INDIANA UNIVERSITY

TRANSPORTATION RESEARCH CENTER
School of Public and Environmental Affairs
501 S. Madison Street, Suite 105
Bloomington, Indiana 47403-2452
(812) 855-3908 Fax: (812) 855-3537

ON-SITE SIDE IMPACT INFLATABLE OCCUPANT PROTECTION INVESTIGATION

CASE NUMBER - IN08030
LOCATION - TEXAS
VEHICLE - 2007 CHEVROLET IMPALA LT
CRASH DATE - May 2008

Submitted:

April 6, 2009

Contract Number: DTNH22-07-C-00044

Prepared for:

U.S. Department of Transportation
National Highway Traffic Safety Administration
National Center for Statistics and Analysis
Washington, D.C. 20590-0003

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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. *Supplementary Notes*
On-site Side Impact Inflatable Occupant Protection Investigation involving a 2007 Chevrolet Impala LT.

16. *Abstract*
This report covers an on-site investigation of a crash that involved a 2007 Chevrolet Impala LT, which departed the roadway and impacted multiple fixed and non-fixed objects. The focus of this on-site investigation was the Chevrolet, which was equipped with side curtain air bags, both of which deployed as a result of the crash. The Chevrolet's driver and two occupants were traveling north in the center lane of a curved, divided city street. As the driver was negotiating a right curve, the vehicle continued straight and departed the roadway into the median where it impacted the curb and a shrub. The vehicle traveled across the south lane and again departed the roadway where it impacted a curb, multiple trees and bushes, and a fence. The vehicle's side curtain air bags deployed during the crash sequence and the restrained driver, restrained front right passenger, and second row passenger (unknown if restrained) were not injured.

17. *Key Words* Side Air Bag; Side Air Bag Deployment; Motor Vehicle Traffic Crash; Injury Severity		18. *Distribution Statement* General Public	
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BACKGROUND


Figure 1: The damaged 2007 Chevrolet Impala LT

This crash was brought to the National Highway Traffic Safety Administration's attention on June 24, 2008 by the sampling activities of the National Automotive Sampling System. This on-site investigation was assigned on August 14, 2008. This crash involved a 2007 Chevrolet Impala LT (**Figure 1**), which departed the roadway and impacted multiple fixed and non-fixed objects. The crash occurred in May, 2008, at 0040 hours, in Texas and was investigated by the applicable city police department. The focus of this on-site investigation was the Chevrolet, which was equipped with side curtain air bags, both of which deployed as a result of the crash. This contractor inspected the Chevrolet on August 19, 2008 and inspected the crash scene on August 20, 2008. The driver interview was not conducted because the driver could not be located. This report is based on the police crash report, scene and vehicle inspections, exemplar vehicle inspection, occupant kinematic principles, and this contractor's evaluation of the evidence.

CRASH CIRCUMSTANCES

Crash Environment: The trafficway on which the Chevrolet was traveling was a curved, 6-lane, divided, city street, traversing in a nominal north-south direction. The trafficway was divided by a raised grass median, which contained small trees, bushes, chevron alignment warning signs, and street light poles. Each roadway had three through lanes and was bordered by 15 cm (6 in) high barrier curbs. Each through lane was nominally 3.2 m (10.5 ft) in width. The roadway pavement markings consisted of solid white edge lines, broken white lane lines, and solid yellow median edge lines. The posted speed limit was 56 km/h (35 mph). At the time of the crash the light condition was dark with overhead lights, the atmospheric condition was clear, and the roadway pavement was dry concrete, with a varying negative grade (see the Crash Diagram on page 10 of this report). The traffic density at the time of the crash is unknown. The site of the crash was urban residential.


Figure 2: Approach of Chevrolet to roadway departure into median

Pre-Crash: The Chevrolet was occupied by a restrained 18-year-old male driver, restrained 19-year-old male front right passenger, and a 19-year-old female second row right passenger (unknown if restrained). The driver was traveling north in the center lane (**Figure 2**) and negotiating a right curve. The Event Data Recorder's (EDR) pre-crash data indicated that the vehicle was traveling 142 km/h (88 mph) at 20 percent throttle 2.5 seconds prior to Algorithm Enable (AE). The brake switch circuit status was recorded as on, also at 2.5 seconds prior to AE and remained on until the end of the pre-crash recording at 0.5 seconds.

Crash: As the roadway curved right, the Chevrolet continued straight toward the median and departed the roadway. As the vehicle entered the median, the left front and left rear wheels impacted the median curb (Events 1 and 2, **Figures 4** and **5**). The front of the vehicle then impacted a shrub (Event 3) while traveling across the median (**Figure 3**) The Chevrolet then departed the median into the south through lanes. It continued across all three lanes and the left front and rear wheels impacted the west curb (Events 4 and 5). The Chevrolet continued off the roadway in a northerly direction and rotated slightly clockwise. The front plane (**Figure 6**) impacted some small trees and bushes lining a small chain link fence (Event 6) as well as the fence itself (Event 7, **Figure 7**). After this impact, the front and rear sections of the left side (**Figures 8** and **9**) impacted the dense trees and bushes (Events 8 and 9, respectively) that lined the fence on the west roadside (**Figure 4**). The impact to the left side doors and quarter panel redirected the Chevrolet into a counterclockwise rotation and the right side (**Figure 10**) impacted the fence **(**Event 10**)** and a another group of trees and bushes (Event 11). The side curtain air bags deployed during the crash sequence while neither frontal air bag deployed. The Chevrolet came to final rest amidst the foliage on the west roadside, heading northwest.

Figure 3: Chevrolet's median curb and shrub impacts (arrow shows path of vehicle)

Figure 4: Left front wheel damage from curb impacts

Figure 5: Left rear wheel damage from curb impacts

Post-Crash: The investigating police officer was flagged down at the scene by persons unknown, three minutes after the crash occurred. None of the three passengers were injured and no emergency medical personnel responded to the scene. The Chevrolet was towed from the scene due to damage.

