

**TRANSPORTATION SCIENCES
CRASH DATA RESEARCH CENTER**

Advanced Information Engineering Services
A General Dynamics Company
Buffalo, NY 14225

**GENERAL DYNAMICS REMOTE CERTIFIED ADVANCED COMPLIANT
VEHICLE CRASH INVESTIGATION**

SCI TECHNICAL SUMMARY REPORT

NASS/SCI COMBO CASE NO. 03-09-224C

VEHICLE – 2003 GMC SIERRA

LOCATION - STATE OF MARYLAND

CRASH DATE – OCTOBER 2003

Contract No. DTNH22-01-C-17002

Prepared for:

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

DISCLAIMER

This document is disseminated under the sponsorship of the Department of Transportation in the interest of information exchange. The United States Government assumes no responsibility for the contents or use thereof.

The opinions, findings, and conclusions expressed in this publication are those of the authors and not necessarily those of the National Highway Traffic Safety Administration.

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

<p>1. <i>Report No.</i> 03-09-224C</p>	<p>2. <i>Government Accession No.</i></p>	<p>3. <i>Recipient's Catalog No.</i></p>	
<p>4. <i>Title and Subtitle</i> General Dynamics Remote Certified Advanced Compliant Vehicle Crash Investigation Vehicle: 2003 GMC Sierra Location: State of Maryland</p>		<p>5. <i>Report Date:</i> February 2004</p>	
		<p>6. <i>Performing Organization Code</i></p>	
<p>7. <i>Author(s)</i> Crash Data Research Center</p>		<p>8. <i>Performing Organization Report No.</i></p>	
<p>9. <i>Performing Organization Name and Address</i> Transportation Sciences Crash Data Research Center Advanced Information Engineering Services A General Dynamics Company P.O. Box 400 Buffalo, New York 14225</p>		<p>10. <i>Work Unit No.</i> C00410.0000.0172</p>	
		<p>11. <i>Contract or Grant No.</i> DTNH22-01-C-17002</p>	
<p>12. <i>Sponsoring Agency Name and Address</i> U.S. Department of Transportation National Highway Traffic Safety Administration Washington, D.C. 20590</p>		<p>13. <i>Type of Report and Period Covered</i> Technical Report Crash Date: October 2003</p>	
		<p>14. <i>Sponsoring Agency Code</i></p>	
<p>15. <i>Supplementary Note</i> This remote investigation focused on the performance of the Certified Advanced Compliant vehicle safety system in a 2003 GMC Sierra.</p>			
<p>16. <i>Abstract</i> This remote investigation focused on the performance of the Certified Advanced Compliant (CAC) safety system in the 2003 GMC Sierra pickup truck. A CAC vehicle is certified by the manufacturer to be compliant to the Advanced Air Bag portion 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. In addition, the GMC was equipped with an Event Data Recorder (EDR) that was downloaded by the NASS researcher. The EDR printout is included as Attachment A of this report. The 2003 GMC Sierra was occupied by a restrained 32-year-old male driver and a restrained 29-year-old male front right occupant. The GMC was involved in a moderate severity intersection-type crash with a 2001 Ford F-150. The Ford was occupied by a 17-year-old male driver and a 17-year-old male front right occupant. The GMC was traveling eastbound on a two-lane, two-way roadway approaching a parking lot to a local business. The Ford was traveling northbound exiting the parking lot and attempting to turn left to travel westbound. The Ford failed to yield the right-of-way and turned left in front of the GMC. The impact resulted in a Stage two deployment of the driver's frontal air bag in the GMC. Although the front right seat was occupied and the cut-off switch was keyed to the "Auto-On" position, the front right air bag did not deploy. The driver of the GMC was transported to a hospital where he was treated and released for complaints of pain of the neck and extremities. The front right occupant of the GMC sustained an AIS-3 right mid shaft femur fracture and an AIS-1 left median nerve neurapraxia. The front right occupant was transported to a local hospital where he was admitted for treatment and surgical repair of the right femur fracture. Both vehicles sustained moderate damage and were towed from the crash site.</p>			
<p>17. <i>Key Words</i> Certified Advanced Compliant Vehicle Adult Front Right Passenger Non-Deployed Front Right Air Bag</p>		<p>18. <i>Distribution Statement</i> General Public</p>	
<p>19. <i>Security Classif. (of this report)</i> Unclassified</p>	<p>20. <i>Security Classif. (of this page)</i> Unclassified</p>	<p>21. <i>No. of Pages</i> 16</p>	<p>22. <i>Price</i></p>

