

**TRANSPORTATION SCIENCES  
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**GENERAL DYNAMICS ON-SITE ADVANCED 208-COMPLIANT VEHICLE  
INVESTIGATION  
SCI TECHNICAL SUMMARY REPORT**

**CASE NO. CA04-009**

**VEHICLE – 2004 CADILLAC ESCALADE**

**LOCATION - STATE OF MICHIGAN**

**CRASH DATE – JANUARY 2004**

Contract No. DTNH22-01-C-17002

Prepared for:

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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.

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<b>16. Abstract</b> <p>This on-site investigative effort focused on the performance of the Certified Advanced 208-Compliant (CAC) safety system that was present in a 2004 Cadillac Escalade sport utility vehicle. The manufacturer of this vehicle has certified that this 2004 Escalade meets the advanced air bag requirements of Federal Motor Vehicle Safety Standard (FMVSS) No. 208. The Escalade was equipped with dual-stage frontal air bags for the driver and front right passenger positions, seat track positioning sensors, a front right occupant presence system, and an Event Data Recorder (EDR). In addition, the Escalade was also equipped with seat-mounted side impact air bags. The Escalade was occupied by a 67-year-old restrained male driver who was operating the Escalade on a two-lane undivided roadway during nighttime hours. The driver fell asleep and relinquished control of the vehicle. The Escalade traveled left across the centerline and departed the left roadside. The front aspect of the Escalade struck a tree, knocking it forward. The vehicle sustained moderate frontal damage and the impact was sufficient to deploy the driver's air bag. The front right seat was unoccupied and the front right passenger's air bag did not deploy. The driver loaded the safety belt and contacted the deployed driver's air bag. The EDR-recorded delta-V for the deployment event was 10.3 km/h (6.4 mph). The Escalade continued in a forward direction through the first tree and struck a second tree with the front aspect. The second tree impact was severe and resulted in an EDR-recorded (Deployment Level event) delta-V of 53.5 km/h (33.3 mph). The driver was displaced forward due to the initial impact and continued his forward trajectory in response to the second tree impact. He loaded the safety belt, knee bolster, deployed driver's air bag, and steering wheel rim/column, evidenced by shear capsule displacement. He sustained left upper and lower eyelid lacerations from contact with the driver's air bag and a comminuted open fracture of the right lower tibia/fibula, metatarsal fractures, and ankle fractures. His face struck the upper instrument panel or steering wheel rim, which resulted in a displaced nasal fracture and a nose laceration. He lost consciousness after the crash and was transported by ambulance to a local hospital, transferred to a regional trauma center for treatment and admitted for 11 days.</p>			
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## TABLE OF CONTENTS

<b>BACKGROUND</b> .....	<b>1</b>
<b>VEHICLE DATA – 2004 CADILLAC ESCALADE</b> .....	<b>2</b>
<b>CRASH SITE</b> .....	<b>2</b>
<b>CRASH SEQUENCE</b> .....	<b>3</b>
PRE-CRASH .....	3
CRASH .....	3
POST-CRASH.....	4
<b>VEHICLE DAMAGE</b> .....	<b>4</b>
EXTERIOR DAMAGE - 2004 CADILLAC ESCALADE .....	4
INTERIOR DAMAGE – 2004 CADILLAC ESCALADE.....	5
<b>MANUAL RESTRAINTS – 2004 CADILLAC ESCALADE</b> .....	<b>6</b>
<b>CERTIFIED ADVANCED 208-COMPLIANT SAFETY SYSTEM (CAC)</b> .....	<b>6</b>
FRONTAL AIR BAG SYSTEM – 2004 CADILLAC ESCALADE .....	6
OCCUPANT SENSING SYSTEM – 2004 CADILLAC ESCALADE .....	7
EVENT DATA RECORDER (EDR) .....	7
<b>OCCUPANT DEMOGRAPHICS – 2004 CADILLAC ESCALADE</b> .....	<b>7</b>
DRIVER.....	7
DRIVER INJURIES .....	7
DRIVER KINEMATICS .....	8
<b>FIGURE 9: SCENE SCHEMATIC</b> .....	<b>10</b>
<b>APPENDIX A: EDR SUMMARY</b> .....	<b>11</b>

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VEHICLE: 2004 CADILLAC ESCALADE  
CRASH DATE: JANUARY, 2004**

***BACKGROUND***

This on-site investigative effort focused on the performance of the Certified Advanced 208-Compliant (CAC) safety system that was present in a 2004 Cadillac Escalade sport utility vehicle (**Figure 1**). The manufacturer of this vehicle has certified that this 2004 Escalade meets the advanced air bag requirements of Federal Motor Vehicle Safety Standard (FMVSS) No. 208. The Escalade was equipped with dual-stage frontal air bags for the driver and front right passenger positions, seat track positioning sensors, a front right occupant presence system, and an Event Data Recorder (EDR). In addition, the Escalade was also equipped with seat-mounted side impact air bags. The Escalade was occupied by a 67-year-old restrained male driver



**Figure 1. Damaged 2004 Cadillac Escalade**

who was operating the Escalade on a two-lane undivided roadway during nighttime hours. The driver fell asleep and relinquished control of the vehicle. The Escalade traveled left across the centerline and departed the left roadside. The front aspect of the Escalade struck a tree, knocking it forward. The vehicle sustained moderate frontal damage and the impact was sufficient to deploy the driver's air bag. The front right seat was unoccupied and the front right passenger's air bag did not deploy. The driver loaded the safety belt and contacted the deployed driver's air bag. The EDR-recorded delta-V for the deployment event was 10.3 km/h (6.4 mph). The Escalade continued in a forward direction through the first tree and struck a second tree with the front aspect. The second tree impact was severe and resulted in an EDR-recorded (Deployment Level event) delta-V of 53.5 km/h (33.3 mph). The driver was displaced forward due to the initial impact and continued his forward trajectory in response to the second tree impact. He loaded the safety belt, knee bolster, deployed driver's air bag, and steering wheel rim/column, evidenced by shear capsule displacement. He sustained left upper and lower eyelid lacerations from contact with the driver's air bag and a comminuted open fracture of the right lower tibia/fibula, metatarsal fractures, and ankle fractures. His face struck the upper instrument panel or steering wheel rim, which resulted in a displaced nasal fracture and a nose laceration. He lost consciousness after the crash and was transported by ambulance to a local hospital, transferred to a regional trauma center for treatment and admitted for 11 days.

