

# Event Data Recorders

National Highway Traffic Safety Administration

John Hinch

2004

**Greetings from NHTSA**



# Persons Killed and Injured in Crashes

	Year		
	2001	2002	2003
Persons Killed	42,196	42,815	43,220
Persons Injured	3,033,000	2,926,000	2,891,000

Red double-headed arrows indicate an increase in the number of persons killed from 2001 to 2002 and from 2002 to 2003. Green double-headed arrows indicate a decrease in the number of persons injured from 2001 to 2002 and from 2002 to 2003.

# How People Die on the US Roadways

## Single Vehicle 20%

- Front 13%
- Side 5%
- Other 2%

*~120/day*

## Single Vehicle Rollover 20%

- Pass Car 10%
- Light Truck 9%
- Heavy Truck 1%

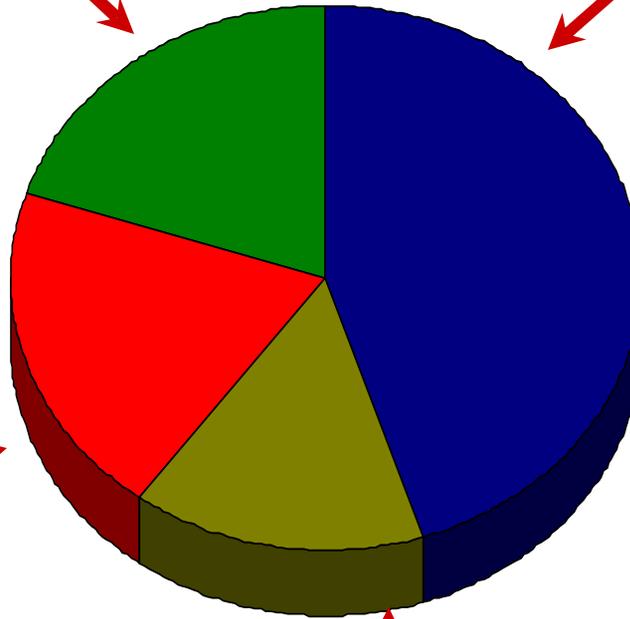
## Multi-Vehicle 45%

- Frontal 25%
- Side 17%
- Rear 3%

*~43,000  
deaths  
in 2003*

## Non-Occupant 15%

- Pedestrian 13%
- Pedalcyclist 2%



# Traffic Injuries in the US

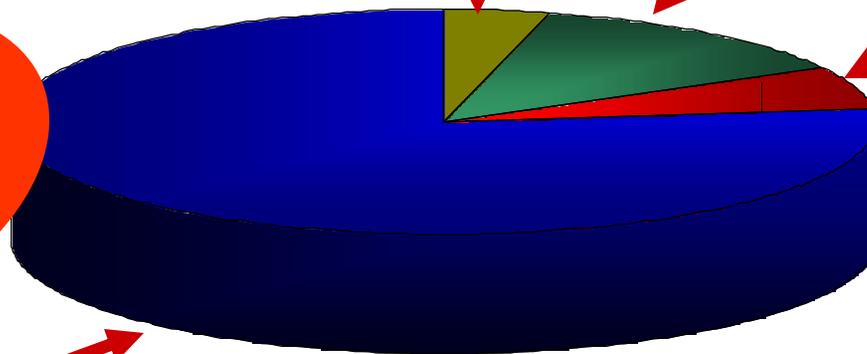
## Non Occupant 4%

- Pedestrian 2%
- Pedalcyclist 2%

## Single Vehicle 13%

- Front 9%
- Side 3%
- Other 1%

*~8,000/day*



*~2.9 million  
injured  
in 2003*

## Multi-Vehicle 77%

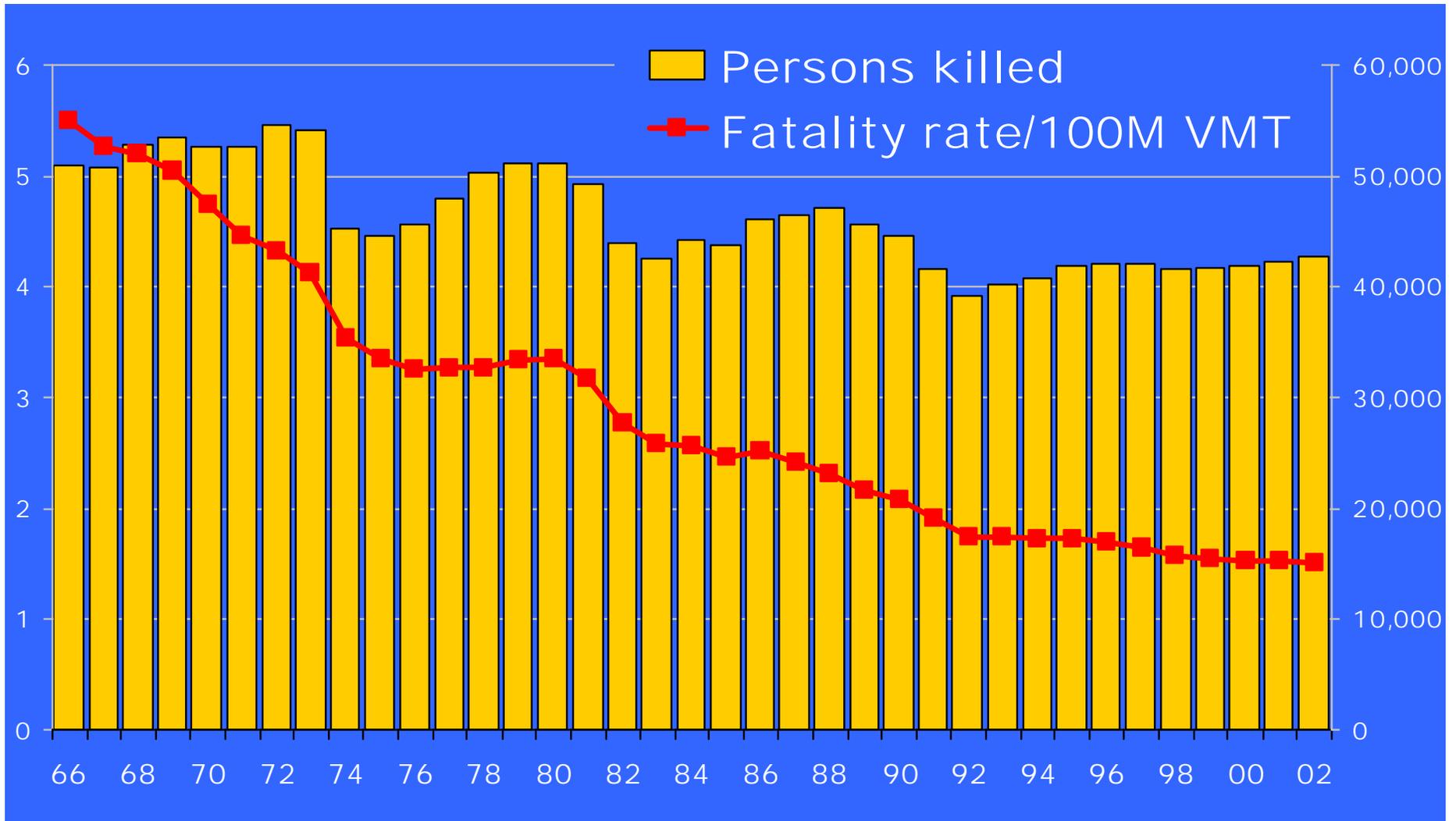
- Front 31%
- Side 25%
- Rear 21%

## Rollover 6%

- Pass 3%
- Light Truck 2%
- Heavy Truck 1%

Source: NASS GES - 0.7% Sample

# Persons Killed and Rate Per 100M VMT



# Top 10 Leading Causes of Death in the United States for 2001, by Age Group

RANK	Cause and Number of Deaths											Years of Life Lost
	Infants Under 1	Toddlers 1-3	Young Children 4-7	Children 8-15	Youth 16-20	Young Adults 21-24	Other Adults			Elderly 65+	All Ages	
							25-34	35-44	45-64			
1	Perinatal Period 13,734	Congenital Anomalies 496	<b>MV Traffic Crashes 533</b>	<b>MV Traffic Crashes 1,546</b>	<b>MV Traffic Crashes 5,979</b>	<b>MV Traffic Crashes 4,136</b>	<b>MV Traffic Crashes 6,759</b>	Malignant Neoplasms 16,569	Malignant Neoplasms 139,785	Heart Disease 582,730	Heart Disease 700,142	Malignant Neoplasms 23% (8,614,131)
2	Congenital Anomalies 5,513	<b>MV Traffic Crashes 421</b>	Malignant Neoplasms 400	Malignant Neoplasms 829	Homicide 2,414	Homicide 2,738	Homicide 5,204	Heart Disease 13,326	Heart Disease 98,885	Malignant Neoplasms 390,214	Malignant Neoplasms 553,768	Heart Disease 22% (8,110,571)
3	Heart Disease 479	Accidental Drowning 393	Exposure to Smoke/Fire 178	Suicide 447	Suicide 1,879	Suicide 1,924	Suicide 5,070	<b>MV Traffic Crashes 6,891</b>	Stroke 15,518	Stroke 144,486	Stroke 163,538	<b>MV Traffic Crashes 5% (1,700,952)</b>
4	Homicide 332	Homicide 362	Congenital Anomalies 168	Homicide 391	Malignant Neoplasms 814	Accidental Poisoning 771	Malignant Neoplasms 3,994	Suicide 6,635	Diabetes 14,913	Chronic Lwr. Resp. Dis. 106,904	Chronic Lwr. Resp. Dis. 123,013	Stroke 5% (1,687,683)
5	Septicemia 312	Malignant Neoplasms 321	Accidental Drowning 164	Congenital Anomalies 324	Accidental Poisoning 566	Malignant Neoplasms 768	Heart Disease 3,160	HIV 5,867	Chronic Lwr. Resp. Dis. 14,490	Influenza/Pneumonia 55,518	Diabetes 71,372	Chronic Lwr. Resp. Dis. 4% (1,444,745)
6	Influenza/Pneumonia 299	Heart Disease 200	Homicide 133	Accidental Drowning 293	Heart Disease 398	Heart Disease 543	Accidental Poisoning 2,507	Accidental Poisoning 5,036	Chronic Liver Disease 13,009	Diabetes 53,707	Influenza/Pneumonia 62,034	Suicide 3% (1,079,822)
7	<b>MV Traffic Crashes 139</b>	Exposure to Smoke/Fire 170	Heart Disease 82	Heart Disease 273	Accidental Drowning 326	Accidental Drowning 211	HIV 2,101	Homicide 4,268	Suicide 9,259	Alzheimer's 53,245	Alzheimer's 53,852	Perinatal Period 3% (1,070,154)
8	Nephritis/Nephrosis 133	Septicemia 96	MV NonTraffic Crashes 51	Exposure to Smoke/Fire 140	Congenital Anomalies 244	Congenital Anomalies 206	Stroke 601	Chronic Liver Disease 3,336	<b>MV Traffic Crashes 8,750</b>	Nephritis/Nephrosis 33,121	<b>MV Traffic Crashes 42,443</b>	Diabetes 3% (1,014,201)
9	Stroke 108	Influenza/Pneumonia 92	Benign Neoplasms 46	MV NonTraffic Crashes 125	Accidental Falls 114	HIV 167	Diabetes 595	Stroke 2,491	HIV 5,437	Septicemia 25,418	Nephritis/Nephrosis 39,480	Homicide 3% (924,263)
10	Meningitis 78	Perinatal Period 63	Septicemia 33	Chr. Lwr. Resp. Dis. 102	Acc. Dischg. of Firearms 114	Accidental Falls 134	Congenital Anomalies 458	Diabetes 1,958	Nephritis/Nephrosis 5,106	Hypertension Renal Dis. 16,397	Septicemia 32,238	Chronic Liver Disease 2% (623,998)
ALL	27,568	4,288	2,703	6,672	15,851	14,940	41,683	91,674	412,204	1,798,420	2,416,425	All Causes 100% (36,866,317)