TABLE OF CONTENTS

BACKGROUND.....1

SUMMARY.....2

CRASH SITE..... 2

VEHICLE DATA2

 2003 GMC SIERRA..... 2

 2001 FORD F-150..... 2

CRASH SEQUENCE3

PRE-CRASH 3

CRASH..... 4

POST-CRASH..... 4

VEHICLE DAMAGE.....4

EXTERIOR – 2003 GMC SIERRA..... 4

INTERIOR – 2003 GMC SIERRA..... 5

EXTERIOR – 2001 FORD F-150..... 5

MANUAL RESTRAINT SYSTEMS – 2003 GMC SIERRA 5

CERTIFIED ADVANCED COMPLIANT SAFETY SYSTEM – 2003 GMC SIERRA6

EVENT DATA RECORDER (EDR) - 2003 GMC SIERRA7

OCCUPANT DEMOGRAPHICS – 2003 GMC SIERRA.....7

DRIVER..... 7

DRIVER INJURIES 7

DRIVER KINEMATICS 7

FRONT RIGHT PASSENGER..... 8

FRONT RIGHT PASSENGER INJURIES 8

FRONT RIGHT PASSENGER KINEMATICS 8

FIGURE 11. NASS SCENE SCHEMATIC.....10

ATTACHMENT A: EDR OUTPUT11

**GENERAL DYNAMICS REMOTE CERTIFIED ADVANCED COMPLIANT
VEHICLE CRASH INVESTIGATION
SCI SUMMARY TECHNICAL REPORT
NASS/SCI COMBO CASE NO. 03-09-224C
SUBJECT VEHICLE – 2003 GMC SIERRA
LOCATION - STATE OF MARYLAND
CRASH DATE - OCTOBER 2003**

BACKGROUND

This remote investigation focused on the performance of the Certified Advanced Compliant (CAC) safety system in the 2003 GMC Sierra pickup truck (**Figure 1**). A CAC vehicle is certified by the manufacturer to be compliant to the Advanced Air Bag portion 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. In addition, the GMC was equipped with an Event Data Recorder (EDR) that was



Figure 1. Subject vehicle 2003 GMC Sierra.

downloaded by the NASS researcher. The EDR printout is included as **Attachment A** of this report. The 2003 GMC Sierra was occupied by a restrained 32-year-old male driver and a restrained 29-year-old male front right occupant. The GMC was involved in a moderate severity intersection-type crash with a 2001 Ford F-150. The Ford was occupied by a 17-year-old male driver and a 17-year-old male front right occupant. The GMC was traveling eastbound on a two-lane, two-way roadway approaching a parking lot to a local business. The Ford was traveling northbound exiting the parking lot and attempting to turn left to travel westbound. The Ford failed to yield the right-of-way and turned left in front of the GMC. The impact resulted in a Stage two deployment of the driver's frontal air bag in the GMC. Although the front right seat was occupied and the cut-off switch was keyed to the "Auto-On" position, the front right air bag did not deploy. The driver of the GMC was transported to a hospital where he was treated and released for complaints of pain of the neck and extremities. The front right occupant of the GMC sustained an AIS-3 right mid shaft femur fracture and an AIS-1 left median nerve neurapraxia. The front right occupant was transported to a local hospital where he was admitted for treatment and surgical repair of the right femur fracture. Both vehicles sustained moderate damage and were towed from the crash site.

This crash was identified by the National Automotive Sampling System (NASS) PSU 09 during the weekly sampling of Police Accident Reports (PARs). This crash was selected and researched as CDS Case No. 03-09-224C. The NASS PSU performed the vehicle and scene inspections, and conducted driver/occupant interviews. Due to the presence of the Certified Advanced Compliant safety system in the GMC, NHTSA assigned the tasks of case review and report preparation to the General Dynamics SCI team.

SUMMARY

Crash Site

This two-vehicle crash occurred during the evening hours of October 2003 in the state of Maryland. At the time of the crash, there were no adverse weather conditions and the asphalt road surface was dry. The crash occurred at a junction of a local road and a parking lot. The east/westbound roadway was a two-lane, two-way roadway. A solid yellow line with a dashed yellow line prohibiting passing for the westbound direction separated the east/westbound lanes. The posted speed limit for the east/westbound roadway was 80 km/h (50 mph).

