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ON-SITE OTHER INFLATABLE OCCUPANT PROTECTION INVESTIGATION

CASE NUMBER - IN10008
LOCATION - KENTUCKY
VEHICLE - 2008 CHEVROLET IMPALA LT
CRASH DATE - December 2009

Submitted:

September 15, 2010

Contract Number: DTNH22-07-C-00044

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 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 other inflatable occupant protection investigation involving a 2008 Chevrolet Impala LT and a 1998 Jeep Cherokee SE.			
16. *Abstract* This on-site investigation focused on the side impact inflatable curtain (IC) air bag system of a 2008 Chevrolet Impala LT and the sources of the driver's injuries. The crash occurred within the 3-leg intersection of a U.S. Highway and a rural roadway, and involved the Chevrolet and a 1998 Jeep Cherokee SE. The Chevrolet was occupied by an unrestrained 47-year-old female driver and a restrained 20-year-old female front right passenger. As the driver was executing a left turn onto the U.S. highway, the vehicle's left side plane was impacted by the front plane of the Jeep. The impact triggered the deployment of the Chevrolet's IC air bags and a first stage deployment of the driver's and front right passenger's frontal air bags. The driver and front right passenger were transported by ambulance to a hospital. The driver sustained serious injuries and was hospitalized for four days. The front right passenger was treated in the emergency room for minor injuries and released.			
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TABLE OF CONTENTS IN10008

Page No.

BACKGROUND 1

CRASH CIRCUMSTANCES 1

CASE VEHICLE: 2008 CHEVROLET IMPALA LT 3
- CASE VEHICLE DAMAGE 3
- EVENT DATA RECORDER 6
- AUTOMATIC RESTRAINT SYSTEM 6
- MANUAL RESTRAINT SYSTEM 8
- CASE VEHICLE DRIVER KINEMATICS 8
- CASE VEHICLE DRIVER INJURIES 9
- CASE VEHICLE FRONT ROW RIGHT PASSENGER KINEMATICS 10
- CASE VEHICLE FRONT ROW RIGHT PASSENGER INJURIES 10

OTHER VEHICLE: 1998 JEEP CHEROKEE SE 11

CRASH DIAGRAM 12

ATTACHMENT: EVENT DATA RECORDER REPORT . . . . .

This on-site investigation focused on the side impact inflatable curtain (IC) air bag system of a 2008 Chevrolet Impala LT and the sources of the driver's injuries. This crash was brought to our attention on February 26, 2010 through the sampling activities of the National Automotive Sampling System-General Estimates System (NASS-GES). The investigation was assigned on March 15, 2010. This crash involved the Chevrolet and a 1998 Jeep Cherokee SE. The crash occurred in December, 2009, at 1230 hours in Kentucky and was investigated by the Kentucky State Police. The crash scene and Chevrolet were inspected on March 18-19, 2010. An interview with the driver of the Chevrolet was completed on March 26, 2010. The Jeep was not inspected since it could not be located. This report is based on the police crash report, scene and vehicle inspections, driver and police interviews, occupant kinematic principles, and evaluation of the evidence.

Figure 1: The damaged 2008 Chevrolet Impala LT

CRASH CIRCUMSTANCES

Crash Environment: This crash occurred within the 3-leg intersection of a U.S. highway and a rural roadway. At the time of the crash, it was daylight and the weather conditions were clear and dry. The Chevrolet was traveling on a two-lane, undivided, rural roadway that traversed in a northwest-southeast direction. The roadway had one through lane in each direction and was bordered by steel, blocked-out, W-beam guardrails. Each lane was 2.9 m (9.5 ft) in width. There were no pavement markings. The intersection was controlled by a stop sign and the grade was positive 4%. The Jeep was traveling on a curved, 3-lane, undivided U.S. highway that traversed in a northeast-southwest direction. On the northeastern leg of the intersection there was one through lane in each direction and a left turn lane for a strip mall located northeast of the intersection. The northeast lane was 3.4 m (11.2 ft) in width and the southwest lane was 3.7 m (12.1 ft) in width. The turn lane was 2.7 m (8.9 ft in width. The roadway was bordered by bituminous shoulders 1.6 m (5.2 ft) in width. Roadway pavement markings consisted of solid white edge lines, solid double yellow center lines, and a solid white left turn arrow. The grade for the Jeep was negative 1.6% and the roadway was superelevated positive 5% to the north. The speed limit for the Jeep was 86 km/h (55 mph). There was no posted speed limit for the Chevrolet. The roadway surface for both vehicles was dry bituminous. There was heavy traffic on the U.S. highway at the time of the crash. The site of the crash was rural commercial. The Crash Diagram can be seen on page 12 of this report.

Pre-Crash: The Chevrolet was occupied by an unrestrained 47-year-old female driver and a restrained 20-year-old female front right passenger. The driver was stopped at the intersection heading southeast (**Figure 2**). She intended to turn left and proceed northeast. The restrained 29-year-old female driver of the Jeep was traveling southwest (**Figure 2**) and intended to continue

through the intersection. During the SCI interview, the driver of the Chevrolet stated that as she was executing the left turn, she saw the Jeep approaching and accelerated to avoid the crash. The crash occurred in the southwest lane of the U.S. highway.

