TRANSPORTATION SCIENCES
CRASH DATA RESEARCH CENTER

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GENERAL DYNAMICS REMOTE CERTIFIED ADVANCED 208-COMPLIANT VEHICLE INVESTIGATION

SCI TECHNICAL SUMMARY REPORT

NASS/SCI COMBO CASE NO. 03-12-136G

VEHICLE – 2003 CHEVROLET SILVERADO

LOCATION - STATE OF MICHIGAN

CRASH DATE – AUGUST 2003

Contract No. DTNH22-01-C-17002

Prepared for:

U.S. Department of Transportation
National Highway Traffic Safety Administration
Washington, D.C. 20590

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The crash investigation process is an inexact science which requires that physical evidence such as skid marks, vehicular damage measurements, and occupant contact points are coupled with the investigator's expert knowledge and experience of vehicle dynamics and occupant kinematics in order to determine the pre-crash, crash, and post-crash movements of involved vehicles and occupants.

Because each crash is a unique sequence of events, generalized conclusions cannot be made concerning the crashworthiness performance of the involved vehicle(s) or their safety systems.

TECHNICAL REPORT STANDARD TITLE PAGE

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16. Abstract

This remote investigation focused on the performance of the Certified Advanced 208-Compliant (CAC) safety system in a 2003 Chevrolet Silverado. The manufacturer of this vehicle has certified that this 2003 Chevrolet Silverado meets the advanced air bag requirements of Federal Motor Vehicle Safety Standard (FMVSS) No. 208. The safety system included dual stage frontal air bags, seat track position sensors for the front left and front right seats and an occupant presence sensor for the front right seat. The Chevrolet was also equipped with an Event Data Recorder (EDR) that was downloaded (Deployment and Non-deployment events were retrieved) by the NASS researcher. The 2003 Chevrolet Silverado was occupied by a restrained 47-year-old female driver. The Chevrolet was involved in a three-vehicle front-to-rear type collision. The front of the 2003 Chevrolet impacted the rear of a 2000 Chevrolet Silverado that was slowing for traffic in a construction zone. The 2000 Chevrolet was displaced forward and the front of the 2000 Chevrolet impacted the rear of a 2003 Chevrolet Silverado that was stopped for traffic in front of the 2000 Chevrolet. The impact with the rear of the 2000 Chevrolet resulted in the deployment of the driver's frontal air bag in the 2003 Chevrolet Silverado. The driver of the striking 2003 Chevrolet was not injured or transported. The 2003 Chevrolet Silverado sustained moderate damage and was towed from the scene. The struck 2000 and 2003 Chevrolets sustained minor damage and were driven from the scene.

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SUBJECT VEHICLE – 2003 CHEVROLET SILVERADO
LOCATION - STATE OF MICHIGAN
CRASH DATE - AUGUST 2003

BACKGROUND

This remote investigation focused on the performance of the Certified Advanced 208-Compliant (CAC) safety system in a 2003 Chevrolet Silverado **(Figure 1)**. The manufacturer of this vehicle has certified that this 2003 Chevrolet Silverado meets the advanced air bag requirements of Federal Motor Vehicle Safety Standard (FMVSS) No. 208. The safety system included dual stage frontal air bags, seat track position sensors for the front left and front right seats and an occupant presence sensor for the front right seat. The Chevrolet was also equipped with an Event Data Recorder (EDR) that was downloaded (Deployment and Non-deployment events were retrieved) by the NASS researcher. The 2003 Chevrolet Silverado was occupied by a restrained 47-year-old female driver. The Chevrolet was involved in a three-vehicle front-to-rear type collision. The front of the 2003 Chevrolet impacted the rear of a 2000 Chevrolet Silverado that was slowing for traffic in a construction zone. The 2000 Chevrolet was displaced forward and the front of the 2000 Chevrolet impacted the rear of a 2003 Chevrolet Silverado that was stopped for traffic in front of the 2000 Chevrolet. The impact with the rear of the 2000 Chevrolet resulted in the deployment of the driver's frontal air bag in the 2003 Chevrolet Silverado. The driver of the striking 2003 Chevrolet was not injured or transported. The 2003 Chevrolet Silverado sustained moderate damage and was towed from the scene. The struck 2000 and 2003 Chevrolets sustained minor damage and were driven from the scene.

Figure 1. 2003 Chevrolet Silverado.

This crash was initially selected and researched by the National Automotive Sampling System (NASS) PSU 12 CDS Case No. 03-12-136G. The NASS PSU performed the vehicle and scene inspections. Due to the presence of the CAC vehicle, NHTSA assigned the tasks of case review and report preparation to the General Dynamics SCI team.

Crash Site

This three-vehicle front-to-rear type collision occurred during the morning hours of August 2003 in the state of Michigan. At the time of the crash, there were no adverse weather conditions and the concrete road surface was dry. The concrete roadway was under construction at the time of the collision **(Figure 2)**. The crash occurred on the eastbound lane of an east/west interstate roadway that was divided by a concrete Jersey barrier. The eastbound roadway was configured with one lane for through traffic. The eastbound lane was bordered with a yellow fog line and a concrete shoulder on the north edge. A yellow fog line with construction cones marked the south edge of the roadway. The posted speed limit for the eastbound construction zone was 72 km/h (45 mph).

