



U.S. Department
of Transportation
**National Highway
Traffic Safety
Administration**



DOT HS 812 965

August 2020

**Special Crash Investigations:
On-Site Disparate Injury Child
Restraint System Crash
Investigation;
Vehicle: 2007 Chevrolet Malibu;
Location: Illinois;
Crash Date: October 2017**

DISCLAIMER

This publication is distributed by the U.S. Department of Transportation, National Highway Traffic Safety Administration, in the interest of information exchange. The opinions, findings, and conclusions expressed in this publication are those of the authors and not necessarily those of the Department of Transportation or the National Highway Traffic Safety Administration. The United States Government assumes no liability for its contents or use thereof. If trade or manufacturers' names are mentioned, it is only because they are considered essential to the object of the publication and should not be construed as an endorsement. The United States Government does not endorse products or manufacturers.

Suggested APA Format Citation:

Indiana University Transportation Research Center. (2020, August). *Special Crash Investigations: On-Site Disparate Injury Child Restraint System Crash Investigation; Location: Illinois; Vehicle: 2007 Chevrolet Malibu; Crash Date: October 2017* (Report No. DOT HS 812 965). National Highway Traffic Safety Administration.

Technical Report Documentation Page

1. Report No. DOT HS 812 965	2. Government Accession No.	3. Recipient's Catalog No.	
4. Title and Subtitle Special Crash Investigations: On-Site Disparate Injury Child Restraint System Crash Investigation; Vehicle: 2007 Chevrolet Malibu; Location: Illinois; Crash Date: October 2017		5. Report Date August 2020	
		6. Performing Organization Code	
7. Author Indiana University Transportation Research Center		8. Performing Organization Report No. IN17034	
9. Performing Organization Name and Address Indiana University Transportation Research Center 501 South Madison Street, Suite 105 Bloomington, IN 47403		10. Work Unit No. (TRIS)	
		11. Contract or Grant No. DTNH22-12-C-00270	
12. Sponsoring Agency Name and Address National Highway Traffic Safety Administration 1200 New Jersey Avenue SE Washington, DC 20590		13. Type of Report and Period Covered Technical Report	
		14. Sponsoring Agency Code	
15. Supplementary Notes Each crash represents a unique sequence of events, and generalized conclusions cannot be made concerning the crashworthiness performance of the involved vehicle(s) or their safety systems. This report and associated case data are based on information available to the Special Crash Investigation team on the date this report was published.			
16. Abstract This on-site investigation documents the side impact crash of a 2007 Chevrolet Malibu that had a child seated in a child restraint system (CRS) who sustained no police-reported injuries and a driver who sustained fatal injuries. The crash occurred at the four-leg intersection of a five-lane, divided, U.S. highway and a two-lane, undivided county roadway. The 4-door Chevrolet sedan was equipped with multi-stage frontal air bags and side impact inflatable curtain air bags. A belted 21-year-old female drove the vehicle and a 19-month-old male was seated in the second-row right position in an Evenflo Tribute convertible CRS secured by a lap and shoulder seat belt. The Chevrolet was initially stopped at a stop sign on the northwest leg of the intersection. A 2009 Mitsubishi Galant was traveling south in the right through lane approaching the intersection. The Chevrolet proceeded across the path of the Mitsubishi intending to turn. The left plane of the Chevrolet was struck by the front plane of the Mitsubishi (event 1). The impact actuated the Chevrolet's front-seat seat belt pretensioners as well as deployed the driver's frontal and the left IC air bags. The Mitsubishi driver's frontal air bag also deployed. The Chevrolet then crashed into a concrete bridge rail. The Chevrolet driver sustained police-reported "K" (fatal) injuries and was transported to the coroner's office. The child in the Chevrolet's CRS did not sustain any police-reported injuries but was transported by ambulance to a hospital for evaluation. The driver of the Mitsubishi sustained police-reported "A" (incapacitating) injuries and was transported by ambulance to a medical facility.			
17. Key Words side impact, child restraint system, CRS, fatality, minor injury		18. Distribution Statement Document is available to the public from the National Technical Information Service, www.ntis.gov.	
19 Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21 No. of Pages 32	22. Price

Table of Contents

BACKGROUND	1
SUMMARY	2
Crash Site	2
Pre-Crash	2
Crash.....	3
Post-Crash.....	4
2007 CHEVROLET MALIBU	4
Description.....	4
Exterior Damage	5
Event Data Recorder	5
Interior Damage.....	6
Manual Restraint Systems	6
Supplemental Restraint Systems	6
Child Restraint System.....	7
2007 CHEVROLET MALIBU OCCUPANTS.....	8
Driver Demographics	8
Driver Injuries	8
Driver Kinematics	10
Second-Row Right Occupant Demographics	10
Second-Row Right Occupant Injuries	11
Second-Row Right Occupant Kinematics	11
2009 MITSUBISHI GALANT	12
Description.....	12
Occupant Data.....	12
CRASH DIAGRAM.....	13
APPENDIX A: 2007 Chevrolet Malibu Event Recorder Data Report	A-1

Special Crash Investigations
On-Site Disparate Injury Child Restraint System Investigation
Case Number: IN17034
Vehicle: 2007 Chevrolet Malibu
Location: Illinois
Crash Date: October 2017

BACKGROUND

This report documents the on-site investigation of a Chevrolet that had a child seated in a child restraint system (CRS) who sustained no police-reported injuries during a crash in which the driver sustained fatal injuries. This crash investigation was initiated by the National Highway Traffic Safety Administration in October 2017 by means of an online news article. The investigation was assigned to the Special Crash Investigation team at the Indiana University Transportation Research Center in November 2017. The crash involved a 2007 Chevrolet Malibu and a 2009 Mitsubishi



Figure 1. The 2007 Chevrolet Malibu.

Galant. The crash occurred in October 2017 in the afternoon in Illinois and was investigated by a local police agency. The Chevrolet, Mitsubishi, and crash site were inspected in November 2017. No interview was conducted since next of kin could not be located.

This crash occurred in the four-leg intersection of a five-lane, divided, U.S. highway and a two-lane, undivided county roadway. The Chevrolet was a four-door sedan, equipped with multi-stage frontal air bags and side impact inflatable curtain (IC) air bags. A belted 21-year-old female drove the vehicle and a 19-month-old male was seated in the second-row right seating position in an Evenflo Tribute convertible CRS. The Chevrolet was traveling southeast and was attempting to turn left at the intersection. The Mitsubishi was traveling southwest approaching the intersection. The left plane of the Chevrolet was struck by the front plane of the Mitsubishi (Event 1). The impact actuated the Chevrolet's seat belt pretensioners as well as deployed the driver's frontal and left IC air bags. The Mitsubishi driver's frontal air bag also deployed. After the impact, both vehicles were redirected southwest. The Chevrolet crossed the three northeast-bound lanes and the front plane struck a concrete bridge rail (Event 2) on the south edge of the roadway. The vehicle came to final rest headed southwest. The Mitsubishi came to final rest heading southwest in the left-turn lane of the northeast-bound lanes. The Chevrolet driver sustained police-reported "K" (fatal) injuries and was transported to the coroner's office. The child in the Chevrolet's CRS did not sustain any police-reported injuries but was transported by ambulance to a hospital for evaluation. The driver of the Mitsubishi sustained police-reported "A" (incapacitating) injuries and was transported by ambulance to a medical facility.

