Event Data Recorder Use in Traffic Crash Reconstruction Level 1

EDR Court ADMISSIBILITY

Dec 2020

Legal Disclaimer

- Your instructors are not lawyers and cannot give legal advice.
- Your instructors can share their experiences which may or may not apply to your state or local circumstances.
- Consult your prosecutor or client attorney for specific rules in your jurisdiction.
- If your lawyers are not yet familiar with EDRs', provide them with this chapter as a starting point of typical legal issues that come in cases involving EDR's.

EDR Data Admissibility Challenges

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

Was the EDR data obtained legally?

The Driver Privacy Act of 2015

- Effective 12/4/2015, President Obama signed US HR22 and it became law.
- The relevant section of HR22 is called “The Driver Privacy Act of 2015.”.
- The following slides offer a summary of the law. The full text is available in student reference materials.

The Driver Privacy Act of 2015

First, the Privacy Act of 2015 addressed data ownership –

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

The Driver Privacy Act of 2015

Next, the Privacy Act addressed data privacy -

To access EDR data you must have

a) written, electronic, or recorded audio consent of the vehicle owner or long term lessee,
b) or a search warrant or other court order.

There are additional exceptions for first responders (think Emergency Medical Services) and traffic safety researchers.

The Driver Privacy Act of 2015

So, what does the Driver Privacy Act mean to you?

• If you previously always collected data in criminal cases with a search warrant it likely has no impact on your practices.

• On the other hand, if you live in a locale where no warrant was required, it would appear that the Driver Privacy Act of 2015 now requires that you obtain one.

•For civil cases, realistically the owner controlled access to the vehicle and you could not read EDR without their implied consent granting you access. The new law requires more formal consent (written, email, or recorded audio consent). Make sure your client gets this consent for you before reading the EDR.

More Restrictive US State Laws

- 17 States have EDR laws: AR, **CA**, CO, **CT**, DE, ME, MT, NV, NH, NY, NJ, ND, **OR**, TX, UT, VA, WA).
- Details at http://www.ncsl.org/research/telecommunications-and-information-technology/privacy-of-data-from-event-data-recorders.aspx
- ***Most*** are consistent with the new federal law. Utah required permission of OWNER ***at the time of the crash*** versus the insurance company owning salvage.
- AR, MT, ND, OR restrict insurance ability to require consent as part of settlement. VA forbids insurance cancellation or rate increase if consent is not given.

More restrictive State Laws

- In addition to CA 9951 on EDR, there is a "**California** Electronic Communications Privacy Act" SB178. While inspired by cell/text record access, the language says it applies to "Electronic device information from an electronic device". Pretty broad.
- Provides new requirements for the **form of a search warrant** targeting electronic information
- **Notice to the target** must now be given for any search warrant that targets electronic communication or device information - **Suppression** is a remedy
- In an abundance of caution, Irvine CA police notify the driver, the owner at the time of the crash, and the current owner before accessing EDR data

More restrictive State Laws

Connecticut General Statute 14-164aa

- The individual who is the registered owner or lessee of the motor vehicle at the time the data is retrieved, obtained or used, or the individual's representative, consents in writing

  (Note Federal Law permitted electronic consent)

- Any person who retrieves "shall not further disclose such data", **except** if the identity of the registered owner, lessee, operator or other occupant is not disclosed.

  (Better save without VIN sequence number!)

- No person may knowingly alter or delete data on an event data recorder, or knowingly destroy an event data recorder, after a crash event that resulted in a death or a serious physical injury, within a reasonable amount of time sufficient for a peace officer to obtain a search warrant.

No 2020 Activity posted as of 4/18/2020

2019 Legislation

MASSACHUSETTS H.B. 3672

Status: Pending

*After a crash event involving an **autonomous** vehicle that is being operated or tested on a public way, **no person shall knowingly destroy, corrupt, alter or delete data** on the autonomous vehicle's event data recorder, or knowingly destroy or impair the autonomous vehicle's event data recorder, **until a sufficient amount** **of time has passed to allow law enforcement a reasonable opportunity to obtain a search warrant** for the purpose of obtaining evidence relating to the crash event.*

(INSTRUCTOR NOTE: SIMILAR TO CONNECTICUT PROVISION FOR REGULAR EDR's)

NEW JERSEY S.B. 573

Status: Pending

Requires disclosure of data recording devices in motor vehicles, limits access to recorded data.

Module Read Prior to Driver Privacy Act?