Figure 2. Crash site.

Vehicle Data – 2003 Chevrolet Silverado (SV)

The 2003 Chevrolet Silverado was identified by the Vehicle Identification Number (VIN): 2GCEK19T63 (production sequence omitted). The odometer reading was 964 km (562 miles) at the time of the inspection. The vehicle was a ½ ton rated four-door pick-up truck that was equipped with a 5.3-liter, eight-cylinder engine, four-wheel disc brakes with ABS, four-wheel drive and a four-speed automatic transmission. The tires on the Chevrolet were Bridgestone Dueler AT radials, size P265/75R16. The manufacturer recommended tire pressure for this vehicle was 241 kpa (35 psi). The maximum pressure listed on the sidewall of the tire was 303 kpa (44 psi). The specific tire data is listed below:

Tire	Measured Pressure	Tread Depth	Restricted	Damage
LF	248 kpa (36 psi)	14 mm (11/32)	No	Outer edge of tire abraded from contact with the bumper
LR	241 kpa (35 psi)	14 mm (11/32)	No	None
RF	248 kpa (36 psi)	14 mm (11/32)	No	None
RR	241 kpa (35 psi)	14 mm (11/32)	No	None

The Chevrolet was configured with front bucket seats with height adjustable head restraints. The second row was configured with a bench seat and height adjustable head restraints for the outboard seating positions.

2000 Chevrolet Silverado

The 2000 Chevrolet Silverado was identified by the VIN No.: 1GCGK29U7Y (production sequence omitted). The odometer reading was unknown at the time of the inspection. The vehicle was a ¾ ton rated three-door pick-up truck that was equipped with 5.9 liter, eight-cylinder engine, with four-wheel drive and a four-speed automatic transmission. The tires on the Chevrolet were Firestone Steeltex A/T radials, size LT245/75R16. The manufacture recommended tire pressure was 345 kpa (50 psi). The maximum tire pressure listed on the sidewall was 414 kpa (60 psi). The specific tire data is listed below:

Tire	Measured Pressure	Tread Depth	Restricted	Damage
LF	310 kpa (45 psi)	14 mm (11/32)	No	None
LR	310 kpa (45 psi)	14 mm (11/32)	No	None
RF	303 kpa (44 psi)	14 mm (11/32)	No	None
RR	317 kpa (46 psi)	14 mm (11/32)	No	None

2003 Chevrolet Silverado

The 2003 Chevrolet Silverado was identified by the VIN No.: 2GCEK19T83 (production sequence omitted). The odometer reading was unknown at the time of the inspection. The vehicle was a ½ ton four-door pick-up truck that was equipped with 5.3 liter, eight-cylinder engine, with four-wheel drive and a four speed automatic transmission. The tires on the Chevrolet Bridgestone Dueler A/T radials, size LT265/75R16. The specific tire data is listed below:

Tire	Measured Pressure	Tread Depth	Restricted	Damage
LF	241 kpa (35 psi)	14 mm (11/32)	No	None
LR	241 kpa (35 psi)	14 mm (11/32)	No	None
RF	221 kpa (32 psi)	14 mm (11/32)	No	None
RR	241 kpa (35 psi)	14 mm (11/32)	No	None

Crash Sequence

Pre-Crash

The 47-year-old female driver of the subject vehicle (SV) 2003 Chevrolet Silverado was operating the vehicle eastbound in the left lane through in a construction zone. A 52-year-old male was operating a 2000 Chevrolet Silverado eastbound ahead of the 2003 Chevrolet. A 51-year-old male was operating a 2003 Chevrolet Silverado in the eastbound lane in front of the 2000 Chevrolet. The 51-year-old male driver of the 2003 Chevrolet came to a stop in the eastbound lane due to stopped traffic ahead. The 52-year-old male driver of the 2000 Chevrolet began to slow down due to the stopped traffic. The 2003 Chevrolet's (SV) EDR indicated that the vehicle was traveling at 62.7 km/h (39.0

mph) five seconds prior to the crash. The EDR also indicated that the driver applied the brakes one second prior to the crash and the vehicle had slowed to 51.5 km/h (32.0 mph).

Crash

The full frontal aspect of the 2003 Chevrolet impacted (SV) the full rear aspect of the 2000 Chevrolet in a 12/6 o'clock impact configuration **(Figure 3)**. The 2000 Chevrolet was subsequently displaced forward by the rear impact. The frontal aspect of the 2000 Chevrolet impacted the rear aspect of the stopped 2003 Chevrolet in a subsequent 12/6 o'clock impact configuration. The impact resulted in moderate severity damage to the front aspect of the 2003 Chevrolet (SV) and was sufficient to deploy the driver's frontal air bag. The WINSMASH program was used to calculate the delta V for this impact. The total delta V for the 2003 Chevrolet (SV) was 27.0 km/h (16.7 mph). The longitudinal and lateral components were -27.0 (16.7 mph) and 0.0 respectively. The total delta V for the 2000 Chevrolet was 25.0 km/h (15.5 mph). The longitudinal and lateral components were 25.0 (15.5 mph) and 0.0 respectively. The 2003 Chevrolet's (SV) EDR recorded a maximum delta V of -19.0 km/h (-11.8 mph) at 170 milliseconds.