SUMMARY

Crash Site

This crash occurred during daylight in the intersection of a multi-lane, divided, U.S. highway and a two-lane, undivided, county roadway. The weather conditions were overcast skies with south winds at 10 km/h (6 mph), a temperature of 15.5 °C (60 °F), and a dew point of 12.8 °C (55 °F), according to the crash report. The Chevrolet's roadway traversed in a southeast/northwest direction with one through lane in each direction that was separated by a raised median. The Mitsubishi's roadway traversed in a southwest/northeast direction, with two through lanes and a right turn lane that were separated from the two northeast-bound lanes by a median with a blocked-out, double steel guardrail on the northeast leg of the intersection. A 4 m (13.1 ft) wide, 10 cm (3.9 in) high median separated the northeast and southwest-bound lanes on the southwest leg of the intersection. The northeast-bound roadway had two through lanes and one left turn lane on the southwest leg of the intersection. Both vehicles' roadways were bituminous and positively graded 2 percent. There was no posted speed limit for the Chevrolet and the speed limit was 89 km/h (55 mph) for the Mitsubishi. The roadway markings for the Chevrolet consisted of a solid yellow median edge line and a solid white edge line. For the Mitsubishi, the roadway markings consisted of a solid yellow median edge line, a broken white lane line, a solid white lane line, and a solid white edge line. A crash diagram is included at the end of this report.

Pre-Crash

The Chevrolet was southeast-bound and stopped at the intersection (**Figure 2**). The EDR-reported data indicated the vehicle was stopped at the -5.0 to -3.0 second intervals prior to algorithm enable (AE). The driver accelerated at the -2.0 and -1.0 second intervals with corresponding vehicle speeds of 1.6 km/h (1 mph) and 11.3 km/h (7 mph), respectively. The EDR reported no steering input in the 5.0 second recoding prior to AE. The Mitsubishi was traveling southwest in the right through lane (**Figure 3**) approaching the intersection. Based on the crash scene evidence, the Mitsubishi driver steered left to avoid the crash.

The Chevrolet's EDR-reported vehicle speed, engine speed, percent throttle, brake switch circuit status state, and accelerator pedal position are presented in the table on the following page.



Figure 2. Southeast view, the Chevrolet approaching the impact area.



Figure 3. Southwest view, the Mitsubishi approaching the impact area.

Parameter	-5 sec	-4 sec	-3 sec	-2 sec	-1 sec
Vehicle Speed, km/h (mph)	0	0	0	1.6 (1)	11.3 (7)
Engine Speed (rpm)	576	576	640	1216	1984
Percent Throttle	14	15	15	25	39
Brake Switch Circuit State	ON	OFF	OFF	OFF	OFF
Accelerator Pedal (percent)	0	0	0	15	29
Steering Wheel Angle (degrees)	0	0	0	0	0

Crash

The left plane of the Chevrolet was struck by the front plane of the Mitsubishi (Event 1). The force direction on the Chevrolet was in the 9 o'clock sector and the impact resulted in actuation of the driver's seat belt pretensioner and deployment of driver's frontal and left IC air bags. The damage algorithm of the WinSMASH program calculated the Chevrolet's total delta V as 47 km/h (29 mph). The longitudinal and lateral velocity changes were -8 km/h (5 mph) and 46 km/h (29 mph), respectively. The results appeared reasonable based on SCI experience. The Chevrolet's EDR reported the longitudinal and lateral velocity changes as -7.63 km/h (-4.74 mph) and 39.27 km/h (24.40 mph), respectively. WinSMASH calculated the Mitsubishi's total delta V as 46 km/h (29 mph). The longitudinal and lateral velocity changes were -45 km/h (-28 mph) and -8 km/h (5 mph), respectively. The results appeared reasonable.

The Chevrolet was redirected to the southwest by the impact. The vehicle traveled 8.5 m (27.9 ft) where the Chevrolet's left-front wheel struck the median curb (Event 2), which was 10 cm (3.9 in) high. The wheel impact was beyond the scope for WinSMASH analysis in order to calculate delta V for this event. The Chevrolet slid 5.5 m (18.0 ft) over the median then continued southwest across the three lanes of travel for 19.5 m (64.0 ft) where the front plane struck the concrete bridge rail (Event 3) on the south side of the roadway. The damage algorithm of the WinSMASH program calculated the Chevrolet's total delta V as 39 km/h (24 mph). The longitudinal and lateral velocity changes were -39 km/h (24 mph) and 7 km/h (4 mph), respectively. The results



Figure 4. SW view, the Chevrolet's impact with the bridge rail/final rest. (On-scene police image.)

appeared reasonable based on SCI experience. The Chevrolet's EDR reported the maximum velocity change as 24.6 km/h (15.29 mph) and occurred at 180 msec after AE. The maximum longitudinal and lateral velocity changes were reported as -23 km/h (-14.23 mph) and 5.5 km/h (3.39 mph), respectively. These occurred at 170 msec and 100 msec after AE, respectively. The Chevrolet came to final rest facing southeast (**Figure 4**) with the front plane against the bridge rail. The Mitsubishi was also redirected southwest and rotated counterclockwise approximately 70 degrees. It also crossed over the median and came to final rest in the left turn lane of the northeast-bound lanes, facing southeast (**Figure 5**).



Figure 5. Northeast view, the Mitsubishi at final rest. (On-scene police image.)

Post-Crash

The police were notified of the crash and rescue personnel also responded. The driver of the Chevrolet sustained fatal injuries to her heart, brain, and cervical spine, and was transported to the county coroner's office. The second-row right occupant did not sustain any police-reported injuries but was transported by ambulance to a hospital for evaluation. The Mitsubishi driver sustained police-reported "A" incapacitating injuries and was transported by ambulance to a hospital for treatment. Both vehicles were towed from the crash scene due to disabling damage.

2007 CHEVROLET MALIBU

Description

The Chevrolet was a front-wheel-drive, 5-passenger, 4-door sedan identified by the Vehicle Identification Number (VIN) 1G1ZT58N67Fxxxxxx and was equipped with a 3.5-liter, V-6 engine, 4-speed automatic transmission, 4-wheel antilock brakes with electronic brake force distribution, and traction control. The vehicle was also equipped with front-seat belt pretensioners, multi-stage frontal air bags, side impact sensing IC air bags, and an EDR. The second row was equipped with Lower Anchors and Tethers for Children (LATCH) in the outboard seating positions. The vehicle's specified wheelbase was 270 cm (106.3 in).

The vehicle was equipped with Uniroyal Tiger Paw Touring tires, size P215/60R16 on all wheels. The left front wheel had separated from the vehicle but was present at the SCI inspection. All tires were in good condition prior to the crash.

The front row was equipped with driver and passenger cloth-covered bucket seats with adjustable head restraints. The second row was equipped with a cloth-covered bench seat with folding backs and adjustable head restraints in the outboard seating positions. The driver's seat track position and degree of seat back incline could not be determined due to intrusion damage to the seat. The top of the driver's head restraint was 24 cm (9.4 in) above the top of the seat back. The second-row left seat sustained moderate damage from intrusion.

Exterior Damage

Exterior Damage Event 1: The Chevrolet sustained direct damage to the left plane during the impact with the Mitsubishi. The direct damage began 246 cm (96.9 in) forward of the back plane and extended 215 cm (84.6 in) forward to the left front wheelhouse (**Figure 6**). The Field L was 248 cm (97.6 in). The crush measurements were taken at the lower-door level, and the maximum residual crush was 40 cm (15.7 in) occurring 133 cm (52.3 in) rear of the left-front axle. The sill height was 29 cm (11.4 in) and the height of the maximum crush was 34 cm (13.4 in). The Door Sill Differential was 12 cm (4.7 in). The crush values were $C_1 = 2$ cm (0.8 in), $C_2 = 36$ cm (14.2 in), $C_3 = 40$ cm (15.7 in), $C_4 = 38$ cm (15.0 in), $C_5 = 9$ cm (3.5 in), and $C_6 = 5$ cm (2 in). The Collision Deformation Classification (CDC) was 09LYEW4 (280 degrees).