The Chevrolet was equipped with an Event Data Recorder (EDR), which recorded 2.5 seconds of pre-crash data. The EDR recorded the Chevrolet traveling 11 km/h (7 mph) at 16% accelerator position 2.5 seconds prior to Algorithm Enable (AE). At 1 second prior to AE, the vehicle's speed had increased to 18 km/h (11 mph) and the brake switch was recorded as "On". At 0.5 second prior to AE, the accelerator pedal position was recorded as 73% and the vehicle's speed was recorded as 18 km/h (11 mph).

Figure 2: Approach of the Jeep; arrow shows the approach of the Chevrolet

Figure 3: Location of the impact on the left side plane of the Chevrolet

Figure 4: The damage on the left fender of the Chevrolet from the secondary impact with the left side plane of the Jeep

Crash: The front plane of the Jeep impacted the left side plane of the Chevrolet (**Figure 3**, event 1). The direction of force on the Chevrolet was within the 10 o'clock sector and the impact force was sufficient to trigger deployment of the IC air bags. The impact also triggered a first stage deployment of the driver's and front right passenger's frontal air bags. As a result of the impact, the Chevrolet rotated counterclockwise and the left fender (**Figure 4**) impacted the left side plane of the Jeep (event 2). The Chevrolet continued rotating counterclockwise and departed the south side of the roadway where the back plane impacted an embankment (event 3). The Chevrolet came to final rest heading northeast. The Jeep came to final rest on the roadway heading southwest.

Post-Crash: The police were notified of the crash at 1230 hours and arrived on-scene at 1240 hours. Both occupants of the Chevrolet exited the vehicle through the right front door since the driver's door was jammed shut. The driver and front right passenger were transported by ambulance to a hospital. The driver was admitted to the hospital and the front right passenger was treated in the emergency room and released. Both occupants of

the Jeep were also transported by ambulance to a hospital. Both vehicles were towed from the crash scene due to damage.

CASE VEHICLE

The 2008 Chevrolet Impala LT was a front wheel drive, 4-door sedan (VIN: 2G1WC583781-------) equipped with a 3.9-liter, V6 engine, an automatic transmission, 4-wheel anti-lock brakes with electronic brake force distribution, traction control, and electronic stability control. The front row was equipped with bucket seats, adjustable head restraints, lap-and-shoulder safety belts, dual stage driver and front right passenger frontal air bags, and side impact IC air bags that provided protection for the front and second row outboard seat positions. The second row was equipped with a bench seat with folding backs, lap-and-shoulder seat safety belts, integral head restraints, and Lower Anchors and Tethers for Children (LATCH) in all seating positions. During the SCI interview, the driver estimated the vehicle's mileage as 39,000 miles (48,280 kilometers). The specified wheelbase was 281 cm (110.6 in).

CASE VEHICLE DAMAGE

Exterior Damage: The Chevrolet sustained left side plane damage during the impact with the Jeep. The rear portion of the left fender, both left side doors, and the front portion of the left quarter panel were directly damaged. The direct damage began 35 cm (13.8 in) rear of the left front axle and extended 234 cm (92.1 in) rearward along the left side. The crush measurements were taken at the mid-door level and the residual maximum crush was 46 cm (18.1 in) occurring at C_4 (**Figure 5**). The vehicle's sill height was 25 cm (9.8 in) and the height of the maximum crush was 70 cm (27.6 in). The Door Sill Differential was 24 cm (9.4 in). The left side wheelbase was reduced 4 cm (1.6 in). The right side wheelbase was extended 1 cm (0.4 in). The induced damage involved the left roof side rail, roof, and left quarter panel. The table below presents the left side crush profile.

Figure 5: The crush on the left side of the Impala from the impact with the front of the Jeep

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	1	234	46	245	0	26	37	46	25	1	15	21
in		92.1	18.1	96.5	0.0	10.2	14.6	18.1	9.8	0.4	5.9	8.3

The Chevrolet sustained damage on the left fender during the secondary impact with the Jeep. The direct damage began 85 cm (33.5 in) forward of the left front axle and extended rearward 83 cm (32.7 in). The crush measurements were taken at the mid-fender level and the residual maximum crush was 1 cm (0.4 in) occurring at C_5. The table below presents the crush profile on the left fender.

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	2	83	1	105	0	0	0	1	1	0	173	167
in		32.7	0.4	41.3	0.0	0.0	0.0	0.4	0.4	0.0	68.1	65.7

The Chevrolet sustained damage on the back plane during the impact with the embankment. The direct damage began at the right bumper corner and extended 79 cm (31.1) across the bumper. The crush measurements were taken at the bumper level and the residual maximum crush was 2 cm (0.8 in) occurring at C_6. The table below presents the crush profile on the back bumper.