# Economic Cost of Crashes

- **\$230 billion total**
  - \$32 billion medical cost
  - \$51 billion for impaired driving
  - \$20 billion failure to use belts



# Event Data Recorder

- **A device that is installed in a motor vehicle to record technical vehicle and occupant-based information for a brief period of time (i.e., seconds, not minutes) before, during and after a crash**
- **Function**
  1. Detect crash event
  2. Sense pre-crash parameters
  3. Store crash data
  4. Playback collected data
- **Commonly referred to as EDRs**

# What Comes to Mind....?



# Current OEM Event Data Recorders (EDR)



Primary purpose:  
Deployment of air bag



Secondary purpose:  
Record/playback  
Crash data

~5 inches



# Why do we need EDRs ?

- **New technology**
  - Stability control systems
  - Advanced air bags
  - Other devices that do not leave evidence
- **Better pre-crash data**
- **Better delta-V estimates**
- **Better crash reconstruction**
- **Automated collision notification**

# EDRs in US Fleet

- **Light fleet**      **200,000,000 vehicles**
- **Estimated**      **30,000,000 equipped vehicles**
- **Estimated**      **15% of current fleet**
- **New models**    **65-90% equipped**

# EDR Activity is Wide-Based

**University Classes**

**Courts**

**NAS/TRB**

**Police**      **OEM**

**Aftermarket**

**NTSB**      **FMCSA**

**Insurance**

**NHTSA**      **State Activity**

The NHTSA logo consists of a solid black rectangle with the text "NHTSA" centered inside it in a bold, white, sans-serif font. This central element is framed by a thin red border that extends slightly beyond the black rectangle on all four sides.

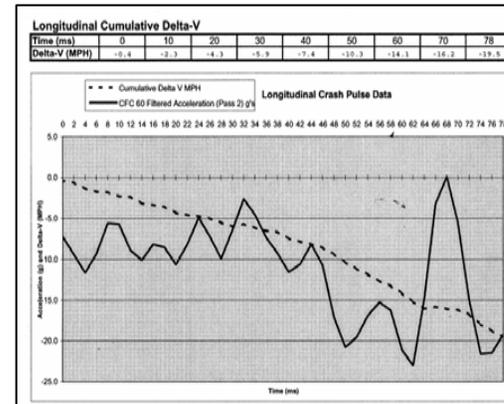
**NHTSA**

# NHTSA

- **Research (late 1990s to current)**
- **Crash data collection (1990s to current)**
- **Petitions for Rulemaking (1998, 1998, 2001)**
- **Notice for public comment (2002/2003)**
- **NPRM (2004?) OMB logged in on 3/9/04**

# NHTSA

- **First EDR case read by NHTSA in 1991**
  - Supporting crash investigation
- **EDR WG 1 – circa 1999**
  - Light vehicles
- **EDR WG 2 – circa 2000**
  - Heavy vehicles
- **EDR studies**



# NHTSA Sponsored Working Group 1

- **Facilitate the collection & utilization of collision avoidance and crashworthiness data from on-board Event Data Recorders**
- **Final report 2001**
  - <http://www-nrd.nhtsa.dot.gov/pdf/nrd-10/EDR/WkGrp0801.pdf>
- **DMS docket - NHTSA-99-5218**

# NHTSA Sponsored Working Group 2

- **T&B EDR**
- **Targeted larger vehicles, including school buses, motorcoaches and large trucks**
- **Focused on three main areas**
  - **Data variables; Survivability; & Definition of event**
- **Final report 2002**
  - [http://www-nrd.nhtsa.dot.gov/pdf/nrd-10/EDR/EDR\\_TruckBusFINAL.pdf](http://www-nrd.nhtsa.dot.gov/pdf/nrd-10/EDR/EDR_TruckBusFINAL.pdf)
- **DMS docket - NHTSA-00-7699**

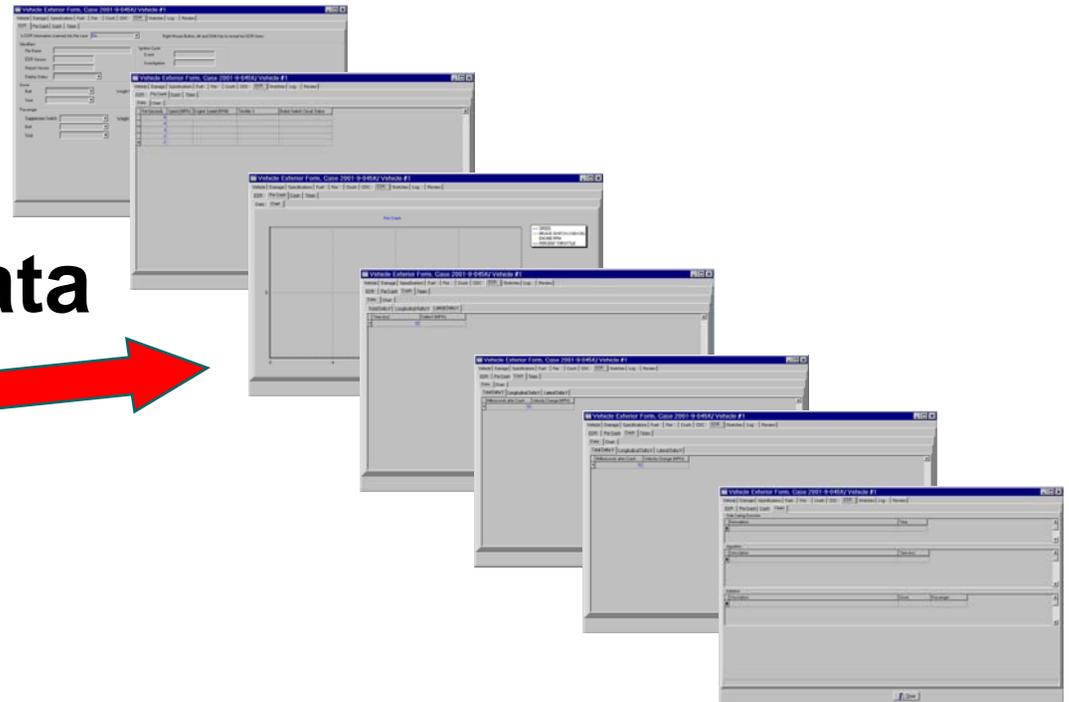
# NHTSA Programs Using EDR Technology

- **Crash investigation**
  - ~2,000 EDRs have been downloaded by NHTSA
  - ~700 in CY03
- **Research opportunities**
  - Currently Underway
    - 100-Car study (Va Tech)
    - Drive study (Ga Tech)
    - Reviewing real-world EDR data (Rowan)
  - EDR introduction provides breakthrough opportunities for beneficial research

# Data Coding in NASS

# NASS-CDS, SCI & CIREN data Coding Using EDS

- **Collecting EDR data since early 1990s**
- **Starting coding EDR data into data bases in late 1990s**
  - Scanned
  - Coded



# EDS EDR Tab

The screenshot shows a software window titled "Exterior Form, Case 2001-9-045K/ Vehicle #1". The window has a menu bar with the following items: Vehicle, Data, Specifications, Fuel, Fire, Crush, CDC, EDR, Sketches, Log, and Review. Below the menu bar is a sub-menu bar with EDR, Pre Wash, Wash, and Tires. The main content area contains several sections:

- Is EDR information scanned in the case:** A dropdown menu set to "No".
- Identifiers:** Fields for File Name, EDR Version, Report Version, and Deploy Status. A sub-section for Ignition Cycle includes Event and Investigation fields. A SIR Lamp Status dropdown is also present.
- Driver:** Fields for Belt, Seat, and Weight Switch.
- Passenger:** Fields for Suppression Switch, Belt, Seat, and Weight Switch.

Red arrows point to the title bar, the "EDR" menu item, and the "Specifications" menu item. A "Close" button is located at the bottom right of the window.

# EDS EDR Pre-Crash Tab Data Sub Tab

Vehicle Exterior Form, Case 2001-9-045K/ Vehicle #1

Vehicle | Damage | Specifications | Fuel | Fire | Crush | CDC | EDR | Sketches | Log | Review