- **What if your EDR data was read prior to the Driver Privacy Act effective date?** Or you are not in the US?
- We believe the **laws** in your jurisdiction that were **in effect at the time** of your investigation prevail.

- A 2018 appellate decision in Missouri recently decided warrants were required even **before** the Driver Privacy Act went in to effect. MO v West, 4/17/2018.

- Again, we are not lawyers. We refer you to your local legal counsel.

FL v Worsham 2017

- Before Dec 2015 US Driver Privacy Act in effect
- Police read EDR without warrant – then applied for warrant, warrant denied since box was already read. (You can't make this stuff up).
- Trial court exclusion upheld on appeal.
- "Increasing privacy concern trend with electronic devices like cell phones."
- Court likened EDR to cell phones (bad)
- Equipment & trng needed to download made EDR different than tire/brake inspections.
- Effect: Warrant needed even before Dec. 2015

US Case Law Prior to Driver Privacy Act

NY v Christmann 2004

- SDM downloaded without warrant, used to determine speed at impact.
- Court refers to NY v Quackenbush (1996) re: conducting mechanical inspection of vehicle – safety equipment "subject to extensive government regulation"
- Diminished expectation of privacy, "overwhelming state interest in investigating fatal accidents"
- Not like a container search, no opportunity for police to manipulate SDM data
- Use of EDR data **upheld** on appeal

Probable Cause: FL v Abbey 2010

- Abbey's corvette was going straight when oncoming victim turned left in front of him in a 40 mph zone
- Affidavit for warrant says both vehicles travel over 125 ft post impact, physical evidence indicates speed >70
- Warrant granted
- Original trial court rules **"the ..affidavit ..did not contain specific and sufficient facts to establish probable cause** that a crime had been committed and that the evidence of that crime would be found in the defendant's vehicle. Speed alone was insufficient."

Probable Cause: FL v Abbey 2010

- "The task of the issuing magistrate is simply to make a practical, common-sense decision whether, given all the circumstances set forth in the affidavit before him, including the `veracity' and `basis of knowledge' of persons supplying hearsay information there is a fair probability that contraband or evidence of a crime will be found in a particular place. And the duty of reviewing courts is simply to ensure that the magistrate had a `substantial basis for ... concluding' that probable cause existed.“
- Trial court should show “great deference” to the magistrate’s decision
- Excessive ***speed is a major factor*** in finding the crime of vehicular homicide occurred and therefore is relevant to proving the felony was committed.
- Appeals court reversed trial court and ***allowed EDR evidence to be admitted***