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	3	79	2	146	0	0	1	1	2	2	38	0
in		31.1	0.8	57.5	0.0	0.0	0.4	0.4	0.8	0.8	15.0	0.0

Damage Classification: The Collision Deformation Classifications (CDC) for the Chevrolet were 10LDAW4 (290 degrees) for the left side plane impact with the Jeep, 09LFMW1 (270 degrees) for the impact on the left fender, and 06BZEW1 (180 degrees) for the back plane impact with the embankment. The Missing Vehicle algorithm of the WinSMASH program calculated the Delta V for the left side plane impact as 62 km/h (38.5 mph). The longitudinal and lateral velocity changes were -21.2 km/h (13.2 mph) and 58.3 km/h (36.2 mph), respectively. Based on the damage on the left side of the Chevrolet, the results appeared to be high. The vehicle's EDR recorded the maximum longitudinal and lateral velocity changes as -6.88 km/h (-4.28 mph) and 26.37 km/h (16.39 mph), respectively. The Missing Vehicle algorithm calculated the Delta V for the second impact with the Jeep as 4 km/h (2.5 mph). The longitudinal and lateral velocity

changes were 0 km/h and 4 kmh (2.5 mph), respectively. Based on the damage on the left fender of the Chevrolet, the results appeared to be reasonable. The barrier algorithm of the WinSMASH program calculated the Delta V for the Chevrolet's impact with the embankment as 10 km/h (6.2 mph). The longitudinal and lateral velocity changes were 10 km/h (6.2 mph) and 0 km/h. The results appeared to be reasonable.

The vehicle manufacturer's recommended tire size was P225/55R17. The Chevrolet was equipped with the recommended size tires. The vehicle's tire data are presented 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	32nd of an inch			
LF	221	32	207	30	6	8	None	No	No
LR	221	32	207	30	5	6	None	No	No
RR	221	32	207	30	5	6	None	No	No
RF	221	32	207	30	6	7	None	No	No

Vehicle Interior: The driver's seat was shifted to the right and the seat back was rotated counterclockwise approximately 20 degrees from the intrusion of the left front door. The left front door panel was damaged by the impact and the center console was damaged from the displacement of the driver's seat, but there was no discernable occupant contact scuff marks or transfer evidence on either component. There was no deformation of the steering wheel and no compression of the energy absorbing steering column.

The left front, left rear, and right rear doors were jammed shut. The right front door remained closed and operational. Prior to the crash, the left front window was partially open. The remaining window glazings were either fixed or closed. The left front, left rear, second left rear, and backlight glazings were disintegrated from impact forces. The windshield was in place and cracked. The remaining glazings were undamaged.

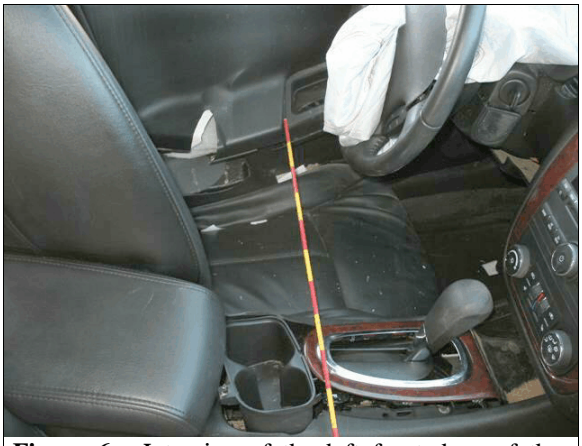

Figure 6: Intrusion of the left front door of the Chevrolet into the driver's seat position

The vehicle sustained 16 intrusions of the passenger compartment. The most severe intrusions occurred in the driver's seat position. The rear lower quadrant of the left front door

(**Figure 6**) intruded 30 cm (11.8 in), while the window frame, left B-pillar (**Figure 7**), and roof side rail intruded 26 cm (10.2 in) 24 cm (9.4 in) and 16 cm (6.3 in), respectively.

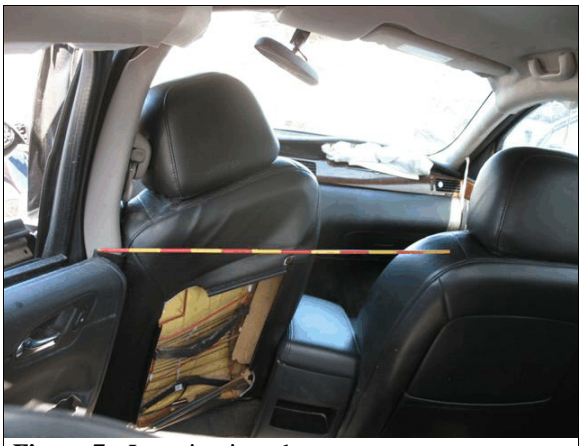

Figure 7: Intrusion into the passenger compartment and displacement of the driver's seat

EVENT DATA RECORDER

The Chevrolet's EDR was imaged using version 3.4 of the Bosch Crash Data Retrieval software via connection to the diagnostic link connector. The EDR recorded a deployment event. The Supplemental Inflatable Restraint (SIR) warning lamp was recorded as "off." The driver's and front right passenger's safety belt switch circuits were recorded as "unbuckled" and "buckled," respectively. Both safety belt pretensioners were commanded to actuate. The front right passenger classification status was recorded as "large occupant."