Figure 6. Left plane, front half of the Chevrolet.

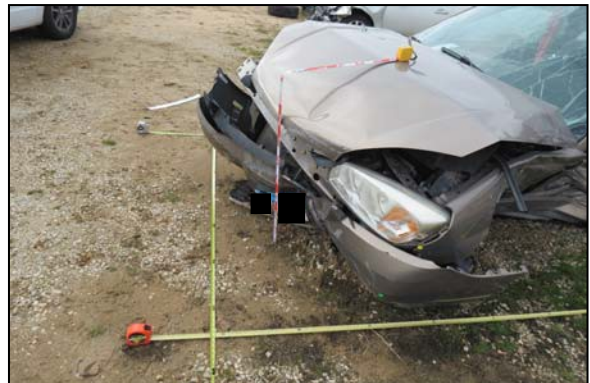


Figure 7. Front-plane damage of the Chevrolet. (Note: the vehicle is bowed.)

Exterior Damage Event 2: The Chevrolet sustained direct damage to the front bumper, bumper fascia, grille, hood, and both headlamp and turn lamp assemblies from the impact with the concrete bridge rail (**Figure 7**). The Field L was 120 cm (47.2 in). The crush measurements were taken on the front bumper bar and the maximum residual crush was 51 cm (20.1 in) occurring at the left corner. The crush values were $C_1 = 51$ cm (20.1 in), $C_2 = 36$ cm (14.2 in), $C_3 = 27$ cm (10.6 in), $C_4 = 17$ cm (6.7 in), $C_5 = 9$ cm (3.5 in), and $C_6 = 7$ cm (2.8 in). The CDC was 12FDEW99 (350 degrees). The extent of 99 represented unknown due to the overlapping damage and bowing of the vehicle.

Event Data Recorder

The Chevrolet's EDR was imaged with version 17.5.1 of the Bosch Crash Data Retrieval software and reported with version 19.3.1. Electrical power was supplied by an external battery and the data were imaged via direct connection to the EDR module. The EDR reported a deployment and a non-deployment event and the event recording was complete for both records. The driver's seat belt switch circuit status was reported as "Buckled" for both events. The time between events was reported as -3.2 sec. The negative sign indicated that the deployment event occurred first in the event sequence. The EDR report is attached at the end of this report as **Appendix A**.

The EDR was capable of recording deployment and non-deployment events. The sensing diagnostic module (SDM) could store up to one non-deployment event and could be overwritten by any event with a greater SDM-recorded vehicle velocity change, unless the non-deployment

event is locked. The data in the non-deployment event file will be locked if the non-deployment event occurs in five seconds of a deployment event. Deployment events cannot be overwritten by the SDM.

System Status at Deployment: This deployment event was recorded during the Chevrolet's impact with the Mitsubishi. The SIR warning lamp status was "Off" and no trouble codes were reported. The record reported that the Initiator 1 and Initiator 2 of the left IC air bag met deployment command criteria 4 msec after AE. The first and second stages of the driver's frontal air bag met deployment command criteria at 40 msec after AE. Both pretensioners were also commanded to actuate. The maximum longitudinal and lateral velocity changes were 7.2 km/h (-4.7 mph) and 39.3 km/h (24.4 mph). Both occurred 150 msec after AE.

System Status at Non-Deployment: This event was recorded during the Chevrolet's impact with the concrete bridge rail, 3.2 seconds after the side impact. The SIR warning lamp status was "On." None of the air bag or pretensioner deployment loops were commanded. The maximum velocity change was reported as 24.6 km/h (15.29 mph) and occurred 180 msec after AE. The maximum longitudinal and lateral velocity changes were reported as 22.9 km/h (-14.23 mph) and 5.5 km/h (3.39 mph) and occurred 170 msec and 100 msec after AE.

Interior Damage

The interior of the Chevrolet sustained severe intrusion damage from the impact with the Mitsubishi. The left B-pillar, rear lower quadrant of the left front door, and the left front sill intruded laterally 60, 57, and 42 cm (23.6, 22.4, and 17.0 in), respectively. The left doors were jammed shut and the right doors remained closed and operational. Inspection of the interior of the vehicle revealed a small hole (<1 cm) and scuff at the bottom of the inboard surface of the left IC air bag from contact by the driver's head. A scuff and blood stain were noted on the rear upper quadrant of the left front door, possibly from the driver's left flank.

Manual Restraint Systems

The front row was equipped with lap and shoulder seat belts and were equipped with retractor-mounted pretensioners, sliding latch plates, and adjustable upper anchors. The driver's upper anchor was adjusted to the full-up position and the pretensioner actuated during the crash. The second row was equipped with lap and shoulder seat belts with sliding latch plates, fixed upper anchors, and emergency/automatic locking retractors (ELR/ALR).

The driver was restrained by the lap and shoulder seat belt as evidenced by a 5 cm (2.0 in) long load mark on the belt webbing from the buckle and load marks on the latch plate belt guide. A length of belt webbing extended from the locked retractor consistent with usage. The second-row right passenger was seated in a forward-facing CRS and the vehicle's seat belt was used to secure it. The switchable retractor was in the ELR mode at the SCI inspection. The CRS tether showed no evidence of being in use during the collision. Inspection of the seat belt system revealed creasing to the webbing as well as a 25 cm (9.8 in) long load mark from the buckle.

Supplemental Restraint Systems

The Chevrolet was equipped with multi-stage frontal air bags and side impact sensing IC air bags. The driver's frontal and left IC air bags deployed during the left-plane impact with the Mitsubishi.

The driver's frontal air bag was located in the steering wheel hub. The deflated air bag was 52 cm (20.5 in) in diameter, and there was no damage and no discernable evidence of occupant contact.

The module cover was a two-flap configuration constructed of pliable vinyl, with a vertical tear seam in the middle and horizontal tear seams at the top and bottom. The flaps were 4 cm (1.6 in) wide and 15 cm (5.9 in) high. The cover flaps opened at the designated tear seams and were undamaged.

The IC air bags were located along the roof-side rail inside the headliner and extended from the A-pillar to the C-pillar. The deflated left IC air bag was 162 cm (63.8 in) long, 32 cm (12.6 in) high. Excursion below the beltline could not be measured accurately due to damage. There was a triangular-shaped sail panel attaching the front of the IC air bag to the A-pillar that was 22 cm (8.7 in) high and 22 cm (8.7 in) long. Inspection revealed a scuff and small tear (both < 1 cm) at the bottom of the inboard air bag fabric at the B-pillar. There was no other damage or discernable evidence of occupant contact to the IC.

Child Restraint System

The Chevrolet's second-row right seating position was occupied by a 19-month-old male who was seated in a forward-facing Evenflo Tribute convertible CRS (**Figure 8**). The CRS model number was 38111711 and the date of manufacture was January 5, 2015. The CRS was constructed of a one-piece plastic shell with a cloth cover and a 2 cm (0.8 in) thick Styrofoam liner on the interior of the shell's backrest. The CRS was equipped with a 5-point harness and a harness retainer clip. The CRS was designed to be used for both forward and rear-facing positions by children along the following parameters:



Figure 8. Evenflo Tribute CRS, used by the second-row right occupant.

CRS Forward-Facing Parameters:

Weight:	Between 2.3 kg and 18 kg (22–44 lbs)
Height:	Between 71 cm and 102 cm (28–40 in)

The child's demographics were appropriate for forward-facing use.