Vehicle Data

2003 GMC Sierra

The 2003 GMC Sierra was identified by the Vehicle Identification Number (VIN): 1GTEK19T53 (production sequence omitted). The odometer reading was unknown at the time of the inspection due to vehicle having no power. The vehicle was a four-door pickup 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 GMC were Goodyear Wrangler ST, size P245/75R16. The maximum pressure for these tires was 303 kpa (44 psi). The manufacturer recommended front and rear tire pressure was 241 kpa (35 psi). The specific tire data was as follow:

Tire	Measured Pressure	Tread Depth	Restricted	Damage
LF	228 kpa (33 psi)	8 mm (10/32)	No	None
LR	0 kpa	8 mm (10/32)	No	None
RF	221 kpa (32 psi)	7 mm (9/32)	No	None
RR	228 kpa (33 psi)	7 mm (9/32)	No	None

The GMC was configured with a front three-passenger split bench seat with separate back cushions and height adjustable head restraints for the outboard positions. The front head restraints were adjusted to the full-down position at the time of the inspection. The second row was configured with a three-passenger bench seat and height adjustable head restraints for the outboard positions. The rear head restraints were adjusted to the full-down position at the time of the inspection.

2001 Ford F-150

The 2001 Ford F-150 was identified by the Vehicle Identification Number (VIN): 1FTRX18L11 (production sequence omitted). The odometer reading was unknown at the time of the inspection due to vehicle having no power. The vehicle was a four-door pickup truck that was equipped with a 5.4-liter, eight-cylinder engine, four-wheel drive and a four-speed automatic transmission, and four-wheel ABS. The front and rear left tires on the Ford were Continental Contitrac SUV, size P265/70R17. The maximum pressure for these tires was 303 kpa (44 psi). The rear right tire on the Ford was a Michelin X Radial LT. The maximum pressure for this tire was 241 kpa (35 psi). The

manufacturer recommended front and rear tire pressure was 241 kpa (35 psi). The specific tire data is listed is as follows:

Tire	Measured Pressure	Tread Depth	Restricted	Damage
LF	55 kpa (8 psi)	6 mm (8/32)	No	None
LR	310 kpa (45 psi)	6 mm (8/32)	No	None
RF	200 kpa (29 psi)	6 mm (8/32)	No	None
RR	262 kpa (38 psi)	10 mm (13/32)	No	None

The Ford was configured with a front three-passenger split bench seat split bench seat with separate back cushions and integrated head restraints for the outboard positions. The second row was configured with a three-passenger bench seat with no head restraints.

Crash Sequence

Pre-Crash

The restrained 32-year-old male driver of the GMC was operating the vehicle eastbound in the through lane (**Figure 2**). A restrained 29-year-old male front right occupant also occupied the GMC. The driver of the Ford was operating the vehicle northbound (**Figure 3**), exiting a parking lot where he was turning left to travel west. The driver of the Ford failed to detect the GMC and turned left across the path of the GMC. There was no physical evidence at the crash site. The EDR data indicated that the GMC was traveling at 98.2 km/h (61.0 mph) five seconds prior to the crash and had slowed to 70.8 km/h (44.0 mph) one second prior to the crash. The EDR also indicated that the brake switch status was in the on-position from two to one second prior to the crash. The NASS scene schematic is included as **Figure 11** of this report.



Figure 2. GMC's eastbound approach.



Figure 3. Ford's northbound approach.

Crash

As the Ford entered the eastbound lane the front aspect of the GMC impacted the left front side aspect of the Ford (**Figure 4**). The impact resulted in moderate severity damage to the front aspect of the GMC and was sufficient to deploy the driver's frontal air bag. The front right air bag of the GMC did not deploy in this crash. The resultant directions of force were within the 12 o'clock sector for the GMC and the 11 o'clock sector for the Ford. The Ford was under repair at the time of the NASS inspection, therefore a WINSMASH missing vehicle algorithm was used to calculate an approximate delta-V for this impact. The total calculated delta-V for the GMC was 35.0 km/h (21.7 mph). The longitudinal and lateral components for the GMC were -34.5 km/h (-21.4) and -6.1 km/h (-3.8 mph), respectively. The EDR data recorded a maximum velocity change of 35.6 km/h (-22.1 mph). The total calculated delta-V for the Ford was 37.0 km/h (22.9 mph). The longitudinal and lateral components for the Ford were -28.3 km/h (-17.6 mph) and 23.8 km/h (14.8 mph), respectively.



Figure 4. Area of impact from GMC's eastbound approach.

Post-Crash

The Ford rotated in a clockwise direction and was displaced right of the point of impact. At rest, the Ford was positioned perpendicular to the travel lane facing in a northerly direction. The GMC was deflected approximately 20 degrees counterclockwise coming to rest near the point of impact. The driver of the GMC was transported to a local hospital where he was treated and released for complaints of pain of the neck and extremities. The front right occupant of the GMC sustained an AIS-3 right mid shaft femur fracture and an AIS-1 left median nerve neurapraxia. The front right occupant was transported to a local hospital where he was admitted for treatment and surgical repair of the right femur fracture. Both vehicles sustained disabling damage and were towed from the crash site.

