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ON-SITE CERTIFIED ADVANCED 208-COMPLIANT VEHICLE INVESTIGATION

CASE NUMBER - IN08033
LOCATION - MISSOURI
VEHICLE - 2007 CHEVROLET MALIBU LS
CRASH DATE - September 2008

Submitted:

May 28, 2009



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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 be 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 Documentation Page

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15. <i>Supplementary Notes</i> On-site Certified Advanced 208-Compliant Vehicle Investigation involving a 2007 Chevrolet Malibu LS.					
16. <i>Abstract</i> This report covers an on-site Certified Advanced 208-Compliant Vehicle Investigation that involved a 2007 Chevrolet Malibu LS, which departed the roadway and impacted several trees, rocks, and a wire fence. The focus of this on-site investigation was the Chevrolet's frontal air bag system, which was certified by the manufacturer to be compliant to the Advanced Air Bag portion of the Federal Motor Vehicle Safety Standard (FMVSS) No. 208, and the sources of injury for the vehicle's restrained 20-year-old female driver. The driver was traveling east on a 2-lane rural roadway and was negotiating a right curve. The vehicle drifted off the right side of the roadway as the driver was repositioning herself in the seat. The driver initiated steering maneuvers in an attempt to regain control of the vehicle, which resulted in the vehicle reentering and again departing the south side of the roadway. The vehicle sustained 10 impact events with trees, rocks, and a fence. A right front wheel impact (event 2) with a large rock was sufficient to trigger a first stage deployment of the driver's frontal air bag. The driver sustained minor injuries and was transported by ambulance to a hospital where she was treated in the emergency room and released.					
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The focus of this on-site investigation was the 2007 Chevrolet Malibu's frontal air bag system, which was certified by the manufacturer to be compliant to the Advanced Air Bag portion of the Federal Motor Vehicle Safety Standard (FMVSS) No. 208, and the sources of injury for the vehicle's restrained 20-year-old female driver. This crash was brought to the National Highway Traffic Safety Administration's attention on September 12, 2008 by Special Crash Investigation team #2. The crash involved a 2007 Chevrolet Malibu LS (**Figure 1**) that departed the roadway and impacted several trees, rocks, and a wire fence. The crash occurred in September, 2008 at 1905 hours in Missouri and was investigated by the Missouri State Highway Patrol. This contractor inspected the scene and the Chevrolet on October 6 and 7, 2008. The driver interview was conducted on October 21, 2008. This report is based on the police crash report, scene and vehicle inspections, driver interview, driver medical records, occupant kinematic principles, and this contractor's evaluation of the evidence.



Figure 1: The damaged 2007 Chevrolet Malibu LX

CRASH CIRCUMSTANCES

Crash Environment: The trafficway on which the Chevrolet was traveling was a 2-lane rural roadway that traversed in an east-west direction. The trafficway had one travel lane in each direction and was bordered by grass shoulders. Each travel lane was 3.2 m (10.5 ft) in width. Roadway pavement markings consisted of solid white edge lines and double yellow, no passing center lines. The roadway was curved to the right on the Chevrolet's eastbound direction of travel, and was straight in the area of the vehicle's last roadway departure. The curved section of the roadway had a negative 3.6% grade and a positive 12.6% superelevation to the north. The radius of curvature was 116 m (380.8 ft). The roadway was level in the area where the vehicle last departed the roadway. The posted speed limit was 88 km/h (55 mph). At the time of the crash the light condition was daylight, the atmospheric condition was cloudy, and the bituminous roadway was wet from a previous rain shower. The traffic density was light and the site of the crash was rural. See the Crash Diagram on page 10 of this report.

Pre-Crash: The Chevrolet's restrained 20-year-old female driver was traveling east and was negotiating the right curve (**Figure 2**). The driver stated during the interview that as she traveled through the curve, she began to reposition herself

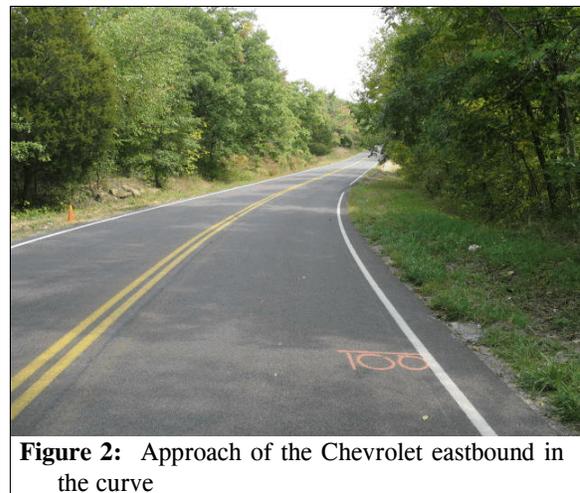


Figure 2: Approach of the Chevrolet eastbound in the curve

in the seat and the vehicle drifted off the right (south) side of the roadway. She steered left, accelerated, and reentered the roadway and then steered right. As a result of the right steer, the vehicle again departed the south side of the roadway (**Figure 3**) where the crash occurred. The driver stated she did not apply the brakes in an attempt to avoid the crash, which was supported by the vehicle's Event Data Recorder (EDR) data. The EDR steering wheel angle data also supported the driver's description of the steering inputs prior to the crash. The EDR data indicated that the vehicle was traveling 77 km/h (48 mph) 5 seconds prior to Algorithm Enable (AE) and had decelerated to 72 km/h (45 mph) at 1 second prior to AE.