CRS Rear-Facing Parameters:

Weight:	Between 2.3 kg and 18 kg (5–40 lbs)
Height:	Between 48 cm and 94 cm (19–37 in)

At the time of SCI vehicle inspection, the CRS was still secured to the vehicle's second-row right seat by the vehicle's lap and shoulder seat belt. The seat belt had a switchable retractor and was observed to be in the emergency locking retractor (ELR) mode. The 5-point harness shoulder straps were routed through the second set of slots from the top. It is unknown if the harness retainer clip was in use.

Inspection of the CRS revealed minor stress marks on the interior armrests and lower front corners and at the top right corner of the plastic shell. The CRS loaded the vehicle's seat belt during the crash and resulted in a 1 cm (0.4 in) long cut in left belt webbing guide plastic (**Figure 9**). There were 3 cm (1.2 in) long vertical cracks in the Styrofoam liner between the top and second set of shoulder strap guides and a small portion broken out under the left shoulder strap port. The left side of the Styrofoam liner was completely broken away. The remainder of the CRS was unremarkable.



Figure 9. Stress marks/damage to the CRS.

2007 CHEVROLET MALIBU OCCUPANTS

Driver Demographics

Age/sex:	21 years/female
Height:	165 cm (65 in)
Weight:	42 kg (93 lb)
Eyewear:	None
Seat type:	Bucket
Seat track position:	Unknown
Manual restraint usage:	Lap and shoulder seat belt
Usage source:	Vehicle inspection
Air bags:	Front and side impact IC air bags deployed
Alcohol/drug data:	BAC=0; positive for THC (5.7 ng/mL); positive for 11 hydroxy delta-9 THC (1.3 ng/mL); positive for delta-9 carboxy THC (21 ng/mL)
Egress from vehicle:	Pronounced deceased before removal from vehicle
Transport from scene:	Coroner
Medical treatment:	None

Driver Injuries

Injury No.	Injury	Injury Severity AIS 2015	Involved Physical Component (IPC)	IPC Confidence Level
1	3.3 cm laceration of posterior left ventricle	441012.5	Isolated IPC Left Door Panel – Unknown/multiple quadrant	Certain

Injury No.	Injury	Injury Severity AIS 2015	Involved Physical Component (IPC)	IPC Confidence Level
2	Atlanto-occipital dislocation	650208.3	Tandem IPC Initial: Left Air Bag – Left roof side rail Secondary: Left Side – Left B-pillar	Probable Probable
3	Scant subdural hemorrhage over bilateral cerebral convexities	140651.3	Tandem IPC Initial: Left Air Bag – Left roof side rail Secondary: Left Side – Left B-pillar	Probable Probable
4	Contusions of bilateral lungs	441410.3	Isolated IPC Left Door Panel – Unknown/multiple quadrant	Certain
5	7 cm laceration of spleen	544224.3	Isolated IPC Left Door Panel – Unknown/multiple quadrant	Probable
6	6 cm laceration of left lobe of liver	541822.2	Isolated IPC Left Door Panel – Unknown/multiple quadrant	Probable
7	Left pelvis fracture, NFS	856100.2	Isolated IPC Left Door Panel – Left rear lower quadrant	Certain
8	6 x 5 cm hemorrhage to superior posterior left scalp	110402.1	Isolated IPC Left Side – Left B-pillar	Certain
9	3.0 x 1.5 cm abrasion to chin	210202.1	Isolated IPC Left Air Bag – Steering wheel hub	Probable
10	0.5 x 0.5 cm abrasion to left chest	441012.5	Isolated IPC Left Door Panel – Left rear upper quadrant	Possible
11	3.0 x 1.0 cm abrasion to left abdomen	510202.1	Isolated IPC Left Door Panel – Left rear lower quadrant	Probable
12	Multiple linear abrasions 0.5-1.0 cm on inferior bilateral abdomen	510202.1	Isolated IPC Interior – Lap portion of belt restraint	Certain
13	Multiple 0.1-0.2 cm abrasions to posterior right hand	710202.1	Isolated IPC Left Air Bag – Steering wheel hub	Possible

Injury No.	Injury	Injury Severity AIS 2015	Involved Physical Component (IPC)	IPC Confidence Level
14	Multiple 0.1-0.5 cm abrasions to posterior left hand	710202.1	Isolated IPC Left Air Bag – Steering wheel hub	Possible
15	Multiple 1.0-3.0 cm abrasions to anterior right lower leg	810202.1	Isolated IPC Front – Left lower instrument panel (includes knee bolster)	Certain
16	Multiple 1.0-2.0 cm abrasions to anterior left lower leg	810202.1	Isolated IPC Front – Left lower instrument panel (includes knee bolster)	Certain

Source: medical examiner report (internal).

Driver Kinematics

At the time of the crash, the driver was restrained by the lap and shoulder seat belt. The seat track adjustment could not be determined and the seatback was reclined 30 degrees aft of vertical at the time of the SCI inspection. The top of the driver's head restraint was 24 cm (9.4 in) above the top of the seatback. The left plane impact to the Chevrolet resulted in actuation of the driver's seat belt pretensioner and deployment of the frontal and left IC air bags. The driver was displaced to the left in her seat belt. She loaded the left IC air bag and contacted the left B-pillar with her head and the intruding door with her left flank. She rebounded to the right and then was redirected forward as a result of the front-place impact with the bridge rail. The driver sustained fatal injuries and was pronounced deceased at the scene. The heart laceration, spleen and liver lacerations, and left pelvis fracture were caused by contact with the intruding left door. The atlanto-occipital dislocation and subdural hemorrhage were most likely due to contact with the left B-pillar.

Second-Row Right Occupant Demographics

Age/sex:	19 months/male
Height:	81 cm (32 in)
Weight:	13 kg (29 lb)
Eyewear:	None
Seat type:	Convertible child restraint system
Seat track position:	Non-adjustable
Manual restraint usage:	5-point harness CRS
Usage source:	Vehicle inspection
Air bags:	Right IC air bag, not deployed
Alcohol/drug data:	None
Egress from vehicle:	Removed from vehicle by a bystander
Transport from scene:	Ambulance to a trauma center
Medical treatment:	Hospitalized for 1 day

Second-Row Right Occupant Injuries

Injury No.	Injury	Injury Severity AIS 2015	Involved Physical Component (IPC)	IPC Confidence Level
1	Bruising below right eye	210402.1	Isolated IPC Interior – Child safety seat shell (i.e., interior, exterior, base, cup holder, padding, head restraint, handle)	Certain
2	3 x 3 cm abrasion to right forehead	210202.1	Isolated IPC Interior – Child safety seat shell (i.e., interior, exterior, base, cup holder, padding, head restraint, handle)	Certain
3	Right neck abrasion	310202.1	Isolated IPC Interior – Child safety seat harness system (i.e., straps, retainer clip, latchplate, buckle)	Certain
4	Chest abrasion over sternum	410202.1	Isolated IPC Interior – Child safety seat harness system (i.e., straps, retainer clip, latchplate, buckle)	Certain
5	Left clavicle area abrasion	710202.1	Isolated IPC Interior – Child safety seat harness system (i.e., straps, retainer clip, latchplate, buckle)	Certain

Source: EMS and emergency room records.

Second-Row Right Occupant Kinematics

This child occupant was restrained in a forward-facing CRS. The left plane impact displaced the occupant to the left in the shell of the CRS. He rebounded to the right and was redirected forward as a result of the bridge rail impact. The occupant was reported as uninjured on the police crash report but was transported by ambulance to the hospital where he was admitted for one day for observation. He sustained minor soft tissue injuries as a result of contact to the shell and harness system of the CRS.