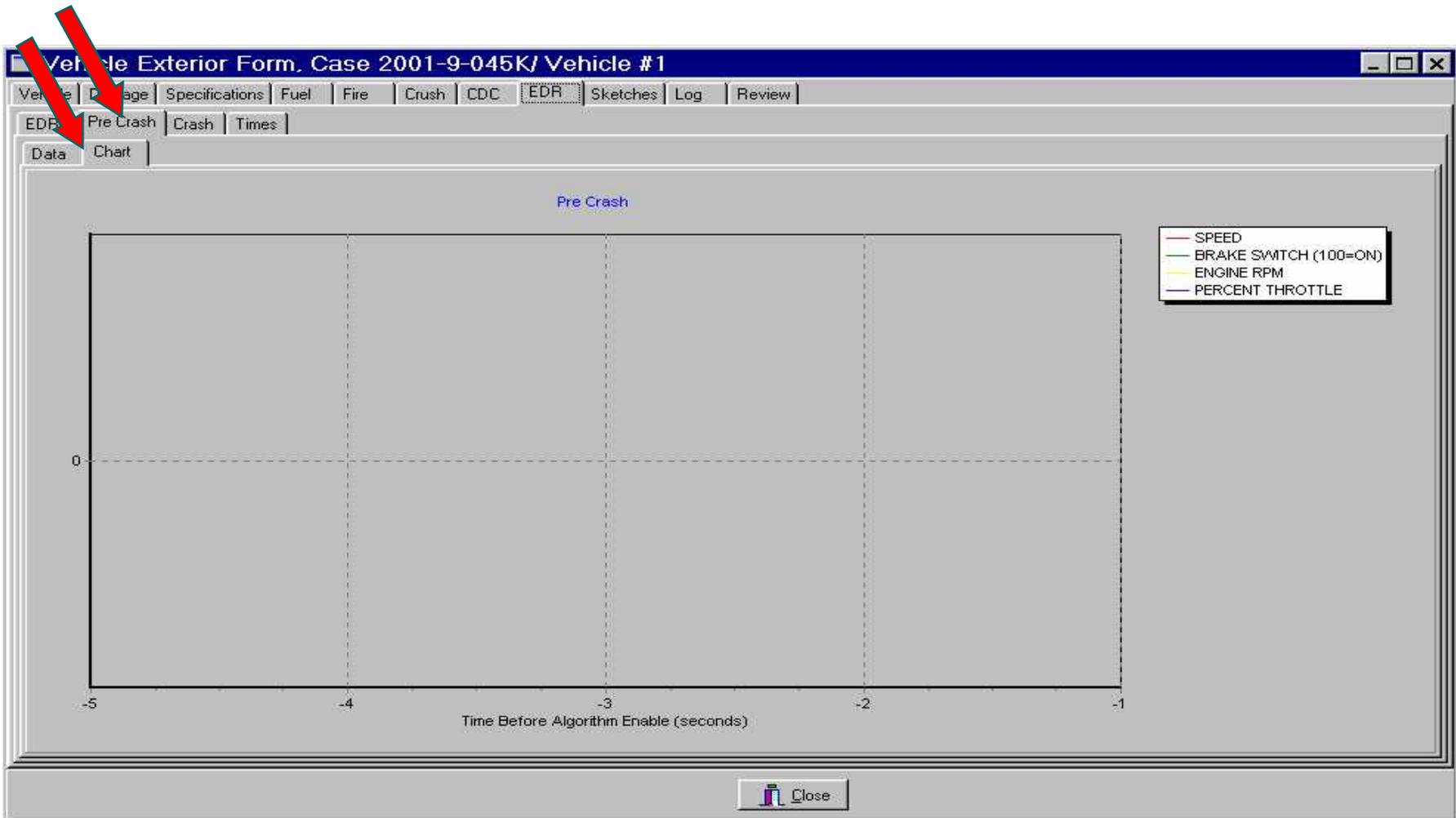
Pre-Crash | Crash | Times

Data | Chart

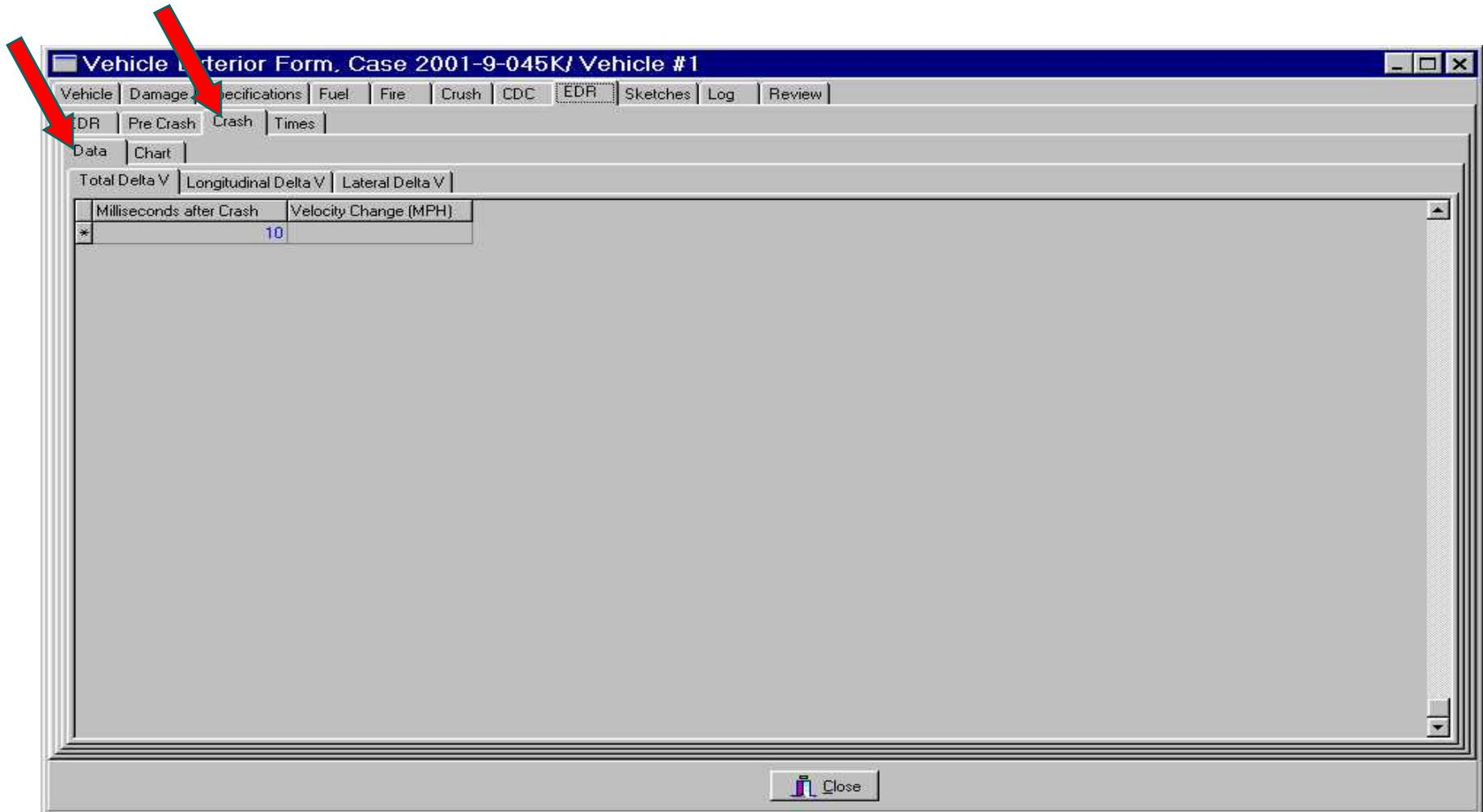
Pre-Seconds	Speed (MPH)	Engine Speed (RPM)	Throttle %	Brake Switch Circuit Status
-5				
-4				
-3				
-2				
* -1				