Figure 6: Damage to the front and front bumper fascia

Figure 7: Area of multiple impacts on northwest side of south travel lanes

Figure 8: Damage to the left fender

Figure 9: Damage to left side doors and quarter panel

Figure 10: Right side damage

CASE VEHICLE

The 2007 Chevrolet Impala LT was a front wheel drive, 4-door sedan (VIN: 2G1WT58N279------) equipped with a 3.5L, 6-cylinder engine and automatic transmission. The front row was equipped with a split bench seat with separate backs, adjustable head restraints and lap-and-shoulder belts in the outboard seating positions, lap belt in the center seating position, tilt steering column, dual stage driver and front right passenger frontal air bags, and side curtain air bags that protected all outboard seating positions. The second row was equipped with a bench seat, integral head restraints, lap-and-shoulder seat belts, and Lower Anchors and Tethers for Children (LATCH) in the outboard positions.

Exterior Damage: The Chevrolet's curb impacts (events 1, 2, 4, and 5) involved the left front and rear wheels **(Figures 5** and **6)** and both rims were damaged in multiple areas. The impact with the foliage in the median (event 3) involved the frontal plane. The direct damage involved the bumper fascia and hood. The front of the vehicle had overlapping damage from events 6 and 7 (tree/shrub and fence), which involved the whole front end. The bumper fascia and energy absorbing material were removed, and there was no residual crush to the bumper bar (**Figure 7**). The direct damage from the vehicle's impact with the fence (Event 7) involved the entire lower portion of the bumper fascia (**Figure 7**) and consisted of scratches. There was no induced damage observed. The Chevrolet's next four impacts (events 8, 9, 10 and 11) to the fence, trees, and bushes involved the left and right sides. For the first of these impacts (Event 8), only the left fender was directly damaged (**Figure 8**). The direct damage began 365 cm (143.7 in) forward of the left rear axle (extrapolated from an exemplar vehicle due to the displacement of the left rear axle and the missing left front wheel on the subject vehicle) and extended rearward 109 cm (42.9 in). The induced damage involved the hood, fender, and the left front turn light/headlamp assembly. The crush measurements for this impact were taken at the mid-fender level and the residual maximum crush was 8 cm (3.1 in), occurring at C_3. The Chevrolet's second left side impact with the trees and bushes (Event 9) involved the left rear half of the vehicle (**Figure 9**). The direct damage involved the left front and rear doors, left rear wheel, left quarter panel, and a portion of the side of the back bumper fascia. The direct damage began 146 cm (57.5 in) forward of the left rear axle and extended 255 cm (100.4 in) rearward. The induced damage involved the left front door, left rear door, and quarter panel. The crush measurements were taken at the mid-door and lower quarter panel level and the residual maximum crush was 14 cm (5.5 in), occurring at C_3. The Chevrolet's third impact with the fence, trees, and bushes (Events 10 and 11) involved the right side plane. The direct damage involved the right fender, right front door, hood, and right front wheel (**Figure 10**). The direct damage began 364 cm (143.3 in) forward of the right rear axle and extended rearward 180 cm (70.9 in). The crush measurements were taken at the lower door and fender level, and the residual maximum crush was 12 cm (4.7 in) occurring at C_3. The crush was primarily due to the impact with the trees (Event 11), but scratches from the fence impact (Event 10) also overlapped the damage area. The Chevrolet's right wheelbase was shortened 4 cm (1.6 in). The left wheelbase measurement could not be determined due to the detached left front wheel. Induced damage involved the right front door. The tables below show the crush profiles for events 8, 9, and 11.

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								$\pm$D	$\pm$D
cm	8	109	8	134	0	3	8	3	0	0	159	147
in		42.9	3.2	52.8	0.0	1.2	3.2	1.2	0.0	0.0	62.6	57.9

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	9	255	14	259	9	11	14	4	7	0	-108	-105
in		100.4	5.5	102.0	3.5	4.3	5.5	1.6	2.8	0.0	-42.5	-41.3

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	11	180	12	180	0	4	12	8	0	0	130	130
in		70.9	4.7	70.9	0.0	1.6	4.7	3.2	0.0	0.0	51.2	51.2

Damage Classification: The Chevrolet's Collision Deformation Classifications were as follows:

1st Event: **12-FLWN-3** (**0** degrees)……….1st curb impact
2nd Event: **12FLWN-9** (**0** degrees)………..2nd curb impact
3rd Event: **12FCLN-1** (**0** degrees)…………Shrub in median impact
4th Event: **12-FLWN-3** (**0** degrees)……….3rd curb impact
5th Event: **12-FLWN-9** (**0** degrees)……….4th curb impact
6th Event: **12-FDEW-1** (**0** degrees)……….Impact with trees/bushes
7th Event: **12-FDLW-1** (**0** degrees)………..Fence impact
8th Event: **10-LFEW-1** (**290** degrees)…….Impact with trees/bushes
9th Event: **09-LZEW-2** (**270** degrees)…….Impact with trees/bushes
10th Event: **02-RYEW-1** (**60** degrees)…….Fence impact
11th Event: **02-RYEW-2** (**60** degrees)…….Impact with trees/bushes

The WinSMASH Damage algorithm could not be used to reconstruct the Delta V for any of the impacts because they involved curbs and yielding objects, which are out of scope for the program. However, the Barrier Algorithm of the WinSMASH program was used to calculate a Barrier Equivalent Speed (BES) for events 8, 9, and 11. The BES for each of the three events was 9 km/h (5.6 m.p.h.), 22 km/h (13.7 m.p.h.), and 16 km/h (9.9 mph), respectively.

The Chevrolet's recommended tire size was P250/55R16 and the vehicle was equipped with the recommended size tires. The Chevrolet's tire data are shown in the table below.

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	6	8	None	Yes	Yes
LR	Flat	Flat	207	30	7	9	Cut in sidewall	Yes	Yes
RR	Flat	Flat	207	30	7	9	None	No	Yes
RF	124	18	207	30	6	8	None	Yes	No

Vehicle Interior: The inspection of the Chevrolet's interior (**Figures 11** and **12**) revealed no discernable evidence of occupant contact. There was steering rim deformation or compression of the energy absorbing steering column. All the doors remained closed and operational. The left front and left rear window glazing was open and the remaining glazing was either fixed or closed. The windshield glazing was cracked and in place due to impact forces, and the left rear glazing was disintegrated due to impact forces. The remainder of the Chevrolet's glazing was undamaged. The vehicle sustained no passenger compartment intrusion.