Florida District Court of Appeals, 4th district, 4D09-88

Probable Cause: MA v Zimmerman

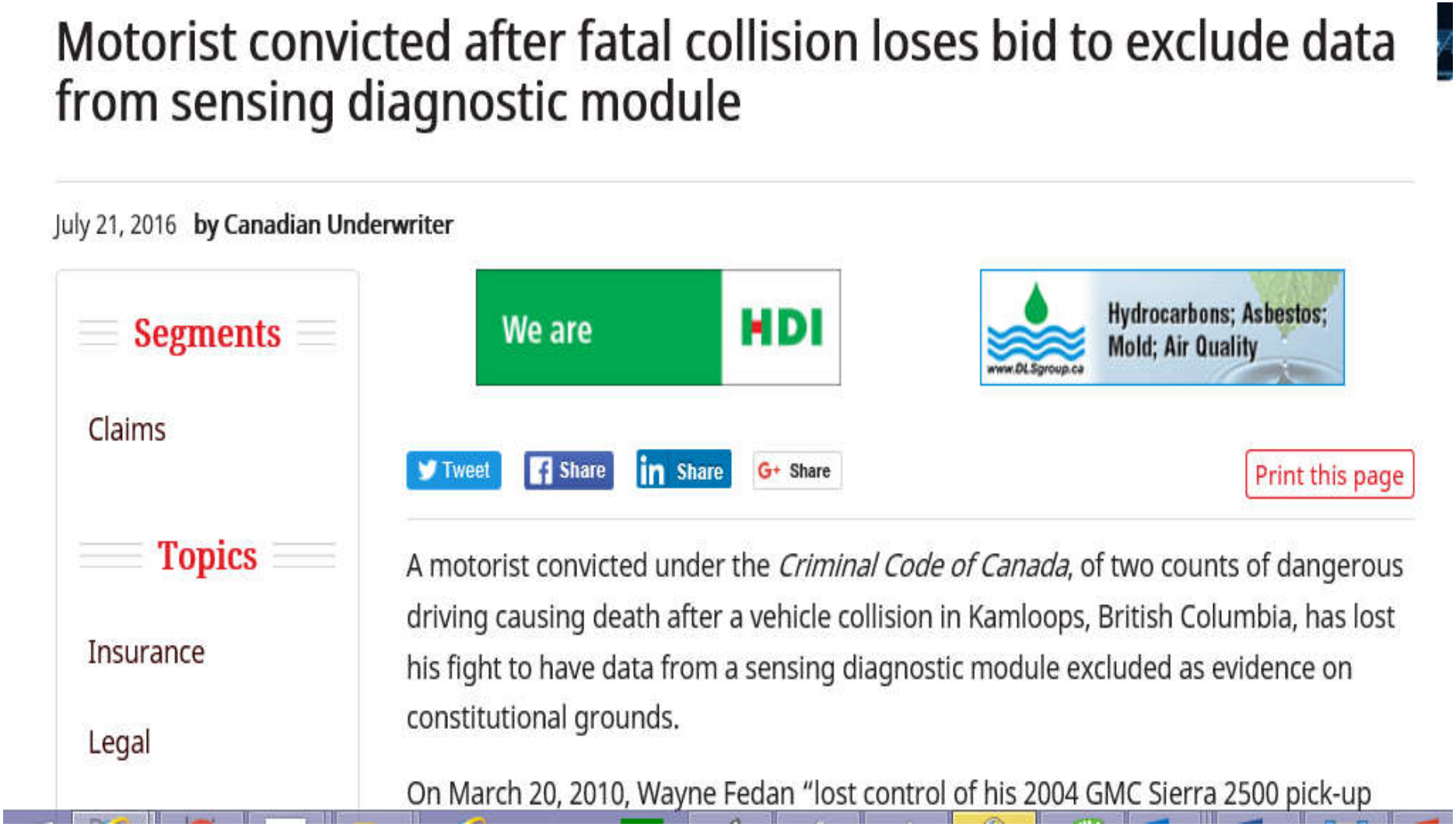
- Homicide case, 02 Yukon lost control on snowy road, slid off road and impacted a tree killing the passenger. Defendant claimed 20-30 mph speed.
- Investigating Officer told judge he had reason to believe vehicle was not operating safely and prudently for conditions based on his experience and that EDR was likely to contain relevant evidence, & got warrant
- EDR showed 58 mph at -5.

Probable Cause: MA v Zimmerman

- Defendant appealed two trial court rulings
  1) Whether a Warrant was necessary
  2) Affidavit for warrant established probable cause
- Appeals court ruled **while officer did not articulate probable cause explicitly**, his training and experience and accident facts were sufficient to establish probable cause, & EDR had evidence
- Court did not decide if a warrant was necessary since it was obtained and probable cause was established.

Canadian EDR Law

Some jurisdictions permit warrantless searches



Motorist convicted after fatal collision loses bid to exclude data from sensing diagnostic module

July 21, 2016 **by Canadian Underwriter**

Segments

Claims

Topics

Insurance

Legal

A motorist convicted under the *Criminal Code of Canada*, of two counts of dangerous driving causing death after a vehicle collision in Kamloops, British Columbia, has lost his fight to have data from a sensing diagnostic module excluded as evidence on constitutional grounds.

On March 20, 2010, Wayne Fedan "lost control of his 2004 GMC Sierra 2500 pick-up

Other EDR Access Considerations

- The police's authority to conduct warrantless searches in the US before Dec 2015, or elsewhere, may be affected by **how soon** after the crash the search occurs.

- The more **immediate** the search occurs following the accident, particularly if ON SCENE, the greater the officers' authority to conduct a warrantless search.

- Exigent circumstances and concern about data overwriting or loss during vehicle transport to impound have been cited in the past.
- Again, check with your attorneys

US EDR Regulatory Status

- 49 CFR Part 563, does not require EDR's, defines EDR's, requires any car equipped with EDR to have minimum standardized content on vehicles produced after 9/1/2012.
- Accuracy specified is only required within the range of the sensor, but effective 9/1/2015 if the sensor range is exceeded, data must include WHEN it was.
- A Notice of *Proposed* Rulemaking **NHTSA-2012-0177-0001** was published 12-13-2012 to require EDR's by 9/1/2014, and upgrade 49CFR 563 to an FMVSS 405. FMVSS requires self certification and could require recalls to fix EDR's that do not meet the safety regulation. Proposal was rescinded Feb 2019

Worldwide Regulatory Status

- Korea and Japan have voluntary EDR regulations similar to US 563. Korea coverage now has its own market code in Bosch CDR.
- China is actively developing an EDR regulation
- Transportation Research Laboratory did a study in 2014 recommending EDR's be made mandatory for European Union in 2020. No evidence that has been implemented is available at present.
- More manufacturers are going worldwide.