2009 MITSUBISHI GALANT

Description

The Mitsubishi was a front-wheel-drive, 5-occupant, 4-door sedan identified by the VIN 4A3AB36F39Exxxxxx manufactured in April 2008. It was equipped with a 2.4-liter, I-4 engine, 4-speed automatic transmission, and 4-wheel antilock brakes with electronic brake force distribution. The vehicle was also equipped with front-seat belt pretensioners, multi-stage frontal air bags, seat-mounted side impact air bags, and side-impact-sensing IC air bags. This vehicle was not supported by Bosch CDR software.



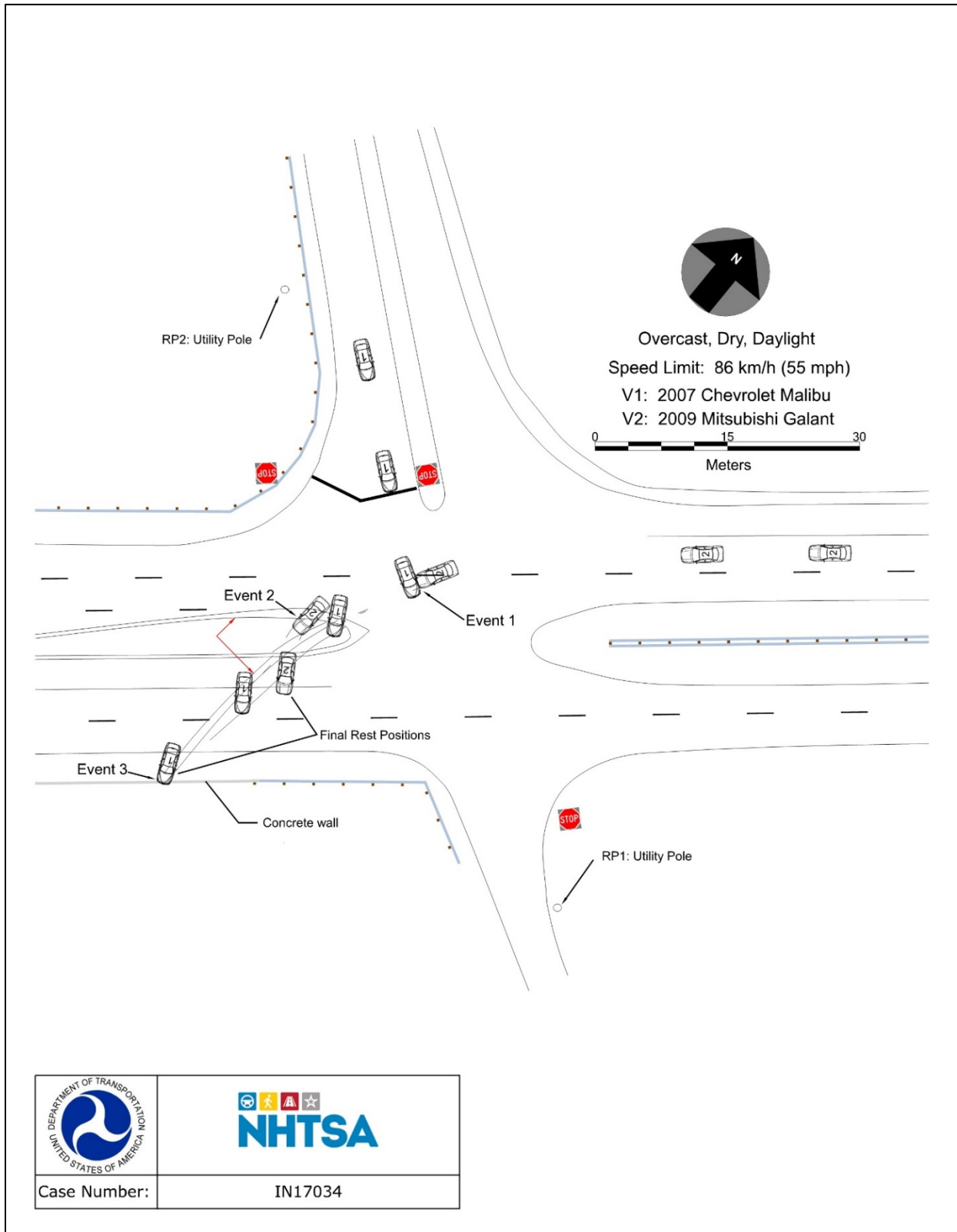
Figure 10. Front end of the damaged Mitsubishi.

Exterior Damage Event 1: The Mitsubishi sustained direct damage to the entire front plane from the impact with the right plane of the Chevrolet (**Figure 10**). The crush measurements were taken at the bumper level with the maximum residual crush was 45 cm (17.7 in) occurring 31 cm (12.2 in) left of the front center point. The CDC was 12FDEW2 (10 degrees).

Occupant Data

The 29-year-old female driver of the Mitsubishi was restrained by her lap and shoulder seat belt, according to the police crash report. The driver sustained police-reported "A" (incapacitating) injuries and was transported to a hospital. Injury and treatment information is unknown.

CRASH DIAGRAM



APPENDIX A: 2007 Chevrolet Malibu Event Recorder Data Report¹

¹ The EDR Report contained in this technical report was imaged using the current version of the Bosch CDR software at the time of the vehicle inspection. The CDR report contained in the associated Crash Viewer application may differ relative to this report.



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	1G1ZT58N67F*****
User	
Case Number	
EDR Data Imaging Date	11/16/2017
Crash Date	
Filename	IN17034_V1_ACM.CDRX
Saved on	Thursday, November 16 2017 at 12:47:33
Imaged with CDR version	Crash Data Retrieval Tool 17.5.1
Imaged with Software Licensed to (Company Name)	NHTSA
Reported with CDR version	Crash Data Retrieval Tool 19.3.1
Reported with Software Licensed to (Company Name)	NHTSA
EDR Device Type	Airbag Control Module
Event(s) recovered	Deployment Non-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 can be overwritten by an event that has a greater SDM recorded vehicle velocity change. 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. The data in the Non-Deployment Event file will be locked, if the Non-Deployment Event occurred within five seconds of a Deployment Event. A locked Non Deployment Event cannot be overwritten or cleared 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 up to 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. If a CDR Printout user were to calculate resultant velocity change using X and Y axis time history data, the calculated value may be different than the Maximum SDM Recorded Velocity Change parameter value displayed in the CDR report. This is due to the rounding that occurs within the SDM while calculating the Maximum SDM Recorded Velocity Change value.