This crash was identified by the Crash Investigations Division of the National Highway Traffic Safety Administration (NHTSA) on March 9, 2004 due to the CAC safety system. An on-site investigation was assigned to the General Dynamics SCI team on March 10, 2004. The EDR was downloaded as part of the vehicle inspection.

### ***VEHICLE DATA – 2004 CADILLAC ESCALADE***

The 2004 Cadillac Escalade was identified by the Vehicle Identification Number (VIN): 1GYEK63N24R (production sequence omitted). There was no power available to the vehicle during the inspection, and the odometer could not be read. The driver estimated the odometer reading to be approximately 12,875 km (8,000 miles). The Cadillac was a four-door, 4 x 4, sport utility vehicle that was equipped with 6.0 liter, V-8 engine, a four-speed automatic transmission, all-speed traction control, four-wheel disc brakes with Anti-Lock Brake System (ABS), a fully automatic rear leveling system, road-sensing suspension, StabiliTrak, adjustable pedals, power steering, and a tilt steering wheel. At the time of the vehicle inspection, the pedals were adjusted to the full-rear position (with respect to the vehicle) and the tilt steering wheel was jammed in a mid-position. The Escalade was also equipped with the OnStar communications system.

The Escalade was configured with Goodyear Wrangler HP P265/70R17 tires. The vehicle manufacturer's recommended tire pressure was 220 kPa (32 PSI). The specific tire information was as follows:

<b>Position</b>	<b>Measured Pressure</b>	<b>Measured Tread Depth</b>	<b>Restricted</b>	<b>Damage</b>
LF	251.7 kPa (36.5 PSI)	9.5 mm (12/32")	No	None
LR	248.2 kPa (36.0 PSI)	9.5 mm (12/32")	No	None
RF	255.1 kPa (37.0 PSI)	8.7 mm (11/32")	No	None
RR	251.7 kPa (36.5 PSI)	8.7 mm (11/32")	No	None

The front seating positions in the 2004 Cadillac Escalade were configured with leather-trimmed, heated, bucket seats with adjustable head restraints. Both front head restraints were in the full-down position at the time of the vehicle inspection. The driver's seat was adjusted to 14.0 cm (5.5") rear of full-forward and 8.9 cm (3.5") forward of full-rear. The seat back was reclined 20 degrees from vertical, and the seat cushion was angled a negative 5 degrees in a forward direction. At this seat position, the horizontal distance between the driver's seat back and the steering wheel hub was 58.4 cm (23.0"). The front right passenger's seat was positioned in a full-rear track position. The seat back angle was 20 degrees from vertical and the seat cushion angle was 10 degrees.

The Escalade was configured with reclining leather-trimmed, heated bucket seats with adjustable head restraints for the rear left and rear right positions. The third row was configured with a leather-trimmed, 50/50 split, removable bench seat. The third row bench seat was folded forward at the time of the vehicle inspection.

### ***CRASH SITE***

This single vehicle crash occurred during the nighttime hours of January 2004 in the state of Michigan. At the time of the crash, the weather was clear and the asphalt roadway surface was dry. The crash occurred on the west roadside of a local north/south two-lane roadway, north of a 3-leg, "T" intersection on the west side of the roadway. The north/south roadway was configured with one traffic lane in each direction separated by a double-yellow centerline and bordered by

shallow concrete drainage channels with receivers. The drainage channels measured 0.9 m (3.0') in width. The roadway was straight and exhibited a slight negative northbound grade. The west side of the roadway gradually widened an additional distance of 3.9 m (12.8') at the mouth of the intersection, to accommodate traffic entering and exiting the east/west roadway. The east/west roadway was configured with two lanes and bordered by concrete curbs that extended around the corners of the mouth of the intersection and gradually terminated at the north/south road edge. The curbs measured 20.0 cm (7.9") in height along the east/west roadway. The west roadside exhibited a positive slope from the roadway that measured 0.7 m (2.3') in elevation over a width of 3.0 m (9.8') from the road edge. A group of trees was present on the top aspect of the sloped roadside. The struck trees were located 2.4 m (7.9') from the road edge and measured 34.0 cm (13.4") in diameter. The first struck tree was located 22.5 m (73.8') north of the northwest corner of the intersection. The second tree was located 2.0 m (6.6') behind the first tree, with respect to the Escalade's trajectory. The posted speed limit for the north/south roadway was 56 km/h (35 mph). The scene schematic is included as **Figure 9** at the end of this report.

## **CRASH SEQUENCE**

### **Pre-Crash**

The 67-year-old male driver was operating the 2004 Cadillac Escalade in a northbound direction on the two-lane roadway. He stated that he was listening to a book-on-tape prior to the crash. As the Escalade approached the 3-leg intersection, the driver fell asleep and relinquished control of the vehicle. The Escalade drifted left across the centerline, traversed the southbound lane, and traversed the mouth of the T-intersection (**Figure 2**). It traveled over the reduced-height curb at the northwest corner of the intersection and onto the sloped west roadside. The Escalade continued in a tracking mode on the roadside toward the trees. The EDR-recorded pre-crash vehicle speed five seconds prior to the Algorithm Enable (AE) was 66 km/h (41 mph) and the EDR-recorded pre-crash vehicle speed one second prior to AE was 69 km/h (43 mph). There were no attempted pre-crash avoidance maneuvers.