Figure 3. Area of impact.

The police reported that the vehicles came to rest which stabilized this crash event. The 2003 Chevrolet (SV) was subsequently impacted in the rear by another vehicle. Due to the stabilization of the original crash this event was not included in the NASS investigation.

Post-Crash

The three vehicles came to rest in the original travel lane, east of the area of impact. The drivers of the three vehicles were not injured or transported to medical facilities. The 2003 Chevrolet (SV) sustained disabling damage and was towed from the scene. The 2000 and 2003 Chevrolet's were sustained non-disabling damage and were driven from the scene.

Vehicle Damage

Exterior –2003 Chevrolet Silverado (SV)

The 2003 Chevrolet Silverado sustained moderate severity frontal damage as a result of the rear-end collision with the 2000 Chevrolet **(Figure 4 and 5)**. The direct contact damage width was 168.0 cm (66.1") and extended from bumper corner-to-bumper corner. The damage consisted of a longitudinally displaced front bumper, hood, left and right front fenders. The damage also consisted of disintegrated front left and front right headlights and grille. The maximum crush was located 5.0 cm left of crush measurement three. Six crush measurements were documented along the front bumper using a combined direct and induced damage width of 168.0 cm (66.1") and were as follows:

C1= 11.0 cm (4.3”) C2= 21.0 cm (8.3”) C3= 29.0 cm (11.4”) C4= 20.0 cm (7.9”) C5= 14.0 cm (5.5”) C6= 5.0 cm (2.0”). The Collision Deformation Classification for the frontal impact with the 2000 Chevrolet was 12-FDEW-2. The four doors remained closed and operational. The windshield was fractured on the left edge at the A-pillar from contact with the hood edge. The remainder of the glazing was not damaged.

Figure 4. Damage profile of the 2003 Chevrolet Silverado (SV).

Figure 5. Lateral view of the rush profile of the SV.

Interior –2003 Chevrolet Silverado (SV)

The 2003 Chevrolet Silverado sustained no interior damage as a result of the crash. The NASS researcher documented one occupant contact to a radar detector that was mounted on bottom edge of the left knee bolster.

Exterior – 2000 Chevrolet Silverado

Figure 6. Rear damage to 2000 Chevrolet Silverado.

The 2000 Chevrolet Silverado sustained moderate severity rear damage **(Figure 6)** as result of the impact with the 2003 Chevrolet. The damage consisted of a longitudinally and vertically displaced bumper and deformed rear tailgate. The direct contact damage width was 169.0 cm (66.5”) and extended from bumper corner-to-bumper corner. Maximum crush was located at crush measurement three. Six crush measurements were documented along the rear bumper using a combined direct and induced damage width of 178.0 cm (70.1”) and were as follows: C1= 22.0 cm (8.6”), C2 =21.0 cm (8.3), C3= 29.0 cm (11.4”), C4= 27.0 cm (10.6”), C5= 17.0 cm (6.7”), C6= 21.0 cm (8.3”). The Collision Deformation Classification for this impact was 06-BDEW-2. The doors remained closed and operational and all glazing remained intact.

A secondary impact was documented to the front of the Chevrolet from the impact with the rear of the stopped 2003 Chevrolet. The damage consisted of a 3.0 cm gouge on the plastic molding **(Figure 7)** of the front bumper that was located 87.0 cm (34.3") right of the front left bumper corner. The Collision Deformation Classification for this impact was 12-FCEN-1.

Figure 7. Damage to 2000 Chevrolet Silverado from 2nd event minor gouge on plastic bumper molding,

Exterior – 2003 Chevrolet Silverado

The 2003 Chevrolet Silverado sustained minor severity rear damage **(Figure 8)** as result of the impact with the 2000 Chevrolet. The damage consisted of a 2.0 cm (0.8") gouge in plastic molding on the front bumper that was located 86.0 cm (33.8") right of the rear left bumper corner. The Collision Deformation Classification for this impact was 06-BCLN-1.

Figure 8. Damage to rear of 2003 Chevrolet Silverado.

Manual Restraints System –2003 Chevrolet Silverado (SV)

The 2003 Chevrolet Silverado was equipped with integrated manual 3-point lap and shoulder belts for the front seating positions. The driver's safety belt was configured with a sliding latch and a belt sensitive Emergency Locking Retractor (ELR). The driver utilized his safety belt during the crash. No loading evidence was noted on the safety belt by the NASS researcher. The front right safety belt was configured with a sliding latch plate and a switchable ELR/Automatic Locking Retractor (ALR). The rear outboard safety belts were configured with sliding latch plates and switchable ELR/ALR retractors. The rear center safety belt was configured with a locking latch plate and no retractor.