-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 open/closed state of the brake switch circuit.
- Pre-Crash data is recorded asynchronously. The 1.0 second Pre-crash data value (most recent recorded data point) is the data point last sampled before AE. That is to say, the last data point may have been captured just before AE but no more than 1.0 second before AE. All subsequent Pre-crash data values are referenced from this data point.
- 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 is present to send the pre-crash data
- Vehicle speed, Transmission Gear Select, and Transmission Actual Gear will be marked as invalid for manual transmission vehicles
- Pre-crash data associated with this event will always be for the first event even if it is not recorded.
- Driver's and Passenger's Belt Switch Circuit Status indicates the status of the seat belt switch circuit, except: The Passenger Belt Switch Circuit Status for 2005 vehicles is available only on the Cadillac STS. 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), always reports a default value of "Buckled," because there is no passenger belt switch with the Recaro seat option. The Passenger Belt Switch Circuit Status for 2010 Chevrolet Cobalt and 2010 Pontiac G5 vehicles, with RPO Z49, will report a default value of "Buckled". The Passenger Belt Switch Circuit Status for 2010 and 2011 Chevrolet HHR, with the LS or LT trim package and RPO Z49, will report a default value of "Buckled".
- 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. Time Between events is measured from end of one event to the beginning of a next event. An event may occur within 5 seconds of another event, known as an extended event. This occurs when three or more sequential events are separated by more than 5 seconds but each event in the sequence is no more than 5 seconds apart from a subsequent event. Pre-crash data is locked to the first event in an extended event.
- 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 counter.
- Steering Wheel Angle data is reported in 16 degree increments. 2005 through 2010 Chevrolet Cobalt, 2005 and 2006 Pontiac Pursuit, 2007 through 2010 Pontiac G5, and 2006 through 2011 Chevrolet HHR, do not record Steering Wheel Angle data and should not be relied upon.
- If more than one event is recorded, use the follow to determine which event the Multiple Event Data is associated with:
 - If a Deployment event and not locked Non-Deployment event are recorded, the Multiple Event Data is associated with the Deployment event.
 - If a Deployment event and a locked Non-Deployment event are recorded, then the Multiple Event Data is associated with both events.
 - If a Deployment event and Deployment event #2 are recorded, then the Multiple Event Data is associated with both events.
- 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.

Data Element Sign Convention:

The following table provides an explanation of the sign notation for data elements that may be included in this CDR report. Directional references to sign notation are all from the perspective of the driver when seated in the vehicle facing the direction of forward vehicle travel.

Data Element Name	Positive Sign Notation Indicates
Longitudinal Velocity Change	Forward
Lateral Velocity Change	Left to Right
Lateral Acceleration	Left to Right
Yaw Rate	Clockwise *
Steering Wheel Angle	Clockwise *

*For Cadillac STS model vehicles with StabiliTrak 3.0 systems (RPO JL7), the positive sign notation Indicates a counterclockwise rotation.

Hexadecimal Data:

Data that the vehicle manufacturer has specified for data retrieval is shown in the hexadecimal data section of the CDR report. The hexadecimal data section of the CDR report may contain data that is not translated by the CDR program. The control module contains additional data that is not retrievable by the CDR tool.

01016_SDMEps_r011

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	**1ZT58N*7*****
Low Tire Pressure Warning Lamp (If Equipped)	OFF
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)	First Gear
Transmission Selector Position (If Equipped)	Drive
Traction Control System Active (If Equipped)	No
Service Engine Soon (Non-Emission Related) Lamp	OFF
Service Vehicle Soon Lamp	OFF
Outside Air Temperature (degrees F) (If Equipped)	62
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

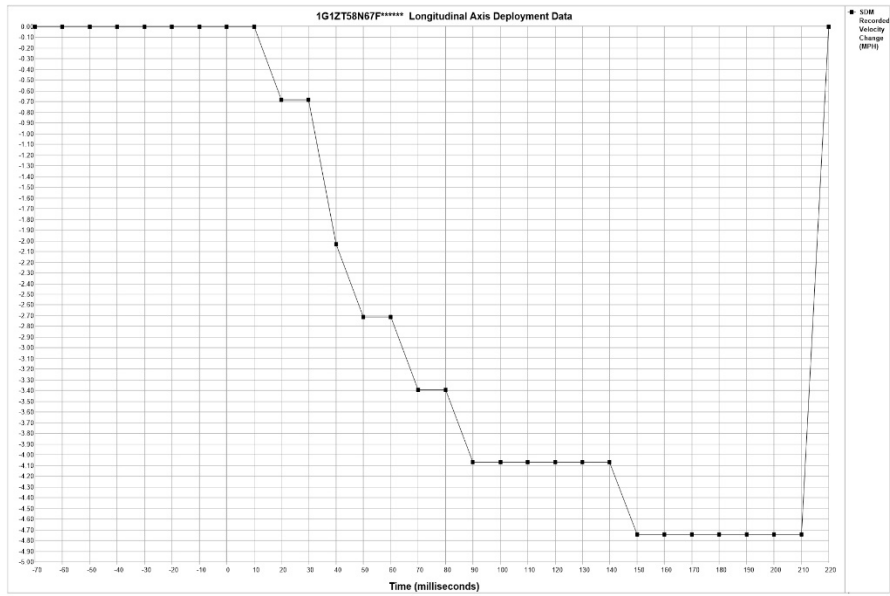
Parameter	-5 sec	-4 sec	-3 sec	-2 sec	-1 sec
Vehicle Speed (MPH)	0	0	0	1	7
Engine Speed (RPM)	576	576	640	1216	1984
Percent Throttle	14	14	15	25	39
Brake Switch Circuit State	ON	OFF	OFF	OFF	OFF
Accelerator Pedal Position (percent)	0	0	0	15	29
Antilock Brake System Active (If Equipped)	No	No	No	No	No
Lateral Acceleration (feet/s ²) (If Equipped)	Invalid	Invalid	Invalid	Invalid	Invalid
Yaw Rate (degrees per second) (If Equipped)	Invalid	Invalid	Invalid	Invalid	Invalid



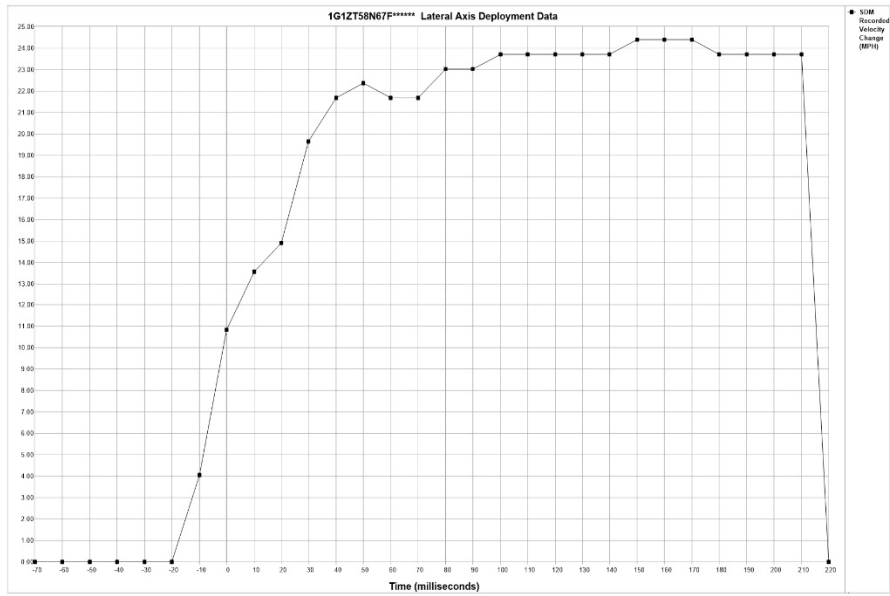
Parameter	-5 sec	-4 sec	-3 sec	-2 sec	-1 sec
Steering Wheel Angle (degrees) (If Equipped)	0	0	0	0	0
Vehicle Dynamics Control Active (If Equipped)	Invalid	Invalid	Invalid	Invalid	Invalid