**Figure 2. Northbound approach for the 2004 Cadillac Escalade**

### **Crash**

The Escalade struck the first tree with the front center aspect. The impact was sufficient to command a first and second stage deployment of the frontal air bag system. The EDR-reported Maximum SDM Recorded Velocity Change was -10.3 km/h (-6.4 mph) and the time between algorithm enable to the maximum SDM Recorded Velocity Change was 157.5 milliseconds. The impact fractured and uprooted the tree as the Escalade continued in a forward direction over the struck tree. The Escalade struck the second tree located 2.0 m (6.6') behind the first tree with the front center aspect. The



**Figure 3. Close-up of the struck trees**

secondary impact resulted in severe damage to the Escalade. The EDR recorded a Deployment Level event for the secondary impact, and the EDR-reported time between Deployment and Deployment Level events was 0.3 seconds. The Maximum SDM Recorded Velocity Change for the secondary impact was -53.5 km/h (-33.3 mph). The damage algorithm of the WinSMASH program calculated a total delta-V of 26.0 km/h (16.2 mph) based on the frontal crush profile. Based on the vehicle damage and EDR output, the WinSMASH-calculated delta-V appeared low. The Escalade rebounded slightly rearward and came to rest against the tree. **Figure 3** illustrates the proximity of the struck trees.

### **Post-Crash**

The driver stated that he woke up immediately after the impact. He stated that the OnStar system activated, recalled acknowledging the OnStar operator, and attempted to exit the vehicle. He stated that he could not exit the vehicle due to his injuries, and lost consciousness. According to the driver, OnStar did not alert rescue personnel to the crash, and after the driver inquired about the crash, he was told that OnStar had no record of the crash notification. A passer-by stopped to assist and used a cellular telephone to report the crash. The driver was removed from the vehicle by rescue personnel and transported by ambulance to a local hospital. He was subsequently transferred to a regional trauma center for treatment.

### **VEHICLE DAMAGE**

#### **Exterior Damage - 2004 Cadillac Escalade**

The 2004 Cadillac Escalade sustained severe frontal damage as a result of the two sequential tree impacts (**Figure 4**). Due to the masking nature of the damage, it was not possible to separate the two impacts. The direct contact damage began 35.6 cm (14.0") left of the centerline and extended 45.7 cm (18.0") to the right. Abrasions were present on the front aspect of the hood from direct contact with the trees. The maximum crush was located 17.8 cm (7.0") left of the centerline and measured 81.3 cm (32.0"). The tree impacts penetrated the bumper fascia, which separated from the vehicle, and crushed the bumper beam, and the upper and lower radiator supports. The steel bumper beam was completely fractured 83.8 cm (33.0") inboard from the front left corner and exhibited a 15.2 cm (6.0") lateral gap at the fracture site (**Figure 5**). The radiator core sustained direct contact scratches from the tree and fragments of tree bark were present on the entire vertical height of the direct damage area. The combined direct and induced damage measured 114.3 cm (45.0") in width between the damaged bumper corners. The severe crush pulled both corners of the beam inward and forward, and the center aspect was displaced slightly upward. The front aspects of the frame rails were displaced inward and the distance between the



**Figure 4. Frontal view of the damaged 2004 Cadillac Escalade**



**Figure 5. Close-up of maximum crush and fractured bumper beam**



frame rails measured 30.5 cm (12.0”) at the forward aspects. The hood was buckled rearward and upward and both front fenders were buckled rearward and outward. The impact resulted in slight roof buckling at both B-pillars. The left front and right front doors were displaced slightly rearward. The windshield was fractured from crash forces. The Collision Deformation Classification for the first tree impact was 12-FYE9-9, as the damage from the second impact overlapped the damage from the first impact. The CDC for the second tree impact was 12-FYEW-2. Six crush measurements were documented along the cross member behind the front bumper beam and were as follows: C1 = 0.0 cm C2 = 0.5 cm (0.2”), C3 = 38.0 cm (15.0”), C4 = 34.8 cm (13.7”), C5 = 15.1 cm (6.0”), C6 = 0.0 cm.

**Interior Damage – 2004 Cadillac Escalade**

The 2004 Cadillac Escalade sustained moderate interior damage as a result of occupant contact and passenger compartment intrusion (**Figure 6**). Two diagonal scuff marks were present on the knee bolster from contact with the driver’s knees. The scuff mark from his left knee measured 3.8 x 3.8 cm (1.5 x 1.5”) and was located 19.1 cm (7.5”) left of the knee bolster centerline and 7.6 cm (3.0”) below the top of the knee bolster. The scuff mark from the right knee measured 5.1 x 3.8 cm (2.0 x 1.5”) and was located 7.6 cm (3.0”) to the right of the bolster centerline and 14.0 cm (5.5”) below the top of the bolster. The top aspect of the bolster was deformed in the area around the steering column and sustained a small fracture. The left and center instrument panel trim was displaced from crash forces. The driver loaded the steering wheel, which resulted in the forward displacement of the steering column and complete separation of the shear capsules. The shear capsule displacement measured 7.6 cm (3.0”). The driver’s toe pan sustained minor pocketing behind the accelerator pedal, and the accelerator pedal was deformed slightly upward and outboard. Passenger compartment intrusions were documented as follows:

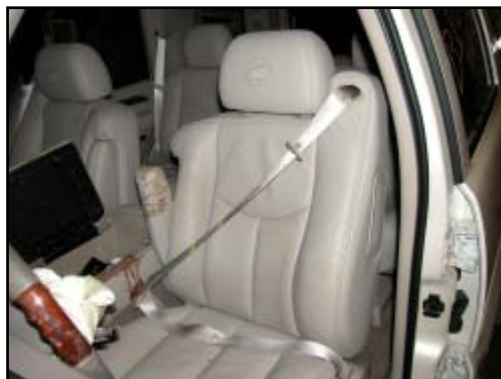


**Figure 6. Left front view of interior damage**

<b>Position</b>	<b>Intruded Component</b>	<b>Magnitude of Intrusion</b>	<b>Direction</b>
FL	Left instrument panel	5.1 cm (2.0”)	Longitudinal
FL	Left toe pan	15.2 cm (6.0”)	Longitudinal
FR	Right instrument panel	8.3 cm (3.3”)	Longitudinal
FR	Right toe pan	11.4 cm (4.5”)	Longitudinal