Figure 11: Driver's seating area

Figure 12: The front right passenger's seating area

EVENT DATA RECORDER

The Chevrolet's EDR was imaged during the vehicle inspection using version 2.9 of the Bosch Crash Data Retrieval tool and the data was subsequently read using version 3.1. The EDR recorded a deployment event and a non-deployment event. The time between the two events was recorded as 0. The System Status at Deployment record indicated that the pre-crash data was associated with the deployment event and the recording of the data was complete. The SIR warning lamp was recorded as off and the driver and front right passenger seat belt switch circuits were recorded as buckled. Both the driver and front right passenger pretensioners were commanded to actuate. The front right passenger classification status was recorded as a large occupant. The time from AE to the deployment command criteria being met for both side curtain air bags was recorded as 2 milliseconds. The maximum lateral velocity change was recorded as 1.14 km/h (0.71 mph) beginning at the 20 msec point of recorded data. The maximum longitudinal velocity change was recorded as -1.14 km/h (-0.71 mph), also at the 20 msec point of recorded data. The System Status at Non-deployment record indicated that the maximum recorded velocity change was 46.32 km/h (28.78 mph) and occurred 390 msec after AE. The pre-crash data is discussed under the pre-crash section on page 2. The EDR report is attached at the end of this report[1].

AUTOMATIC RESTRAINT SYSTEM

The Chevrolet was equipped with a Certified Advanced 208-Compliant (CAC) frontal air bag system that consisted of dual stage driver and front right passenger air bags, retractor mounted pretensioners and a weight recognition system for the front right passenger. The manufacturer has certified that the vehicle is compliant to the Advanced Air Bag portion of the Federal Motor Vehicle Safety Standard (FMVSS) No. 208.

The driver's frontal air bag was located in the steering wheel hub and did not deploy as a result of the crash. This module was removed for salvage prior to inspection. The front right passenger frontal air bag was located within the top of the instrument panel and did not deploy as a result of the crash.

The Chevrolet's was also equipped with side curtain air bags. The vehicle's side impact sensors were located on each side of the vehicle within the lower B and C-pillars and the inflation cylinders were located within the C-pillars.

The left and right side curtain air bags were located along the left and right roof side rails inside the head liners and extended from the A-pillar to the C-pillar. The deployed side curtain air bags were 170 cm (66.9 in) in width and 42 cm (16.5 in) in height. The bottom portions were attached at the A-pillar by a 50 cm (19.7 in) nylon rope tether (**Figure 11**). There were no visible tethers connected to the C-pillar. The gap between the air bag and the A-pillar was 7 cm (2.8 in) at the approximate center of the air bag and 17 cm (6.7 in) at the belt line. Inspection of the both side curtain air bags revealed no discernable evidence of occupant contact and no damage.

MANUAL RESTRAINT SYSTEM

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

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[1] Please note that the pages containing the hexadecimal data have been deleted for confidentiality purposes.

The front center lap belt had a locking latch plate. The second row seat belts consisted of continuous loop belt webbing, switchable ELR/ALRs, sliding latch plates and fixed upper anchors.

The inspection of the driver's and front right passenger's seat belt systems revealed that the pretensioners had actuated in the crash. The webbing of both belts was wedged in the forward corner of their respective D-rings (**Figures 13** and **14**). The wedge point on the driver's seat belt was 100 cm (39.4 in) from the stop button and 90 cm (35.4 in) for the front right passenger's seat belt. When unwedged from the D-ring, the front right belt webbing would not retract and the webbing for both belts had a slightly stretched appearance. The evidence indicated that the driver and front right passenger were restrained by the lap-and-shoulder belt. The EDR also recorded the driver and front right passenger seat belt switch circuit status as buckled. Inspection of the second row right passenger's seat belt system revealed no evidence that it was in use during the crash. The front center, second row left, and second row center seat positions were not occupied.

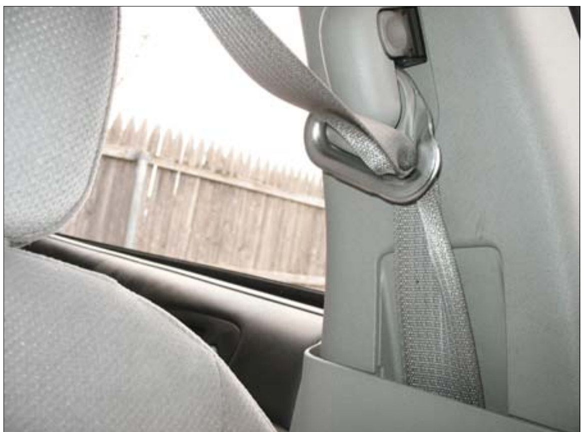


Figure 13: Driver's seat belt webbing wedged in D-ring

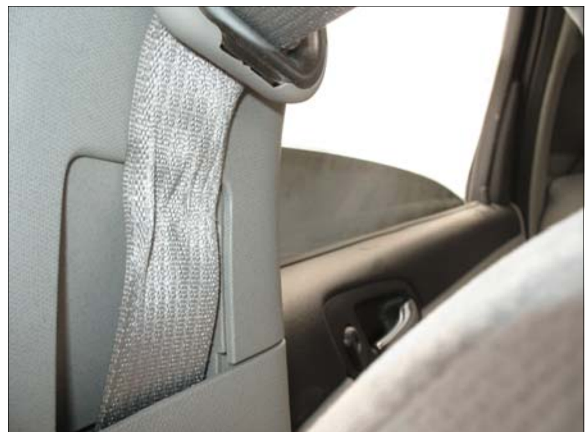


Figure 14: Front right seat belt and D-ring

CASE VEHICLE DRIVER KINEMATICS

The Chevrolet's driver [18-year-old, male; unknown height and weight] was seated in an unknown posture. At the time of the vehicle inspection, the driver's seat track was adjusted between the middle and full forward positions and the seat back was slightly reclined. The adjustable head restraint was located in the full down position. The distance from the top of the seat back to the top of the head restraint was 19 cm (7.5 inches). The tilt steering column was located in the full down position.