Evidence Preserved Properly?

- OK v Ingram CF-2006-403 – court ruled to suppress EDR evidence
- State kept a PDF copy of the CDR report but lost the ".cdr" raw data file so it could not be re-interpreted in the latest version of CDR
- "State did not make a bonafide good faith effort to maintain the integrity so it could be tested by the defense …heightened ten times by the fact that these additional updates could have obtained more information that could have been highly relevant".

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Was the recording from my Event?

- Vailes v. Desoto Parish (LA) Police Commission
  Case No. 494,553-B 13 May 07
- 2000 Pontiac Sunfire loses control and hits bridge guardrail, crashes through and goes in to river. Airbags do not deploy. Lawsuit says the guardrail was insufficient, defendant used -5 speed of 45 mph to say deceased was speeding and no guard rail could have withstood the impact
- CDR report had only ignition cycles at event of 7883

From my event?

- CDR report had ignition cycles at event of 7883 (no current ignition cycle count)
- Both parties agreed to create a new event in the SDM to get the current key cycle count. It was 7907, or 24 key cycles more than the first event
- Only 5 key cycles could be accounted for
- The data was **ruled inadmissible** on the grounds it could not be established it was from the event of interest.

Source: Jim Harris, www.harristechnical.com

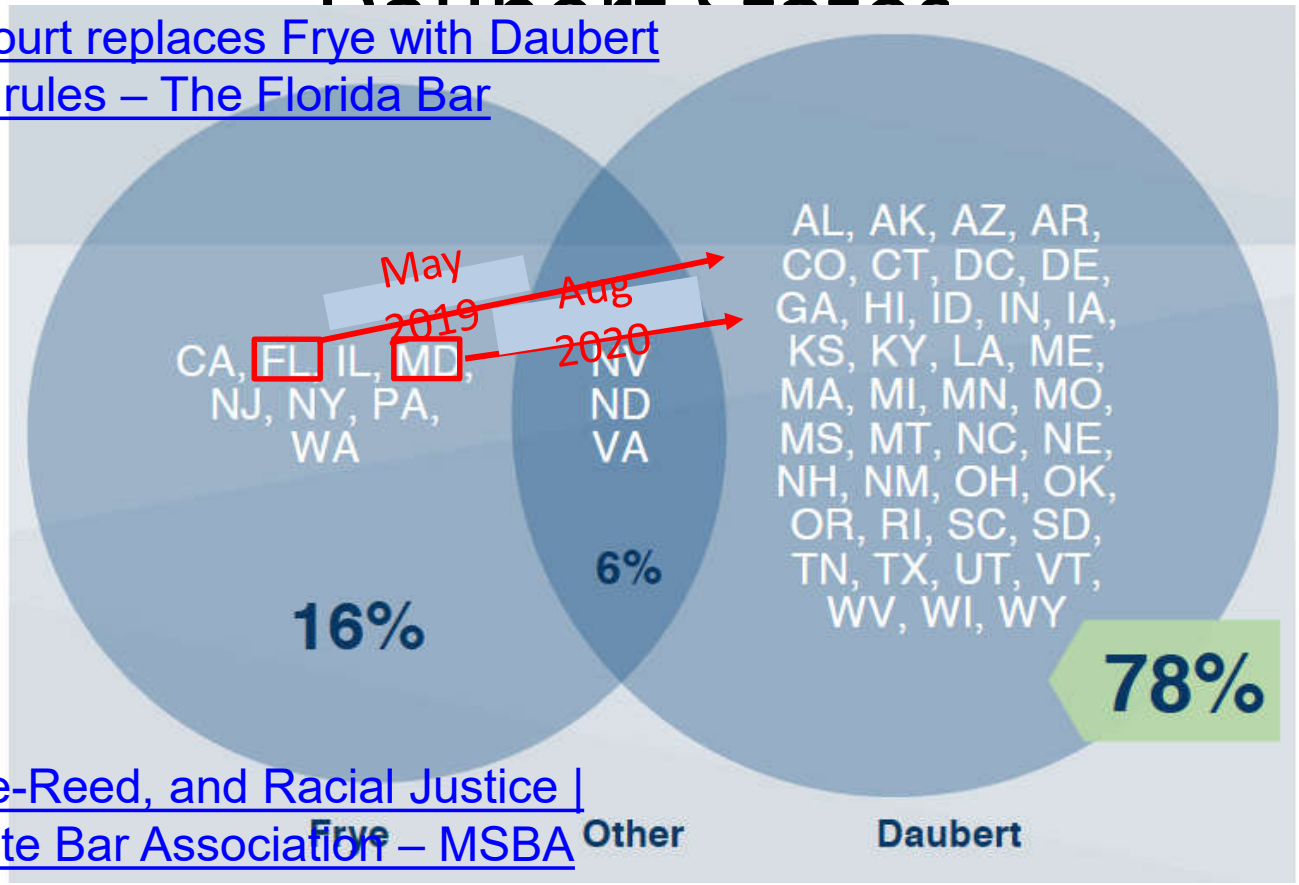
EDR Data Admissibility

- Data may be challenged on the grounds it does not meet the standard for reliability.
- Acceptance Criteria:
  - **Frye** (older criteria, still used in about 8 US states)
  - **Daubert** (based on newer US Federal Rules of Evidence, used in 39 states)
  - 3 states use a hybrid of both

If one side objects to the admission of EDR data, the judge must conduct a hearing on whether the evidence can be admitted.

CH. 10 admissibility update- Frye vs Daubert States

[Supreme Court replaces Frye with Daubert in evidence rules – The Florida Bar]



[Daubert, Frye-Reed, and Racial Justice | Maryland State Bar Association – MSBA]

