.6		-0.895	1.25
- 0.5		-0.83	1.87
- 0.4		-0.835	0.75
- 0.3		-0.607	0.37
- 0.2		-0.653	0.75
- 0.1		-0.823	-3.37
0.0	-0.004	-0.811	-3.75

Integrate lat accel - get velocity – integrate again – get displacement

Reaction

Drag Factor!

Integrate yaw – get **approach angle change!!**
Take tangent of cumulative angle, multiply by speed, get **sideways movement** – how far out of lane vehicle went!!

Ford Occupant Size Classification

not in data limitations

Pre-Crash Data -1 sec (First Record)

Ignition cycle, crash	359
Frontal air bag warning lamp, on/off	OFF
Occupant size classification, front passenger (Child size Yes/No [Hex value])	No [08]
Safety belt status, driver	Driver Buckled

- The Hex Value provides additional information that just child yes/no
- The Decoder is different for Ford's 2 main suppliers, Autoliv and Bosch
- Look at end of data limitations for module type – Autoliv=RC5, RC6, RC7;
Bosch=AB9, AB10

02011_RCM-AB10P_r001

02007_RCM-RC6_r002

Autoliv Bosch

\$01	\$00	Empty
\$02	\$01	Child (clearly 55 lbs or less)
\$04	\$05	Indeterminate (gray zone somewhere between 55 to 110 lbs)
\$08	\$02	Small Adult (not a child and always registers for 110 lb 5 th female adult)
\$10	\$03	Medium adult (not a 5 th female and always registers for what is probably a 50 th male adult of 170 lbs)
\$20	\$04	Large Adult (next bigger threshold than above, 95 th male , 223 lbs)

New Second Decoder for Bosch

Autoliv RC6 Anomalies (09-10)

- There are timing delays in reporting the 0.5 sec interval precrash data in the early Ford Autoliv RC6 modules (09 F150-Escape-Econoline and many 2010). Identify by lag between stability control longitudinal (braking) g's and brake on time and speed lost. Use Stability Control System long. accel for timing of accel release and brake on.
- Fixed by “RC6X”, identifiable only by opening COPY of .cdrx in notepad, observe “RC6_2011” in header (and by agreement between stability control and 0.5 sec interval precrash data).

2012-2015 AB10 Anomaly

- The “Bosch AB10” ACM found in 2012+ Focus and 2015 Escape and other vehicles **produced before Nov. 2015**, which have a **second event**, incorrectly label pre-crash **time** to impact in the second event.
- Time between events is accurate – use it
- Second event precrash (both speed and stability control sections) include extra points at irregular intervals labeled as if they occurred at regular intervals.

AB10 Anomaly cont'd

- If you can see the first event in the second event's data, it will lead you to think the time between events is longer than it really is.
- The data in the second event did occur, just not at the time it said it did.
- The second event last precrash speed is still within 0.5 seconds of the second event.
- There is no software fix for EDR's produced before Nov. 2015. Fix implemented 11/2015.
- No mention in DL's yet.

Bosch AB10P Unique Info

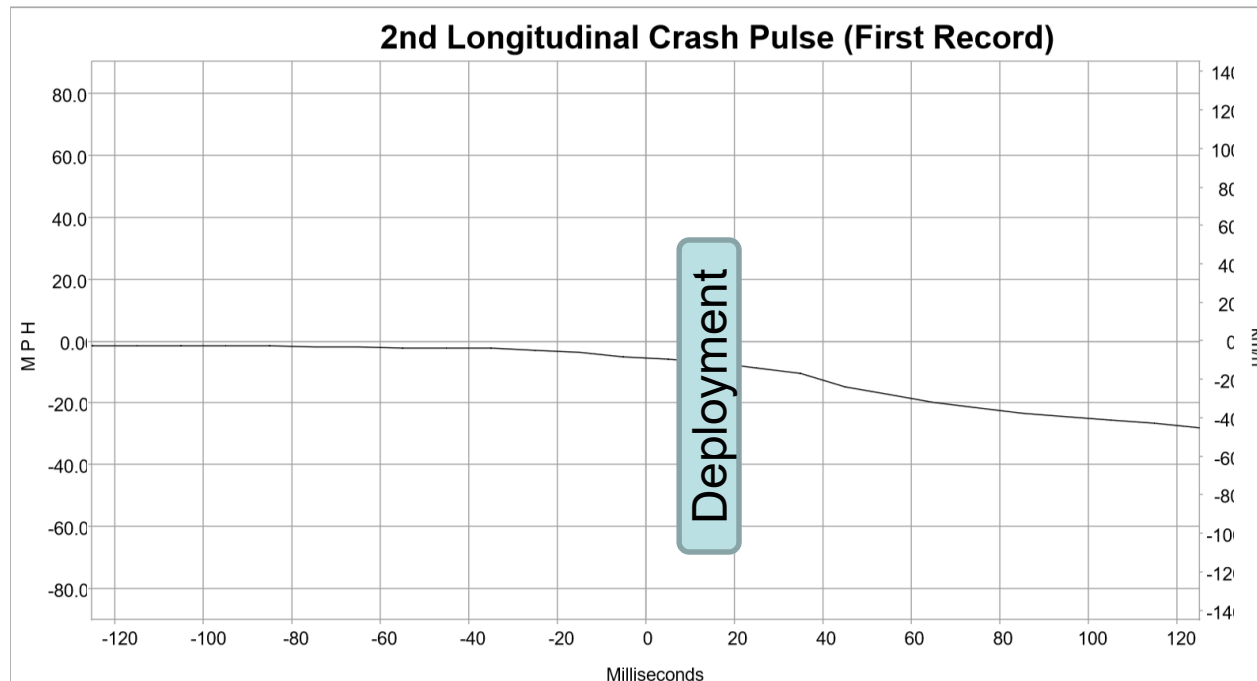
- Longitudinal Accel Stability Control Info is **positive for slowing down**, **negative for speeding up** – *opposite of what data limitations say.*
- Lateral Accel data is **positive right**, **negative left** – different than the other Ford modules.
- Steering and Yaw remain positive left and are identified as such in data limitations.

Bosch AB12 ACM - 2017 MKZ

- Precrash data ***every 0.2 seconds*** instead of every 0.5 seconds
- Stability control data steering/yaw are on a different page than lat/long accel are (need to cut/paste columns to use current analysis template)
- Some Driver Assistance data elements

New RC7P Feature- 2017 F250

- Ford has added a second graph to capture the deployment decision $\pm 125\text{ms}$. This is important in hit-curb-then-hit-tree cases where the deployment was previously off the end of the mandated 250ms after wakeup graph



Steering Angle Glitch

- Ford stores one value for steering relative to original zero position set at factory
- If vehicle steering is serviced, original zero may be lost and system learns a new one from average of all new driving.
- EDR may write down ORIGINAL position relative to zero – so a FEW models serviced may appear to have WRONG value for zero.
- No warning in DL's about this yet

Backpowering New Fords

- Ford has added a feature where even if the key is turned off, the airbag system will stay on until the car slows to a near stop. So there must be a switched battery feed to replace the current ignition switch feed.
- There may no longer be ANY fuse labeled “airbag”. It may be called “Extended Power Module”.

For Ford EDR not supported by Bosch CDR
See the document on my website
“Unsupported Fords”

Many requests can go directly to Ford’s suppliers.
Other requests for assistance to Ford legal:

Email to EDRFORD@FORD.COM

(this is an address for a Bowman and Brooke outside counsel that handles these requests for Ford)

Contact Rick Ruth for additional information prior to making request

As of this writing, Veoneer (former Autoliv) charges \$2000 to all, Bosch and Conti are no charge to law enforcement but \$1500 to private parties.

Veoneer now says it cannot download modules >15 years old

Recent 05 Freestar RCM sent to Takata was returned with Hex Data only and no guide to interpretation (no charge, no value!)

Available on my website

Getting EDR Data from unsupported Fords

Richard R. Ruth, P.E.

(this copy has been updated 11-24-2019, after the original
presentation at the Jan 2016 CDR Summit)



FCA 19.3 CDR Coverage 64%

Last 3 digits of Bosch CDR DTM adapter/cable number s			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Chrysler	200	Console, aft of shifter							790/516		387/516		387/785				
Chrysler	300	Center stack		226 ^{3,3}	228 ⁵				387/598								
Chrysler	Aspen	Console, aft of			226 ⁴	226											
Chrysler	Cirrus (not sold in US)	Console, aft of						387/516 ⁸									
Chrysler	Grand Voyager	Center stack						387/385 ⁸									
Chrysler	Pacifica	Center stack			228 ⁵										387/785		
Chrysler	PT Cruiser	Console, fwd of		226 ^{3,4}	228 ⁵												
Chrysler	Sebring	Console, aft of			226 ⁴	226		387/516 ⁸									
Chrysler	Town & Country	Center stack					385 ⁶	387/385 ⁸			387/785						
Dodge	Avenger	Console, aft of				226		387/516 ⁸	387/790/516		387/516						
Dodge	Caliber	Center stack			226 ⁴	226		387/516 ⁸	387/790/516								
Dodge	Caravan	Center stack					385 ⁶	387/385 ⁸			387/785						
Dodge	Challenger	Center stack					228		387/228 ¹⁰	387/228			387/598				
Dodge	Charger	Center stack		226 ^{3,3}	228 ⁵				387/598								
Dodge	Dakota/Raider	Center stack			228 ³				228	Mex Only							
Dodge	Dart	Center Stack									387/785						
Dodge	Durango	Console, aft	226 ^{3,4}	226 ^{4,4}	226 ^{4,4}	226 ²	226 ²		387/228 ¹⁰	387/228		387/598					
Dodge	Journey	Console, fwd of shifter					385	387/385 ⁸			387/385	+516PPT				387/821	
Dodge	Magnum	Center stack		228 ^{3,3}	228 ³												
Dodge	Nitro	Console, aft of			227 ⁴	227		387/516 ⁸									
Dodge/Ram	Promaster City												387/802	+ 709 DLC Adapter			
Dodge/Ram	Promaster (Big Van)											387/829 new 17_4	+ 709 DLC Adapter	387/785			
Dodge/Ram	Ram	CF Seat/console		226 ⁴				387/453 ⁸									
Dodge/Ram	Ram Pickup (2500)	CF Seat/console		226 ⁴			226 ³	387/453 ⁸									
Dodge/Ram	Ram Pickup (1500)	Center stack		226 ⁴		226	453 ⁸	387/453 ⁸	387/453		387/785						
Dodge/Ram	Ram Van	Center Stack									387/785						
Dodge/SRT	Viper	Center Stack									387/785						
Jeep	Commander	Console, aft		226 ^{3,3}	228 ⁵												
Jeep	Compass/Patriot	Center stack			226 ⁴	226		387/516 ⁸	790/516		387/516		387/808 OR 819			387/819	
Jeep	Grand Cherokee	Console, aft of		226 ^{3,3}	228 ⁵				387/228 ¹⁰	387/228+	387/228	387/598					
Jeep	Liberty/Cherokee	Console, aft of				227		387/516 ⁸			?	387/785					
Jeep	Renegade												387/819*				
Jeep	Wrangler	Console, aft of			227 ⁴	227		387/546 ⁸			387/546					387/821	96

Call FCA

Maybe Call FCA

Frontal Deploy

Frontal/Side Deploy

Non Deploys

563 Non Deploys

Chrysler Recent Changes

- **Added Full Size Promaster Van Coverage for 2014-2017 (Sprinter?)**
- **Fixed issue where 100% accel pedal and throttle reported at 77% in 17.7.1**
- **Tire Pressure data at 0.25 sec intervals instead of 0.1 sec to make room for other data to be recorded**
- **Four wheel speeds *in kph* instead of rpm – see non driven vs driven wheels**
- **Brake master cylinder pressure added to some 2018+ models**
- **Gear Position added (changes at end of shift)**

Output New Look –

Removed multiple brake elements, added ABS/SC, moved strg to P1, hi res

Pre-Crash Data [10 samples/sec] (Most Recent Event - table 1 of 2)

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

Time Stamp (sec)	Pre-Crash Recorder Status	Speed, Vehicle Indicated (MPH [km/h])	Accelerator Pedal, % Full	Service Brake	Engine RPM	ABS Activity	Stability Control	Steering Input (deg)
-5.0	Complete	96 [155]	0.00	Off	3,878	No	On	1
-4.9	Complete	96 [154]	0.00	Off	3,835	No	On	-1
-4.8	Complete	96 [154]	0.00	Off	3,726	No	On	-5
-4.7	Complete	96 [154]	0.00	Off	3,621	No	On	-10
-4.6	Complete	96 [154]	0.00	Off	3,489	No	On	-18
-4.5	Complete	95 [154]	0.00	Off	3,344	No	On	-21
-4.4	Complete	95 [153]	0.00	Off	3,210	No	On	-20
-4.3	Complete	95 [153]	0.00	Off	3,109	No	On	-19
-4.2	Complete	95 [153]	0.00	Off	3,068	No	On	-19
-4.1	Complete	95 [152]	0.00	Off	3,108	No	On	-18
-4.0	Complete	95 [152]	0.00	Off	3,079	No	On	-18

Wheel RPM replaced by speed

See driven vs non driven, left vs right, ABS working...