Close

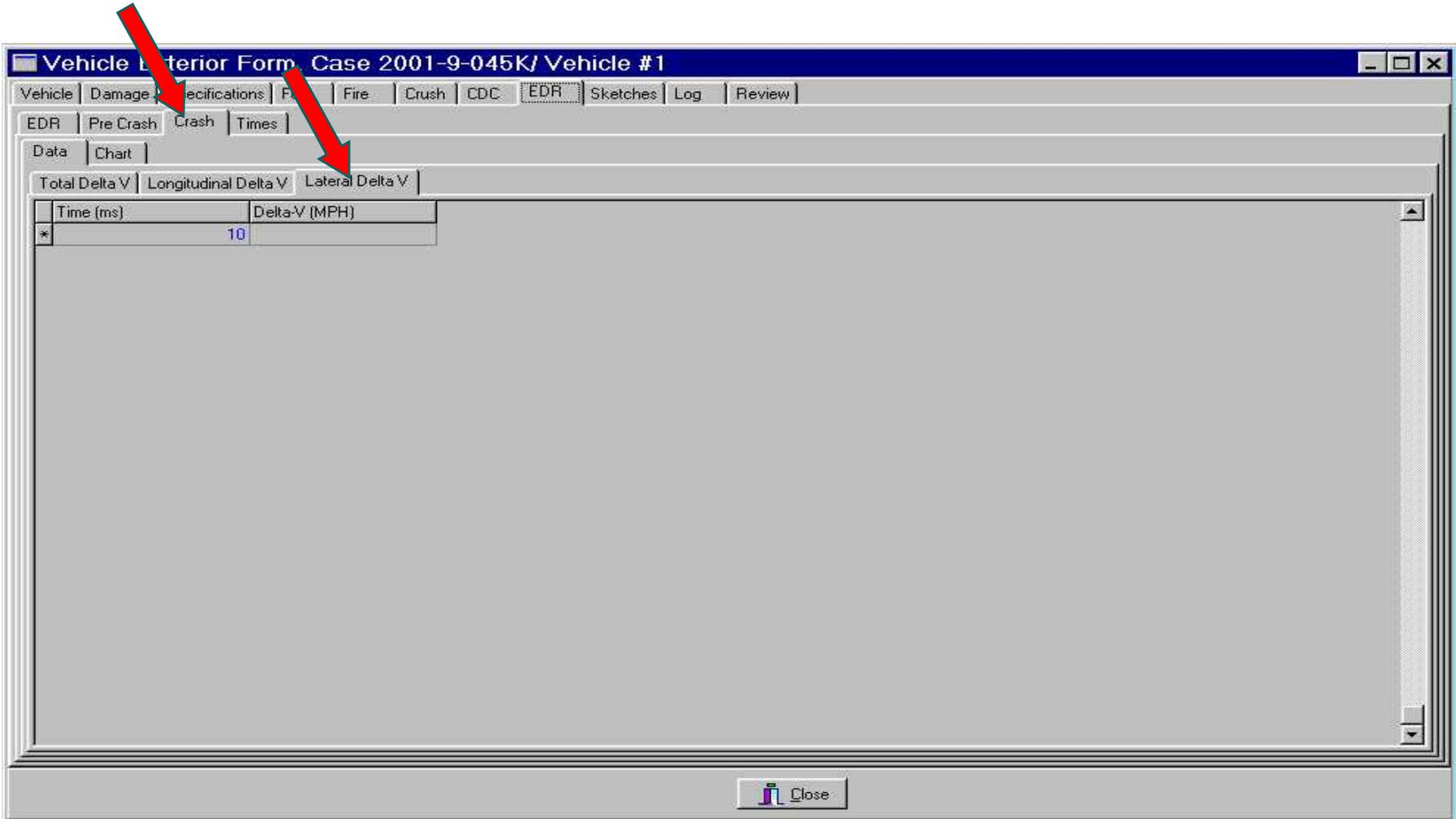
# EDS EDR Pre-Crash Tab Chart Sub Tab



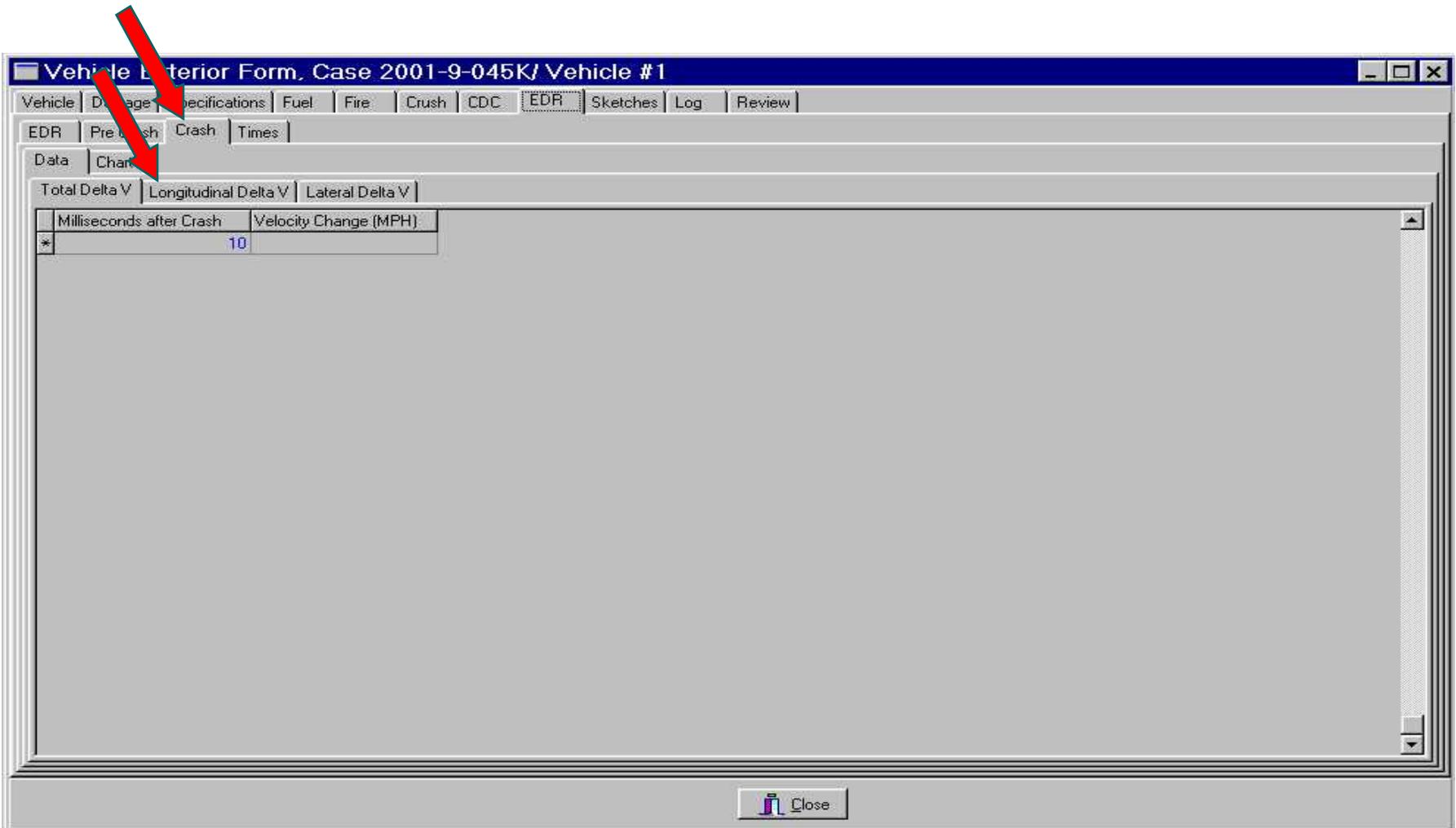
# EDS EDR Crash Tab Data Sub Tab/Total Delta V



# EDS EDR Crash Tab Data Sub Tab/ Lateral Delta V



# EDS EDR Crash Tab, Data Sub Tab/ Longitudinal Delta V



# EDS EDR Tab Times Sub Tab

Vehicle Exterior Form, Case 2001-9-045K/ Vehicle #1

Vehicle | Damage | Specifications | Fuel | Fire | Crush | CDC | **EDR** | Sketches | Log | Review

EDR | Pre Crash | Crash | **Times**

Side Safing Decision

Description	Time

Algorithm

Description	Time (ms)

Initiation

Description	Driver	Passenger

Close

# NASS CDS

## Oracle to SAS Data Set

- **11 tables in current SAS**
- **26 tables in Oracle to SAS set**
  - Far more data available for detailed analysis
- **CY 2002 weighted Oracle to SAS file is scheduled for release in May**
- **Will be available at NHTSA web site**
  - <http://www.nhtsa.dot.gov> (general)
  - Direct link to data center
    - <http://www-nrd.nhtsa.dot.gov/departments/nrd-30/ncsa/>

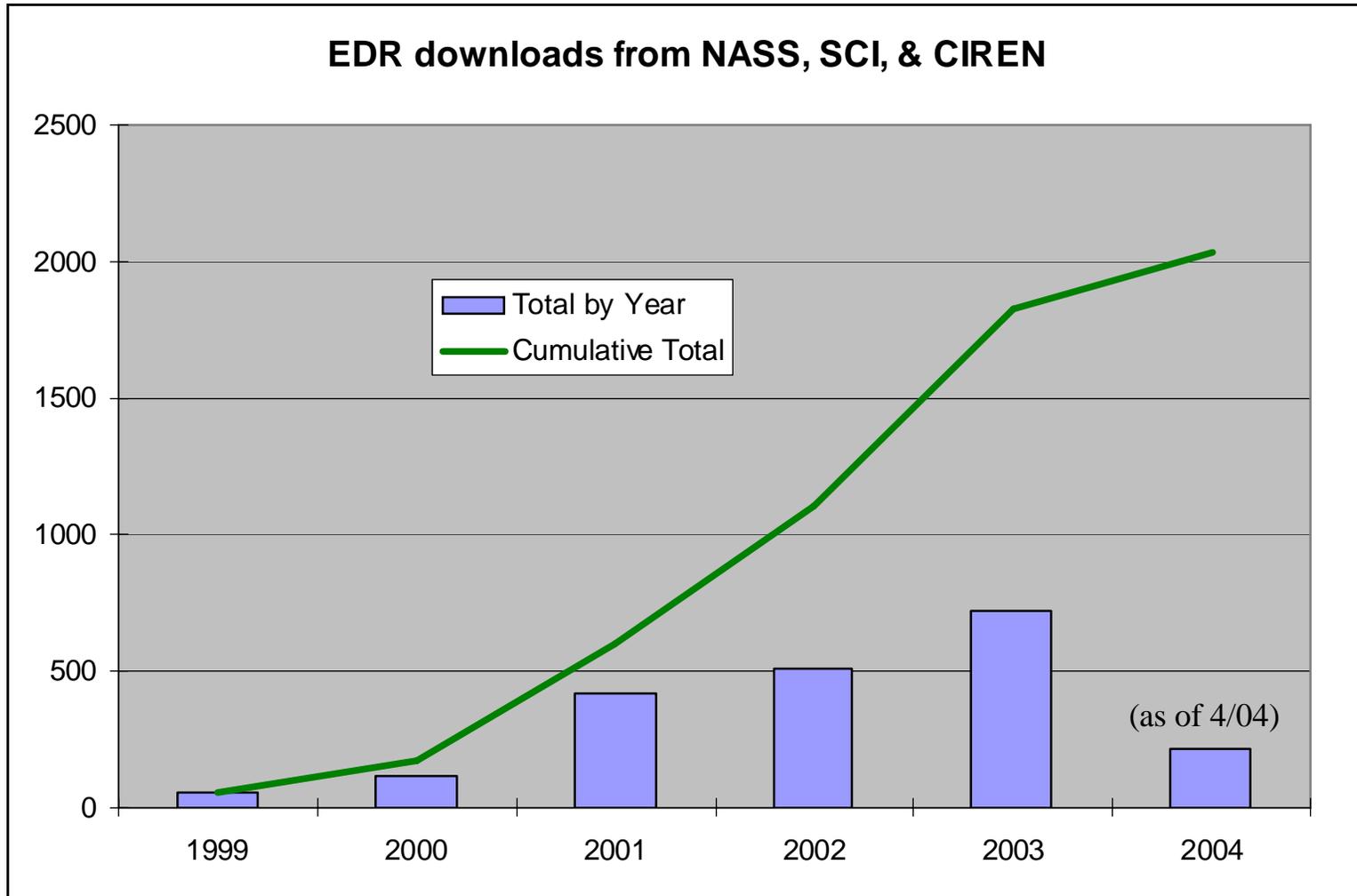
# Data Collection

**How Much Data**

**Field Collection Problems**

**Data Quality**

# EDR Field Data Collection Progress, All Programs



# Data Collection

**How Much Data**

**Field Collection Problems**

**Data Quality**

# Data Collection Experience

## 2002 Data Review

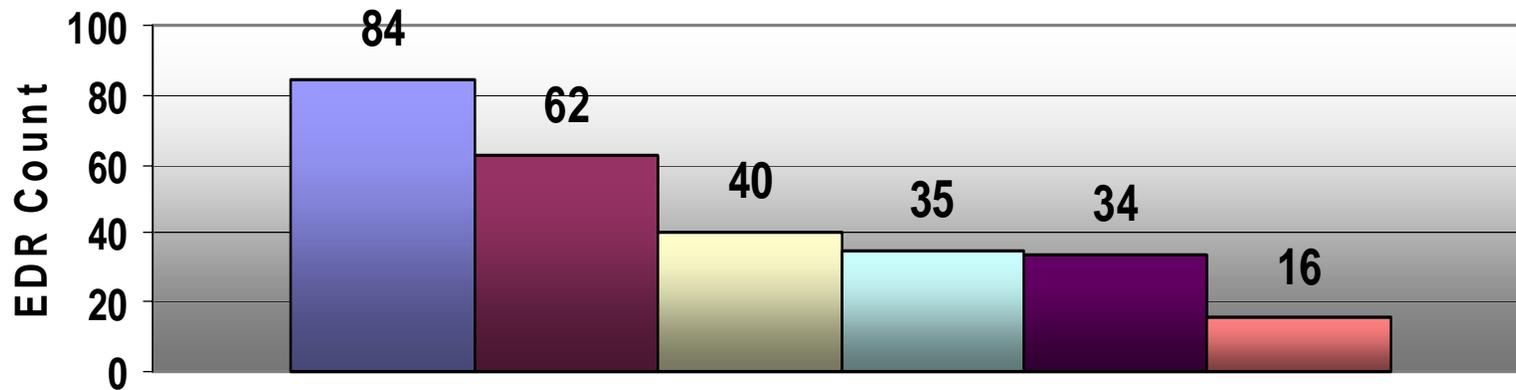
- **NASS/CDS (11 months of 2002)**
- **684 vehicles identified as being equipped with an EDR**
  - 60% of those vehicles were successfully downloaded
  - 271 vehicles were identified as being equipped with an EDR but the data were not obtained.