VEHICLE DAMAGE

Exterior – 2003 GMC Sierra

The 2003 GMC Sierra sustained moderate severity frontal damage as a result of the collision with the Ford (**Figure 5**). The maximum crush was located 19.0 cm (7.5") right of C3 and measured 39.0 cm (15.4"). The direct contact damage began on the front right bumper corner and extended left 117.0 cm (46.1"). The damage involved the bumper, hood, radiator support, and front right fender. Six crush measurements were



Figure 5. Damage to 2003 GMC Sierra.

documented along the front bumper using a combined direct and induced damage with of 156.0 cm (61.4”) and were as follows: C1 = 0.0 cm, C2 = 2.0 cm (0.8”), C3 = 9.0 cm (3.5”), C4 = 36.0 cm (14.2”), C5 = 27.0 cm (10.6”), C6 = 20.0 cm (7.9”). The Collision Deformation Classification (CDC) for this impact was 12-FDEW-2. The four doors remained closed and operational post-crash. The windshield was fractured at the base of the right A-pillar from contact with the rear right corner of the hood edge as it was deformed rearward. All side glazing and backlight remained intact.

Interior – 2003 GMC Sierra

The 2003 GMC Sierra sustained minor interior damage (**Figure 6**) as a result of occupant contacts; no interior intrusions were noted. The occupant contacts consisted of the driver’s left hand contacting and fracturing the turn signal stalk and the driver’s left knee contacting and scuffing the knee bolster. Also noted, was body fluid on the front left air bag from contact with the driver’s face. The front right occupant contact involved his right hip contacting and scuffing the front right door panel. A small dirt scuff was noted to the glove box door that was not related to an occupant contact.



Figure 6. Interior view of front row. Note contact damage to turn signal lever.

Exterior – 2001 Ford F-150

The 2001 Ford F-150 sustained moderate severity left side damage (**Figure 7**). The direct contact damage could not be identified due to the fenders, hood and frontal components being removed from the vehicle prior to the NASS inspection. The NASS researcher documented a crush profile at the upper left side frame and the maximum crush was approximately 20.0 cm (8.0”) at the forward aspect of the front left fender. The CDC for this impact was 71-LY99-9 with incremented shift of 60 and a direction of force of 11 o’clock.



Figure 7. Damage to 2001 Ford F-150

Manual Restraint Systems – 2003 GMC Sierra

The 2003 GMC Sierra was equipped with integrated manual 3-point lap and shoulder safety belts for the front outboard seating positions. The front and rear center seating positions were configured with manual 2-point lap belts. The rear outboard seating positions were configured with manual 3-point lap and shoulder safety belts. The driver’s safety belt was configured with a sliding latch plate and a belt-sensitive Emergency Locking Retractor (ELR). The driver and front right passenger utilized their safety belts. The front right and two rear outboard safety belts were configured with

sliding latch plates and switchable ELR/Automatic Locking Retractor (ALR). The front and rear center safety belts were configured with locking latch plates and no retractors.

Certified Advanced Compliant Safety System – 2003 GMC Sierra

The 2003 GMC Sierra was equipped with a Certified Advanced Compliant safety system. The 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 system was monitored and controlled by a Sensing and Diagnostic control Module (SDM) that was mounted to the floor under the driver's seat. The SDM deploys the appropriate safety component(s) dependant on occupant presence, belt usage, seat track position and crash severity. In this crash, the SDM commanded a stage two deployment of the driver's frontal air bag (**Figure 8**). The front left air bag was located in the center of the steering wheel hub. The air bag was concealed by two I-symmetrical cover flaps that measured 12.0 cm (4.7") in height and 7.0 cm (2.8") in width. The air bag was 57.0 cm (22.4") in diameter and contained two tethers on the face of the air bag and two vent ports at the 11 and 1 o'clock positions on the rear aspect of the air bag. Body fluid was noted on the face of the air bag by the NASS researcher.

The SDM did not command a deployment of the front right air bag (**Figure 9**). Therefore, the front right occupant did not receive supplemental protection from the air bag. The front right air bag was equipped with a cut-off switch that was located on the bottom right aspect of the center instrument panel. The cut-off switch was keyed to "Auto-On" position at the time of the NASS inspection (**Figure 10**).



Figure 8. Deployed front left air bag.



Figure 9. Non-deployed front right air bag.



Figure 10. Front right air bag cut-off switch.