Pre-Crash Data [10 samples/sec] (Most Recent Event - table 2 of 2)

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

Time Stamp (sec)	ABS MIL	Yaw Rate (deg/sec)	Wheel Speed LF (km/h)	Wheel Speed RF (km/h)	Wheel Speed LR (km/h)	Wheel Speed RR (km/h)
-5.0	Off	0.40	154.37	154.52	154.55	154.52
-4.9	Off	-0.48	154.28	154.16	154.25	154.25
-4.8	Off	-1.76	154.40	154.09	153.88	153.77
-4.7	Off	-2.80	154.28	153.95	153.88	153.67
-4.6	Off	-4.24	154.01	153.64	153.85	153.55
-4.5	Off	-6.80	153.98	153.16	153.80	153.19
-4.4	Off	-7.12	153.80	152.88	153.70	152.80
-4.3	Off	-5.84	153.49	152.67	153.37	152.62
-4.2	Off	-5.12	153.13	152.19	153.25	152.38
-4.1	Off	-4.64	152.80	152.04	152.91	151.91
-4.0	Off	-4.64	152.49	151.73	152.46	151.65
-3.9	Off	-4.00	152.13	151.55	152.13	151.31
-3.8	Off	-3.68	151.83	151.25	151.95	151.13

Current Gear & More @ 0.25 sec

Pre-Crash Data [4 samples/sec] (Most Recent Event - table 1 of 2)

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

Time Stamp (sec)	Pre-Crash Recorder Status	Raw Manifold Pressure (kPa)	PCM MIL	ETC Lamp	Current Gear	Reverse Gear Status
-5.00	Complete	20.00	Off	Off	D5	Not Reverse
-4.75	Complete	20.00	Off	Off	D5	Not Reverse
-4.50	Complete	21.60	Off	Off	D5	Not Reverse
-4.25	Complete	23.20	Off	Off	D5	Not Reverse
-4.00	Complete	23.20	Off	Off	D6	Not Reverse
-3.75	Complete	23.20	Off	Off	D6	Not Reverse
-3.50	Complete	23.20	Off	Off	D6	Not Reverse
-3.25	Complete	23.20	Off	Off	D6	Not Reverse
-3.00	Complete	22.40	Off	Off	D6	Not Reverse
-2.75	Complete	21.60	Off	Off	D6	Not Reverse
-2.50	Complete	21.60	Off	Off	D7	Not Reverse
-2.25	Complete	21.60	Off	Off	D7	Not Reverse
-2.00	Complete	21.60	Off	Off	D7	Not Reverse
-1.75	Complete	21.60	Off	Off	D7	Not Reverse

NEW

Changes at END of shift

Tire pressure @ 0.25 sec intervals

Pre-Crash Data [4 samples/sec] (Most Recent Event - table 2 of 2)

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

NEW

Time Stamp (sec)	Tire Pressure Position	Tire Pressure Status	Tire Pressure Value (PSI)	Cruise Control Lamp Status	Cruise Control Engaged Status	ACC On/Off	ACC Set Speed (MPH [km/h])
-5.00	LHF	Normal	34	Off	Not_Engaged	Off	0 [0.0]
-4.75	RHR	Normal	32	Off	Not_Engaged	Off	0 [0.0]
-4.50	RHR	Normal	32	Off	Not_Engaged	Off	0 [0.0]
-4.25	RHR	Normal	32	Off	Not_Engaged	Off	0 [0.0]
-4.00	RHR	Normal	32	Off	Not_Engaged	Off	0 [0.0]
-3.75	LHR	Normal	33	Off	Not_Engaged	Off	0 [0.0]
-3.50	LHR	Normal	33	Off	Not_Engaged	Off	0 [0.0]
-3.25	LHR	Normal	33	Off	Not_Engaged	Off	0 [0.0]
-3.00	LHR	Normal	33	Off	Not_Engaged	Off	0 [0.0]
-2.75	RHF	Normal	33	Off	Not_Engaged	Off	0 [0.0]
-2.50	RHF	Normal	33	Off	Not_Engaged	Off	0 [0.0]

Integrating FCA Yaw Rate

From 08 charger case

$$- 3 \text{ deg/sec} * 0.1 \text{ sec} = -0.3 \text{ degrees}$$

$$-11 \text{ deg/sec} * 0.1 \text{ sec} = -1.1 \text{ degrees}$$

$$-18 \text{ deg/sec} * 0.1 \text{ sec} = -1.8 \text{ degrees}$$

$$-15 \text{ deg/sec} * 0.1 \text{ sec} = -1.5 \text{ degrees}$$

$$- 9 \text{ deg/sec} * 0.1 \text{ sec} = -0.9 \text{ degrees}$$

$$- 4 \text{ deg/sec} * 0.1 \text{ sec} = -0.4 \text{ degrees}$$

$$- 1 \text{ deg/sec} * 0.1 \text{ sec} = \underline{-0.1 \text{ degrees}}$$

$$\text{Total Swerve Right} \quad 6.1 \text{ degrees}$$

Note 1: this is how far nose of car is pointing right – CG motion may lag

Note 2: Polarity reversed in this module

Pedestrian Protection

- Starting 2012 Fiat Freemont & Dodge Journey, ***In Europe only***, FCA has added a pedestrian protection feature to deploy a feature that pops the hood up slightly to make the angle better and less injurious to pedestrians.
- It is a separate module with separate data and must be imaged separately thru the DLC or via cable 516.
- Widespread in Europe, may come to US

Other FCA News

- Revised reporting of deploy times (was stage 1 to stage 2 vs AE to stage 2).
- 17.2 fixed some WOT reporting as 77%, rest fixed in 17.7.1
- 10-12 Journey + Minivan – all ND's display as “interrupted” recording
- 2013 TRW – key cycle counters may not match perfectly (different sources)
- Recording threshold intent 5mph DV, but some models may report a 4.9 DV.
- Most “features” noted in data lim's.

New Chrysler Info

- Frontal sensors are 100G at 45 degrees ($100 \cdot \cos 45^\circ = 71\text{g}$ straight ahead).
- Replaced clipping flag with “Sensor Design Range Exceeded” line on graph
- Buckle switch NOT normally used to determine if pre-tensioner fires (Exceptions on some non US built vehicles)
- Fiat Spider = Mazda Miata, threshold <5mph
- Master Cylinder Pressure on some 2018!
- Driver assistance data elements coming in⁰⁶

Toyota US CDR 19.3 Coverage 84%

TOYOTA/LEXUS/SCION Vehicles by MODEL year, Bosch CDR 17.9 Coverage US Market																				
		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
LEXUS	CT200h																			
	ES																			GEN 4
	GS																			
	GX																			
	IS																			
	LFA																			
	LS																			GEN 4
	LX																			
	NX																			
	RC350																			
	RC-F																			
	RX																			
TOYOTA	SC																			
	4Runner																			
	Avalon																			
	Camry																			
	Celica																			Coaster
	Corolla																			
	Echo																			
	FJ																			
	Highlander																			
	Land Cruiser																			
	Matrix																			
	MR-2																			
	Prius																			
	RAV4																			
	Sequoia																			
	Sienna																			
	Solara																			
	Tacoma																			
	Tundra																			
	Venza																			
	Yaris																			
Scion	FR-S																			
	iA																			
	iM																			
	iQ																			
	tC																			
	xA																			
	xB																			
Scion	xD																			

No EDR

DR + Precrash 04/06 Type

ESP Intent

Scion
Brand
folded
into
Toyota

108

Toyota EDR Evolution

GEN 1
00,02 EDR

GEN 2
04,06 EDR

GEN 3
12,13,15 EDR

GEN 4
17 EDR

3 front
1 side
1 roll

2 front
2 side
2 roll

4 front
4 side
6 precrash

Record on 2g
wakeup

Record on
5mph XDV,
side 3.5g wake

Record
on 5 X or
Y DV

150ms XDV
5PC@1 + TRG

200ms XDV
5PC@1+TRG

250ms XDV
10PC@0.5 + TRG

250ms XY
10PC@0.5+TRG

Toyota EDR Evolution cont'd

GEN 1
00,02 EDR

GEN 2
04,06 EDR

GEN 3
12,13,15 EDR

GEN 4
17 EDR

70ms
YDV@ACM+sats

12 YDV 70ms
sats only
13 250ms ACM

250ms
YDV

REFRESH
500 MS SPEED

REFRESH
24 MS SPEED

78 MPH TOP,
2kph res

75 MPH TOP.
2kph res

124 MPH TOP
1 kph res

Accel Pedal Volts

Accel Pedal % & Throttle
%

Toyota EDR Evolution cont'd

GEN 1
00,02 EDR

GEN 2
04,06 EDR

GEN 3
12,13,15 EDR

GEN 4
17 EDR

RPM to next lower 400

RPM to 100

No Key Cycles

Key Cycles

Time Between
Events < 5
sec

Time Between Events <16 sec

Brk Oil Pres, Stab.
Cont. Long Accel

Strg & Yaw

New “17 EDR”

- “Front/Rear” events also triggered by 5mph Y DV or side deployment
- Y Delta V from ACM added to frontal events for recon
- More precrash registers (6 vs 2 prior)
- More front/rear & side registers (4 vs 2)
- Separate side events still reported, but do NOT have precrash associated with them. Side events have detail of side satellite sensors (generally ***not used*** by Recons).
- Odometer data element added

Same Data, New Look to Precrash

Pre-Crash Data -5 to 0 Seconds (1st Prior Event, TRG 2) - Table 1 of 4

Time (sec)	Vehicle Speed (MPH [km/h])	Accelerator Pedal, % Full (%)	Percentage of Engine Throttle (%)	Fuel Injection Quantity (mm ³ /st)	Engine RPM (RPM)	Motor RPM (RPM)	Service Brake, ON/OFF
-5.00	29.8 [48]	49.5	24.5	Invalid	2,400	Invalid	OFF
-4.50	32.3 [52]	47.0	24.5	Invalid	2,500	Invalid	OFF
-4.00	34.2 [55]	38.0	20.0	Invalid	2,700	Invalid	OFF
-3.50	35.4 [57]	32.5	16.0	Invalid	2,800	Invalid	OFF
-3.00	36.7 [59]	26.5	13.5	Invalid	2,400	Invalid	OFF
-2.50	37.3 [60]	22.5	11.0	Invalid	2,400	Invalid	OFF
-2.00	37.3 [60]	19.0	8.5	Invalid	2,200	Invalid	OFF
-1.50	38.5 [62]	19.0	6.0	Invalid	1,900	Invalid	OFF
-1.00	37.9 [61]	18.0	5.5	Invalid	1,900	Invalid	OFF
-0.50	37.9 [61]	18.0	5.0	Invalid	1,800	Invalid	OFF
TRG(0)	36.0 [58]	100.0	26.0	Invalid	1,700	Invalid	OFF

Pre-Crash Data -5 to 0 Seconds (1st Prior Event, TRG 2) - Table 2 of 4

Time (sec)	ABS Control Status	BOS Control Status	Brake Oil Pressure (Mpa)	Longitudinal Acceleration , VSC Sensor (m/s ²)	Yaw Rate (deg/s)	Steering Input (degrees)	Shift Position
-5.00	OFF	OFF	0.00	1.579	-0.98	-4.5	D
-4.50	OFF	OFF	0.00	1.795	0.00	-1.5	D
-4.00	OFF	OFF	0.00	1.292	0.49	0.0	D
-3.50	OFF	OFF	0.00	0.861	0.00	-1.5	D
-3.00	OFF	OFF	0.00	0.718	0.00	-1.5	D
-2.50	OFF	OFF	0.00	-0.072	0.00	-1.5	D
-2.00	OFF	OFF	0.00	0.000	0.00	-1.5	D
-1.50	OFF	OFF	0.00	0.000	-0.49	-1.5	D
-1.00	OFF	OFF	0.00	0.287	0.00	-1.5	D
-0.50	OFF	OFF	0.00	-0.144	0.00	-1.5	D
TRG(0)	OFF	OFF	0.48	-1.507	61.00	-19.5	D

Pre-Crash Data -5 to 0 Seconds (1st Prior Event, TRG 2) - Table 3 of 4

Time (sec)	Sequential Shift Range	Cruise Control Status	VSC Control Status	READY Signal	Drive Mode, Power Train	Drive Mode, Snow	Drive Mode, EV
-5.00	Undetermined	OFF	ON (enable)	Invalid	Normal	OFF	Invalid
-4.50	Undetermined	OFF	ON (enable)	Invalid	Normal	OFF	Invalid

Pedestrian Protection 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

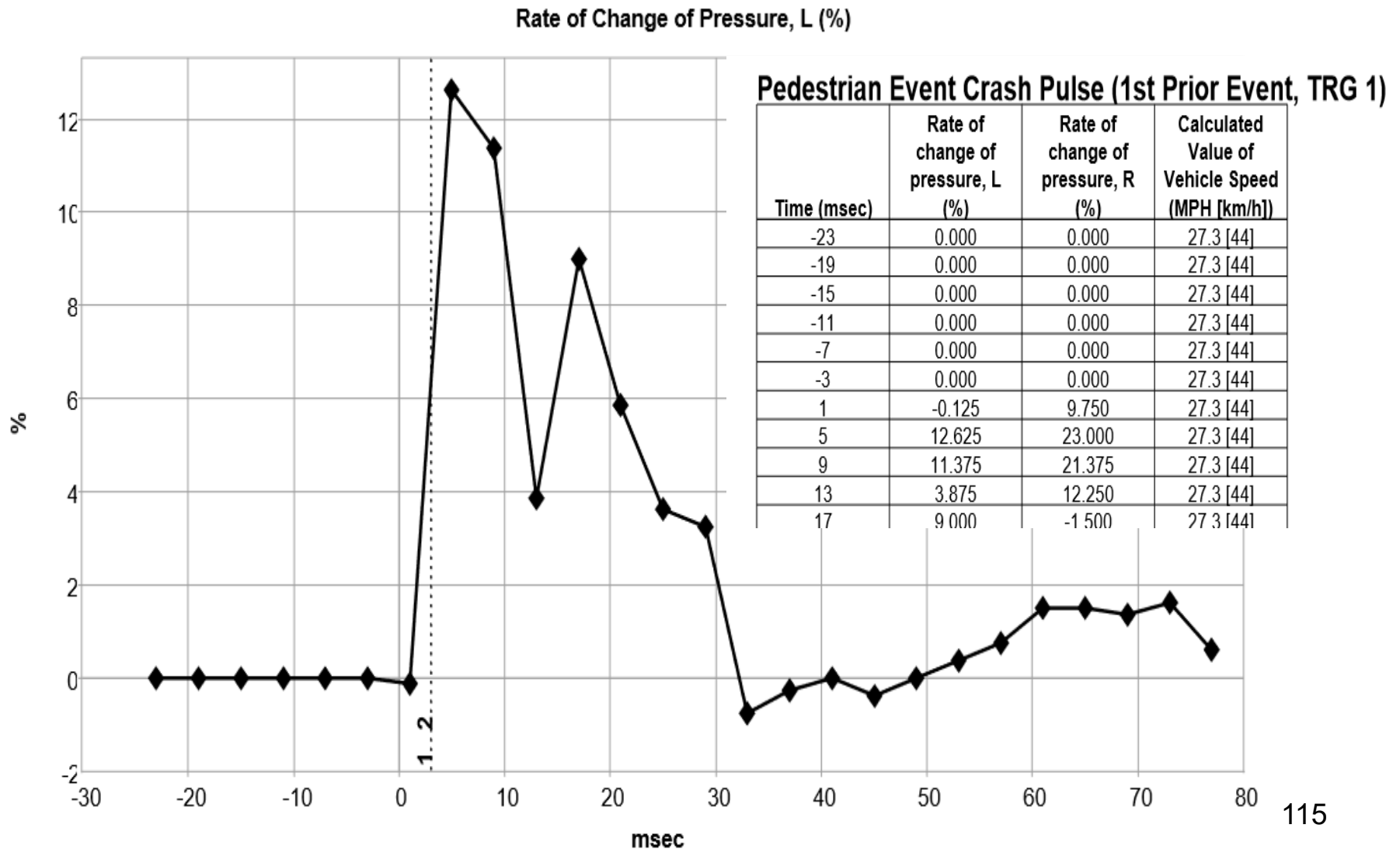
DTCs Present at Time of Event (1st Prior Event, TRG 1)

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

Data from L/R bumper pressure sensors



Toyota Help File Organization

Supported Toyota Vehicles

Use this section of the help file to determine if a vehicle is supported by the CDR tool and to look up the correct cable (and in some cases, adapter) to use for EDR data directly from the ACM. It is important to note that even if the vehicle is listed in this section, CDR must also support the part number on the ACM. Click on the list of supported ACM part numbers.

[Click here for tips on how to use this Supported Vehicles help topic](#)

This Started in Nov 2015

IMPORTANT: To prevent damage to Toyota ECUs when imaging EDR data directly from the ECU, you must always use the appropriate cable called out in this help file.

General Toyota Application Notes:

The CDR Tool software will accept most Toyota VINs entered by the user and the *Collect Airbag Control Module Data* icon will no longer be grayed out. **This is not an indicator that the vehicle is supported.** Only the vehicles listed in the help file below are supported as indicated by the list and any associated coverage notes.