**2003 ESV paper by Gabler:**

**Estimating Crash Severity: Can Event Data Recorders Replace Crash Reconstruction?**

<http://www-nrd.nhtsa.dot.gov/pdf/nrd-01/esv/esv18/CD/Files/18ESV-000490.pdf>

# Data Collection Experience 2002 Data Review



- Technical and/or Training Issues (unable to access without causing damage to the vehicle)
- Software Issues (includes Unsuccessful OBD Attempts)
- Data Collection Failed / No Recording
- OBD Unusable (no power, no keys, etc) Unable to connect to EDR (e.g. no cable)
- No Permission
- Crash Damage Prevented Access

# **Data Collection Experience 2003 Data Review (In Progress)**

- **635 NASS/CDS Successful downloads**
- **Several hundred not successful**
- **Major reasons**
  - **Technical/Training Issues**
  - **Permission refused to access/read EDR**
    - **Appears to be increasing**
  - **Vehicle damage prevents downloading EDR data**
- **Analysis underway – to be reported at SAE's Highway Vehicle Electronic Data Recorder Symposium, June 04, Ashburn, VA**

# Data Collection

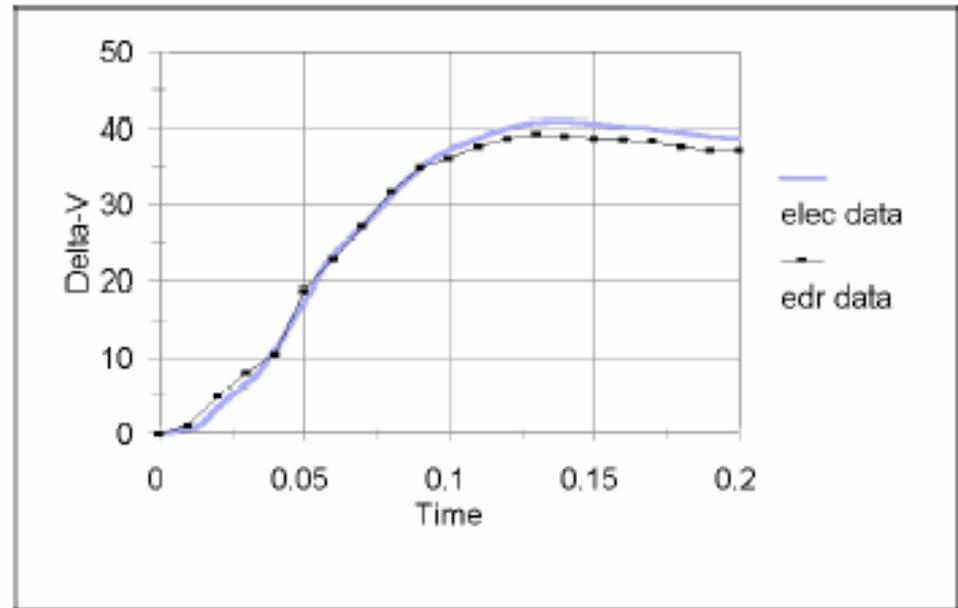
**How Much Data**

**Field Collection Problems**

**Data Quality**

# How Well Are EDRs Performing ESV Paper Reporting NHTSA Tests

- **EDR data from GM SDM compared to accelerometer data**
- **Delta V used to compare**
- **EDR slightly under estimates**

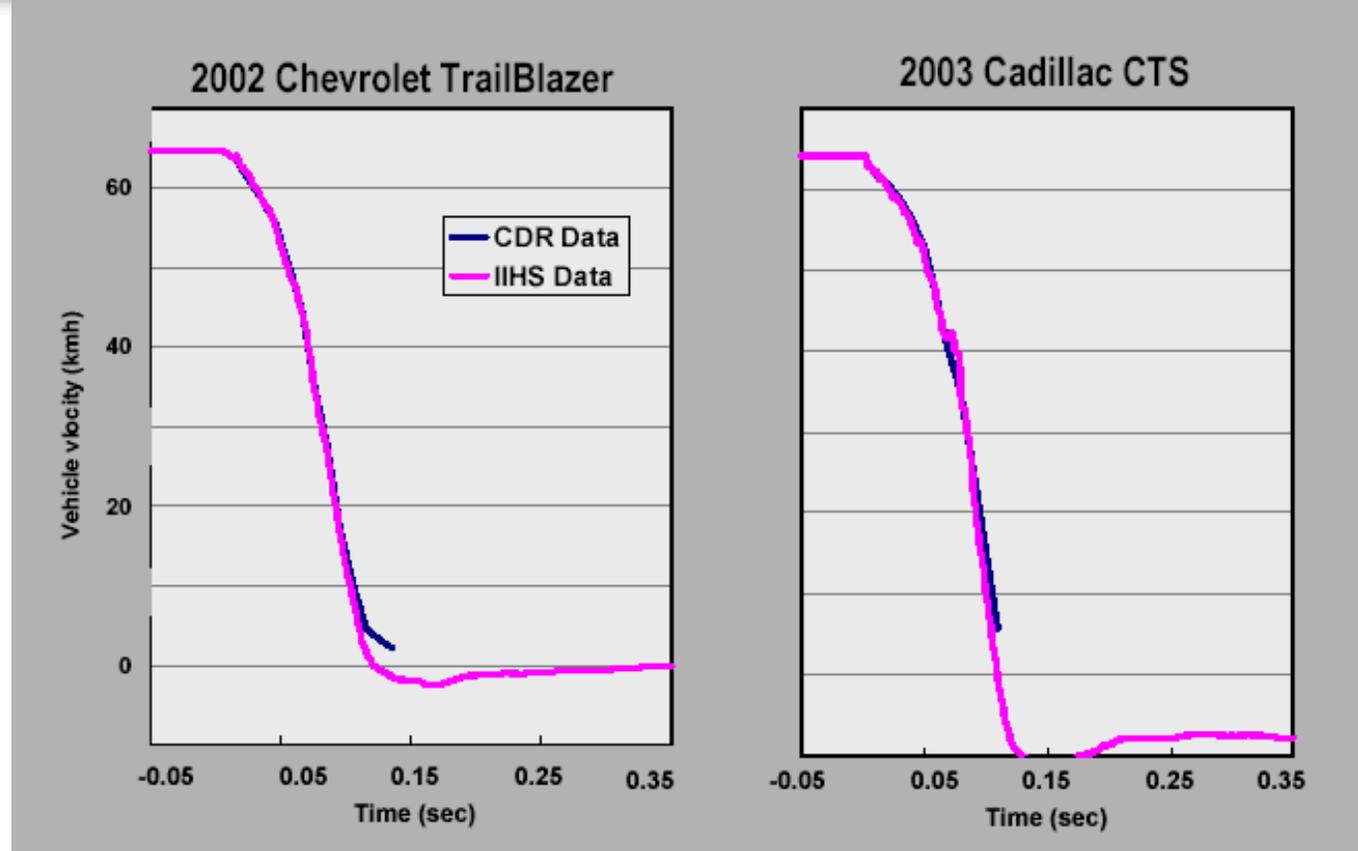


ESV paper: Real World Experience with Event Data Recorders

<http://www-nrd.nhtsa.dot.gov/pdf/nrd-01/esv/esv17/proceed/00203.pdf>

# How Well Are EDRs Performing IIHS Testing

- IIHS tests
- Show good relation between EDR and crash data



IEEE Presentation: **Motor Vehicle EDRs and Crash Data; Susan A. Ferguson**

[http://grouper.ieee.org/groups/1616/134\\_Ferguson\\_EDR.pdf](http://grouper.ieee.org/groups/1616/134_Ferguson_EDR.pdf)

# How Well Are EDRs Performing NHTSA Round Robin Test

- 2001 Ford F-150 pickup
- Crashed into a flat fixed rigid barrier at 30 mph (48 kph)
- EDR's were mounted on an aluminum plate which was attached to the bed of the truck.
- Systems:
  - IWI
  - DriveCam
  - G.Tech.MACBOX
  - Ford RCM
  - Three Endevco accelerometers

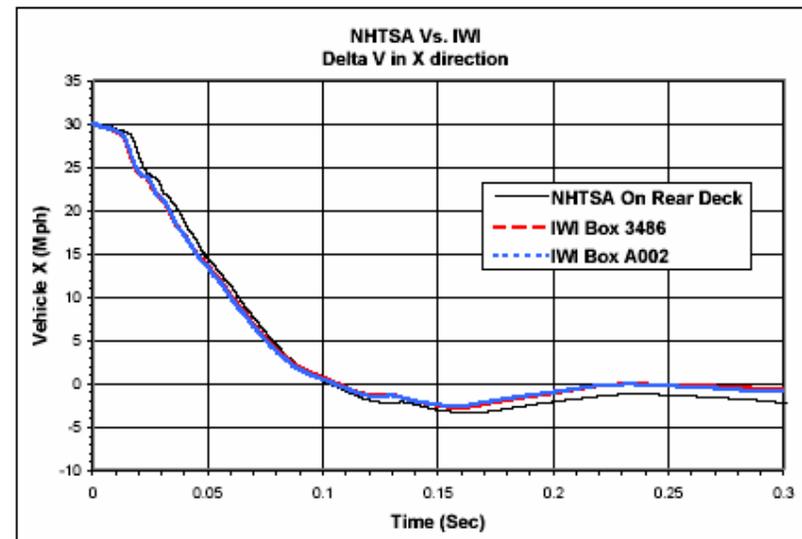
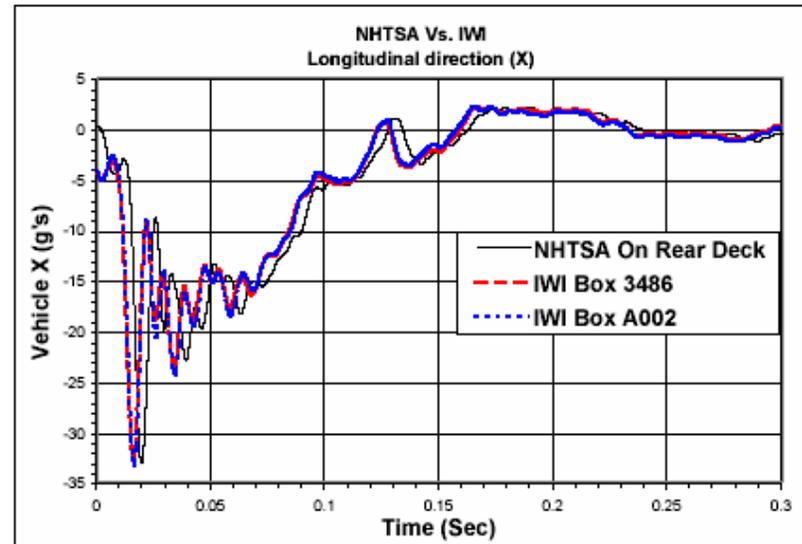