Crash: The Chevrolet was in a slight clockwise yaw as it departed the south side of the roadway and continued to yaw clockwise as it traversed a distance of 16 m (52.5 ft) across a negative 1.3% grade. The tire mark evidence in the grass indicated that the vehicle was yawed clockwise approximately 10 degrees when the lower right portion of the front bumper fascia (**Figure 4**) impacted a rock 91 cm (35.8 inches) x 56 cm (22 in) in size (**Figure 5**, event 1). The right front wheel (**Figure 6**) then impacted the same rock (event 2). The impact force was sufficient to displace the right front wheel rearward into the back of the wheel well and triggered a first stage deployment of the driver's frontal air bag. The vehicle continued an additional 5 m (16.4 ft) where the front right bumper corner (**Figure 4**) impacted a 10 cm (3.9 in) diameter tree (**Figure 7**, event 3). The vehicle traversed an additional 4 m (13 ft) and the right rear door, right rear wheel, and quarter panel (**Figure 8**) sideswiped an 11 cm (4.3 in) diameter tree (**Figure 7**, event 4), and the front bumper impacted a 7 cm (2.8 in) diameter tree (**Figure 9**, event 5). The vehicle continued an additional 5.6 m (18.4 ft) and the right quarter panel sideswiped a 14 cm (5.5 in) diameter tree (**Figures 8 and 9**, event 6). The vehicle traversed another 16.5 m (54.1 ft) through small trees and brush and the right rocker panel (**Figure 10**) sideswiped a rock (**Figure 11**, event 7). The right front corner also penetrated a wire fence



Figure 3: Location where the Chevrolet departed the south side of the roadway



Figure 4: Bottom arrow shows impact location on lower bumper fascia with a rock (event 1), top arrow shows impact location with a tree (event 3)



Figure 5: Chevrolet's lower front right bumper fascia and right front wheel impacted and displaced rock (arrow)

(events 8 and 9) and the left fender (**Figure 12**) sideswiped a 69 cm (27.2 in) diameter tree (**Figure 11**, event 10) as the vehicle came to final rest. At final rest of the vehicle was located 5.8 m (19 ft) off the south roadway edge heading southeast.



Figure 6: Damage to right front wheel from impact with a rock



Figure 7: Arrow on left shows tree impacted by the front right bumper corner (event 3); arrow on right shows tree sideswiped by right rear door and quarter panel (event 4)



Figure 8: Damage to right side from sideswiping two trees (events 4 and 5)



Figure 9: Chevrolet's front bumper impacted tree (arrow on left, event 5) and right quarter sideswiped another tree (arrow on right, event 6)



Figure 10: Damage to right rocker panel from impact with a rock (event 7)



Figure 11: Impacts with rock, wire fence, and tree (events 7-10), and final rest

Post-Crash: The driver was not entrapped in the vehicle and exited without assistance through the left front door. The police were notified of the crash at 1910 hours and arrived on scene at 1924 hours. Emergency medical personnel also responded to the scene and the driver was transported by ambulance to a hospital. The vehicle was towed due to damage.

CASE VEHICLE

The 2007 Chevrolet Malibu LS was a front wheel drive, 4-door sedan (VIN: 1G1ZS58F8F-----) equipped with a 2.2L engine, automatic transmission, traction control, and an EDR. The front row was equipped with driver and front right passenger dual stage frontal air bags, bucket seats, adjustable head restraints, and lap-and-shoulder belts with adjustable upper anchors. The second row was equipped with a bench seat, adjustable head restraints in the outboard seating positions, lap-and-shoulder belts in all three seating positions, and Lower Anchors and Tethers for Children (LATCH) in the outboard seating positions. The vehicle's mileage at the time of the inspection was 45,566 kilometers (28,314 miles). The specified wheelbase was 270 cm (106.3 in).

CASE VEHICLE DAMAGE

Exterior Damage: The damage from the multiple impacts involved the front plane, both side planes, top plane and the right side wheels. The direct damage from the initial impact to a rock (event 1) began 34 cm (13.4 in) right of the centerline and extended 27 cm (10.6 inches) to the right on the lower portion of the bumper fascia. This impact involved only the plastic bumper fascia and there was no crush to the metal bumper bar. The second impact with the same rock (event 2) involved the right front wheel, and it was displaced rearward 12 cm (4.7 in) and loaded into the back of the wheel well.

The direct damage on the front right bumper corner from the impact to a tree (event 3) began at the corner of the bumper fascia and extended 5 cm (2 in) to the left. This impact involved only the plastic bumper fascia. There was no crush to the bumper bar. The direct damage extended 91 cm (35.8 in) along the right side on the right fender.

The direct damage on the right rear door and quarter panel from a sideswipe to a tree (event 4) began 122 cm (48 in) forward of the right rear axle and extended 206 cm (81.1 in) rearward on the side. The maximum residual crush was 7 cm (2.8 inches) and occurred at C₄. A sideswipe to a another tree (event 6) also partially overlapped the damage from event 4, but this event appeared to consist of only scratches. The table below shows the crush profile for event 4.



Figure 12: Damage to left fender from sideswiping a tree (event 10)

Units	Event	Direct Damage		Field L	C ₁	C ₂	C ₃	C ₄	C ₅	C ₆	Direct	Field L
		Width CDC	Max Crush								±D	±D
cm	4	206	4	212	0	3	2	7	4	0	-109	-107
in		81.1	1.6	83.5	0.0	1.2	0.8	2.8	1.6	0.0	-42.9	-42.1

The direct damage from a tree impact to the front bumper (event 5) began 37 cm (94 in) right of the centerline and extended 24 cm (9.4 in) to the right on the bumper. This impact only scuffed the plastic bumper fascia and produced no crush to the bumper bar.

The direct damage on the right rocker panel from a sideswipe to a rock (event 7) began 194 cm (76.4 in) forward of the right rear axle and extended 148 cm (58.3 in) rearward. The maximum crush was 5 cm (2 in) and occurred at C₄. The table below shows the crush profile for event 7.

Units	Event	Direct Damage		Field L	C ₁	C ₂	C ₃	C ₄	C ₅	C ₆	Direct	Field L
		Width CDC	Max Crush								±D	±D
cm	7	148	5	148	1	2	2	5	4	0	-4	-4
in		58.3	2.0	58.3	0.4	0.8	0.8	2.0	1.6	0.0	-1.6	-1.6

The direct damage from the impact with the wire fence (event 8) began at the front right bumper corner and extended 5 cm (2 in) to the left on the bumper. The damage extended down the right side and along the right A-pillar to the top of the pillar. There was no residual crush from this impact, only scratches in the paint. As the vehicle penetrated the wire fence, the fence also scratched the right portion of the hood and roof (event 9). The scratches extended along the top plane to the right C-pillar.

The direct damage from a tree impact to the left fender (event 10) involved the left side of the bumper fascia and the fender. The direct damage began 27 cm (10.6 in) forward of the left front axle and extended 38 cm (15 in) forward along the fender. The maximum residual crush was 7 cm (2.8 in) and occurred at C₄. The table below shows the crush profile for event 10.