All supported vehicles listed can be imaged through the vehicle's DLC connector using the CDR OBDII DLC Cable (F00K108287) unless otherwise stated.

All supported vehicles require the vehicle's ignition key to be switched on prior to and during EDR record imaging through the vehicle's DLC connector.

Vehicle Specific Application Notes:

[Click here to view all vehicle specific Toyota coverage notes](#)

Vehicles Are Listed Alphabetically

Not by Model Year

Toyota Models begin with: [4](#) [8](#) [9](#) [A](#) [B](#) [C](#) [D](#) [E](#) [F](#) [H](#) [I](#) [K](#) [L](#) [M](#) [N](#) [P](#) [R](#) [S](#) [T](#) [V](#) [W](#) [X](#) [Y](#) [Z](#)

4Runner (Toyota)	2003 and later	Market: Z		
Year	EDR Generation	CDR Cable & Adapter	Module	Module Location
2002 - 2008	Gen 1 (02EDR)	F00K108617 (no adapter)	ACM	Under Center Stack
2009 - 2011	Gen 2 (06EDR)	F00K108616 & F00K108387	ACM	Under Center Stack
2012 and later	Gen 3 (12EDR/13EDR)	F00K108616 & F00K108387	ACM	Under Center Stack

Help file may be CALENDAR year not model year,
EDR may not yet be present in Model Year of first year listed

Toyota Vehicle Lookup

Camry (Toyota)

2001 and later

Market: [7](#)

All Markets the Vehicle is Sold

Year	EDR Generation	CDR Cable & Adapter	M
2001 - 2004 2005 (US/Canada)	Gen 1 (00EDR/02EDR)	F00K108615 (no adapter) F00K108617 (no adapter) Click here [?] to match the ACM part number to the correct cable	Al
2005 - 2011	Gen 2 (04EDR/06EDR)	F00K108613 (no adapter) F00K108614 & F00K108387 F00K108615 (no adapter) F00K108616 & F00K108387 Click here [?] to match the ACM part number to the correct cable	Al
2012 and later	Gen 3 (12EDR/13EDR)	F00K108616 & F00K108387	Al

Note CAMRY got EDR in 02 Model Year in US

Note CAMRY got 04 EDR in 07 Model Year in US

Note CAMRY got 12 EDR as running change in 12 model year, early models have 04/06 EDR in US

[< Models](#)

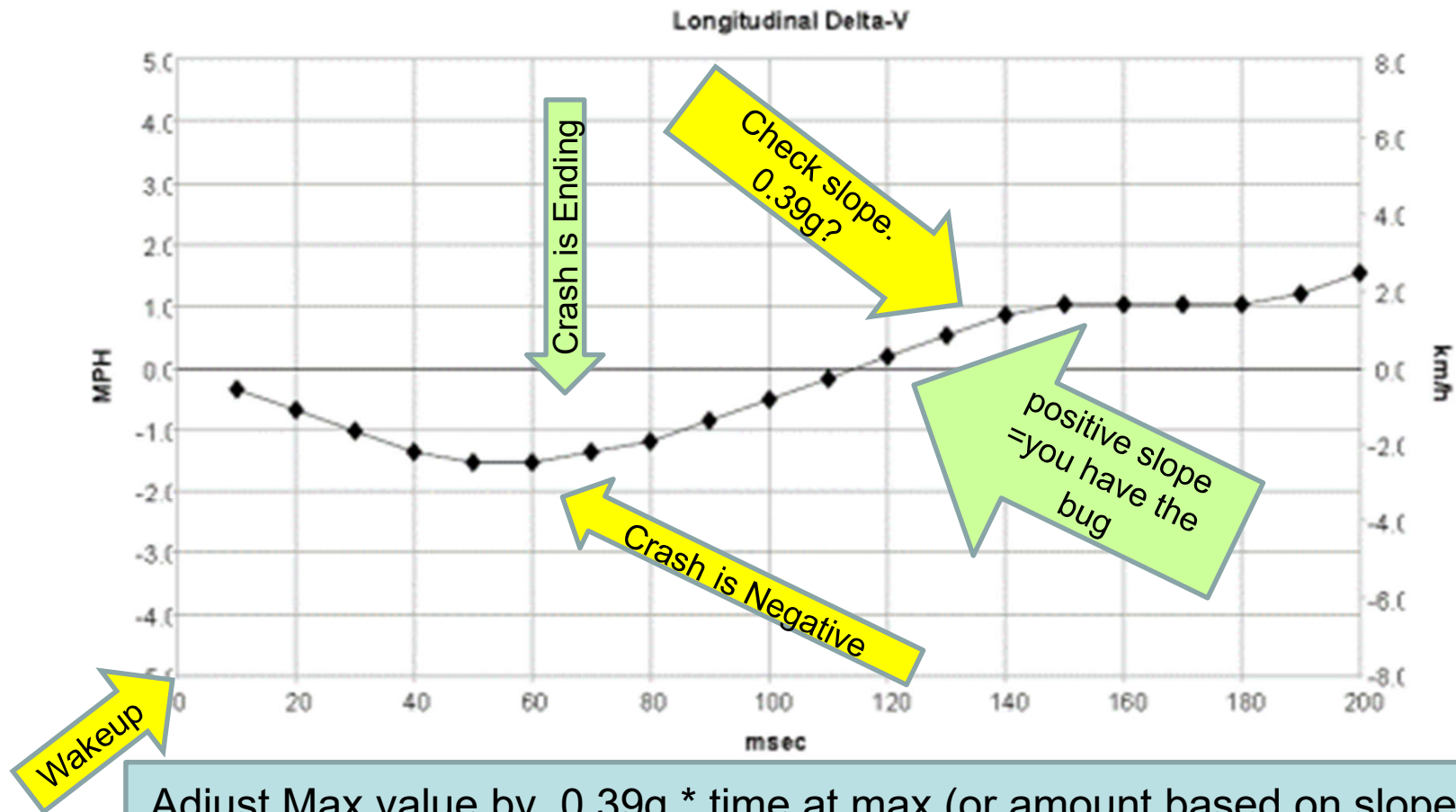
Known Bug in Gen 1&2 Delta V

- Empirical research indicates in all Gen 1's tested to date and SOME Gen 2 models
- Under reports frontals slightly
- Over reports rears slightly
- Sources in Toyota indicate the zero-offset applied when converting analog to digital accelerometer output may be off by 1 count, creating an error of 0.39G.
- $0.39g * 150msec * 32.2 / 1.466 = 1.3 \text{ mph}$
- Empirical data suggests 2 counts on some

How to Identify you have the bug

Longitudinal Crash Pulse (Most Recent Event, TRG 3 - table 1 of 2)

Recording Status, Time Series Data	Complete
Max Longitudinal Delta-V (MPH [km/h])	1.5 [2.5]



No positive slope = no adjustment needed

Toyota 12 EDR Drawback

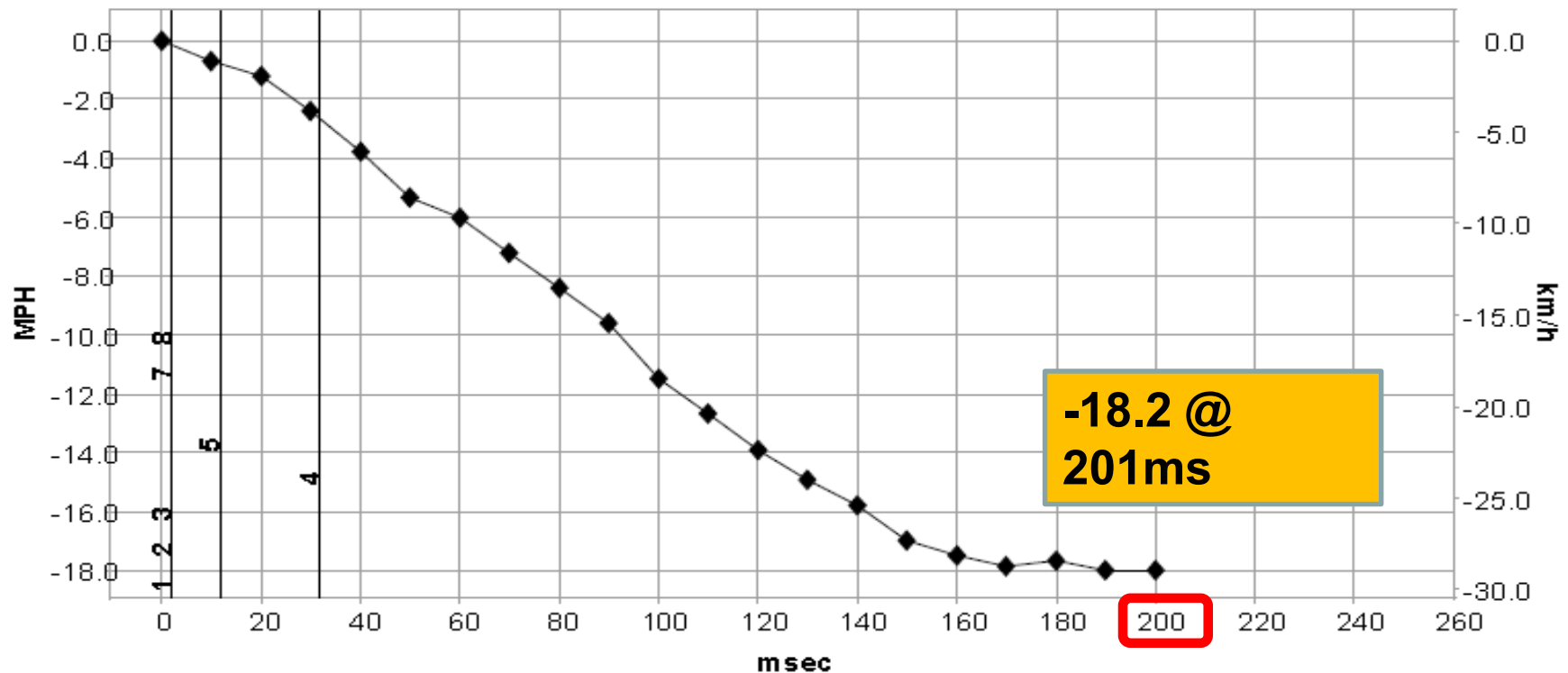
- Lateral acceleration is only recorded in a side algorithm wakeup.
- When it is recorded, it is only for 68ms
- It is only recorded for the side satellites, not for the central control module
- If trying to calculate a PDOF you must be very aware of the different recording timing and sensor location
- Fixed in “13EDR” – get 250ms of Y accel

Delta V analysis – What's the PDOF? The Total?? 12 EDR

Longitudinal Crash Pulse (1st Prior Event, TRG 2 - table 1 of 2)

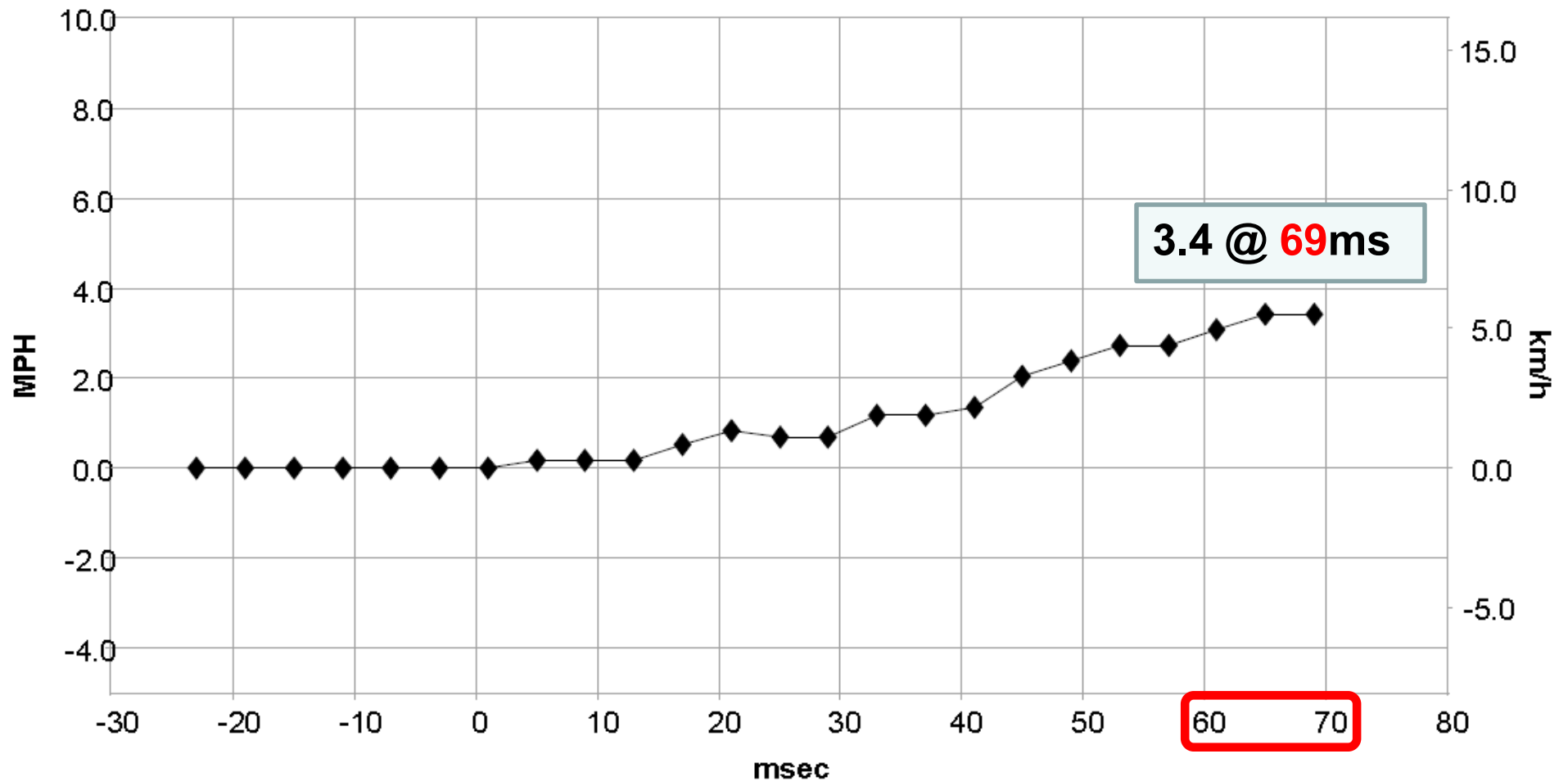
Recording Status, Time Series Data	Complete
Time from Time Zero to TRG (msec)	2.0
Length of Delta-V (msec)	200
Max. Longitudinal Delta-V (MPH [km/h])	-18.2 [-29.2]
Time, Maximum Delta-V, Longitudinal (msec)	201.0
Power Supply Status at Max. Delta-V	ON