Event Data Recorder (EDR) - 2003 GMC Sierra

The 2003 GMC Sierra was equipped with an Event Data Recorder (EDR). The NASS researcher successfully downloaded the EDR, which recorded a deployment event. The EDR data indicated that the driver’s safety belt was buckled at the time of the crash and that a stage two deployment of the driver’s frontal air bag was commanded. The first stage was commanded at 12.5 milliseconds followed by the second stage at 15.0 milliseconds after Algorithm Enable (AE). The maximum recorded delta V was -35.6 km/h (-22.1 mph) at 155.0 milliseconds of AE. The EDR data did not indicated the status of the front right air bag cut-off switch. The EDR data also indicated that the GMC was traveling at 98.2 km/h (61.0 mph) five seconds prior to the crash and had slowed to 70.8 km/h (44.0 mph) one second prior to the crash. The EDR output is included with report as **Attachment A**.

OCCUPANT DEMOGRAPHICS – 2003 GMC Sierra

Driver

Age/Sex: 32-year-old male
Height: 178.0 cm (70.0”)
Weight: 91.0 kg (201.0 lbs)
Seat Track Position: Between mid and full rear
Manual Restraint Use: Integrated manual 3-point lap and shoulder belt
Usage Source: Vehicle inspection
Eyewear: Unknown
Type of Medical Treatment: Transported to a local hospital where he treated and released.

Driver Injuries

Injury	Injury Severity (AIS 90/Update 98)	Injury Mechanism
Left hand pain	Not coded under AIS	Turn signal lever
Right hand pain	Not coded under AIS	Steering column shifter lever
Tenderness over left fifth metacarpal joints	Not coded under AIS	Turn signal lever
Tenderness over mid left tibia	Not coded under AIS	Knee bolster
Moderate left anterior neck tenderness/pain	Not coded under AIS	Flexion over shoulder belt

Source- Emergency room records

Driver Kinematics

The 32-year-old male driver of the 2003 GMC Sierra was seated in an upright driving posture and was restrained by the integrated manual 3-point lap and shoulder belt. The seat track was in the mid to full rear position. At impact with the Ford, the restrained driver initiated a forward trajectory and loaded the safety belt. The driver’s head flexed over the shoulder, which resulted in the moderate tenderness and pain to the left anterior

of the neck. The driver’s face contacted the deployed air bag, which is evidenced by the body fluid noted by the NASS researcher. The deploying air bag deflected his left and right hands and as a result, the driver’s left hand contacted and fractured the turn signal stalk, which resulted in the left hand pain and tenderness over the left fifth metacarpal joints. The driver’s right hand probably contacted the steering column shift lever, which resulted in the right hand pain. The driver’s left leg contacted the knee bolster, which resulted in the pain and tenderness over the mid left tibia. The driver was transported to a local hospital where he was treated for the pain and was released.

Front Right Passenger

Age/Sex: 29-year-old male
 Height: 175.0 cm (69.0”)
 Weight: 79.0 kg (174.0 lbs)
 Seat Track Position: Full rear
 Manual Restraint Use: Integrated manual 3-point lap and shoulder belt
 Usage Source: Vehicle Inspection
 Eyewear: Unknown
 Type of Medical Treatment: Hospitalized for an unknown number of days

Front Right Passenger Injuries

Injury	Injury Severity (AIS 90/Update 98)	Injury Mechanism
Right mid shaft femur fracture (several small comminuted fragments)	Serious (851814.3,1)	Unknown
Left median nerve neurapraxia, NFS	Moderate (730499.1,2)	Induced injury from left hand bracing against the upper instrument panel