Units	Event	Direct Damage		Field L	C ₁	C ₂	C ₃	C ₄	C ₅	C ₆	Direct	Field L
		Width CDC	Max Crush								±D	±D
cm	10	38	7	53	0	0	3	5	7	0	180	173
in		15.0	2.8	20.9	0.0	0.0	1.2	2.0	2.8	0.0	70.9	68.1

The Chevrolet’s left side wheelbase was reduced 3 cm (1.2 in) and the right side wheelbase was reduced 12 cm (4.7 in). The induced damage involved the front bumper fascia, the left fender, and right quarter panel.

Damage Classification: The Collision Deformation Classifications for the 10 events are as follows:

- Event 1: front bumper fascia impact to a rock: **12-FRLN-1**
- Event 2: right front wheel impact to a rock: **12-FRWN-3**
- Event 3: front right bumper corner impact to a tree: **12-FRES-3**
- Event 4: right rear door and quarter panel sideswipe to a tree: **12-RZAS-2**
- Event 5: front bumper impact to a tree: **12-FRLN-1**
- Event 6: right quarter panel sideswipe to a tree: **12-RBMS-9** (unknown extent zone)
- Event 7: right rocker panel sideswipe to a rock: **12-RPLS-2**
- Event 8: right front bumper corner impact to a wire fence: **12-FRAS-7**
- Event 9: wire fence scratches on the top plane (i.e., top swipe): **12-TYZS-1**
- Event 10: left fender sideswipe to a tree: **12-LFES-2**

The WinSMASH reconstruction program could not be used to reconstruct the Delta V for any of the events because yielding object impacts, wheel impacts, and sideswipe impacts are out of scope for the program.

The vehicle manufacturer’s recommended tire size was P205/65R15. The Chevrolet was equipped with tires of the recommended size. The vehicle’s tire data are shown in the table on the next page.

Tire	Measured Pressure		Vehicle Manufacturer’s Recommended Cold Tire Pressure		Tread Depth		Damage	Restricted	Deflated
	kPa	psi	kPa	psi	milli-meters	32 nd of an inch			
LF	Flat	Flat	207	30	5	6	Bead separation	No	Yes
LR	179	26	207	30	7	9	None	No	No
RR	Flat	Flat	207	30	7	9	Bead separation	No	Yes
RF	Flat	Flat	207	30	5	6	Bead separation	No	Yes

Vehicle Interior: The inspection of the Chevrolet’s interior revealed no evidence of occupant contact to any interior surfaces or objects. There was no deformation of the steering wheel or compression of the energy absorbing steering column. The rear upper quadrant of the right rear door intruded 2 cm (0.8 in), and the window frame of the right rear quarter window intruded 1 cm (0.4 in). The right rear door was jammed shut while the other doors remained closed and operational. All of the window glazing was either closed or fixed. The right rear window and

second right rear window glazing were disintegrated from impact forces while the remaining window glazing was undamaged.

EVENT DATA RECORDER

The Chevrolet's EDR was imaged using version 3.0 of the Bosch Crash Data Retrieval tool via connection to the vehicle's diagnostic link connector. The EDR recorded two events, a deployment event and a non-deployment event. The imaged data for the deployment event indicated that the SIR warning lamp was off and the driver's seat belt switch circuit was recorded as buckled. The first stage deployment criteria for the driver's air bag was met at 62 msec following AE, and there was disposal of the air bag's second stage. The maximum recorded longitudinal Delta V was -12.0 km/h (-7.46 mph) at 140 msec. The time between the deployment and non-deployment events was 2.72 msec, and the non-deployment event occurred prior to the deployment event.

The imaged data for the non-deployment event indicated that the driver's and front right passenger's seat belt pretensioners were commanded to deploy. The maximum recorded longitudinal Delta V was reported on the System Status at Non-Deployment Record as -9.62 km/h (-5.98 mph) occurring 140 msec following AE. The brake switch circuit was recorded as off for each of the 5 recorded data points. The recorded steering wheel data indicated the driver applied two cycles of right and left steer prior to AE. The EDR report is attached at the end of this report¹.

AUTOMATIC RESTRAINT SYSTEM

The Chevrolet was equipped with a frontal air bag system that was certified by the manufacturer to be compliant to the Advanced Air Bag portion of Federal Motor Vehicle Safety Standard (FMVSS) No. 208. The system consisted of dual stage driver and right front passenger frontal air bags, a capacitance sensor for the front right passenger seating position, seat belt buckle switch sensors, driver seat position sensor, and retractor mounted pretensioners. Based on the manufacturer's website, the dual stage frontal air bag system senses the severity of a crash, then determines if the air bags should be deployed and whether a full or less-than-full amount of inflation is to be used. The front right passenger sensing system automatically switches the front right passenger air bag on or off based on the passenger's weight and the type of pressure on the seat.

The driver's frontal air bag was located within the steering wheel hub and the module cover was a bi-fold configuration (**Figure 13**)



Figure 13: Driver's air bag module cover

¹ Please note that pages 11-13 of the EDR report have been omitted for confidentiality reasons.

constructed of pliable vinyl. Each flap was 10 cm (4 in) in width and 15 cm (6 in) in height. There was a cutout on the left flap to accommodate the Chevrolet emblem on the right flap. The air bag module cover flaps opened at the designated tear points. The deployed air bag (**Figure 14**) was round with a diameter of 60 cm (23.6 in) and was designed with four tethers and two vent ports. The vent ports were 3 cm (1.2 in) in diameter and were located at the 11 and 1 o'clock positions. Each tether was 11 cm (4.3 in) in width. There was no damage to the air bag and no discernable evidence of occupant contact. A localized area of dark scuffing was present on the front upper right quadrant of the air bag, but this did not appear to be occupant contact and was possibly the result of deployment or post-crash handling of the air bag.

The front right passenger air bag was located within the middle of the instrument panel. The front right passenger position was not occupied at the time of the crash and this air bag did deploy.

MANUAL RESTRAINT SYSTEM

The Chevrolet was equipped with lap-and-shoulder belts for all the seating positions. The driver's seat belt consisted of continuous loop belt webbing, an Emergency Locking Retractor (ELR), sliding latch plate, and an adjustable upper anchor that was in the full down position. The front right seat belt was equipped with a switchable ELR/Automatic Locking Retractor (ALR), sliding latch plate, and adjustable upper anchor that was located in the middle position.

The second row seat belts were similar to the front right seat belt with the exception that they had fixed upper anchors and were not equipped with pretensioners.