System Status At Deployment

Ignition Cycles At Investigation	14071
SIR Warning Lamp Status	OFF
SIR Warning Lamp ON/OFF Time (seconds)	595800
Number of Ignition Cycles SIR Warning Lamp was ON/OFF Continuously	550
Ignition Cycles At Event	14071
Ignition Cycles Since DTCs Were Last Cleared	254
Driver's Belt Switch Circuit Status	BUCKLED
Passenger Belt Switch Circuit Status (If Equipped)	UNBUCKLED
Diagnostic Trouble Code at Event Enable, fault number: 1	N/A
Diagnostic Trouble Code at Event Enable, fault number: 2	N/A
Diagnostic Trouble Code at Event Enable, fault number: 3	N/A
Diagnostic Trouble Code at Event Enable, fault number: 4	N/A
Diagnostic Trouble Code at Event Enable, fault number: 5	N/A
Diagnostic Trouble Code at Event Enable, 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)	40
Driver 2nd Stage Time From Algorithm Enable to Deployment Command Criteria Met (msec)	40
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)	4
Passenger Side or Roof Rail/Head Curtain Time From Algorithm Enable to Deployment Command Criteria Met (msec)	N/A
Time Between Events (sec)	-3.2
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	Yes
Driver (Initiator 1) Roof Rail/Head Curtain Loop Commanded	Yes
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 Pretensioner Deployment Loop Commanded	No
Third Row Left Roof Rail/Head Curtain 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	No
Passenger 2nd Stage Deployment Loop Commanded for Disposal	No
Crash Record Locked	Yes
Vehicle Event Data (Pre-Crash) Associated With This Event	Yes
Event Recording Complete	Yes



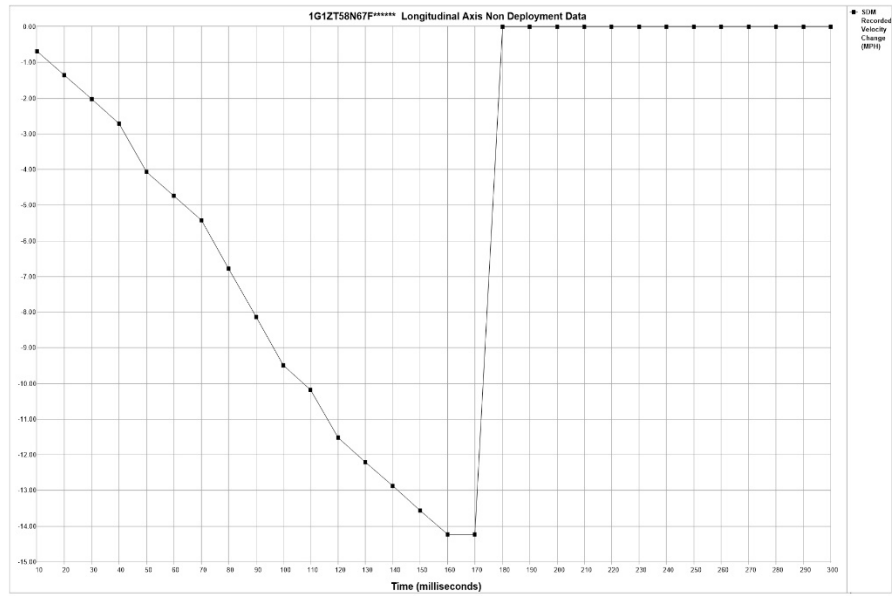
Time (milliseconds)	-70	-60	-50	-40	-30	-20	-10	0	10	20	30	40	50	60	70
SDM Longitudinal Axis Recorded Velocity Change (MPH)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.68	-0.68	-2.03	-2.71	-2.71	-3.39
Time (milliseconds)	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220
SDM Longitudinal Axis Recorded Velocity Change (MPH)	-3.39	-4.07	-4.07	-4.07	-4.07	-4.07	-4.07	-4.74	-4.74	-4.74	-4.74	-4.74	-4.74	-4.74	0.00



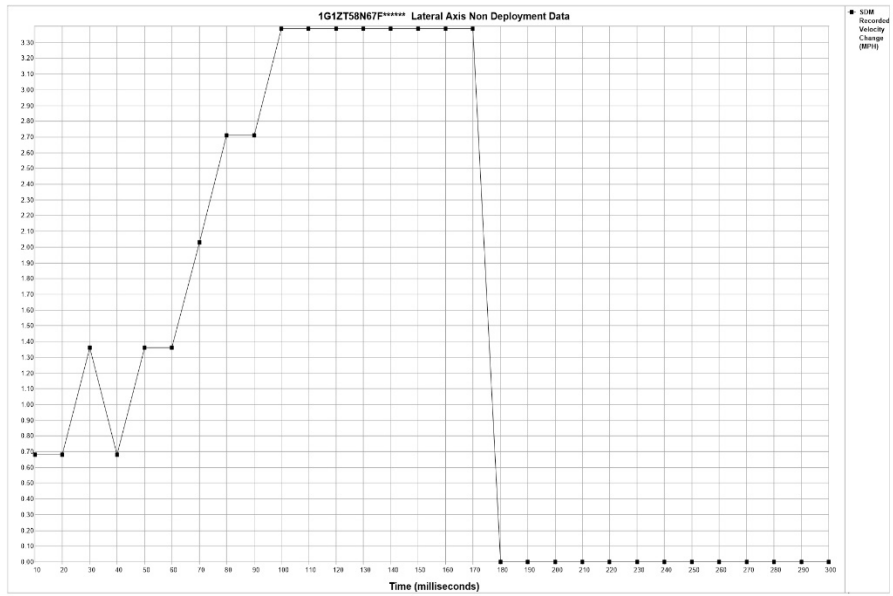
Time (milliseconds)	-70	-60	-50	-40	-30	-20	-10	0	10	20	30	40	50	60	70
SDM Lateral Axis Recorded Velocity Change (MPH)	0.00	0.00	0.00	0.00	0.00	0.00	4.07	10.84	13.55	14.91	19.65	21.69	22.36	21.69	21.69
Time (milliseconds)	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220
SDM Lateral Axis Recorded Velocity Change (MPH)	23.04	23.04	23.72	23.72	23.72	23.72	23.72	24.40	24.40	24.40	23.72	23.72	23.72	23.72	0.00

System Status At Non-Deployment

Ignition Cycles At Investigation	14071
SIR Warning Lamp Status	ON
SIR Warning Lamp ON/OFF Time (seconds)	0
Number of Ignition Cycles SIR Warning Lamp was ON/OFF Continuously	0
Ignition Cycles At Event	14071
Ignition Cycles Since DTCs Were Last Cleared	254
Driver's Belt Switch Circuit Status	BUCKLED
Passenger Belt Switch Circuit Status (If Equipped)	UNBUCKLED
Automatic Passenger SIR Suppression System Validity Status at AE	Valid
Automatic Passenger SIR Suppression System Status at AE	Air Bag Suppressed
Diagnostic Trouble Code at Event Enable, fault number: 1	B0052-00
Diagnostic Trouble Code at Event Enable, fault number: 2	B0084-02
Diagnostic Trouble Code at Event Enable, fault number: 3	N/A
Diagnostic Trouble Code at Event Enable, fault number: 4	N/A
Diagnostic Trouble Code at Event Enable, fault number: 5	N/A
Diagnostic Trouble Code at Event Enable, fault number: 6	N/A
Maximum Resultant SDM Recorded Vehicle Velocity Change (MPH)	15.29
Time From Algorithm Enable to Maximum Resultant SDM Recorded Vehicle Velocity Change (msec)	180
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	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 Pretensioner Deployment Loop Commanded	No
Third Row Left Roof Rail/Head Curtain 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	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
SDM Longitudinal Axis Recorded Velocity Change (MPH)	-0.68	-1.36	-2.03	-2.71	-3.39	-4.07	-4.74	-5.42	-6.10	-6.78	-7.46	-8.14	-8.82	-9.50	-10.18
Time (milliseconds)	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300
SDM Longitudinal Axis Recorded Velocity Change (MPH)	-14.23	-14.23	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
SDM Lateral Axis Recorded Velocity Change (MPH)	0.68	0.68	1.36	0.68	1.36	1.36	2.03	2.71	2.71	3.39	3.39	3.39	3.39	3.39	3.39
Time (milliseconds)	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300
SDM Lateral Axis Recorded Velocity Change (MPH)	3.39	3.39	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