Longitudinal Delta-V

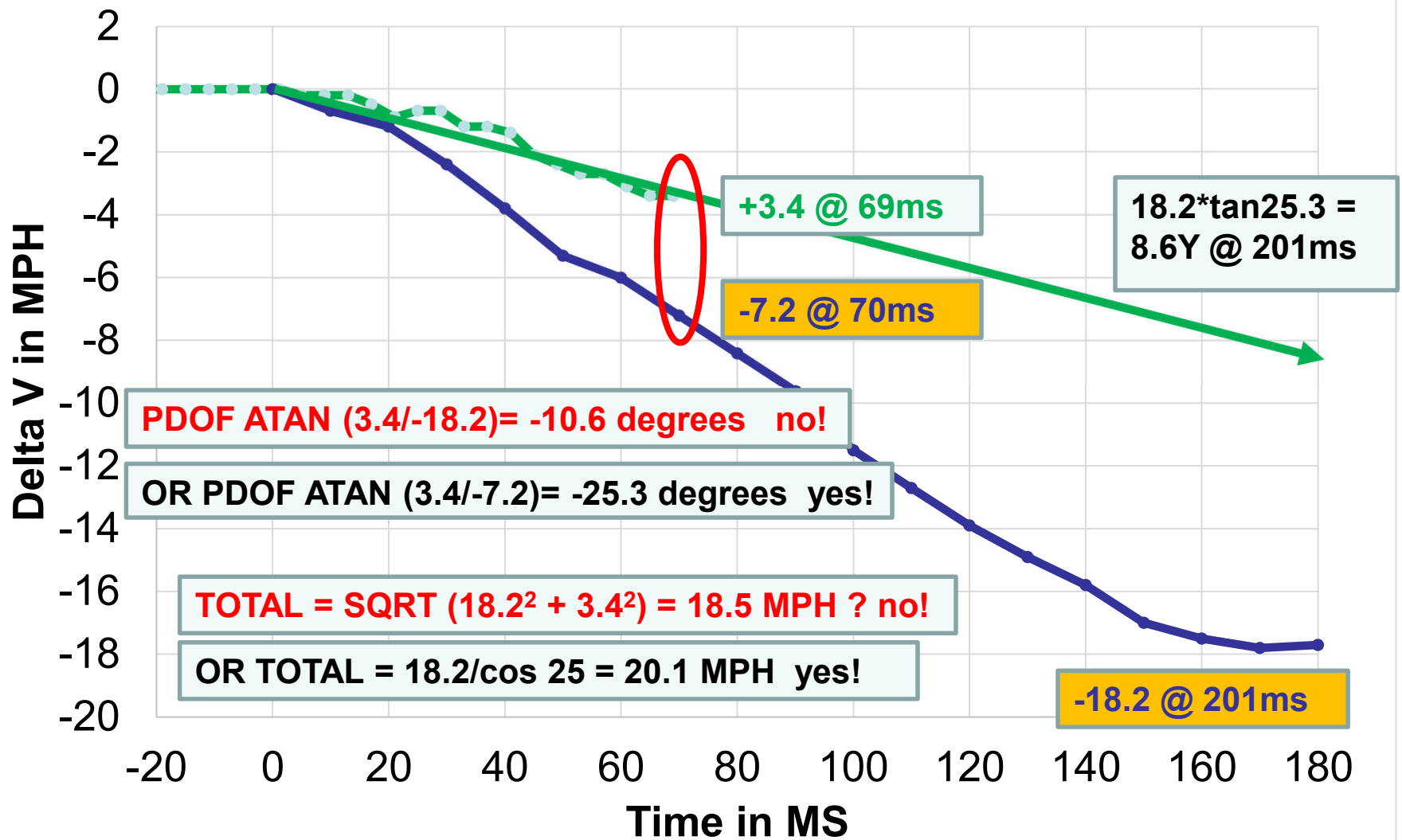


12 EDR Lateral Delta V -

Side Satellite Sensor 1



Lateral Delta V and Longitudinal Overlaid Sign of Lateral Reversed for Graphing Ease



Additional Freeze Frame Data in 2013+

- New “Vehicle Control History” feature in 2013+ Rav 4 and 2014+ Highlander & Lexus IS, 2015+ Lexus NX & RC, Camry, Corolla, Prius C, Prius V. 2016+ Avalon, Land Cruiser, Mirai, Prius, Tacoma, Scion iM, and Lexus ES, GS, LX, and RX. Likely in all now!
- 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. Now Lane Keep Assist, ICS, EDR too.
- Accessible with Toyota Techstream service tool (or Nexiq interface or CDR900) and Toyota service subscription software (days, month, or annual) (TSS 2.0 now out, new undocumented trigger #25 EDR).
- Data exports as CSV to Microsoft excel
- 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)**

TOYOTA Vehicle Control History and TSS Crash Avoidance										
			2013	2014	2015	2016	2017	2018	2019	2020
LEXUS			CHART IS INCOMPLETE (especially Lexus) AS OF THIS PRINTING							
	ES								GEN 4	
	GS		absense of TSS/LSS entries does not have significance, they are not filled in yet							
	GX									
	IS									
	LC									
	LS								GEN 4	
	LX									
	NX									
	RC									
	RX									GEN 4
	UX									
TOYOTA	4Runner									
	86									
	Avalon					TSS		GEN4		
	CH-R									
	Camry							GEN4		
	Corolla						TSS		GEN4	
	GR Supra									
	Highlander						TSS			
	iM									
	Land Cruiser									
	Mirai									
	Prius					VCH/TSS				GEN4
	Prius C (city hybrid)					VCH/TSS				
	Prius Prime (plug in hybrid)						VCH/TSS			
	RAV4									
	Sequoia							VCH/TSS/GEN4		
	Sienna							VCH/TSS		
	Tacoma							TSS		
	Tundra							VCH/TSS/GEN4		
	Venza									
	Yaris						TSS	VCH		

New “13 EDR” & “15 EDR”

- **13 EDR** Adds Lateral Accel data from ACM in frontal events for 200ms
(Fixes biggest drawback of **12 EDR**)

Longitudinal/Lateral Crash Pulse (Most Recent Event,

Time (msec)	Longitudinal Delta-V (MPH [km/h])	Lateral Acceleration for Frontal/Rear Crash, Floor Sensor (m/sec^2)	F
0	0.0 [0.0]	0.0	
10	0.3 [0.6]	-1.9	
20	0.5 [0.8]	0.0	

- 10ms interval
- $DV_{10ms} = \text{Accel} / 9.8 * (32.2 / 1.466) * 0.01s$
- Add up intervals to get total Delta V
- Template available to calculate it

New “17EDR” for Ped Protect

- “Front/Rear” events also triggered by 5mph Y DV or side deployment
- Y Delta V from ACM recording added to frontal events
- More precrash registers (6 vs 2 prior)
- More front/rear & side registers (4 vs 2)
- Separate side events still reported, but do NOT have precrash associated with them. Side events have detail of satellite sensors

NISSAN EDR's 19.3 (CDR 51%)

Model	Location	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Last 3 digits of Bosch CDR cable number																
INFINITI																
G CONVERTIBLE	TUNNEL BETWEEN SEATS			*			Jul-12		780							
G COUPE	TUNNEL BETWEEN SEATS		*	Yellow = Proprietary Consult Tool Only					780							
G SEDAN	TUNNEL BETWEEN SEATS		*	No direct to module cables				Jul-12	780							
M	TUNNEL BETWEEN SEATS								780							
Q30													780	780	780	780
Q40	TUNNEL BETWEEN SEATS										780					
Q50	TUNNEL BETWEEN SEATS								780	780	780	780	780	780	780	780
Q60	TUNNEL BETWEEN SEATS								780	780	780		780	780	780	780
Q70	TUNNEL BETWEEN SEATS								780	780	780	780	780	780	780	
EX	TUNNEL BETWEEN SEATS			Dealers do NOT have special software					780							
FX	TUNNEL BETWEEN SEATS			required to read EDR					780							
JX35	TUNNEL BETWEEN SEATS								780							
QX50-80	TUNNEL BETWEEN SEATS								780	780	780	780	780	50,60,80	50,60,80	50,60
QX30	TUNNEL BETWEEN SEATS								780				598	598	598	598
NISSAN																
		2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
370Z	TUNNEL BETWEEN SEATS		*				Aug-12		780	780	780	780	780	780	780	780
ALTIMA COUPE	TUNNEL BETWEEN SEATS			*					780	INCLUDED IN SEDAN BELOW						
ALTIMA SEDAN	TUNNEL BETWEEN SEATS		*	Yellow = Proprietary Consult Tool Only					780	780	780	780	780	780	780	780
ARMADA	TUNNEL BETWEEN SEATS	*		No direct to module cables					780	780	780	?	780	780	780	780
CUBE	TUNNEL BETWEEN SEATS				*				780	780						
FRONTIER	TUNNEL BETWEEN SEATS	*					Oct-12		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
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			
ROGUE, R SPORT	Check Manual			*					780	780	780	780	780	+Qashqai	780	780
SENTRA	TUNNEL BETWEEN SEATS		*						780	780	780	780	780	780	780	780
TITAN	TUNNEL BETWEEN SEATS	*							780	780	780	780	780	780	780	780
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		780	780	780					

Nissan Pre-Crash Data

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

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

Time Stamp (sec)	Speed, Vehicle Indicated (MPH [km/h])	Accelerator Pedal, % full	Engine RPM	Motor RPM	Service Brake (On, Off)	Steering 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

At AE

Hybrid/Electric or Trans Input
Trans input tells you *converters* slip

Table 2 – not req'd

Nissan Long ΔV Polarity Fixed?

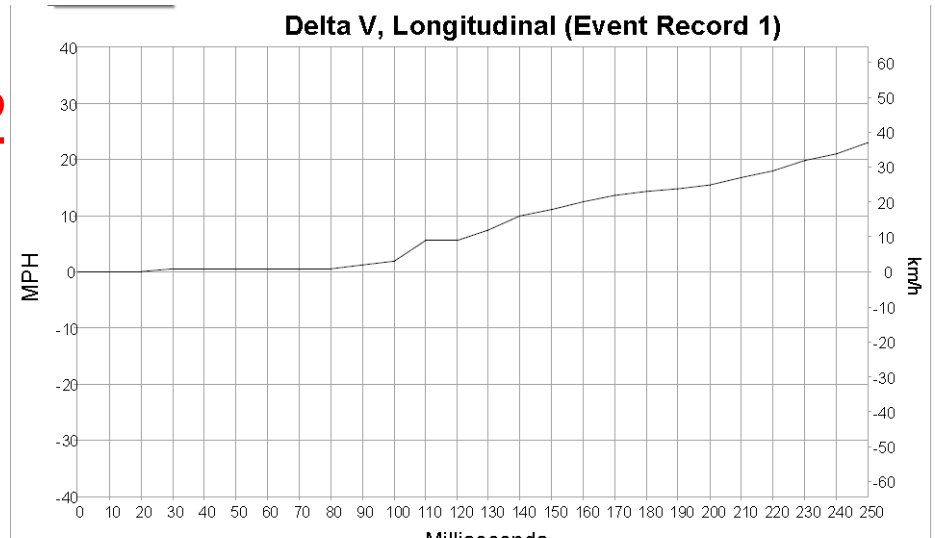
Front hit was positive - *Some exceptions still in 19.3!*

2013 Altima in CDR 12.2

System Status at Event (Event Record 1)

Front Air Bag Deployment Status	3 airbag inhibited
Maximum Delta-V, Longitudinal (MPH [km/h])	29 [47]
Time, Maximum Delta-V, Longitudinal (msec)	300
Maximum Delta-V, Lateral (MPH [km/h])	5 [8]
Time, Maximum Delta-V, Lateral (msec)	210
Maximum Acceleration, Longitudinal (g)	32.5
Time, Maximum Acceleration, Longitudinal (msec)	102.5
Maximum Acceleration, Lateral (g)	36
Time, Maximum Acceleration, Lateral (msec)	112.5

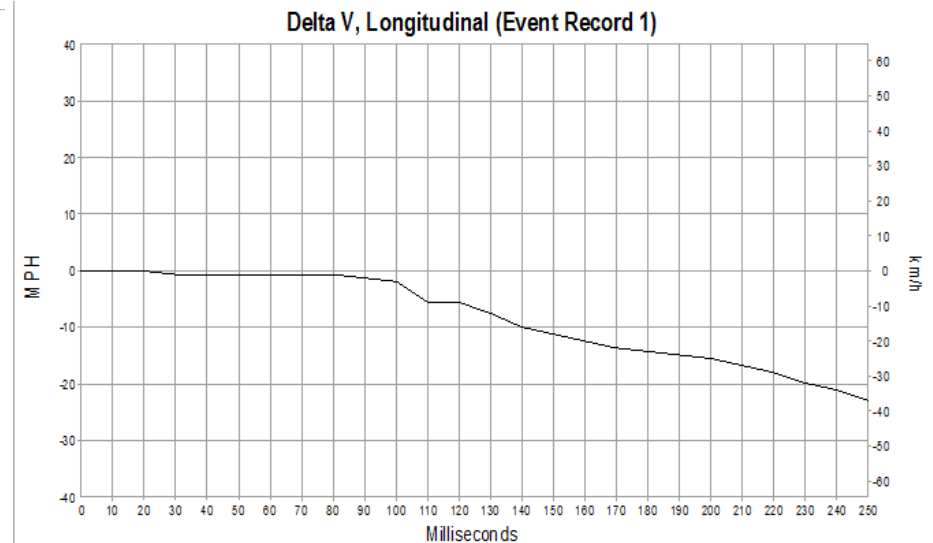
+29 at 300ms



2013 Altima in CDR 16.5

Maximum Delta-V, Longitudinal (MPH [km/h])	-29 [-47]
Time, Maximum Delta-V, Longitudinal (msec)	300
Maximum Delta-V, Lateral (MPH [km/h])	5 [8]
Time, Maximum Delta-V, Lateral (msec)	210
Maximum Acceleration, Longitudinal (g)	-32.5
Time, Maximum Acceleration, Longitudinal (msec)	102.5
Maximum Acceleration, Lateral (g)	36
Time, Maximum Acceleration, Lateral (msec)	112.5

-29 at 300ms



Nissan Recording Threshold

- Several files have been read with events under 5mph Delta V over 150ms.
- From 2013-2019 we believed all Nissans had a wakeup threshold of AE
- At 2020 EDR User Summit, it was reported that tests were done on a 2014 Highlander at low speeds. No events were created below 5mph Delta V, events were created over 5mph.
- Threshold could be model dependent!