The driver's seat belt was found with the retractor jammed and a length of belt webbing extended out of the retractor (**Figure 15**), which supported the EDR reported actuation of the pretensioner during the crash. The length of belt was 133 cm (52.6 in) as measured from the stop button to the D-ring. The inspection of the D-ring revealed load abrasions on the plastic (**Figure 16**) and usage scratches on the latch plate. The evidence indicated that the driver was restrained at the time of the crash. The other seat positions were not occupied.



Figure 14: The driver's air bag; yellow tape outlines a dark scuff, but it did not appear to be an occupant contact



Figure 15: Driver's seat belt

The Chevrolet’s driver [20-year-old, female; 160 cm and 104 kg (63 in, 230 lbs)] stated during the interview that just prior to the event she had repositioned her upper body and was seated in an upright posture with both hands on the steering wheel at the 10 and 3 o’clock positions. The seat track was adjusted to the middle position and the seat back was slightly reclined. The tilt steering column was located in the center position. The driver was not wearing glasses or contact lenses.



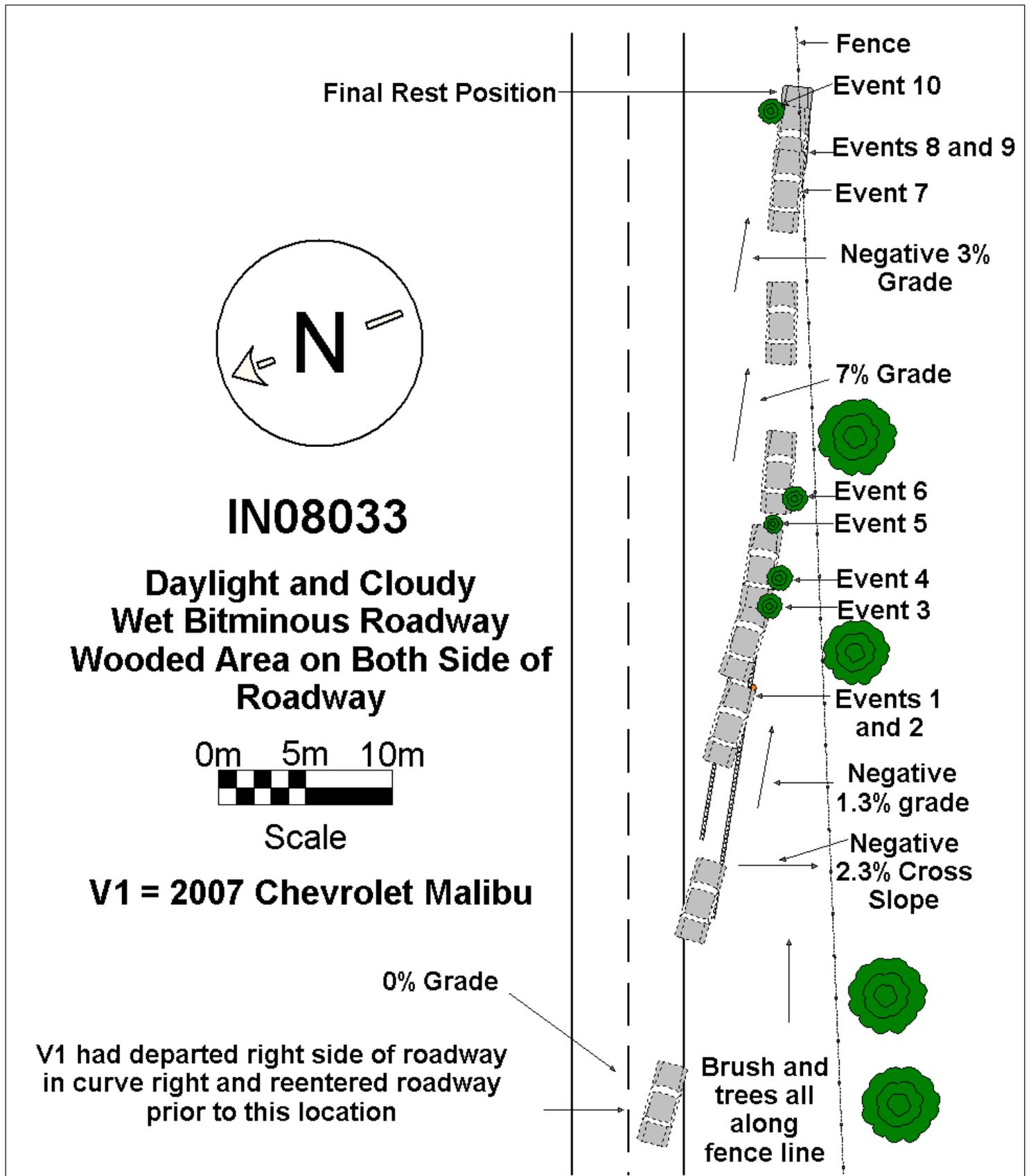
Figure 16: Arrow shows abrasions on driver’s D-ring

The Chevrolet’s right front wheel impact to the rock (event 2) displaced the driver forward opposite the 12 o’clock direction of force and she loaded the seat belt. The interaction with the seat belt resulted in an abrasion on the left side of her neck, and impact force caused a cervical strain. The driver also sustained contusions and abrasion on both forearms. While there was no discernable occupant contact evidence on the air bag, SCI experience indicated that these injuries were probably caused from interaction with the deploying air bag. The driver remained restrained in her seat position throughout the crash sequence.

CASE VEHICLE DRIVER INJURIES

The driver was transported by ambulance from the crash scene to a hospital. Her injuries were minor and she was treated in the hospital emergency room and released. The table below shows the driver’ injuries and injury sources.