Based on occupant kinematics principles, the Chevrolet's initial wheel impacts with the curb probably displaced the driver forward, opposite the 12 o'clock direction of principal force and he loaded the lap-and-shoulder belt. The frontal impact with the shrub in the median probably had little effect on the driver's kinematics. After crossing the southbound lanes, the wheel impacts with the curb again displaced the driver forward within the seat belt. The left side impact with the trees and shrubs on the roadside, redirected the driver to the left. As the Chevrolet continued and the right fender impacted more trees and shrubs, the driver was probably redirected to the right within the seat belt. While there was no discernable evidence of occupant contact on the left side curtain air bag, it is probable that the driver contacted the air bag during the crash sequence.

CASE VEHICLE DRIVER INJURIES

The police crash report indicated that the Chevrolet's driver did not sustain any injury as a result of the crash, and he was not transported from the crash scene to a medical facility.

CASE VEHICLE FRONT ROW RIGHT PASSENGER KINEMATICS

The Chevrolet's front row right passenger [19-year-old, male; unknown height and weight] was seated in an unknown posture. At the time of the vehicle inspection, the front right passenger's seat track was adjusted to the full forward position. The track position was probably not the position in which the passenger was seated at the time of the crash. The seat had probably been repositioned at some time during the post crash handling and storage of the vehicle. The adjustable head restraint was located in the full down position, and the distance from the top of the seat back to the top of the head restraint was 19 cm (7.5 in).

The front right passenger's kinematics during the crash sequence were probably similar to the driver's. The evidence indicated that he loaded his seat belt during the crash sequence. While there was no discernable evidence that he contacted the right side curtain air bag, it is probable that he had some contact with the air bag during crash sequence.

CASE VEHICLE FRONT ROW RIGHT PASSENGER INJURIES

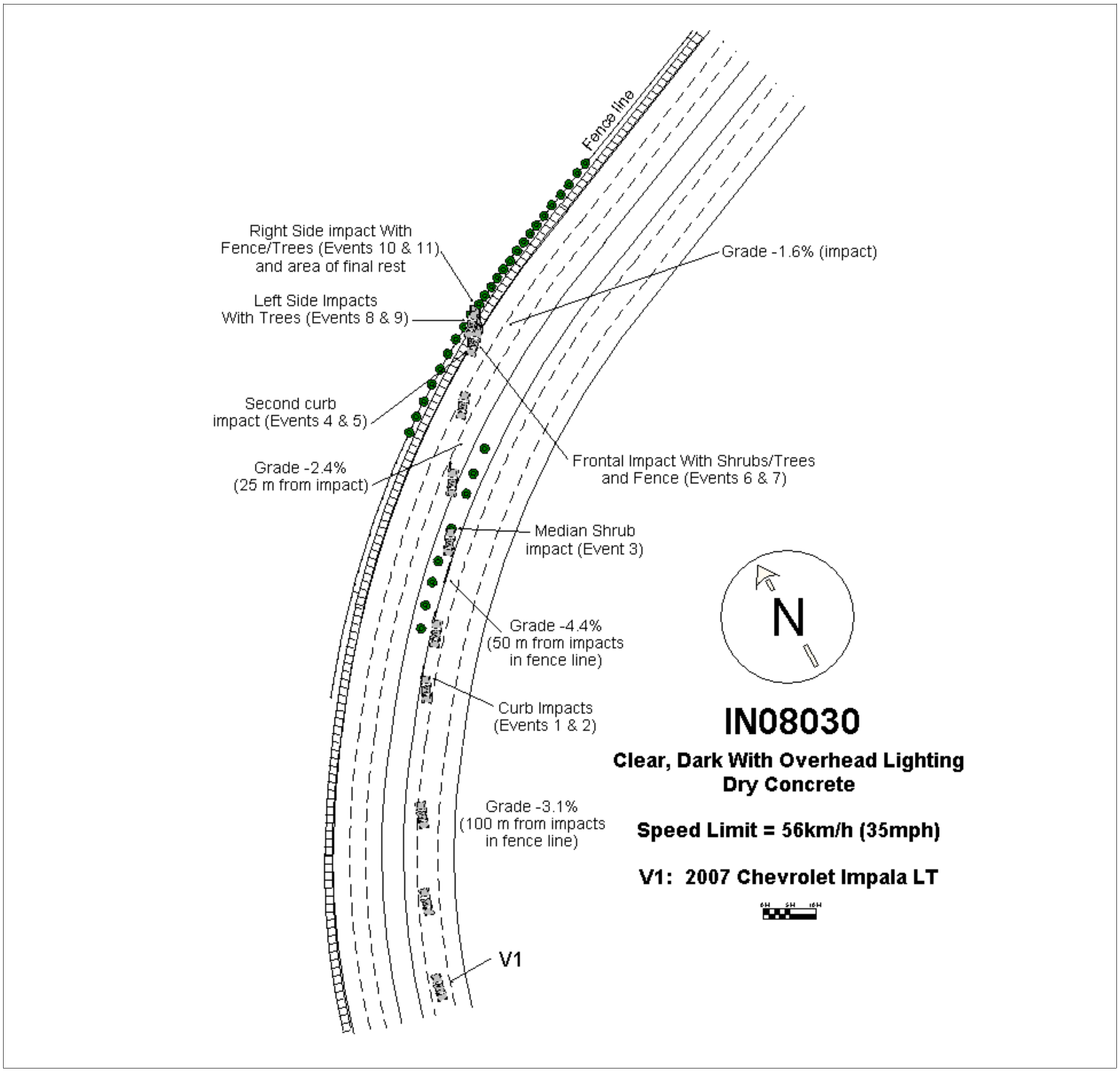
The police crash report indicated that the Chevrolet's front row right passenger did not sustain any injury as a result of the crash, and he was not transported from the crash scene to a medical facility.

CASE VEHICLE SECOND ROW RIGHT PASSENGER KINEMATICS

The Chevrolet's unrestrained second row right passenger [19-year-old, female; unknown height and weight] was seated in an unknown posture. Her kinematics during the crash sequence were probably similar to the front row occupants. While there was no discernable evidence of occupant contact on the back of the front right seat or right side curtain air bag, it is probable that one or both of her knees or lower legs contacted the back of the front right seat during the crash sequence. It is also probable that she contacted the right side right side curtain air bag during the crash sequence.