Performance of Selected Event Data Recorders; Alope Prasad

<http://www-nrd.nhtsa.dot.gov/pdf/nrd-10/EDR/EDR-round-robin-Report.pdf>

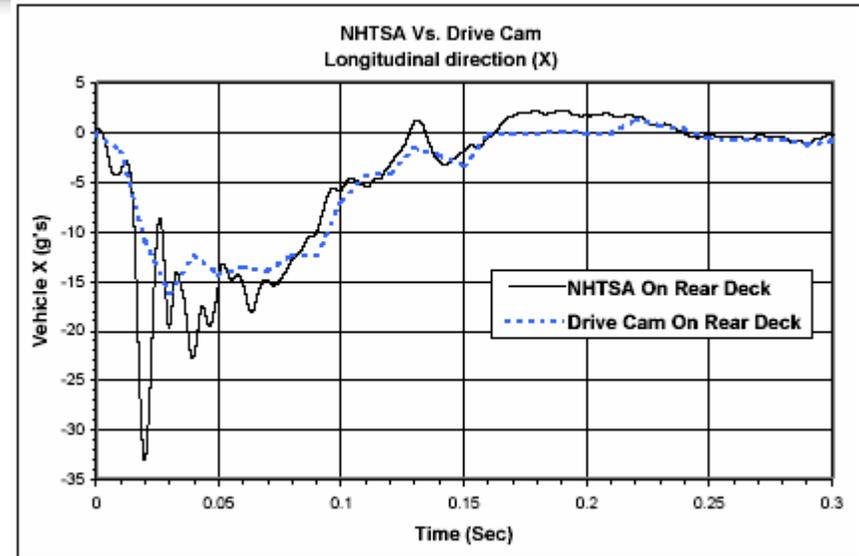
# How Well Are EDRs Performing NHTSA Round Robin Test

- IWI device
  - Acceleration Comparison
    - Good
  - Velocity Comparison
    - Good



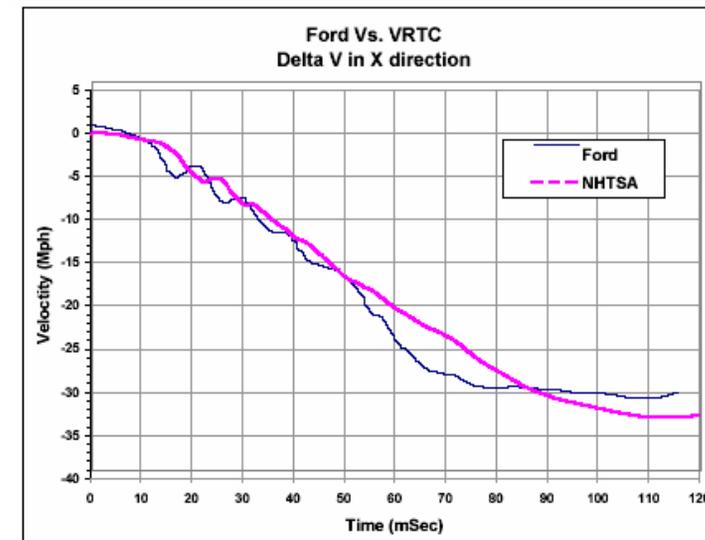
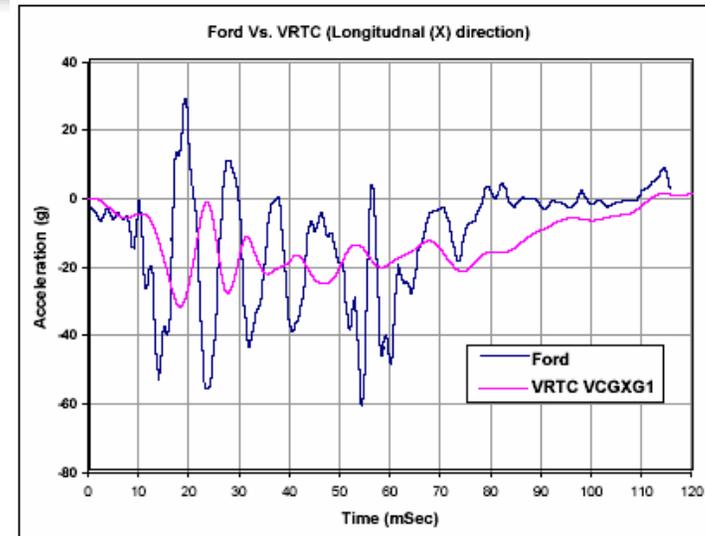
# How Well Are EDRs Performing NHTSA Round Robin Test

- Drive Cam Device
  - Acceleration Comparison
    - Fair
    - Low Sample Rate



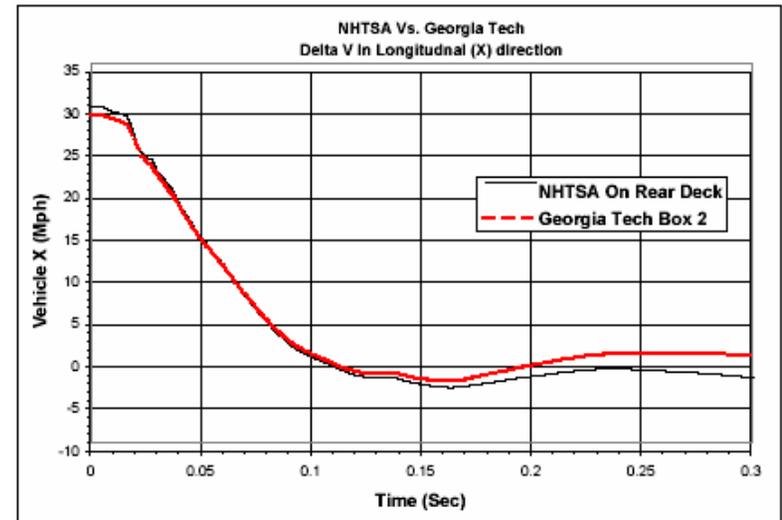
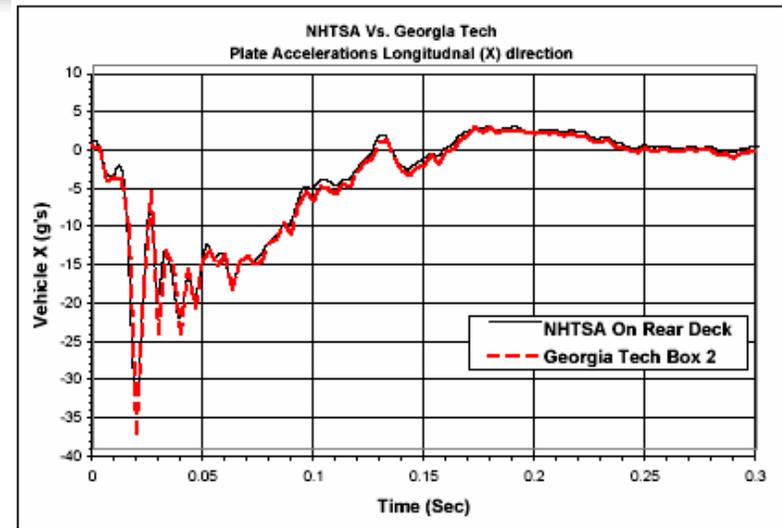
# How Well Are EDRs Performing NHTSA Round Robin Test

- Ford RCM
  - Acceleration Comparison
    - Poor
  
  - Velocity Comparison
    - Good



# How Well Are EDRs Performing NHTSA Round Robin Test

- Ga Tech
- Acceleration Comparison
  - Good
  
- Velocity Comparison
  - Good



# Other NHTSA Activities

**Petitions**

**Notice for Comment**

# Petitions for Rulemaking

- **Price T. Bingham (1998)**
  - Denied
- **Marie E. Birnbaum (1998)**
  - Denied
- **Ricardo Martinez (2001)**
  - No public decision

# Request for Comments

- **Request for comments for public input regarding EDRs**
- **Published on October 11, 2002.**
- **NHTSA asked 17 questions in 4 main areas**
  - Safety
  - Technical
  - Privacy
  - NHTSA's role in the future of EDRs
- **Docket closed in February 2003**

# Request for Comments

- **NHTSA received about 70 comments**
- **About 20 of these were from truck drivers**
- **Passenger vehicle manufacturing industry had very little comment**
- **Those who commented expressed a general belief that EDRs will improve vehicle safety**



**Other  
Activities**

# NTSB

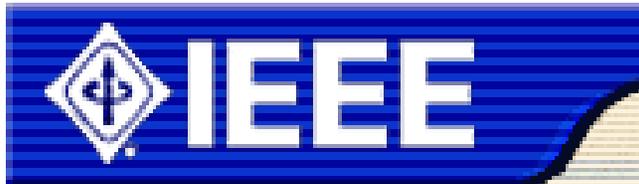
- **NTSB uses recorders on a routine basis**
- **They have provided 3 formal recommendations regarding EDRs**
  - Capture crash pulses
    - Completed
  - Require EDRs on Motorcoaches and School Buses
    - Ongoing
  - Set standards for EDRs for these vehicles
    - Ongoing
- **Conducted 2 major symposiums related to EDRs**

# National Academy of Science

- **Transportation Research Board**
- **NCHRP**
- **\$250 thousand**
- **Rowan University Department of Mechanical Engineering**
- **“Constitutional” investigation led by Professor Michael O’Neill, George Mason Law School**
- <http://www4.trb.org/trb/crp.nsf/All+Projects/NCHRP+17-24>

# IEEE MVEDR Standard

- **Started in early 2002**
- **Working toward a recommended practice for MVEDR**
- **IEEE developed standard for EDRs for FRA**
- **Defining output protocol**
- **Developing a data dictionary**
- **Draft standard has been balloted within WG**
- <http://grouper.ieee.org/groups/1616/home.htm>



# SAE

- **Developing Recommended Practice**
- **First edition completed**
  - J1698
  - Scope
    - Output protocol
    - Data element Specifications
- <http://www.sae.org/servlets/index>



# SAE

- **SAE, NTSB, & FMCSA**
- **Joint sponsored EDR session**
- **Highway Vehicle Electronic Data Recorder Symposium**
  - June 3-4, 2004
  - NTSB Academy at George Washington University, Virginia Campus
  - Ashburn, Virginia, USA
- <http://www.sae.org/events/symposia/hvedr/>