Mazda CDR 19.3 Coverage 48%

Model	Location	Connector													
Last 3 digits of Bosch CDR cable number shown			<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>	
MAZDA		F-00K-108-			All Mazda use 387 adapter for direct to module										
CX-3	TUNNEL BELOW IP	Law Enforcement Contact Your Instructors - Data available from pre-CDR ACM's from Mazda or Mazda suppliers. Mostly Delta V.								812					
Tribute/CX-5	TUNNEL AFT SHIFTER					779				811	812				
CX-9	TUNNEL BELOW IP		778							811					
Mazda 2	TUNNEL AFT SHIFTER		792					not listed		812	not listed				
Mazda 3	TUNNEL AFT SHIFTER				779					811			843		
Mazda 5	TUNNEL BELOW IP				778						not listed				
Mazda 6	TUNNEL BELOW IP		792				779			811		831			
MX-5 Miatta	TUNNEL BELOW IP				no coverage					812					
CX-30															
Memo: The Mazda Tribute was sister to the Ford		F-00K-108-													
		226													
		F-00K-108-													
The source data for this chart is the Bosch CDR help file for Version 19.3															
Always consult the latest help file for the most accurate coverage															
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Typical Mazda Precrash Data

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

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

Time Stamp (sec)	Previous 22	Speed, Vehicle Indicated (MPH [km/h])	Engine Throttle, % full	Service Brake (On, Off)
-5.0	19	19 [31]	0	On
-4.5	17	17 [27]	0	On
-4.0	14	14 [23]	0	On
-3.5	12	12 [19]	0	On
-3.0	11	11 [17]	25	Off
-2.5	10	10 [16]	61	Off
-2.0	11	11 [17]	63	Off
-1.5	13	13 [21]	64	Off
-1.0	16	16 [26]	64	Off
-0.5	18	17 [27]	0	Off
0.0		4 [6]	0	Off

Minimum
Regulatory
Content

Recording
threshold
<5mph

This is a second event – last data pt at impact

Algorithm woke up early, missed later event Noted in newer Fords, Mazda & Kia/Hyundai



System Status at Event (Event Record 1)

Safety Belt Status, Driver	Belted
Safety Belt Status, Right Front Passenger	Unbelted
Occupant Size Classification, Front Passenger	Adult
Frontal Air Bag Warning Lamp (On, Off)	Off
Ignition Cycle, Crash	1892
Multi-Event, Number of Events (1, 2)	No. 1
Complete File Recorded (Yes/No)	Yes
Ignition Cycle, Download	1893
Maximum Delta-V, Longitudinal (MPH [km/h])	1.2 [2]
Time, Maximum Delta-V, Longitudinal (msec)	297.5
Maximum Delta-V, Lateral (MPH [km/h])	-1.2 [-2]
Time, Maximum Delta-V, Lateral (msec)	297.5
Time, Maximum Delta-V, Resultant (msec)	297.5

Deployment Command Data (Event Record 1)

Pretensioner Deployment, Time to Fire, Driver (msec)	250
Pretensioner Deployment, Time to Fire, Right Front Passenger (msec)	250
Frontal Air Bag Deployment, Time to Deploy/First Stage, Driver (msec)	250
Frontal Air Bag Deployment, Time to Deploy/First Stage, Right Front Passenger (msec)	250

Max Value
Mazda

Volvo CDR 19.3 Coverage 32%

<u>Model</u>	<u>Location</u>											
Last 3 digits of Bosch CDR cable number show		<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>
VOLVO		All Volvo use 387 Adapter for DTM images										
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 for this chart is the Bosch CDR help file for Version 19.3												
Always consult the latest help file for the most accurate coverage												
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Old Volvo
DV only
Law Enf
only call
Volvo

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

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

Time (sec)	Speed, Vehicle Indicated (MPH [km/h])	Accelerator Pedal, % Full (%)	Service Brake (On, Off)	Added Data for XC90		
				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

2016+ XC90 Sample Volvo File

System Status at Retrieval

Vehicle Identification Number	YV1LF
Application Diagnostic Database Part Number	31387255 AL
Ignition Cycle, Download	2,765
Lifetime Operating Timer (sec)	2,154,311

System Status at Event (Event Record 1)

Data Area Status, Event Record 1	Locked, Data Stored
Data Area Read Status, Event Record 1	Data Not Read
Complete File Recorded (Yes/No)	Yes
Multi-Event, Number of Events (1,2)	Event Number 1
Time from Preceding Event (sec)	Written but No Data Available
Maximum Delta-V, Longitudinal (MPH [km/h])	Clipped Value (at Max) < -62 [-100]
Time, Maximum Delta-V, Longitudinal (msec)	100
Maximum Delta-V, Lateral (MPH [km/h])	-19.9 [-32.0]
Time, Maximum Delta-V, Lateral (msec)	>300

Not present in 2013, Added for XC90

BMW CDR US 19.3 Coverage 42%

See help file for Rolls Royce

<u>Model</u>	<u>Location</u>										
Last 3 digits of Bosch CDR 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>
BMW	All BMW require 387 Adapter for DTM										
1 Series				Europe only not covered							
2 Series	Driver side, behind IP, rt of strg										
3 Series	Driver side, behind IP, rt of strg		796								
Active Hybrid 3	Passenger side, behind the glove box		796								
4 Series	Driver side, behind IP, rt of strg			796							
5 Series	Passenger side, behind the glove box		796						500/822		
6 Series	Passenger side, behind the glove box		796								
6 Series GT	See Service Manual								500/822		
7 Series	Passenger side, behind the glove box		796				500/796	500/822			
8 Series	Passenger side, behind the glove box								500/822		
X3 xDrive	Passenger side, behind the glove box		796								
X5	Center Tunnel, Between Seats			796					500/822		
X1, X2	Center Tunnel, Between Seats				798	500/798	500/807	also X2			
X3, X4	See Help File - Various				796				500/822		
X6	Center Tunnel, Between Seats				796						
X7	See Service Manual								500/822		
Z4	Center Tunnel, Under Dash				798				500/822		
i3, i8	See Service Manual	500-flex rev			500/807						

No "back model" coverage

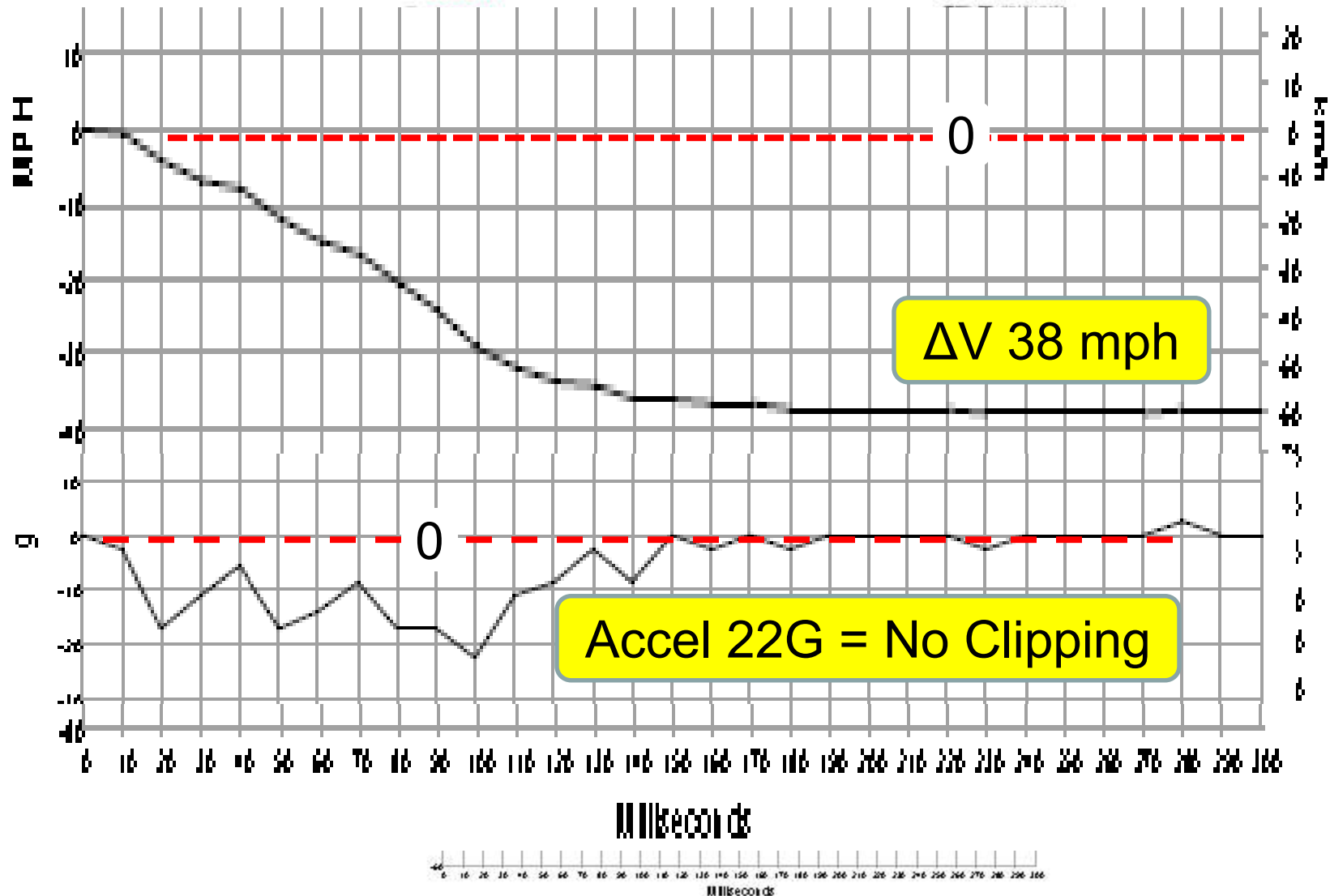
500=flex ray

BMW Sample Pre-Crash

Pre-Crash Data -5 to 0 sec (Record 1, Most 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 – Both ΔV & Accel



BMW EDR Evolution

- Basic EDR 2013
- “Extension” 2014
- Some driver assist mid-2015 - timing
- Auto Steering (autonomous vehicle)
Cameras all views 4 fps
Not intended for CDR,
only BMW can access

Clock and odometer in 2019 Mini Cooper

BMW Data before 2013?

- Text files in early 2000's BMW were retrieved by BMW w/proprietary tools (in German).
- One speed somewhere <2 sec to impact.
- No Delta V or Acceleration data.
- Time to airbag deployment(s) & software level
- System configuration & component serial #'s
- Diagnostics w/resistance checks of circuits
- Occupancy of seats and seatbelt use.

Mercedes CDR Coverage 19.2 36%

<u>Model</u>	<u>Start of Sales</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>
Last 3 digits of Bosch CDR DTM cable number									
Mercedes	EDR Start	All Mercedes use 387 adapter for direct to module downloads							
A-Class Limo								832	
AMG-GT					800				
B-Class EV	after 4/1/2014		598						
B-Class	after 6/2/2014			598					832 Limo
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		800				801 w steering data		
EQC								801 w s	
G Class	after 11/1/2014			598				801	
GL Class	after 7/11/2014			598	?	?			
GLA Class	after 6/2/2014			598					
GLC Class					598		801		
GLE Class					598				832
GLK	after 12/2013		800		?	?			
GLS Class					598				832
GT								801	
G wagon									801
Maybach S600					801				
ML-Class	after 7/11/2014			598	?				
S-class Sedan	after 9/2013		801						
S-Class Coupe	after 9/1/2014			801					
SL	after 12/2013		800						
SLC							800		
SLK	after 12/2013		800						
Sprinter								832	
Vito					598				
Smart & 2016 with "E"	after 9/1/2014			809					
Smart with VIN 4th "F"					820				
Smart for two, coupe, cabrio							820		
Metris							598		

No "back model" coverage

Mercedes Details

- Mercedes phased in EDR in anticipation of the NPRM requiring EDR's for Sept. 2014
- Precrash speed, brake, throttle (563 Table 1) & lat/longitudinal ΔV .
- Can hold 5 events, D's lock, ND's FIFO
- Recording threshold is 5 mph over 150ms
- Speed is avg. of 4 wheel speed sensors
- The new 2018 E Class has Steering, ABS, Stab Cont'l. This marks a departure from their philosophy to record only the minimum required by law.

Any EDR data in older Mercedes? NO

- Some diagnostic codes may include “freeze frame” data, but airbag codes don’t record speed. Some codes do.
- By the time those other codes get set after a crash, the speed is no longer the precrash speed.
- Mercedes will assist law enforcement. Call 1-88-4Mercedes.

VW/Audi Brands EDR

- EDR in 2014 EOS, most 2015+ VW/Audi.
- EDR was installed in anticipation of the US NPRM requiring EDR's by 9/1/2014, which was never implemented.
- **Bentley** has EDR 2016+.
- **Lamborghini** has EDR in Adventadore/Huracan
- **Porsche** NEVER implemented EDR.
- US only 2015-17, Worldwide 2018+ in transverse engine platforms

VW/Audi 19.2 US Coverage 34%

See help file for Rolls Royce

Model	Location	2009-13	2014	2015	2016	2017	2018	2019	2020
Last 3 digits of Bosch CDR adapter /cable number		2009-13	2014	2015	2016	2017	2018	2019	2020
All VW/Audi Require the 387 Adapter to read DTM			Gold = US only (Canada not covered)				Yellow=Worldwide		
VW									
Arteon	UNDER CENTER STACK						805		
Atlas	UNDER CENTER STACK						805		
Beetle	UNDER CENTER STACK			804			Canada added		
CC	UNDER CENTER STACK			804					
Crafter	UNDER CENTER STACK						805		
EOS	UNDER CENTER STACK		806						
Golf, eGolf	UNDER CENTER STACK			805			Worldwide		
Jetta	UNDER CENTER STACK			804			805		
Passat	UNDER CENTER STACK			804				500/826	
Polo	UNDER CENTER STACK						805		
Routan	UNDER CENTER STACK	785							
Sportwagen + Alltrack									
T-Roc	UNDER CENTER STACK							805	
T-Cross	UNDER CENTER STACK						805		
Tiguan	UNDER CENTER STACK			804		805			
Touareg	UNDER GEAR SELECTOR			804					
Touran	UNDER CENTER STACK						805		
AUDI				2015	2016	2017	2018	2019	2020
A1	Under Center Stack							805	
A3,S3	Under Center Stack			805					842
A4, allroad	Tunnel between 1st/2nd row seats			804		500/813			
A5, S5, RS5	Tunnel between 1st/2nd row seats			804			500/813		
A6, S6	Tunnel between 1st/2nd row seats			804			500/826		
A7, S7, RS7	Tunnel between 1st/2nd row seats			804			500/826		
A8, S8	Tunnel between 1st/2nd row seats			804			500/826		
Q2	Under Center Stack						805		
Q3	Under Center Stack			804				805	
Q5, SQ5	Tunnel between 1st/2nd row seats			804			500/813		
Q7	Under Center Stack					500/813			500/826
Q8	Under Center Stack						500/826		
R8	Under Center Stack					804			
TT, TTS						not covered at this time			
eTron	Under Center Stack							500/826	

Chrysler Minivan
Sister

No
“back
model”
coverage

VW/Audi Details

- Same data set for all event types
- Time from last precrash to AE noted
- Recorder holds up to 6 ND events in Chronological order.
- New modules will use Flex Ray
- Date/Time of Crash from clock (GPS if clock not set) in 2015+ Audi models, phasing into VW models

VW/Audi Details

- Modules live for 15 sec after power out
- Image time 1-5 minutes
- Pushbutton ignition – only 1 push to ACC
- Battery disconnect after serious crashes may force backpowering
- Must power ACM **and** gateway module

Threshold & Time between events (Five Overlaid)

System Status at Event (Record 5)