CASE VEHICLE SECOND ROW RIGHT PASSENGER INJURIES

The police crash report indicated that the Chevrolet's second row right passenger sustained no injury as a result of the crash, and she was not transported from the crash scene to a medical facility.


Fence line
Right Side impact With
Fence/Trees (Events 10 & 11)
and area of final rest
Left Side Impacts
With Trees (Events 8 & 9)
Grade -1.6% (impact)
Second curb
impact (Events 4 & 5)
Grade -2.4%
(25 m from impact)
Frontal Impact With Shrubs/Trees
and Fence (Events 6 & 7)
Median Shrub
impact (Event 3)
N
Grade -4.4%
(50 m from impacts
in fence line)
Curb Impacts
(Events 1 & 2)
IN08030
Clear, Dark With Overhead Lighting
Dry Concrete
Grade -3.1%
(100 m from impacts
in fence line)
Speed Limit = 56km/h (35mph)
V1: 2007 Chevrolet Impala LT
V1

CDR File Information

User Entered VIN	2G1WT58N279******
User	
Case Number	
EDR Data Imaging Date	
Crash Date	
Filename	IN08030.CDR
Saved on	Tuesday, August 19 2008 at 01:23:58 PM
Collected with CDR version	Crash Data Retrieval Tool 2.900
Reported with CDR version	Crash Data Retrieval Tool 3.1
EDR Device Type	airbag control module
Event(s) recovered	Deployment Non-Deployment

IMPORTANT NOTICE: Robert Bosch LLC recommends that the latest production release of Crash Data Retrieval software be utilized when viewing, printing or exporting any retrieved data from within the CDR program. This ensures that the retrieved data has been translated using the most recent information including but not limited to that which was provided by the manufacturers of the vehicles supported in this product.

Data Limitations

Recorded Crash Events:
There are two types of recorded crash events. The first is the Non-Deployment Event. A Non-Deployment Event records data but does not deploy the air bag(s). The minimum SDM Recorded Vehicle Velocity Change, that is needed to record a Non-Deployment Event, is five MPH. A Non-Deployment Event contains Pre-Crash and Crash data. The SDM can store up to one Non-Deployment Event. This event will be cleared by the SDM, after approximately 250 ignition cycles. This event can be overwritten by a second Deployment Event, referred to as Deployment Event #2, if the Non-Deployment Event is not locked. A locked Non Deployment Event cannot be overwritten by the SDM.
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 a second Deployment Event occurs any time after the Deployment Event, the Deployment Event #2 will overwrite any non-locked Non-Deployment Event. Deployment Events cannot be overwritten or cleared by the SDM. Once the SDM has deployed an air bag, the SDM must be replaced.

Data:
-SDM Recorded Vehicle Velocity Change reflects the change in velocity that the sensing system experienced during the recorded portion of the event. SDM Recorded Vehicle 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. For Deployment Events, the SDM can 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 can record up to the first 300 milliseconds of data after algorithm enable. Velocity Change data is displayed in SAE sign convention.
-Maximum Recorded Vehicle Velocity Change is the maximum square root value of the sum of the squares for the vehicle's combined "X" and "Y" axis change in velocity.
-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 by various factors, including but not limited to the following:
  -significant changes in the tire's rolling radius
  -final drive axle ratio changes
  -wheel lockup and wheel slip
-Brake Switch Circuit Status indicates the status of the brake switch circuit.
-Pre-Crash data is recorded asynchronously.
-Pre-Crash Electronic Data Validity Check Status indicates "Data Invalid" if:
  -the SDM receives a message with an "invalid" flag from the module sending the pre-crash data
  -no data is received from the module sending the pre-crash data
  -no module present to send the pre-crash data
-Driver's and Passenger's Belt Switch Circuit Status indicates the status of the seat belt switch circuit.

-The Time Between Non-Deployment to Deployment Events is displayed in seconds. If the time between the two events is greater than five 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-moding messages, on the GMLAN communication bus, to increment the counter. Applying and removing of battery power to the module will not increment the ignition cycle counter.
-All data should be examined in conjunction with other available physical evidence from the vehicle and scene.

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

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

Pre-crash data

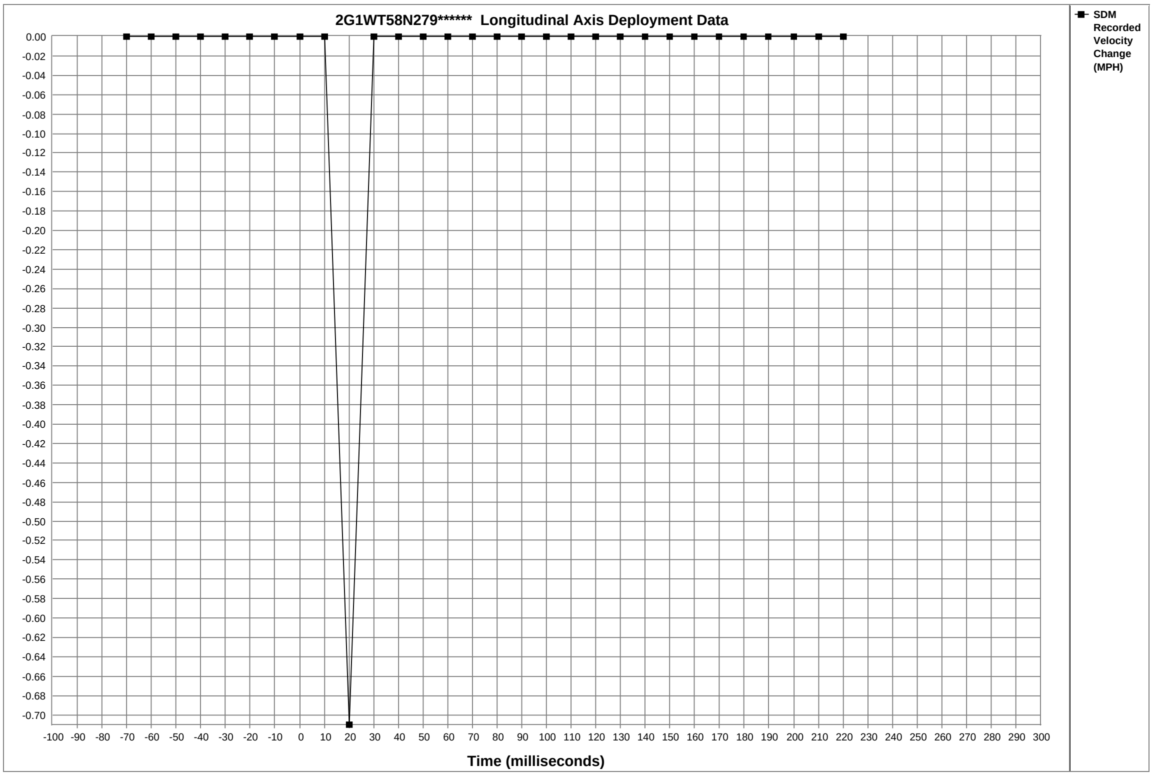
Parameter	-1.0 sec	-0.5 sec
Reduced Engine Power Mode	OFF	OFF
Cruise Control Active (If Equipped)	No	No
Cruise Control Resume Switch Active (If Equipped)	No	No
Cruise Control Set Switch Active (If Equipped)	No	No
Engine Torque (foot pounds)	10.7	50.53