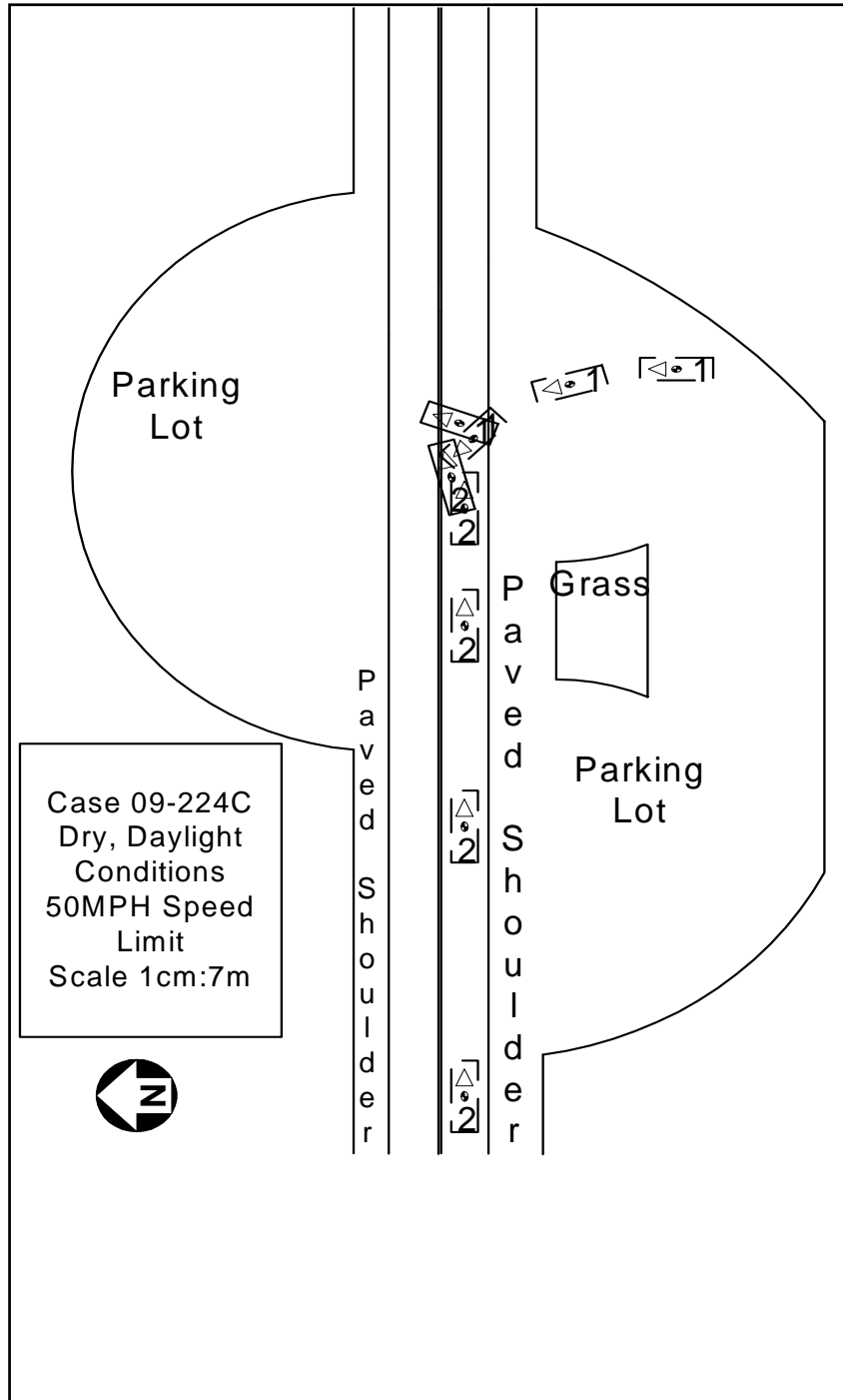
Source- Hospital medical records

Front Right Passenger Kinematics

The 29-year-old male front right passenger was seated in a presumed upright posture and was restrained by the integrated manual 3-point lap and shoulder belt. The seat track was adjusted to the full-rear position. Prior to the impact, the passenger braced with his left hand against the upper instrument panel. At impact with the Ford, he initiated a forward trajectory in response to the 12 o’clock direction of force. His forward trajectory and bracing against the instrument panel resulted in the hyper-flexion of the left wrist. This motion resulted in the left median nerve neurapraxia. The front right passenger also sustained a right mid shaft femur fracture. This injury may have been a result of torsion from the passenger’s leg twisting or axial loading of the right leg as a result of a contact to the right instrument panel/glove box door. There was no distinct contact evidence or damage to the glove box door or right instrument panel to support this injury. A small dirt scuff was noted to the upper left aspect of the glove box door, however this was not contact related. Due to the lack of distinct contact evidence, the injury mechanism for the femur fracture was unknown. The front right passenger was transported to a local

hospital where he was admitted for surgical repair of the fractured right femur. It was unknown the length of time he was hospitalized for.

Figure 11. NASS Scene Schematic



Attachment A: EDR output

CDR File Information

Vehicle Identification Number	1GTEK19T53Exxxxxx
Investigator	
Case Number	
Investigation Date	
Crash Date	
Filename	
Saved on	
Data check information	
Collected with CDR version	
Collecting program verification number	6B1D6F0F
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: 39 Date: 10-09-03 Checksum: 0300
Event(s) recovered	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:

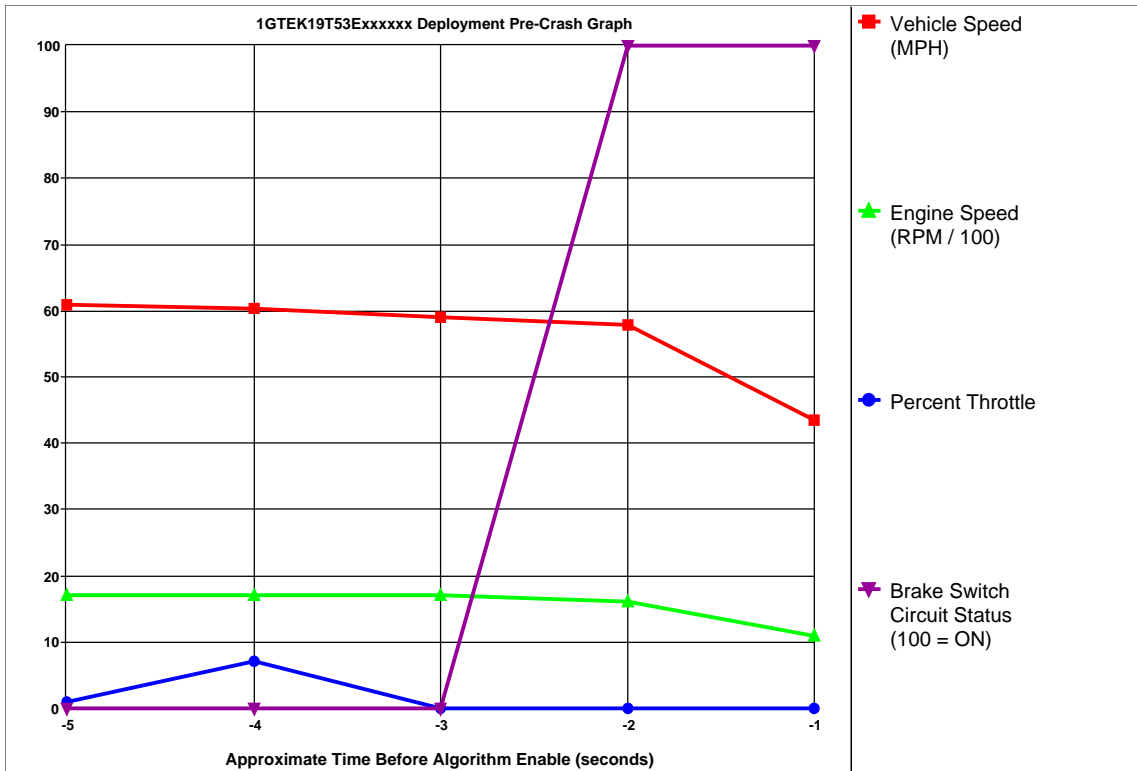
-Vehicle Speed, Engine Speed, and Percent Throttle data are transmitted once a second by the Powertrain Control Module (PCM), via the Class 2 data link, to the SDM.

-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.

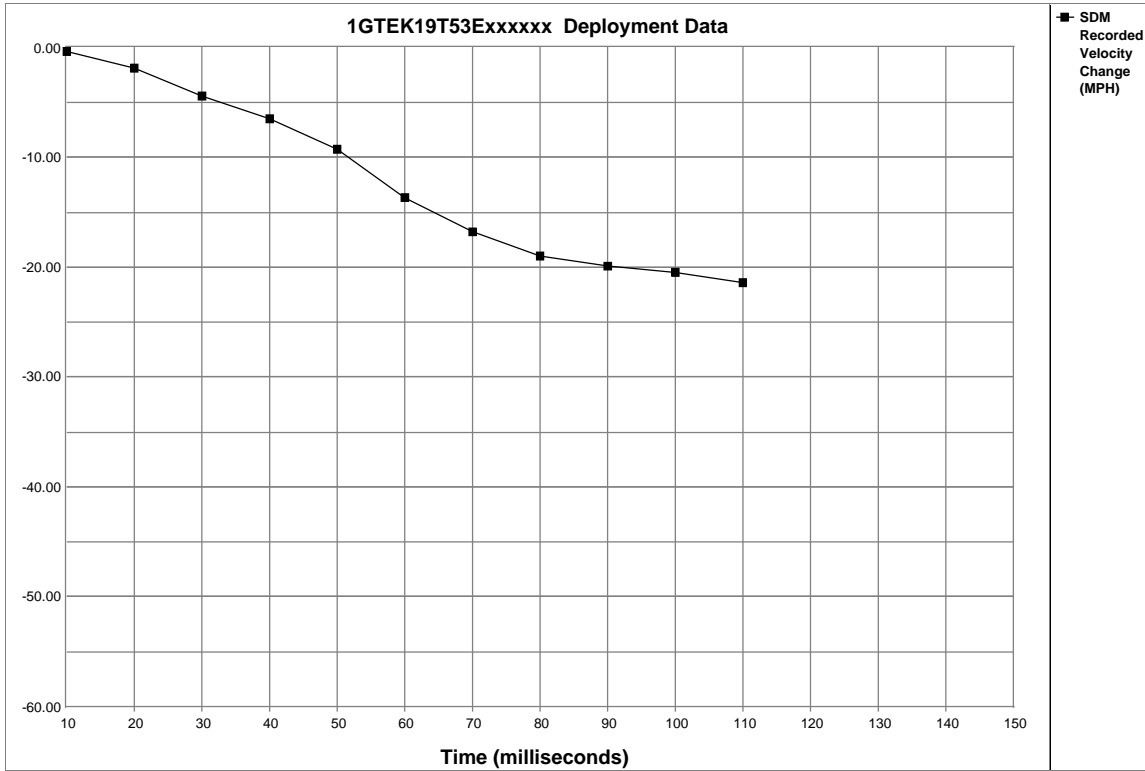
-In most vehicles, the Driver's Belt Switch Circuit is wired directly to the SDM. In some vehicles, the Driver's Belt Switch Circuit Status data is transmitted from the Body Control Module (BCM), via the Class 2 data link, to the SDM.