The first stage deployment criteria for the driver's and front right passenger's frontal air bags was met at 62 msec following AE. There was disposal of the second stage for both air bags. The deployment command timing for the side impact IC air bags was recorded as "N/A." The maximum longitudinal and lateral velocity changes occurred at 80 msec after the deployment criteria were met and were recorded as -6.88 km/h (-4.28 mph) and 26.37 km/h (16.39 mph), respectively. The pre-crash data were discussed in the pre-crash section on page 1 of this report. 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 frontal air bags, driver seat position sensor, front right passenger weight sensor, and retractor-mounted pretensioners. The frontal air bag sensors were located on the left and right radiator supports. 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. Both frontal air bags deployed in this crash.

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The Chevrolet was also equipped with a side impact air bag system that consisted of roof rail-mounted IC air bags. The vehicle was not equipped with front seat-mounted side impact air bags. Based on the Holmatro Rescuer's Guide to Vehicle Safety Systems, the side impact sensors were located within the front doors and the inflators were located within the C-pillars. Both IC air bags deployed in this crash.

The driver's frontal air bag was located within the steering wheel hub and the module cover was a two-flap configuration constructed of pliable vinyl. Each cover flap was 4 cm (1.8 in) in

[1] Pages 8-10 of the EDR report have been deleted for confidentiality purposes.

width at the top, 6 cm in width at the bottom and 13 cm (5.1 in) in height. The left cover flap opened at the designated tear seams. The upper tear seam on the right flap (**Figure 8**) did not separate and the flap did not open. The air bag partially deployed with an approximate 36 cm (14.2) x 28 cm (11 in) portion deploying through the left flap and a portion of the air bag deploying from under the top of the steering wheel hub cover (**Figure 9**). There was no discernable evidence of occupant contact on the air bag.

Figure 8: The top seam on the right air bag module cover flap did not separate (arrow)

The front right passenger frontal air bag was located within the top of the instrument panel. There was no air bag cover flap. The top of the instrument panel was designed to displace vertically as the air bag deployed. The deployed air bag (**Figure 10**) was 42 cm (16.5 in) in width and 52 cm (20.5 in) in height. The air bag was designed with one internal tether and one vent port on each side of the air bag. The vent ports were located at the 3 and 9 o'clock positions and were 4.5 cm (1.8 in) in diameter. There was no discernable evidence of occupant contact on the air bag and no damage.

Figure 9: The driver's frontal air bag did not fully deploy

The IC air bags were located along the roof side rails inside the headliner and extended from the A-pillar to the C-pillar. There were no external vent ports. The deployed left IC air bag (**Figure 11**) was 159 cm (62.6 in) in width and 35 cm (13.8 in) in height. It was attached to the A-pillar by a 44 cm (17.3 in) nylon tether. The gap between the front of the IC air bag and the window frame was 12 cm (4.7 in). There was no gap between the back of the IC air bag and the C-pillar. The distance the IC air bag extended vertically below the beltline was 10 cm (3.9 in). The dimensions and features of the right IC air bag were the same as the left. There was no discernable evidence of occupant contact on either IC air bag. There was no damage on the left IC air bag. The right IC air bag and front tether had been cut.

Figure 10: The front passenger's deployed frontal air bag

The deployment of the left IC air bag was obstructed by the intruded left B-pillar. The intrusion of the B-pillar closed the gap between the B-pillar and the driver's seat back. The IC air bag extended no further than the top of the adjustable upper anchor (**Figure 12**) in this area.

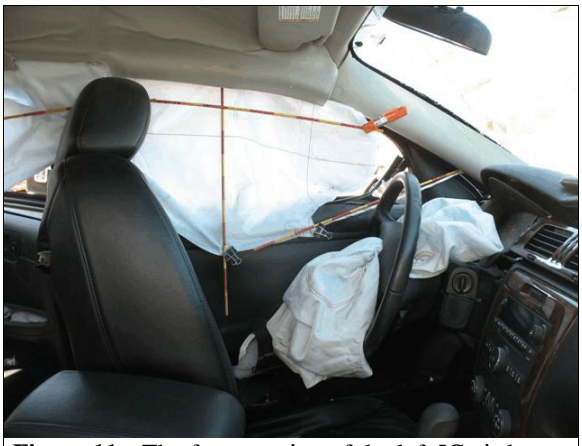


Figure 11: The front portion of the left IC air bag

Figure 12: The deployment of the left IC air bag was obstructed when the intrusion of the left B-pillar closed the gap between the B-pillar and the seat back

MANUAL RESTRAINT SYSTEM

The Chevrolet was equipped with lap-and-shoulder safety belts in all the seating positions. The driver's safety 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 passenger safety belt was similarly equipped. The adjustable upper anchor was located in the full-down position. Both safety belt systems were equipped with retractor-mounted pretensioners that actuated during the crash. The second row safety belts consisted of continuous loop belt webbing with switchable ELR/Automatic Locking Retractors (ALR), sliding latch plates, and fixed upper anchors.