Event Counter at Event	1	2	3	4	5
Event Type	Frontal	Frontal	Frontal	Data Not Available	Data Not Available
Multi-Event, Number of Events	1. Event	2. Event	3. Event	4. Event	5. Event
Time from Initial Event to Current Event (msec)	0.0	306.0	608.0	1,275.0	1,327.0
Vehicle Clock, Date and Time at Event (YYYY-MM-DD, HH:MM)	2019-11-01, 19:50:40	2019-11-01, 19:50:41	2019-11-01, 19:50:41	2019-11-01, 19:50:41	2019-11-01, 19:50:43
Vehicle Mileage (km)	55,370	55,370	55,370	55,370	55,370
Operating Time (min)	80,639	80,639	80,639	80,639	80,639
Ignition Cycle at Event (Cycles)	5,265	5,265	5,265	5,265	5,265
Ignition Cycle at Download (Cycles)	5,271	5,271	5,271	5,271	5,271
Maximum Delta-V, Longitudinal (MPH [km/h])	-24.9 [-40]	-2.5 [-4]	0.0 [0]	1.9 [3]	1.9 [3]
Time, Maximum Delta-V, Longitudinal (msec)	300.0	290.0	75.0	300.0	300.0
Clipping Time, Longitudinal Acceleration Sensor (msec)	Clipping Not Reached	Clipping Not Reached	Clipping Not Reached	Clipping Not Reached	Clipping Not Reached
Maximum Delta-V, Lateral (MPH [km/h])	-7.5 [-12]	0.0 [0]	-0.6 [-1]	2.5 [4]	1.9 [3]
Time, Maximum Delta-V, Lateral (msec)	300.0	252.5	230.0	285.0	300.0
Clipping Time, Lateral Acceleration Sensor (msec)	Clipping Not Reached	Clipping Not Reached	Clipping Not Reached	Clipping Not Reached	Clipping Not Reached
Time, Maximum Delta-V, Resultant (msec)	300.0	300.0	230.0	297.5	300.0
Time from Last Speed Data Sample (Precrash) to Time Zero	110	304	2	335	283
Time from Time Zero to Algorithm Start (Front) (msec)	Algorithm Started at Time Zero	Algorithm Not Started	Algorithm Not Started	Algorithm Not Started	Algorithm Not Started
Time from Time Zero to Algorithm Reset (Front) (msec)	285	Algorithm Not Reset	Algorithm Not Reset	Algorithm Not Reset	Algorithm Not Reset
Time from Time Zero to Algorithm Start (Side) (msec)	7	196	Algorithm Not Started	Algorithm Not Started	Algorithm Not Started
Time from Time Zero to Algorithm Reset (Side) (msec)	Algorithm Not Reset	206	Algorithm Not Reset	Algorithm Not Reset	Algorithm Not Reset
Time from Time Zero to Algorithm Start (Rear) (msec)	3	Algorithm Not Started	Algorithm Not Started	Algorithm Not Started	Algorithm Not Started
Time from Time Zero to Algorithm Reset (Rear) (msec)	20	Algorithm Not Reset	Algorithm Not Reset	Algorithm Not Reset	Algorithm Not Reset
Time from Time Zero to Deployment (Rollover) (msec)	Algorithm Not Started	Algorithm Not Started	Algorithm Not Started	Algorithm Not Started	Algorithm Not Started
Time from Time Zero to Algorithm Reset (Rollover) (msec)	Algorithm Not Reset	Algorithm Not Reset	Algorithm Not Reset	Algorithm Not Reset	Algorithm Not Reset
Vehicle Identification Number (VIN)	WVWZZZ7JW162808	WVWZZZ7JW162808	WVWZZZ7JW162808	WVWZZZ7JW162808	WVWZZZ7JW162808
Part Number, ACM	5Q0959655BH	5Q0959655BH	5Q0959655BH	5Q0959655BH	5Q0959655BH
Supplier ID, ACM	TSR	TSR	TSR	TSR	TSR
Production Date, ACM	171117	171117	171117	171117	171117
Supply Voltage (Before Event) (V)	14.7	12.6	12.6	12.6	12.6
Complete File Recorded	Completed Successfully	Completed Successfully	Completed Successfully	Completed Successfully	Completed Successfully

Less than 5mph

110+500-(306-0)=304

304-(608-306)=2

2+1000-(1275-608)=335

335-(1327-1275)=283

TESLA



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

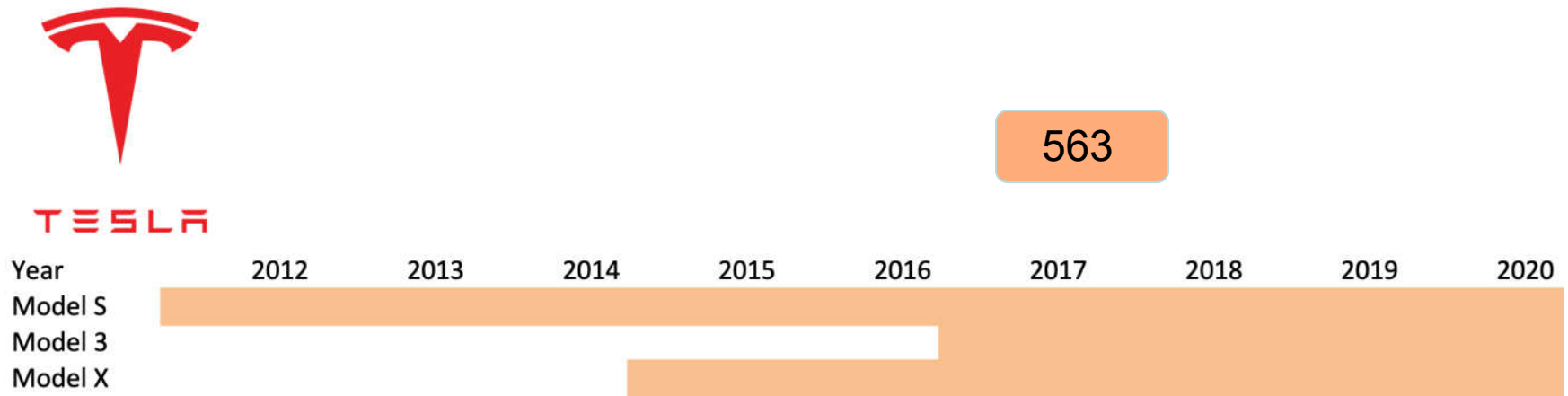
Tesla EDR

- Kit includes:
 - TIV-144: In vehicle cable for Tesla Model S and X
 - TIV-145: In vehicle cable for Tesla legacy Model S
 - TIV-996: In vehicle cable for Tesla Model 3
 - TD2M-601: Direct to Module cable for Tesla Model X and 3
 - TD2M-602: Direct to Module cable for Tesla Model S
 - TD2M-139: Direct to Module cable for Tesla Model S (NEW CABLE)
 - AC Power Adapter
 - PCAN-USB adapter
 - Hard Shell Case



COST: \$1200.00

Tesla EDR Coverage



TESLA

- More information is available on their website <https://edr.tesla.com>
- 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

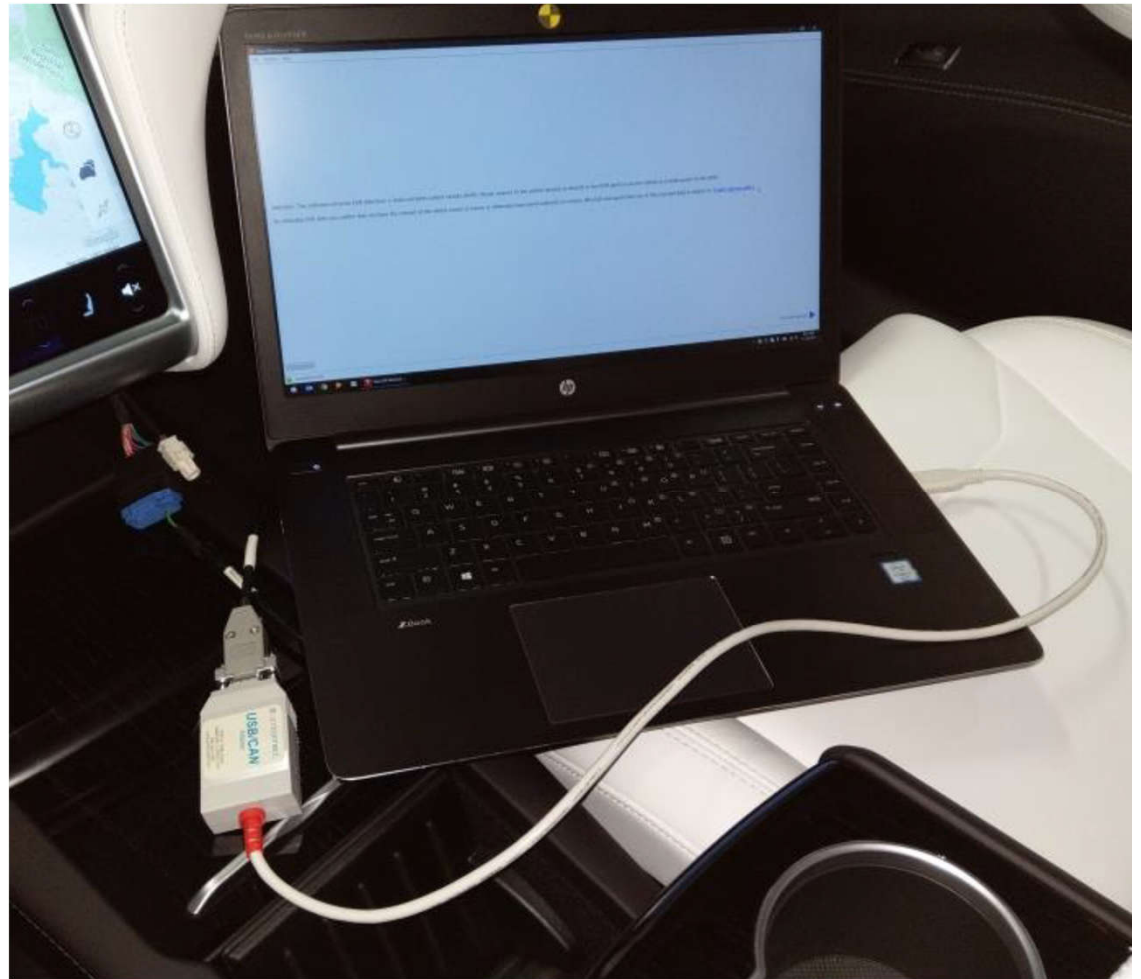
Download the Tesla EDR Retrieval Program

This free software program is used to retrieve EDR data.

DOWNLOAD

The Tesla EDR Tool

- Tesla provides the software free of charge on their website that installs on your laptop. No special computer is needed.
- 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.

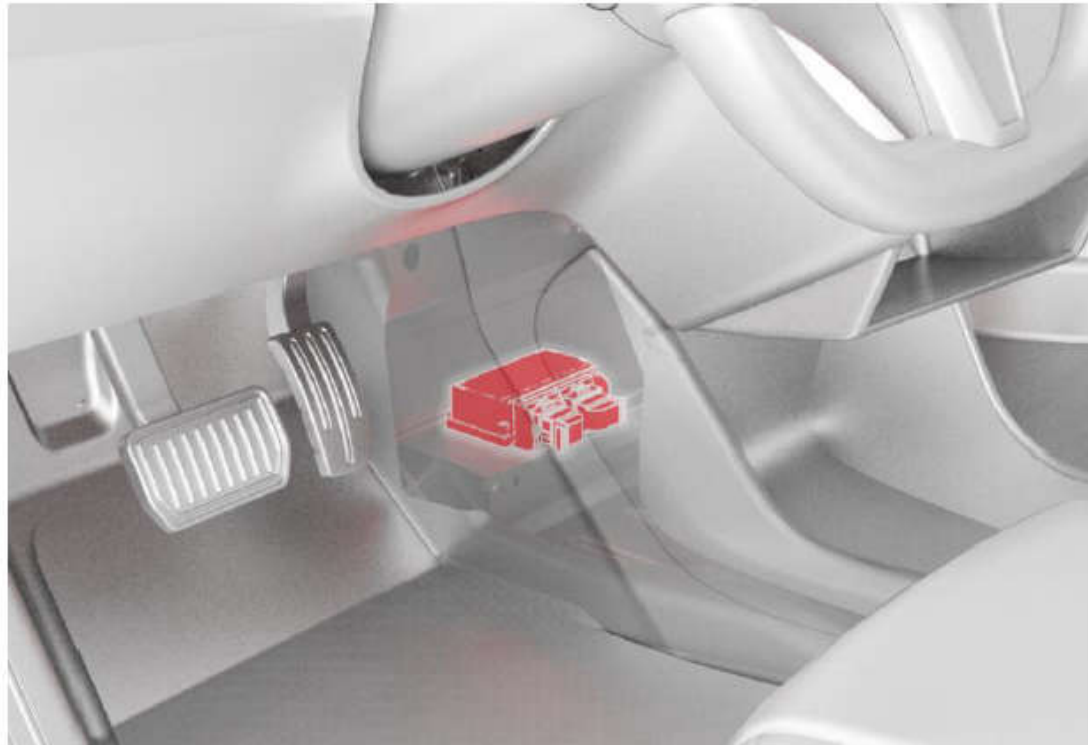


Plug in the PCAN adapter to the Body Harness. Model X and Model 3 are in other places & use a different connector described in Tesla's 27-page EDR guide at **edr.tesla.com/help**.



TESLA also has 3 direct to module connectors

If the In-Vehicle Connection procedure is unsuccessful, you might be able to connect to the RCM directly, and establish a direct-to-module connection. The RCM is located forward of the center console, below the instrument panel and center screen.



Some 2018 Model 3 Cables must be replaced

External Power must be used for DTM readouts

- Connect 12V power to the Tesla Model S Direct-To-Module EDR Retrieval Harness.

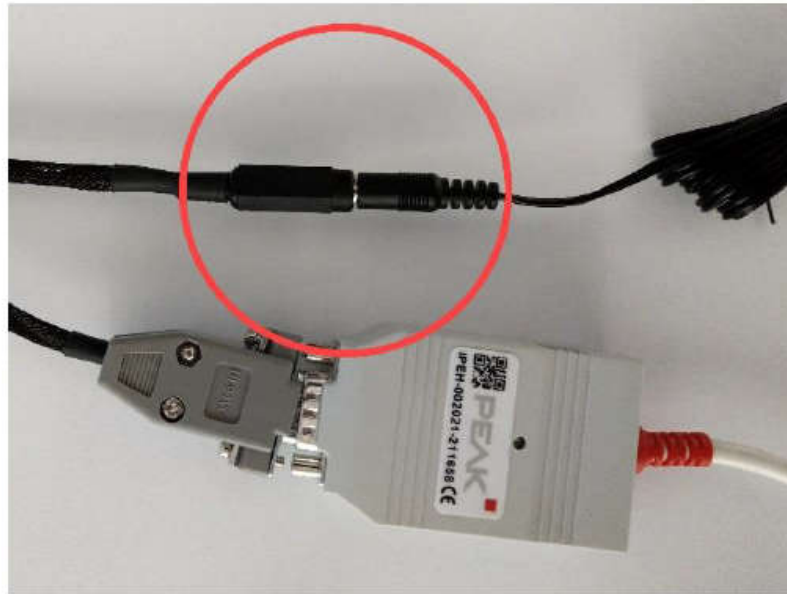


Figure 20. Connecting 12V power to the EDR retrieval harness

- Proceed to “Retrieve Data” on page 26 to complete the data retrieval procedure.