Certified Advanced 208-Compliant Safety System – 2003 Chevrolet Silverado (SV)

The 2003 Chevrolet Silverado was equipped with a Certified Advanced Compliant safety system. The manufacturer of this vehicle has certified that this 2003 Chevrolet Silverado meets the advanced air bag requirements of Federal Motor Vehicle Safety Standard (FMVSS) No. 208. The system included dual-stage frontal air bags, seat track position sensor for the front left and front right seat and an occupant presence sensor for the front right seat. The system is controlled by a Sensing and Diagnostic Module (SDM). The SDM deploys the appropriate safety system dependant on the crash severity, occupant presence and seat track position. In this crash the SDM commanded a stage one deployment of the driver's frontal air bag. There was no front right passenger; therefore the SDM did not deploy the front right air bag.

Frontal Air Bag – 2003 Chevrolet Silverado (SV)

The driver's frontal air bag was located in the steering wheel hub. The air bag contained two symmetrical "I" configuration cover flaps that measured 11.0 cm (4.3") in height and 8.0 cm (3.1") in width. The air bag was 61.0 cm (24.0") in diameter **(Figure 8)** and contained four tethers and was vented by two vent ports on the rear aspect of the air bag at the 11 and 1 o'clock positions. The front right air bag was located on the center of the right front instrument panel. The front right air bag did not deploy in this crash.

Figure 4. Deployed driver's frontal air bag.

Event Data Recorder (EDR) –2003 Chevrolet Silverado (SV)

The 2003 Chevrolet Silverado was equipped with an Event Data Recorder (EDR). The EDR was downloaded by the NASS researcher and is included in this report as **Attachment A**. The EDR data included both deployment and non-deployment events for this crash. The EDR data indicated that driver's safety belt was buckled at the time of the crash. The EDR data also indicated the vehicle was traveling at 62.7 km/h (39.0 mph) five seconds prior to the crash and the driver applied the brakes and slowed the vehicle to 51.5 km/h (32.0 mph) one second prior to the crash. The EDR recorded a maximum delta V of -19.0 km/h (-11.8 mph) at 170.0 milliseconds.

Occupant Demographics – 2003 Chevrolet Silverado (SV)