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source	Source Confidence	Source of Injury Data
1	Strain, cervical, not further specified	minor 640278.1,6	Noncontact injury: impact forces	Probable	Emergency room records
2	Abrasion left side of neck, not further specified	minor 390202.1,2	Torso portion of safety belt system	Certain	Interviewee (same person)
3	Contusion left forearm, not further specified	minor 790402.1,2	Air bag, driver’s	Probable	Interviewee (same person)
4	Contusion medial {inside} right forearm from elbow to wrist	minor 790402.1,1	Air bag, driver’s	Certain	Interviewee (same person)
5	Abrasions forearms, not further specified	minor 790202.1,3	Air bag, driver’s	Probable	Emergency room records



CDR File Information

Vehicle Identification Number	1G1ZS58F87F*****
Investigator	
Case Number	IN08033
Investigation Date	
Crash Date	
Filename	IN08033.CDR
Saved on	Tuesday, October 7 2008 at 09:29:23 AM
Collected with CDR version	Crash Data Retrieval Tool 3.00
Reported with CDR version	Crash Data Retrieval Tool 3.00
EDR Device Type	airbag control module
Event(s) recovered	Deployment Non-Deployment

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 can contain 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 can contain 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 cannot 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 Event file will be locked after a Deployment Event, if the Non-Deployment Event occurred within 5 seconds before the Deployment Event unless a Deployment Level Event occurs within 5 seconds after the Deployment Event, and then the Deployment Level Event will overwrite the Non-Deployment Event file.

SDM Data Limitations:

-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 Deployment Events and Deployment Level Events, the SDM will record 220 milliseconds of data after deployment criteria is met and up to 70 milliseconds before deployment criteria is met. For Non-Deployment Events, the SDM will record up to the first 300 milliseconds of data after algorithm enable. The minimum SDM Recorded Vehicle Forward Velocity Change, that is needed to record a Non-Deployment Event, is 5 MPH.

-Maximum Recorded Vehicle Velocity Change is the maximum recorded velocity change in the vehicle's combined "X" and "Y" axis. It is calculated every ten ms by taking the square of the "X" axis value and adding it to the square of the "Y" axis value and then taking the square root of the sum. The greatest calculated value is the one that is stored.

-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 receive an invalid message from the module sending the pre-crash data.

-Driver's and Passenger's Belt Switch Circuit Status indicates the status of the seat belt switch circuit. The Passenger Belt Switch Circuit Status for 2005 vehicles is only available on the Cadillac STS. Also, the Passenger Belt Switch Circuit Status for 2006 Chevrolet Cobalt Sport Coupe (AP) model vehicles, with the option package that includes Recaro brand seats (RPO ALV), will always report a default value of "Buckled".

-The Time Between Non-Deployment and Deployment Events is displayed in seconds. If the time between the two events is greater than 5 seconds, "N/A" is displayed in place of the time. If the value is negative, then the Deployment Event occurred first. If the value is positive, then the Non-Deployment Event occurred first.

-If power to the SDM is lost during a crash event, all or part of the crash record may not be recorded.

-The ignition cycle counter relies upon the transitions through OFF->RUN->CRANK power-modding messages, on the GMLAN communication bus, to increment the counter. Applying and removing of battery power to the module will not increment the ignition counter.

-Steering Wheel Angle data is displayed as a positive value, when the steering wheel is turned to the right, and a negative value, when the steering wheel is turned to the left. For Cadillac STS models with Stabilatrac 3 systems, the Steering Wheel Angle data will be displayed just the opposite. When the steering wheel is turned to the right, a negative value will be displayed and when the steering wheel is turned to the left, a positive value will be displayed.

SDM Data Source:

All SDM recorded data is measured, calculated, and stored internally, except for the following:

1G1ZS58F87F*****

- Vehicle Status Data (Pre-Crash) is transmitted to the SDM, by various vehicle control modules, via the vehicle's communication network.
- The Belt Switch Circuit is wired directly to the SDM.

Multiple Event Data

Associated Events Not Recorded	0
An Event(s) Preceded the Recorded Event(s)	No
An Event(s) was in Between the Recorded Event(s)	No
An Event(s) Followed the Recorded Event(s)	No
The Event(s) Not Recorded was a Deployment Event(s)	No
The Event(s) Not Recorded was a Non-Deployment Event(s)	No

System Status At AE

Vehicle Identification Number	**1ZS58F*7*****
Low Tire Pressure Warning Lamp (If Equipped)	Invalid
Vehicle Power Mode Status	Run
Remote Start Status (If Equipped)	Inactive
Run/Crank Ignition Switch Logic Level	Active
Brake System Warning Lamp (If Equipped)	OFF

System Status At 1 second

Transmission Range (If Equipped)	Fourth Gear
Transmission Selector Position (If Equipped)	Drive
Traction Control System Active (If Equipped)	Invalid
Service Engine Soon (Non-Emission Related) Lamp	OFF
Service Vehicle Soon Lamp	OFF
Outside Air Temperature (degrees F) (If Equipped)	63
Left Front Door Status (If Equipped)	Closed
Right Front Door Status (If Equipped)	Closed
Left Rear Door Status (If Equipped)	Unused
Right Rear Door Status (If Equipped)	Unused
Rear Door(s) Status (If Equipped)	Closed

Pre-crash data

Parameter	-2 sec	-1 sec
Reduced Engine Power Mode	OFF	OFF
Cruise Control Active (If Equipped)	No	No
Cruise Control Resume Switch Active (If Equipped)	No	No
Cruise Control Set Switch Active (If Equipped)	No	No