System Status At Deployment

SIR Warning Lamp Status	OFF
Driver's Belt Switch Circuit Status	BUCKLED
Ignition Cycles At Deployment	1530
Ignition Cycles At Investigation	1535
Maximum SDM Recorded Velocity Change (MPH)	-22.12
Algorithm Enable to Maximum SDM Recorded Velocity Change (msec)	155
Driver First Stage Time Algorithm Enabled to Deployment Command Criteria Met (msec)	12.5
Driver Second Stage Time Algorithm Enabled to Deployment Command Criteria Met (msec)	15
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	61	1728	1	OFF
-4	60	1728	7	OFF
-3	59	1728	0	OFF
-2	58	1600	0	ON
-1	44	1088	0	ON



Time (milliseconds)	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150
Recorded Velocity Change (MPH)	-0.31	-1.86	-4.34	-6.51	-9.30	-13.64	-16.74	-18.91	-19.84	-20.46	-21.39	N/A	N/A	N/A	N/A

Hexadecimal Data

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

```
$01 F1 26 C4 F8 AE 5A
$02 F1 F1 00 00 B8 00
$03 41 53 32 33 35 32
$04 4B 39 35 4D 51 31
$05 00 00 00 00 00 00
$06 15 19 24 46 00 00
$07 00 00 00 00 00 00
$08 00 00 00 00 00 00
$09 00 00 00 00 00 00
$0A 00 00 00 00 00 00
$0B 00 00 00 00 00 00
$0C 00 00 00 00 00 00
$0D 00 00 00 00 00 00
$0E 00 00 00 00 00 00
$0F 00 00 00 00 00 00
$10 FF 40 80 00 00 00
$11 81 80 82 7C 7C 7E
$12 94 83 83 22 21 01
$13 FF 02 00 00 00 00
$14 03 03 00 00 6C 00
$15 FA FA FA FA FA FA
$16 FA FA FA FA FA FA
$17 FA FA 00 00 00 00
$18 00 0F 05 AC F1 00
$19 09 00 0A 00 00 64
$1A 00 00 00 00 00 00
$1B 00 00 00 00 00 00
$1C 00 0C 00 00 00 00
$1D 00 00 00 00 00 00
$1F FE 00 00 00 00 00
$20 FF FF FF FF FF FF
$21 FF FF FF FF FF FF
$22 FF FF FF FF FF FF
$23 FF FF FF FF FF FF
$24 FF FF FF FF FF FF
$25 FF FF FF FF FF FF
$26 FF FF FF FF FF FF
$27 FF FF FF FF FF FF
$28 FF FF FF FF FF FF
$29 FF FF FF FF FF FF
$2A FF FF FF FF FF FF
$2B FF FF FF FF FF FF
$2C FF FF FF FF FF FF
$2D FF FF 00 00 00 00
$30 B2 FE 00 00 FF FF
$31 FF FF FF FF FF FF
$32 FF FF FF FF FF FF
$33 FF FF FF FF FF FF
$34 00 00 35 0B 05 03
$35 00 00 00 00 00 00
$36 35 0C 06 03 00 00
$37 00 00 00 04 74 42
$38 3E 07 4D 2B 00 00
$39 05 00 00 03 FF FF
$3A 01 06 0E 15 1E 2C
$3B 36 3D 40 42 45 00
$3C 00 00 00 0B FF 40
$3D FC A5 00 00 00 00
$40 46 5D 5F 61 62 00
$41 C0 00 00 00 00 12
$42 03 00 11 19 1B 1B
$43 1B 00 75 F8 00 00
```

```
$44 00 00 00 00 00 00
$45 00 00 00 00 00 00
$46 00 00 0B 0B 0B 0B
$47 0B 00 01 FF 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
```