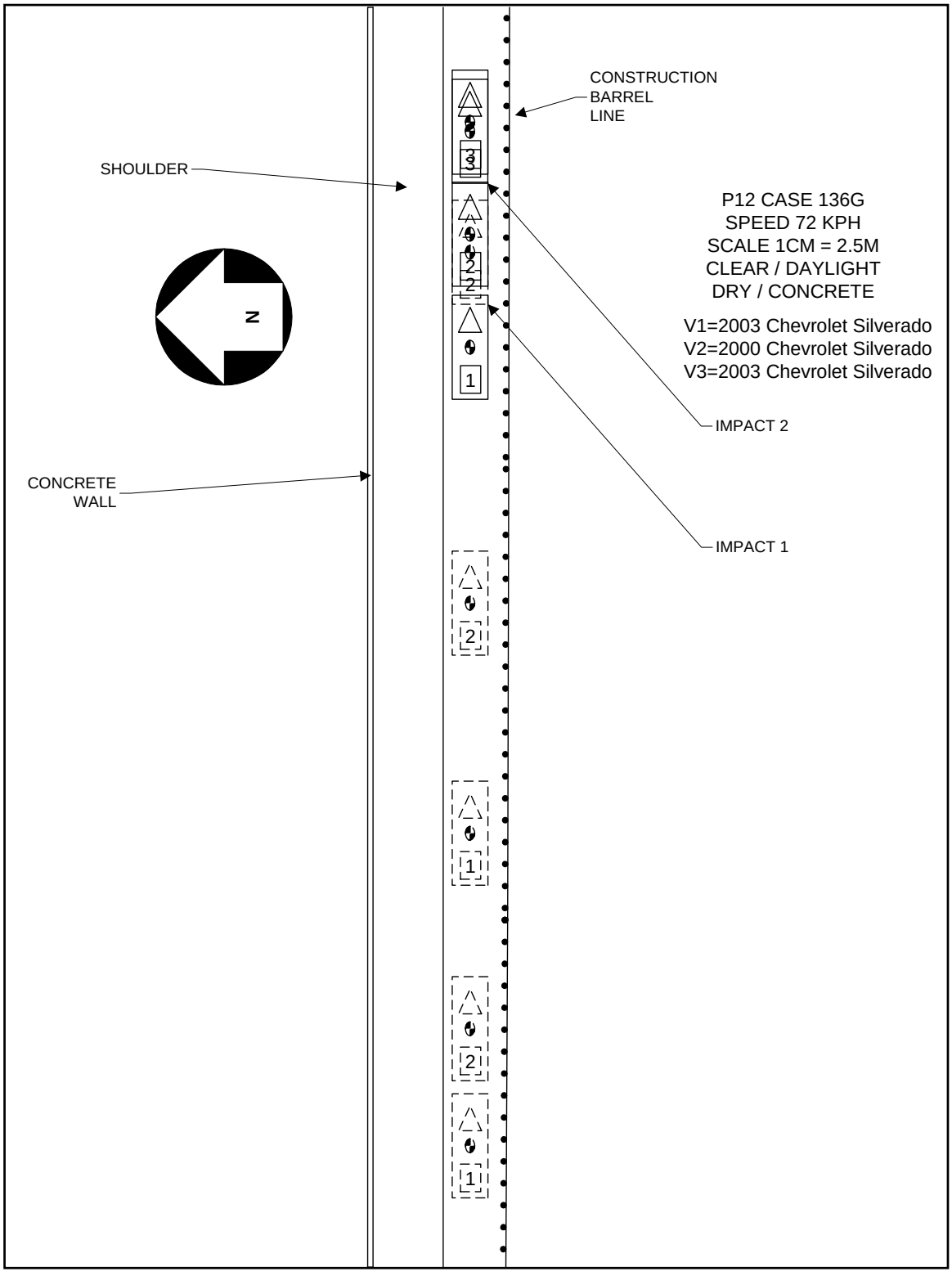
Driver

Age/Sex:	47-year-old female
Height:	175.3 cm (69.0")
Weight:	90.7 kg (200.0 lbs)
Seat Track Position:	Between middle and rear
Manual Restraint Use:	Integrated manual 3-point lap and shoulder belt
Usage Source:	Vehicle inspection
Eyewear:	Eyeglasses/Sunglasses
Type of Medical Treatment:	Not transported

Driver Kinematics

The 47-year-old female driver of the 2003 Chevrolet Silverado was seated in a presumed upright driving posture and was restrained by the manual 3-point lap and shoulder belt. The seat track was in the mid-track position. At impact, the restrained driver initiated a forward trajectory and loaded the safety belt. The driver was not injured in this crash or transported to a hospital. However, she stated to the NASS researcher that she had soreness in her neck. The restraint use by the driver prevented her from possible contact with the interior of the vehicle thus preventing possible injuries.

Figure 18. NASS Scene Schematic



Attachment A: EDR Data 2003 Chevrolet Silverado

CDR File Information

Vehicle Identification Number	2GCEK19T631xxxxxx
Investigator	
Case Number	
Investigation Date	
Crash Date	
Filename	
Saved on	
Data check information	1163A01F
Collected with CDR version	Crash Data Retrieval Tool 2.10
Collecting program verification number	B6B4FDF8
Reported with CDR version	Crash Data Retrieval Tool 2.21
Reporting program verification number	6B1D6F0F
Interface used to collected data	Block number: 00 Interface version: 35 Date: 01-02-03 Checksum: 6200
Event(s) recovered	Deployment Non-Deployment

SDM Data Limitations

SDM Recorded Crash Events:
There are two types of SDM recorded crash events. The first is the Non-Deployment Event. A Non-Deployment Event is an event severe enough to "wake up" the sensing algorithm but not severe enough to deploy the air bag(s). It contains Pre-Crash and Crash data. The SDM can store up to one Non-Deployment Event. This event can be overwritten by an event that has a greater SDM recorded vehicle forward velocity change. This event will be cleared by the SDM after the ignition has been cycled 250 times.
The second type of SDM recorded crash event is the Deployment Event. It also contains Pre-Crash and Crash data. The SDM can store up to two different Deployment Events, if they occur within five seconds of one another. Deployment events can not be overwritten or cleared from the SDM. Once the SDM has deployed the air bag, the SDM must be replaced.
The data in the non-deployment file will be locked after a deployment, if the non-deployment occurred within 5 seconds before the deployment or a deployment level event occurs within 5 seconds after the deployment.