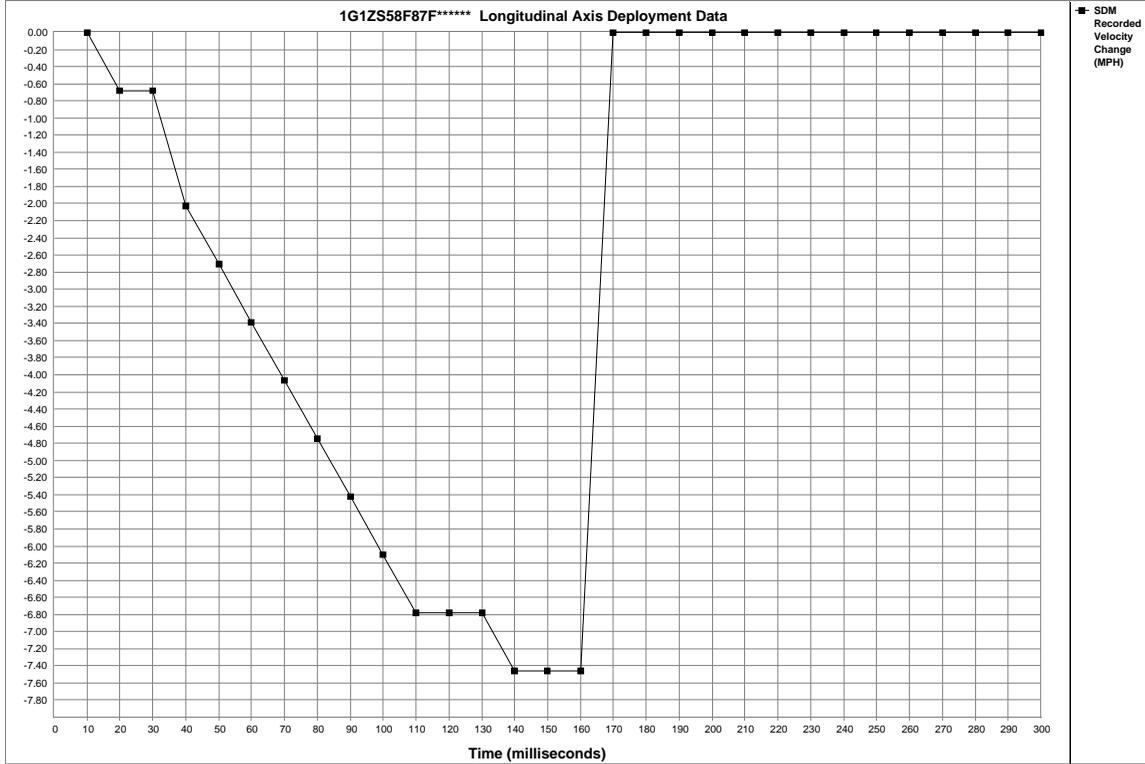
Pre-crash data

Parameter	-5 sec	-4 sec	-3 sec	-2 sec	-1 sec
Vehicle Speed (MPH)	48	50	50	48	45
Engine Speed (RPM)	1792	1664	1664	1792	2688
Percent Throttle	36	36	36	20	100
Brake Switch Circuit Status	OFF	OFF	OFF	OFF	OFF
Accelerator Pedal Position (percent)	14	14	14	0	100
Antilock Brake System Active (If Equipped)	Invalid	Invalid	Invalid	Invalid	Invalid
Lateral Acceleration (feet/s ²)(If Equipped)	Invalid	Invalid	Invalid	Invalid	Invalid
Yaw Rate (degrees per second) (If Equipped)	Invalid	Invalid	Invalid	Invalid	Invalid

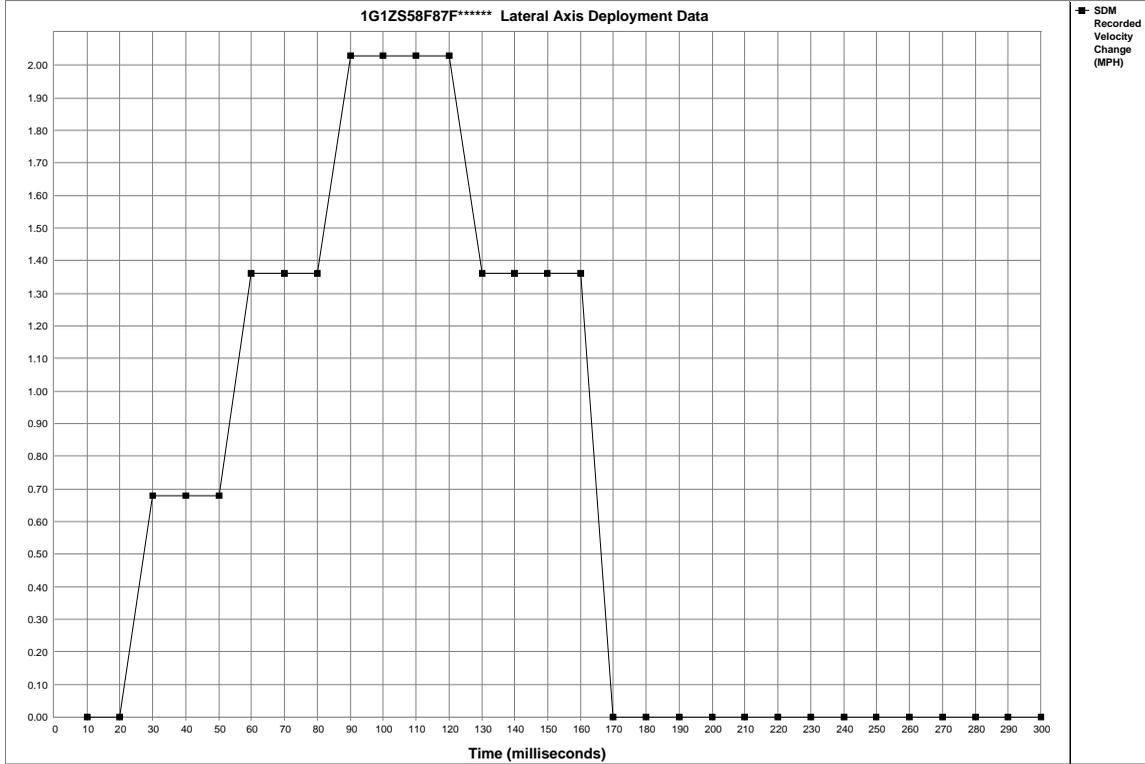
Parameter	-5 sec	-4 sec	-3 sec	-2 sec	-1 sec
Steering Wheel Angle (degrees) (If Equipped)	16	0	-48	144	-512
Vehicle Dynamics Control Active (If Equipped)	Invalid	Invalid	Invalid	Invalid	Invalid