U.S. "Frye" Standard

- Frye only applies if the judge decides the EDR is "**new or novel**" scientific evidence.
- If new, is it "sufficiently established to have gained ***general acceptance*** in the particular field in which it belongs"
- The first EDR case to address this was **Bachman** v General Motors, *776 N.E.2d 262,* 281 (Ill. App. Ct. 2002).

Bachman v GM (civil suit)

- Bachman claimed his airbag should have deployed in an accident
- GM used the SDM Delta V information to show the airbag was not required to deploy
- Bachman sought to keep the SDM data out

Bachman v. Gen. Motors, 776 N.E.2d 262, 281 (Ill. App. Ct. **2002**).

"We agree with the trial court that the process of recording and downloading SDM data does **not** appear to constitute a **novel** technique or method. . . . Crash sensors such as the SDM have been in production in automobiles for **over a decade**, and the microprocessors that run them and record their data also run everyday appliances, such as computers and televisions."

Bachman v. Gen. Motors, 776 N.E.2d 262, 281 (Ill. App. Ct. 2002).

The Bachman court went on to find *in the alternative* that the SDM data **satisfied the *Frye* test** for admissibility. *Id. at 282-83.*

Note the Bachman SDM was limited to longitudinal Delta V data

Florida v. Matos (Appeal)

CASE NO. 4D03-2043 – Opinion 3/30/2005

The court cited BACHMAN, and ruled:

"We agree on both points. The process of recording and downloading SDM data is **not a novel technique** or method. In any event, the state demonstrated that when used as a tool of automotive accident reconstruction, the **SDM data is generally accepted** in the relevant scientific field, warranting its introduction."

Note Matos SDM included precrash speed data

Daubert v. Merrell Dow Pharmaceuticals (92-102), 509 U.S. 579 (1993).

- Based on the Federal Rules of Evidence
- Determined "General Acceptance" could exclude new but reliable scientific information
- Created additional guidance for judges on how to determine if new scientific evidence is reliable.