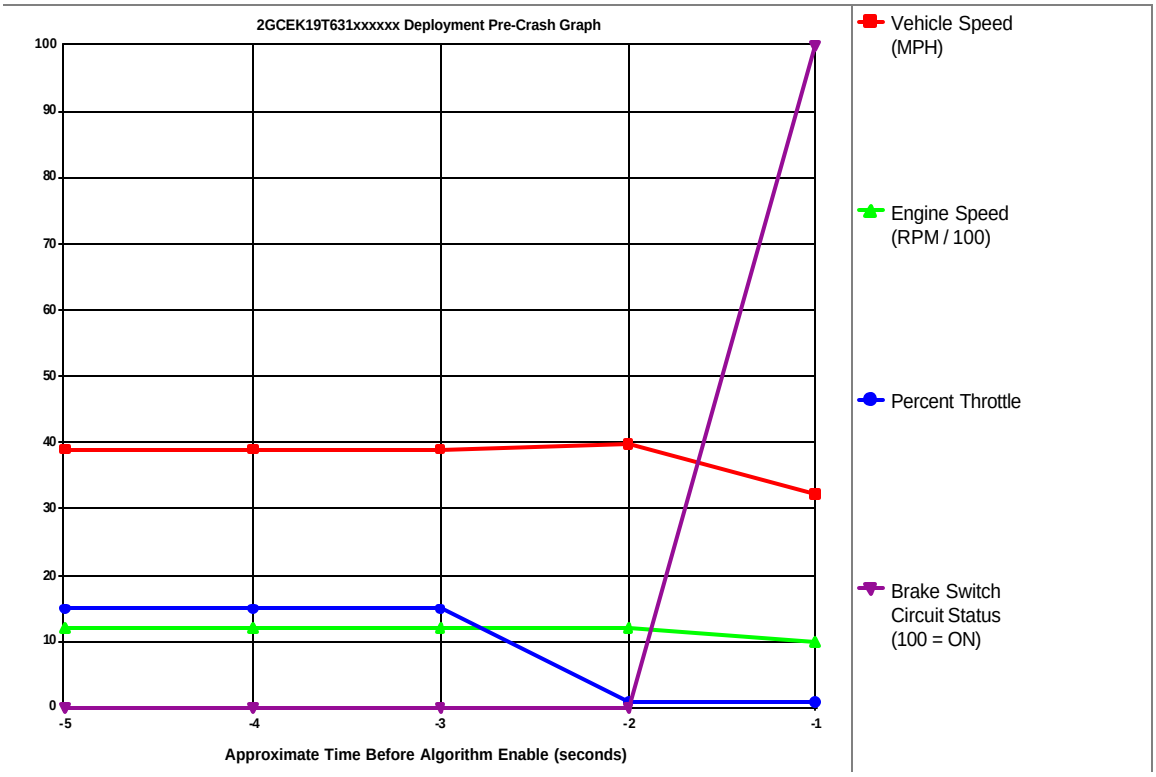
SDM Data Limitations:
-SDM Recorded Vehicle Forward Velocity Change is one of the measures used to make air bag deployment decisions. SDM Recorded Vehicle Forward Velocity Change reflects the change in forward velocity that the sensing system experienced during the recorded portion of the event. SDM Recorded Vehicle Forward Velocity Change is the change in velocity during the recording time and is not the speed the vehicle was traveling before the event, and is also not the Barrier Equivalent Velocity. This data should be examined in conjunction with other available physical evidence from the vehicle and scene when assessing occupant or vehicle forward velocity change. For deployments and deployment level events, the SDM will record 100 milliseconds of data after deployment criteria is met and up to 50 milliseconds before deployment criteria is met. For non-deployments, the SDM will record the first 150 milliseconds of data after algorithm enable.
-Event Recording Complete will indicate if data from the recorded event has been fully written to the SDM memory or if it has been interrupted and not fully written.
-SDM Recorded Vehicle Speed accuracy can be affected if the vehicle has had the tire size or the final drive axle ratio changed from the factory build specifications.
-Brake Switch Circuit Status indicates the status of the brake switch circuit.
-Pre-Crash Electronic Data Validity Check Status indicates "Data Invalid" if the SDM does not receive a valid message.
-Driver's Belt Switch Circuit Status indicates the status of the driver's seat belt switch circuit
-The Time Between Non-Deployment and Deployment Events is displayed in seconds. If the time between the two events is greater than 25.4 seconds, "N/A" is displayed in place of the time.
-If power to the SDM is lost during a crash event, all or part of the crash record may not be recorded.

SDM Data Source:
All SDM recorded data is measured, calculated, and stored internally, except for the following:
-Vehicle Speed, Engine Speed, and Percent Throttle data are transmitted once a second by the Powertrain Control Module (PCM), via the Class 2 data link, to the SDM.
-Brake Switch Circuit Status data is transmitted once a second by either the ABS module or the PCM, via the Class 2 data link, to

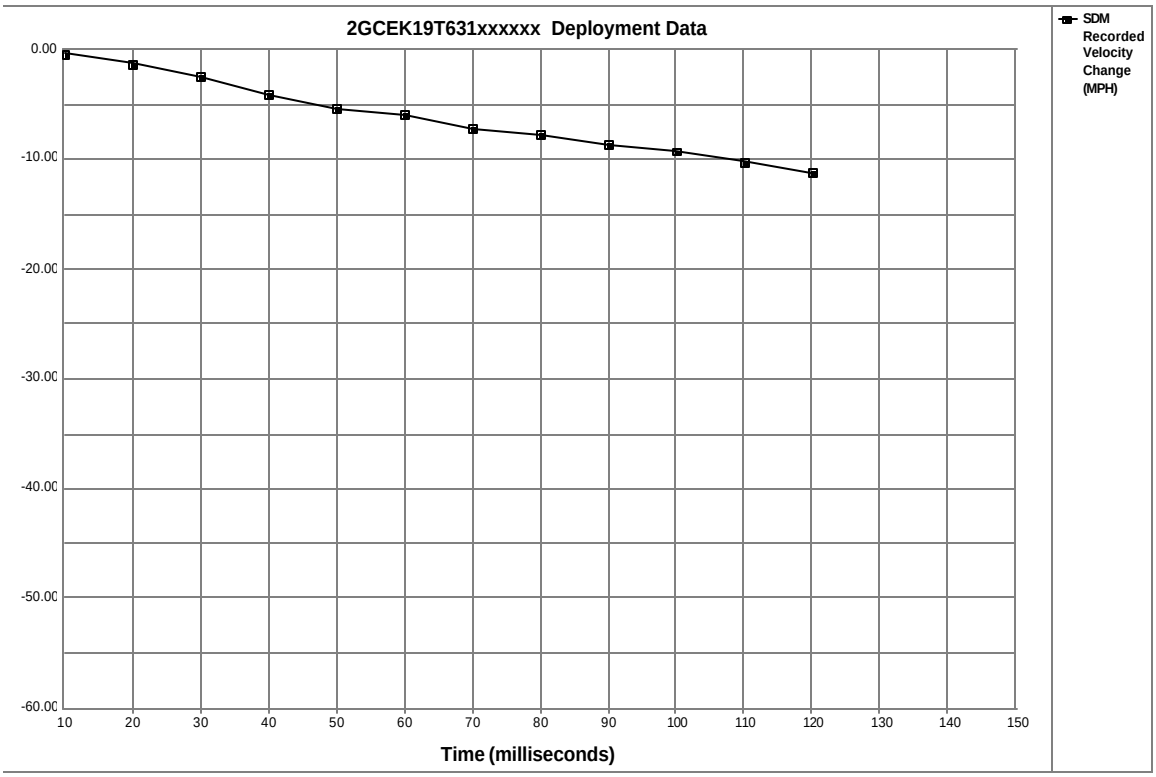
the SDM.
-In most vehicles, the Driver's Belt Switch Circuit is wired directly to the SDM. In some vehicles, the Driver's Belt Switch Circuit Status data is transmitted from the Body Control Module (BCM), via the Class 2 data link, to the SDM.