### **MANUAL RESTRAINTS – 2004 CADILLAC ESCALADE**

The 2004 Cadillac Escalade was configured with integrated manual 3-point lap and shoulder belts for the front seat positions. The driver's safety belt (**Figure 7**) was configured with a sliding latch plate and an Emergency Locking Retractor (ELR). The shoulder belt webbing retracted through a plastic guide located on the outboard aspect of the top of the seat back. At the time of the crash, the driver had two spring-loaded plastic clips positioned on each edge of the safety belt webbing against the plastic guide while the safety belt was worn. He stated that the clips were used to maintain approximately 5.1 – 7.6 cm (2 – 3") of slack in the shoulder belt while the safety belt was in use. The driver's belt was not restricted and was found in the stowed position at the time of the vehicle inspection. Minor cupping of the webbing was present on the lap belt 22.9 cm (9.0") above the plastic stop button from occupant loading. Two lateral creases were present on the webbing 48.3 cm (19.0") above the plastic stop button from probable loading against the latch plate. Body fluid (blood) was present on the shoulder belt webbing, and began 55.9 cm (22.0") above the stop button and extended up the webbing 41.9 cm (16.5"). The plastic guide was separated from the seat fabric.



**Figure 7. Driver's safety belt**

The integrated front right passenger's safety belt was configured with a sliding latch plate and a switchable ELR/Automatic Locking Retractor (ALR). The second row non-integrated safety belts were also configured with sliding latch plates and switchable ELR/ALR retractors. Integrated manual 3-point lap and shoulder belts were present in the third row seats.

### **CERTIFIED ADVANCED 208-COMPLIANT SAFETY SYSTEM (CAC)**

#### **Frontal Air Bag System – 2004 Cadillac Escalade**

The 2004 Cadillac Escalade was equipped with a CAC safety system that included dual stage frontal air bags for the driver and front right passenger positions, seat track positioning sensors, a front right occupant presence system, and an Event Data Recorder (EDR). The initial tree impact was sufficient to warrant a first and second stage deployment of the driver's air bag, 10 and 12.5 milliseconds after algorithm enable, respectively. The driver's air bag (**Figure 8**) deployed from the steering wheel hub through symmetrical I-configuration module cover flaps. Each cover flap measured 8.3 cm (3.3") in width and 11.4 cm (4.5") in height. The deployed air bag measured 66.0 cm (26.0") in diameter. The air bag was vented by two circular ports located on the rear aspect of the air bag at the 11 and 1 o'clock positions. The vent ports measured 2.5 cm (1.0") in diameter and were located 8.9 cm (3.5") from the peripheral seam. The air bag was tethered by two internal straps at the 3 and 9 o'clock positions. An area of body fluid (blood) was present on the upper left



**Figure 8. Deployed driver's air bag**

quadrant of the air bag face. The transfer was located 3.8 cm (1.5”) above the horizontal centerline, measured 10.2 cm (4.0”) in height, began at the vertical centerline and extended 8.9 cm (3.5”) to the left.

**Occupant Sensing System – 2004 Cadillac Escalade**

The CAC safety system was configured with a weight sensor in the front right seat cushion. The system was designed to detect occupant presence and automatically suppress the front right passenger’s air bag if it detected a weight consistent with a child seat, a booster seat, or a child sitting in the front seat, or it if determined that the front seat was empty. The air bag on/off status could be confirmed by a light on the rearview mirror. Since the front right seat was not occupied, the CAC system suppressed the front right passenger’s air bag. Both front seat positions were also equipped with seat track position sensors, which adjusted the air bag deployment level if the seat was in a forward track position.

**Event Data Recorder (EDR)**

The Escalade’s EDR was downloaded by the SCI investigator and the EDR summary report is attached as Attachment A at the end of this narrative report. The system recorded a Deployment event as a result of the first tree impact, and a Deployment Level event as a result of the secondary tree impact. The EDR-recorded Time Between Deployment And Deployment Level Events was 0.3 seconds. The EDR reported the driver’s belt switch circuit status as ‘buckled’, which was supported by the vehicle inspection.

***OCCUPANT DEMOGRAPHICS – 2004 CADILLAC ESCALADE***

**Driver**

Age/Sex: 67-year-old/Male  
 Height: 170 cm (67”)  
 Weight: 79 kg (175 lb)  
 Seat Track Position: Between mid-track and full forward (14.0 cm (5.5”) rear of full-forward and 8.9 cm (3.5”) forward of full-rear)  
 Manual Restraint Use: Integrated 3-point lap and shoulder belt  
 Usage Source: Vehicle inspection, EDR  
 Eyewear: Prescription contact lenses  
 Type of Medical Treatment: Transported by ambulance to a local hospital, transferred to a regional trauma center, and admitted for 11 days

**Driver Injuries**

<b>Injury</b>	<b>Injury Severity (AIS 90/Update 98)</b>	<b>Injury Mechanism</b>
Open, comminuted fracture of the distal right tibia involving the articular surface	Serious (853405.3,1)	Toe pan
Bilateral displaced nasal fracture with septum deviation to right	Moderate (251004.2,4)	Steering wheel rim

<b>Injury</b>	<b>Injury Severity (AIS 90/Update 98)</b>	<b>Injury Mechanism</b>
Open, comminuted fracture of the distal right fibula	Moderate (851605.2,1)	Toe pan
Linear second and fourth right metatarsal fracture	Moderate (852200.2,1)	Toe pan
Lateral right cuneiform and cuboid bone fracture (tarsals)	Minor (852200.2,1)	Toe pan
Left nare laceration	Minor (290602.1,4)	Steering wheel rim
Left upper and lower complex eyelid lacerations	Minor (297602.1,2)	Driver's air bag
Abdominal contusion	Minor (590402.1,9)	Lap belt webbing

Injury source: Emergency Room Records, Radiology Report, Discharge Summary

### **Driver Kinematics**

The 67-year-old male driver stated that he fell asleep and was seated in an upright posture. The seat track was adjusted between the mid- and full-rear track positions and the adjustable pedals were fully extended rearward (with respect to the vehicle). The driver was restrained by the integrated 3-point lap and shoulder belt, although, the use of the plastic clips introduced approximately 5 – 8 cm (2 – 3”) of driver-reported slack in the shoulder belt webbing. It should be noted that additional slack in the safety belt webbing may have been present if the driver had slumped forward prior to impact.