System Status At Deployment

Ignition Cycles At Investigation	2758
SIR Warning Lamp Status	OFF
SIR Warning Lamp ON/OFF Time (seconds)	655200
Number of Ignition Cycles SIR Warning Lamp was ON/OFF Continuously	2754
Ignition Cycles At Event	2755
Ignition Cycles Since DTCs Were Last Cleared	254
Driver's Belt Switch Circuit Status	BUCKLED
Passenger's Belt Switch Circuit Status	UNBUCKLED
Diagnostic Trouble Codes at Event, fault number: 1	N/A
Diagnostic Trouble Codes at Event, fault number: 2	N/A
Diagnostic Trouble Codes at Event, fault number: 3	N/A
Diagnostic Trouble Codes at Event, fault number: 4	N/A
Diagnostic Trouble Codes at Event, fault number: 5	N/A
Diagnostic Trouble Codes at Event, fault number: 6	N/A
Automatic Passenger SIR Suppression System Validity Status at AE	Valid
Automatic Passenger SIR Suppression System Status at AE	Air Bag Suppressed
Automatic Passenger SIR Suppression System Validity Status at First Deployment Command	Valid
Automatic Passenger SIR Suppression System Status at First Deployment Command	Air Bag Suppressed
Driver 1st Stage Time From Algorithm Enable to Deployment Command Criteria Met (msec)	62
Driver 2nd Stage Time From Algorithm Enable to Deployment Command Criteria Met (msec)	Disposal
Passenger 1st Stage Time From Algorithm Enable to Deployment Command Criteria Met (msec)	Suppressed
Passenger 2nd Stage Time From Algorithm Enable to Deployment Command Criteria Met (msec)	Suppressed
Driver Side or Roof Rail/Head Curtain Time From Algorithm Enable to Deployment Command Criteria Met (msec)	N/A
Passenger Side or Roof Rail/Head Curtain Time From Algorithm Enable to Deployment Command Criteria Met (msec)	N/A
Time Between Events (sec)	2.72
Driver First Stage Deployment Loop Commanded	Yes
Driver Second Stage Deployment Loop Commanded	Yes
Driver Side Deployment Loop Commanded	No
Driver Pretensioner Deployment Loop Commanded	No
Driver (Initiator 1) Roof Rail/Head Curtain Loop Commanded	No
Driver (Initiator 2) Roof Rail/Head Curtain Loop Commanded	No
Driver Knee Deployment Loop Commanded	No
Passenger First Stage Deployment Loop Commanded	No
Passenger Second Stage Deployment Loop Commanded	No
Passenger Side Deployment Loop Commanded	No
Passenger Pretensioner Deployment Loop Commanded	No
Passenger (Initiator 1) Roof Rail/Head Curtain Loop Commanded	No
Passenger (Initiator 2) Roof Rail/Head Curtain Loop Commanded	No
Passenger Knee Deployment Loop Commanded	No
Second Row Left Side Deployment Loop Commanded	No
Second Row Left Pretensioner Deployment Loop Commanded	No
Third Row Left Roof Rail/Head Curtain Loop Commanded	No
Second Row Right Side Deployment Loop Commanded	No
Second Row Right Pretensioner Deployment Loop Commanded	No
Third Row Right Roof Rail/Head Curtain Loop Commanded	No
Second Row Center Pretensioner Deployment Loop Commanded	No
Driver 2nd Stage Deployment Loop Commanded for Disposal	Yes
Passenger 2nd Stage Deployment Loop Commanded for Disposal	No
Crash Record Locked	Yes
Vehicle Event Data (Pre-Crash) Associated With This Event	No
Deployment Event Recorded in the Non-Deployment Record	No
Event Recording Complete	Yes



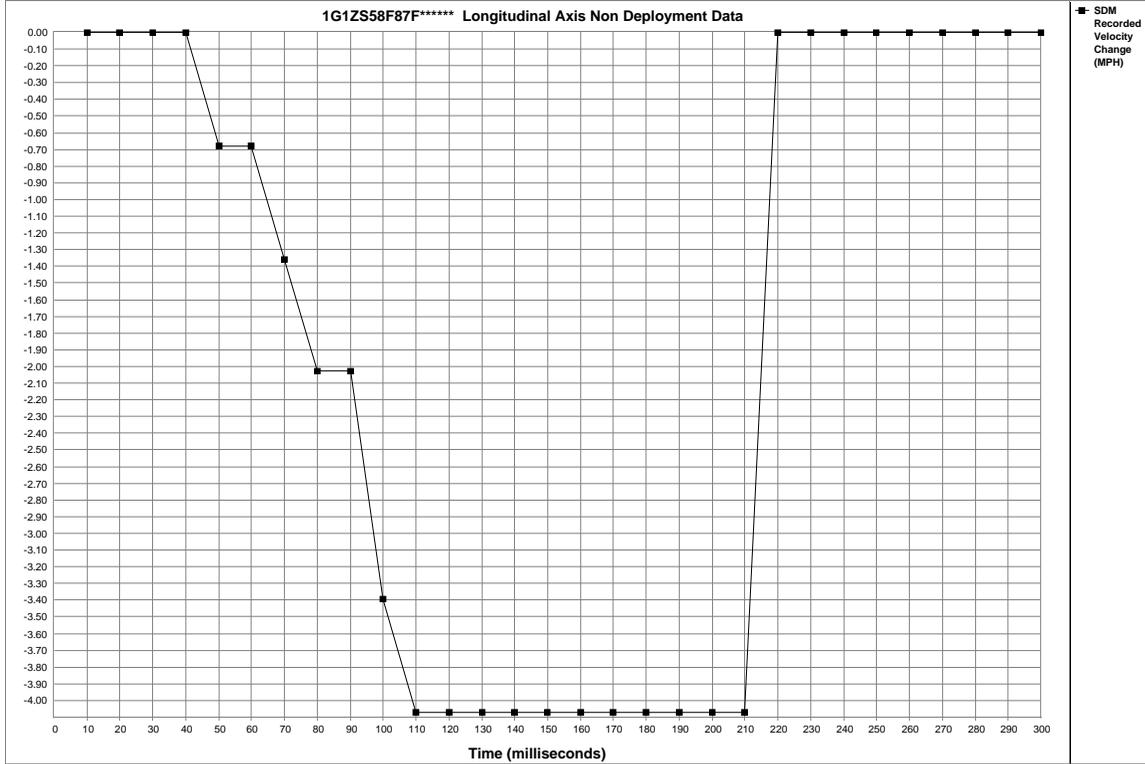
Time (milliseconds)	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150
Longitudinal Axis Recorded Velocity	0.00	-0.68	-0.68	-2.03	-2.71	-3.39	-4.07	-4.74	-5.42	-6.10	-6.78	-6.78	-6.78	-7.46	-7.46
Time (milliseconds)	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300
Longitudinal Axis Recorded Velocity	-7.46	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