Link to decision:
http://supct.law.cornell.edu/supct/html/92-102.ZO.html

U.S. "Daubert" criteria for evaluating the admissibility of expert testimony:

1. Whether the methods upon which the testimony is based are centered upon a **testable** hypothesis;
2. Whether the method has been subject to **peer review & publication**
3. The known or potential **rate of error** associated with the method;
4. The existence of Standards controlling the technique's operation
5. Whether the method is **generally accepted in the relevant scientific community (same as Frye)**

Source: decision records

1. Tested or Testable Hypothesis

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

2. Published and Peer Reviewed

- Chidester “Recording Automotive Crash Event Data” at Intn’l Symposium on Transportation Recorders-1999
- Lawrence “The accuracy of pre-crash speed captured by event data recorders” SAE 2003-01-0889.
- Niehoff “Evaluation of Event Data Recorders in full system crash tests” 19th International Technical Conference on Enhanced Safety of Vehicles (2005).
- **Gabler et al, “Preliminary Evaluation of Advanced Air Bag Field Performance Using Event Data Recorders”** NHTSA 2008 Report DOT HS 811 015
- Tsoi et al, “Validation of Event Data **Rec**orders in High Severity Full-Frontal Crash Tests”, SAE 2013-01-1265
- 49CFR Part 563 published 2006 effective 9/1/2012
- Additional publications listed at end of this section.

3. Known Error Rate – (Speed)

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

4. Existence & Maintenance of Standards

- The National Highway Traffic Safety Administration (NHTSA) issued final rule 49CFR Part 563 in 2006 setting minimum content, resolution, and accuracy for EDR data elements, effective 9/1/2012.
- The Society of Automotive Engineers (SAE) published recommended practice J1698 for EDR's in 200X, recently updated.
- The International Standards Organization has has an EDR document.

5. General Acceptance

- Auto manufacturers install EDR's and rely upon the EDR data to investigate field concerns and to give feedback to product development on current product performance to influence future designs.
- In 1997 the National Transportation Safety Board called for EDR's to be installed in all vehicles (REFERENCE "H97-18").
- National Highway Traffic Safety Administration (NHTSA) estimated that 65 to 90 percent of new vehicles already had some type of recording capability in 2004. In 2017, 99% of all new cars and light trucks are equipped with an EDR.
- NHTSA proposed requiring EDR's in all cars by 9/2014 (still pending).

5. General Acceptance cont'd

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

Additional Considerations

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

Use EDR as stand alone evidence?

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

Use EDR as Stand Alone evidence?

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

EDR Stand Alone?

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

Summary

- EDR evidence has been admitted in the vast majority of cases. It meets Frye standards but should not have to since it is no longer novel, and meets Daubert standards.
- CDR data has not been excluded to this author's knowledge on the basis that it was unreliable.
- It has been excluded for case specific reasons such as lack of an expert to validate it, unqualified experts, improper evidence preservation, or because the recording was not from the event of interest.

Latest Challenges

- A Kentucky criminal defendant has challenged admissibility because NHTSA ODI is investigating (EA 19-001) 12 million TRW ACM's in Kia/Hyundai, FCA, Toyota, Honda and Mitsu for potential non-deployment due to electrical overload of a front sensor circuit. The ACM may not communicate with CDR if the receiving chip (ASIC) inside the ACM gets fried.
- Front sensor electrical overload has nothing to do with EDR's. The EDR is still reliable.

EDR Accuracy References

1. Chidester A., Hinch J., Mercer T. & Schultz K. "Recording automotive crash event data", Proceedings of the International Symposium on Transportation Recorders, 1999.
2. Lawrence J., Wilkinson C., Heinrichs B., Siegmund G., "The accuracy of pre-crash speed captured by event data recorders", SAE 2003-01-0889.
3. Niehoff, P., Gabler, H., Brophy, J., Chidester, A. and Ragland, C. "Evaluation of Event Data Recorders in Full Systems Crash Tests", Proceedings of the 19th International Technical Conference on Enhanced Safety of Vehicles, Washington, D.C. June 6-9, 2005), Paper No. 05-0271-O.
4. Ruth, R., West, O, Engle, J. and Reust, T. "The Accuracy of Powertrain Control Module Event Data Recorders", SAE 2008-01-0162.
5. Ruth, R, and Reust, T., "Dynamic Accuracy of Powertrain Control Module (PCM) Event Data Recorders During ABS Braking", Collision Magazine, Spring 2008.
6. **Gabler et al, "Preliminary Evaluation of Advanced Air Bag Field Performance Using Event Data Recorders"** NHTSA 2008 Report DOT HS 811 015
7. Ruth, R. and Reust, T. "Accuracy of Selected 2008 Chrysler ACM EDR's During Braking" Collision Magazine, Spring 2009.