Pre-Crash Data

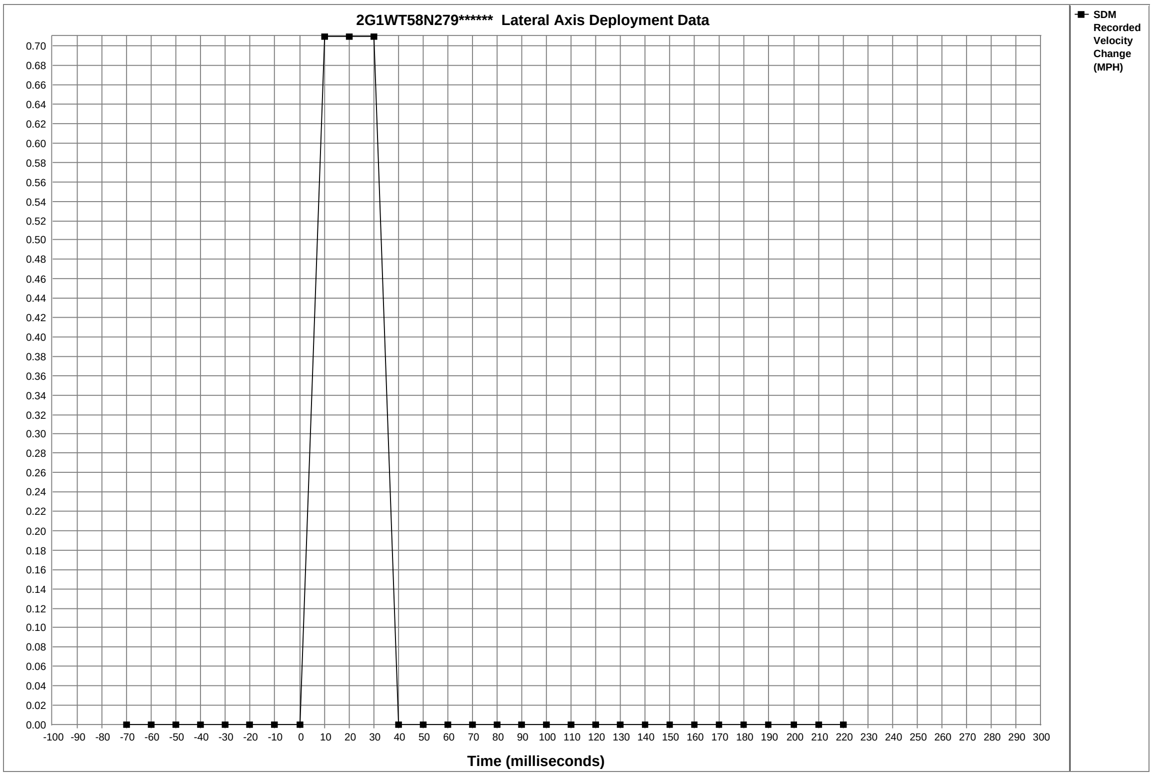
Parameter	-2.5 sec	-2.0 sec	-1.5 sec	-1.0 sec	-0.5 sec
Accelerator Pedal Position (percent)	0	0	0	0	0
Vehicle Speed (MPH)	88	85	57	16	9
Engine Speed (RPM)	2112	2048	1280	512	768
Percent Throttle	20	18.8	15.7	13.3	16.9
Brake Switch Circuit Status	ON	ON	ON	ON	ON