At impact with the first tree, the driver's air bag deployed and the driver initiated a forward trajectory. The EDR reported a first and second stage deployment at 10 and 12.5 milliseconds after algorithm enable. Given the seat track position and the slack in the safety belt, he most likely contacted the deployed air bag prior to loading the safety belt. Due to the slack in the safety belt webbing created by the clips, he was probably able to travel forward a moderate distance prior to the ELR engagement. It was not known when the spring-loaded clips disengaged from the webbing, or exactly how much slack remained in the webbing when the ELR activated and the driver loaded the safety belt. He contacted the deployed air bag with his face, which resulted in complex left upper and lower eyelid lacerations. He may have also contacted the knee bolster with his knees. Given the EDR-reported delta-V of 10.27 km/h (-6.38 mph), it was not likely that the initial impact produced the driver's serious injuries. Although the driver was restrained, his forward position at the initial impact placed him slightly out-of-position forward as the Escalade struck the second tree. Considering the pre-crash vehicle speed and distance between the first and second impact, the driver did not have an opportunity to rebound after the initial impact.

At impact with the second tree, the driver initiated a forward trajectory. The combination of probable forward seat back deflection and the slack already present in the integrated safety belt allowed the driver to be in close proximity to the deployed air bag and steering wheel when the second impact occurred. The driver loaded through the previously deployed air bag, compressed the steering column, and loaded the safety belt. The loading to the lap belt resulted in an abdominal contusion. His knees struck the knee bolster, evidenced by two pronounced scuff

marks on either side of the steering column. The driver's right foot was jammed on the inboard aspect of the accelerator pedal and his right leg loaded the knee bolster as the toe pan intruded longitudinally. The toe pan intrusion against his right foot resulted in an open, comminuted fracture of the distal right tibia involving the articular surface, an open, comminuted fracture of the distal right fibula, linear second and fourth right metatarsal fractures, lateral right cuneiform bone fracture, and a lateral right cuboid bone fracture. Due to his position as a result of the first impact, he loaded the deployed driver's air bag, which was probably still partially inflated. He loaded through the air bag and compressed the steering wheel and steering column, evidenced by 7.6 cm (3.0") displacement of the shear capsules. His face probably contacted the top of the steering wheel rim through the top aspect of the deployed air bag, which resulted in a bilateral displaced nasal fracture with septum deviation to right and a left side nose laceration. He rebounded rearward into the seat back as the vehicle came to rest.

The driver stated that he recalls acknowledging OnStar immediately after the crash. He recalled assessing his injuries and lost consciousness. A passer-by utilized a cellular telephone to report the crash, and the driver of the Escalade was removed from the vehicle by rescue personnel while unconscious. He was transported by ambulance to a local hospital, transferred to a regional trauma center, and admitted for 11 days.