The driver's safety belt was jammed in the retracted position. The driver stated that she was not restrained at the time of the crash. The EDR recorded the driver's safety belt switch circuit as "unbuckled."

Inspection of the front right passenger's safety belt assembly revealed minor historical usage scratches on the latch plate. The retractor was jammed with a length of belt extended out of the retractor consistent with usage. The length of belt webbing as measured from the D-ring to the stop button was 110 cm (43.3 in). A few load abrasions were present on the latch plate belt guide. This evidence indicated that the front right passenger was restrained at the time of the crash. The EDR recorded the passenger's safety belt switch circuit as "buckled."

CASE VEHICLE DRIVER KINEMATICS

Based on the SCI interview, the unrestrained driver of the Chevrolet [47-year-old, female; 152 cm (60 in) and 49 kg (108 lbs)] was seated in an upright posture with her back against the seat back. She had both hands on the steering wheel at the 9 and 2 o'clock positions and the right foot on the accelerator pedal. The seat track was adjusted between the forward and middle position and the seat back was upright. The tilt steering column was adjusted between the center and full-down position. The driver was not wearing glasses or contact lenses.

The left side impact on the Chevrolet displaced the driver to the left and forward opposite the 10 o'clock direction of force. The left side of the driver's torso contacted the intruding left front door and she sustained fractures of left ribs 2-9 with pneumothorax and a puncture of the left lung with pneumomediastinum. Her left hip, thigh, and buttock contacted the left front door arm rest, which caused contusions on the hip, thigh, and buttock. While there was no discernable evidence of occupant contact on the left IC air bag, the driver's head probably contacted this air bag and she sustained a contusion on the left neck. The back plane impact on the embankment redirected the driver rearward into her seat back. She sustained a cervical strain from impact force. She was unable to exit the vehicle through the left front door since it was jammed shut and exited the vehicle through the right front door.

CASE VEHICLE DRIVER INJURIES

The driver was transported by ambulance to a hospital and admitted. She hospitalized for four days. The driver had one follow-up visit for treatment of the rib fractures and lost 20 work days. The table below presents the driver's injuries and injury sources.

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source	Source Confidence	Source of Injury Data
1	Fractures lateral left ribs: 2nd through 9th, not further specified, with pneumothorax left chest transitioning from significant to residual; no tension component	severe 450230.3,2	Left front door panel, rear upper quadrant	Certain	Hospitalization records
2	Laceration (puncture) left lung, not further specified, with	serious 441416.3,2	Left front door panel, rear upper quadrant	Certain	Interviewee (same person)
	"some" pneumomediastinum, not further specified				Emergency room records
3	Strain, acute, cervical, not further specified	minor 640278.1,6	Noncontact injury: impact forces	Probable	Emergency room records
4	Contusion left neck, not further specified	minor 390402.1,2	Air bag, driver's side inflatable curtain	Probable	Interviewee (same person)
5	Contusions associated with left lateral rib fractures, not further specified	minor 490402.1,2	Left front door panel, rear upper quadrant	Certain	Emergency room records
6 7	Contusions left hip, thigh, and buttock, not further specified	minor 590402.1,2 890402.1,2	Left front hardware/armrest, rear lower quadrant	Probable	Interviewee (same person)
8	Contusion, 10.2 cm (4 in) right lower thigh, not further specified	minor 890402.1,1	Floor-mounted transmission selector lever	Probable	Interviewee (same person)

The restrained front row right passenger of the Chevrolet [20-year-old, female; (unknown height and weight)] was seated in an unknown posture. Both feet were on the floor and she was using both hands to send a text message on her cellular telephone. The seat track was adjusted between the middle and rear position and the seat back was slightly reclined. The passenger was wearing sunglasses and contact lenses.

The left side impact on the Chevrolet displaced the passenger to the left and forward opposite the 10 o'clock direction of force and she loaded the safety belt. She sustained a contusion on the left knee from center instrument panel and a contusion on the right knee from contacting the glove box door. The passenger also sustained a contusion on the left side of her neck and a cervical strain from contacting the driver's seat back. The back plane impact on the embankment redirected the passenger rearward into her seat back. The passenger exited the vehicle through the right front door.

CASE VEHICLE FRONT ROW RIGHT PASSENGER INJURIES

The front row right passenger was transported by ambulance to a hospital where she was treated in the emergency room and released. She had no follow-up visits for her injuries and lost no work days as a result of the crash. The table below presents the passenger's injuries and injury sources.