**OEM**

# GM Event Data Recorders



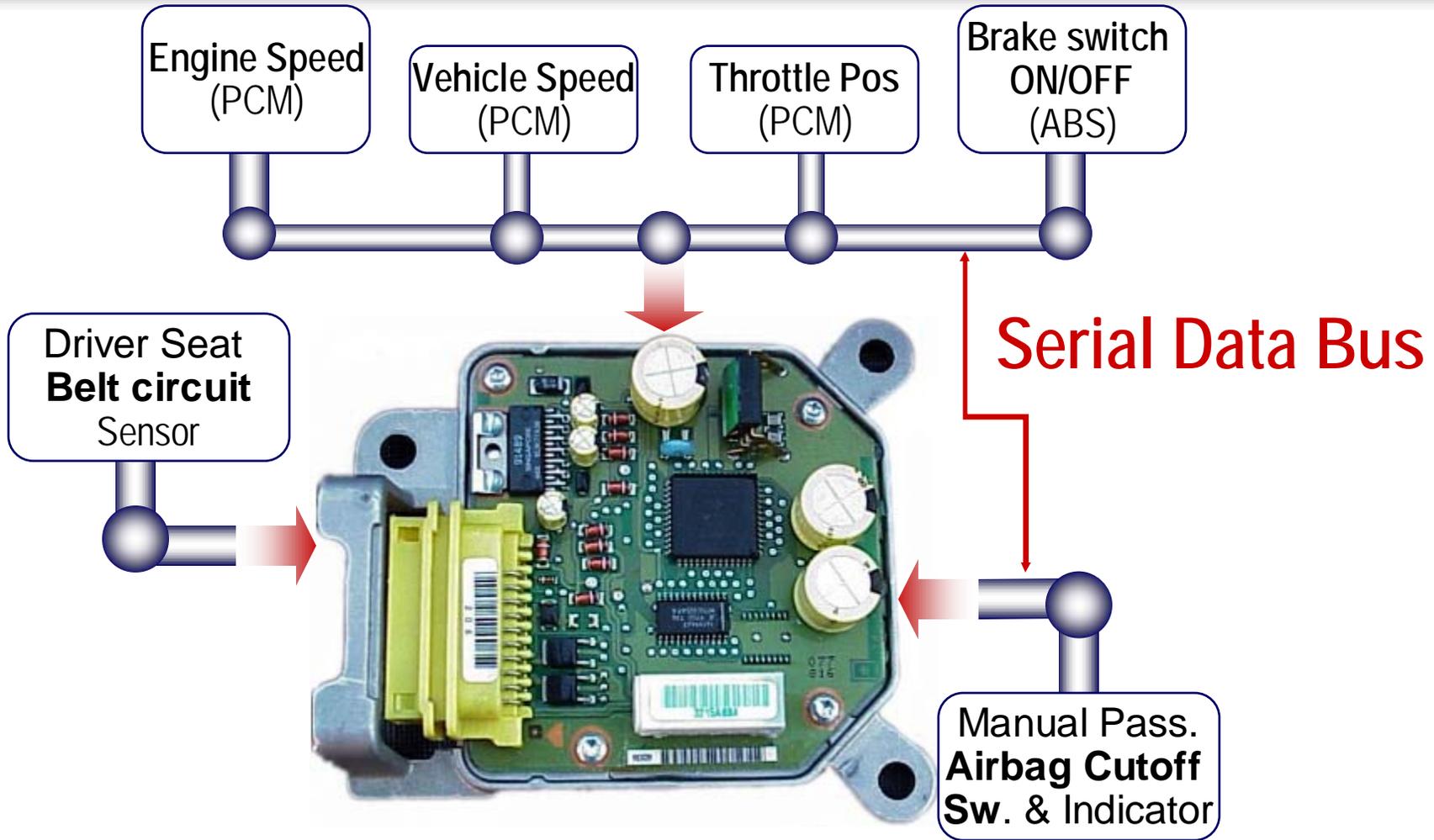
- Sensing and Diagnostic Module (SDM):
  - **Primary function is to control the deployment of the occupant protection systems**
    - **This system measures longitudinal acceleration and captures longitudinal changes in velocity**
      - Up to 300 milliseconds of crash pulse
    - **Data related to the driver and passenger air bag deployment**
      - Driver Seat belt use
      - Air bag deployment timing
    - **5 seconds of pre-crash data**
      - Vehicle speed, engine RPM, engine throttle opening, and brake application

# GM Airbag Systems Data Stored



Parameter	1990 DERM	1994 SDM	1999 SDM
State of Warning Indicator when event occurred (ON/OFF)	★	★	★
Length of time the warning lamp was illuminated	★	★	★
Crash-sensing activation times or sensing criteria met	★	★	★
Time from vehicle impact to deployment	★	★	★
Diagnostic Trouble Codes present at the time of the event	★	★	★
Ignition cycle count at event time	★	★	★
Maximum Delta-V for near-deployment event		★	★
Delta-V vs. time for frontal airbag deployment event		★	★
Time from vehicle impact to time of maximum Delta-V		★	★
State of driver's seat belt switch		★	★
Time between near-deploy and deploy event (if within 5 seconds)		★	★
Passenger's airbag enabled or disabled state			★
Engine speed (5 sec before impact)			★
Vehicle speed (5 sec before impact)			★
Brake status (5 sec before impact)			★
Throttle position (5 sec before impact)			★

# SDM Simplified

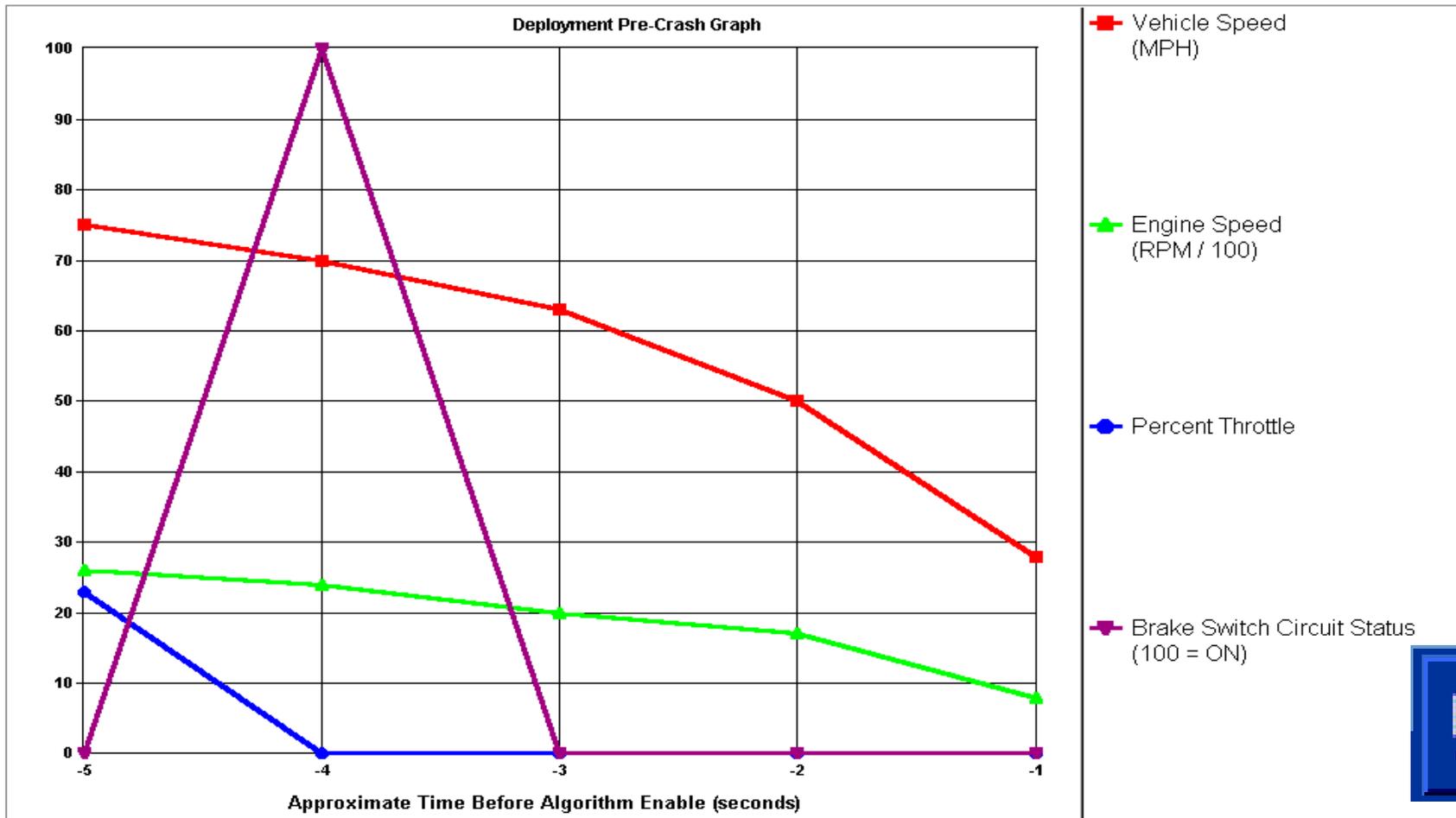


# SDM-Number of Events and Duration Stored



- **Near Deployment Event**
  - Stores one event
  - Cleared after 250 ignition cycles or
  - Overwritten by a greater Vehicle Forward Velocity Change (Delta V)
- **Deployment Event**
  - Stores up to two events
  - Cannot be overwritten or erased
  - Must replace SDM

# Sample of GM pre-crash data



# Ford EDR Program



- **Restraint Control Module (RCM)**
  - Primary function is to control the deployment of the occupant protection systems.
- **Some systems record longitudinal and lateral acceleration.**



# Ford EDR Program



- **Data related to the driver and passenger air bag deployment may include**
  - 80 milliseconds of crash pulse
  - Deployment strategy of the dual-stage air bag system
  - Seat belt use
  - Pre-tensioner operation
  - Driver seat position

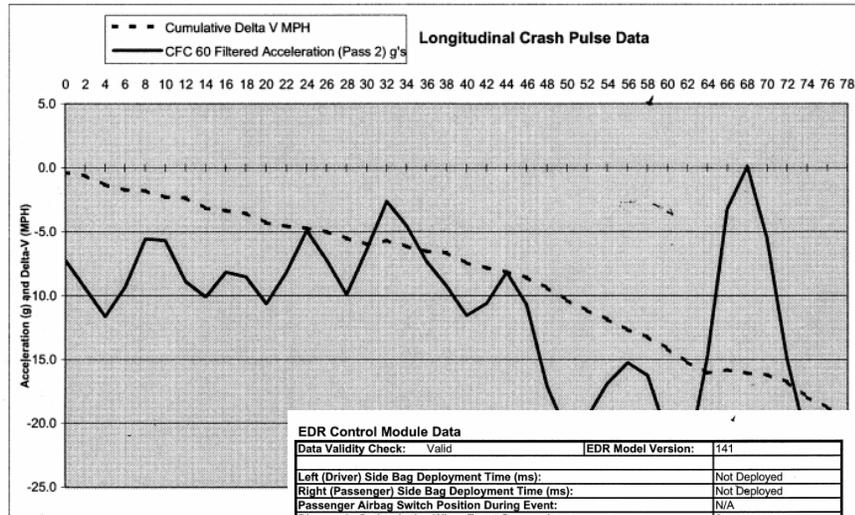
# Ford EDR Program



## Typical Ford Outputs

### Longitudinal Cumulative Delta-V

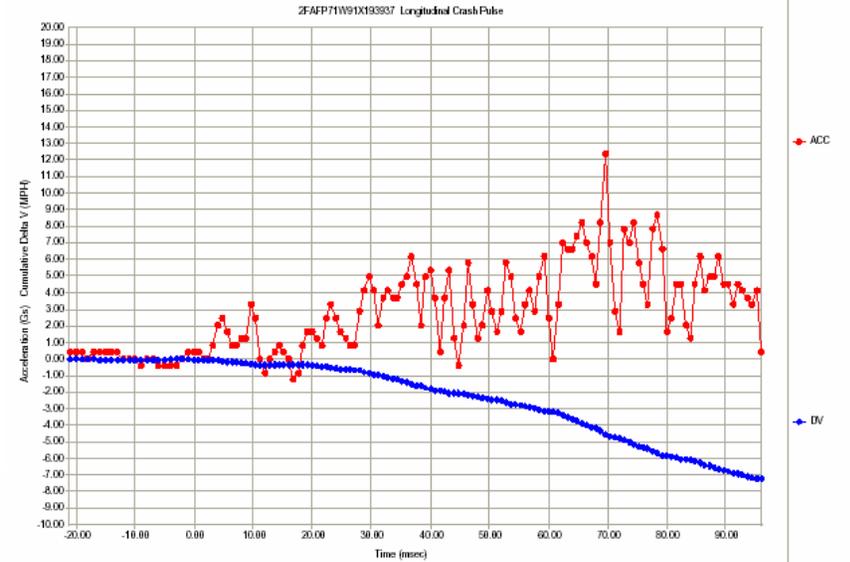
Time (ms)	0	10	20	30	40	50	60	70	78
Delta-V (MPH)	-0.4	-2.3	-4.3	-5.9	-7.4	-10.3	-14.1	-16.2	-19.5