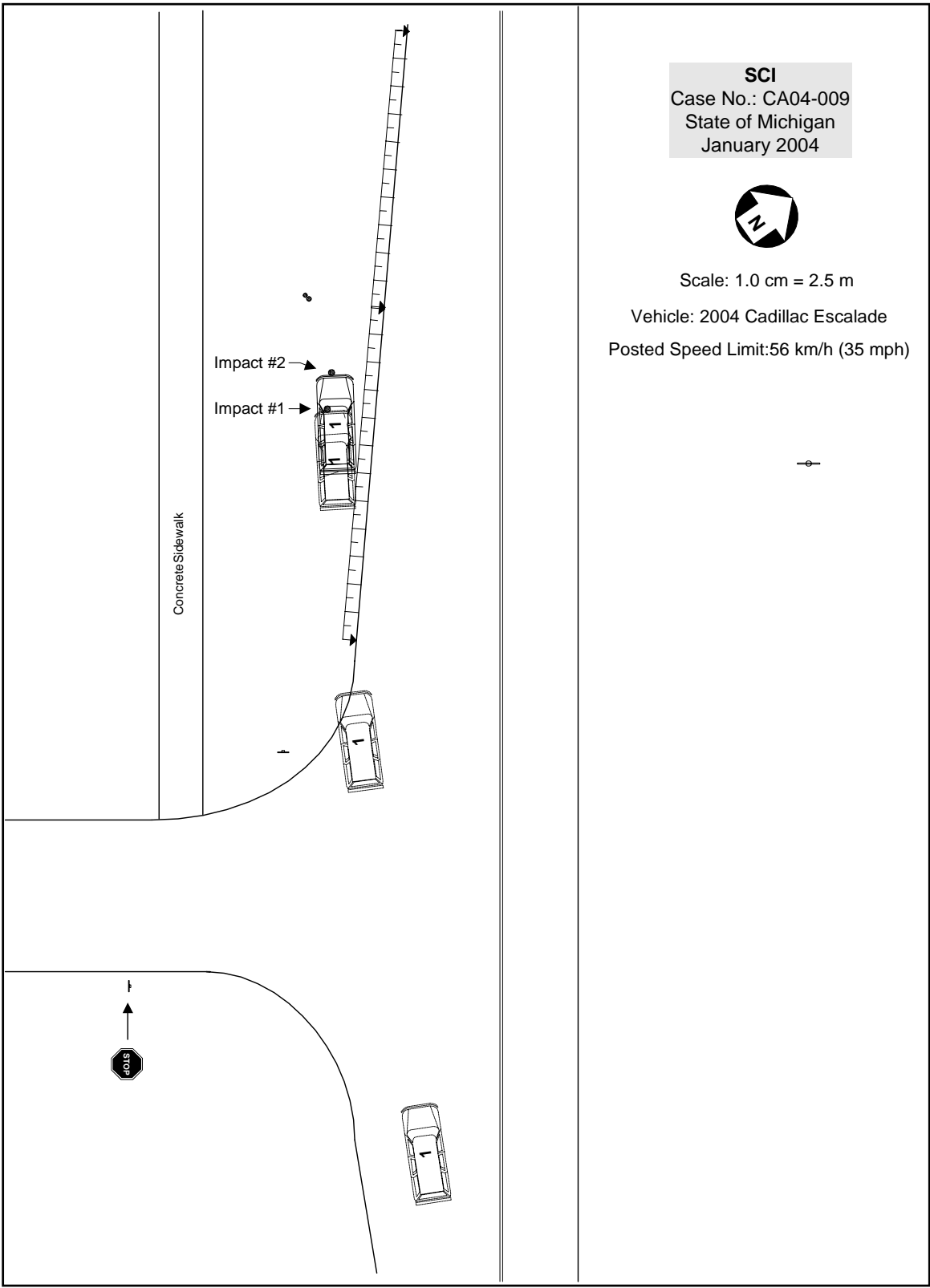


Figure 9: Scene schematic

***APPENDIX A: EDR SUMMARY***

## CDR File Information

Vehicle Identification Number	1GYEK63N24Rxxxxxx
Investigator	
Case Number	
Investigation Date	
Crash Date	
Filename	
Saved on	Wednesday, March 17 2004 at 12:58:50 PM
Data check information	14230BC0
Collected with CDR version	Crash Data Retrieval Tool 2.24
Collecting program verification number	70CD83DD
Reported with CDR version	Crash Data Retrieval Tool 2.40
Reporting program verification number	32B7A917
Interface used to collected data	Block number: 00 Interface version: 39 Date: 10-09-03 Checksum: 0300
Event(s) recovered	Deployment Deployment Level

## 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.

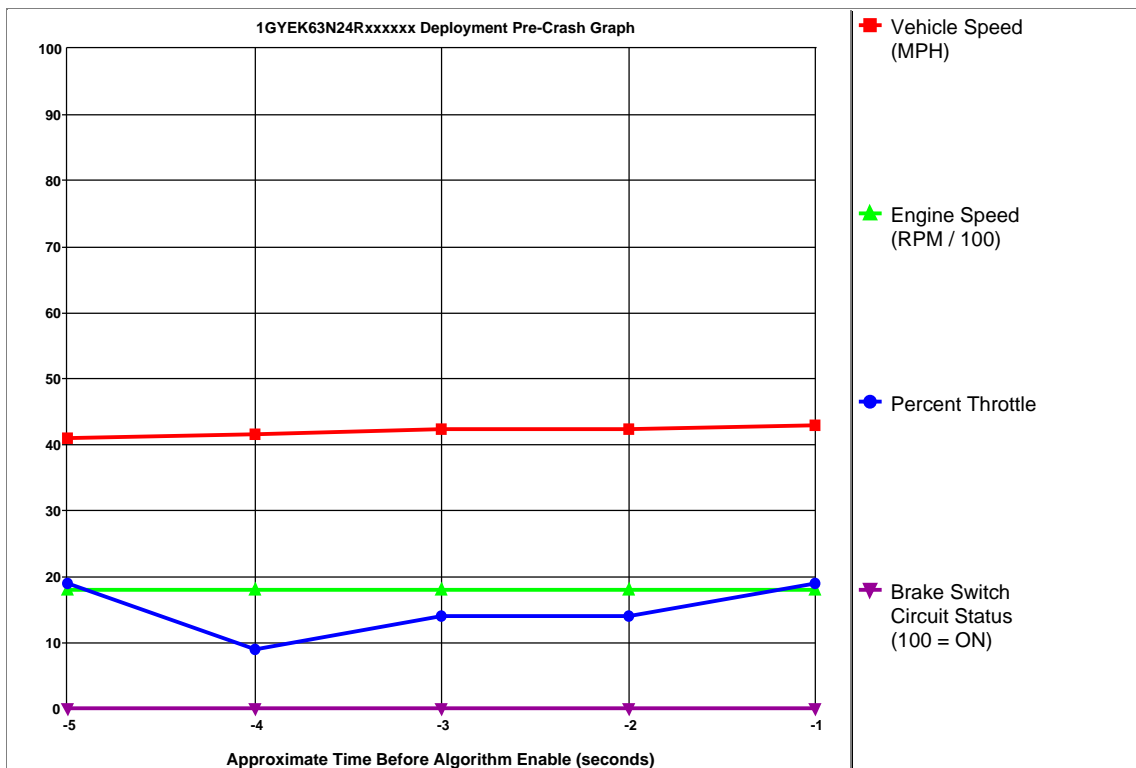
### SDM Data Source:

- 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.