System Status At Deployment

SIR Warning Lamp Status	OFF
Driver's Belt Switch Circuit Status	BUCKLED
Ignition Cycles At Deployment	110
Ignition Cycles At Investigation	113
Maximum SDM Recorded Velocity Change (MPH)	-11.83
Algorithm Enable to Maximum SDM Recorded Velocity Change (msec)	170
Driver First Stage Time Algorithm Enabled to Deployment Command Criteria Met (msec)	20
Driver Second Stage Time Algorithm Enabled to Deployment Command Criteria Met (msec)	N/A
Passenger First Stage Time Algorithm Enabled to Deployment Command Criteria Met (msec)	N/A
Passenger Second Stage Time Algorithm Enabled to Deployment Command Criteria Met (msec)	N/A
Time Between Non-Deployment And Deployment Events (sec)	N/A
Frontal Deployment Level Event Counter	1
Event Recording Complete	Yes
Multiple Events Associated With This Record	No
One Or More Associated Events Not Recorded	No



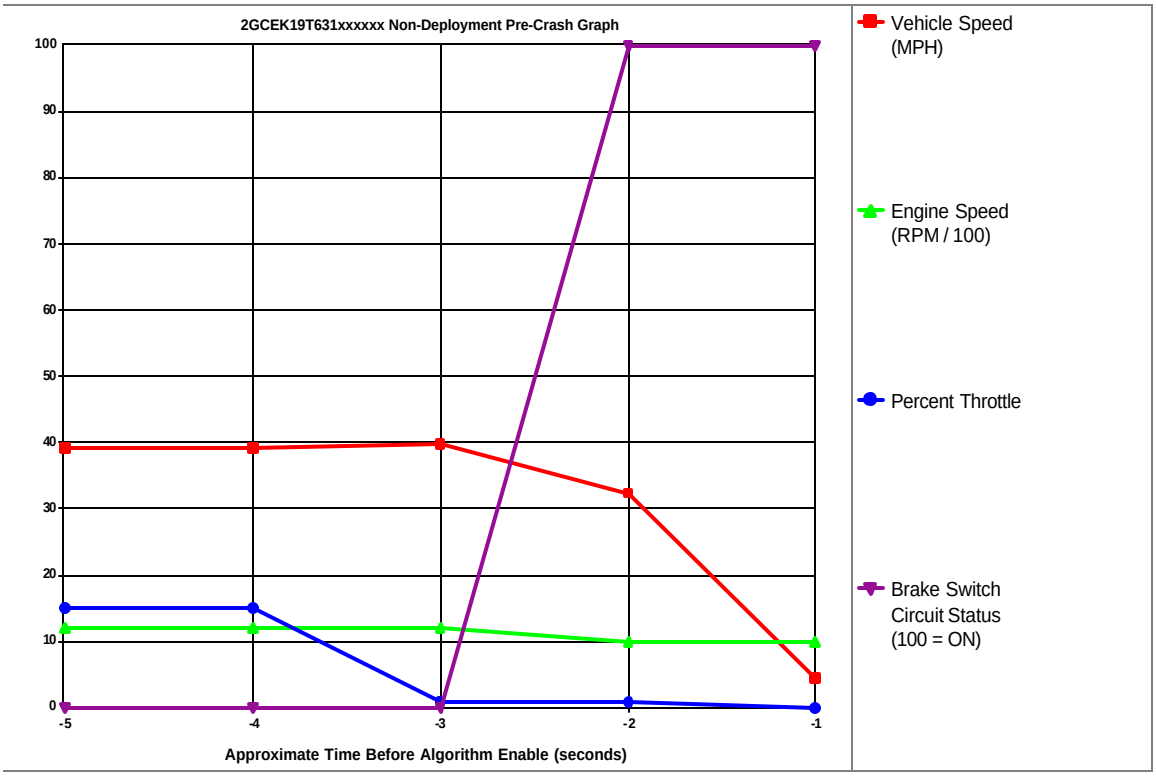
Seconds Before AE	Vehicle Speed (MPH)	Engine Speed (RPM)	Percent Throttle	Brake Switch Circuit Status
-5	39	1152	15	OFF
-4	39	1152	15	OFF
-3	39	1152	15	OFF
-2	40	1152	1	OFF
-1	32	960	1	ON