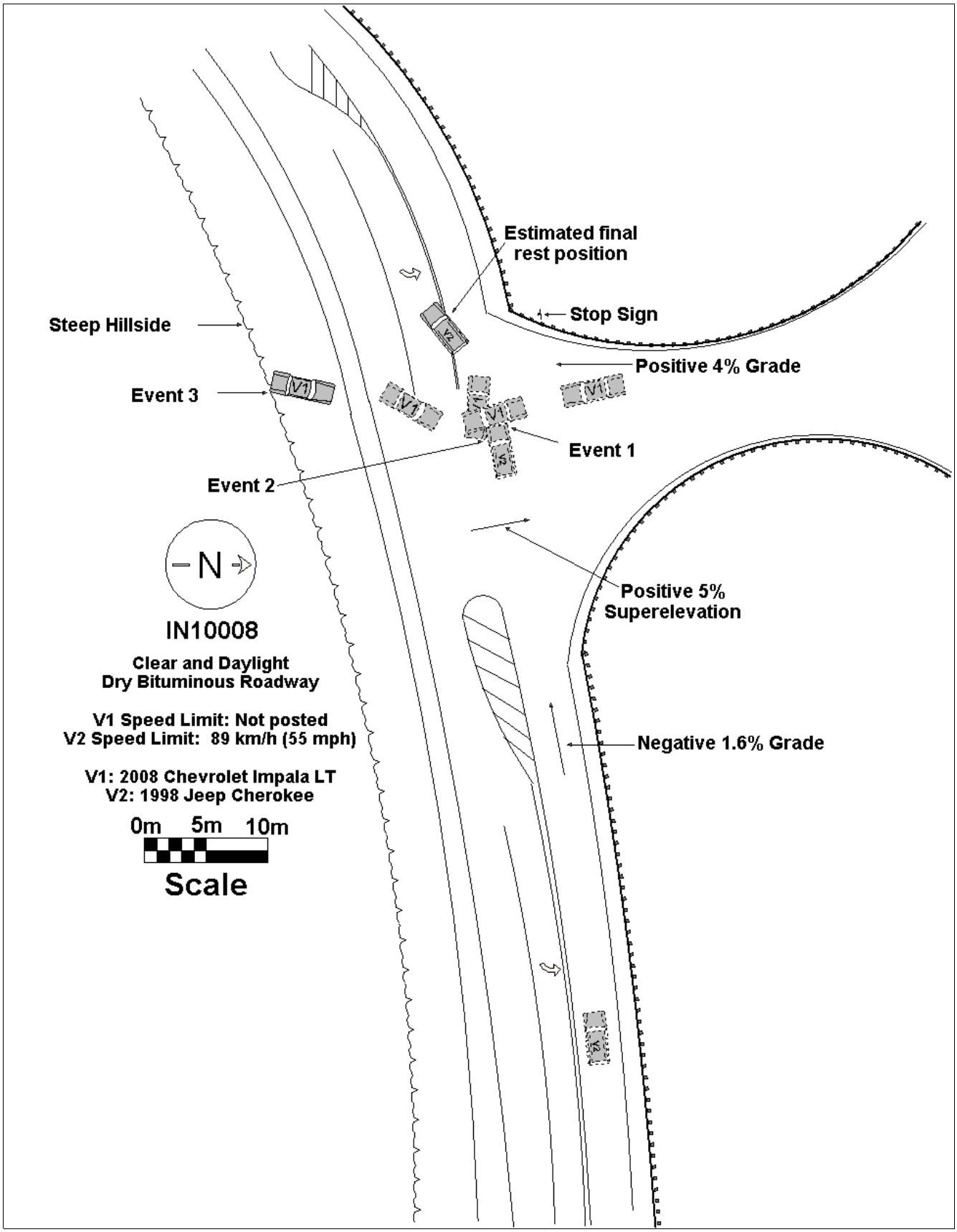
Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source	Source Confidence	Source of Injury Data
1	Strain, acute, cervical, not further specified	minor 640278.1,6	Seat back, driver's	Possible	Emergency room records
2	Contusion left neck, not further specified	minor 390402.1,2	Seat back, driver's	Possible	Interviewee (driver)
3	Contusion left knee, not further specified	minor 890402.1,2	Center lower instrument panel	Probable	Interviewee (driver)
4	Contusion right knee, not further specified	minor 890402.1,1	Glove compartment door	Probable	Interviewee (driver)

OTHER VEHICLE

The 1998 Je ep Cherokee SE was a 4-wheel drive, 5-passenger , 4-door sport utility vehicle (VIN: 1J4FJ28S2WL------) equipped with a 4.0-liter, I6 engine.

Exterior Damage: The vehicle was not inspected since it could not be located. The missing vehicle algorithm of the WinSMASH program calculated the Delta V for the frontal impact with the left side plane of the Chevrolet (event 1) as 70 km/h (43.5 mph). The longitudinal and lateral velocity changes were -65.8 km/h (40.9 mph) and -23.9 km/h (14.9 mph), respectively. The results appeared high and should be considered borderline since they are based only on the crush on the Chevrolet.

Other Vehicle's Occupants: The police crash report indicated that the driver of the Jeep (29-year-old, male) was restrained by the lap-and-shoulder safety belt. The second row center passenger (3-year-old, female) was restrained in a CRS. The driver and passenger both sustained A (incapacitating) injuries and were transported from the crash scene by ambulance to a hospital.