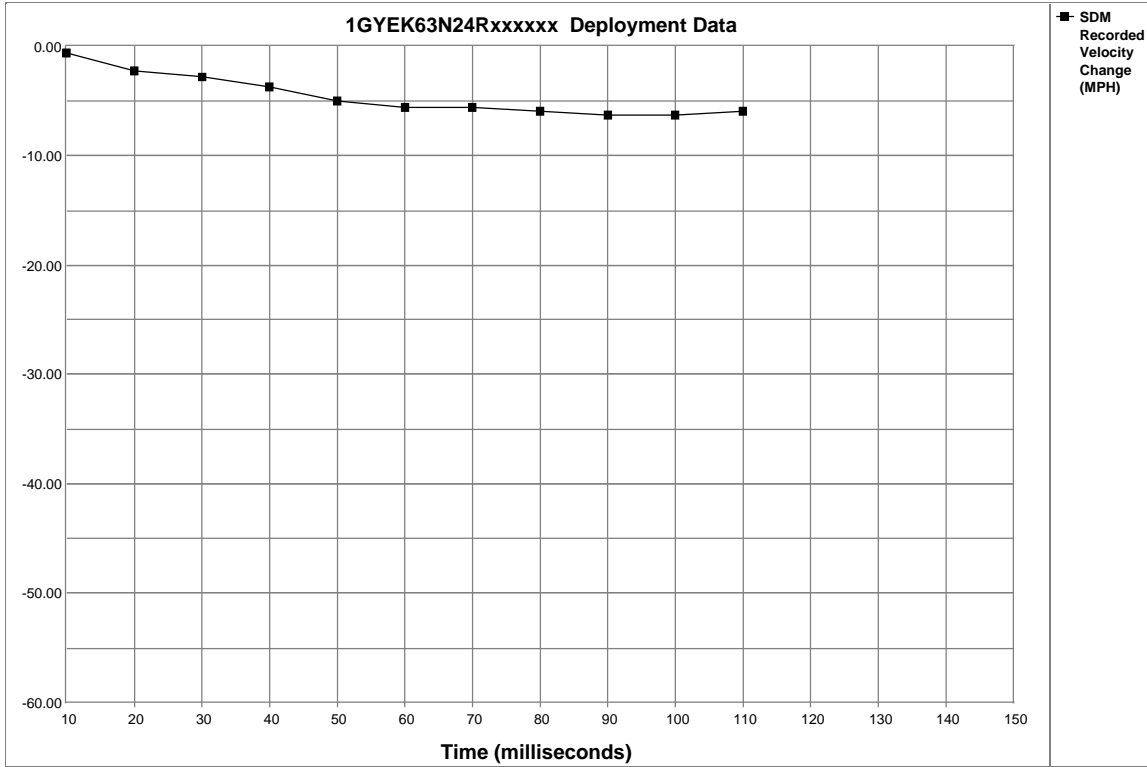


### System Status At Deployment

SIR Warning Lamp Status	OFF
Driver's Belt Switch Circuit Status	BUCKLED
Passenger's Belt Switch Circuit Status	UNBUCKLED
Ignition Cycles At Deployment	674
Ignition Cycles At Investigation	677
Maximum SDM Recorded Velocity Change (MPH)	-6.38
Algorithm Enable to Maximum SDM Recorded Velocity Change (msec)	157.5
Driver First Stage Time Algorithm Enabled to Deployment Command Criteria Met (msec)	10
Driver Second Stage Time Algorithm Enabled to Deployment Command Criteria Met (msec)	12.5
Passenger First Stage Time Algorithm Enabled to Deployment Command Criteria Met (msec)	Suppressed
Passenger Second Stage Time Algorithm Enabled to Deployment Command Criteria Met (msec)	Suppressed
Time Between Non-Deployment And Deployment Events (sec)	N/A
Frontal Deployment Level Event Counter	2
Automatic Passenger SIR Suppression System Status	Air Bag Suppressed
Event Recording Complete	Yes
Multiple Events Associated With This Record	No
One Or More Associated Events Not Recorded	No



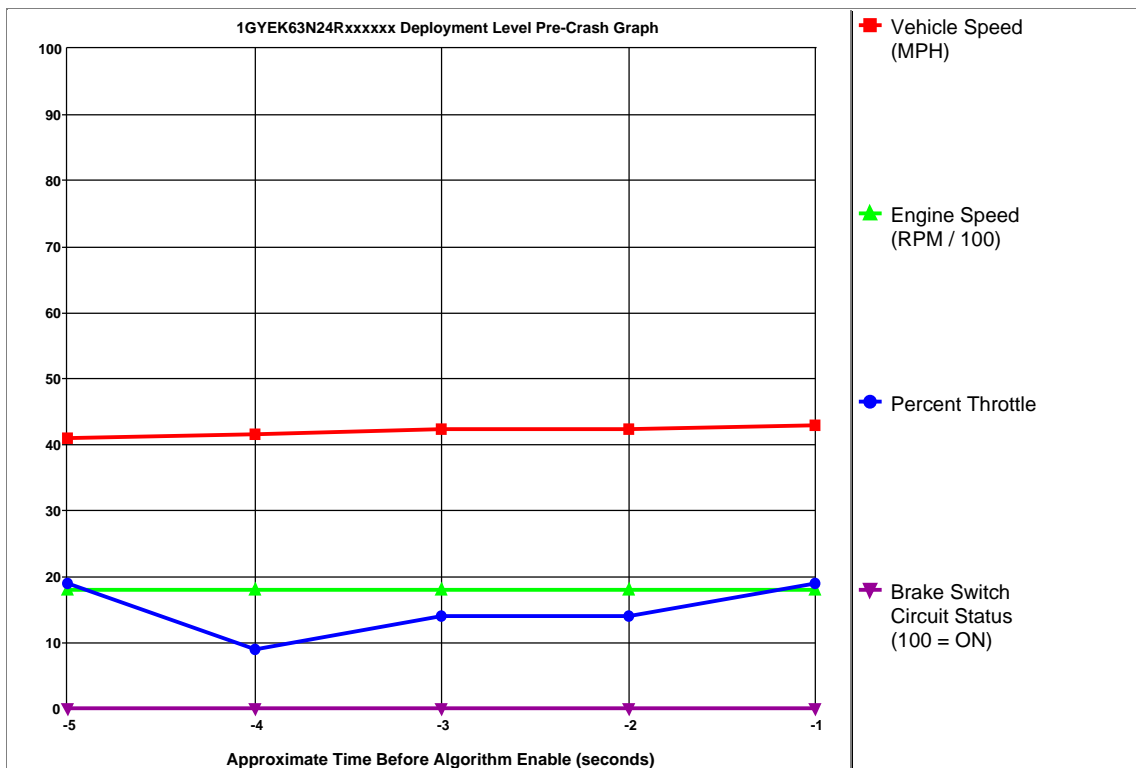
Seconds Before AE	Vehicle Speed (MPH)	Engine Speed (RPM)	Percent Throttle	Brake Switch Circuit Status
-5	41	1792	19	OFF
-4	42	1792	9	OFF
-3	42	1792	14	OFF
-2	42	1792	14	OFF
-1	43	1792	19	OFF