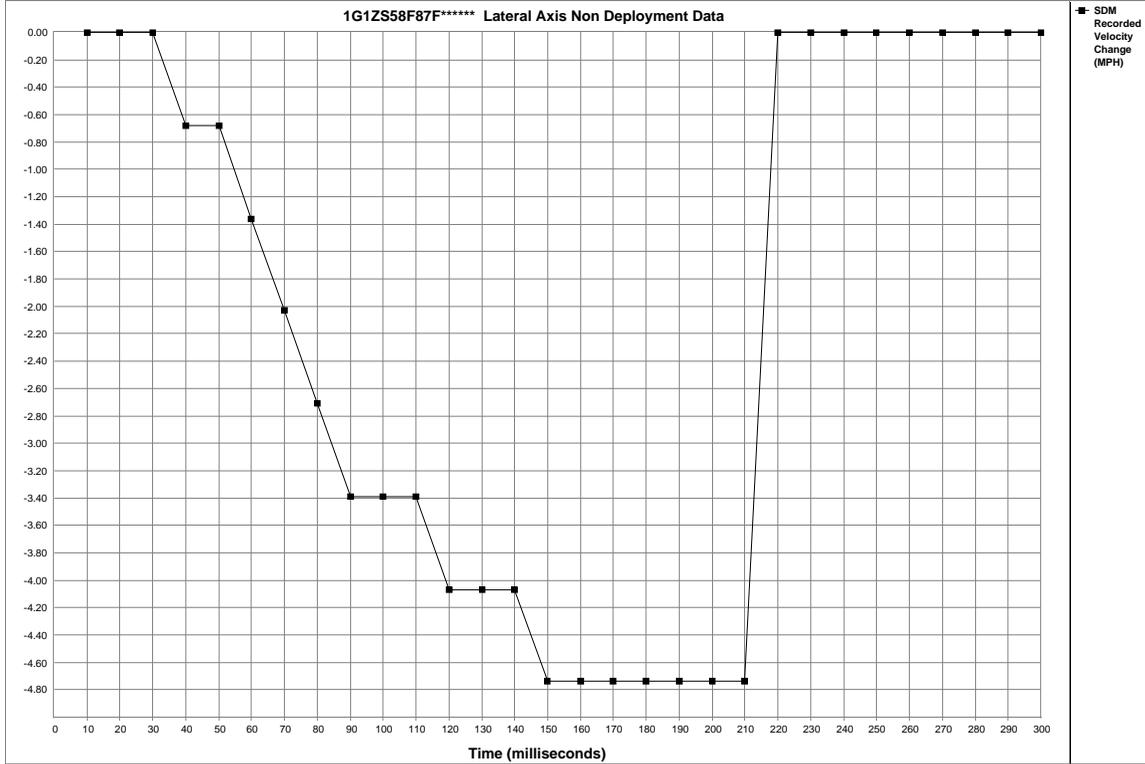
Time (milliseconds)	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150
Lateral Axis Recorded Velocity Change (MPH)	0.00	0.00	0.68	0.68	0.68	1.36	1.36	1.36	2.03	2.03	2.03	2.03	1.36	1.36	1.36
Time (milliseconds)	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300
Lateral Axis Recorded Velocity Change (MPH)	1.36	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

System Status At Non-Deployment

Ignition Cycles At Investigation	2758
SIR Warning Lamp Status	OFF
SIR Warning Lamp ON/OFF Time (seconds)	655200
Number of Ignition Cycles SIR Warning Lamp was ON/OFF Continuously	2754
Ignition Cycles At Event	2755
Ignition Cycles Since DTCs Were Last Cleared	254
Driver's Belt Switch Circuit Status	BUCKLED
Passenger's Belt Switch Circuit Status	UNBUCKLED
Automatic Passenger SIR Suppression System Validity Status	Valid
Automatic Passenger SIR Suppression System Status	Air Bag Suppressed
Diagnostic Trouble Codes at Event, fault number: 1	N/A
Diagnostic Trouble Codes at Event, fault number: 2	N/A
Diagnostic Trouble Codes at Event, fault number: 3	N/A
Diagnostic Trouble Codes at Event, fault number: 4	N/A
Diagnostic Trouble Codes at Event, fault number: 5	N/A
Diagnostic Trouble Codes at Event, fault number: 6	N/A
Maximum SDM Recorded Velocity Change (MPH)	5.98
Algorithm Enable to Maximum SDM Recorded Velocity Change (msec)	140
Driver First Stage Deployment Loop Commanded	No
Driver Second Stage Deployment Loop Commanded	No
Driver Side Deployment Loop Commanded	No
Driver Pretensioner Deployment Loop Commanded	Yes
Driver (Initiator 1) Roof Rail/Head Curtain Loop Commanded	No
Driver (Initiator 2) Roof Rail/Head Curtain Loop Commanded	No
Driver Knee Deployment Loop Commanded	No
Passenger First Stage Deployment Loop Commanded	No
Passenger Second Stage Deployment Loop Commanded	No
Passenger Side Deployment Loop Commanded	No
Passenger Pretensioner Deployment Loop Commanded	Yes
Passenger (Initiator 1) Roof Rail/Head Curtain Loop Commanded	No
Passenger (Initiator 2) Roof Rail/Head Curtain Loop Commanded	No
Passenger Knee Deployment Loop Commanded	No
Second Row Left Side Deployment Loop Commanded	No
Second Row Left Pretensioner Deployment Loop Commanded	No
Third Row Left Roof Rail/Head Curtain Loop Commanded	No
Second Row Right Side Deployment Loop Commanded	No
Second Row Right Pretensioner Deployment Loop Commanded	No
Third Row Right Roof Rail/Head Curtain Loop Commanded	No
Second Row Center Pretensioner Deployment Loop Commanded	No
Crash Record Locked	Yes
Vehicle Event Data (Pre-Crash) Associated With This Event	Yes
Deployment Event Recorded in the Non-Deployment Record	No
Event Recording Complete	Yes



Time (milliseconds)	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150
Longitudinal Axis Recorded Velocity	0.00	0.00	0.00	0.00	-0.68	-0.68	-1.36	-2.03	-2.03	-3.39	-4.07	-4.07	-4.07	-4.07	-4.07
Time (milliseconds)	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300
Longitudinal Axis Recorded Velocity	-4.07	-4.07	-4.07	-4.07	-4.07	-4.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00



Time (milliseconds)	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150
Lateral Axis Recorded Velocity Change (MPH)	0.00	0.00	0.00	-0.68	-0.68	-1.36	-2.03	-2.71	-3.39	-3.39	-3.39	-4.07	-4.07	-4.07	-4.74
Time (milliseconds)	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300
Lateral Axis Recorded Velocity Change (MPH)	-4.74	-4.74	-4.74	-4.74	-4.74	-4.74	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00