Estimated final rest position
Stop Sign
Steep Hillside
Positive 4% Grade
Event 3
Event 1
Event 2
N
Positive 5% Superelevation
IN10008
Clear and Daylight
Dry Bituminous Roadway
V1 Speed Limit: Not posted
V2 Speed Limit: 89 km/h (55 mph)
V1: 2008 Chevrolet Impala LT
V2: 1998 Jeep Cherokee
0m 5m 10m
Scale
Negative 1.6% Grade

IMPORTANT NOTICE: Robert Bosch LLC and the manufacturers whose vehicles are accessible using the CDR System urge end users to use the latest production release of the Crash Data Retrieval system software when viewing, printing or exporting any retrieved data from within the CDR program. Using the latest version of the CDR software is the best way to ensure that retrieved data has been translated using the most current information provided by the manufacturers of the vehicles supported by this product.

CDR File Information

User Entered VIN	2G1WC583781******
User	
Case Number	
EDR Data Imaging Date	
Crash Date	
Filename	IN10008.CDR
Saved on	Friday, March 19 2010 at 11:00:08 AM
Collected with CDR version	Crash Data Retrieval Tool 3.4
Reported with CDR version	Crash Data Retrieval Tool 3.4
EDR Device Type	airbag control module
Event(s) recovered	Deployment

Comments

No comments entered.

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 may contain 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 may contain 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.

-The CDR tool displays time from Algorithm Enable (AE) to time of deployment command in a deployment event and AE to time of maximum SDM recorded vehicle velocity change in a non-deployment event. Time from AE begins when the first air bag system enable threshold is met and ends when deployment command criteria is met or at maximum SDM recorded vehicle velocity change. Air bag systems such as frontal, side, or rollover, may be a source of an enable. The time represented in a CDR report can be that of the enable of one air bag system to the deployment time of another air bag system.

-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.

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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

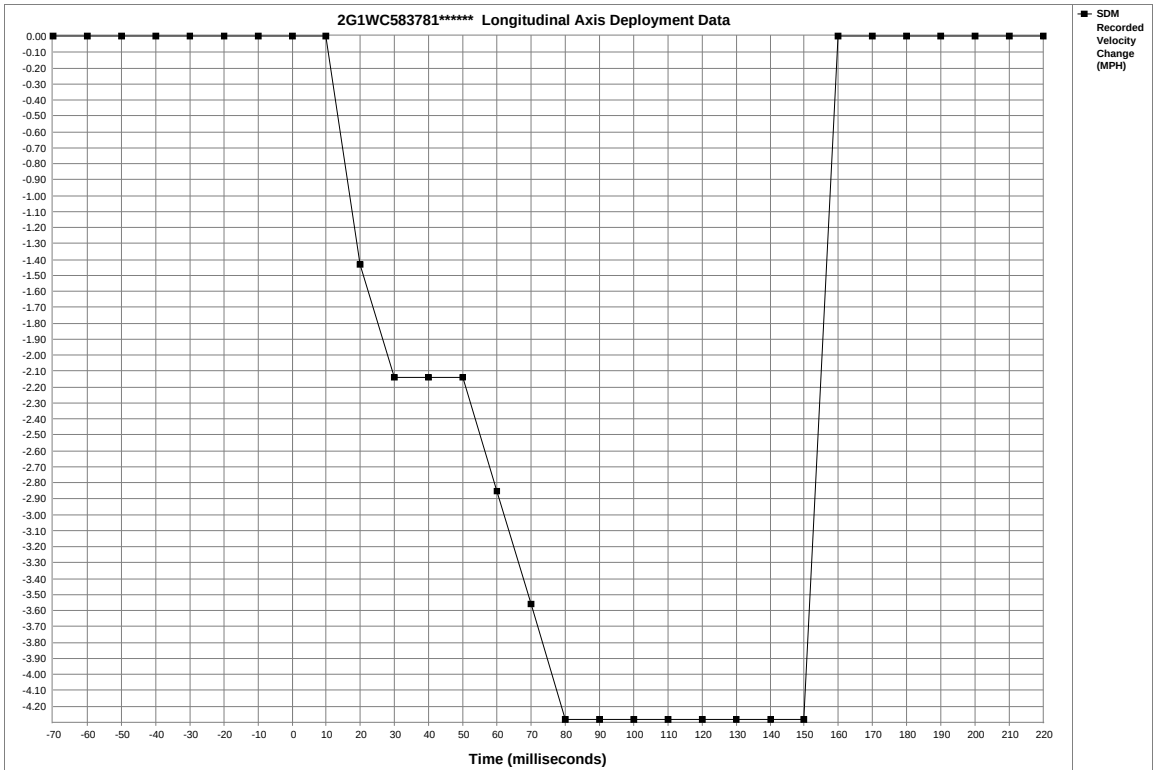
Parameter	-1.0 sec	-0.5 sec
Reduced Engine Power Mode	OFF	OFF
Cruise Control Active (If Equipped)	No	No
Cruise Control Resume Switch Active (If Equipped)	No	No
Cruise Control Set Switch Active (If Equipped)	No	No
Engine Torque (foot pounds)	20.28	12.54