EDR Accuracy References cont'd

8. Reust, T, Morgan, J. and Ruth, R, "Using Ford PCM Data to Evaluate Deceleration Rates, Brake Time and Impact Speeds", Collision Magazine, Spring 2009
9. Ruth, R, West, O and Nasrallah, H "Accuracy of Selected 2008 Ford Restraint Control Module Event Data Recorders" SAE 2009-01-0884.
10. Ruth, R and Reust, T "Accuracy of Selected 2008 Chrysler Airbag Control Module Event Data Recorders", SAE 2009-01-0887
11. Takubo, N et al, "Study on Characteristics of Event Data Recorders in Japan" SAE 2009-01-0883
12. Ruth, R and Brown, T "2009 Crown Victoria PCM EDR Accuracy in Steady State and ABS Braking Conditions" SAE 2010-01-1000
13. Ruth, R, Brown, T and Lau, J, "Accuracy of EDR During Rotation on Low Friction Surfaces" SAE 2010-01-1001
14. Bortolin, R et al, "Chrysler Airbag Control Module (ACM) Data Reliability" SAE 2010-01-1002

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15. Bare, C et al "Analysis of Pre-crash Data Transferred Over the Serial Data Bus and Utilized by the SDM-DS Module" SAE 2011-01-0809

16. Ruth, R, and Daily, J "Accuracy of Event Data Recorder in 2010 Ford Flex During Steady State and Braking Conditions" SAE 2011-01-0812

17. Ruth, Daily, and Bartlett, "Accuracy of Event Data in the 2010 and 2011 Toyota Camry during Steady State and Braking Conditions", SAE 2012-01-0999

18. Brown, R. et al, "Evaluation of Camry HS-CAN Pre-Crash Data", SAE 2012-01-0996

19. Brown, R et al, "Confirmation of Toyota EDR Pre-crash Data", SAE 2012-01-0998 .

EDR Accuracy References cont'd

20. Tsoi et al, "Validation of Event Data **Rec**orders in High Severity Full-Frontal Crash Tests", SAE 2013-01-1265
21. Diacon et al "Accuracy and Characteristics of 2012 Honda Event Data Recorders from Real-Time Replay of Controller Area Network (CAN) Traffic", SAE 2013-01-1264
22. Wilkinson, et al. "The Accuracy and Sensitivity of 2005 to 2008 Toyota Corolla Event Data Recorders in Low-Speed Collisions" SAE 2013-01-1268
23. Vandiver et al, "Accuracy of Pre-Crash Speed Recorded in 2009 Mitsubishi Lancer Event Data Recorders", SAE 2013-01-1263

EDR Accuracy References Cont'd

24. SAE 2014-01-0504 **Accuracy and Timing of 2013 Ford Flex Event Data Recorders,** Ruth et al

25. SAE 2014-01-0502 **Accuracy of Translations Obtained by 2013 GIT Tool on 2010-2012 Kia and Hyundai EDR Speed and Delta V Data in NCAP Tests,** Ruth et al

26. SAE 2014-01-0503 **Validation of Event Data Recorders in Side-Impact Crash Tests,** Tsoi et al

27. SAE 2014-01-0505 **Accuracy of Recorded Driver Inputs in Toyota Part 563 EDR,** Webster

EDR Accuracy References Cont'd

28. SAE 2015-01-1445 Analysis of Crash Data from a 2012 Kia Soul Event Data Recorder, Vandiver

29. SAE 2015-01-1448 EDR Pulse Component Vector Analysis, Carr

30. SAE 2015-01-1449 Survivability of EDR data in Exposure to High temperature, Submersion, and Static Crush, Tsoi et al

31. SAE 2015-01-1444 "**Analysis of EDR survivability in Crashes with Fire, Immersion, and High Delta V" Tsoi** et al

EDR Accuracy References Cont'd

32. SAE 2016-01-1494 Comparison of Accuracy and Sensitivity of Gen 1,2 and 3 Toyota EDR's in Low Speed Collisions, Xing et al, MEA

33. SAE 2016-01-1495 EDR Developed by Toyota, Iyoda et al, Toyota

34. SAE 2016-01-1496 Longitudinal Delta V offset between Front and Rear Crashes in a 2007 Yaris, Ruth and Muir

35. SAE 2016-01-1497 "**Compendium** of Pass Vehicle EDR Literature and Analysis of Validation Studies" Bortles et al

EDR Accuracy references cont'd

36. SAE 2017-01-1436 Analysis of **EDR** Data in **Kawasaki** Ninja 300 **Motorcycles,** Fatzinger, **(records if bike falls over while moving)**