The Tesla 27-page Guide

- The Guide is VERY thorough and helpful
- It gives step by step instructions for the hardware assembly and to navigate the EDR program
- There are photographs of connector and module locations
- There are instructions for disassembly to get to the connectors and modules

Tesla EDR

- Data varies by model

Model	S	Model 3	X
Event Data			
Max X Δv	X	X	X
Time to X Max ΔV	X	X	X
Max Y Δv	X	X	X
Time to Y Max ΔV	X	X	X
Time to Max Resultant Δv	X	X	X
Ignition cycle Event	X	X	X
Ignition cycle runtime	X	X	X
Odometer at event	X	X	X
Driver Seat Track Position	X	X	X
Driver belt	X	X	X
Passenger Belt/Occupant	X	X	X
2nd row Belt/Occupant	X		X
3rd row Belt/Occupant			X
File Complete	X	X	X

Tesla EDR

- Data varies by model

	Model		
	S	3	X
PreCrash Data			
Vehicle Speed	2Hz	5Hz	2Hz
Accelerator Pedal	2Hz	5Hz	2Hz
Rear Motor Speed	2Hz	5Hz	2Hz
Service Brake	2Hz	2Hz	2Hz
Stability Control	2Hz	2Hz	2Hz
ABS	2Hz	2Hz	2Hz
Steering Wheel Angle	2Hz	10 Hz	10 Hz
Lateral Acceleration	Not Reported	10 Hz	10 Hz
Longitudinal Acceleration	Not Reported	10 Hz	10 Hz
Roll Rate	Not Reported	10 Hz	10 Hz
Yaw Rate	Not Reported	10 Hz	10 Hz

Tesla EDR

- Data varies by model

	S	Model 3	X
Crash Data			
Longitudinal Δv	300ms	300ms	250ms
Lateral Δv	300ms	300ms	250ms
Longitudinal Acceleration	500Hz (300ms)	2000Hz (60ms)	2000Hz (60ms)
Lateral Acceleration	500Hz (300ms)	2000Hz (60ms)	2000Hz (60ms)
Normal Acceleration	Not Reported	Not Reported	50Hz (1.4s)
Roll Angle	100Hz (6s)	Not Reported	Not Reported

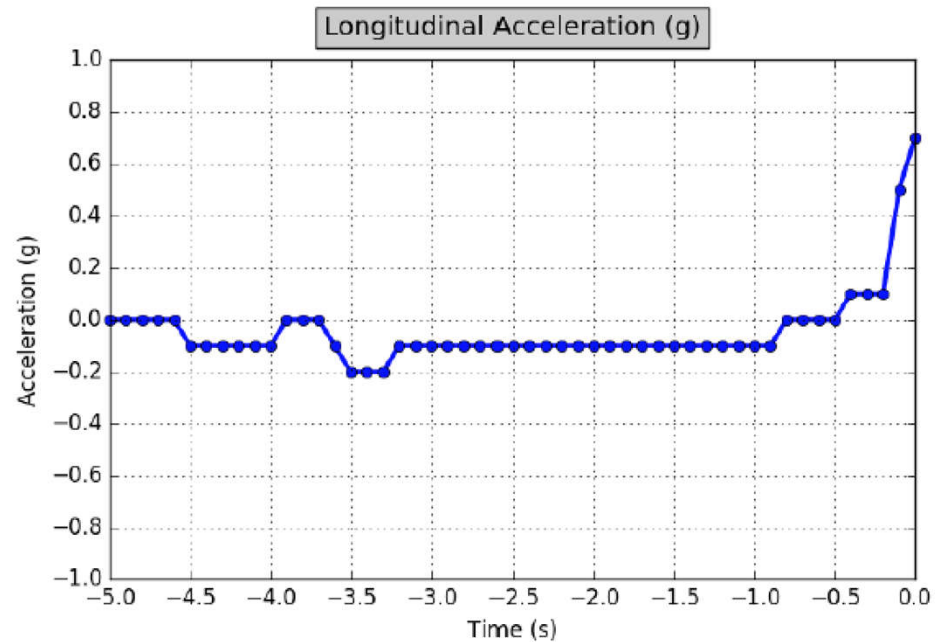
Tesla EDR Sample File

- Model 3 Data

Time (sec)	Service Brake	Stability Control	ABS Activity
-5.0	Off	Off	Off
-4.5	Off	Off	Off
-4.0	Off	Off	Off
-3.5	Off	Off	Off
-3.0	Off	Off	Off
-2.5	Off	Off	Off
-2.0	Off	Off	Off
-1.5	Off	Off	Off
-1.0	Off	Off	Off
-0.5	Off	Off	Off
0.0	On	Off	Off
-2.8	6.0	10.8	714
-2.6	6.0	10.8	714
-2.4	6.0	13.2	746
-2.2	6.0	14.8	784
-2.0	7.0	12.4	807
-1.8	7.0	12.4	845
-1.6	7.0	12.4	883
-1.4	7.0	11.2	905
-1.2	8.0	12.0	922
-1.0	8.0	10.4	941
-0.8	8.0	4.8	932
-0.6	8.0	0.0	916
-0.4	8.0	0.0	888
-0.2	8.0	0.0	843
0.0	7.0	0.0	749

Tesla EDR Sample File

- Model 3 Data



Time (s)	Acceleration (g)	Time (s)	Acceleration (g)	Time (s)	Acceleration (g)
-5.0	0.0	-3.2	-0.1	-1.4	-0.1
-4.9	0.0	-3.1	-0.1	-1.3	-0.1
-4.8	0.0	-3.0	-0.1	-1.2	-0.1
-4.7	0.0	-2.9	-0.1	-1.1	-0.1
-4.6	0.0	-2.8	-0.1	-1.0	-0.1
-4.5	-0.1	-2.7	-0.1	-0.9	-0.1
-4.4	-0.1	-2.6	-0.1	-0.8	0.0
-4.3	-0.1	-2.5	-0.1	-0.7	0.0
-4.2	-0.1	-2.4	-0.1	-0.6	0.0
-4.1	-0.1	-2.3	-0.1	-0.5	0.0
-4.0	-0.1	-2.2	-0.1	-0.4	0.1
-3.9	0.0	-2.1	-0.1	-0.3	0.1
-3.8	0.0	-2.0	-0.1	-0.2	0.1
-3.7	0.0	-1.9	-0.1	-0.1	0.5
-3.6	-0.1	-1.8	-0.1	0.0	0.7
-3.5	-0.2	-1.7	-0.1		
-3.4	-0.2	-1.6	-0.1		
-3.3	-0.2	-1.5	-0.1		

Troubleshooting

- Some users report a “time out” error when trying to read data. The vehicle is going back to sleep.
Putting your foot on the brake pedal and keeping it there for the whole readout keeps the vehicle alive.
- Low battery power accentuates the time out problem.
Tesla NEMA 5-15 adapter?



- Or see the Help Guide for information how to backpower through the First-Responder loop.

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.

[LOG IN](#)

[Create a MyTesla account](#)

Worried about report conversion being biased by Tesla?

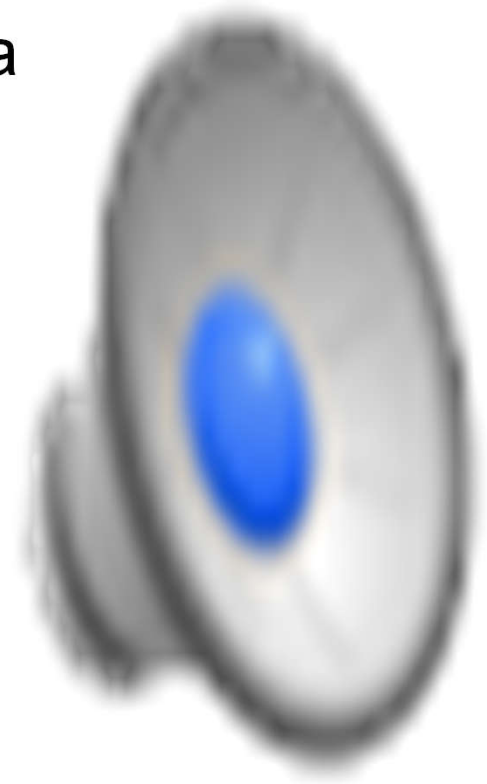
- Data is Encrypted.
- The report is returned IMMEDIATELY.
There is no time for Tesla to alter any data to Tesla's benefit.
- However, some clients insist that no one has a copy of the data except them.
- There is a "Save without VIN sequence" option to de-identify data
- There is no alternative.

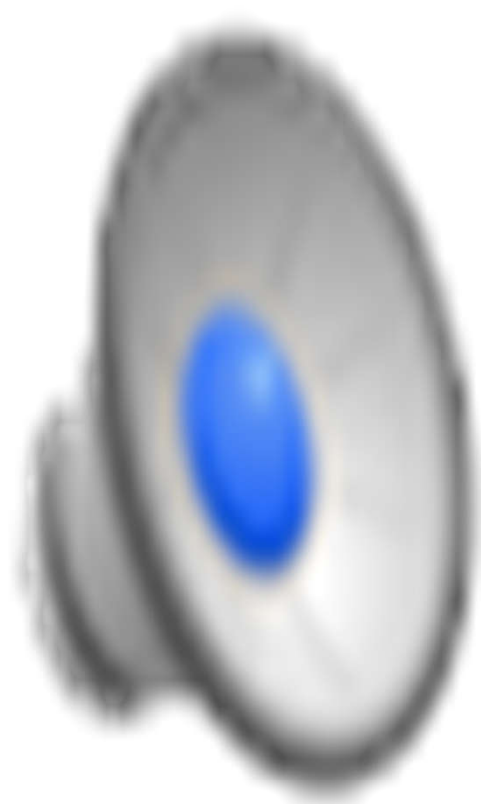
What about OTHER data Tesla Data Records?

- Most of the time you will NOT NEED to access the other data Tesla records, the EDR should be sufficient. But if you need a longer time history, Tesla records MANY data parameters every one second plus, when anything electronically monitored happens. It gets uploaded to the cloud.
- It is NOT an “event” data recorder, it is a continuous recorder (does **NOT** meet Part 563 definition of a data recorder) (so **NO** PUBLICLY AVAILABLE tool to read it)
- Law Enforcement contact Tesla and demonstrate proper legal authority
- Tell them what you are interested in (they have so much you have to narrow it down)

What about OTHER data Tesla Data Records?

- Modern Tesla have recorded video that can be uploaded to Tesla
- This data can be retrieved from Tesla
- Contact legal@tesla.com





Other sources for Tesla equipment

- www.edrfinder.com has developed their own independent Tesla hardware kit. (They are affiliated with one of the Bosch CDR distributors for Europe, and are located in Germany)
- It utilizes the same interface PCAN-USB adapter
- They have made an adapter from the PCAN adapter to a Bosch CDR DLC cable and the Bosch 783 direct-to-module cable
- They still have to make a special cable for the Delphi DTM cable
- Assuming you have a CDR system, this system is lower cost because it has fewer parts
- Introductory pricing is \$695

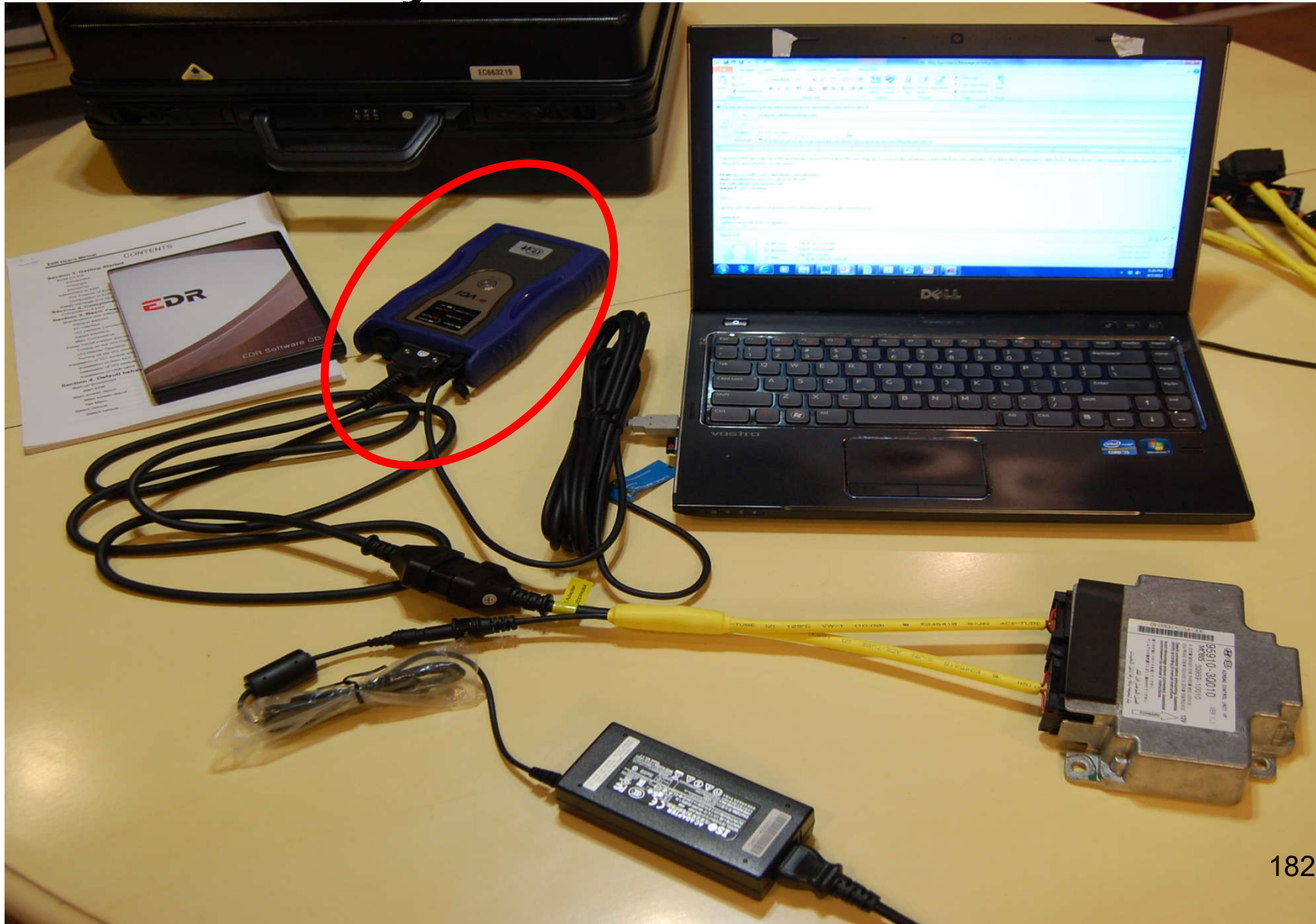
Hyundai/Kia Tools

- 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 G0Z**H**DMN001 **\$6450 does not include software.**
- GIT now also sells Kia tool, (was Snap On), order part GIT0Z**K**DMN001 **\$6950 + tax+ship**
- Software updates **\$495/yr** per brand from GIT Tool Company. Software V#35 Hyundai/ V#34 Kia released 3/10/2020. New \$1120 CAN-FD adapter for GV80.
- Dan Portillo dportillo@gitamerica.com (888) 549-4977
- **Different version of tool for Korea and non-US markets.**

Additional Info

- K/H Interface modules are identical, but you must buy both to get software for both. Software updates won't download unless the correct interface module is attached to your laptop.
- I read K/H modules for others for \$500. More people are buying Hyundai kits now that we have 7+ model years on the road, only a few own Kia tool.