Pre-Crash Data

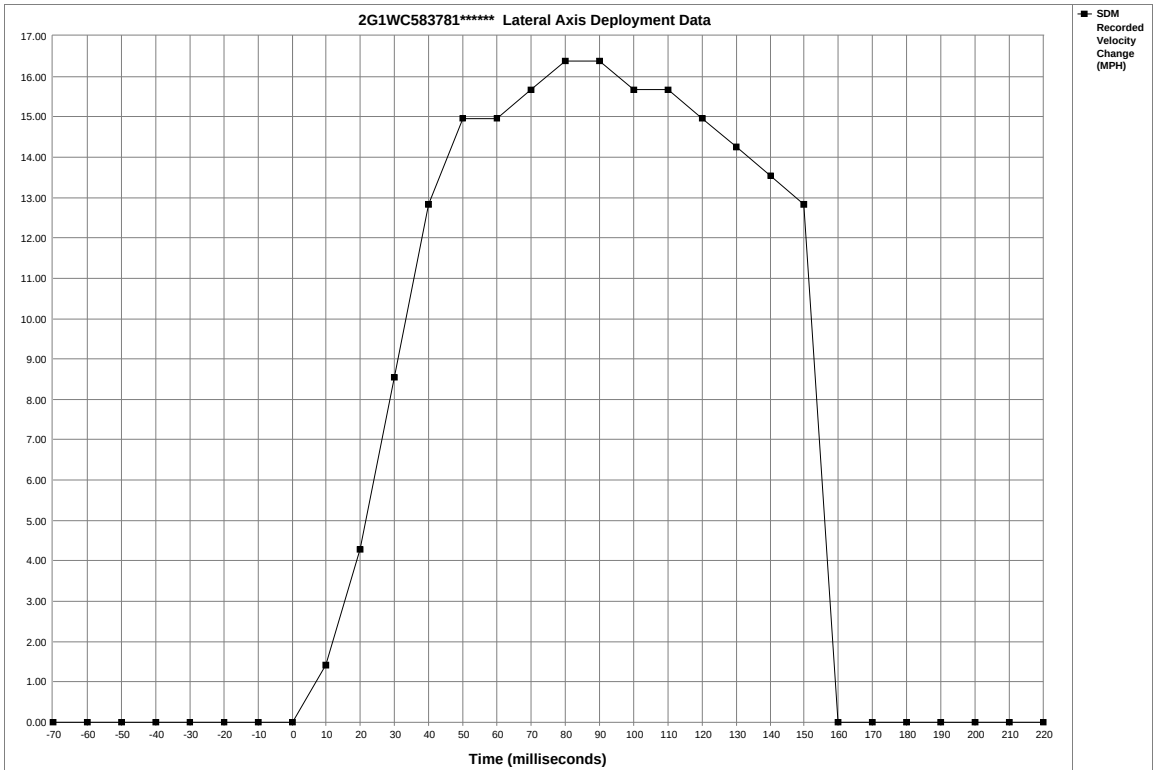
Parameter	-2.5 sec	-2.0 sec	-1.5 sec	-1.0 sec	-0.5 sec
Accelerator Pedal Position (percent)	16	17	17	0	73
Vehicle Speed (MPH)	7	9	9	11	11
Engine Speed (RPM)	1472	1600	1664	1600	1344
Percent Throttle	27	28	28	15	22
Brake Switch Circuit Status	OFF	OFF	OFF	ON	OFF

System Status At Deployment

Ignition Cycles At Investigation	4748
SIR Warning Lamp Status	OFF
SIR Warning Lamp ON Time Continuously (seconds)	0
Number of Ignition Cycles SIR Warning Lamp was ON/OFF Continuously	3
Ignition Cycles At Event	4746
Ignition Cycles Since DTCs Were Last Cleared	255
Driver's Belt Switch Circuit Status	UNBUCKLED
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)	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)	62
Passenger 2nd Stage Time From Algorithm Enable to Deployment Command Criteria Met (msec)	Disposal
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)	0
Crash Record Locked	Yes
Vehicle Event Data (Pre-Crash) Associated With This Event	Yes
SDM Synchronization Counter	4745
Event Recording Complete	Yes
Driver First Stage Deployment Loop Commanded	Yes
Passenger First Stage Deployment Loop Commanded	Yes
Driver Second Stage Deployment Loop Commanded	Yes
Driver 2nd Stage Deployment Loop Commanded for Disposal	Yes
Passenger Second Stage Deployment Loop Commanded	Yes
Passenger 2nd Stage Deployment Loop Commanded for Disposal	Yes
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	-1.43	-2.14	-2.14	-2.14	-2.85	-3.56
Time (milliseconds)	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220
SDM Longitudinal Axis Recorded Velocity Change (MPH)	-4.28	-4.28	-4.28	-4.28	-4.28	-4.28	-4.28	-4.28	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	1.43	4.28	8.55	12.83	14.97	14.97	15.68
Time (milliseconds)	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220
SDM Lateral Axis Recorded Velocity Change (MPH)	16.39	16.39	15.68	15.68	14.97	14.25	13.54	12.83	0.00	0.00	0.00	0.00	0.00	0.00	0.00