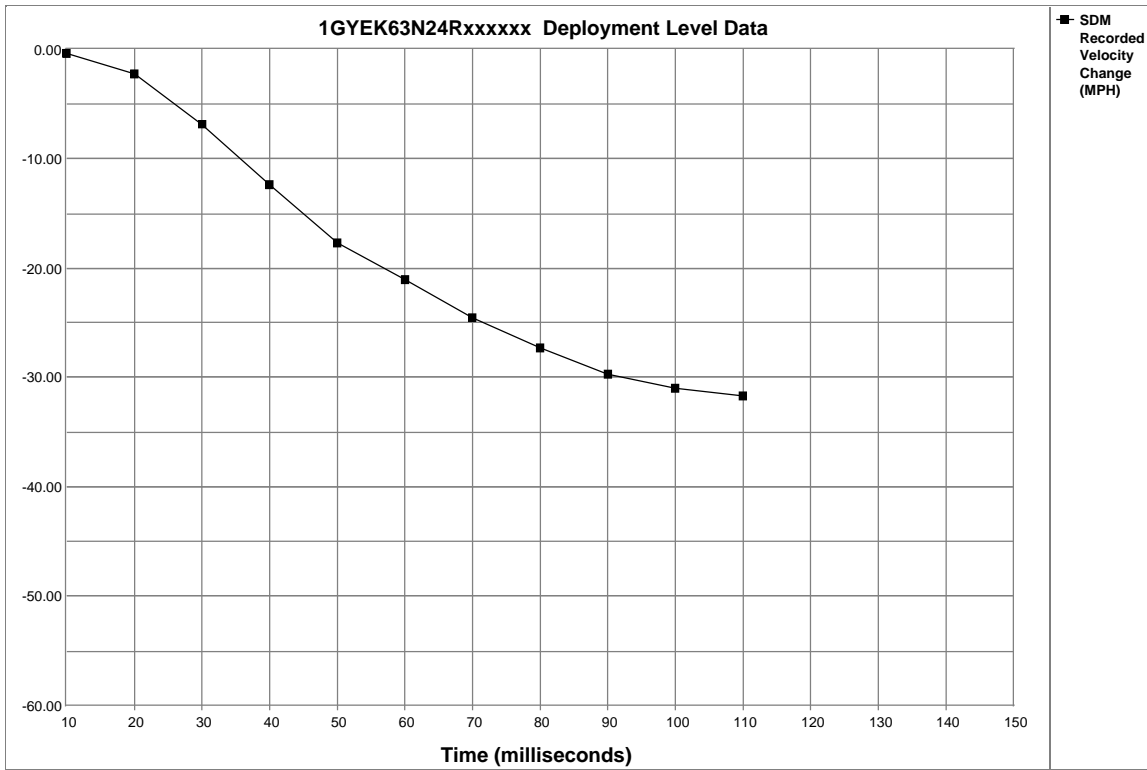
Time (milliseconds)	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150
Recorded Velocity Change (MPH)	-0.62	-2.17	-2.79	-3.72	-4.96	-5.58	-5.58	-5.89	-6.20	-6.20	-5.89	N/A	N/A	N/A	N/A

## System Status At Deployment Level

SIR Warning Lamp Status	OFF
Driver's Belt Switch Circuit Status	BUCKLED
Passenger's Belt Switch Circuit Status	UNBUCKLED
Ignition Cycles At Deployment Level	674
Ignition Cycles At Investigation	677
Maximum SDM Recorded Velocity Change (MPH)	-33.25
Algorithm Enable to Maximum SDM Recorded Velocity Change (msec)	137.5
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)	N/A
Passenger First Stage Time Algorithm Enabled to Deployment Command Criteria Met (msec)	Suppressed
Passenger Second Stage Time Algorithm Enabled to Deployment Command Criteria Met (msec)	N/A
Frontal Deployment Level Event Counter	2
Automatic Passenger SIR Suppression System Status	Air Bag Suppressed
Time Between Deployment And Deployment Level Events (sec)	.3
Event Recording Complete	Yes
Multiple Events Associated With This Record	Yes
One Or More Associated Events Not Recorded	No



Seconds Before AE	Vehicle Speed (MPH)	Engine Speed (RPM)	Percent Throttle	Brake Switch Circuit Status
-5	41	1792	19	OFF
-4	42	1792	9	OFF
-3	42	1792	14	OFF
-2	42	1792	14	OFF
-1	43	1792	19	OFF



Time (milliseconds)	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150
Recorded Velocity Change (MPH)	-0.31	-2.17	-6.82	-12.40	-17.67	-21.08	-24.49	-27.28	-29.76	-31.00	-31.62	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 F0 2C 94 4D B1 64
$02 F1 F1 3C 3C A8 00
$03 41 53 33 32 33 38
$04 4B 41 34 46 46 31
$05 30 31 34 50 38 33
$06 15 17 27 09 00 00
$07 32 03 31 56 00 00
$08 41 44 75 06 56 32
$09 39 4A 4C 46 43 33
$0A 00 00 00 00 00 00
$0B 00 00 00 00 00 00
$0C 41 55 75 08 56 32
$0D 38 30 45 4B 4C 5A
$0E 41 55 75 08 56 32
$0F 33 30 45 44 44 5A
$10 FF AB E0 00 00 00
$11 80 80 80 79 78 79
$12 93 00 00 3B 3B 00
$13 FF 02 00 00 00 00
$14 1D 03 45 05 64 40
$15 FA FA FA FA FA FA
$16 FA FA FA FA FA FA
$17 FA FA 00 00 00 00
$18 00 3F 55 EC F5 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 FD 00 00 00 00 00
$20 FA FD 00 00 FF FF
$21 FF F7 FF FF FF FF
$22 FF FF FF FF FF FF
$23 FF FF FF FF FF F7
$24 00 00 30 09 05 03
$25 00 00 00 00 00 00
$26 00 00 00 00 00 00
$27 00 00 00 06 B2 51
$28 37 07 57 34 FC 00
$29 01 00 00 03 FF FF
$2A 01 07 16 28 39 44
$2B 4F 58 60 64 66 00
$2C 00 00 00 0B FF AB
$2D FC A5 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 55 09 04 03
$35 00 00 00 00 00 00
$36 55 0A 05 03 00 00
$37 00 00 00 01 49 00
$38 3F 07 28 18 00 00
$39 05 00 00 03 FF FF
$3A 02 07 09 0C 10 12
$3B 12 13 14 14 13 00
$3C 00 00 00 0B FF AB
$3D FC A5 00 00 00 00
$40 45 44 44 43 42 00
$41 00 00 30 23 23 16
$42 30 00 1C 1C 1C 1C
$43 1C 00 54 FF 00 00
```

```
$44 45 44 44 43 42 00
$45 00 00 30 23 23 16
$46 30 00 1C 1C 1C 1C
$47 1C 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
```