System Status At Deployment

Ignition Cycles At Investigation	3981
SIR Warning Lamp Status	OFF
SIR Warning Lamp ON Time Continuously (seconds)	0
Number of Ignition Cycles SIR Warning Lamp was ON/OFF Continuously	76
Ignition Cycles At Event	3980
Ignition Cycles Since DTCs Were Last Cleared	255
Driver's Belt Switch Circuit Status	BUCKLED
Passenger's Belt Switch Circuit Status	BUCKLED
Passenger Classification Status at Event Enable	Large Occupant Classification Type #1
Current Passenger Position Status at Event Enable	Position Not Applicable
Previous Passenger Position Status at Event Enable	Unknown
Passenger Air Bag Indicator Status at Event Enable	ON
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
Diagnostic Trouble Codes at Event, fault number: 7	N/A
Diagnostic Trouble Codes at Event, fault number: 8	N/A
Diagnostic Trouble Codes at Event, fault number: 9	N/A
Driver 1st Stage Time From Algorithm Enable to Deployment Command Criteria Met (msec)	N/A
Driver 2nd Stage Time From Algorithm Enable to Deployment Command Criteria Met (msec)	N/A
Passenger 1st Stage Time From Algorithm Enable to Deployment Command Criteria Met (msec)	N/A
Passenger 2nd Stage Time From Algorithm Enable to Deployment Command Criteria Met (msec)	N/A
Driver Side or Roof Rail/Head Curtain Time From Algorithm Enable to Deployment Command Criteria Met (msec)	2
Passenger Side or Roof Rail/Head Curtain Time From Algorithm Enable to Deployment Command Criteria Met (msec)	2
Time Between Events (sec)	0
Crash Record Locked	Yes
Vehicle Event Data (Pre-Crash) Associated With This Event	Yes
SDM Synchronization Counter	3980
Event Recording Complete	Yes
Driver First Stage Deployment Loop Commanded	No
Passenger First Stage Deployment Loop Commanded	No
Driver Second Stage Deployment Loop Commanded	No
Driver 2nd Stage Deployment Loop Commanded for Disposal	No
Passenger Second Stage Deployment Loop Commanded	No
Passenger 2nd Stage Deployment Loop Commanded for Disposal	No
Driver Pretensioner Deployment Loop Commanded	Yes
Passenger Pretensioner Deployment Loop Commanded	Yes
Driver Side Deployment Loop Commanded	No
Passenger Side Deployment Loop Commanded	No
Second Row Left Side Deployment Loop Commanded	No
Second Row Right Side Deployment Loop Commanded	No
Driver (Initiator 1) Roof Rail/Head Curtain Loop Commanded	Yes
Passenger (Initiator 1) Roof Rail/Head Curtain Loop Commanded	Yes
Driver (Initiator 2) Roof Rail/Head Curtain Loop Commanded	No
Passenger (Initiator 2) Roof Rail/Head Curtain Loop Commanded	No
Driver (Initiator 3) Roof Rail/Head Curtain Loop Commanded	No
Passenger (Initiator 3) Roof Rail/Head Curtain Loop Commanded	No
Driver Knee Deployment Loop Commanded	No
Passenger Knee Deployment Loop Commanded	No
Second Row Left Pretensioner Deployment Loop Commanded	No
Second Row Right Pretensioner Deployment Loop Commanded	No
Second Row Center Pretensioner Deployment Loop Commanded	No



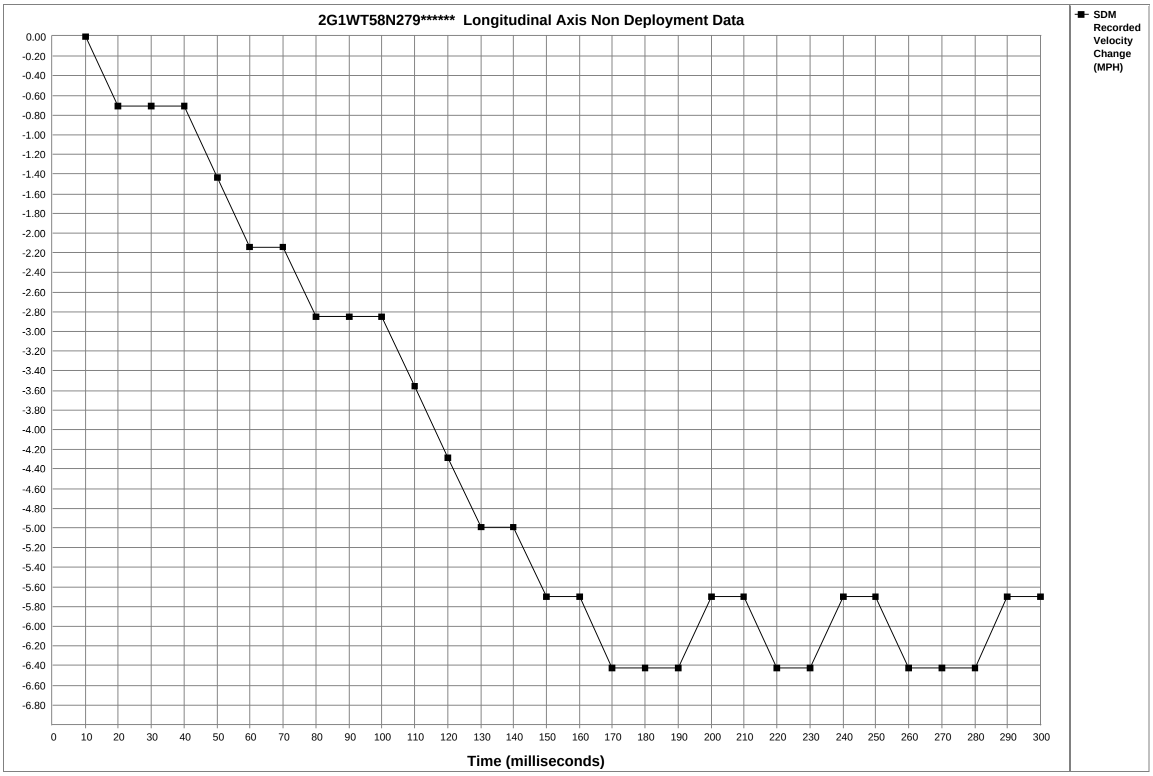
Time (milliseconds)	-70	-60	-50	-40	-30	-20	-10	0	10	20	30	40	50	60	70
SDM Longitudinal Axis Recorded Velocity Change (MPH)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.71	0.00	0.00	0.00	0.00	0.00
Time (milliseconds)	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220
SDM Longitudinal Axis Recorded Velocity Change (MPH)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00