Algorithm Times	ms
Time From Algorithm Wakeup to Pretensioner:	8
Time From Algorithm Wakeup to First Stage - Unbelted:	10
Time From Algorithm Wakeup to First Stage - Belted:	21
Time From Algorithm Wakeup to Second Stage:	0

Restraint System Status	
Driver Seat Belt Buckle:	Engaged
Passenger Seat Belt Buckle:	Not Engaged
Driver Seat Track In Forward Position:	No
Passenger Seat Weight Switch Position:	N/A

Deployment Initiation Attempt Times	Driver	Passenger
Time From Algorithm Wakeup to Pretensioner Deployment Attempt:	8	Unbelted
Time From Algorithm Wakeup to First Stage Deployment Attempt:	21	21
Time From Algorithm Wakeup to Second Stage Deployment Attempt:	Disposal	Disposal



**Passenger Return Information**

Vehicle Type	Passenger	VIN : 2FAPP71W91X193937	Error Status : <span style="color: red;">OK</span>
Make	FORD	Year	2001
Body Style	4D - Sedan 4 Dr.	CID	281
Series	CVP - CROWN VIC POLICE INTCPTR	Fuel	Gas
Weight	3996 LBS.	Tire Size	16R225
Wheel Base	114.7-000.0	Base List	Unknown
Carburetion	Fuel Injected	Restraint	Air bags both sides / manual belt system

# Vetronix CDR Retrieval Tool

- Publicly available (~\$2,500)
- Works with mainly GM and Ford vehicles
- Download
  - directly to module
  - DSL



- <http://www1.vetronix.com/diagnostics/cdr/index.html>

# Vetronix CDR Retrieval Tool

- **Direct connect with module removed from vehicle**
- **Can be preformed in vehicle**

Source of 12v



SDM



**Vetronix**  
CORPORATION

# Vetronix CDR Retrieval Tool

- In-car at the Diagnostic Link Connector (DLC)
- Connection is via the DLC (SAE) J1962 connector
- Typically located under the instrument panel

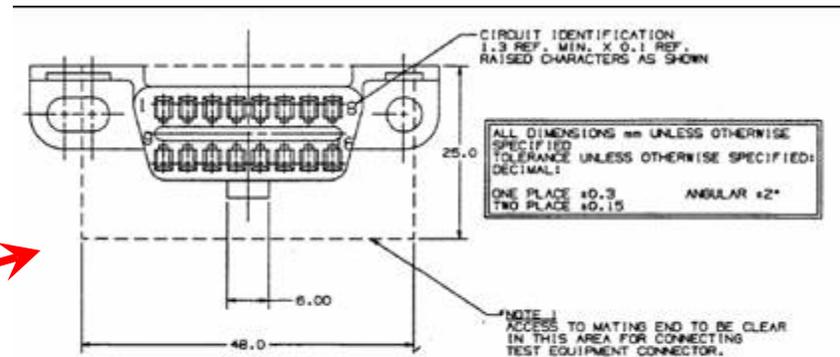
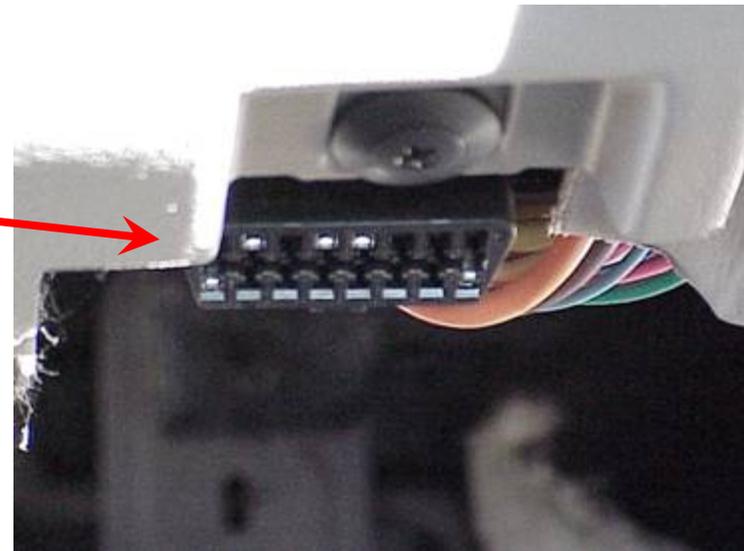


FIGURE 1—VEHICLE CONNECTOR





# Aftermarket

# Carchip

- **Connects directly to the OBD connector**
- **2 basic models - 75 hours and 300 hours**
- **Records (continuous data logging) time and date, distance, speed, idle time, hard accelerations and decelerations, engine diagnostic trouble codes, and other OBD II data**
- [http://www.davisnet.com/home\\_flash.asp](http://www.davisnet.com/home_flash.asp)



# Road Safety International

- Connects to OBD port
- Collects (continuous data logging) vehicle information related to driving
- Can give audible alarms
- <http://www.roadsafety.com/index.php>



# Independent Witness, Inc

- **Records events in three ways**
  - Direction of movement (3-dimensional)
  - G-force rating of the collision
  - Delta V, the change of velocity that occurs between impact
- **Events are identified with an indelible time and date stamp**
- **Used by NASCAR**
- <http://www.iwiwitness.com/>



# Drive Cam

- **DriveCam monitors driving activity**
- **Records**
  - Video – Audio – G-forces
  - Saves the 30 seconds before and after the driving “event” for later viewing.
  - Can be manually activated by the driver at any time.
- <http://www.drivecam.com/>



# Drive Cam Video



# VDO-Siemens

- **UDS system**

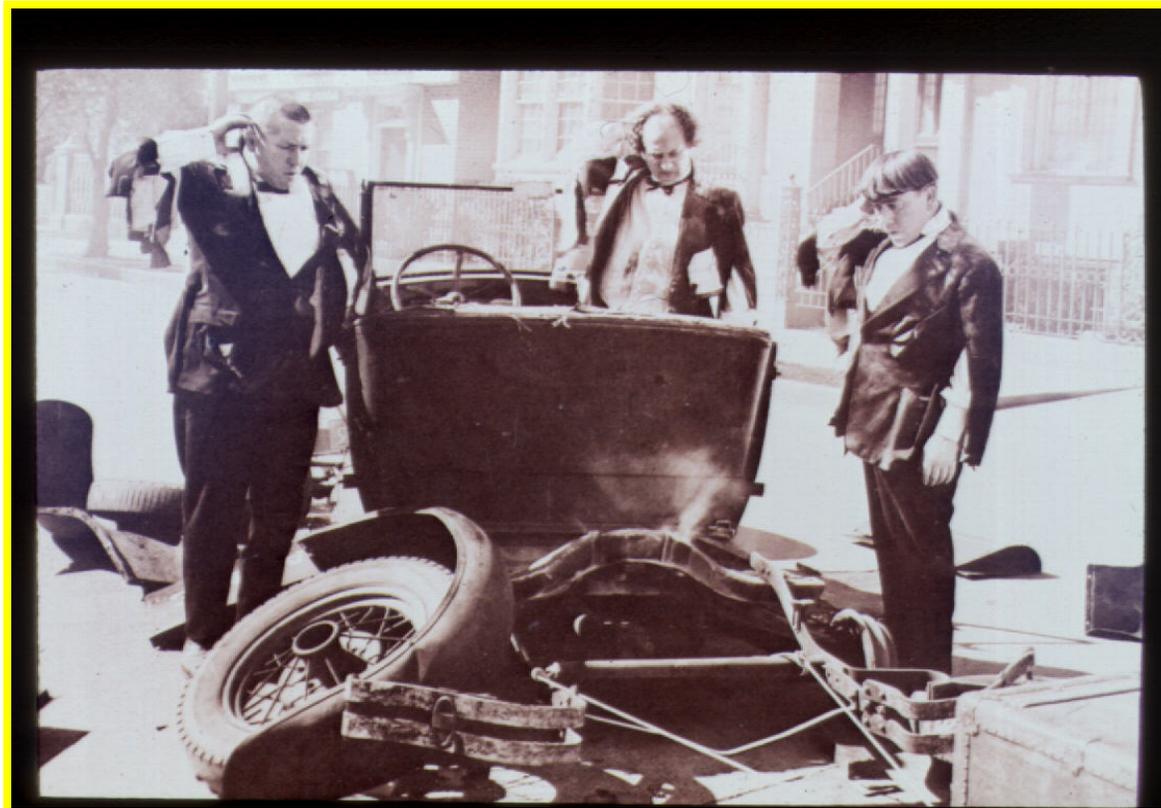
- Records accidents and critical driving events.
- Measures longitudinal and lateral acceleration, as well as any change in direction.
- Vehicle speed
- Other vehicle systems
  - Brakes
  - Indicators
  - lights



- [http://www2.vdo.com/vdo/business\\_customer/bc\\_product\\_ext&fza=&ID=157.aspx](http://www2.vdo.com/vdo/business_customer/bc_product_ext&fza=&ID=157.aspx)

# Summing it up!!!

Without EDR data, there is no way of knowing how advanced air bag and other “non-evidence” systems in automobiles are performing in the real world



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- **NHTSA web site**
  - Main NHTSA site - <http://www.nhtsa.dot.gov>
  - EDR web site - <http://www-nrd.nhtsa.dot.gov/edr-site/>

# Questions?



**THE END**