The Hyundai EDR Reader



Hyundai/Kia Tool Info (not new)

- The tool “officially” only reads 2013 and later models – software requires VIN input and locks out 2010-2012.
- But it communicates with several 2010-2012 models.
- However, your report will say you told the software it is a 2013.
- Admissibility must be presented skillfully (get help). **Data successfully admitted in Virginia, Florida, and California.**

Kia/Hyundai GIT Tool V30/31

[illegible]

New GENESIS brand

- The Luxury brand of Hyundai
- G80 and G90 models. G70 new for 2019.
- Read with Hyundai data recorder tool
- New GV80 will require CAN-FD adapter
attached to interface (\$1180 part)

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.
- Recommended: **Secure module** as evidence

K/H 2010-2012 data reliability?

- In 50+ NHTSA crashes, speed, delta V and belt use appear OK (one exception)
- Steering angle, and accel data appear implausible on some
- Key cycles at download not in all models
- SAE 2014-01-0502 has details.
- Additional testing on 2012 Soul reported in SAE 2015-01-1445.

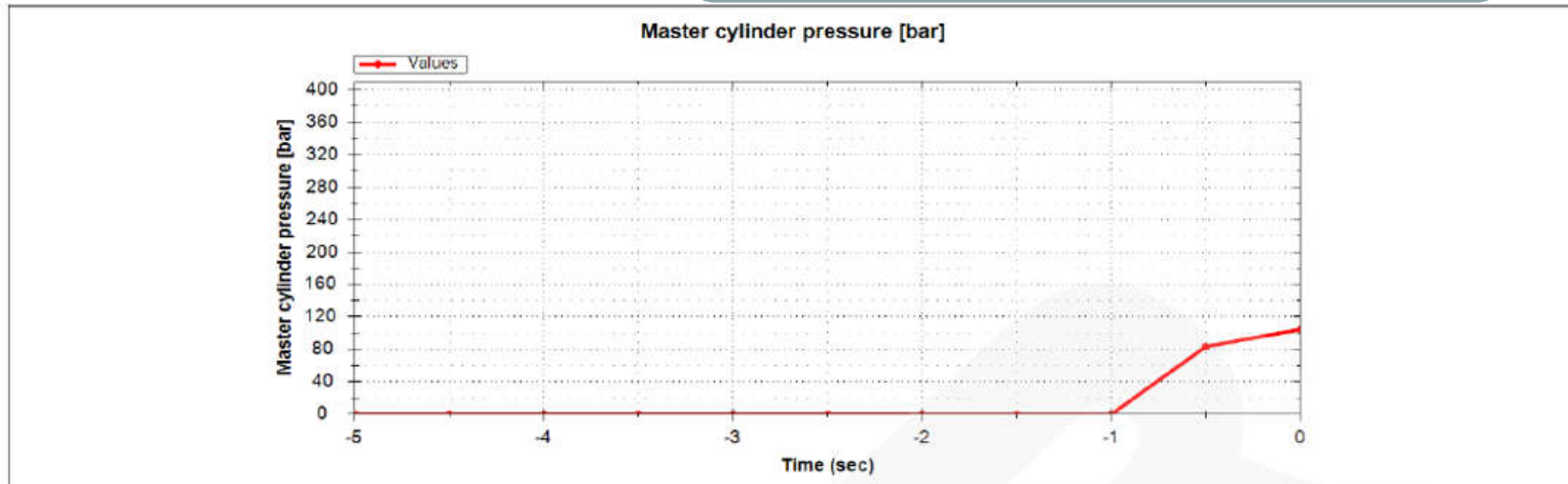
Brake Pres. added to 2019 Forte

Page Movement | Show | Zoom | Macros

< Event 1 >

Master cylinder pressure

Units in Bars. 1 Mpa=10 bars
Toyota max scale is 12 Mpa=120
bar



Num	Time (sec)	Master cylinder pressure [bar]
1	-5.0	0.2
2	-4.5	0.2
3	-4.0	0.2
4	-3.5	0.2
5	-3.0	0.2
6	-2.5	0.2
7	-2.0	0.2
8	-1.5	0.2
9	-1.0	0.2
10	-0.5	83.7
11	0.0	104.6

Other Non-Bosch CDR Tools

<div>Law Enforcement: Ask Subaru dealer to help you with my tutorial</div>		2012	Nov YTD		
		Nov YTD	US Market	2013	
		<u>SALES</u>	<u>SHARE</u>	<u>EDR?</u>	<u>Tool?</u>
SUBARU	Bosch coverage starts	299,788	2.3%	YES	Denso DST-i
Dealer scan tool \$2835 plus software \$1835/mfr (905)669-4812					
New Denso tool from Nuspire required for 2016+, \$6K, \$2700 software/yr					
MITSUBISHI	Bosch coverage starts	53,677	0.4%	YES	OTC tool co
Panasonic Touchpad + software \$6395, annual \$1200/yr, 888 727 6672					
JAG/LAND ROVER (Tata Motors India)		49,452	0.4%	YES	OTC/Bosch SPX
Full dealer scan tool, Toughbook & software approx \$5000					
SAAB		480	0.0%	YES?	Hitachi HDS-3000?
Hitachi HDS-3000		software \$1835 for Saab			

Subaru EDR Availability

Hitachi HDS-3000

CDR900

Denso DSTi Interface

SSM3 Software

SSM4

CDR 19.1 on some

<u>Model</u>	<u>Year</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>
SUBARU			<----Yellow=Old Hitachi SSM3 or new Denso w SSM4 Blue = SSM4 ONLY New Denso Tool								
Ascent										CDR 835	
BRZ (Scion FRS sister)		Japan	Yes SSM3	Yes	Yes	Yes	SSM4	Yes	Yes		
			For BRZ you can use CDR - select Toyota as Brand but enter Subaru VIN - it will work								
Impreza	No	Yes SSM3	Yes	Yes	Yes	SSM4	Yes	Yes	Yes		
WRX/STI	No	No	No	No	Yes SSM3	SSM4	Yes	Yes	Yes		
Legacy	No	No	Yes SSM3	Yes	CDR 836 Bosch ECU						
Outback	No	No	Yes SSM3	Yes	CDR 836 Bosch ECU						
Forester	No	No	Japan	Yes SSM3	Yes	Yes	SSM4	Yes	CDR 835		
Tribeca	No	No	No	No	Discontinued						
Crosstrek	n/a	n/a	Yes SSM3	Yes	Yes	SSM4	Yes	Yes	Yes		

NOTE: The Subaru tool is a dealership fault code tester made to work in thru the DLC in vehicles with functioning electrical systems only.

Instructors may be able to fabricate a direct to module cable from a vehicle side connector

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Subaru EDR Tools

- Bosch CDR 900 reads 2015+ Legacy/Outback and 2019+Forester/Ascender. **CDR 19.4 is expected to cover more (expected end March)**
- 2016+ Subaru went to a new Denso DSTi diagnostic interface with SSM4 software from Nuspire. Tool + 1st year software sub now \$5.8K/yr, is compatible to '04. Software sub \$2700/yr.
- Denso is reverse compatible with 2012-2015 Models but uses the older SSM3 software.
- SSM3 allows data to be saved as a CSV file. There is no PDF report and no data limitations

Subaru

- The Dealer tool (DSTi) is sold as DLC only. The electrical system must be working, or you must backpower both ACM and DLC fuses, or put ACM in surrogate vehicle.
- Tutorial on Subaru available my website and your reference thumb drive
- 2016+ SSM4 software does not have a PDF or CSV output – must be viewed in software (Requires MANY screen shots to document readout – or a good screen video capture software on laptop)

Subaru DTM Cables Available

ATTENTION:
 GENERAL MANAGER ☐
 PARTS MANAGER ☐
 CLAIMS PERSONNEL ☐
 SERVICE MANAGER ☐

IMPORTANT - All
 Service Personnel
 Should Read and
 Initial in the boxes
 provided, right.



QUALITY DRIVEN® SERVICE

SERVICE BULLETIN

APPLICABILITY: 2013MY and Later Legacy and Outback
 2014MY and Later Forester
 2012MY and Later Impreza 2.0L NA
 2013MY and Later XV Crosstrek
 2013MY and Later BRZ
 2015MY and Later WRX and WRX STI

NUMBER: 17-17-13R

DATE: 03/18/13

REVISED: 12/15/17

SUBJECT: Event Data Recorder (EDR) Function of Airbag Module

INTRODUCTION

NOTE: The Airbag systems used on previous and current WRX, STI and Tribeca models are NOT equipped with EDR functionality.

CDR cable 835 for 2019 Ascender & 836 for 2015+ Outback now available

Test harnesses required to access EDR data from the airbag control module along with current pricing are available from SPX / Kent-Moore (1-800-345-2233). Use the new harness applicability table below.

Description	Part Number	Applicability
EDR HARNESS	98299FJ040	2013-14MY Legacy / Outback
		2012MY and Later Impreza
		2013MY and Later Crosstrek
		2015MY and Later WRX and STI
		2013MY and Later BRZ
	98299AL040	2015MY and Later Legacy / Outback

2 in 1 2013 cable \$1060, new 2015 Outback cable is \$3K

Subaru BR-Z

- Is a sister/clone of a Scion FS-R and Toyota 86
- Data is same as other Toyotas but Subaru presents in different format in Subaru SSM
- Data is very different than other Subaru's
- **Bosch CDR accepts Subaru BRZ VIN under Toyota brand.**
- **Bosch CDR used on a 2017 BRZ gave steering data, the official Subaru tool did not!**

MITSUBISHI 0.5% market share

- Bosch CDR now covers 2011+ Outlander Sport, 2014+ Outlander & 2017+ Mirage Cross. ***More expected in 19.4 at end March 2020.***
- Pre-Bosch Mitsubishi EDR only tool based on dealership a Panasonic **Touch**pad. Cost to \$6380.
- The kit is made to work only on vehicles with a functioning electrical system thru the **DLC**.
- 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).
- Some incomplete files retrieved (no data).
- Bug in V33 of software prevented converting .csv file into report format – now fixed

Mitsubishi EDR's

Some use CDR, some use private tool

Model	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2
Eclipse (PS Platform)	Part MU141170 4/2005 to 8/2011		Proprietary EDR Tool		Production ends 8/2011								
Eclipse Spyder Conv.		?	Data in deployments only?										
Eclipse Cross (SUV)										837 Bosch CDR			
Endeavor SUV (PS Platform)		?			Production ends 8/2011 replaced by Outlander								
Galant (PS Platform)		?				Production ends 8/2012							
iMiEV		Not sold in US				No gateway module							
Lancer		2.3 sec@0.1 deploys only	Part 288 11-12 read w CDR as Caliber			ETACS gateway. Part A307-308 thru 2015					Production Ends		
Lancer Evolution		?	or send to Mitsu										
Lancer Sportback		?											
Mirage (subcompact)		Not in production				No gateway module							
Outlander SUV (GF platform) & PHEV		A208 Read w/CDR as Caliber	A208/A304 mix. A208 5 sec@0.1. Deploy only. Read as 09 Caliber.			ETACS gateway			838 Bosch CDR				
Outlander Sport, RVR, AS				838 Bosch CDR									
Raider pickup (Dodge Dakota sister)		Bosch CDR supported cable 228 (2007 -2010)	Not in production						Bosch cables 839 and 840 released in anticipation of future coverage - Mirage & Lancer??			196	

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 interval₁₉₇

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).
- Requests to insur@jaguarlandrover.com
- **They are now referring requesters to suppliers.** (call to find out who supplier is)
- Some Mid 2000's have **PCM data** (when Jag/LR was owned by 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.
- This is the first known instance of a manufacturer that had an EDR pulling the EDR out.

Newly published research

- Every year at the SAE World Congress in April new research is presented.
- A very brief summary follows, I encourage you to read these papers.
- Other good sources of EDR info include Collision Magazine and Accident Reconstruction Journal.

EDR SAE Papers 2020

2020-01-1327 Performance of Event Data

Accuracy of Speed Change Measured by Event Data Recorders during Oblique Offset Frontal Impacts by by Curtat, Wilkinson, Siegmund (MEA Forensic)

2020-01-1328 Evaluation of General Motors Event Data Recorder Performance in Semi-Trailer Rear Underride Collisions by Famiglietti, Fatzinger et al (Momentum Engineering)

2020-01-TBD Analysis of Honda Accord EDR Data for Low- to High Speed Impact Severities by Crosby/Skiera/Bare (Exponent)

2020-01-1329 Further Non-deployment and Deployment Laboratory Experiments Using a Toyota Auris 2007 Event Data Recorder by Tabone (Univ. of Malta)

EDR SAE Papers 2020

Heavy Truck EDR's

2020-01-1326 Chip and Board Level Digital Forensics of Cummins Heavy Vehicle EDR's **by Daily (Colorado State), Disogra (Delta V)**

2020-01-TBD International Truck EDR Data Anomalies by Grimes (CEA), Wilcoxson, Austin, Cheek, Plant, & Steiner

Regulatory Update

- NHTSA issued NPRM in Dec 2012 to **require** 563-EDR's by Sept 2014 (past!)
- NPRM proposed EDR as FMVSS 405, OEM's would have to self certify EDR's. Strong OEM objections were filed.
- Officially withdrawn Feb 2019 (Fed Reg'tr)
<https://www.federalregister.gov/documents/2019/02/08/2019-01651/federal-motor-vehicle-safety-standards-event-data-recorders>

Mfrs are NOT expected to remove EDR's

Regulatory Update

- NHTSA/IIHS got 10 auto mfrs to agree on 9/11/2015 to making **Auto Emergency Braking (AEB)** standard (timeline 2022). Voluntary commitment is a relatively new strategy by NHTSA. Now 20 have agreed.
- Next big issue is Autonomous Vehicles (self driving cars).
- States are drafting conflicting regulations on type of certification required – could hinder development.

EDR admissibility update

- “Every year EDR evidence is admitted at the trial level in hundreds of cases and we never hear about them.” - Prosecutor Bill Melkonian at the 2014 CDR User’s Conference Legal Update. **No change.**
- Warrants now required, admissibility shifts to Probable Cause for getting that warrant.
- Smaller battles on 2010-2012 Kia/Hyundai, Nissan 2006-2012, **unsupported Ford PCM’s.**
- **Delaware Daubert hearing accepted EDR!**
- **See new Ruth presentation for prosecutors**

EDR read before Privacy Act?

- Florida vs Worsham recent 2016 decision holds that warrant was still required before Driver Privacy Act. Court likened EDR to cell phones or tablets (we disagree). Went to appellate level.
- Worsham circumstances were unusual, police read module without warrant then applied for one. Judge denied the warrant since readout was already complete.

Crash Data Retrieval Update Mar 2020 End



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