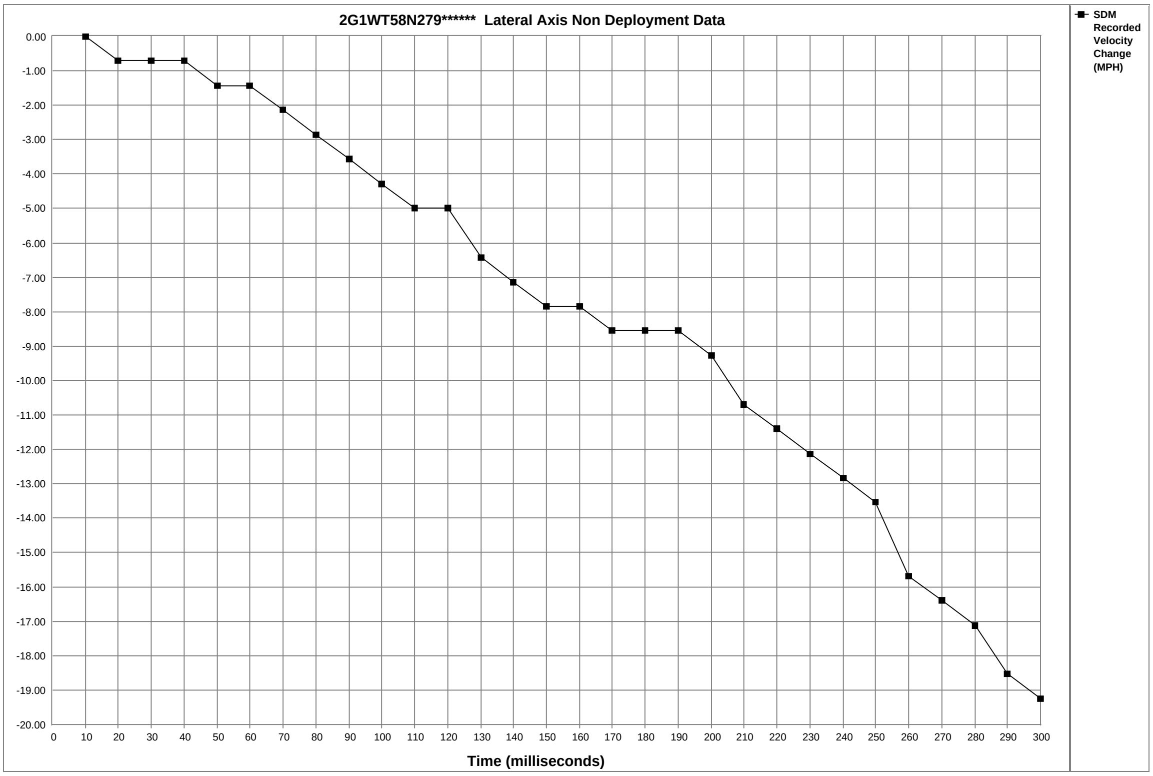
Time (milliseconds)	-70	-60	-50	-40	-30	-20	-10	0	10	20	30	40	50	60	70
SDM Lateral Axis Recorded Velocity Change (MPH)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.71	0.71	0.71	0.00	0.00	0.00	0.00
Time (milliseconds)	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220
SDM Lateral Axis Recorded Velocity Change (MPH)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

System Status At Non-Deployment

Ignition Cycles At Investigation	3981
SIR Warning Lamp Status	OFF
SIR Warning Lamp ON Time Continuously (seconds)	0
Number of Ignition Cycles SIR Warning Lamp was ON/OFF Continuously	76
Ignition Cycles At Event	3980
Ignition Cycles Since DTCs Were Last Cleared	255
Driver's Belt Switch Circuit Status	BUCKLED
Passenger's Belt Switch Circuit Status	BUCKLED
Diagnostic Trouble Codes at Event, fault number: 1	B0052
Diagnostic Trouble Codes at Event, fault number: 2	B0055
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
Diagnostic Trouble Codes at Event, fault number: 7	N/A
Diagnostic Trouble Codes at Event, fault number: 8	N/A
Diagnostic Trouble Codes at Event, fault number: 9	N/A
Maximum SDM Recorded Vehicle Velocity Change (MPH)	28.78
Algorithm Enable to Maximum SDM Recorded Velocity Change (msec)	390
Crash Record Locked	Yes
Deployment Event Recorded in the Non-Deployment Record	No
Vehicle Event Data (Pre-Crash) Associated With This Event	No
SDM Synchronization Counter	3980
Event Recording Complete	Yes
Driver First Stage Deployment Loop Commanded	No
Passenger First Stage Deployment Loop Commanded	No
Driver Second Stage Deployment Loop Commanded	No
Driver 2nd Stage Deployment Loop Commanded for Disposal	No
Passenger Second Stage Deployment Loop Commanded	No
Passenger 2nd Stage Deployment Loop Commanded for Disposal	No
Driver Pretensioner Deployment Loop Commanded	No
Passenger Pretensioner Deployment Loop Commanded	No
Driver Side Deployment Loop Commanded	No
Passenger Side Deployment Loop Commanded	No
Second Row Left Side Deployment Loop Commanded	No
Second Row Right Side Deployment Loop Commanded	No
Driver (Initiator 1) Roof Rail/Head Curtain Loop Commanded	No
Passenger (Initiator 1) Roof Rail/Head Curtain Loop Commanded	No
Driver (Initiator 2) Roof Rail/Head Curtain Loop Commanded	No
Passenger (Initiator 2) Roof Rail/Head Curtain Loop Commanded	No
Driver (Initiator 3) Roof Rail/Head Curtain Loop Commanded	No
Passenger (Initiator 3) Roof Rail/Head Curtain Loop Commanded	No
Driver Knee Deployment Loop Commanded	No
Passenger Knee Deployment Loop Commanded	No
Second Row Left Pretensioner Deployment Loop Commanded	No
Second Row Right Pretensioner Deployment Loop Commanded	No
Second Row Center Pretensioner Deployment Loop Commanded	No



Time (milliseconds)	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150
SDM Longitudinal Axis Recorded Velocity Change (MPH)	0.00	-0.71	-0.71	-0.71	-1.43	-2.14	-2.14	-2.85	-2.85	-2.85	-3.56	-4.28	-4.99	-4.99	-5.70
Time (milliseconds)	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300
SDM Longitudinal Axis Recorded Velocity Change (MPH)	-5.70	-6.42	-6.42	-6.42	-5.70	-5.70	-6.42	-6.42	-5.70	-5.70	-6.42	-6.42	-6.42	-5.70	-5.70



Time (milliseconds)	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150
SDM Lateral Axis Recorded Velocity Change (MPH)	0.00	-0.71	-0.71	-0.71	-1.43	-1.43	-2.14	-2.85	-3.56	-4.28	-4.99	-4.99	-6.42	-7.13	-7.84
Time (milliseconds)	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300
SDM Lateral Axis Recorded Velocity Change (MPH)	-7.84	-8.55	-8.55	-8.55	-9.27	-10.69	-11.41	-12.12	-12.83	-13.54	-15.68	-16.40	-17.11	-18.53	-19.25