Hexadecimal Data

```
$01 08 00 00 00 00 00 00
$02 30 00 00 00 00 00 00
$03 00 00 00 00 00 00 00
$04 00 00 00 00 00 00 00
$05 00 00 00 00 00 00 00
$06 00 0A 00 03 0A 00 00
$07 00 20 00 00 00 00 00
$08 00 00 00 00 00 00 00
$09 00 00 00 00 00 00 00
$0A 00 00 00 00 00 00 00
$0B 00 00 0F 0F 03 00 00
$0C 00 00 00 00 00 00 00
$0D 00 00 40 00 00 00 00
$0E 00 00 00 00 00 00 00
$0F 00 00 00 00 00 00 00
$10 00 00 00 00 00 00 00
$11 00 00 00 00 00 00 00
$12 00 00 00 00 00 00 00
$13 00 00 00 00 00 00 00
$14 00 00 00 00 00 00 00
$15 00 00 00 00 00 00 00
$16 03 06 0C 16 34 00 00
$17 00 00 00 00 00 00 00
$18 00 00 00 00 00 00 00
$19 00 00 00 00 00 00 00
$1B 3F 30 00 67 00 7A 00
$1C 3F 30 00 66 00 1A 00
$1D 00 00 00 00 00 00 00
$1E 00 00 00 00 00 00 00
$1F 28 00 00 00 00 00 00
$20 40 00 00 00 00 00 00
$21 00 00 00 00 F0 00 00
$22 00 7B 00 00 00 00 00
$24 00 00 00 00 00 00 00
$25 00 00 00 00 00 00 00
$26 00 00 00 00 00 00 00
$27 FF 00 FF 00 00 00 00
$2A 00 00 00 00 00 00 00
$2B 00 00 00 00 00 00 00
$2D 00 00 00 00 00 00 00
$2E 00 E8 89 02 26 00 00
$2F 00 FE 36 F7 00 00 00
$30 9D 00 00 00 00 00 00
$31 4B 26 00 00 00 00 00
$32 08 00 00 00 00 00 00
$33 63 41 25 24 24 00 00
$34 1F 13 0A 09 09 00 00
$35 0B 02 00 00 00 00 00
$36 00 00 00 00 00 00 00
$37 00 00 00 01 0B 00 20
$38 71 00 00 00 03 C0 00
$39 00 00 00 00 00 80 00
$3A 00 00 00 00 00 80 00
$3B 03 06 0C 00 00 00 00
$3C 00 00 00 00 00 00 C0
$3D 31 5A 54 35 38 4E 00
$3E 37 FF FF FF 00 00 00
$3F 00 00 90 00 00 00 00
$40 80 A5 00 00 00 00 00
$41 00 00 00 00 00 00 00
$42 80 00 00 00 00 00 00
$43 FE 36 F7 00 00 00 00
$44 80 52 00 80 84 02 00
1G1ZT58N67F*****
```



\$45 00 00 00 00 00 00 00
\$46 00 00 00 00 00 00 00
\$47 01 FF 01 FE 02 FD 00
\$48 01 FC 02 FA 02 F9 00
\$49 03 F8 04 F6 04 F4 00
\$4A 05 F2 05 F1 05 EF 00
\$4B 05 EE 05 ED 05 EC 00
\$4C 05 EB 05 EB 00 00 00
\$4D 00 00 00 00 00 00 00
\$4E 00 00 00 00 00 00 00
\$4F 00 00 00 00 00 00 00
\$50 00 00 00 00 00 00 00
\$51 D0 00 00 00 00 00 00
\$52 00 00 00 10 00 00 00
\$53 12 01 FD 00 00 00 00
\$54 00 00 00 00 00 00 00
\$55 00 00 00 00 00 00 00
\$67 A0 A5 00 00 00 00 00
\$68 D8 10 00 00 00 00 00
\$69 00 E8 BC 02 26 00 00
\$6A FE 36 F7 00 00 00 00
\$6B 00 00 00 00 00 00 00
\$6C 00 00 00 00 00 00 00
\$6D 00 00 00 00 00 00 00
\$6E 00 00 00 00 00 00 00
\$6F 00 00 00 00 00 00 00
\$70 06 00 10 00 14 00 00
\$71 16 FF 1D FF 20 FD 00
\$72 21 FC 20 FC 20 FB 00
\$73 22 FB 22 FA 23 FA 00
\$74 23 FA 23 FA 23 FA 00
\$75 23 FA 24 F9 24 F9 00
\$76 24 F9 23 F9 23 F9 00
\$77 23 F9 23 F9 00 00 00
\$78 D0 00 00 00 00 00 00
\$79 00 00 00 10 00 00 00
\$7A 00 00 00 00 00 00 00
\$7B 14 14 00 00 02 00 B0

\$01 41 55 37 31 31 31 52 37 31 33 31 32 44 44 58 54
\$02 41 0A 22 34
\$03 41 54 37 31 31 31 52 37 31 33 31 32 44 44 4C 32
\$04 41 0A 22 34
\$05 42 55 FF FF FF FF FF FF FF FF FF FF FF FF FF FF
\$06 FF FF FF FF
\$07 42 54 FF FF FF FF FF FF FF FF FF FF FF FF FF FF
\$08 FF FF FF FF
\$0D 41 48 37 31 31 32 52 37 31 31 33 33 4E 4D 44 5A
\$0E 01 59 D3 B3
\$0F 41 4A 37 31 31 32 52 37 31 31 33 31 4E 4C 33 46
\$10 01 59 D3 B3
\$13 42 52 38 36 39 36 44 31 37 31 35 39 34 31 41 47
\$14 16 45 45 46
\$17 42 54 FF FF FF FF FF FF FF FF FF FF FF FF FF FF
\$18 FF FF FF FF
\$21 32 16 B8 0B D0 2E 91 9A
\$22 97 19
\$23 31 5A FA FA FA FA FA
\$24 31 5A FA FA FA FA FA
\$25 31 5A FA FA FA FA FA
\$26 31 5A FA FA FA FA FA
\$40 00 00
\$41 3F 30 00 66 00 1A
\$42 D0 E4
\$43 00 00 8E 80
\$44 C6 00 00 FC 80 C0
\$45 07 01 07 01 05 01
\$46 00 0F 0F 64 64
1G1ZT58N67*****



```
$47 0A 64 06 04 04 05 0A 06 04 0A 00 00 FA 00 00 FF 04 64
$48 18 08 08
$B0 58
$B1 FD FE 00
$B2 FF FF FF FF FF
$B4 41 53 39 37 31 39 32 31 33 32 58 51 20 20 20 20
$B7 50 AA 01 0F 02
$B8 4C 54 69 09 30
$C1 30 46 30 32
$CA 30 46 30 32
$CB 00 E9 74 87
$CC 00 E9 74 87
$D1 00 00
$DB 00 00
$DC 00 00
```

Disclaimer of Liability

The users of the CDR product and reviewers of the CDR reports and exported data shall ensure that data and information supplied is applicable to the vehicle, vehicle's system(s) and the vehicle ECU. Robert Bosch LLC and all its directors, officers, employees and members shall not be liable for damages arising out of or related to incorrect, incomplete or misinterpreted software and/or data. Robert Bosch LLC expressly excludes all liability for incidental, consequential, special or punitive damages arising from or related to the CDR data, CDR software or use thereof.

DOT HS 812 965
August 2020



U.S. Department
of Transportation
**National Highway
Traffic Safety
Administration**