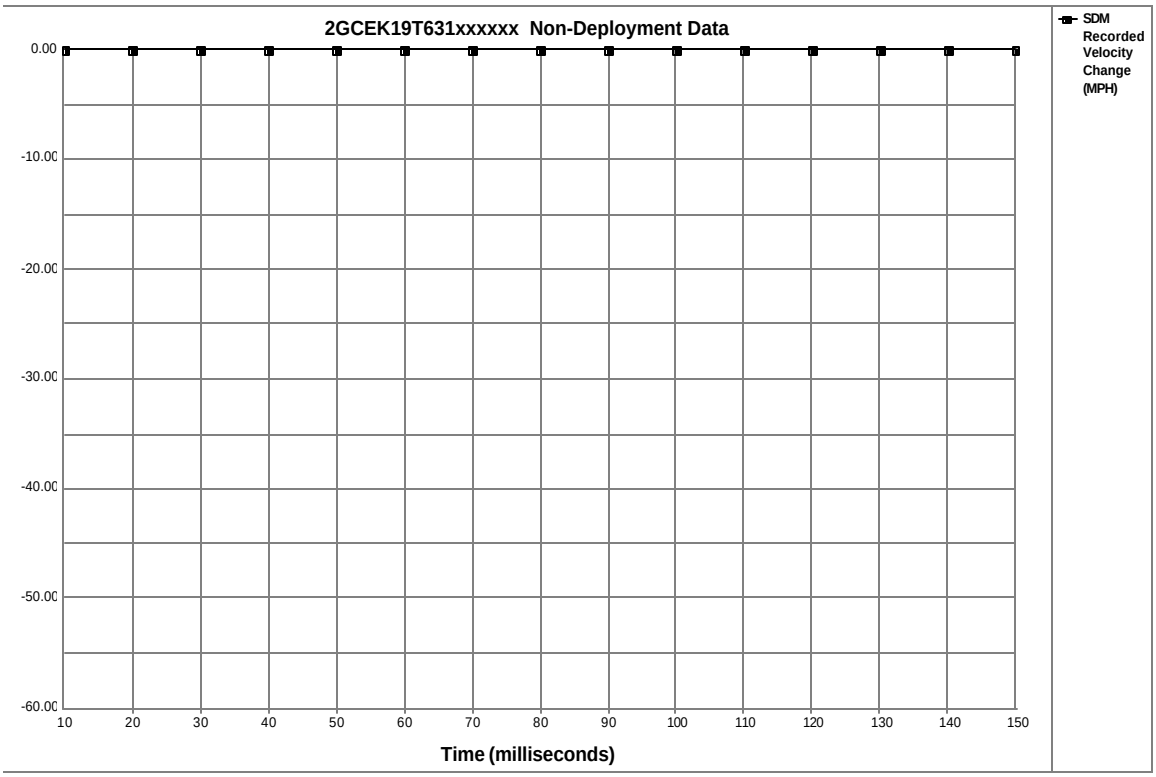
Time (milliseconds)	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150
Recorded Velocity Change (MPH)	-0.31	-1.24	-2.48	-4.03	-5.27	-5.89	-7.13	-7.75	-8.68	-9.30	-10.23	-11.16	N/A	N/A	N/A

System Status At Non-Deployment

SIR Warning Lamp Status	OFF
Driver's Belt Switch Circuit Status	BUCKLED
Ignition Cycles At Non-Deployment	110
Ignition Cycles At Investigation	113
Maximum SDM Recorded Velocity Change (MPH)	0.00
Algorithm Enable to Maximum SDM Recorded Velocity Change (msec)	175
Event Recording Complete	Yes
Multiple Events Associated With This Record	No
One Or More Associated Events Not Recorded	No



Seconds Before AE	Vehicle Speed (MPH)	Engine Speed (RPM)	Percent Throttle	Brake Switch Circuit Status
-5	39	1152	15	OFF
-4	39	1152	15	OFF
-3	40	1152	1	OFF
-2	32	960	1	ON
-1	4	1024	0	ON



Time (milliseconds)	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150
Recorded Velocity Change (MPH)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Hexadecimal Data

This page displays all the data retrieved from the air bag module.
It contains data that is not converted by this program.

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$0A  41 44 75 06 56 30
$0B  16 48 50 30 52 33
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$0E  00 00 00 00 00 00
$0F  00 00 00 00 00 00
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$41  80 00 02 02 26 26
$42  26 00 0F 12 12 12
$43  12 00 0D F0 00 00
$44  07 34 40 3F 3F 00
$45  C0 00 00 02 02 26
$46  26 00 10 0F 12 12
$47  12 00 80 FE 00 00
$48  FF FF FF FF FF FF
$49  FF FF FF FF FF FF
$4A  FF FF FF FF FF FF
$4B  FF FF FF FF 00 00
$4C  FF FF FF FF FF FF
$4D  FF FF FF FF FF FF
$4E  FF FF FF FF FF FF
$4F  FF FF FF FF 00 00
$50  FF FF FF FF FF FF
$51  FF FF FF FF FF FF
$52  FF FF FF FF FF FF
$53  FF FF FF FF FF FF
$54  FF FF FF FF FF FF
```