37. SAE 2017-01-1437 Intro to Forensic Acquisition of Pass Veh Infotainment & telematics systems, **Bortles** et al, (extracting OEM GPS data using the Berla iVe system)

38. SAE 2017-01-1438 Behavior of **Toyota Event Data Recorders** subjected to low and mid severity pulses – Lee, MEA (Continues prior documenting under reporting in some older ACM's)

EDR Accuracy References 2018

39. SAE 2018-01-0522 Correleation of Non Zero Speedometer Readings with EDR data – Yannacone & Kinder, DJS Associates

40. SAE 2018-01-0533 The effect of target features on Toyota's Autonomous Emergency Braking System – Yang, Zing et al, MEA Forensic

41. SAE 2018-01-1443 An Analysis of EDR Data in Kawaski Ninja ZX-6R and ZX-10R Motorcycles Equipped with ABS (KIBS) and Traction Control (KTRC) – Fatzinger & Landerville, Momentum Eng

EDR Accuracy References 2018

42. 2018-01-1440 Accident Reconstruction with Data Recorded by Electronic Control Units in Vehicles with a Pre-crash Safety System
Oga, Takubo, et al, National Res. Inst. of Police Science

43. 2018-01-1441 The Accuracy of Toyota Vehicle Control History Data during Autonomous Emergency Braking
Peter Xing, Yang et al, MEA Forensic Engineers & Scientists

EDR Accuracy References 2018

44. SAE 2018-01-1442 Accuracy of Speed Data Acquired from Ford Sync Generation 2 and Generation 3 Modules Utilizing the Berla iVe System

Wesley Vandiver, Collision and Injury Dynamics, Inc.; Robert Anderson, Biomechanics Analysis

EDR SAE Papers 2019

45. 2019-01-0633 Performance of Event Data Recorders Found in Toyota Airbag Control Modules in High Severity Frontal Oblique Offset Crash Tests by William Bortles, Kineticorp et al (finds Delta V is understated due to offset).

46. 2019-01-0634 Event Data Recorder Performance during High Speed Yaw Testing Subsequent to a Simulated Tire Tread Separation Event by William Bortles et al

(finds tires balloon after tread sep causing speed under rerporting)

EDR SAE Papers 2019

47. 2019-01-0635 Laboratory Experiments Using a 2007 Toyota Auris Event Data Recorder and Additional Data

from CAN Bus by Miguel Tabone et al, University of Malta (took electrical system out of car into lab, injected ABS wheel speed sensor signals to simulate moving vehicle as events were set by hammer blows)

48. 2019-01-0632 Reconstructing Vehicle Dynamics from On-Board Event Data by Brandon Tsuge et al, MEA Forensic (read out Vehicle Control History, discovered VCS has data 6.6 times per second in ABS events vs 2 times in hard accel events)

EDR SAE Papers 2019

49. 2019-01-0416 A Study of the Performance of Automatic Emergency Braking (AEB) Systems Equipped on Passenger Vehicles for Model Years 2013 to 2018

By Djordje Miholjcic et al, 30 Forensic Engineering

(good summary)

50. 2019-01-0412 Brake Vacuum Booster Characterization by James Walker, Carr Engineering et al

Memo Heavy Truck EDR Papers

51. 2019-01-0636 Evaluation of the Heavy Vehicle Event Data Recorder for the Freightliner New Cascadia with Detroit Diesel Engines by David Plant, D P Plant & Associates et al (found numerous anomalies in time base)

EDR SAE Papers 2020

2020-01-1327 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)

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

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

Possible EDR @ SAE 2021

currently in peer review

1. **Accuracy of Gen 2 Toyota EDR in Low Speed Side Impacts**
2. **Analysis of Crash Data from a 2012 Hyundai Genesis Coupe Event Data Recorder**
3. **Re-Evaluating Event Data Recorder Sample Rates to Accurately Capture Evasive Maneuvers in Modern Vehicles**
4. **Validation of EEPROM Chip Removal and Reinstallation for Retrieval of Electronic Crash Data**

Other Resources

Accident Reconstruction Journal

May June 2015 – Subaru EDR – A case study by Bartlett

May June 2017 - “Using E.D.R. Pre-crash Data to Calculate a Range for Speed at Impact” by Wright and Ruth.

Collision Magazine :

- CDR Report Data from Vehicles Subject to the GM Ignition Switch Recall with the “Epsilon” ACM – Haight – Fall 2014 (peer reviewed)
- Kia/Hyundai EDR – Haight – Spring 2014.